Project Manual
For

Pennies for Progress 3

Widening of US 21 Bypass and SC 51 From Springfield Parkway to the North Carolina Line

June 2025

County Management
Josh Edwards, County Manager
Tom Couch, Assistant County Manager
Kevin Madden, Assistant County Manager
David Garner, Assistant County Manager

County Council
District 1: Tom Audette, Vice Chairman
District 2: Andy Litten
District 3: Tommy Adkins
District 4: William “Bump” Roddey
District 5: Christi Cox, Chairwoman
District 6: Watts Huckabee
District 7: Debi Cloninger

York County Engineering Reference No. 11149-004
SCDOT Project ID. 0042332

Prepared for:
York County Engineering Department
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York, South Carolina 29745
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BID FORM

Pennies for Progress - Widening of US 21 Bypass and SC 51
Project # 1149-004 – Project ID 0042332

Submitted: _____, 2025

York County Government
6 South Congress Street
York, SC 29745

Sir or Madam:

The undersigned, as Bidder, hereby declares that the only person or persons interested in the Bid, as principal or principals, is or are named herein and that no other person than herein mentioned has any interest in the Bid of the Contract to which the work pertains; that this Bid is made without connection or arrangement with any other person, company, or parties making a bid or proposal and that the Bid is in all respects fair and made in good faith without collusion or fraud.

The Bidder further declares that he has examined the site of the Work and, through personal knowledge and experience and/or subsurface investigations, has fully satisfied himself in regard to all conditions pertaining to such site and he assumes full responsibility therefore; that he has examined the Drawings and Specifications for the Work and from his own experience or from professional advice that the Drawings and Specifications are sufficient for the Work to be done; that he has examined the other Contract Documents and all addenda relating thereto, and that he has satisfied himself fully, relative to all matters and conditions with respect to the Work to which this Bid pertains.

The Bidder proposes and agrees, if this Proposal is accepted, to contract with York County Government (OWNER) in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, transportation and labor and to perform all work necessary to complete the Work specified in the Bid and other Contract Documents.

The Bidder further proposes and agrees to commence substantial work on this project within 15 days of a Notice to Proceed and agrees that the Work will be completed and ready for final payment **within 1095 days** of the Notice to Proceed.

The Bidder further agrees that the deductions for liquidated damages, as stated in the Agreement and General Conditions, constitute fixed, agreed, and liquidated damages to reimburse the OWNER for additional costs to the OWNER resulting from the Work not being completed within the time limit stated in the Contract Form. The liquidated damages shall be **$2,200.00** for each consecutive calendar day thereafter for the project completion. Additional liquidated damages shall be **$1,800.00** for each consecutive calendar day thereafter for the Gold Hill realignment with US 21 interim completion date of **June 30, 2026.**

The Bidder further understands and agrees that the work zone traffic control required to complete the work shall be fully included in the Bid and no additional compensation will be made by the OWNER, unless approved and agreed upon at the OWNER sole discretion.

The Bidder further agrees to execute a Contract and furnish satisfactory Performance and Indemnity and Payment Bonds, and the required Certificates of Insurance, within ten (10) consecutive calendar days after receipt of Notice of Award of the Contract, and the undersigned agrees that in case of failure on his part to execute the said Contract and Performance and Indemnity and Payment Bonds within the ten (10) consecutive calendar days after the award of the Contract, the Bid guarantee accompanying his Bid and the money payable thereon shall be paid to the OWNER as liquidation of damages sustained by the OWNER; otherwise, the Bid guarantee shall be returned to the undersigned after the Contract is signed and the Performance and Indemnity and Payment Bonds are filed.

Widening of US 21 and SC 51
BID SCHEDULE - ROADWAY

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid for in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. All costs shall be included in the various pay items in the Bid Schedule or an amount shown as Total Bid Amount for the work shown on the proposed project plans.

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
1031000	MOBILIZATION	NEC.	LS		
1031100	MOBILIZATION - SUBCONTRACTOR	NEC.	LS		
1032010	BONDS AND INSURANCE	NEC.	LS		
1050800	CONSTRUCTION STAKES, LINES & GRADES	1.000	EA		
1052001	UTILITY STAKING	NEC.	LS		
1052100	SMALL PUBLIC WATER RELOCATION NO. 1	1.000	EA		
1052110	LARGE PUBLIC WATER RELOCATION NO. 1	1.000	EA		
1052210	LARGE PUBLIC SEWER RELOCATION NO. 1	1.000	EA		
1071000	TRAFFIC CONTROL	NEC.	LS		
1080300	CPM PROGRESS SCHEDULE	NEC.	LS		
2011001	CLEARING & GRUBBING WITHIN RIGHT OF WAY	2.000	ACRE		
2023000	REMOVAL & DISPOSAL OF EXISTING PAVEMENT	2,165.000	SY		
2025000	REMOVAL & DISPOSAL OF EXISTING ASPHALT PAVEMENT	13,588.000	SY		
2027801	REMOVAL OF EXIST. GUARDRAIL	205.000	LF		
2028605	CULVERT EXTENSION PREPARATION	6.000	EA		
2031000	UNCLASSIFIED EXCAVATION	74,250.000	CY		
2033000	BORROW EXCAVATION	137,926.000	CY		
2033100	BORROW PIT SET-UP	NEC.	LS		
2036020	GEOTEXTILE, SEPARATION	7,000.000	SY		
2037000	GEOGRID REINFORCEMENT (UNIAXIAL)	1,280.000	SY		
2037030	GEOGRID STABILIZATION	200.000	SY		
2041000	STRUCTURE EXCAVATION FOR CULVERTS	1,082.000	CY		
2052000	NO. 57 STONE FOR BACKFILL	253.100	TON		
2052010	STONE BRIDGE LIFT MATERIAL	6,500.000	TON		
2061200	REINFORCED SOIL SLOPE	765.000	SF		
2081001	FINE GRADING	84,395.000	SY		
2103000	FLOWABLE FILL	3,350.000	CY		

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
3069900	MAINTENANCE STONE	5,545.000	TON		
3100310	HOT MIX ASPHALT BASE COURSE - TYPE A	51,722.000	TON		
3100320	HOT MIX ASPHALT BASE COURSE - TYPE B	1,620.000	TON		
4011004	LIQUID ASPHALT BINDER PG64-22	6,348.000	TON		
4012120	FULL DEPTH ASPH. PAV. PATCHING 12"UNIF	4,660.000	SY		
4012150	FULL DEPTH ASPH. PAV. PATCHING 15"UNIF	9,490.000	SY		
4013150	MILLING EXISTING ASPHALT PAVEMENT 1.5"	5,640.000	SY		
4013200	MILLING EXISTING ASPHALT PAVEMENT 2.0"	9,320.000	SY		
4013990	MILLING EXISTING ASPHALT PAVEMENT (VARIABLE)	7,000.000	SY		
4020320	HOT MIX ASPHALT INTERMEDIATE COURSE TYPE B	36,113.000	TON		
4030320	HOT MIX ASPHALT SURFACE COURSE TYPE B	19,875.000	TON		
4030360	HOT MIX ASPHALT SURFACE COURSE TYPE E	12,490.000	TON		
4037210	DRIVEWAY PAVING-SURFACE TYPE B	1,200.000	TON		
4037220	DRIVEWAY PAVING-SURFACE TYPE C	420.000	TON		
6021120	PERMANENT CONSTRUCTION SIGNS (GROUND MOUNTED)	1,412.000	SF		
6021125	PERMANENT CONSTRUCTION SIGNS (BARRICADE MOUNTED)	619.000	SF		
6031400	TEMP. SURFACE MOUNT. FLEX. DELINEATOR POST	168.000	EA		
6041200	BARRICADE - TYPE 3	534.000	LF		
6052121	PORTABLE TERMINAL IMPACT ATTENUATOR-TEST LEVEL 2	4.000	EA		
605212A	ANCHOR KIT - PORT. ATTENUATOR(TEST LEVEL 2)	2.000	EA		
6053110	TEMPORARY CONCRETE BARRIER	600.000	LF		
6062000	CONSTRUCTION ZONE ELECTRIC CHANGEABLE MESSAGE SIGN (TRAILER	4.000	EA		
608100B	TYPE B - FLASHING LIGHT	32.000	EA		
6092100	TEMPORARY CLEAR PAVEMENT MARKERS MONO-DIR.- 4"X4"	1,200.000	EA		
6092155	TEMPORARY YELLOW PAVEMENT MARKERS BI-DIR.- 4"X4"	1,700.000	EA		
6250005	4" WHITE BROKEN LINES -(GAPS EXCLUDED)-FAST DRY PAINT	10,335.000	LF		
6250010	4" WHITE SOLID LINES (PVT. EDGE LINES)-FAST DRY PAINT	152,520.000	LF		
6250025	24" WHITE SOLID LINES (STOP/DIAGONAL LINES)-FAST DRY PAINT	2,940.000	LF		
6250110	4"YELLOW SOLID LINE(PVT.EDGE&NO PASSING ZONE)-FAST DRY PAINT	85,440.000	LF		

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
6271005	4" WHITE BROKEN LINES(GAPS EXCL.)THERMOPLASTIC- 90 MIL.	14,208.000	LF		
6271010	4" WHITE SOLID LINES (PVT. EDGE LINES) THERMO.- 90 MIL.	16,090.000	LF		
6271015	8" WHITE SOLID LINES THERMOPLASTIC - 125 MIL.	4,270.000	LF		
6271025	24" WHITE SOLID LINES (STOP/DIAG LINES)-THERMO.-125 MIL	2,025.000	LF		
6271030	WHITE SINGLE ARROWS (LT, STRGHT, RT) THERMO.-125 MIL.	105.000	EA		
6271035	WHITE WORD MESSAGE "ONLY" - THERMOPLASTIC - 125 MIL.	75.000	EA		
6271040	WHITE COMBINATION ARROWS(STR&RT.OR STR&LT)THERMO-125MIL	2.000	EA		
6271064	4" YELLOW BROKEN LINES(GAPS EXC)THERMOPLASTIC - 90 MIL.	3,209.000	LF		
6271074	4" YELLOW SOLID LINES(PVT.EDGE LINES) THERMO-90 MIL.	53,940.000	LF		
6271076	6" YELLOW SOLID LINES(PVT.EDGE LINES) THERMO-90 MIL.	17,855.000	LF		
6271078	8" YELLOW SOLID LINES(PVT.EDGE LINES) THERMO-90 MIL.	134.000	LF		
6271080	24" YELLOW SOLID LINES - THERMOPLASTIC - 125 MIL.	660.000	LF		
6300005	PERMANENT CLEAR PAVEMENT MARKERS-MONO-DIR.- 4"X4"	600.000	EA		
6301005	PERMANENT YELLOW PAVEMENT MARKERS MONO-DIR.- 4"X 4" PERM. YEL.	270.000	EA		
6301100	PERMANENT YELLOW PAVEMENT MARKERS BI-DIR.- 4"X4"	850.000	EA		
6510105	FLAT SHEET, TYPE III, FIXED SZ. & MSG. SIGN	983.480	SF		
6510106	FLAT SHEET, TYPE III, SIZE DETERMINED BY MSG	195.500	SF		
6513015	MOUNTING ASSEMBLY FOR F.S. SIGN ERCTD ON SPAN WIRE	20.000	EA		
6531210	U-SECTION POST FOR SIGN SUPPORTS - 3P	2,001.000	LF		
6531215	U-SECTION POST FOR SIGN BRACING - 2P	43.330	LF		
6750275	FURNISH & INSTALL 1.0" SCHEDULE 80 PVC CONDUIT	500.000	LF		
6750278	FURNISH & INSTALL 2.0" SCHEDULE 80 PVC CONDUIT	6,300.000	LF		
675027C	FURNISH & INSTALL 3.0" SCHEDULE 80 PVC CONDUIT	180.000	LF		
6760060	FURNISH & INSTALL 2" SCHEDULE 80 HDPE CONDUIT (TRENCHLESS)	1,000.000	LF		
6770388	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - BLACK	12,500.000	LF		
6770389	FURNISH & INSTALL NO. 14 COPPER WIRE, 4 CONDUCTOR - GRAY	12,800.000	LF		
6770393	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (BLACK)	8,100.000	LF		
6770394	FURNISH & INSTALL NO. 14 COPPER WIRE, 8 CONDUCTOR (GRAY)	2,900.000	LF		
6770413	FURNISH & INSTL NO. 14 COPPER WIRE,1-CONDUCTOR FOR LOOP WIRE	1,300.000	LF		
6770470	FURNISH & INSTALL FIBER OPTIC CABLE-SINGLE MODE	6,500.000	LF		
6770476	FURNISH & INSTALL FIBER OPTIC INTERCONNECT CENTER	5.000	EA		

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
6780495	SAWCUT FOR LOOP DETECTOR	530.000	LF		
6800499	FURNISH & INSTALL ELECTRICAL SERVICE FOR TRAFFIC SIGNAL	6.000	EA		
6800518	F&I-13"X24"X18"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	21.000	EA		
680052C	F&I-17"X30"X24"D.ELEC.FLUSH UNDGRD.ENCLOS-(STR.POLY.CONC.)HD	16.000	EA		
6825020	FURNISH & INSTALL - 35' WOOD POLE-CLASS II-CCA TR(0.60)	12.000	EA		
682505C	FURNISH AND INSTALL 13" X 30' STEEL STRAIN POLE AND FOUNDATION	24.000	EA		
6825090	FURNISH & INSTALL 1/4" GALVANIZED STEEL CABLE	600.000	LF		
6825092	FURNISH & INSTALL 3/8" GALVANIZED STEEL CABLE	4,500.000	LF		
6825480	FURNISH & INSTALL 4' BREAK-AWAY ALUMINUM PEDESTAL POLE	5.000	EA		
6825484	FURNISH & INSTALL 10' BREAK-AWAY ALUM PEDESTAL POLE AND BASE	18.000	EA		
6825486	FURNISH & INSTALL ALUMINUM PEDESTAL POLE CONCRETE FOUNDATION	33.000	EA		
6845511	F&I - CONTR 332/336 CABINET ASSEMBLY - BASE MOUNTED	6.000	EA		
6845518	FURNISH AND INSTALL BATTERY BACK-UP INCLUDING FOUNDATION	6.000	EA		
6865710	FURNISH & INSTALL - 12" 5 SECTION SIGNAL HEAD	5.000	EA		
6865720	FURNISH & INSTALL -12" 4 SECTION SIGNAL HEAD	4.000	EA		
6865723	FURNISH & INSTALL - 12" 3 SECTION SIGNAL HEAD	57.000	EA		
6865783	F&I - 1-WAY-1SECT.(COUNTDOWN HAND/MAN EMBLEM)PED.SIG.HEAD	42.000	EA		
6865794	F&I-PED PUSH BUTTON MICRO ASSEMBLY(9"X15")AND SIGN(R-10-3E or R10-4a)	42.000	EA		
6865834	BACKPLATE W/ RETROREFL.BORDERS FOR TRAFF. SIG.	66.000	EA		
6885990	REMOVAL,SALVAGE,&DISP.OF EXISTING TRAF. SIGNAL EQUIPMENT	NEC.	LS		
6885992	TEMPORARY ADJUSTMENT OF TRAFFIC SIGNAL EQUIPMENT	NEC.	LS		
6885996	TEMPORARY TIMING ADJUSTMENTS PER SITE VISIT	4.000	EA		
6887951	FURNISH & INSTALL CONCRETE CABINET FOUNDATION	6.000	EA		
6887971	F&I RADAR FOR STOP BAR DETECTION, INC 150' CABLE & MTG. HW.	22.000	EA		
6887972	F&I CABINET INTERFACE COMPONENTS FOR STOP BAR DETECTION	22.000	EA		
6887973	F&I RADAR FOR SETBACK DETECTION, INC 150' CABLE & MTG. HW.	12.000	EA		
6887974	F&I CABINET INTERFACE COMPONENTS FOR SETBACK DETECTION	12.000	EA		
7011402	CONC. FOR STRUCTURES - CLASS 4000(CULVERT)	340.900	CY		
7011403	CONC. FOR STRUCTURES - CLASS 4000(ROADWAY)	13.700	CY		

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
7013550	CLEAN OUT EXISTING BOX CULVERT	326.000	CY		
7016145	STRAIGHT HEADWALL FOR 30" CIRCULAR PIPE-1 LINE	5.000	EA		
7016155	STRAIGHT HEADWALL FOR 36" CIRCULAR PIPE-1 LINE	5.000	EA		
7016165	STRAIGHT HEADWALL FOR 42" CIRCULAR PIPE-1 LINE	2.000	EA		
7027010	DESIGN,DETAIL AND CONSTRUCT RETAINING WALL	400.000	SF		
7031100	REINF. STEEL FOR STRUCTURES (ROADWAY)	57,107.000	LB		
7141123	18" RC PIPE CUL.-CLASS IV	376.000	LF		
7141133	18" RC PIPE CUL.-CLASS V	880.000	LF		
7141124	24" RC PIPE CUL.-CLASS IV	216.000	LF		
7141125	30" RC PIPE CUL.-CLASS IV	160.000	LF		
7141126	36" RC PIPE CUL.-CLASS IV	320.000	LF		
7141887	24" REINFORCED CONCRETE PIPE (CLASS V SPECIAL)TRENCHLESS	72.000	LF		
7141889	36" REINFORCED CONCRETE PIPE (CLASS V SPECIAL)TRENCHLESS	184.000	LF		
7143618	18" SMOOTH WALL PIPE	19,840.000	LF		
7143624	24" SMOOTH WALL PIPE	10,576.000	LF		
7143630	30" SMOOTH WALL PIPE	2,120.000	LF		
7143636	36" SMOOTH WALL PIPE	1,008.000	LF		
7143642	42" SMOOTH WALL PIPE	1,104.000	LF		
7149999	CLEANING EXISTING PIPE	4,000.000	LF		
7191050	CATCH BASIN - TYPE 1 SPECIAL	25.000	EA		
7191625	CATCH BASIN -TYPE 17	224.000	EA		
7191650	CATCH BASIN -TYPE 18	11.000	EA		
7192010	DROP INLET (24" X 24")	16.000	EA		
7192020	DROP INLET (24" X 36")	27.000	EA		
7192107	MANHOLE WITH STANDARD 4' X 4' BOX	23.000	EA		
7196000	EXTRA DEPTH OF BOX	579.000	LF		
7199100	BEVELING OF PIPE END	53.000	EA		
7203210	CONCRETE CURB AND GUTTER(2'-0") VERTICAL FACE	36,920.000	LF		
7204100	CONCRETE SIDEWALK(4" UNIFORM)	15,450.000	SY		
7204900	DETECTABLE WARNING MATERIAL	1,050.000	SF		
7205000	CONCRETE DRIVEWAY(6" UNIFORM)	5,039.000	SY		

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
7206000	CONCRETE MEDIAN	4,043.000	SY		
7209000	PEDESTRIAN RAMP CONSTRUCTION	2,100.000	SY		
8041010	RIP-RAP (CLASS A)	1,115.000	TON		
8041020	RIP-RAP (CLASS B)	2,197.000	TON		
8041030	RIP-RAP (CLASS C)	368.000	TON		
8042800	GEOTEXTILE FABRIC FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)	4,058.000	SY		
8051050	PREMASH W-BEAM STRONG POST SYSTEM WSP3	2,625.000	LF		
8051151	MT3 LEADING END TREATMENT TL3	9.000	EA		
8051710	MB TRAILING END TREATMENT	5.000	EA		
8052100	MGS3 GR STANDARD SHOULDER	400.000	LF		
8052200	MGS2C GR BEHIND CURB	1,362.500	LF		
8052210	PREMASH TRAILING W-BEAM TYPE B 12.5'	7.000	EA		
8055800	PREMASH W-BEAM TIGHT CURVED SYSTEM	162.500	LF		
8055801	PREMASH W-BEAM MEDIUM CURVED SYSTEM	200.000	LF		
8057100	PREMASH TYPE T TL3 LEADING 50'	2.000	EA		
8068301	TEMPORARY BARRIER FENCE	1,935.000	LF		
8081000	MOVING ITEM NO. SHT 2C #1, 13 & 15	NEC.	LS		
8091010	RIGHT OF WAY MARKER(REBAR AND CAP)	310.000	EA		
8091050	RIGHT OF WAY PLAT	NEC.	LS		
8100100	PERMANENT COVER	36.409	ACRE		
8100200	TEMPORARY COVER	18.205	ACRE		
8104005	FERTILIZER (NITROGEN)	3,641.000	LB		
8104010	FERTILIZER (PHOSPHORIC ACID)	3,641.000	LB		
8104015	FERTILIZER (POTASH)	3,641.000	LB		
8105005	AGRICULTURAL GRANULAR LIME	72,818.000	LB		
8109050	SELECTIVE WATERING	271,500.000	GAL		
8109901	MOWING	109.227	ACRE		
8151101	TURF REINFORCEMENT MATTING (TRM) TYPE 1	0.984	MSY		
8151102	TURF REINFORCEMENT MATTING (TRM) TYPE 2	0.025	MSY		
8151111	TEMPORARY EROSION CONTROL BLANKET (CLASS A)	69.558	MSY		

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
8151201	HYDRAULIC EROSION CONTROL PRODUCT (HECP) - TYPE 1	49.000	ACRE		
8151203	HYDRAULIC EROSION CONTROL PRODUCT (HECP) - TYPE 3	42.023	ACRE		
8152004	INLET STRUCTURE FILTER - TYPE F (WEIGHTED)	7,672.000	LF		
8152006	INLET STRUCTURE FILTER- TYPE F (NON-WEIGHTED)	7,672.000	LF		
8152007	SEDIMENT TUBES FOR DITCH CHECKS	8,880.000	LF		
8153000	SILT FENCE	34,734.000	LF		
8153090	REPLACE/REPAIR SILT FENCE	3,474.000	LF		
8154010	CLEANING SILT BASINS	4,556.000	CY		
8154050	REMOVAL OF SILT RETAINED BY SILT FENCE	8,684.000	LF		
8156205	INLET STRUCTURE FILTER - TYPE D1	22.000	EA		
8156215	INLET STRUCTURE FILTER - TYPE D2	43.000	EA		
8156219	INLET STRUCTURE FILTER - TYPE A	504.000	LF		
8156410	AGGREGATE NO.5 OR 57 FOR EROSION CONTROL	324.000	TON		
8156490	STABILIZED CONSTRUCTION ENTRANCE	1,650.000	SY		

INCLUSION ITEM NOT LISTED IN PLANS QUANTITIES. INCLUDED PER BID PACKAGE SECTION I-04C SPECIAL CONDITIONS #3.					
2021000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	NEC.	LS		

Total Cost Subtotal

Widening of US 21 and SC 51
BID SCHEDULE - UTILITY RELOCATION

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid for in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid Item. All costs shall be included in the various pay items in the Bid Schedule or an amount shown as Total Bid Amount for the work shown on the proposed project plans.

ITEM #	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	TOTAL AMOUNT ($)
1052100 SMALL PUBLIC WATER RELOCATION NO. 1 FERN FOREST WATER DETAILS					
F1	3" WATER MAIN	565.00	LF		
F2	3" PVC BALL VALVE W/VALVE BOX	1.00	EA		
F3	CONNECT TO EXISTING 3" WATER MAIN	2	EA		

1052100 SMALL PUBLIC WATER RELOCATION NO. 1 Base Subtotal

1052110 LARGE PUBLIC WATER RELOCATION NO. 1 YORK COUNTY WATER AND SEWER DETAILS					
W1	6" WATER LINE	20.0	LF		
W2	8" WATER LINE	41.0	LF		
W3	12" WATER LINE	4,162.0	LF		
W4	24" WATER LINE	834.0	LF		
W5	2" TAPPING SLEEVE & VALVE	2	EA		
W6	RELOCATE WATER METER	10	EA		
W7	RELOCATE 2" DCV BACKFLOW PREVENTION ASSEMBLY	1	EA		
W8	RELOCATE FIRE HYDRANT	11	EA		
W9	8" LINE STOP WITH BYPASS	2	EA		
W10	WATER SERVICE LINE	167.0	LF		
W11	REMOVE FIRE HYDRANT	1	EA		

1052110 LARGE PUBLIC WATER RELOCATION NO. 1 Base Subtotal

1052110 LARGE PUBLIC SEWER RELOCATION NO. 1 YORK COUNTY WATER AND SEWER DETAILS					
SS1	8" SDR35 PVC FORCE MAIN W/FITTINGS	456.00	LF		
SS2	CONCRETE THRUST BLOCKING	108.40	CY		
SS3	8" LINE STOP WITH TEMP 6" BYPASS PIPING	8	EA		
SS4	8" SANITARY GRAVITY SEWER	1,290.0	LF		
SS5	4' DIA UTILITY MANHOLE	9	EA		

1052110 LARGE PUBLIC SEWER RELOCATION NO. 1 Base Subtotal

Base Bid List and Total

(The base bid of this bid document shall include all costs to provide each line item described to the roads contained within this bid and as outlined in this bid document.)

Roadway Base Bid Subtotal:	$ -
Large Pubic Water and Sewer Base Bid Subtotal *(Pay Item 1052110 & 1052210)*	$ -
Small Pubic Water Base Bid Subtotal *(Pay Item 1052100)*	$ -
Total Cost (Roadway Items + Water & Sewer Items)	$ -
10% for Allowance (Total Cost X 10%):	$ -

Allowance will be for additional services and will only be used if necessary for additional services performed by the Bidder during the Project only after written instructions to do so are received from Owner.

Total Project Bid: $ -

BID FORM

Widening of US 21 Bypass and SC 51

Base Bid List

(The base bid of this bid document shall include all costs to provide each line item described to the roads contained within this bid and as outlined in this bid document.)

Roadway Base Bid Subtotal **$**_____

Large Public Water and Sewer Base Bid Subtotal **$**_____
(Pay Item 1052110 & 1052210)

Small Public Water Base Bid Subtotal **$**_____
(Pay Item 1052100)

Total Cost (Roadway Items + Water & Sewer Items) **$**_____

10% for Allowance (Total Cost X 10%) **$**_____

Total Project Bid: $_____

Attached hereto is a cashier's check on the _____

Bank of _____

or Bid Bond for the sum _____

Dollars (_____),made payable to _____(Owner).

_____ L.S.
(Name of Bidder) (Affix Seal)

_____ L.S.
(Signature of Officer)

_____ L.S.
(Title of Officer)

Address:

P.O. Box_____ Street:_____

City:_____ State, Zip Code:_____

Telephone:_____ Fax:_____

Federal ID#:_____

Email address: _____

Contractor License type: _____ Contractor License number: _____

License status: _____ Expiration: _____

Classification: _____

The full names and residences of persons and firms interested in the foregoing bid, as principals, are as follows:

_____

_____

Name of the executive who will give personal attention to the work:

_____

_____

Attach list of subcontractors as required by Article 13.4 of Information to Bidders.

END OF SECTION

BID BOND

STATE OF SOUTH CAROLINA
COUNTY OF YORK

KNOW ALL MEN BY THESE PRESENTS, that _____

as Principal, and _____, as Surety, a Corporation chartered and existing under the laws of the State of _____, with its principal offices in the City of_____, and authorized to do business in the State of South Carolina are held and firmly bound unto the OWNER, _____

_____ in the penal Sum of _____

_____Dollars ($_____) lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted to the OWNER the accompanying bid, dated _____***, 2025***, for:

York County No 11149-004 SCDOT Proj ID 0042332
Widening of US 21 Bypass and SC 51

NOW, THEREFORE,

A. If said Bid shall be rejected, or

B. If the principal shall not withdraw said Bid within twenty-four (24) hours after date of opening of the same, and shall within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the OWNER in accordance with the Bid as accepted, and give bonds with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract, then the above obligations shall be void and of no effect, otherwise to remain in full force and effect.

C. In the event of the withdrawal of said Bid within the period specified, or the failure to enter into such contract and give such bonds within the time specified, if the principal shall pay the OWNER the difference between the amount specified in said bid and the amount for which the OWNER may procure the required work and supplies, if the latter amount be in excess of the former, then the above obligations shall be void and of no effect, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, the above bounded parties have executed this instrument under their several seals, this ____ day of _____, A.D., *2025,* the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESS: (If Sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

WITNESSES: PRINCIPAL:

_____ _____
Name of Firm

_____ _____
Signature of Authorized Officer
(Affix Seal)

_____
Title

_____
Business Address

_____
City State

WITNESS: SURETY:

_____ _____
Corporate Surety

_____
(Affix Attorney-in-Fact Seal)

_____
Business Address

_____
City State

_____
Name of Local Insurance Agency

CERTIFICATES AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____who signed the said bond on behalf of the principal, was then _____ of said corporation; that I know his signature, and his signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said corporation by authority of its governing body.

_____
(Corporate Secretary Seal)

STATE OF SOUTH CAROLINA
COUNTY OF YORK

Before me, a Notary Public duly commissioned, qualified and acting, personally appeared _____to me well known, who being by me first duly sworn upon oath, says that he is the Attorney-in-Fact, for the _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the Contractor named therein in favor of the OWNER, the _____.

Subscribed and sworn to before me this ____ day of_____, *2025*, A.D.

(Attach Power of Attorney
to original Bid Bond)

_____
Notary Public
State of South Carolina-at-Large

My Commission Expires:_____

END OF SECTION

AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, *2025* A.D., by and between the York County Government, party of the first part (hereinafter sometimes called the "OWNER"), and _____, party of the second part (hereinafter sometimes called the "CONTRACTOR").

WITNESSETH: That the parties hereto, for the consideration hereinafter set forth, mutually agree as follows:

1. SCOPE OF THE WORK

1.1. The CONTRACTOR shall furnish all labor, materials, equipment, machinery, tools, apparatus, and transportation and perform all of the Work shown on the Drawings and described in the Specifications entitled:

Pennies for Progress Project 3
Widening of US 21 Bypass and SC 51
York County No 11149-004 SCDOT Proj ID 0042332

as prepared by York County Engineering Department acting as, and in the Contract Documents entitled the ENGINEER, and shall do everything required by this Contract and the other Contract Documents.

2. THE CONTRACT SUM

2.1. The OWNER shall pay to the CONTRACTOR for the faithful performance of the Contract, in lawful money of the United States, and subject to addition and deductions as provided in the Contract Documents, a total sum as follows:

Based upon the prices shown in the Bid heretofore submitted to the OWNER by the CONTRACTOR, a copy of said Proposal being a part of these Contract Documents, the aggregate amount of this Contract (obtained from either the lump sum price, the application of unit prices to the quantities shown in the Bid, or the combination of both) being the sum of

_____

($_____).

3. COMMENCEMENT AND COMPLETION OF WORK

3.1. The CONTRACTOR shall commence Work and the Contract Time will commence to run on the date fixed in the Notice to Proceed.

3.2. The CONTRACTOR shall prosecute the Work with faithfulness and diligence and shall be completed and ready for final payment within ***1095 calendar* days** after commencement date fixed in the Notice to Proceed.

3.3 The CONTRACTOR shall prosecute the Work with faithfulness and diligence and shall be completed with the by the **interim completion date of June, 30 2026** before the school opening for the 2026/2027 school year.

4. CONTRACTOR'S ACCEPTANCE OF CONDITIONS

4.1. The CONTRACTOR hereby agrees that, by virtue of submitting a completed Bid including his declarations therein of full satisfaction, knowledge and understanding of the Contract Documents, site conditions (surface and subsurface) and all other conditions affecting the Work, he assumes full responsibility for performance of the Work as required under this Contract. It is expressly agreed that under no circumstances, conditions or situations shall this Contract be more strongly construed against the OWNER than against the CONTRACTOR and his Surety.

4.2. It is understood and agreed that the passing, approval and/or acceptance of any part of the Work or material by the OWNER, ENGINEER, or by any agent or representative, as being in compliance with the terms of this Contract and/or of the Contract Documents, shall not operate as a waiver by the OWNER of strict compliance with the terms of this Contract, and/or the Contract Documents covering said Work; and the OWNER may require the CONTRACTOR and/or his surety to repair, replace, restore and/or make to comply strictly and in all things with this Contract and the Contract Documents any and all of said Work and/or materials which within a period of two years from and after the date of the acceptance of any such Work or material, are found to be defective or to fail in any way to comply with this Contract or with the Contract Documents. This provision shall not apply to materials or equipment normally expected to deteriorate or wear out and become subject to normal repair and replacement before their condition is discovered. Failure on the part of the CONTRACTOR and/or his Surety, immediately after notice to either, to repair or replace any such defective materials and workmanship shall entitle the OWNER, if it sees fit, to replace or repair the same and recover the reasonable cost of such replacement and/or repair from the CONTRACTOR and/or his surety, who shall in any event be jointly and severally liable to the OWNER for all damage, loss and expense caused to the OWNER by reason of the CONTRACTOR's breach of this Contract and/or his failure to comply strictly and in all things with this Contract.

4.3. The CONTRACTOR understands and hereby agrees that the work zone traffic control required to complete the work shall be full included in the Bid and no additional compensation will be made by the OWNER, unless approved and agreed upon by the OWNER sole discretion.

5. LIQUIDATED DAMAGES

5.1. It is mutually agreed that time is of the essence of this Contract and should the CONTRACTOR fail to complete the work within the specified time, or any authorized extension thereof, there shall be deducted from the compensation otherwise to be paid to the CONTRACTOR, and the OWNER will retain the amount of ***Two Thousand, Two Hundred Dollars ($2,200.00)*** per calendar day as fixed, agreed, and liquidated damages for each calendar day elapsing beyond the specified time for **substantial completion** or any authorized extension thereof, which sum shall represent the actual damages which the OWNER will have sustained by failure of the CONTRACTOR to complete the work within the specified time. After substantial completion, if the CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, Contractor shall pay OWNER ***Two Thousand, Two Hundred Dollars ($2,200.00)*** per for each calendar day that expires after the date specified for Final Completion and readiness for final payment until the work is complete and ready for final payment. It being further agreed that said sum is not a penalty, but is the stipulated amount of damages sustained by the OWNER in the event of such default by the CONTRACTOR.

5.2. It is mutually agreed that time is of the essence of this Contract and should the CONTRACTOR fail to complete the work within the specified time, or any authorized extension thereof, there shall be deducted from the compensation otherwise to be paid to the CONTRACTOR, and the OWNER will retain the amount of ***One Thousand, Eight Hundred Dollars ($1,800.00)*** per calendar day as fixed, agreed, and liquidated damages for each calendar day elapsing beyond the specified time for interim completion date for Gold Hill realignment with US 21 or any authorized extension thereof, which sum shall represent the actual damages which the OWNER will have sustained by failure of the CONTRACTOR to complete the work within the specified

time. After substantial completion of the Gold Hill realignment with US 21 , if the CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, Contractor shall pay OWNER ***One Thousand, Eight Hundred Dollars ($1,800.00)*** per for each calendar day that expires after the date specified for interim Completion and readiness for final payment until the work is complete and ready for final payment.

5.3. For the purposes of this Article, the day of final acceptance of the Work shall be considered a day of delay, and the scheduled day of completion of the work shall be considered a day scheduled for production.

6. PARTIAL AND FINAL PAYMENTS

6.1. In accordance with the provisions fully set forth in the General Conditions, and subject to additions and deductions as provided, the OWNER shall pay the CONTRACTOR as follows:

6.1.1. Within 30 days after receipt by the OWNER of the CONTRACTOR's request for partial payment, the OWNER shall make partial payments to the CONTRACTOR, on the basis of the estimate of Work as approved by the ENGINEER, for work performed during the preceding calendar month, less five percent (5%) of the amount of such estimate which is to be retained by the OWNER until all Work has been performed strictly in accordance with this Agreement and until such Work has been accepted by the OWNER.

6.1.2. Upon submission by the CONTRACTOR of evidence satisfactory to the OWNER that all payrolls, material bills and other costs incurred by the CONTRACTOR in connection with the construction of the Work have been paid in full, including all retainage to subcontractors on the project, and also after all guarantees that may be required in the specifications have been furnished and are found acceptable by the OWNER, final payment on account of this Agreement shall be made within sixty (60) days after completion by the CONTRACTOR of all Work covered by this Agreement and acceptance of such Work by the OWNER.

6.1.3. Retainage will be released in full at Final Completion.

7. ADDITIONAL BOND

7.1. It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Performance and Payment Bonds hereto attached for its faithful performance, the OWNER shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bond(s) ceases to be adequate to cover the performance of the Work, the CONTRACTOR shall, at his expense, and within three days after the receipt of notice from the OWNER to do so, furnish an additional bond or bonds, in such form and amount, and with such sureties as shall be satisfactory to the OWNER. In such event, no further payment to the CONTRACTOR shall be deemed due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the OWNER.

8. CONTRACT DOCUMENTS

8.1. The Contract Documents, as stated in the Instructions to Bidders, including this Project Manual and General Conditions, and the accompanying Contract Drawings, shall form the Contract and are as fully a part of this Contract as if herein repeated.

IN WITNESS WHEREOF the parties hereto have executed this Agreement on the day and date first above written in three (3) counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original Contract.*

Owner	Contractor
By:_____	By:_____
[Corporate Seal]	[Corporate Seal]
Attest:_____	Attest:_____
Address for giving notices:	Address for giving notices:
	License No._____
	Agent for service of process:_____

(*) In the event that the CONTRACTOR is a Corporation, a certificate of resolution of the Board of Directors of the Corporation, authorizing the officer who signs the Contract to do so in its behalf shall be completed and submitted with this form.

END OF SECTION

GENERAL CONDITIONS

1. DEFINITIONS

1.1. Whenever used in any of the Contract Documents, the following meanings shall be given to the terms herein defined:

1.1.1. *Addendum* or *Addenda* - Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the Contract Documents.

1.1.2. *Agreement* - The written contract between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

1.1.3. *Application for Payment* - The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

1.1.4. *Bid* - The offer or proposal of the bidder on the prescribed Bid Form setting forth the prices for the Work to be performed.

1.1.5. *Bidder* - One who submits a Bid directly to OWNER, as distinct from sub-bidder, who submits a Bid to a Bidder.

1.1.6. *Bidding Documents* - The Invitation for Bids, Instruction to Bidders, the Bid Form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

1.1.7. *Bonds* - Performance and Indemnity and Payment Bonds and other instruments of security.

1.1.8. *Change Order* - A document recommended by ENGINEER, which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

1.1.9. *Contract Documents* - Executed Agreement, Addenda (if any), Invitation for Bids, Instructions to Bidders, Signed Copy of Bid, Bid Guarantee, Statement of Bidder's Qualifications, Performance and Indemnity Bond, Payment Bond, Certification of Insurance, General Conditions, Supplemental Conditions (if any), Special Conditions (if any), Technical Specifications, and Drawings (as listed in the Index of Drawings).

1.1.10. *Contract Price* - The moneys payable by OWNER for completion of the Work in accordance with the Contract Documents.

1.1.11. *Contract Times* - The numbers of days or the dates stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the work so that it is ready for final payment as evidenced by ENGINEER's written records.

1.1.12. *CONTRACTOR* - The person, firm, or corporation entering into Contract with the OWNER to construct and install the improvements embraced in this Contract.

1.1.13. *Defective* - An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or had been damaged prior to ENGINEER's recommendation or final payment.

1.1.14. *Drawings* - The construction drawings which graphically show the scope, extent, and character of the Work to be furnished and performed by the CONTRACTOR and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents. These Drawings are listed in the Index of Drawings.

1.1.15. *ENGINEER* – The person, firm or corporation serving the OWNER with Engineering services, his successors, or any other person or persons, employed by said OWNER for the purpose of directing or having charge of the work embraced in this Contract.

1.1.16. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, ordinances codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.

1.1.17. *Liens* - Liens, charges, security interests or encumbrances upon project funds, real property or personal property.

1.1.18. *Local Government* - York County, South Carolina, within which the Project Areas are situated.

1.1.19. *Milestone* - A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

1.1.20. *Notice of Award* - The written notice by OWNER to the apparent successful Bidder stating that upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the agreement.

1.1.21. *Notice to Proceed* - A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform, CONTRACTOR's obligations under the Contract Documents.

1.1.22. O*WNER* - The York County Government, which is authorized to undertake this Contract.

1.1.23. *Partial Utilization* - Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

1.1.24. *Project* - The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

1.1.25. *Project Area* - The area within which are the specified limits of the improvements to be constructed in whole or in part under this Contract.

1.1.26. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

1.1.27. *Resident Project Representative* – The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

1.1.28. *Samples* - Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

1.1.29. *Site* – Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of the CONTRACTOR.

1.1.30. *Shop Drawings* - All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

1.1.31. S*pecial Conditions* - The part of the Contract Documents that amends or supplements the Technical Specifications.

1.1.32. *Subcontractor* - An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

1.1.33. *Substantial Completion* - The Work (or specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER's definitive certification of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by ENGINEER's written recommendation of final payment. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

1.1.34. *Successful Bidder* - The lowest, qualified, responsible and responsive Bidder to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

1.1.35. *Supplier* – A manufacturer, fabricator, supplier, distributor, material man or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

1.1.36. *Supplemental Conditions* - The part of the Contract Documents that amends or supplements these General Conditions.

1.1.37. *Technical Specifications* - The part of the Contract Documents that describes, outlines, and stipulates: the quality of materials, equipment and systems to be furnished; the quality of workmanship required; and the methods to be used in carrying out the construction work to be performed under this Contract.

1.1.38. *Underground Facilities* - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.

1.1.39*. Unit Price Work* - Work to be paid for on the basis of unit prices.

1.1.40. *Work* - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing and incorporating materials and equipment into the construction, and furnishing, installing and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

1.2 Other technical terms not specifically defined within the Contract Documents shall have the meanings given in AIA Document "Glossary of Construction Industry Terms," current edition. Technical terms not defined as above and used to describe items of the Work, and which so applied have a well-known technical or trade meaning, shall be deemed to have such recognized meaning.

2. CONTRACTOR'S OBLIGATIONS

2.1. All work shall be done in strict accordance with the Contract Documents. Observations, construction reviews, tests, recommendations or approvals by the ENGINEER or persons other than the CONTRACTOR, shall in no way relieve the CONTRACTOR of his obligations to complete all work in accordance with the Contract Documents. All work shall be done under the direct supervision of the CONTRACTOR. The CONTRACTOR shall be responsible for construction means, methods, techniques, and procedures, and for providing a safe place for the performance of the work by the CONTRACTOR, Subcontractors, suppliers, and their employees and for access, use, work, or occupancy by all authorized persons.

3. LANDS BY CONTRACTOR

3.1. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application, but specifically related to the use of the Site with which the CONTRACTOR must comply in performing work.

3.2. Any land and access thereto not specifically shown to be furnished by the OWNER that may be required for temporary construction facilities or for storage of materials and equipment shall be provided by the CONTRACTOR with no liability to the OWNER. The CONTRACTOR shall confine his apparatus and storage to such additional areas as he may provide at his expense.

3.3. The CONTRACTOR shall not enter upon private property for any purpose without obtaining permission, and he shall be responsible for the preservation of all public property, trees, monuments, structures and improvements, along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits, and other underground structures, and shall protect carefully from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed.

4. SURVEYS BY CONTRACTOR

4.1. Based upon the Construction Documents and any additional information provided by the OWNER, the CONTRACTOR shall develop and make all detailed surveys necessary for construction, including working points, lines and elevations.

5. PUBLIC UTILITIES

5.1. The elevation and location of all public utilities shown on the Drawings were taken from existing public records. It shall be the duty of the CONTRACTOR to make final and exact determination of the location and extent of all utilities and he will be liable for any expense resulting from damage to them.

6. SUPERINTENDENT

6.1. A qualified superintendent, who is acceptable to the OWNER, shall be maintained on the Work and shall give efficient supervision to the Work until its completion. The superintendent shall have full authority to act in behalf of the CONTRACTOR, and all instruction given to the superintendent shall be considered as given to the CONTRACTOR. It shall be the responsibility of this CONTRACTOR's superintendent to coordinate the Work of all the Subcontractors. The superintendent shall be present on the site at all times required to perform adequate supervision and coordination.

7. SUBCONTRACTORS

7.1. At the time set forth in the Contract Documents or when requested by the OWNER, the CONTRACTOR shall submit in writing for review of the OWNER the names of the Subcontractors proposed for the work. Subcontractors may not be changed except at the request or with the approval of the OWNER. The CONTRACTOR is responsible to the OWNER for the acts and deficiencies of his Subcontractors, and of their direct and indirect employees, to the same extent as he is responsible for the acts and deficiencies of his employees. The Contract Documents shall not be construed as creating any contractual relation between any Subcontractor and the OWNER. The CONTRACTOR shall bind every Subcontractor by the terms of the Contract Documents.

8. ASSIGNMENTS

8.1. The CONTRACTOR shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder without written consent of the OWNER. In case the CONTRACTOR assigns all or any part of any moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

9. MUTUAL RESPONSIBILITY OF CONTRACTORS

9.1. If through acts of neglect on the part of the CONTRACTOR, any other CONTRACTOR or any Subcontractor shall suffer loss or damage on the work, the CONTRACTOR agrees to settle with such other CONTRACTOR or Subcontractor by agreement or arbitration if such other CONTRACTOR or Subcontractor will so settle. If such other CONTRACTOR or Subcontractor shall assert any claim against the OWNER on account of any damage alleged to have been sustained, the OWNER shall notify the CONTRACTOR, who shall indemnify and save harmless the OWNER against any such claim.

10. ORAL AGREEMENTS

10.1. No oral order, objection, claim or notice by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents, and none of the provisions of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

11. MATERIALS, SERVICE AND FACILITIES

11.1. It is understood that except as otherwise specifically stated in the Contract Documents, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, gas, light, power, transportation, superintendence, taxes, insurance, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

11.2. Any work necessary to be performed after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the OWNER.

12. MATERIALS AND EQUIPMENT

The materials and equipment installed in the work shall meet the requirements of the Contract Documents and no materials or equipment shall be ordered until reviewed by the ENGINEER. The CONTRACTOR shall furnish all materials and equipment not otherwise specifically indicated or provided by the OWNER.

The CONTRACTOR shall guarantee all materials and equipment he provides in accordance with Section 16 of these GENERAL CONDITIONS.

12.1. Substitutions: In order to establish standards of Quality, the ENGINEER has, in the detailed Specifications, referred to certain products by name and catalog number without consideration of possible substitute or “or equal” items. This procedure is not to be construed as eliminating from competition other products of equal or better quality by other manufacturers where fully suitable in design.

12.1.1. Whenever it is indicated in the Drawings or specified in the specifications that a substitute or “or-equal” item of material or equipment may be furnished or used by the CONTRACTOR, application for such acceptance will not be considered by the ENGINEER until after the Effective Date of the agreement. The CONTRACTOR shall furnish the complete list of proposed desired substitutions, together with such engineering and catalog data as the ENGINEER may require. All proposals for substitutions shall be submitted in writing by the General Contractor and not by individual trades or material suppliers. The ENGINEER will review proposed substitutions and make his recommendations in writing within reasonable time.

12.1.2. The CONTRACTOR shall abide by the ENGINEER's recommendation when proposed substitute materials or items of equipment are not recommended for installation and shall furnish the specified material or item of equipment in such case.

12.2. Space Requirements: It shall be the responsibility of the CONTRACTOR to insure that materials and equipment to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall order such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Contract Documents.

12.3. Arrangement: Where equipment requiring different arrangement of connections from those shown is approved, it shall be the responsibility of the CONTRACTOR to install the equipment to operate properly, and in harmony with the intent of the work required by such arrangement.

12.4. Unacceptable Materials and Equipment: Materials and equipment which do not conform to the requirements of the Contract Documents, or are not equal to samples reviewed by the ENGINEER, or are in any way unsatisfactory or unsuited to the purpose for which they are intended, shall not be furnished nor installed.

12.5. Storage: Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground and/or they shall be placed under cover. Stored materials and equipment shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the property owner or leasee. Materials, equipment, construction machinery, fuel, and oils shall not be stored or parked within the drip-line of any trees in or adjacent to the project site or additional off-site easements and right-of-ways.

12.6. Manufacturer's Directions: Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer.

13. INSPECTION AND TESTING OF MATERIALS

13.1. Unless otherwise specifically provided for in the specifications, the inspection and testing of material and finished articles to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by the OWNER. The cost of such inspection and testing shall be paid by the CONTRACTOR. The CONTRACTOR shall furnish evidence satisfactory to the OWNER that the material and finished articles have passed the required tests prior to the incorporation of such materials

and finished articles in the work. The CONTRACTOR shall promptly segregate and remove rejected material and finished articles from the site of the work.

14. SAMPLES

14.1. All samples called for in the Specifications or required by the ENGINEER shall be furnished by the CONTRACTOR and shall be submitted to the ENGINEER for his review. Samples shall be furnished so as not to delay fabrication, allowing the ENGINEER reasonable time for the consideration of the samples submitted.

14.1.1. Samples for Tests: CONTRACTOR shall furnish such samples of material as may be required for examination and test. All samples of materials for tests shall be taken according to standard methods or as provided in the Contract Documents.

14.1.2. CONTRACTOR's Guaranty: All samples shall be submitted by the CONTRACTOR with a covering letter indicating that such samples are recommended by the CONTRACTOR for the service intended and that the CONTRACTOR's Guaranty will fully apply.

14.1.3. All materials, equipment and workmanship shall be in accordance with samples guaranteed by the CONTRACTOR and reviewed by the ENGINEER.

15. SHOP DRAWINGS

15.1. The CONTRACTOR shall provide shop drawings, setting schedules and such other drawings as may be necessary for the prosecution of the work in the shop and in the field as required by the Drawings, Specifications or the ENGINEER's instructions. Deviations from the Drawings and Specifications shall be called to the attention of the ENGINEER at the time of the first submission of shop drawings and other drawings for consideration. The ENGINEER's review of any drawings shall not release the CONTRACTOR from responsibility for such deviations. Shop drawings shall be submitted according to a schedule prepared jointly by the CONTRACTOR and the ENGINEER.

15.1.1. CONTRACTOR's Certification: When submitted for the ENGINEER's review, shop drawings shall bear the CONTRACTOR's certification that he has reviewed, checked and approved the shop drawings, that they are in harmony with the requirements of the Project and with the provisions of the Contract Documents, and that he has verified all field measurements and construction criteria, materials, catalog numbers and similar data. CONTRACTOR shall also certify that the work represented by the shop drawings is recommended by the CONTRACTOR and the CONTRACTOR's Guaranty will fully apply.

16. GUARANTY

16.1. The CONTRACTOR shall guarantee all materials and equipment furnished and work performed for a period of one years from the date of final payment of the work.

16.1.1. The Performance and Indemnity Bond shall remain in full force and effect during the guaranty period.

16.1.2. Correction of faulty work after final payment shall be as provided in Paragraph 41.

17. INSURANCE

17.1. The CONTRACTOR shall not commence any work until he obtains, at his own expense, all required insurance. Such insurance must have the approval of the OWNER as to the limit, form, and amount. The CONTRACTOR will not permit any Subcontractor to commence work on this project until such Subcontractor has complied with the same insurance requirements.

Types: The types of insurance the CONTRACTOR is required to obtain
and maintain for the full period of the Contract will be: Workmen's Compensation Insurance, Automobile and Comprehensive General Liability Insurance as detailed in the following portions of this specification.

17.1.2. Evidence: As evidence of specified insurance coverage, the OWNER may, in lieu of actual policies, accept certificates issued by the insurance carrier showing such policies in force for the specified period. Each policy or certificate will bear an endorsement or statement waiving right of cancellation or reduction in coverage within ten days' notice in writing to be delivered by registered mail to the OWNER. Should any policy be cancelled before final payment by the OWNER to the CONTRACTOR and the CONTRACTOR fails immediately to procure other insurance as specified, the OWNER reserves the right to procure such insurance and to deduct the cost thereof from any sum due the CONTRACTOR under this Contract.

17.1.3. Adequacy of Performance: Any insurance bearing on adequacy of performance shall be maintained after completion of the project for the full guaranty period. Should such insurance be cancelled before the end of the guaranty period and the CONTRACTOR fails immediately to procure other insurance as specified, the OWNER reserves the right to procure such insurance and to charge the cost thereof to the CONTRACTOR.

17.1.4. Payment of Damages: Nothing contained in these insurance requirements is to be construed as limiting the extent of the CONTRACTOR's responsibility for payment of damages resulting from his operations under this Contract.

18. WORKMEN'S COMPENSATION INSURANCE

18.1. Before the Agreement between the OWNER and the CONTRACTOR is entered into, the CONTRACTOR shall submit written evidence that he and all Subcontractors have obtained, for the period of the Contract, full Workman's Compensation Insurance coverage for all persons whom they employ or may employ in carrying out the work under this Contract. This insurance shall be in strict accordance with the requirements and statutory limits of the most current and applicable South Carolina Workman's Compensation Insurance Laws.

19. COMPREHENSIVE GENERAL LIABILITY AND AUTOMOBILE INSURANCE

19.1. Before commencement of the work, the CONTRACTOR shall submit written evidence that he and all his Subcontractors have obtained for the period of the Contract, full Comprehensive General Liability Insurance and automobile coverage. This coverage shall provide for both bodily injury and property damage.

19.1.1. Comprehensive General Liability Insurance shall include coverage for bodily injury, sickness or disease, death, or property damage arising directly or indirectly out of or in connection with the performance of work under this Contract, and shall provide for a combined single limit of not less than one million ($1,000,000) dollars for all damages arising out of bodily injury, sickness or disease, death, or property damage for each occurrence.

19.1.2. Automobile insurance shall include coverage for bodily injury and property damage arising directly or indirectly out of or in connection with the performance of work under this Contract, and shall provide for a combined single limit of not less than one million ($1,000,000) dollars for all damages arising out of bodily injury or property damage for each occurrence.

19.1.3. Indemnity: Included in such insurance will be contractual coverage sufficiently broad to insure the provisions of Paragraph 20.

20. INDEMNITY

20.1. The CONTRACTOR shall hold harmless, indemnify and defend the OWNER, it's successors and assigns, the ENGINEER, their consultants, and each of their officers and employees and agents, from any and all liability claims, losses or damage arising or alleged to arise from the performance of the work described herein, but not including the sole negligence of the OWNER or the ENGINEER.

21. PATENTS AND ROYALTIES

21.1. If any design, device, material or process covered by letters, patent or copyright is used by the CONTRACTOR, he shall provide for such use by legal agreement with the OWNER of the patent or a duly authorized licensee of such OWNER, and shall save harmless the OWNER, and the ENGINEER, from any and all loss or expense on account thereof, including its use by the OWNER.

22. PERMITS

22.1. All permits and licenses necessary for the prosecution of the work shall be secured and paid for by the CONTRACTOR. This shall include all Business Licenses required by the Local Government.

23. LAWS TO BE OBSERVED

23.1. The CONTRACTOR shall give all notices and comply with all Federal, State and local laws, ordinances and regulations in any manner affecting the conduct of the work, and all such orders and decrees as exist, or may be enacted by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless the OWNER its successors and assigns, the ENGINEER, their consultants, and each of their officers and employees and agents against any claim or liability arising from, or based on, the violation of any such law, ordinance, regulation, order or decree, whether by himself or his employees.

24. WARNING SIGNS AND BARRICADES

24.1. The CONTRACTOR shall provide adequate signs, barricades, red lights and watchmen and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction and shall be placed and illuminated at night as to show in advance where construction, barricades, or detours exist.

25. PUBLIC CONVENIENCE

25.1. The CONTRACTOR shall at all times so conduct his work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property. No road or street shall be closed to the public except with permission of the proper authorities. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed.

26. SAFETY

26.1. The CONTRACTOR shall be solely and completely responsible for the conditions of the job site, including safety of all persons and property affected directly or indirectly by his operation during the performance of the work. This requirement will not be limited to normal working hours but will only apply continuously 24 hours per day until written acceptance of the work by the OWNER and shall not be limited to normal working hours.

26.2. The ENGINEER's construction reviews of the CONTRACTOR's performance is not intended to include review of the adequacy of the CONTRACTOR's safety measures in, on, or near the construction site.

27. NOTICE TO PROCEED

27.1. Following the execution of the Contract by the OWNER and the CONTRACTOR, written Notice to Proceed with the work shall be given by the OWNER to the CONTRACTOR. The CONTRACTOR shall begin and shall prosecute the work regularly and uninterruptedly thereafter (except as provided for herein) with such force as to secure the completion of the work within the Contract Time.

28. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

28.1. It is hereby understood and mutually agreed, by and between the CONTRACTOR and the OWNER, that the date of beginning and the time for completion as specified in the Contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the Notice to Proceed.

28.2. The CONTRACTOR agrees that said work shall proceed regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

28.3. If said CONTRACTOR shall neglect, fail, or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this Contract, to pay to the OWNER the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the CONTRACTOR shall be in default after the time stipulated in the Contract for completing the work.

28.4. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER would sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.

28.5. It is further agreed that time is of the essence of each and every portion of this Contract and of the Specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. PROVIDED, that the CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to the following:

28.5.1. Any preference, priority or allocation order duly issued by the Federal or State Government.

28.5.2. Unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, flood, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather; and

28.5.3. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsection 28.5.1. and 28.5.2. of this article:

PROVIDED, FURTHER, that the CONTRACTOR shall, within 10 days from the beginning of such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the contract, notify the OWNER, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter, and grant such extension of time as the OWNER shall deem equitable and just.

29. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

29.1. Immediately after execution and delivery of the contract, and before the first partial payment is made, the CONTRACTOR shall deliver to the OWNER an estimated construction progress schedule in a form satisfactory to the OWNER, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents.

30. EXTENSION OF CONTRACT TIME

30.1. A delay beyond the CONTRACTOR's control occasioned by an Act of God, by act or omission on the part of the OWNER or by strikes, lockouts, fire, etc., may entitle the CONTRACTOR to any extension of time in which to complete the work as agreed by the OWNER, provided, however, that the CONTRACTOR shall immediately give written notice to the OWNER of the cause of such delay.

30.2. Act of God shall mean an earthquake, flood, cyclone, or other cataclysmic phenomenon. Storms of normal intensity for the locality shall not be construed as an Act of God and no reparation shall be made to the CONTRACTOR for damages to the work resulting there from.

31. EXTRA WORK

31.1. New and unforeseen items of work found to be necessary, and which cannot be covered by any item or combination of items for which there is a Contract price, shall be classed as Extra Work. It shall be the responsibility of the CONTRACTOR to identify necessary work items classed as Extra Work and for which no previous contract price has been arranged and advise the ENGINEER and the OWNER of the need for the aforesaid necessary Extra Work. The CONTRACTOR shall do such Extra Work and furnish such materials as may be required for the proper completion or construction of the whole work contemplated, upon written order from the OWNER as approved by the ENGINEER. In the absence of such written order, no claim for Extra Work shall be considered.

31.2. Extra Work shall be performed in accordance with these Contract Documents where applicable and work not covered by such shall be done in accordance with the best construction practice and in a workmanlike manner.

31.3. Extra Work required in an emergency to protect life and property shall be performed by the CONTRACTOR as required.

32. CLEANING UP

32.1. The CONTRACTOR shall at all times, keep the premises clean and shall remove from the OWNER's property, and from all public and private property, temporary structures, rubbish, waste materials resulting from his operation or caused by his employees, and all surplus materials, leaving the site smooth, clean and true to line and grade and in the same condition as existed prior to the work performed by the CONTRACTOR or his Subcontractors and as approved by the OWNER. Failure to maintain a clean project site or to complete clean-up of the project site at the completion of the work shall be cause for the OWNER to perform the necessary clean-up and the costs thereof shall be charged to the CONTRACTOR.

33. REQUEST FOR PAYMENT

33.1. The CONTRACTOR may submit to the OWNER periodically, but not more than once each month, a Request for Payment for work done and materials delivered to and stored on the site. The CONTRACTOR shall furnish the OWNER all reasonable information required for obtaining the necessary data relative to the progress and execution of the work. Payment for materials stored on the site will be conditioned upon evidence submitted to establish the OWNER's title to such materials. Each Request for Payment shall be computed on the basis of work completed on all items listed in the Detailed Breakdown of Contract (or on unit prices, as the case may be), less retainage as stated in Special Provisions until final completion and acceptance of the work and less previous payments.

34. ENGINEER'S ACTION ON REQUEST FOR PAYMENT

34.1. All CONTRACTOR's Requests for Payment shall be referred to the ENGINEER for his review and, within a reasonable period, the ENGINEER shall:

34.1.1. Recommend payment by the OWNER of the Request for Payment as submitted.

34.1.2. Recommend payment by the OWNER of such other amount as the ENGINEER shall consider as due the CONTRACTOR, informing the OWNER and the CONTRACTOR in writing of his reasons for recommending the amended amount.

34.1.3. Recommend to the OWNER that payment of the Request for Payment be withheld, informing the CONTRACTOR and the OWNER in writing of his reasons, for so recommending.

35. OWNER'S ACTION ON REQUEST FOR PAYMENT

35.1. Within thirty days after receipt of a Request for Payment from the CONTRACTOR, the OWNER shall:

35.1.1. Pay the Request for Payment as recommended by the ENGINEER.

35.1.2. Pay such other amount, in accordance with Paragraph 36, as he shall decide is due the CONTRACTOR, informing the CONTRACTOR and the ENGINEER in writing of this reasons for paying the amended amount.

35.1.3. Withhold payment in accordance with Paragraph 36, informing the CONTRACTOR and the ENGINEER of his reasons for withholding payment.

36. OWNER'S RIGHT TO WITHHOLD PAYMENT OF A REQUEST FOR PAYMENT

36.1. The OWNER may withhold payment, in whole or in part, of a Request for Payment to the extent necessary to protect himself from loss on account of any of the following:

36.1.1. Defective work.

36.1.2. Evidence indicating the probable filing of claims by other parties against the CONTRACTOR that may adversely affect the OWNER.

36.1.3. Failure of the CONTRACTOR to make payments due to Subcontractors, material suppliers, or employees.

36.1.4. Damage to another CONTRACTOR.

37. PAYMENT FOR EXTRA WORK

37.1. Written notice of claims for payment for Extra Work shall be given by the CONTRACTOR within ten days after receipt of instructions from the OWNER to proceed with the Extra Work and also before any work is commenced, except in emergency endangering life or property. No claim shall be valid unless so made. In all cases, the CONTRACTOR's itemized estimate sheets showing all labor and material shall be submitted to the OWNER. The OWNER's order for Extra Work shall specify any extension of the Contract Time and one of the following methods of payment:

37.1.1. Unit prices or combination of unit prices which formed the basis of the original Contract.

37.1.2. A lump sum based on the CONTRACTOR's estimate and accepted by the OWNER.

37.1.3. Actual cost plus 15 percent for overhead and profit. Actual costs are defined as follows:

37.1.3.1. Labor costs, including time of foreman while engaged directly upon extra work.

37.1.3.2. Labor insurance and taxes.

37.1.3.3. Materials and supplies actually used on the work.

37.1.3.4. Associated General Contractors of America standard rental rates on each piece of equipment having a value in excess of $50.00. Equipment and tools of lesser value are considered "small tools" and, as such, are considered to be part of overhead.

38. ACCEPTANCE AND FINAL PAYMENT

38.1. When the CONTRACTOR has completed the work in accordance with the terms of the Contract Documents, he shall certify completion of the work to the OWNER and submit a final Request for Payment, which shall be the Contract Amount plus all approved additions, less all approved deductions and less previous payments made. The CONTRACTOR shall furnish evidence that he has fully paid all debts for labor, materials, and equipment incurred in connection with the work, and upon acceptance by the OWNER, the OWNER will release the CONTRACTOR except as to the conditions of the Performance and Indemnity Bond and the Labor and Material Payment Bond, any legal rights of the OWNER, required guaranties, and Correction of Faulty Work after Final Payment, and will pay the CONTRACTOR's final Request of Payment. The CONTRACTOR shall allow sufficient time between the time of completion of the work and approval of the final Request for Payment for the ENGINEER to assemble and check the necessary data.

38.1.1. Release of Liens: The CONTRACTOR shall deliver to the OWNER a complete release of all liens arising out of this Contract before the retained percentage or before the final Request for Payment is paid. If any liens remains unsatisfied after all payments are made, the CONTRACTOR shall refund to the OWNER such amounts as the OWNER may have been compelled to pay in discharging such liens including all costs and a reasonable attorney's fees.

39. OWNER'S RIGHT TO TERMINATE AGREEMENT

39.1. The OWNER shall have the right to terminate his agreement with the CONTRACTOR after giving ten days' written notice of termination to the CONTRACTOR in the event of any default by the CONTRACTOR.

39.1.1 Default by CONTRACTOR: It shall be considered a default by the CONTRACTOR whenever he shall:

39.1.1.1. Declare bankruptcy, become insolvent, or assign his assets for the benefit of his creditors.

39.1.1.2. Disregard or violate provisions of the Contract Documents or fail to prosecute the work according to the agreed Schedule of Completion, including extensions thereof.

39.1.1.3. Fail to provide a qualified superintendent, competent workmen or Subcontractors, or proper materials, or fail to make prompt payment thereof.

39.1.2. Completion by the OWNER: In the event of termination of the Agreement by the OWNER because of default by the CONTRACTOR, the OWNER may take possession of the work and of all materials and equipment thereon and may finish the work by whatever method and means he may select.

40. TERMINATION OF CONTRACTOR'S RESPONSIBILITY

40.1. The Contract will be considered complete when all work has been finished and the project accepted in writing by the OWNER. The CONTRACTOR's responsibility shall then cease, except as set forth in his Performance and Indemnity Bond, as provided in Paragraph 16, Guaranty, and as provided in Paragraph 41, Correction of Faulty Work After Final Payment.

41 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT

41.1. The making of the final payment by the OWNER to the CONTRACTOR shall not relieve the CONTRACTOR of responsibility for faulty materials or workmanship. The CONTRACTOR shall promptly replace any such defects, as determined by the ENGINEER, discovered within two years from the date of final payment of the work.

42. INSPECTION

42.1. The authorized representatives of the ENGINEER and OWNER shall be permitted to inspect all materials, workmanship, and other relevant project records and data. Materials and workmanship will be subject to the approval of the OWNER and/or his representative.

43. CORRECTION OF WORK

43.1. All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be, at all times and places, subject to the inspection of the ENGINEER who shall be the final judge of the quality and suitability of the work, materials, process of manufacturer, and methods of construction for the purposes for which they are used. Should they fail to meet his approval, they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the CONTRACTOR at his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the ENGINEER, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract hereunder shall be reduced by such amount as in the judgment of the ENGINEER shall be equitable.

44. SUBSURFACE CONDITIONS FOUND DIFFERENT

44.1. Should the CONTRACTOR encounter subsurface and/or latent conditions at the site materially differing from those shown on the Plans or indicated in the Specifications, he shall immediately give notice to the ENGINEER of such conditions before they are disturbed. The ENGINEER will thereupon promptly investigate the conditions, and if he finds and so determines that they materially differ from those shown on the Plans or indicated in the Specifications, he will at once make such changes in the Plans

and/or Specifications, as he may find necessary. Any increase or decrease of cost resulting from such changes are to be adjusted in the manner provided in Paragraph 37 of the General Conditions.

45. CONTRACT SECURITY

45.1. The CONTRACTOR shall furnish a Performance Indemnity Bond and Payment Bond (forms attached) in an amount at least equal to 100% of the contract prices as security for the faithful performance of this Contract, as the security for the payment of all persons performing labor on the project under this Contract, and furnishing materials in connection with this Contract. The Performance and Indemnity Bond and the Payment Bond may be in one or in separate instruments in accordance with local law. Before final acceptance, each bond must be approved by the OWNER.

46. DISPUTE RESOLUTION

46.1 OWNER and CONTRACTOR agree to negotiate all disputes between them in good faith prior to exercising their rights under law.

46.2 Any claim, dispute or other matter in question arising from or related to this Agreement or the performance or breach thereof, which cannot be resolved through direct discussions between parties shall be subject to mediation as a condition precedent to the institution of legal or equitable proceedings by either party, and only after both parties have completed the mediation process.

46.3 Through mediation, CONTRACTOR and OWNER shall endeavor to resolve claims, disputes, or other matters in question between them by mediation in an informal process in which a third-party mediator facilitates discussion between the parties. The parties may designate a mediator mutually agreeable to both CONTRACTOR and OWNER to conduct the mediation. If the parties are unable to agree upon a mediator, mediation shall be conducted in accordance with the mediation provision of the South Carolina Circuit Court Alternative Dispute Resolution Rules. The mediation shall be conducted in York County, South Carolina. A request for mediation shall be filed in writing with the other party to this Agreement, and legal or equitable proceedings shall be stayed pending mediation for a period of sixty (60) days from the date of the request for mediation is filed, unless stayed for a longer period of time by agreement of the parties or court order. The cost of a third-party mediator will be shared equally by the parties.

46.4 If the parties reach an agreement during the mediation process, they shall reduce the agreement to writing and sign it with their attorneys, if any. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

46.5 In any action or proceedings to enforce or interpret any provision of this Agreement, or where any provision herein is validity asserted as a defense, each Party shall bear its own attorney fees, costs, and expenses.

47. CONTRACTOR'S/SUBCONTRACTOR'S PERSONNEL

47.1 Contractor warrants that all Contractor/Subcontractor personnel engaged in the performance of Work under this Contract shall possess sufficient experience and/education to perform the services requested by the County. County expressly retains the right to have any of the Contractor/Subcontractor personnel removed from performing services under this Contract. Contractor shall effectuate the removal of the specified Contractor/Subcontractor personnel from providing any services to the County under this Contract within one business day of notification by County. County shall submit the request in writing to the Contractor's Project Manager. The County is not required to provide any reason, rationale or additional factual information if it elects to request any specific Contractor personnel be removed from performing services under this Contract.

END OF SECTION

SPECIAL CONDITIONS

1. All work performed by the Contractor must be in accordance with the South Carolina Department of Transportation (SCDOT) 2007 Standard Specification for Highway Construction and SCDOT Traffic Signals Material Specifications (latest edition), unless directed otherwise in the plans or by the Engineer. A full version of the 2007 Edition SCDOT Standard Specifications For Highway Construction may be viewed or downloaded on SCDOT's website at www.scdot.org.

2. All work performed by the Contractor shall be constructed using the SCDOT'S Current Standard Drawings with all updates effective at the time of the letting, unless directed otherwise in the plans or by the Engineer. The Standard Drawings are available for download on SCDOT's website www.scdot.org. All drawings that are updated are labeled with their effective letting date in red.

3. There are no known underground storage tanks (UST) within the (present/new) right-of-way. Phase I and Phase II Environmental Site Assessments were conducted for the project and are attached in the Appendix. Seven (7) LUST sites are located adjacent to the subject project. It is the Contractor's responsibility to investigate the project site prior to bidding to determine all structures and obstructions requiring removal. In accordance with Section 202 of SCDOT Specifications, payment for the removal and satisfactory disposal of all underground storage tanks shall be included in the lump sum bid item of 2021000 "Removal of Structures and Obstructions" and includes all materials, labor, equipment, tools, supplies, transportation, removal & disposal of soil and all other incidentals necessary to complete the work. For bidding purposes, it is to be assumed that there is one (1) UST in the Lum Sum pay item 2021000. The Contractor shall be paid based on the Lum Sum cost per UST found and removed, or the bid unit price submitted by the contractor multiplied the number of UST actual found and removed within the construction limits. The contractor shall notify the RCE and County of any discovered UST prior to removal and obtain written approval.

   All work shall be performed in accordance with the Department of Health and Environmental Control (DHEC) requirements by contracting personnel certified by DHEC. The Contractor will be required to obtain all permits and provide the required closure reports for all tank removals.

4. The Contractor shall be liable and responsible for payment of fines assessed by any regulatory agency due to non-compliance with applicable permit requirements and/or regulations by the Contractor. In the event that Owner is fined due to non-compliance with permit requirements, the Owner will charge the Contractor the cost of the fine by deducting an equal amount from the next progress pay estimate.

5. In the Bid Proposal Form and Schedule, Division I-Section 3, contract items given a unique seven (7) digit Item Number shall be constructed in accordance with SCDOT Standard Specifications. The first three (3) digits correspond to sections of the SCDOT Standard Specifications. The remaining four (4) digits are for individual identification of each contract item. Contract items that are identified with Item Numbers beginning with W, S, F, and SP shall be constructed in accordance with specifications contained within this document.

6. Construction conditions requiring minor vertical adjustments (0-2 ft.) to existing water line valve boxes, sanitary sewer manholes, and other minor appurtenances shall be the responsibility of the Contractor. The costs for the adjustments shall be the Contractor's responsibility and shall be included in Bid Item, Mobilization. Other utilities requiring relocation or adjustment for construction activities will be the responsibility of the utility owner.

7. Reconstruction of driveways and other special provisions on properties, included in the right-of-way acquisition, shall be coordinated with the Engineer. Contractor shall notify Engineer prior to construction of driveways.

8. The Owner will obtain the South Carolina Department of Health and Environmental Control (DHEC) Notice of Intent (NOI) for the project. The Contractor's signature is required on several documents necessary for obtaining the permit including, but not limited to, the NOI application, weekly inspection reports and Co-Permittee Agreements. The Contractor shall cooperate with the Owner in providing the required signatures. The Contractor shall be responsible for posting at the project site and keeping on file, permit approvals and other notices as required by permits for the project. The NOI also requires that on-site preconstruction conferences be held for the Prime Contractor and all subcontractors. The Contractor shall participate in these meetings as required by the NOI.

9. Testing shall be conducted by the Owner/Engineer in accordance with the procedures defined in the SCDOT Standard Specifications, and applicable Supplemental Specifications.

10. The Contractor shall provide all record drawing information to the Engineer prior to final approval.

11. Commercial advertising signs (realtor signs) within the construction limits should be removed and left on adjacent property - Do not reinstall. No direct payment will be made for removing these signs as the work is considered incidental to the item of clearing and grubbing.

12. Mailboxes are to be relocated at the direction of the Engineer. No direct payment will be made for the relocation of mailboxes.

13. The removal or relocation of billboards is not the Contractor's responsibility.

14. Non-conforming signs that are not to be relocated shall be removed and placed on the property beyond the construction limits.

15. In the interest of closing out this project in a prompt and timely manner, the Contractor shall complete item 1090200 (as-built construction plans) within 45 days of the substantial completion or final acceptance of the project. The final pay request as required in Section 4.37 of the General Conditions shall be submitted within 120 calendar days of the Owner's final acceptance of the project. The Owner shall impose a $200 per calendar day penalty for failure on the Contractor's part to complete and submit final closeout documents including the final pay request within the required 120 days. This late penalty shall be deducted from the project retainage for each calendar day beyond the allowed 120 days.

16. Temporary lane closure shall be conducted in accordance with SCDOT standard details and as directed by the Engineer. The Contractor shall submit a lane closure plan to the Engineer seven (7) calendar days prior to a lane closure. The Contractor shall notify all agencies responsible for emergency services of the lane closure schedule seven (7) calendar days prior to closure.

17. Partial Payments – The following retainage will be withheld pending final completion and final payment. A percentage based on the amount of the contract completed, shall be retained on each estimate until payment of the final estimate. The retainage shall be 5 percent until the project is 75 percent complete, at which time the retainage will be reduced to 2.5 percent. However, when the Contractor has completed at least 99 percent of the work, the Owner may, at his discretion, further reduce the retainage to an amount which will be adequate to complete the remaining work plus any anticipated liquidated damage. The Contractor may be required to furnish consent of surety before the retained amount is reduced to less than 2.5 percent.

18. The Geotechnical Reports included as part of this manual were prepared to assist the Owner in preparing the project design. The reports have been included for general information and are not intended to be used to determine the nature of the unclassified materials on the project. The Owner, STV Inc., nor S&ME, guarantee the accuracy or accept liability for information contained there-in. Any use of the geotechnical reports shall be at the Contractor's own risk as it is the Contractor's responsibility to make his own investigations and determinations.

19. The Contractor shall develop and submit prior to beginning construction, a schedule of work which will allow construction of the project while maintaining vehicular access to all adjacent parcels during the construction period.

20. The Contractor shall be responsible for abandoning wells, septic tanks and drain fields in accordance with DHEC and other applicable requirements. Payment for all work associated with the abandonment removal and capping of wells and septic tanks and drain fields shall be included in the clearing and grubbing pay item.

21. The Contractor shall be aware of the following special conditions related to right-of-way settlements with property owners adjacent to the project limits. The Contractor shall be responsible for coordinating with property owners to meet the conditions stipulated below. **The Contractor shall also notify and confirm with the Owner prior to coordination with the property owner:**

2021 YORK COUNTY CAPITAL PROJECTS SALES AND USE TAX PROGRAM
11149-004: WIDENING OF US 21 BYPASS AND SC 51 PROJECT
RIGHT-OF-WAY SPECIAL CONDITIONS

Tract	OWNER/CONTACT INFO	CONDITIONS
34	Coalition of Prison Evangelist POC: Keith Blackwell | 864.505.0847	See R/W Form 803 (06-11) Special Provision
81	H & A Associates LLC POC: Metrolina Collision Center | 803.548.4239	See R/W Form 803 (06-11) Special Provision
85	GTA Properties LLC POC: Tina Pappas | 704.552.8580	See R/W Form 803 (06-11) Special Provision
162	HOF LLC POC: Brandy Mcbee | 864.761.6980	Existing Fence on Tract 162 along relocated SC 51 to be relocated by property owner. Give 30 Day notice.
163	McDonalds Real Estate Company POC: Sumita Patel | 919.740.8436	See R/W Form 803 (06-11) Special Provision
185	Ross Dress for Less POC: Micheal Jewett | 803.396.2479 | 803.833.7796 | Michael.jewett@ros.com POC: Jonathan Hartman | 803.448.3345 | Jonathan.hartman@ros/com	See R/W Form 803 (06-11) Special Provision

22. A summary of the known utilities within the project limits of the project is included in Section 4D: Utilities Special Conditions. While the Owner has coordinated utility relocation work with the utilities prior to the letting of this contract, it will be the successful low bidder's responsibility to coordinate the construction work with the utilities work during construction. The contractor shall provide Utility Staking for all utilities within the project limits to eliminate conflict between the utility and construction activities which will be paid for as pay item 1052001 Utility Staking.

23. For this project, the following will be eligible for adjustments:

    - A.C. Binder Adjustments for Liquid Asphalt Binder (PG 64-22)

    Base date for adjustment will be determined at the Preconstruction meeting dependent on the bid date for this project.

24. Contractor shall comply with all general and regional conditions identified in the nationwide permit.

25. The Contractor shall be liable and responsible for payment of fines assessed by any regulatory agency due to non-compliance with applicable permit requirements and/or regulations by the Contractor. In the event the Owner is fined due to non-compliance with permit requirements, the Owner will charge the Contractor the cost of the fine by deducting the fine amount from the next month's progress pay estimate.

26. The Roadway Boring Logs included as part of the attached Geotechnical Report were prepared to assist the Owner with preparing the project design. They have been included for general information and are not intended to be used to determine the nature of the unclassified materials on the project. The Owner, STV Inc., and S&ME, Inc. does not guarantee the accuracy or accept liability for information contained there-in. This information shall be used at the Contractor's own risk as it is the Contractor's responsibility to make his own investigation and determination of unclassified excavation material.

27. Moving Items – Certain items will need to be moved from within the project limits to allow for the construction of the project. It is the Contractor's responsibility to investigate the various project sites prior to bidding to determine the items requiring removal.

28. Mobilization shall be paid in accordance with Section 103.11 of the SCDOT 2007 Standard Specifications For Highway Construction.

29. The Contractor shall be responsible for abandoning wells, septic tanks and drain fields in accordance with DHEC and other applicable requirements. Payment for all work associated with the abandonment, removal and capping of wells, septic tanks and drain fields shall be included in the Clearing and Grubbing pay item, unless it is provided by other pay items included in this contract.

30. The contractor shall read the Section 404 General Permit included in this Project Manual and comply with all appropriate conditions during construction.

31. The typical pavement section used for the construction of temporary pavement during construction operations shall include the following assumptions:

    H/M ASPHALT SURFACE COURSE TYPE B (200 LB/SY)
    H/M ASPHALT INTERMEDIATE COURSE TYPE B (400 LB/SY)
    H/M ASPHALT BASE COURSE TYPE A (840 LB/SY)

    Quantities for temporary pavement are shown on the General Construction Notes sheet 5 in the plans if noted in the Traffic Control Plans. Should the Contractor determine additional temporary pavement is required it shall be included in the Lum Sum pay item 1071000 Traffic Control.

32. PAYMENT FOR MATERIAL TO BE USED IN THE WORK

    Material Delivered on the Project
    When so authorized by York County/SCDOT, partial payments will be made up to 95% of the delivered cost of materials on hand that are to be incorporated in the work, provided that such materials have been delivered on or in close proximity to the project and stored in an acceptable manner. Material payments will be allowed when 95% of the accumulated costs of unpaid invoices are equal to or greater than $10,000, materials have been inspected and approved by York County/SCDOT

    Material Stored at Fabricator's Facilities or Contractor's Facilities
    When so authorized by York County/SCDOT, partial payments will be made up to 95% of the invoiced cost, exclusive of delivery cost, for bulky materials requiring fabrication at an offsite location that are durable in nature and represent a significant portion of the project cost, if it has been determined by York County/SCDOT, that the material cannot be reasonably stockpiled in the vicinity of the work. Material payments will be allowed when the materials have been inspected and approved by York County/SCDOT

    Materials with Delayed Delivery to the Project
    When so authorized by York County/SCDOT, partial payments will be made up to 95% of the invoiced cost of materials that have been ordered by the contractor but will be more than 45 days before being delivered to the project.

    Required Documents
    (1) Written consent of surety to make such partial payments,
    (2) Bill of Sale from the Contractor to the Department, and
    (3) Copy of invoice from material supplier verifying the cost of the material.

General Requirements

The partial payments will be made on the conditional basis that the material meets the requirements of the contract and will be incorporated into the project. The Contractor shall reimburse the Department for all partial payments for material paid, but not incorporated into the project.

Partial payments for materials on hand or already ordered but not yet delivered to the project will not constitute acceptance, and any faulty material will be rejected even though previous payment may have been made for same in the estimates.

Partial payment will not be made for fuel, supplies, form lumber, falsework, or used materials.

Partial payments will not be made on seed or any living or perishable plant materials except that when such materials have been planted or otherwise incorporated in the work, payment may be made, not as materials, but as work done as part of a contract item for which a contract unit or lump sum price has been established.

Partial payments will not exceed 95% of the contract unit or lump sum prices for the work.

33. R/W Form 803 (06-11)

THE STATE OF SOUTH CAROLINA

COUNTY OF YORK

PERMISSION FOR:

Slope
Silt fence & Sediment Tubes
Right to Enter
Drop Inlet

York County PID No. **11149-004**
Project Name: **US Route 21/SC 51**
Tract No. **34**
PID No. **0042332**

KNOW ALL MEN BY THESE PRESENTS, That I (or we) **COPE/Freedom Ministry F/K/A Coalition of Prison Evangelists, PO Box 1461, Fort Mill, SC 29716,** in consideration of the sum of One Dollar ($1.00), to me (or us) in hand paid, and other valuable consideration at and before the sealing and delivering hereof, do hereby grant to the County of York permission to do the work as outlined below, with the understanding that this work is to be done on property of the Grantor outside of the right of way, it being fully understood and agreed that no right of way is being granted to the County for the purpose of this construction.

SPECIAL PROVISIONS:

Herein granted is permission for construction slopes to extend beyond the right of way on the right of US Route 21 between approximate survey stations 37+90 and 38+80 with the understanding that no additional property is granted for construction slopes, during this construction.

Also, herein granted is permission to use heavy equipment for clearing, placement, maintenance, and access for the purpose of construction of a silt fence for NPDES (National Pollutant Discharge Elimination System) to extend beyond the right of way right of US Route 21, between approximate survey stations 37+90 and 38+80, and right of Fern Forest Court between approximate survey stations 10+80 and 11+00, and the construction of sediment tubes to extend beyond the right of way right of US Route 21, at approximate survey stations 38+04 and 38+52, as shown on the plans for this project with the understanding no additional property is granted for the permission, in accordance with County standards.

Also, herein granted is permission for the County, its contractors, or assigns to use heavy equipment beyond the right of way to demolish or remove the Pine Trees right of approximate survey stations 38+20 and 38+36 US 21 and to remove all materials and debris, during this construction.

Also herein granted is permission for the County to install a drop inlet on the property of the grantor and adjacent to the right of way right of US Route 21 at approximate survey station 38+80, as shown on the plans for this project, during this construction.

Checked _____ By _____

Recorded _____ By _____

Project _____ File _____ **Tract 34**

TO HAVE AND TO HOLD, all and singular, the said Permission hereinbefore granted, unto the said County of York. E. Keith Blackwell - Executive Director

IN WITNESS WHEREOF, I (or we) have hereunto set my (or our) hand(s) and seal(s) this 21 day of August, in the year of our Lord, Two Thousand and Nineteen.

Signed, sealed and delivered in the presence of:

COPE/Freedom Ministry
F/K/A Coalition of Prison Evangelists

Alexandria McFadden
1st Witness *(can not be Notary)*

By: E. Keith Blackwell (L.S.)

Richard L. Hyatt
2nd Witness *(can be Notary)*

Its: Executive Director

NOTE: All right-of-way agreements or easements must be in writing and are subject to rejection by the County of York.

THE STATE OF South Carolina)
)
COUNTY OF York)

Acknowledgement

The foregoing instrument was acknowledged before me this 21 day of August, 2019, by E. Keith Blackwell Alexandria McFadden of COPE/Freedom Ministry a executive director of corporation, on behalf of the corporation.

Witness my hand and official seal this the 21 day of August, 2019.

Richard L. Hyatt
Signature of Notary Public

RICHARD L. HYATT NOTARY PUBLIC SOUTH CAROLINA COMM. EXP. 01-16-2028

Richard L. Hyatt
Printed Name of Notary Public

NOTARY PUBLIC FOR THE STATE OF
South Carolina
My Commission Expires: 01/16/2028
(Affix seal if outside SC)

Checked _____ By _____
Recorded _____ By _____
Project _____ File _____ **Tract 34**

THE STATE OF SOUTH CAROLINA

COUNTY OF YORK

PERMISSION FOR:

Drive

York County PID No. 11149-004
Project Name: US Route 21/SC 51
Tract No. 81
PID No. 0042332

KNOW ALL MEN BY THESE PRESENTS, That I (or we) **H&A Associates, LLC, 3031 Highway 21, Fort Mill, SC, 29715,** in consideration of the sum of One Dollar ($1.00), to me (or us) in hand paid, and other valuable consideration at and before the sealing and delivering hereof, do hereby grant to the County of York permission to do the work as outlined below, with the understanding that this work is to be done on property of the Grantor outside of the right of way, it being fully understood and agreed that no right of way is being granted to the County for the purpose of this construction.

SPECIAL PROVISIONS:

It is understood and agreed that a drive entrance will be constructed left of US Route 21 at approximate survey station 79+50 during this construction.

It is also understood that the County will relocate the existing business sign currently located within the existing road right at its expense to a place outside of the existing right-of-way.

SAME DRIVEWAY ENTRANCE + WIDTH -

Checked _____ By _____

Recorded _____ By _____

Project _____ File _____ **Tract 81**

TO HAVE AND TO HOLD, all and singular, the said Permission hereinbefore granted, unto the said County of York.

IN WITNESS WHEREOF, I (or we) have hereunto set my (or our) hand(s) and seal(s) this 25th day of January, in the year of our Lord, Two Thousand and ~~Eighteen~~ Twenty two Calw
Signed, sealed and delivered in the presence of: **H&A Associates, LLC**

Elizabeth F. Garrett
1st Witness *(can not be Notary)*

By: [signature] (L.S.)

Cynthia L. Whetsel
2nd Witness *(can be Notary)*

Its: Manager

NOTE: All right-of-way agreements or easements must be in writing and are subject to rejection by the County of York.

THE STATE OF South Carolina)
) Acknowledgement
COUNTY OF York)

The foregoing instrument was acknowledged before me this 25 day of January, 2022, by Harold A. Sumner of H&A Associates, LLC a _____ corporation, on behalf of the corporation.

Witness my hand and official seal this the 25 day of January, 2022.

CYNTHIA L. WHETSEL
MY COMM EXP
NOTARY
PUBLIC
09/26/2028
SOUTH CAROLINA

Cynthia L. Whetsel
Signature of Notary Public

Cynthia L. Whetsel
Printed Name of Notary Public

NOTARY PUBLIC FOR THE STATE OF
South Carolina
My Commission Expires: Sept. 26, 2028
(Affix seal if outside SC)

Checked _____ By _____
Recorded _____ By _____
Project _____ File _____ **Tract 81**

THE STATE OF SOUTH CAROLINA

COUNTY OF YORK

PERMISSION FOR:

Slope

Drive

York County PID No. 11149-004
Project Name: US Route 21/SC 51
Tract No. 85
PID No. 0042332

KNOW ALL MEN BY THESE PRESENTS, That I (or we) **GTA Properties, LLC, 2707 Huntingtowne Farms Lane, Charlotte, NC 28210** ("Grantor") in consideration of the sum of One Dollar ($1.00), to me (or us) in hand paid, and other valuable consideration at and before the sealing and delivering hereof, do hereby grant to the County of York ("Grantee")permission to do the work as outlined below, with the understanding that this work is to be done on property of the Grantor outside of the right of way, it being fully understood and agreed that no right of way is being granted to the County for the purpose of this construction.

SPECIAL PROVISIONS:

Herein granted is permission for 4 to 1 construction slopes to extend beyond the right of way on the left of US 21 between approximate survey stations 83+80 and 85+96 with the understanding that no additional property is granted for construction slopes, during this construction. The contractor will work the slope around the sign located left of station 84+38 so that it remains in its current location and undisturbed.

Also, it is understood and agreed that a drive entrance to Grantor's property will be constructed left of US 21 at approximate survey station 85+90 during this construction.

The Grantee will restore all areas that are disturbed during or as a result of construction or maintenance activities to a manageable condition. Disturbed areas will be graded to a smooth surface free of ruts, with a uniform slope to prevent ponding, and disturbed areas will be seeded

The Grantee will require the use of protective measures during construction to prevent silting of adjacent creeks and streams. In addition, the Grantee will require the use of traffic control measures including flaggers, as appropriate, when working in the road or driveway. Grantee will require contractor to keep one lane of traffic open during construction at all times.

The Grantee will use at a minimum the following driveway specifications: 150 lbs./SY of asphalt concrete surface course, over 400 lbs./SY of asphalt concrete base course to repair any area of the driveway that is disturbed by this work.

The Grantor shall be responsible for the replacement of all landscaping other than the seeding that the Grantee will perform upon completion of construction.

The Grantor will be allowed to place, at their expense, temporary business signs stating that tenants on the property are Open for Business. Such signs shall not interfere with the Grantee's Contractor's work. The County waives any County permitting fees that would normally apply to these temporary signs (See Attachment "A").

The Grantee will coordinate with its contractors during the pre-construction conference to have minimum impact to the Grantor's tenants' business during business hours throughout construction.

Checked _____ By _____

Recorded _____ By _____

Project _____ File _____ **Tract 85**

TO HAVE AND TO HOLD, all and singular, the said Permission hereinbefore granted, unto the said County of York.

IN WITNESS WHEREOF, I (or we) have hereunto set my (or our) hand(s) and seal(s) this 20 day of November, in the year of our Lord, Two Thousand and Nineteen

Signed, sealed and delivered in the presence of: **GTA Properties, LLC**

Gina Pappas
1st Witness *(can not be Notary)*

By: Angelo Pappas (L.S.)

Georgia Pappas
2nd Witness *(can be Notary)*

Its: Manager

NOTE: All right-of-way agreements or easements must be in writing and are subject to rejection by the County of York.

THE STATE OF South Carolina)
)
COUNTY OF York) Acknowledgement

The foregoing instrument was acknowledged before me this 20 day of November, 2019, by Angelo Pappas of GTA Properties, LLC a South Carolina corporation, on behalf of the corporation.

Witness my hand and official seal this the 20 day of November 2019.

T. Michael Smith
Signature of Notary Public

T. Michael Smith
Printed Name of Notary Public

NOTARY PUBLIC FOR THE STATE OF
South Carolina

My Commission Expires: September 24, 2025

(Affix seal if outside SC)

Checked _____ By _____

Recorded _____ By _____

Project _____ File _____ **Tract 85**

R/W Form 803 (06-11)

THE STATE OF SOUTH CAROLINA

COUNTY OF YORK

PERMISSION FOR:

Drive

York County PID No. 11149-004
Project Name: US Route 21/SC 51
Tract No. 163
PID No. 0042332

KNOW ALL MEN BY THESE PRESENTS, That I (or we) **McDonalds Real Estate Company, 110 N. Carpenter Street, Chicago, IL 60607-2101 Attn. US Legal Department L/C 039-0773 ("McDonald's")** in consideration of the sum of One Dollar ($1.00), to me (or us) in hand paid, and other valuable consideration at and before the sealing and delivering hereof, do hereby grant to the County of York ("County") permission to do the work as outlined below, with the understanding that this work is to be done on property of the McDonald's outside of the right of way, it being fully understood and agreed that no right of way is being granted to the County for the purpose of this construction.

SPECIAL PROVISIONS:

The proposed work is to tie the new curb and gutter being installed on US Route 21 into the curb and gutter on McDonald's property at its existing curb cut onto US Route 21. If the exiting fire hydrant at the curb cut needs to be relocated to facilitate this work it will be done by and at the expense of County.

It is understood and agreed that a drive entrance will be constructed right of US Route 21 at approximate survey station 132+60 during this construction.

Immediately after County completes the work, County will restore the work area to the same or better condition as it was in before County began the work and to a safe condition, and will remove all of its equipment, tools, trash and debris from the work area.

Unless otherwise agreed in writing, County will not move, remove or demolish any of McDonald's signs, access drives curbing or other improvements located within the work area.

County will separate by cones or other appropriate construction safety barriers ("cone off") the work area while County performs any work in the work area.

County will perform all work in such a manner so as to not unduly disrupt the operation of the McDonald's restaurant on McDonald's property. County will "cone off" no

more than 4 parking stalls at any one time, and will not "cone off" or block in any manner more than half of any access drive at any time, allowing at least one lane open at all times in each access drive for vehicular traffic.

County will not park on or store any construction vehicles, equipment or materials within the work area or on McDonald's other property.

If any damage occurs to McDonald's property or any improvements thereon arising out of, related to, or as a consequence of any of County's work in the work area, McDonald's promptly will notify County in writing of the damage. Unless otherwise agreed by the parties, County will repair the damage (or commence and diligently pursue repairing the damage) within 30 days after receipt of McDonald's notice.

Checked _____ By _____

Recorded _____ By _____

Project _____ File _____ **Tract 163**

TO HAVE AND TO HOLD, all and singular, the said Permission hereinbefore granted, unto the said County of York.

IN WITNESS WHEREOF, I (or we) have hereunto set my (or our) hand(s) and seal(s) this 14th day of October, in the year of our Lord, Two Thousand and 19.

Signed, sealed and delivered in the presence of:

McDonalds Real Estate Company

1st Witness *(can not be Notary)*

2nd Witness *(can be Notary)*

By: _____ (L.S.)

Its: Senior Counsel of McDonald's Corporation, Authorized Signatory for McDonald's Real Estate Company

NOTE: All right-of-way agreements or easements must be in writing and are subject to rejection by the County of York.

THE STATE OF Illinois)
)
COUNTY OF Cook)

Acknowledgement

The foregoing instrument was acknowledged before me this 14th day of October, 2019, by Patricia A. Molloy of McDonald's Real Estate Company a Delaware corporation, on behalf of the corporation.

Witness my hand and official seal this the 14th day of October, 2019.

OFFICIAL SEAL
PATRICIA HENSLER
NOTARY PUBLIC - STATE OF ILLINOIS
MY COMMISSION EXPIRES:07/28/20

_____
Signature of Notary Public

Patricia Hensler
Printed Name of Notary Public

NOTARY PUBLIC FOR THE STATE OF
Illinois

My Commission Expires: 7-28-20

(Affix seal if outside SC)

Checked _____ By _____

Recorded _____ By _____

Project _____ File _____ **Tract 163**

Memorandum

To: Patrick Hamilton

From: Jerry Bernie

Date: 11/9//2020

Re: SEDC Easement for Highway 21 Widening

The attached has been executed by Ross and included for your records. Please note that all work should be coordinated through ~~James Blevins (james.blevins@ros.com / 805-396-2479)~~ to ensure no disruption to vehicular traffic entering or exiting Retail Drive at Highway 21.

Jerry

10-12-21:

The new contact is Michael Jewett: michael.jewett@ros.com | 803-396-2479 (O) | 803-833-7796 (Cell)

His backup is Jonathan Hartman: jonathan.hartman@ros.com | 803-909-277 (O) | 803-448-3345 (Cell)

THE STATE OF SOUTH CAROLINA

COUNTY OF YORK

PERMISSION FOR:

Slope tie-in

Driveway tie-in

York County PID No. 11149-004
Project Name: US Route 21/SC 51
Tract No. 185
PID No. 0042332

KNOW ALL MEN BY THESE PRESENTS, That I (or we) **Ross Dress for Less, Inc., 5130 Hacienda Drive, Dublin, CA 94568-7579,** in consideration of the sum of One Dollar ($1.00), to me (or us) in hand paid, and other valuable consideration at and before the sealing and delivering hereof, do hereby grant to the County of York. in the State of South Carolina ("York County") permission to do the work as outlined below, with the understanding that this work is to be done on property of the Grantor outside of the right of way, it being fully understood and agreed that no right of way is being granted to York County for the purpose of this construction.

SPECIAL PROVISIONS:

Herein granted is permission for construction slopes to extend beyond the right of way on the left of US 21 between approximate survey stations 107+70 and 109+00 with the understanding that no additional property is transferred for construction slopes, during this construction. This grant of permission is conditioned on York County relocating the existing "NO TRUCKS ALLOWED, ROSS EMPLOYEE/VISITOR ENTRANCE ONLY" sign ("No Trucks Sign"), located at Retail Drive, at its expense during construction of the subject project to its final location as shown on the plans attached hereto at Exhibit A.

1. Also, it is understood and agreed that a driveway tie-in (Retail Drive) will be constructed left of US 21 at approximate survey station 108+40 during this construction. The Contractor shall develop and submit prior to beginning construction, a schedule of work which will allow construction of the project while maintaining vehicular access to all adjacent parcels during the construction period.

TO HAVE AND TO HOLD, all and singular, the said Permission hereinbefore granted, unto York County.

IN WITNESS WHEREOF, I (~~or we~~) have hereunto set my (~~or our~~) hand(~~s~~) and seal(~~s~~) this 6 day of NOVEMBER, in the year of our Lord, Two Thousand and Twenty.

ROSS DRESS FOR LESS, INC.,
a Virginia corporation

By: _____
Gregg McGillis
Its: Group Executive Vice President,
Property Development

TENANT ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
)
County of Alameda)

On 11-6-20 before me, KAREN FOSTER, a Notary Public, personally appeared Gregg McGillis, who proved to me on the basis of satisfactory evidence to be the person~~(s)~~ whose name~~(s)~~ is~~/are~~ subscribed to the within instrument and acknowledged to me that he~~/she/they~~ executed the same in his~~/her/their~~ authorized capacity~~(ies)~~, and that by his~~/her/their~~ signature~~(s)~~ on the instrument the person~~(s)~~, or the entity upon behalf of which the person~~(s)~~ acted, executed the instrument.

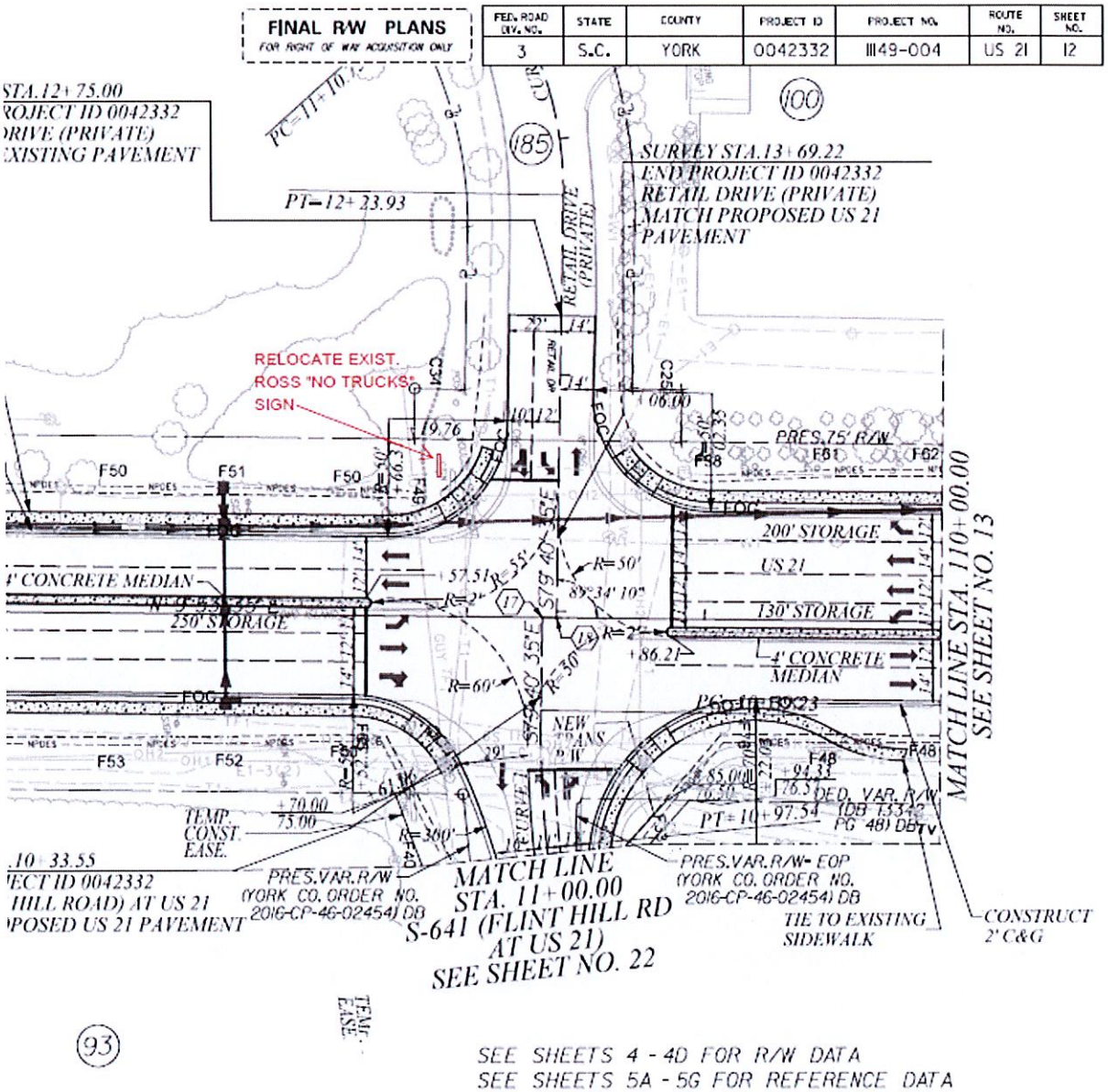
I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Karen Foster
Notary Public

NRO1 KAREN FOSTER
COMM. #2269902
Notary Public · California
Alameda County
My Comm. Expires Jan. 1, 2023 NRO1

EXHIBIT A
Location of Relocated No Trucks Sign



FINAL

6061.1719/1566860.1

UTILITY SPECIAL PROVISIONS/CONDITIONS
COORDINATION OF RELOCATION WORK WITH HIGHWAY CONSTRUCTION

Widening of US 21 Bypass and SC 51 YORK COUNTY, SC
YORK COUNTY PROJECT – 11149-004 SCDOT PROJECT ID 0042332

Utility As-Builts:

The roadway contractor shall be responsible for the collection and incorporation of the utility as-builts in their final submittal. all existing, proposed, and abandon lines must be shown.

Utility Staking:

Contractor shall be aware on as needed basis; utilities may request staking of construction items and right-of-way to help facilitate relocations and to avoid potential conflict with roadway construction and other utilities.

Utility Relocation Incidentals:

For the relocation of services, adjustments of valve covers and/or manhole lids, adjustments for point conflicts, and any other utility appurtenances adjustments, the contractor shall notify the utility owner 5 days prior to needing adjust and allow 2 weeks to complete.

Utility Relocation Window & Sequence:

Temporary Suspension for Utility Work and Utility Window:

The County has determined that in the best interest of the traveling public, the contractor shall perform the early utility preparation work as noted in the below table as soon as possible after the award of the contract to allow for utilities to continue with their relocations within a specified 480-day utility window. Once the notice to proceed has been established, the contractor shall begin associated early utility preparation on US 21. Upon completion of the early site preparation and construction staking, the contractor shall notify the RCE by letter. Once the RCE has been notified that early site preparation, erosion control, and staking operations are complete, the utility window shall begin. The RCE shall establish the beginning and end date of the utility windows.

During the utility window, the contractor will not be allowed to perform any work activities unless approved by the RCE. If work activities are approved, they should in no way hinder or interfere with the utility relocations during the utility window provided. If work activities interfere with utility relocations, all work by the prime contractor and subcontractors will be suspended until the end of the utility window.

The contractor shall be responsible for maintaining all erosion control measures on the project. The department will not compensate the contractor for any additional mobilization other than the bid amount for mobilization.

This provision in no way provides a guarantee that all utility relocations will be completed during the utility window.

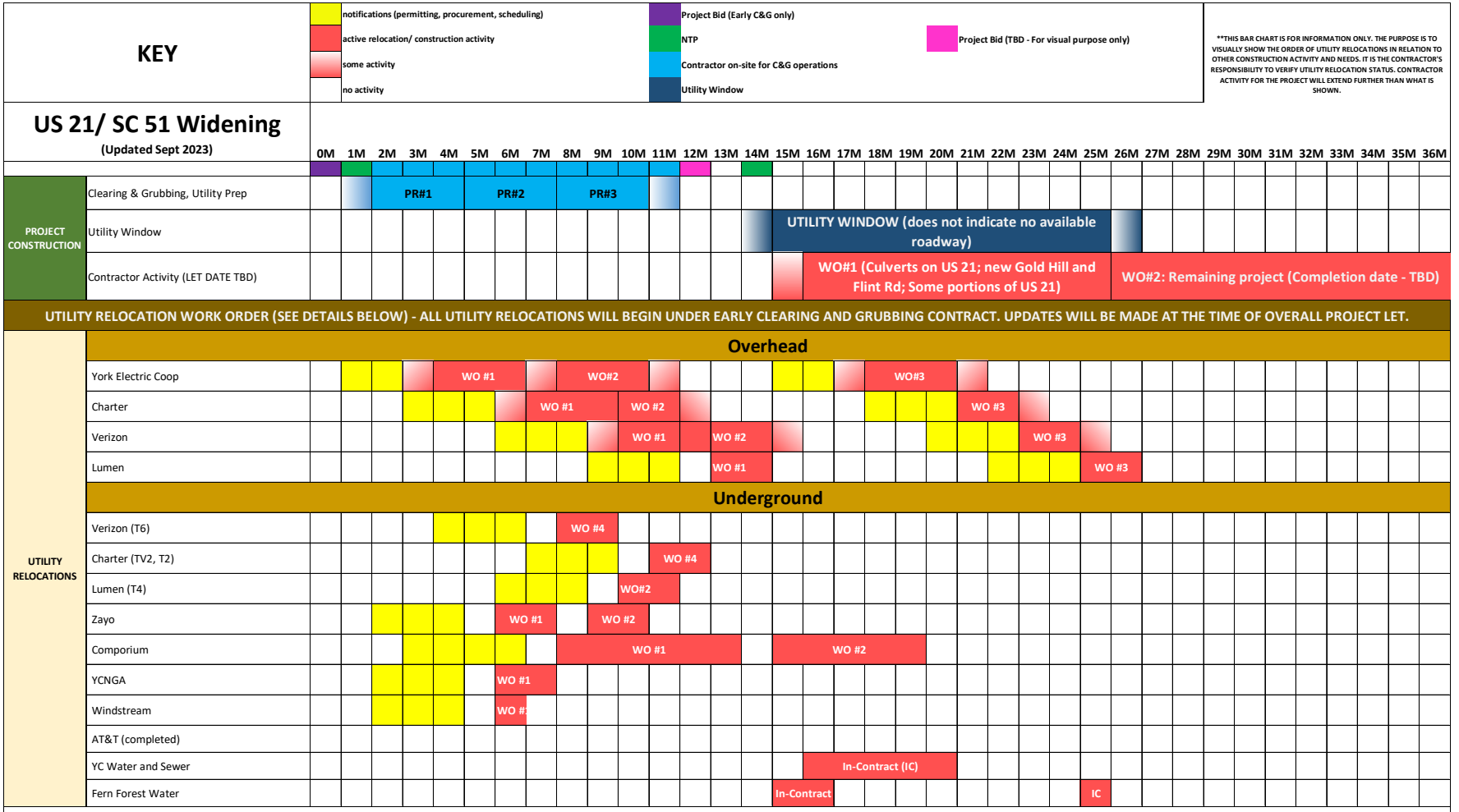
Utility Relocation Approach:

It is the intention of the utilities to relocate according to the following construction sequence. If the contractor plans to deviate from the proposed phasing, then it is the responsibility of the contractor to coordinate any changes and account for any potential delays.

Contractor will perform early site preparation between Stations 39+50 (Fern Forest Circle) to 45+00 (Forest Drive) RT for the overhead relocations. The early site preparation includes adding fill to approximately 70-80% of the final elevation and grade to drain to allow poles to be set.

It is the intent that utilities will start working in all available locations, where and when possible. The utility window shown is driven by the overhead relocations throughout the project since many are currently underground and converting overhead. If there are locations where existing utilities are not in conflict with proposed roadway work, then the contractor may work in those locations as long as they do not interfere with the utility's ability to install new facilities. These areas are noted below; however, it is the contractor's responsibility to determine if this complies with their own approach. These are examples only.

Existing utilities will remain active until all new facilities are installed and cut over.



WORK AREAS, CONTRACTOR ACTIVITY, AND PRECEDING RELOCATION REQUIRED FOR UTILITY RELOCATION

York Electric Cooperative (E1):
WO #1: SC 51 (need clearing and new alignment graded)
WO #2: Old Nations to SC 51
WO#3: Remaining US 21 (require fill efforts from prime)

Charter (TV2, T2):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 72+00

Verizon (T6):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 61+00

Zayo (T5):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

Comporium (T1):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

AT&T (T3):
Work is complete for Encrochment #A029Y30

Windstream:
WO #1: Adjust as needed; 1 month notification

Lumen (T4):
WO #1: Old Nations to end of SC 51 (OH) (need YEC & Tele OH)
WO #2: Gold Hill to Old Nations (UG only) (need C&G)
WO #3: All remaining OH (need YEC OH & Other OH Telecoms)

YCNGA (G1):
WO #1: SC 51 (need clearing & grubbing)
WO#2: All remaining relocations

York County Water/Sewer (W1/SS1):
In-contract

Fern Forest Water (T2):
In-contract (2 parts)

Clearing Priorities:
PR#1:
C&G SC51 and Flint Hill Road (new and existing); Includes rough grading new alignments of existing ground
PR#2:
C&G RT/LT Side from Gold Hill to SC 43 and cut from Sta 44+00 to 54+00 LT on US 21; Includes rough grading for new alignment for Gold Hill of existing ground
PR#3:
Remaining project

PERFORMANCE AND INDEMNITY BOND

STATE OF SOUTH CAROLINA
COUNTY OF YORK

KNOW ALL MEN BY THESE PRESENTS that _____ _____ as Principal, hereinafter called Contractor, and _____ _____as Surety, hereinafter called Surety, are held and firmly bound unto the York County Government, as Obligee, hereinafter called owner, in the amount of _____ _____Dollars ($_____) for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated_____, *2025,* entered into a Contract with Owner for:

Pennies for Progress Project 3
Widening of US 21 Bypass and SC 51

in accordance with Drawings and Specifications prepared by York County Engineering Department, ENGINEER, which Contract is by reference made a part hereof and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that, if the Principal shall in all respects promptly and faithfully perform and comply with the terms and conditions of said Contract and his obligations thereunder and shall indemnify the OWNER and the ENGINEER and save either or all of them harmless against and from all costs, expenses and damages arising from the performance of said Contract or the repair of any work thereunder, then this obligation shall be void; otherwise, this Bond shall remain in full force and effect, in accordance with the following terms and conditions:

A. The Principal and Surety jointly and severally agree to pay the OWNER any difference between the sum to which the said Principal would be entitled on the completion of the Contract, and that sum which the OWNER may be obliged to pay for the completion of said work by Contract or otherwise, and any damages, direct or indirect or consequential, which the said OWNER may sustain on account of such work, or on account of the failure of said CONTRACTOR to properly and in all things, keep and execute all of the provisions of said Contract.

B. And this Bond shall remain in full force and effect for a period of two (2) years from the date of final payment of the project by the OWNER and shall provide that the CONTRACTOR guarantees to repair or replace for said period of one (1) years all work performed and materials and equipment furnished that were not performed or furnished according to the terms of the Contract, and shall make good, defects thereof which have become apparent before the expiration of said period of two (2) years. If any part of the project, in the judgment of the OWNER, for the reasons above stated needs to be replaced, repaired or made good during that time, the OWNER shall so notify the CONTRACTOR in writing. If the CONTRACTOR refuses or neglects to do such work within five (5) days from the date of service of such Notice, the OWNER shall have the work done by others and the cost thereof shall be paid by the CONTRACTOR or his Surety. After the one year warranty period and after all warranty work has been completed satisfactorily to the Owner, the Contractor may request that this Bond be terminated.

C. And the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligations on this bond, and it does hereby waive Notice of any change, extension of time, alteration or addition to the terms of the Contract or to the Work or to the Specifications.

D. The surety represents and warrants to the OWNER that they have a minimum Best's Key Rating Guide General Policyholder's Rating of "A –" and Financial Category of "Class VIII".

IN WITNESS WHEREOF, the above bounded parties executed this instrument under their several seals, this ____ day of _____ *2025*, A.D., the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESS: (If Sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

PRINCIPAL:

_____

_____
Signature of Authorized Officer
(Affix Seal)

WITNESSES:

_____ _____
Title

_____ _____
Business Address

_____
City State

SURETY:

WITNESS: _____
Corporate Surety

_____ _____
Attorney-in-Fact (Affix Seal)

_____
Business Address

_____
City State

_____
Name of Local Insurance Agency

CERTIFICATES AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____ who signed the said bond on behalf of the Principal, was then _____ of said Corporation; that I know his signature, and his signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

_____
Secretary

Corporate
Seal

STATE OF SOUTH CAROLINA

COUNTY OF YORK

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared _____ to me well known, who being by me first duly sworn upon oath, says that he is the Attorney-in-Fact, for the _____ _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the Contractor named therein in favor of the_____.

Subscribed and sworn to before me this . day of _____, *2025* A.D.

(Attach Power of Attorney)

_____
Notary Public
State of South Carolina-at-Large

My Commission Expires:

END OF SECTION

PAYMENT BOND

STATE OF SOUTH CAROLINA
COUNTY OF YORK

KNOW ALL MEN BY THESE PRESENTS that _____ _____ as Principal, hereinafter called CONTRACTOR, and _____ as Surety, hereinafter called Surety, are held and firmly bound unto the York County Government, as Obligee, hereinafter called OWNER, in the amount of _____ _____Dollars($_____) for the payment whereof CONTRACTOR and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, CONTRACTOR has by written agreement dated_____, *2025*, entered into a Contract with OWNER for:

Pennies for Progress Project 3
Widening of US 21 Bypass and SC 51

in accordance with Drawings and Specifications prepared by York County Engineering Department, ENGINEER, which Contract is by reference made a part hereof and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that, if the Principal shall promptly make payments to all claimants, as herein below defined, then this obligation shall be void; otherwise, this Bond shall remain in full force and effect, subject to the following terms and conditions:

A. A claimant is defined as any person supplying the Principal with labor, material and supplies, used directly or indirectly by the said Principal or any subcontractor in the prosecution of the work provided for in said Contract.

B. The above named Principal and Surety hereby jointly and severally agree with the OWNER that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after performance of the labor or after complete delivery of materials and supplies by such claimant, may sue on this Bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The OWNER shall not be liable for the payment of any costs or expenses of any such suit.

C. No suit or action shall be commenced hereunder by any claimant:

   1. Unless claimant, other than one having a direct contract with the Principal, shall within forty-five (45) days after beginning to furnish labor, materials or supplies for the prosecution of the work, furnish the Principal with a notice that he intends to look to this bond for protection.

   2. Unless claimant, other than one having a direct contract with the Principal, shall within ninety (90) days after such claimant's performance of the labor or complete

delivery of materials and supplies, deliver to the Principal written notice of the performance of such labor or delivery of such material and supplies and the nonpayment therefore.

3. After the expiration of one (1) year from the performance of the labor or completion of delivery of the materials and supplies; it being understood, however, that if any limitation embodied in this Bond is prohibited by any law controlling the construction hereof such limitations shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

4. Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.

D. The Principal and the Surety jointly and severally, shall repay the OWNER any sum which the OWNER may be compelled to pay because of any lien for labor or materials furnished for any work included in or provided by said Contract.

E. The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration of or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications applicable thereto shall in any way affect its obligations on this Bond, and the Surety hereby waives notice of any such change, extension of time, alterations of or addition to the terms of the Contract, or to the work or to the Specifications.

F. The Surety represents and warrants to the Owner that they have a minimum Best's Key Rating Guide General Policyholder's rating of "___A -___" and Financial Category of "Class __VIII___".

IN WITNESS WHEREOF, the above bounded parties executed this instrument under their several seals, this _____ day of _____ *2025*, A.D., the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESS: (If Sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

PRINCIPAL:

_____

_____
Signature of Authorized Officer
(Affix Seal)

WITNESSES:

_____ _____
Title

_____ _____
Business Address

_____
City State

SURETY:

WITNESS:

_____
Corporate Surety

_____ _____
Attorney-in-Fact
(Affix Seal)

_____
Business Address

_____
City State

_____
Name of Local Insurance Agency

CERTIFICATES AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____ who signed the said bond on behalf of the Principal, was then _____ of said Corporation; that I know his signature, and his signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

_____

Secretary

Corporate
Seal

STATE OF SOUTH CAROLINA

COUNTY OF YORK

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared _____ to me well known, who being by me first duly sworn upon oath, says that he is the Attorney-in-Fact, for the _____ _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the CONTRACTOR named therein in favor of the_____.

Subscribed and sworn to before me this ____ day of _____, *2025*, A.D.

(Attach Power of Attorney)

_____
Notary Public
State of South Carolina-at-Large

My Commission Expires: _____

END OF SECTION

NOTICE OF AWARD

TO: _____

_____

_____

FROM: York County Engineering

P.O. Box 148

York, SC 29745

PROJECT TITLE: Pennies for Progress Project 3 - Widening of US 21 Bypass and SC 51

PROJECT DESCRIPTION: Widening of US 21 Bypass and SC 51 from US 21 at SC 460 (Springfield Pkwy) to 700' South of S-48 (Springhill Farm Rd) and SC 51 from US 21 to the NC State Line. The total estimated length of roadway is 5.051 miles.

The Owner has considered the Bid submitted by you for the above described work in response to its Advertisement for Bids dated _____ and Information for Bidders.

You are hereby notified that your Bid has been accepted for items in the amount of

$ _____

($ _____).

You are required by the Information for Bidders to execute the Agreement and furnish the required Contractor's Performance Bond, Payment Bond and certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said Bonds within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner.

Dated this _____ day of _____, *2025*.

On behalf of the York County Council

By: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged

By: _____

Title: _____

This _____ day of _____, *2025*

NOTICE TO PROCEED

Date: _____

To: _____

_____

_____

Project:

Pennies for Progress Project 3
Widening of US 21 Bypass and SC 51

You are hereby notified to commence work in accordance with the Agreement dated _____ on or before _____, and you are to complete the work within **1095** consecutive calendar days thereafter. The date of completion of all work is therefore _____.

On behalf of the

YORK COUNTY GOVERNMENT

By: _____

Title: York County Engineer

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged by _____, this the _____day of _____, ***2025***.

By: _____

Title: _____

NON-COLLUSION AFFIDAVIT

State of _____

County of _____

_____, being first duly sworn, deposes and says that:

(1) He is _____ of _____, the Bidder
Title Company Name
that has submitted the attached Bid;

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other bidder, or to secure through any collusion, conspiracy, conveyance or unlawful agreement any advantage against the OWNER or any person interested in the proposed contract;

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affidavit.

(Signed)_____

_____
(Title)

Subscribed and sworn to before me

this ____ day of _____, 20_____

_____

(Title)

My commission expires _____

CERTIFICATE OF INSURANCE
(May also use applicable Accord form)

THIS IS TO CERTIFY THAT THE _____
Insurance Company

Address _____

Of _____
has issued policies of insurance, as described below and identified by a policy number, to the insured named below; and to certify that such policies are in full force and effect at this time. It is agreed that none of these policies will be cancelled or changed so as to affect the interest(s) of the York County Government (hereinafter sometimes called the OWNER) until thirty (30) days after written notice of such cancellation or change has been delivered to the ENGINEER.

Insured: _____

Address: _____

Status of Insured
_____ Corporation _____ Partnership _____ Individual

Insured: _____

Description of Work: _____

_____

_____

INSURANCE POLICIES IN FORCE

Forms of Coverage	Policy Number	Expiration Date
*Worker's Comp./Employers' Liability	_____	_____
**Comprehensive Auto Liability	_____	_____
***Excess Liability	_____	_____
Other (Please specify type)	_____	_____

POLICY INCLUDES COVERAGE FOR:		YES	NO
1.	Additional Insured: OWNER and ENGINEER	_____	_____
2.	*Liability under the United States Longshore-men's and Harbor Workers' Compensation Act.	_____	_____
3.	**All owned, hired, or non-owned automotive equipment used in connection with work done for the Owner.	_____	_____
4.	Contractual Liability	_____	_____
5.	Damage caused by explosion, collapse or structural injury, and damage to underground utilities.	_____	_____
6.	Products/Completed Operations	_____	_____
7.	Owners and Contractors Protective Liability	_____	_____
8.	Personal Injury Liability	_____	_____
9.	***Excess Liability applies excess of:		
	(a) Employers' Liability	_____	_____
	(b) Comprehensive General Liability	_____	_____
	(c) Comprehensive Automobile Liability	_____	_____

Types of Coverage	Forms of Coverage	Minimum Limits of Liability	
Workers' Compensation	Bodily Injury	$ 1,000,000	Statutory
Employers' Liability	Bodily Injury	$ 500,000	Each Accident
	Disease	$ 500,000	Each Person
	Disease	$ 500,000	Policy Limit
Comprehensive Auto Liability	Combined Single Limit BI/PD	$ 1,000,000	Each Accident
Comprehensive General Liability	Bodily Injury	$ 1,000,000	Each Occurrence
		$ 5,000,000	Aggregate

The Insurance Company hereby agrees to deliver, within ten (10) days, two (2) copies of the above policies to the Engineer when so requested.

NOTE: Entries on this certificate are limited to the Authorized Agent or Insurance Company Representative.

Date_____ (SEAL) _____
Insurance Company

Issued at_____
Authorized Representative

Insurance Agent or Company

- Send original and one copy to:

York County Engineering
Post Office Box 148
6 South Congress Street
York, South Carolina 29745

END OF SECTION

APPLICATION FOR PAYMENT No. _____

Date: _____ Contractor: _____

Project: _____

Project Number: _____ For Period _____ To _____

Total value of work completed to date (see attached sheet)	$ _____
Total value of materials stored for project (see attached sheet)	$ _____
SUB TOTAL	$ _____
LESS _____ %RETAINED	$ _____
TOTAL	$ _____
LESS PREVIOUS PAYMENTS	$ _____
Other Changes, additions, or deductions (see attached sheet)	$ _____
TOTAL AMOUNT DUE THIS PAYMENT	**$ _____**

Previous Payments

1. _____	**4.** _____	**7.** _____	**10.** _____
2. _____	**5.** _____	**8.** _____	**11.** _____
3. _____	**6.** _____	**9.** _____	**12.** _____

Submitted By:
I hereby certify to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, and that all amounts have been paid by the Contractor for Work which previous Applications for Payment were issued and payments received from the Owner, that current payment shown herein is now due.

Contractor: _____

Signed By: _____

Date: _____

Notarized: _____
(affix seal)
My Commission Expires: _____

Recommended By:
Architect/Engineer: _____ Date: _____

Certified Amount: $ _____

The Certified amount is payable only to the Contractor named herein. Issuance, payment, and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

Accepted By:
Owner: _____ Date: _____

CONTRACT CHANGE ORDER

CHANGE ORDER NO:_____

PROJECT: _____

DATE OF ISSUANCE: _____

DESCRIPTION OF CHANGE: _____

_____

_____

_____

CONTRACT AMOUNT		CONTRACT TIME (Calendar Days)	
Original	$ _____	Original Durations	_____ Days
Previous Change Orders (Add/Deduct)	$ _____	Previous Change Order (Add/Deduct)	_____ Days
This Change Order (Add/Deduct)	$ _____	This Change Order (Add/Deduct)	_____ Days
Revised Contract Amount	$ _____	Revised Contract Time	_____ Days

REVISED CONTRACT COMPLETION DATE IS: _____, *20___*

	OWNER	CONTRACTOR	ENGINEER
SIGNATURE			
PRINT NAME			
COMPANY			
DATE			

RELEASE AND WAIVER OF CLAIM
BY PRIME CONTRACTOR

Know all men by these presents that the undersigned, _____of _____20____ first being duly sworn, states that all payrolls, materials bills, sales tax, privilege tax or license, old age benefits tax, state and federal unemployment insurance, and other liabilities incurred for use in the performance of the contract for the ***Pennies for Progress Project 3: Widening of US 21 Bypass and SC 51*** located in York County, South Carolina have been paid in full and waives any and all claims and releases York County Government (York County, South Carolina) from any rights or claims for debts due and owing by virtue of the furnishing of any material or supplies or any lien thereon.

_____
(Name of Company)

By: _____

Its: _____

Sworn to before me
this _____day of _____, 20 _____.

_____

Notary Public for _____

My Commission expires: _____

VALUE ENGINEERING INCENTIVE

INTENT AND OBJECTIVE

(1) This Subarticle applies to any cost reduction proposal (hereinafter referred to as a Value Engineering Change Proposal or VECP) initiated and developed by the Contractor for the purpose of refining the contract documents so as to contribute to design cost effectiveness or significantly improve the quality of the end result. This Subarticle does not, however, apply to any such proposal unless it is identified by the Contractor, at the time of its submission to the County, as a proposal submitted pursuant to this Subarticle.

(2) VECPs contemplated are those that would result in net savings to the County by providing either: (A) a decrease in the cost of performance of the Contract, or; (B) a reduction in cost of ownership (hereinafter referred to as collateral costs) of the work provided by this Contract, regardless of acquisition costs. VECPs must result in savings without impairing essential functions and characteristics such as safety, service, life, reliability, economy of operation, ease of maintenance, aesthetics and necessary standard design features. However, nothing herein prohibits the submittal of VECPs where the required functions and characteristics could be combined, reduced or eliminated as being nonessential or excessive. Plan errors which are identified by the Contractor and which result in a cost reduction, will not qualify for submittal as a VECP.

(3) The County reserves the right to reject at its discretion any VECP submitted which proposes a change in the design of the pavement system or which would require additional right-of- way. Substitution of another design alternate, which is detailed in the plans, for the one on which the Contractor bid, will not be allowed under this Subarticle. Pending execution of a formal supplemental agreement, implementing an approved VECP, the Contractor shall remain obligated to perform in accordance with the terms of the existing contract. No time extensions will be granted due to the time required to review a VECP.

SUBCONTRACTORS

(1) The Contractor is encouraged to include the provisions of this Subarticle in contracts with subcontractors. The Contractor shall encourage submission of VECPs from subcontractors, however, it is not mandatory that VECPs be submitted nor is it mandatory that the Contractor accept or transmit to the County VECPs proposed by his subcontractors.

DATA REQUIREMENTS

(1) A description of the difference between the existing contract requirement and the proposed change, and the comparative advantages and disadvantages.

(2) Separate detailed cost estimates for both the existing contract requirement and the proposed change. The cost estimates shall be broken down by contract item numbers indicating quantity increases or decreases and deleted pay items. Additional proposed work, not covered by contract items, shall be identified by current County pay item numbers. In preparing the estimate, the Contractor shall include overhead, profit, and bond. No separate

pay item(s) for these costs will be allowed.

(3) An itemization of plan details, plan sheets, design standards and Specifications that must be changed or added if the VECP is adopted. Preliminary plan drawings must be sufficient to describe the proposed changes.

(4) An estimate of the effects the VECP would have on collateral costs to the County.

(5) Engineering or other analysis in sufficient detail to identify and describe specific features of the contract which must be changed if the VECP is accepted, with a proposal as to how these changes can be accomplished and an assessment of their effect on other project elements. The County may require that engineering analyses be performed by a prequalified consultant in the applicable class of work. Any design changes which result from the VECP must be supported by computations sealed by a Professional Engineer registered in the State of South Carolina.

(6) A statement of the time by which approval of the VECP must be issued by the County to obtain the total estimated cost reduction during the remainder of this Contract, noting any effect on the contract completion time or delivery schedule.

PROCESSING PROCEDURES

(1) Two copies of each VECP shall be submitted, one to the Engineer, or his duly authorized representative, and one to the County's Value Engineering Office. VECPs will be processed expeditiously; however, the County will not be liable for any delay in acting upon a VECP submitted pursuant to this Subarticle. The Contractor may withdraw, in whole or in part, a VECP not accepted by the County within the period specified in the VECP. The County shall not be liable for any VECP development cost in the case where a VECP is rejected or withdrawn.

The Engineer shall be the sole judge of the acceptability of a VECP and of the estimated net savings in construction and/or collateral costs from the adoption of all or any part of such proposal. In determining the estimated net savings, the right is reserved to disregard the contract bid prices if, in the judgment of the Engineer, such prices do not represent a fair measure of the value of work to be performed or to be deleted.

Prior to approval, the Engineer may modify a VECP, with the concurrence of the Contractor, to make it acceptable. If any modification increases or decreases the net savings resulting from the VECP as modified and upon determination of final quantities, the new savings shall be computed by subtracting the revised total cost of all bid items affected by the VECP design from the total cost of the same bid items as represented in the original contract.

Prior to approval of the VECP, which initiates the supplemental agreement, the Contractor shall provide acceptable contract quality plan sheets revised to show all details consistent with the VECP design.

COMPUTATIONS FOR CHANGE IN CONTRACT COST OF PERFORMANCE

Contractor development and implementation costs for the VECP will not be recoverable. If the VECP is adopted, the Contractor's share of the net savings as defined hereinafter shall be considered full compensation to the Contractor for the VECP.

County costs of processing or implementation of a VECP will not normally be considered in the estimate. However, the County reserves the right, where it deems such action appropriate, to require the Contractor to pay the County's cost of investigating and implementing a VECP submitted by the Contractor as a condition of considering such proposal. Where such a condition is imposed, the Contractor shall indicate his acceptance thereof in writing, and such acceptance shall constitute full authority for the County to deduct amounts payable to the County from any monies due or that may become due to the Contractor under the contract.

COMPUTATIONS FOR COLLATERAL COSTS

When collateral cost savings are sought by the Contractor, separate estimates must be prepared for collateral costs of both the existing contract requirement and the proposed change. Each estimate shall consist of an itemized breakdown of all costs and the basis for the data used in the estimate. Cost benefits to the County include, but are not limited to: reduced costs of operation, maintenance or repair, and extended useful service life. Increased collateral costs include the converse of such factors.

Computations shall be as follows:

(1) Costs shall be calculated over a 20-year period on a uniform basis for each estimate.

(2) If the difference in the estimates as approved by the County indicates a savings, the Contractor shall divide the resultant amount by 20 to arrive at the average annual net collateral savings. The resultant savings shall be shared as stipulated in Sharing Arrangements.

SHARING ARRANGEMENTS

If a VECP is approved by the County, the Contractor may be entitled to share in both construction savings and collateral savings to the full extent provided for in this Subarticle.

Except for innovative ideas, the Contractor and County shall each receive 50 percent of net reduction in the cost of performance of this Contract. For innovative ideas, the reduction in the cost of performance shall be shared as follows:

Accrued Net Savings	Contractor's Share %	County's Share %
Less than $25,000	100	0
$25,000 to $50,000	75	25
Over $50,000	50	50

If an approved change is identical or similar to a previously submitted VECP or an idea previously utilized by the County it will not be considered an innovative idea, thus will only qualify for a 50 percent sharing of savings.

When collateral savings occur, the Contractor shall receive 20 percent of the average one year's net collateral savings.

The Contractor shall not receive construction savings or collateral savings on optional work listed in this Contract, until the County exercises its option to obtain that work.

TRAFFIC CONTROL:
The Contractor shall execute the item of Traffic Control as required by the Standard Specifications, the plans, the Standard Drawings For Road Construction, these special provisions, all supplemental specifications, the MUTCD, and the Engineer. This is an amendment to the Standard Specifications to require the following:

GENERAL REGULATIONS -

These special provisions shall have priority to the plans and comply with the requirements of the MUTCD and the standard specifications. Revisions to the traffic control plan through modifications of the special provisions and the plans shall require approval by the department. **Final approval of any revisions to the traffic control plan shall be pending upon review by the Director of Traffic Engineering.**

Install and utilize changeable message signs in all lane closures installed on high volume high-speed multilane roadways. Use of changeable message signs in lane closures installed on low volume low speed multilane roadways is optional unless otherwise directed by the plans and the Engineer. Install and use a changeable message sign within a lane closure set-up as directed by the *Standard Drawings For Road Construction*. When a lane closures is not present for any time to exceed 24 hours, remove the changeable message sign from the roadway. Place the sign in a predetermined area on the project site, as approved by the Engineer, where the sign is not visible to passing motorists. Utilize preprogrammed messages in accordance with the *Standard Drawings For Road Construction* when using the changeable message sign as part of the traffic control set-up for lane closures. Only those messages pertinent to the requirements of the traffic control situation and the traffic conditions are permitted for display on a changeable message sign at all times. At no time will the messages displayed on a changeable message sign duplicate the legends on the permanent construction signs.

During operation of changeable message signs, place the changeable message sign on the shoulder of the roadway no closer than 6 feet between the sign and the near edge of the adjacent travel lane. When the sign location is within 30' of the near edge of a travel lane open to traffic, supplement the sign location with no less than 5 portable plastic drums placed between the sign and the adjacent travel lane for delineation of the sign location. Install and maintain the drums no closer than 3 feet from the near edge of the adjacent travel lane. This requirement for delineation of the sign location shall apply during all times the sign location is within 30' of the near edge of a travel lane open to traffic, including times of operation and non-operation. Oversized cones are prohibited as a substitute for the portable plastic drums during this application.

All signs mounted on portable sign supports shall have a minimum mounting height of 5' from the bottom of the sign to the ground. All signs mounted on ground mounted u-channel posts or square steel tube posts shall have a minimum mounting height of 7' from the bottom of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present.

On multilane primary routes, avoid placement of signs mounted on portable sign supports within paved median areas utilized for two-way left turns unless otherwise directed by the RCE.

When mounting signs on multiple ground mounted sign supports, ensure that each post is of the same type. Combining and installing both ground mounted u-section and square steel tube posts within the same sign assembly is prohibited.

When mounting signs on ground mounted u-section or square steel tube posts, utilize either a sign support / ground support post combination with an approved breakaway assembly or a single direct driven post for each individual sign support of a sign assembly installation. Do not combine a sign support / ground support post combination and a direct driven post on the same sign assembly installation that contains two or more sign supports. Regarding sign support / ground support post combination installations, ensure that post lengths, stub heights and breakaway assemblies comply with the manufacturer's requirements and specifications. Use approved breakaway assemblies found on the *Approved Products List For Traffic Control Devices in Work Zones*.

When covering signs with opaque materials, the Department prohibits attaching a covering material to the face of the sign with tape or a similar product or any method that will leave a residue on the retroreflective sheeting. Residue from tape or similar products, as well as many methods

utilized to remove such residue, damages the effective reflectivity of the sign. Therefore, contact of tape or a similar product with the retroreflective sheeting will require replacement of the sign. Cost for replacement of a sign damaged by improper covering methods will be considered incidental to providing and maintaining the sign; no additional payment will be made.

Overlays are prohibited on all rigid construction signs. The legends and borders on all rigid construction signs shall be either reversed screened or direct applied.

Signs not illustrated on the typical traffic control standard drawings designated for permanent construction signs shall be considered temporary and shall be included in the lump sum price bid item for "Traffic Control" unless otherwise specified.

Install "Grooved Pavement" signs (W8-15-48) supplemented with the "Motorcycle" plaque (W8-15P-30) in advance of milled or surface planed pavement surfaces. On primary routes, install these signs no further than 500 feet in advance of the beginning of the pavement condition. On interstate routes, install these signs no less than 500 feet in advance of the beginning of the pavement condition. Install two sign assemblies at each sign location, one on each side of the roadway, on multilane roadways when the pavement condition is present. Install these signs immediately upon creation of this pavement condition and maintain these signs until this pavement condition is eliminated.

Install "Steel Plate Ahead" signs (W8-24-48) in advance of an area of roadway where temporary steel plates are present. Install these signs no further than 300 feet in advance of locations where steel plates are present. On multilane roadways, comply with the same guidelines as applied to all other advance warning signs and install two sign assemblies at each sign location, one on each side of the roadway, when roadway conditions warrant. Install these signs immediately upon installation of a temporary steel plate and maintain the signs until the temporary steel plates are removed.

Install and maintain any necessary detour signing as specified by the typical traffic control standard drawings designated for detour signing, Part VI of the MUTCD, these Special Provisions, and the Engineer. The lump sum price bid item for "Traffic Control" includes payment for installation and maintenance of the detour signing.

The Contractor shall maintain the travel patterns as directed by the traffic control plans and shall execute construction schedules expeditiously. The Contractor shall provide the Resident Engineer with no less than a two-week prior notification of changes in traffic patterns.

During nighttime flagging operations, flaggers shall wear a safety vest and safety pants that comply with the requirements of ANSI / ISEA 107 standard performance for Class 3 risk exposure, latest revision, and a fluorescent hard hat. The safety vest and the safety pants shall be retroreflectorized and the color of the background material of the safety vest and safety pants shall be fluorescent orange-red or fluorescent yellow-green.

During nighttime flagging operations, the contractor shall illuminate each flagger station with any combination of portable lights, standard electric lights, existing street lights, etc., that will provide a minimum illumination level of 108 Lx or 10 fc.

During nighttime flagging operations, supplement the array of advance warning signs with a changeable message sign for each approach. These changeable message signs are not required during daytime flagging operations. Install the changeable message signs 500' in advance of the advance warning sign arrays. Messages should be "Flagger Ahead" and "Prepare To Stop".

During surface planing and milling operations, grade elevation differences greater than 1 inch in areas with pavements composed of hot mixed asphalt (HMA) base courses, intermediate courses or surface courses and Portland cement concrete are PROHIBITED unless otherwise directed by the Department. However, during surface planing and milling operations for removal of Open-Graded Friction courses ONLY, a grade elevation difference of 1½ inches between adjacent travel lanes opened to traffic may exist unless otherwise directed by the Department.

During the paving operations, the length of roadway with an acceptable grade elevation difference less than or equal to 2" shall be restricted to 2 miles.

During the milling and surface planing operations, the length of roadway with an acceptable grade elevation difference less than or equal to 1" shall be restricted to 2 miles.

Supplement and delineate the shoulder edges of travel lanes through work zones with traffic control devices to provide motorists with a clear and positive travel path. Utilize portable plastic drums unless otherwise directed by the Department. Vertical panels may be used where specified by the plans and directed by the RCE. The installation of traffic control devices are required in all areas where those areas immediately adjacent to a travel lane open to traffic have been altered in any manner by work activities, including but not limited to activities such as grading, milling, etc. Install the traffic control devices immediately upon initiating any alterations to the areas immediately adjacent to or within 15 feet of the near edge line of the adjacent travel lane. When sufficient space is available, place the traffic control devices no closer than 3 feet from the near edge of the traffic control device to the near edge line on the adjacent travel lane. When sufficient space is unavailable, place the traffic control device at the maximum distance from the near edge of the adjacent travel lane available.

LANE CLOSURE RESTRICTIONS -

The lane closure restrictions stated below are project specific. For all other restrictions see supplemental specification "Closure Restrictions" dated July 1, 2019.

- **Lane Closure Restriction**
  https://www.scdot.org/business/technicalPDFs/supSpecs/Lane-Closure-Restriction-2019July.pdf
- **Primary Hour Restrictions**
  http://www.scdot.org/business/pdf/accessMgt/trafficEngineering/PrimaryHourRestrictions.pdf
- **Interstate Hour Restrictions**
  https://www.scdot.org/business/pdf/accessMgt/trafficEngineering/InterstateHourRestrictions.pdf

The Contractor shall install all lane closures as directed by the Standard Specifications For Highway Construction (latest edition), the Standard Drawings For Road Construction, these special provisions, the MUTCD, and the Engineer. The Contractor shall close the travel lanes of two-lane two-way roadways by installing flagging operations. The Contractor shall close the travel lanes of multilane primary and secondary routes as directed by the typical traffic control standard drawings designated for lane closures on primary routes.

The Department prohibits lane closures on primary and secondary routes during any time of the day that traffic volumes in the travel lanes remaining open to traffic exceed 800 vehicles per hour per lane per direction. In addition to this restriction the Department specifically restricts lane closures on US 21 & SC 51 & SC 460 & I-77 NB Offramp during the hours listed in the table below. These restrictions also apply to all road closures and pacing operations. The Department reserves the right to suspend a lane closure if any resulting traffic backups are deemed excessive by the Engineer. Maintain all lane closure restrictions as directed by the plans, these special provisions, and the Engineer.

HOURLY LANE CLOSURE PROHIBITIONS (US 21 & SC 51 & SC 460)	HOURLY LANE CLOSURE PROHIBITIONS (I-77 NB Off Ramp)
MON-FRI: 7A-9A and 4P-6P SAT-SUN: N/A	MON-THU: 5A-8P FRI: 5A-9P SAT: 7A-9P SUN: 9A-9P

The contractor is advised that the Lane Closure Restrictions outline in this Traffic Control Special Provision will be strictly enforced. Should lane closures remain in place or not be completely removed by the time specified, a penalty will be assessed at the rate of $500.00 (FIVE HUNDRED DOLLARS) for each hour interval (or any portion thereof).

Flagging operations are considered to be lane closures for two-lane two-way operations and shall be subject to all restrictions for lane closures as specified by this contract.

Lane closures, including flagging operations, are restricted to maximum distances of 2 miles. Install all lane closures according to the typical traffic control standard drawings. On occasions when daytime lane closures must be extended into the nighttime hours, substitute the nighttime lane closure standards for the daytime lane closure standards.

Installation and maintenance of a lane closure is PROHIBITED when the Contractor is not actively engaged in work activities specific to the location of the lane closure unless otherwise specified and approved by the Engineer. The length of the lane closure shall not exceed the length of roadway anticipated to be subjected to the proposed work activities within the work shift time frame or the maximum lane closure length specified unless otherwise approved by the Engineer. Also, the maximum lane closure length specified does not warrant installation of the specified lane closure length when the length of the lane closure necessary for conducting the work activity is less. The length and duration of each lane closure, within the specified parameters, shall require approval by the Engineer prior to installation. The length and duration of each lane closure may be reduced by the Engineer if the work zone impacts generated by a lane closure are deemed excessive or unnecessary.

The presence of temporary signs, portable sign supports, traffic control devices, trailer mounted equipment, truck mounted equipment, vehicles and vehicles with trailers relative to the installation or removal of a closure and personnel are prohibited within the 15 to 30 foot clear zone based upon the roadway speed limit during the prohibitive hours for lane closures specified by these special provisions.

SHOULDER CLOSURE RESTRICTIONS -

The hourly restrictions for lane closures shall also apply to work activities conducted under a shoulder closure within 15' of the near edge of an adjacent travel lane or a median area. The Department reserves the right to suspend work conducted under a shoulder closure if any traffic backups develop and are deemed excessive by the Engineer. Maintain all shoulder closure restrictions as directed by the plans, these special provisions, and the Engineer.

On primary and secondary roadways, the Department prohibits the Contractor from conducting work within 1' or less of the near edge of an adjacent travel lane under a shoulder closure. All work that may require the presence of personnel, tools, equipment, materials, vehicles, etc., within 1' of the near edge of an adjacent travel lane shall be conducted under a lane closure.

The Contractor shall install all shoulder closures as directed by the typical traffic control standard drawings designated for shoulder closures, and the Engineer. Substitution of the portable plastic drums with oversized cones during nighttime shoulder closures is PROHIBITED.

MOBILE OPERATIONS -

A mobile operation moves continuously at all times at speeds 3 mph or greater without any stops. The minimal traffic flow impacts generated by these operations involve brief traffic flow speed reductions and travel path diversions. Conduct work operations that cannot be performed at speeds of 3 mph or greater under standard stationary lane closures.

The distance intervals between the vehicles, as indicated in the *Standard Drawings For Road Construction*, may require adjustments to compensate for sight distance obstructions created by hills and curves and any other conditions that may obstruct the sight distance between the vehicles. However, adjustments to the distance intervals between the vehicles should be maintained within the range of variable distance intervals indicated in the standard drawings unless otherwise directed by the Engineer.

Maintain two-way radio communication between all vehicles in the vehicle train operating in a mobile operation.

Supplement the work vehicles and the shadow vehicles with amber colored flashing dome lights. The vehicles may also be supplemented with advance warning arrow panels and truck mounted attenuators as directed in the *Standard Drawings For Road Construction* and the Standard Specifications.

The Contractor shall install, operate and maintain all advance warning arrow panels, truck mounted attenuators and truck mounted changeable message signs as required by these special provisions, the manufacturer's specifications, the *Standard Drawings For Road Construction*, the Standard Specifications, the plans and the Engineer.

CHANGES TO INTERSECTION TRAFFIC CONTROL -

(A) Traffic Signal to Two-Way Stop Control –

1. Approximately two weeks prior to the date the change is to be implemented:

   a. On the approaches that will be uncontrolled, install changeable message signs having the messages "SIGNAL WILL BE REMOVED" and "ON XX/XX" (XX/XX is the removal date in month/day format).

   b. On the approaches to which stop control will be installed, erect signs (R24-2-36) giving notice that a stop will be effective on a specific date. The signs may be erected below or adjacent to the SIGNAL AHEAD signs on the stop approaches.

2. An explanation of the change should be provided by public notice to the local news media approximately one week in advance of the date the change is to be implemented.

3. On the date of the change, the following steps should be done:

   a. Erect STOP signs and signs having the message CROSS TRAFFIC DOES NOT STOP (W4-4P-XX) below or adjacent to the STOP signs on approaches that are to be stop approaches. Erect STOP AHEAD signs on approaches that are to be stop approaches.

   b. Place the traffic signal into flash mode. Flash yellow on approaches where traffic is not required to stop. Flash red on the stop approaches.

   c. Remove SIGNAL AHEAD signs on all approaches.

   d. Remove R24-2-36 signs and changeable message signs that were used to give notice of the change in traffic control.

   e. Pavement markings on the new through street should be corrected by removing any stop lines that exist.

4. The traffic signal should flash for seven days. After seven days the signal should be disconnected and all signal heads removed. If all signal heads cannot be removed in a single work day the remaining signal heads may be bagged until their removal. All signal heads shall be removed within seven days of the signal being disconnected.

5. Signs with the message CROSS TRAFFIC DOES NOT STOP should remain in place a minimum of two months after the date of the change.

TRAFFIC CONTROL PROCEDURES SPECIFIC TO TRAFFIC SIGNAL WORK OPERATIONS –

Utilize a vehicle train consisting of a primary work vehicle and no less than 1 shadow vehicle. The shadow vehicle is required for all Traffic Signal Work Operations except on a two-lane roadway for a time duration of 15 minutes or less when no pedestrian workers are present, excluding the flagger. A second shadow vehicle is necessary in some applications on multilane roadways as depicted on the Standard Drawings. Install and maintain the vehicle train as directed by these special provisions, the Standard Drawings For Road Construction, and the Engineer.

Two-Lane Two-Way Roadways

A. Utilize flagging operations to control the traffic flow around the work site where the vehicle train is operating.

B. Utilize flaggers to control the traffic flow on an intersecting two-lane two-way roadway. The advance warning signs for the flagging operations shall include the following:

W20-7a-48	Flagger symbol
W20-4-48-A	One Lane Road Ahead
W20-1-48-A	Road Work Ahead

C. Maintain two-way radio communications between all flaggers.

Multilane Roadways

A. During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration of 15 minutes or less, advance warning signs may be omitted.

B. During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration in excess of 15 minutes but less than 60 minutes, advance warning signs are required. Typical advance warning signs required for a temporary closure of a travel lane shall include the following:

W4-2R(L)-48	Lane Ends symbol
W20-5R(L)-48-A	Right (Left) Lane Closed Ahead
W20-1-48-A	Road Work Ahead

C. Utilization of flaggers to control the traffic flow in the travel lanes adjacent to the travel lane the vehicle train is operating in is PROHIBITED except as allowed in the Standard Drawings Requirements for a Temporary Cessation of Traffic Flow for a time duration of 3 minutes or less.

D. Utilize flaggers to control the traffic flow on an intersecting two-lane two-way roadway. Only flaggers and advance warning signs are required on the approaches intersecting the travel lane the vehicle train is operating in. The advance warning signs for the flagging operations shall include the following:

W20-7a-48	Flagger symbol
W3-4-48	Be Prepared to Stop
W20-1-48-A	Road Work Ahead

E. **During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration in excess of 60 minutes, install a standard lane closure as directed by these special provisions, the Standard Drawings For Road Construction, and the Engineer.**

Conduct all equipment and material preparations prior to entering the roadway.

Conducting traffic signal work or conducting any activities that interfere with or create disruptions to normal traffic operations during morning, mid-day, and afternoon-evening high traffic volume peak periods is PROHIBITED. The contractor shall observe all lane closure restrictions.

Conduct all work activities within the boundaries of a travel lane closed to vehicular traffic or a pedestrian thoroughfare closed to pedestrian traffic. Conducting work activities over a travel lane open to traffic is PROHIBITED. Conducting work activities over a pedestrian thoroughfare open to pedestrian traffic is PROHIBITED. Do not conduct any work activities in any manner over a thoroughfare open to vehicular or pedestrian traffic.

When advance warning signs are required to supplement the vehicle train, install the advance warning signs at spacing intervals based on the regulatory speed limit of the roadway prior to beginning any work. When a work zone traffic control plan or a work zone traffic control standard drawing is not provided to indicate the spacing intervals for a typical 3 advance warning sign array installation, utilize the sign placement intervals below. **These sign intervals do not apply to the sign intervals of the advance sign intervals for standard lane closures.**

ADVANCE WARNING SIGN PLACEMENT INTERVALS	
URBAN / RURAL (LOW SPEED) ≤ 35 MPH	200 / 200 / 200 Feet
URBAN / RURAL (INTERMEDIATE SPEED) 40 - 50 MPH	350 / 350 / 350 Feet
RURAL (HIGH SPEED) ≥ 55 MPH	500 / 500 / 500 Feet
INTERSTATE	1000 / 1500 / 2600 Feet

TYPICAL TRAFFIC CONTROL STANDARD DRAWINGS -

The typical traffic control standard drawings of the "Standard Drawings For Road Construction", although compliant with the MUTCD, shall take precedence over the MUTCD. The typical traffic control standard drawings of the "Standard Drawings For Road Construction" shall apply to all projects let to contract.

Install the permanent construction signs as shown on the typical traffic control standard drawings designated for permanent construction signing.

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Scheme A		
Scheme C	**US 21 (Hwy 21 Byp) x2** **S-1426 (Gold Hill Rd)** **US 21 Bus (Old Nation Rd)** **SC 51 (Hwy 51)**	**92 Square Feet**
Scheme E	**SC 460 (Springfield Pkwy) x2** **Mercantile Place** **Crescent Moon Drive** **S-1134 (Lakeview Dr)** **S-1467 (Amelia Dr)** **S-1469 (Fern Forest Ct)** **S-1133 (Lakeshore Dr)** **S-1470 (Forest Way Dr)** **S-1109 (Forest Way Dr)** **Embassy Dr** **Drewsky Ln** **Ed Thompson Rd** **Heritage Blvd** **S-676 (Garrison Farm Rd)** **Regent Driveway** **Lakes Blvd** **S-641 (Flint Hill Rd) x2** **Retail Dr** **Terrys Rd** **S-48 (Springhill Farm Rd) x2** **I-77 Exit 90 NB Off Ramp** **Centre Cir x2** **S-328 (Andrew L Tucker Rd)**	**24 Square Feet**
Total		**1,156 Square Feet**

ADDENDUMS

(Addendums to the "2007 Standard Specifications for Highway Construction")

(A) Construction (Sub-section 601.4) –

Sub-section 601.4.2 Construction Vehicles (paragraph 2) -

When working within the rights-of-way of access-controlled roadways such as Interstate highways, the Contractor's vehicles may only change direction of travel at interchanges. These vehicles are prohibited from crossing the roadway from right side to the median or vice versa. Use a flagger to control the Contractor's vehicles when these vehicles attempt to enter the roadway from a closed lane or the median area. Ensure the flagger does not stop roadway traffic, cause roadway traffic to change lanes, or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

The Contractor shall have flaggers available to control all construction vehicles entering or crossing the travel lanes of secondary and primary routes. The RCE shall determine the necessity of these flaggers for control of these construction vehicles. The RCE shall consider sight distance, vertical and horizontal curves of the roadway, prevailing speeds of roadway traffic, frequency of construction vehicles entering or crossing the roadway and other site conditions that may impact the safety of the workers and motorists when determining the necessity of these flaggers. Ensure these flaggers do not stop roadway traffic, cause roadway traffic to change lanes or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

When working within the rights-of-way of access-controlled roadways with posted regulatory speed limits of 55 MPH or greater and average daily traffic volumes {ADT} of 10,000 vehicles per day or greater, i.e. Interstate highways, all construction and work vehicles possessing any one or more of the vehicular characteristics listed below are only permitted to enter and exit a right or left shoulder work area during the presence of active lane closures unless otherwise directed by the RCE. These vehicles are not permitted to enter or exit these work areas without the presence of active lane closures unless otherwise directed by the RCE. Shoulder closures are unacceptable and insufficient methods for control of traffic at ingress / egress areas for these vehicles. The restrictive vehicular characteristics include the following:

- Over six (6) tires
- Tandem rear axles
- A base curb weight greater than 8000 lbs.
- A gross vehicular weight greater than 12000 lbs. unless performing duties as a shadow vehicle while supporting a truck mounted attenuator
- A trailer in tow except under the following conditions:
    - Trailers transporting traffic control devices (including but not limited to standard and 42" oversized traffic cones, portable plastic drums, signs, portable sign supports, u-channel and square steel tube sign posts) relative to the installation of lane closures, shoulder closures or other traffic control operations approved by the RCE
    - Trailer mounted traffic control devices (including but not limited to advance warning arrow panels, changeable message signs, temporary traffic signals, highway advisory radios, work zone intelligent transportation systems and trailer towed truck mounted attenuators)

(B) <u>Construction</u> (Sub-section 601.4) –

<u>Sub-section 601.4.2 Construction Vehicles</u> -

<u>Auxiliary Warning Lights for Vehicles and Equipment</u> -

Supplement all construction and/or construction-related vehicles and equipment that operate in a stationary or mobile work zone within or adjacent to a roadway within the highway rights-of-way with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists.

All auxiliary warning light models shall meet *Society of Automotive Engineers* (SAE) Class I standards and SAE Standard J575 relative to *Tests for Motor Vehicle Lighting Devices and Components* and these specifications.

The amber/yellow color of the dome/lens of an auxiliary warning light device shall meet SAE Standard J578 for amber/yellow color specifications.

Auxiliary warning lights with parabolic reflectors that rotate shall rotate around a halogen lamp at a rate to produce approximately 175 flashes per minute. The parabolic reflector shall produce a minimum 80,000 candle power and a minimum 54,000 candela through an SAE Standard J846 approved amber dome.

Equip strobe type flashing auxiliary warning light devices with photosensitive circuit controls to adjust the lighting intensity in response to changes in ambient light conditions such as from day to night. These lights shall have a double-flash capability rated at approximately 80 double flashes per minute and produce a minimum 24 joules of flash energy at the highest power level setting.

Acceptable auxiliary warning light models shall provide sufficient light output to be clearly recognizable at a minimum distance of 1750 feet.

Mount all auxiliary warning light devices intended to function as the auxiliary warning light system or as an element thereof on vehicles and equipment at locations no less than 3 feet above the ground and in conspicuous locations to provide visibility to approaching motorists.

Auxiliary warning light devices and/or models that mount in the locations of the standard vehicle lighting system are unacceptable as the specified auxiliary warning light system due to restrictive simultaneous visibility capabilities from multiple sight angles. However, auxiliary warning light devices that mount in the standard vehicle lighting system locations are acceptable as supplements to the specified lighting devices mounted in locations that do meet the minimum height requirements and provide simultaneous visibility capabilities from multiple sight angles.

Standard vehicle hazard warning lights are only permitted as supplements to the specified auxiliary warning light devices.

(C) General Requirements for Providing and Maintaining Traffic Control Devices in the Work Zone (Section 602) –

Sub-section 602.4 Construction (paragraph 8) -

Mount flat sheet signs straight and level and with the face of the signs perpendicular to the surface of the roadway. This requirement applies to flat sheet signs whether they are portable or have the embedded supports. Mount advance construction signs 2 feet from the edge of a paved shoulder or the face of a curb, or if no paved shoulder exists, 6 feet to 12 feet from the edge of an adjacent travel lane to the nearest edge of the signs. The mounting height of single signs mounted on ground embedded sign supports is no less than 7 feet or no greater than 8 feet from the bottom edge of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present. Any secondary sign on the same assembly has a minimum mounting height of 6 feet from the ground to the bottom edge of the secondary sign. Ensure that signs mounted on portable sign supports, including advance construction signs, regulatory signs, warning signs, etc., have a minimum mounting height of 5 feet from the ground to the bottom edge of the sign. Provide special sign mounting assemblies, when necessary, in areas of double-layered guardrail, concrete median barrier, or bridge parapet walls.

(D) Category I Traffic Control Devices (Section 603) –

Sub-section 603.2.2 Oversized Traffic Cones (paragraph 6) -

Reflectorize each oversized traffic cone with 4 retroreflective bands: 2 orange and 2 white retroreflective bands. Alternate the orange and white retroreflective bands, with the top band always being orange. Make each retroreflective band not less than 6 inches wide. Utilize Type III – Microprismatic retroreflective sheeting for retroreflectorization on all projects let to contract after May 1, 2010 unless otherwise specified. Separate each retroreflective band with not more than a 2-inch non-reflectorized area. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the cone surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

Sub-section 603.2.3 Portable Plastic Drums (paragraph 3) -

Reflectorize each drum with Type III – Microprismatic retroreflective sheeting: 2 orange and 2 white retroreflective bands, 6 inches wide on all projects let to contract after May 1, 2010 unless otherwise specified. Alternate the orange and white retroreflective bands with the top band always being orange. Ensure that any non-reflectorized area between the orange and white retroreflective bands does not exceed 2 inches. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the

retroreflective sheeting directly to the drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

(E) Category II Traffic Control Devices (Section 604) –

Sub-section 604.2.1 Type I and Type II Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle in the direction of passing traffic. The stripes shall be 6 inches wide.

Sub-section 604.2.2 Type III Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle. Apply the sloping orange and white stripes in accordance with the requirements of the Plans, SCDOT Standard Drawings and the MUTCD. The stripes shall be 6 inches wide.

(F) Temporary Concrete Barrier (Sub-section 605.2.3.2) –

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 6) -

Previously used temporary concrete barrier walls are subject to inspection and approval by the RCE before use. Ensure that previously used temporary concrete barrier walls are in good condition. Defects to a temporary concrete barrier wall that may disqualify a section of wall for use include gouges, cracks, chipped, or spalled areas. A defect that exposes reinforcing steel warrants immediate disqualification. A disqualification grade type defect shall consist of measurements in excess of 1 inch, entirely or partially within the boundaries of the end connection areas and the drainage slot areas as illustrated in the “Standard Drawings for Road Construction”, and/or in excess of 4 inches for all areas beyond the end connection areas. To warrant disqualification, these measurements shall exceed the specified dimensions in all three directions, width, height, and depth. A defect that exceeds the specified dimensions in only one or two of the three directions does not warrant disqualification.

Temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel may be repaired in accordance with the following requirements. Repair is prohibited on temporary concrete barrier walls with defects 6 inches or greater in all three directions, width, height and depth.

For repair of temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel, repair the defect with a premanufactured patching material specifically fabricated for patching structural concrete. The strength of the patch must meet or exceed the design strength of the class 3000 concrete of the temporary concrete barrier wall. Perform the repair procedures in accordance with all requirements and instructions from the manufacturer of the patch material. Use a bonding compound between the patch material and the concrete unless specifically stated by the manufacturer that a bonding compound is not required. If the manufacturer states that application of a bonding compound is optional, SCDOT requires application of a bonding compound compatible with the patch material. If cracking occurs within the patched area, remove the patch material completely and repeat the repair process. The contractor shall submit documentation stating all repairs have been conducted in accordance with these requirements prior to installing any temporary concrete barrier walls with repairs. Utilization of temporary concrete barrier walls with repairs shall require approval by the RCE prior to installation.

The Contractor shall submit certification documents for the patch material utilized for repairs to the Engineer prior to placing temporary concrete barrier walls that have been repaired on the project site.

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 5) -

In regard to projects let to contract after January 1, 2017, ALL *NCHRP Report 350* compliant temporary concrete barrier walls placed on a project site SHALL comply with the requirements for the recessed approval stamp as directed by the *SCDOT Standard Drawings*. Those *NCHRP Report 350* compliant temporary concrete barrier walls with the original recessed approval stamp that reads "SCDOT 350" will continue to be acceptable on projects let to contract after January 1, 2017. However, those temporary concrete barriers with the “SCDOT 350” identification plate attached to the side of the barrier walls with mechanical anchors previously grandfathered will no longer be acceptable on projects let to contract after January 1, 2017.

(G) Construction Signs (Sub-section 605.4.1.1) –

On all projects relative to **interstate highways** let to contract after January 1, 2016, all signs attached to portable sign supports on and/or adjacent to **interstate highways** shall be rigid. Fabricate each of these rigid signs from an approved aluminum laminate composite rigid sign substrate approved by the Department. Utilization of signs fabricated from roll-up fabric substrates attached to portable sign supports installed on and/or adjacent to **interstate highways** will no longer be acceptable on projects let to contract after January 1, 2016.

ONLY those portable sign supports specified and approved for support of rigid signs fabricated from approved aluminum laminated composite rigid sign substrates and included on the *Approved Products List for Traffic Control Devices in Work Zones*, latest edition, are acceptable. To facilitate location of acceptable portable sign supports, the listing of portable sign supports is now separated into two (2) sections; “Portable Sign Supports for Use with Roll-Up Signs ONLY” and “Portable Sign Supports for Use with Roll-Up Sign Substrates and Rigid Sign Substrates”.

The trade names of the approved aluminum laminate composite rigid sign substrates are “Acopan”, “Alpolic”, “Dibond” and “Reynolite”. These rigid sign substrates are restricted to thicknesses no greater than 2 millimeters.

Rigid signs fabricated from standard aluminum sign blanks or any other rigid material other than Acopan, Alpolic, Dibond or Reynolite are PROHIBITED for attachment to portable sign supports. However, rigid signs fabricated from standard 0.080 and 0.100 inches thick aluminum sign blanks will continue to be acceptable for mounting on ground mounted sign supports.

Signs fabricated from roll-up fabric substrates approved by the Department will continue to be acceptable for use on and/or adjacent to secondary and primary roadways unless otherwise directed by the Department.

The minimum mounting height of signs mounted on these portable sign supports shall continue to be 5 feet from the ground to the bottom edge of the sign except where a minimum 7 foot mounting height is required in accordance with the standard specifications, the standard drawings, these special provisions and the MUTCD, latest edition.

(H) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.2.2.2.3.3 Color (paragraph 1) -

Use industrial grade enamel paint for cover of the metal aspects of the unit. Provide and attach supplemental striping to the rear face of the unit with a minimum Type III high intensity retroreflective sheeting unless otherwise directed by the Department. Utilize an alternating 4 to 8 inch black and 4 to 8 inch yellow 45-degree striping pattern that forms an inverted “V” at the center of the unit that slopes down and to the sides of the unit in both directions from the center.

(I) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.4.2.2 Truck-Mounted Attenuators (paragraph 6) -

A direct truck mounted truck mounted attenuator is mounted and attached to brackets or similar devices connected to the frame of a truck with a minimum gross vehicular weight (GVW) of 15,000 pounds (actual weight) unless otherwise directed. A trailer towed truck mounted attenuator is towed from behind and

attached via a standard pintle hook / hitch to the frame of a truck with a minimum gross vehicular weight (GVW) of 10,000 pounds (actual weight) unless otherwise directed.

Each truck utilized with a truck mounted attenuator shall comply with the manufacturer's requirements to ensure proper operation of the attenuator. The minimum gross vehicular weight (GVW) (actual weight) for each truck shall comply with these specifications unless otherwise directed within the "Remarks" column of the *Approved Products List For Traffic Control Devices in Work Zones* in regard to specific requirements for the device in question.

If the addition of supplemental weight to the vehicle as ballast is necessary, contain the material within a structure constructed of steel. Construct this steel structure to have a minimum of four sides and a bottom to contain the ballast material in its entirety. A top is optional. Bolt this structure to the frame of the truck. Utilize a sufficient number of fasteners for attachment of the steel structure to the frame of the truck to ensure the structure will not part from the frame of the truck during an impact upon the attached truck mounted attenuator. Utilize either dry loose sand or steel reinforced concrete for ballast material within the steel structure to achieve the necessary weight. The ballast material shall remain contained within the confines of the steel structure in its entirety and shall not protrude from the steel structure in any manner.

(J) Trailer-Mounted Changeable Message Signs (Sub-section 606.3.2) -

Sub-section 606.3.2.7 Controller (paragraphs 1-4) -

The controller shall be an electronic unit housed in a weatherproof, rust resistant box with a keyed lock and a light for night operation. Provide the unit with a jack that allows direct communications between the on-board controller and a compatible personal computer. The unit shall have a LCD display screen that allows the operator to review messages prior to displaying the message on the sign.

The controller shall have the capability to store 199 factory preprogrammed messages and up to 199 additional messages created by the user in a manner that does not require a battery to recall the messages. Also, the controller shall allow the operator the capability to program the system to display multiple messages in sequence.

Provide the controller with a selector switch to allow the operator to control the brightness or intensity level of the light source of the sign panel. The selector switch shall include "bright," "dim" and "automatic" modes; inclusion of additional modes is permissible. When the selector switch is in the "automatic" mode, a photosensitive circuit shall control the brightness or intensity level of the light source in response to changes in ambient light such as from day to night and other various sources of ambient light.

Equip each sign with remote communications capabilities, such as utilization of cellular telephone or internet browser technology, to allow the operator to revise or modify the message selection from the office or other remote location. Also, provide protection to prohibit unauthorized access to the controller, (i.e. password protection).

Sub-section 606.5 Measurement (paragraph 2) -

Trailer-mounted changeable message signs are included in the lump sum item for Traffic Control in accordance with **Subsections 107.12** and **601.5** of the "2007 Standard Specifications for Highway Construction". No separate measurement will be made for trailer-mounted changeable message signs unless the contract includes a specific pay item for trailer-mounted changeable message signs.

The Contractor shall provide, install, operate, and maintain the trailer-mounted changeable message sign per traffic control set-up as directed by the Plans, the "Standard Drawings for Road Construction", these Special Provisions, the Specifications, and the Engineer.

Sub-section 606.6 Payment (paragraph 2) -

In addition to **Subsections 107.12** and **601.6**, the payment for Traffic Control is full compensation for providing, installing, removing, relocating, operating, and maintaining trailer-mounted advance warning arrow panels and trailer-mounted changeable message signs as specified or directed and includes providing the units' primary power source; repairing or replacing damaged or malfunctioning units within the specified time;

providing traffic control necessary for installing, operating, and maintaining the units; and all other materials, labor, hardware, equipment, tools, supplies, transportation, incidentals, and any miscellaneous items necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other items of the Contract.

Sub-section 606.6 Payment (paragraph 3) -

Disregard this paragraph unless the Contract includes a specific pay item for trailer-mounted changeable message signs.

(K) Temporary Pavement Markings (Sub-section 609.4.1) –

Sub-section 609.4.1.1.1 Application Requirements General (in addition to paragraph 3) -

On two-lane two-way roadways, apply and place temporary or permanent pavement markings, as specified hereupon, prior to the end of each day's work or shift or reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines on edge lines and solid center lines and 4-inch wide by 10 feet long broken lines with a 30-foot gap for broken center lines and lane lines unless otherwise specified. The center line pavement markings shall be either double yellow solid lines, yellow broken lines or an appropriate combination of a yellow solid line and yellow broken lines for passing / no passing zones. Placement of a singular yellow solid line for a center line pavement marking is unacceptable. The edge line pavement markings shall be a white solid line.

On multilane primary and secondary roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines, utilized for edge lines and solid center lines, and 4-inch wide by 10 feet long broken lines with a 30-foot gap, utilized for lane lines and turn lanes, unless otherwise specified. The center line pavement markings shall be either double yellow solid lines or an appropriate combination of a yellow solid line and 4-inch wide by 10 feet long yellow broken lines for two-way left turn median areas. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas. The lane lines between travel lanes and turn lanes shall be 4-inch wide by 10 feet long white broken lines with a 30-foot gap.

However, on two-lane two-way and multilane primary and secondary roadways, application of a 4-inch wide solid line utilized for an edge line adjacent to an earth shoulder, white or yellow, may be delayed up to 72 hours after eradication of the original line when the length of eradicated line at a single location is no longer than 250 feet. In the event of multiple locations along the same line, each location must be separated from the adjacent location by no less than 250 feet with a cumulative total distance of eradicated line of no more than 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location. If the length of eradicated line exceeds 250 feet at any single location, the distance interval between multiple adjacent locations is less than 250 feet or a cumulative total distance of multiple locations of eradicated line exceeds 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location, replace the eradicated line(s) prior to reopening the adjacent travel lane to traffic.

On interstate roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 6-inch wide solid lines, utilized for edge lines, and 6-inch wide by 10 feet long white broken lines with a 30-foot gap, utilized for lane lines between travel lanes and auxiliary lanes, unless otherwise specified. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas.

On all roadways, apply and place white stop bars and white triangle yield bars in all locations where previous stop bars and triangle yield bars have been eradicated by the work. Apply and place white stop bars and white triangle yield bars at intersections controlled by stop and yield signs within 72 hours of the eradication of the original pavement marking. Apply and place white stop bars at signalized intersections controlled by traffic control signals and at railroad crossings prior to reopening a closed travel lane to traffic.

Within the limits of existing turn lanes on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work unless otherwise directed by the RCE. Apply and place white arrows within 72 hours of the eradication of the original pavement markings. However, in regard to newly constructed turn lanes, apply and place white arrows the within turn lanes as directed by the RCE.

Within the limits of existing lane-drop sites on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work prior to the end of each day's work or shift or reopening the closed travel lane to traffic. In regard to newly constructed lane-drop sites, apply and place white arrows within the travel lane to be terminated prior to opening the travel lane to traffic and as directed by the RCE.

(L) Temporary Pavement Markings (Sub-section 609.4.1) –

Sub-section 609.4.1.1.1 Application Requirements General (Revision to paragraph 8) -

On two-lane, two-way roadways, passing zones may be eliminated within the work zone through application of 4-inch double yellow centerline pavement markings if determined feasible and directed to do so by the Plans and/or the RCE. Apply no passing zone markings as specified by the Plans, the Specifications, the *MUTCD* and the RCE.

(M) Flagging Operations (Sub-section 610.4.1) –

Sub-section 610.4.1.1 Flagging Operations (paragraph 1) -

Use a flagging operation to control the flow of traffic when two opposing directions of traffic must share a common travel lane. A flagging operation may be necessary during a lane closure on a two-lane two-way roadway, an intermittent ramp closure or an intermittent encroachment of equipment onto a portion of the roadway. Utilize flagging operations to direct traffic around work activities and maintain continuous traffic flow at reduced speeds when determined to be appropriate by the RCE. As stated above, flagging operations shall direct traffic around the work activities and maintain continuous traffic flow, therefore, stopped traffic shall not be required to stop for time durations greater than those listed below unless otherwise directed by the RCE. Begin measurement of the time interval immediately upon the moment the Flagger rotates the Stop/Slow paddle to display the "Stop" condition to the approaching motorists.

LENGTH OF CLOSURE	MAXIMUM TIME DURATION FOR STOPPED TRAFFIC
1 MILE or LESS	5 Minutes
1 to 2 MILES	7 ½ Minutes

If the work activities require traffic to be stopped for periods greater than 5 to 7 ½ minutes as stated above, consider alternate work methods, conducting work activities during times of lowest traffic volumes such as during the hours of darkness or complete road closure with detour installation.

(N) Paving and Resurfacing (Sub-section 611.4.1) –

Sub-section 611.4.1.2 Requirements (paragraph 8) -

Whenever travel lanes with acceptable grade elevation differences are open to traffic, provide "Uneven Lanes" signs (W8-11-48) or "Uneven Pavement" signs (W8-11A-48). Reflectorize these signs with a fluorescent orange colored prismatic retroreflective sheeting unless otherwise specified. Install these signs adjacent to roadways with uneven pavement surfaces between travel lanes or between travel lanes and the adjacent paved shoulders. Install these signs at intervals no greater than 2600 feet.

STAGING

STAGE 1

1. INSTALL PERMANENT CONSTRUCTION SIGNING AS DIRECTED IN THE TRAFFIC CONTROL PLANS, TRAFFIC CONTROL SPECIAL PREVISIONS AND AS DIRECTED BY THE RCE.
2. PLACE PORTABLE PLASTIC DRUMS AND OTHER TRAFFIC CONTROL DEVICES AS SHOWN ON THE TRAFFIC CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
3. INSTALL EROSION CONTROL DEVICES AS SHOWN IN THE EROSION CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
4. INSTALL TEMPORARY BARRIER FENCE ALONG ENVIRONMENTALLY SENSITIVE AREAS AS SHOWN IN THE EROSION CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
5. APPLY TEMPORARY PAVEMENT MARKINGS IN ORDER TO MAINTAIN EXISTING TRAFFIC PATTERNS IN EXISTING TRAVEL LANES WITH ALLOWABLE LANE REDUCTION WIDTHS AS SHOWN AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
6. CONSTRUCT CULVERT EXTENSIONS AND INSTALLATION OF TRENCHLESS PIPES.
7. REMOVE AND REPLACE US 21 EXISTING PAVED SHOULDERS AS NOTED ON THE TYPICAL SECTION AS DIRECTED BY THE REC. REPAIR/REPLACE EXISTING PAVEMENT AS NOTED ON THE TYPICAL SECTION AND SHOWN IN THE PLANS. (NOT SHOWN IN TRAFFIC CONTROL PLANS)
8. BEGIN CONSTRUCTION OF NEW BASE AND INTERMEDIATE PAVEMENT, CURB AND GUTTER, SIDEWALK, AND DRAINAGE AS INDICATED.

STAGE 2

1. MAINTAIN PERMANENT CONSTRUCTION SIGNING AS DIRECTED IN THE TRAFFIC CONTROL PLANS, TRAFFIC CONTROL SPECIAL PREVISIONS AND AS DIRECTED BY THE RCE.
2. PLACE PORTABLE PLASTIC DRUMS AND OTHER TRAFFIC CONTROL DEVICES AS SHOWN ON THE TRAFFIC CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
3. MAINTAIN AND INSTALL EROSION CONTROL DEVICES AS SHOWN IN THE EROSION CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
4. MAINTAIN AND INSTALL TEMPORARY BARRIER FENCE ALONG ENVIRONMENTALLY SENSITIVE AREAS WERE DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
5. APPLY TEMPORARY PAVEMENT MARKINGS IN ORDER TO MAINTAIN OR SHIFT EXISTING TRAFFIC PATTERNS WITH ALLOWABLE LANE REDUCTION WIDTHS AS SHOWN AND AS DIRECTED BY THE RCE.
6. CONTINUE CONSTRUCTION OF NEW BASE AND INTERMEDIATE PAVEMENT, CURB AND GUTTER, SIDEWALK AND DRAINAGE AS INDICATED.

THE CONTRACTOR IS ADVISED THAT THE US 21 BUSINESS CLOSURE SHOWN IN THE PLANS SHALL BE INSTALLED FOR A **SINGLE INSTANCE OF NO MORE THAN 180 DAYS**. SHOULD THE US 21 BUSINESS CLOSURE REMAIN IN PLACE OR NOT BE COMPLETELY REMOVED, **A PENALTY WILL BE ASSESSED AT A RATE OF $500.00 PER DAY**.

THE CONTRACTOR IS ADVISED THAT THE OLD SC 51 CLOSURE SHOWN IN THE PLANS SHALL BE INSTALLED FOR A **SINGLE INSTANCE OF NO MORE THAT 180 DAYS**. SHOULD THE OLD SC 51 BUSINESS CLOSURE REMAIN IN PLACE OR NOT BE COMPLETELY REMOVED, **A PENALTY WILL BE ASSESSED AT A RATE OF $500.00 PER DAY**.

STAGE 3

1. MAINTAIN PERMANENT CONSTRUCTION SIGNING AS DIRECTED IN THE TRAFFIC CONTROL PLANS, TRAFFIC CONTROL SPECIAL PREVISIONS AND AS DIRECTED BY THE RCE.
2. PLACE PORTABLE PLASTIC DRUMS AND OTHER TRAFFIC CONTROL DEVICES AS SHOWN ON THE TRAFFIC CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
3. MAINTAIN AND INSTALL EROSION CONTROL DEVICES AS SHOWN IN THE EROSION CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
4. MAINTAIN AND INSTALL TEMPORARY BARRIER FENCE ALONG ENVIRONMENTALLY SENSITIVE AREAS WERE DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
5. APPLY TEMPORARY PAVEMENT MARKINGS IN ORDER TO MAINTAIN OR SHIFT EXISTING TRAFFIC PATTERNS WITH ALLOWABLE LANE REDUCTION WIDTHS AS SHOWN AND AS DIRECTED BY THE RCE.
6. CONTINUE CONSTRUCTION OF NEW BASE AND INTERMEDIATE PAVEMENT, CURB AND GUTTER, SIDEWALK AND DRAINAGE AS INDICATED.

STAGE 4

1. MAINTAIN PERMANENT CONSTRUCTION SIGNING AS DIRECTED IN THE TRAFFIC CONTROL PLANS, TRAFFIC CONTROL SPECIAL PREVISIONS AND AS DIRECTED BY THE RCE.
2. PLACE PORTABLE PLASTIC DRUMS AND OTHER TRAFFIC CONTROL DEVICES AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
3. MAINTAIN AND INSTALL EROSION CONTROL DEVICES AS SHOWN IN THE EROSION CONTROL PLANS AND AS DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
4. MAINTAIN AND INSTALL TEMPORARY BARRIER FENCE ALONG ENVIRONMENTALLY SENSITIVE AREAS WERE DIRECTED BY THE RCE IN ACCORDANCE WITH SCDOT STANDARDS.
5. SHIFT TRAFFIC TO FINAL LANE CONFIGURATION AS SHOWN IN THE PAVEMENT MARKING PLANS.
6. COMPLETE CONSTRUCTION OF TEMP JUNCTION BOX, CONSTRUCT CONCRETE MEDIANS & ISLAND, PREFORM MILLING AS NOTE IN THE PLANS AND APPLY FINAL SURFACE PAVEMENT. IMPLEMENT TEMPORARY LANE CLOSURES AS NEEDED AND AS DIRECTED BY THE RCE.
7. APPLY FINAL PAVEMENT MARKINGS AS SHOWN IN THE PAVEMENT MARKING PLANS AND AS DIRECTED BY THE RCE. INSTALL SIGNING AS SHOWN IN THE SIGNING PLANS AND AS DIRECTED BY THE RCE.

General Notes (Apply to all construction stages):

1. ALL WORK AND MATERIALS SHALL CONFORM WITH THE SCDOT STANDARD SPECIFICATION FOR HIGHWAY CONSTRUCTION, SCDOT STANDARD DRAWINGS, SCDOT PROCEDURES & GUIDELINES FOR WORK AND HIGHWAYS, AND OTHER APPLICABLE SCDOT DOCUMENTS, LATEST EDITIONS.
2. APPROPRIATE CHANNELIZING DEVICES SHALL BE MAINTAINED DURING CONSTRUCTION TO SEPARATE WORK FROM TRAFFIC.
3. ALL EXISTING SIGNS IN CONFLICT WITH CONSTRUCTION SIGNING SHALL BE REMOVED, COVERED, OR RELOCATED. PROPOSED TEMPORARY PAVEMENT MARKINGS SHALL TIE TO EXISTING MARKINGS.
4. CONTRACTOR SHALL MAINTAIN SIGNAL OPERATION AT ALL SIGNALIZED INTERSECTIONS AS NOTED IN THE PLANS AND AS DIRECTED BY THE RCE.
5. CONTRACTOR SHALL INSTALL/MAINTAIN STOP BARS AND STOP SIGNS OR YIELD BAR AND YIELD SIGNS AS SHOWN IN THE PLANS AND AS DIRECTED BY THE RCE.
6. CONTRACTOR SHALL INSTALL/MAINTAIN TEMPORARY PAVEMENT MARKING ARROWS PER SCDOT STANDARD DRAWINGS AT ALL TURN LANES ONTO ROADWAYS WHERE DIRECTED BY THE RCE.
7. CONTRACTOR SHALL MAINTAIN MINIMUM TEMPORARY LANE WIDTH IN ACCORDANCE WITH SCDOT WORK ZONE TRAFFIC CONTROL UNLESS OTHERWISE APPROVED BY THE DEPARTMENT.
8. CONTRACTOR SHALL APPLY TEMPORARY 4” WHITE EDGE LINES WHEN THERE IS NO EXISTING OR NEW CURB & GUTTER PRESENT DURING TRAFFIC CONTROL AND WHERE DIRECTED BY THE RCE.
9. THE COST OF OBLITERATING EXISTING STRIPING AND MAINTAINING TRAFFIC STRIPING SHALL BE INCLUDED IN THE COST OF TRAFFIC CONTROL. CONFLICTING STRIPING BETWEEN STAGES SHALL BE ERADICATED.

10. CONTRACTOR SHALL PLACE CONSTRUCTION ZONE ELECTRIC CHANGEABLE MESSAGE SIGNS AS SHOWN IN THE PLANS, OUTLINED IN THE TRAFFIC CONTROL SPECIAL PROVISIONS AND WHERE DIRECTED BY THE RCE.
11. CONTRACTOR SHALL MAINTAIN POSITIVE SURFACE DRAINAGE DURING ALL CONSTRUCTION STAGES. CONTRACTOR SHALL APPLY BUILD-UP/LEVELING TO EXISTING ROADWAY AS PAVEMENT WIDENING OPERATION PROGRESS AS NEEDED AND AS DIRECTED BY THE RCE.
12. CONTRACTOR TO NOTIFY IN WRITING ALL BUSINESSES AND PROPERTY OWNERS OF CONSTRUCTION ACTIVITIES, DRIVEWAY MODIFICATIONS, AND OTHER ACCESS RESTRICTIONS 7 DAYS IN ADVANCE OF ANY CONSTRUCTION ACTIVITIES ADJACENT TO THEIR PROPERTY.
13. CONTRACTOR SHALL MAINTAIN ACCESS TO ALL COMMERCIAL AND PRIVATE DRIVEWAYS IN ACCORDANCE WITH THE FOLLOWING:
    A. SITE WITH TWO OR MORE DRIVEWAYS - ONE DRIVEWAY TO BE MAINTAINED CONTINUOUSLY OPENED. NO DRIVEWAY TO BE CLOSED LONGER THAN 1 DAY.
    B. SITE WITH ONE DRIVEWAY - DRIVEWAY NOT TO BE CLOSED FOR A PERIOD LONGER THAN 1 HOUR.
14. CONTRACTOR SHALL INSTALL PERMANENT CONSTRUCTION SIGNING PER SCDOT STANDARD DRAWINGS 605-010-01 AS NOTED IN THE PLANS AND/OR AS DIRECTED BY THE RCE. SIGNING SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION.
15. THE CONTRACTOR SHALL BE ON SITE AT ALL TIMES TO MAINTAIN TRAFFIC CONTROL ONCE CONSTRUCTION OPERATIONS BEGIN, UNTIL COMPLETE AND APPROVED BY THE RCE.
16. PORTABLE PLASTIC DRUMS SHALL BE PLACED IN ACCORDANCE WITH SCDOT STANDARDS AND AS DIRECTED BY THE RCE. DRUM SPACING MAY BE ADJUSTED/REDUCED NOT TO CONFLICT WITH DRIVEWAY ACCESS. TYPICAL DRUM SPACING IS AS FOLLOWS UNLESS NOTED:
    A. 50 FEET SPACING FOR EXISTING POSTED SPEED 40 MPH OR LESS
    B. 100 FEET SPACING FOR EXISTING POSTED SPEED 45 MPH OR GREATER
    C. 20 FEET SPACING & NO LESS THAN 4 EA FOR RADIUS RETURN
17. CONTRACTOR SHALL INSTALL TEMPORARY CONCRETE BARRIERS PER SCDOT STANDARD DRAWINGS SECTION 605-100 THRU 605-400.
18. TEMPORARY LANE CLOSURES SHALL CONFORM TO SCDOT STANDARD DRAWINGS SECTION 610-000.
19. SHOULDER CLOSURES SHALL CONFORM TO SCDOT STANDARD DRAWINGS SECTION 610-200.
20. CONTRACTOR SHALL INSTALL ADVANCE LANE CLOSURE SIGNING PER SCDOT STANDARD DRAWINGS 610-010-00 THRU 610-040-00.
21. CONTRACTOR SHALL INSTALL EXTENDED ROAD CLOSURE SIGNING PER SCDOT STANDARD DRAWING 610-510-00 & 610-515-00
22. FOR CONSTRUCTION REQUIRING REMOVAL OF EXISTING PAVEMENT THE CONTRACTOR SHALL REMOVE AND REPLACE PAVEMENT WITHIN ONE CONTINUOUS OPERATION AS DIRECTED BY THE RCE.
23. CONTRACTOR SHALL CONSTRUCT CEMENT MODIFIED RECYCLED BASE PER SCDOT SUPPLEMENTAL TECHNICAL SPECIFICATION SC-M-306, LATEST EDITION AND/OR AS DIRECTED BY THE RCE. FOR CMRB-METHOD B THE CONTRACTOR WILL BE REQUIRED TO WAIT 2 TO 5 DAYS AFTER APPLICATION OF ASPHALT SURFACE TREATMENT (SINGLE) BEFORE THE HMA COURSE CAN BE PLACED.
24. CONTRACTOR SHALL FOLLOW LANE CLOSURE RESTRICTIONS PER SCDOT SUPPLEMENTAL SPECIFICATIONS “LANE CLOSURE RESTRICTION” LATEST EDITION, SCDOT “HOURLY RESTRICTION FOR LANE CLOSURES ON MULTILANE PRIMARY AND SECONDARY ROUTES” LATEST EDITION AND AS NOTED IN THE PROJECT TRAFFIC CONTROL SPEC. **THE CONTRACTOR IS ADVISED THAT THE LANE CLOSURE RESTRICTIONS WILL BE STRICTLY ENFORCED. SHOULD LANE CLOSURES REMAIN IN PLACE OR NOT BE COMPLETELY REMOVED BY THE TIME SPECIFIED, A PENALTY WILL BE ASSESSED AT THE RATE OF $500.00 PER HOUR.**
25. CONTRACTOR SHALL NOTIFY THE COUNTY & DEPARTMENT A MINIMUM 30 DAYS BEFORE IMPLEMENTING ANY ROADWAY CLOSURES IN ORDER TO PROVIDE AMPLE NOTIFICATION TO THE ELECTED OFFICIALS, PUBLIC AND EMERGENCY SERVICES.
26. THE CONTRACTOR MAY REVISE THE WORK ZONE TRAFFIC CONTROL WITH THE APPROVAL OF THE RCE WITH NO ADDITIONAL COST TO YORK COUNTY OR SCDOT.

Culvert Crossline Installation Notes:

1. CONTRACTOR TO USE TRENCHLESS PIPE INSTALLATION METHOD TO INSTALL NP-043, CLP-4 AND NP-812. CONTRACTOR TO INSTALL PIPES FROM LEFT TO RIGHT UNDER THE EXISTING ROADWAY PRIOR TO WIDENING AS NOTED IN STAGE 1 NOTES UNLESS APPROVED BY THE RCE. ALL OTHER PIPE CULVERT INSTALLATION SHALL BE CONSTRUCTED UTILIZING NIGHTTIME LANE CLOSURES.
2. SHOULD THE CONTRACTOR CHOOSE AN ALTERNATE MEANS OF PIPE CULVERT INSTALLATION, WITH THE APPROVAL OF THE RCE, ALL ADDITIONAL WORK AND/OR MATERIALS REQUIRED TO COMPLETE THE INSTALLATION SHALL BE AT NO ADDITIONAL COST TO YORK COUNTY OR SCDOT AND SHALL BE CONSIDERED INCIDENTAL TO THE LUMP SUM TRAFFIC CONTROL PAY ITEM.

SCDOT SUPPLEMENTAL SPECIFICATIONS REFERENCE

The following are SCDOT Supplemental Specifications and SCDOT Supplemental Technical Specifications that pertain specifically to the Widening of US 21 Bypass and SC 51. Additional Supplemental Specifications and SCDOT Supplemental Technical Specifications, not included, but which may be required for the project, are on file with the SCDOT and are available on the SCDOT website https://www.scdot.org/business/road-supplemental-specs.aspx & https://www.scdot.org/business/road-technical-specs.aspx

The list of the Supplemental Specifications provided is as follows:

Section

Critical Path Construction Schedules (March 1, 2007)
Asphalt Binder Adjustment Index (March 3, 2009)
Errata to 2007 Standard Specifications for Highway Construction (January 1, 2018)
As-Built Construction Plans (November 4, 2009)
Subsection 401.4.17, Transportation and Delivery of Mixes (July 1, 2010)
Fine Grading (January 4, 2012)
Prompt Payment Clause (July 1, 2017)
Construction Schedules (November 4, 2013)
Muck Excavation (July 1, 2017) – {**Shall be paid as Unclassified Excavation**}
627 Thermoplastic Pavement Markings (July 1, 2020)
204 Structure Excavation (January 1, 2021)
Erosion Control Measures (January 1, 2021)
Temporary Barrier Fence (July 1, 2021)
Asphalt Surface Treatment – Single Treatment (July 2, 2010)
Materials for Full Depth Patching (January 1, 2018)
Removal of Existing Asphalt Pavement before Patching (January 1, 2018)
Work Zone Traffic Control Local Law Enforcement (July 1, 2018)
Section 605 Temporary Concrete Barrier (July 1, 2020)
Work Zone Traffic Control Training Requirements for Contractors/Subcontractors (July 1, 2020)

SC-M-210 Flowable Fill (June 2011)
SC-M-400 Asphalt Mixture Quality Acceptance (February 2020)
SC-M-675 Traffic Signals (January 2023)
SC-M-805-1 Guardrail (January 2023)
SC-M-810-4 Seeding (January 2021)
SC-M-815-2 Silt Fence Systems (July 2018)
SC-M-815-8 Inlet Structure Filters (July 2017)
SC-M-815-9 Rolled Erosion Control Product {RECP} (July 2017)
SC-M-815-10 Stabilized Construction Entrance (July 2018)
SC-M-815-11 Hydraulic Erosion Control Products (April 2011)

SECTION 809: RIGHT OF WAY PLAT:

Description:

The contractor by the "Substantial Work Complete" date shall prepare a right of way plat signed and sealed by a Professional Land Surveyor (PLS) licensed to practice in the state of South Carolina. The right of way plat shall be in accordance with the requirements of Section 49-460-A "General Property Survey" as outlined in the South Carolina "Standards of Practice Manual" for land surveyors. A copy of the plat will be recorded, by the contractor, in the Register Mesne Conveyance (RMC) office of the county or counties in which the project resides. The contractor will provide one copy of the plat on a full sized plan sheet(s) (22" X 36") and submit to the resident construction engineer to be included in the as-built plans. In addition, the contractor shall furnish one PDF copy of the plat sheet(s) and one copy of the cad file(s) of the plat to York County.

Materials: Rebar Cap R/W Marker

Materials used shall comply with those listed on SCDOT Standard Drawing Nos. 809-105-00 or 809-110-00.

Construction Requirements:

The PLS shall set right of way markers along all new right of way lines as well as along any present right of way being retained by the Department at intervals listed on the SCDOT Standard Drawings. Right of way markers shall not be placed at points common to side property lines and/or corners. In the event that the plan reflects a break in the right of way along a side property line the right of way marker will not be set without the side property line being retraced and established by way of survey. The PLS shall prepare a plat documenting the location of all Right of Way Markers set and reflecting the as-built station and offset from the plan alignment. The plat shall show the entire project corridor as an enclosed strip or parcel of land to include the mainline and all side roads as defined on the project plan.

Measurement and Basis of Payment:

The item Right of Way Plat is paid on a lump sum (LS) basis; and therefore, there is no specific measurement for this item. The unit price bid for Property Right of Way Plat shall include all costs for labor, materials, equipment, services of a PLS and any related fees or costs associated with producing a plat, recording the plat at the RMC office, and all required copies. Each marker placed in accordance with the Standard Drawings complete and accepted will be measured and paid at the unit price bid.

Item No.	Description	Unit
8091010	RIGHT OF WAY MARKER (REBAR AND CAP)	EA
8091000	RIGHT OF WAY MARKER (REINFORCED CONCRETE)	EA
8091050	RIGHT OF WAY PLAT	LS

PROJECT ID: 0042332 **COUNTY** YORK

1. **LIST OF TRAFFIC SIGNALS WITHIN PROJECT**

#	Intersection Name	Description of Signal Work
1	US 21 BYPASS AT SC 460	REVISION
2	US 21/US 21 BYPASS AT S-1726/US 21 BUSINESS	NEW CONSTRUCTION (REALIGNED)
3	US 21 AT CENTRAL CAROLINAS PKWY/SHOPPING CENTER	REBUILD
4	US 21 AT REGENT PARKWAY	REBUILD
5	US 21 AT S-641/RETAIL DRIVE	REBUILD
6	US 21 AT SC 51	NEW CONSTRUCTION (REALIGNED)
7	SC 51 AT S-641/S-48	NEW CONSTRUCTION (REALIGNED)

2. **PROJECT DESCRIPTION**

This Project is a ROAD WIDENING **construction project and involves the signal construction of** SEVEN (7) **intersections along** US 21 **in and around** FORT MILL **South Carolina. The intersections involved are shown on the above "List of Traffic Signals within Project or listed on the plans.**

Specific Description of the signal work: Rebuild, New Construction, Temporary Adjustments, Partial work, Communications.

3. **PAY ITEM ADDITIONAL INFORMATION** (if no changes, this can be eliminated)

Below is more information concerning any changes, revisions, or clarifications to the SCDOT Traffic Signal Supplemental Specifications and/or pay items for this particular contract:

Mobilization:

Wiring:

Communications:

Fiber optic cable for interconnect between intersection #2 to intersection #6. Existing fiber from I-77 to intersection #3.

Detection:

Radar detection at all interseections except intersection #1 which will have loops sawcut in pavement. The radar detection will consist of stopbar detection, setback detection and/or speed/volume detection.

Signal Supports:

Steel Strain Poles

Signal Heads, Pedestrian Treatments, Illuminated signs, solar flashing assemblies:

Cabinet Items:

All controller cabinets include an extender base and battery backup.

Service Items:

4. **EQUIPMENT (***Only needed if SCDOT is providing equipment to be installed by contractor.)*

6.1 SCDOT Provided Equipment *(Provide a list of equipment, location of equipment, details concerning equipment & installation)*

6.2 Faulty Equipment

- When SCDOT supplied equipment is designated faulty by the Engineer, the Contractor shall return it to the Manufacturer for replacement if it is under warranty, The Manufacturer shall furnish a replacement unit.
- When SCDOT supplied equipment is designated faulty by the Engineer and it is not under warranty, SCDOT shall replace the equipment.

5. **SIGNAL INTEGRATION** *(Only needed if different than the default. The default wording in the Supplemental Specifications (675.0 General Provisions 1.10) indicates SCDOT or local government signal maintenance staff will perform integration. If different than that, list what entity will perform integration.)*

- The _____ will perform integration in accordance with the Supplemental Specifications, 675.0 General Provisions.

6. **MAINTENANCE DURING CONSTRUCTION –** (*Only needed if different than the default. The default wording in the Supplemental Specifications (675.0 General Provisions 1.5) indicates that this begins at the contract NTP (notice to proceed) for all signals in the contract. If different than that, list whether maintenance begins at:*
   a. *When a work order is assigned by construction office*
   b. *When the contractor begins work at a signal*
   c. *Other option*

7. **CONTRACT SCHEDULE –** (*Only needed if different than the default.* The default wording in the *Supplemental Specifications indicates that contractor will to provide weekly schedule for all signal work. If SCDOT determines a need to set the schedule, indicate such below:)*

Example wording:

This is a "TURN-KEY" project where work is assigned using a work order system. Once work orders have been assigned to the ***CONTRACTOR, he*** *shall furnish the Engineer with a* ***WEEKLY SCHEDULE*** *for all active traffic signal construction work orders, each Friday, for the week to come, listing the location and date of each intended activity. This will permit scheduling signal inspection personnel. Deviation from this schedule may cause the Department to delay Inspection and Payments.*

INSTALLATION OF TRAFFIC SIGNALS

In order to provide uniformity in the manner in which signals are installed and placed in operation, all District Electrical Personnel should use the following procedure for the installation or replacement of new traffic signals.

1. Install poles, guys, overhead cable including signal head connections, but do not install signal heads until ready to place in flashing mode.

2. Install controller cabinet, cut loops and complete incidental work necessary to place signal in flashing mode.

3. Install heads and "bag" if necessary until the head can be placed in flashing mode and flash for at least 3 and not more than 7 days. Bag signal heads only in the event where all of the heads can not be installed within the same work day or if the intersection is a replacement of a closed loop system where the entire system is to be placed in operation at one time and the existing system will remain in operation until the switch over is initiated. **In the event where signalized intersections are replaced with new equipment, there is no mandatory flash period required.**

4. On the day the signal is to be placed in stop and go operation, erect "Signal Ahead" signs (**MUTCD** W3-3) on all approaches with a "NEW" plaque above the signs. When the signal is placed into operation, remove the "Stop" signs from the side street and "Stop Ahead" signs if applicable. Supplement the "Signal Ahead" signs with portable flashers and/or orange flags to draw attention to the signs.

5. The signal should be placed into operation on a normal workday, after the morning peak hour and prior to the afternoon peak hour.

6. The flags or flashers and the "NEW" plaques should be removed approximately two months after the signal is placed in operation.

SCDOT TRAFFIC SIGNAL SPECIAL PROVISIONS – TRAFFIC CONTROL
FOR TRAFFIC SIGNAL PROJECTS

MAINTENANCE OF TRAFFIC

TRAFFIC CONTROL:

The Contractor shall execute the item of Traffic Control as required by the Standard Specifications, the plans, the Standard Drawings For Road Construction, these special provisions, all supplemental specifications, the MUTCD, and the Engineer. This is an amendment to the Standard Specifications to require the following:

GENERAL REGULATIONS -

These special provisions shall have priority to the plans and comply with the requirements of the MUTCD and the standard specifications. Revisions to the traffic control plan through modifications of the special provisions and the plans shall require approval by the department. **Final approval of any revisions to the traffic control plan shall be pending upon review by the Director of Traffic Engineering.**

Install and utilize changeable message signs in all lane closures installed on high volume high-speed multilane roadways. Use of changeable message signs in lane closures installed on low volume low speed multilane roadways is optional unless otherwise directed by the plans and the Engineer. Install and use a changeable message sign within a lane closure set-up as directed by the *Standard Drawings For Road Construction*. When a lane closures is not present for any time to exceed 24 hours, remove the changeable message sign from the roadway. Place the sign in a predetermined area on the project site, as approved by the Engineer, where the sign is not visible to passing motorists. The preprogrammed messages utilized shall be in accordance with the *Standard Drawings For Road Construction* when used as part of the traffic control set-up for lane closures. Only those messages pertinent to the requirements of the traffic control situation and the traffic conditions are permitted for display on a changeable message sign at all times. At no time will the messages displayed on a changeable message sign duplicate the legends on the permanent construction signs.

During operation of changeable message signs, place the changeable message sign on the shoulder of the roadway no closer than 6 feet between the sign and the near edge of the adjacent travel lane. When the sign location is within 30' of the near edge of a travel lane open to traffic, supplement the sign location with no less than 5 portable plastic drums placed between the sign and the adjacent travel lane for delineation of the sign location. Install and maintain the drums no closer than 3 feet from the near edge of the adjacent travel lane. This requirement for delineation of the sign location shall apply during all times the sign location is within 30' of the near edge of a travel lane open to traffic, including times of operation and non-operation. Oversized cones are prohibited as a substitute for the portable plastic drums during this application.

All signs mounted on portable sign supports shall have a minimum mounting height of 5' from the bottom of the sign to the ground. All signs mounted on ground mounted u-channel posts or square steel tube posts shall have a minimum mounting height of 7' from the bottom of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present.

On multilane primary routes, avoid placement of signs mounted on portable sign supports within paved median areas utilized for two-way left turns unless otherwise directed by the RCE.

When mounting signs on multiple ground mounted sign supports, ensure that each post is of the same type. Combining and installing both ground mounted u-section and square steel tube posts within the same sign assembly is prohibited.

When mounting signs on ground mounted u-section or square steel tube posts, utilize either a sign support / ground support post combination with an approved breakaway assembly or a single direct driven post for each individual sign support of a sign assembly installation. Do not combine a sign support / ground support post combination and a direct driven post on the same sign assembly installation that contains two or more sign supports. Regarding sign support / ground support post combination installations, ensure that post lengths, stub heights and breakaway assemblies comply

with the manufacturer's requirements and specifications. Use approved breakaway assemblies found on the *Approved Products List For Traffic Control Devices in Work Zones*.

Temporary "Exit" signs (M1025-00) shall be located within each temporary gore during lane closures on multilane roadways. Mount these signs a minimum of 7' from the pavement surface to the bottom of the sign in accordance with the requirements of the MUTCD.

When covering signs with opaque materials, the Department prohibits attaching a covering material to the face of the sign with tape or a similar product or any method that will leave a residue on the retroreflective sheeting. Residue from tape or similar products, as well as many methods utilized to remove such residue, damages the effective reflectivity of the sign. Therefore, contact of tape or a similar product with the retroreflective sheeting will require replacement of the sign. Cost for replacement of a sign damaged by improper covering methods will be considered incidental to providing and maintaining the sign; no additional payment will be made.

Overlays are prohibited on all rigid construction signs. The legends and borders on all rigid construction signs shall be either reversed screened or direct applied.

Signs not illustrated on the typical traffic control standard drawings designated for permanent construction signs shall be considered temporary and shall be included in the lump sum price bid item for "Traffic Control" unless otherwise specified.

Install "Grooved Pavement" signs (W8-15-48) supplemented with the "Motorcycle" plaque (W8-15P-30) in advance of milled or surface planed pavement surfaces. Install these signs no further than 500 feet in advance of the beginning of this pavement condition on primary routes with speed limits of 60 MPH or less and no less than 500 feet in advance of the beginning of this pavement condition on interstate routes. On multilane roadways, comply with the same guidelines as applied to all other advance warning signs and install two sign assemblies at each sign location, one on each side of the roadway, when roadway conditions warrant. Install these signs immediately upon creation of this pavement condition and maintain these signs until this pavement condition is eliminated.

Install "Steel Plate Ahead" signs (W8-24-48) in advance of an area of roadway where temporary steel plates are present. Install these signs no further than 300 feet in advance of locations where steel plates are present. On multilane roadways, comply with the same guidelines as applied to all other advance warning signs and install two sign assemblies at each sign location, one on each side of the roadway, when roadway conditions warrant. Install these signs immediately upon installation of a temporary steel plate and maintain the signs until the temporary steel plates are removed.

The Contractor shall maintain the travel patterns as directed by the traffic control plans and shall execute construction schedules expeditiously. The Contractor shall provide the Resident Engineer with no less than a two-week prior notification of changes in traffic patterns.

During nighttime flagging operations, flaggers shall wear a safety vest and safety pants that comply with the requirements of ANSI / ISEA 107 standard performance for Class 3 risk exposure, latest revision, and a fluorescent hard hat. The safety vest and the safety pants shall be retroreflectorized and the color of the background material of the safety vest and safety pants shall be fluorescent orange-red or fluorescent yellow-green.

During nighttime flagging operations, the contractor shall illuminate each flagger station with any combination of portable lights, standard electric lights, existing street lights, etc., that will provide a minimum illumination level of 108 Lx or 10 fc.

During nighttime flagging operations, supplement the array of advance warning signs with a changeable message sign for each approach. These changeable message signs are not required during daytime flagging operations. Install the changeable message signs 500' in advance of the advance warning sign arrays. Messages should be "Flagger Ahead" and "Prepare To Stop".

TRAFFIC CONTROL PROCEDURES SPECIFIC TO TRAFFIC SIGNAL WORK OPERATIONS –

Utilize a vehicle train consisting of a primary work vehicle and no less than 1 shadow vehicle. The shadow vehicle is required for all Traffic Signal Work Operations except on a two-lane roadway for a time duration of 15 minutes or less when no pedestrian workers are present, excluding the flagger. A second

shadow vehicle is necessary in some applications on multilane roadways as depicted on the Standard Drawings. Install and maintain the vehicle train as directed by these special provisions, , the Standard Drawings For Road Construction, and the Engineer.

Two-Lane Two-Way Roadways

A. Utilize flagging operations to control the traffic flow around the work site where the vehicle train is operating.

B. Utilize flaggers to control the traffic flow on an intersecting two-lane two-way roadway. The advance warning signs for the flagging operations shall include the following:

W20-7a-48	Flagger symbol
W20-4-48-A	One Lane Road Ahead
W20-1-48-A	Road Work Ahead

C. Maintain two-way radio communications between all flaggers.

Multilane Roadways

A. During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration of 15 minutes or less, advance warning signs may be omitted.

B. During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration in excess of 15 minutes but less than 60 minutes, advance warning signs are required. Typical advance warning signs required for a temporary closure of a travel lane shall include the following:

W4-2R(L)-48	Lane Ends symbol
W20-5R(L)-48-A	Right (Left) Lane Closed Ahead
W20-1-48-A	Road Work Ahead

C. Utilization of flaggers to control the traffic flow in the travel lanes adjacent to the travel lane the vehicle train is operating in is PROHIBITED except as allowed in the Standard Drawings Requirements for a Temporary Cessation of Traffic Flow for a time duration of 3 minutes or less.

D. Utilize flaggers to control the traffic flow on an intersecting two-lane two-way roadway. Only flaggers and advance warning signs are required on the approaches intersecting the travel lane the vehicle train is operating in. Traffic control devices are not required on the intersecting approaches. The advance warning signs for the flagging operations shall include the following:

W20-7a-48	Flagger symbol
W20-4-48-A	One Lane Road Ahead
W20-1-48-A	Road Work Ahead

E. **During work operations that require the vehicle train to encroach upon or operate within the limits of a travel lane for a time duration in excess of 60 minutes, install a standard lane closure as directed by these special provisions, the Standard Drawings For Road Construction, and the Engineer.**

Conduct all equipment and material preparations prior to entering the roadway.

Conducting traffic signal work or conducting any activities that interfere with or create disruptions to normal traffic operations during morning, mid-day, and afternoon-evening high traffic volume peak periods is PROHIBITED. The contractor shall observe all lane closure restrictions.

Conduct all work activities within the boundaries of a travel lane closed to vehicular traffic or a pedestrian thoroughfare closed to pedestrian traffic. Conducting work activities over a travel lane open to traffic is PROHIBITED. Conducting work activities over a pedestrian thoroughfare open to pedestrian traffic is PROHIBITED. Do not conduct any work activities in any manner over a thoroughfare open to vehicular or pedestrian traffic.

When advance warning signs are required to supplement the vehicle train, install the advance warning signs at spacing intervals based on the regulatory speed limit of the roadway prior to beginning any work. When a work zone traffic control plan or a work zone traffic control standard drawing is not provided to indicate the spacing intervals for a typical 3 advance warning sign array installation, utilize the sign placement intervals below. **These sign intervals do not apply to the sign intervals of the advance sign intervals for standard lane closures.**

ADVANCE WARNING SIGN PLACEMENT INTERVALS	
URBAN / RURAL (LOW SPEED) ≤ 35 MPH	200 / 200 / 200 Feet
URBAN / RURAL (INTERMEDIATE SPEED) 40 - 50 MPH	350 / 350 / 350 Feet
RURAL (HIGH SPEED) ≥ 55 MPH	500 / 500 / 500 Feet
INTERSTATE	1000 / 1500 / 2600 Feet

LANE CLOSURE RESTRICTIONS –

The lane closure restrictions stated below are project specific, for all other restrictions, see supplemental specification, "Restrictions", dated September 1, 2015.

The Contractor shall install all lane closures as directed by the Standard Specifications For Highway Construction (latest edition), the Standard Drawings For Road Construction, these special provisions, the MUTCD, and the Engineer. The Contractor shall close the travel lanes of two-lane two-way roadways by installing flagging operations. The Contractor shall close the travel lanes of multilane roadways as directed by the typical traffic control standard drawings designated for lane closures on primary routes.

The Department prohibits lane closures on primary and secondary routes during any time of the day that traffic volumes in the travel lanes remaining open to traffic exceed 800 vehicles per hour per lane per direction. The Department reserves the right to suspend a lane closure if any resulting traffic backups are deemed excessive by the Engineer. Maintain all lane closure restrictions as directed by the plans, these special provisions, and the Engineer.

Flagging operations are considered to be lane closures for two-lane two-way operations and shall be subject to all restrictions for lane closures as specified by this contract.

Lane closures, including flagging operations, are restricted to maximum distances of 2 miles. Install all lane closures according to the typical traffic control standard drawings. On occasions when daytime lane closures must be extended into the nighttime hours, substitute the nighttime lane closure standards for the daytime lane closure standards.

The Department reserves the right to suspend a lane closure if any resulting traffic backups are deemed excessive by the Engineer. Maintain all lane closure restrictions as directed by the Standard Specifications, these special provisions, and the Engineer.

Installation and maintenance of a lane closure is PROHIBITED when the Contractor is not actively engaged in work activities specific to the location of the lane closure unless otherwise specified and approved by the Engineer. The length of the lane closure shall not exceed the length of roadway anticipated to be subjected to the proposed work activities within the work shift time frame or the maximum lane closure length specified unless otherwise approved by the Engineer. Also, the maximum lane closure length specified does not warrant installation of the specified lane closure length when the length of the lane closure necessary for conducting the work activity is less. The length and duration of each lane closure, within the specified parameters, shall require approval by the Engineer prior to installation. The length and duration of each lane closure may be reduced by the Engineer if the work zone impacts generated by a lane closure are deemed excessive or unnecessary.

The presence of temporary signs, portable sign supports, traffic control devices, trailer mounted equipment, truck mounted equipment, vehicles and vehicles with trailers relative to the installation or removal of a closure and personnel are prohibited within the 15 to 30 foot clear zone based upon the roadway speed limit during the prohibitive hours for lane closures specified by these special provisions.

The truck mounted changeable message signs are in addition to the requirements for trailer mounted changeable message signs. Truck mounted changeable message signs and trailer mounted changeable message signs are not interchangeable.

SHOULDER CLOSURE RESTRICTIONS -

The Department prohibits the Contractor from conducting work within 15' of the near edge of the adjacent travel lane on the outside shoulders or the median areas under a shoulder closure during any time that traffic volumes exceed 800 vehicles per hour per direction. The hourly restrictions for lane closures shall also apply to work activities conducted under a shoulder closure within 15' of the near edge of an adjacent travel lane or a median area. The Department reserves the right to suspend work conducted under a shoulder closure if any traffic backups develop and are deemed excessive by the Engineer. Maintain all shoulder closure restrictions as directed by the plans, these special provisions, and the Engineer.

On primary and secondary roadways, the Department prohibits the Contractor from conducting work within 1' or less of the near edge of an adjacent travel lane under a shoulder closure. All work that may require the presence of personnel, tools, equipment, materials, vehicles, etc., within 1' of the near edge of an adjacent travel lane shall be conducted under a lane closure.

The Contractor shall install all shoulder closures as directed by the typical traffic control standard drawings designated for shoulder closures, and the Engineer. Substitution of the portable plastic drums with oversized cones during nighttime shoulder closures is PROHIBITED.

TYPICAL TRAFFIC CONTROL STANDARD DRAWINGS -

The typical traffic control standard drawings of the "Standard Drawings For Road Construction", although compliant with the MUTCD, shall take precedence over the MUTCD. The typical traffic control standard drawings of the "Standard Drawings For Road Construction" shall apply to all projects let to contract.

ADDENDUMS

(Addendums to the "2007 Standard Specifications for Highway Construction")

(A) Construction (Sub-section 601.4) –

Sub-section 601.4.2 Construction Vehicles (paragraph 2) -

When working within the rights-of-way of access-controlled roadways such as Interstate highways, the Contractor's vehicles may only change direction of travel at interchanges. These vehicles are prohibited from crossing the roadway from right side to the median or vice versa. Use a flagger to control the Contractor's vehicles when these vehicles attempt to enter the roadway from a closed lane or the median area. Ensure the flagger does not stop roadway traffic, cause roadway traffic to change lanes, or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

The Contractor shall have flaggers available to control all construction vehicles entering or crossing the travel lanes of secondary and primary routes. The RCE shall determine the necessity of these flaggers for control of these construction vehicles. The RCE shall consider sight distance, vertical and horizontal curves of the roadway, prevailing speeds of roadway traffic, frequency of construction vehicles entering or crossing the roadway and other site conditions that may impact the safety of the workers and motorists when determining the necessity of these flaggers. Ensure these flaggers do not stop roadway traffic, cause roadway traffic to change lanes or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

When working within the rights-of-way of access-controlled roadways with posted regulatory speed limits of 55 MPH or greater and average daily traffic volumes {ADT} of 10,000 vehicles per day or greater, all construction and work vehicles possessing any one or more of the vehicular characteristics listed below are only permitted to enter and exit a right or left shoulder work area during the presence of active lane closures unless otherwise directed by the RCE. These vehicles are not permitted to enter or exit these work areas without the presence of active lane closures unless otherwise directed by the RCE. Shoulder closures are unacceptable and insufficient methods for control of traffic at ingress / egress areas for these vehicles. The restrictive vehicular characteristics include the following:

- Over six (6) tires
- Tandem rear axles
- A base curb weight greater than 8000 lbs.
- A gross vehicular weight greater than 12000 lbs. unless performing duties as a shadow vehicle while supporting a truck mounted attenuator
- A trailer in tow except under the following conditions:
  - Trailers transporting traffic control devices (including but not limited to standard and 42" oversized traffic cones, portable plastic drums, signs, portable sign supports, u-channel and square steel tube sign posts) relative to the installation of lane closures, shoulder closures or other traffic control operations approved by the RCE
  - Trailer mounted traffic control devices (including but not limited to advance warning arrow panels, changeable message signs, temporary traffic signals, highway advisory radios, work zone intelligent transportation systems and trailer towed truck mounted attenuators)

(B) Construction (Sub-section 601.4) –

Sub-section 601.4.2 Construction Vehicles -

Auxiliary Warning Lights for Vehicles and Equipment -

Supplement all construction and/or construction-related vehicles and equipment that operate in a stationary or mobile work zone within or adjacent to a roadway within the highway rights-of-way with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists.

All auxiliary warning light models shall meet *Society of Automotive Engineers* (SAE) Class I standards and SAE Standard J575 relative to *Tests for Motor Vehicle Lighting Devices and Components* and these specifications.

The amber/yellow color of the dome/lens of an auxiliary warning light device shall meet SAE Standard J578 for amber/yellow color specifications.

Auxiliary warning lights with parabolic reflectors that rotate shall rotate around a halogen lamp at a rate to produce approximately 175 flashes per minute. The parabolic reflector shall produce a minimum 80,000 candle power and a minimum 54,000 candela through an SAE Standard J846 approved amber dome.

Equip strobe type flashing auxiliary warning light devices with photosensitive circuit controls to adjust the lighting intensity in response to changes in ambient light conditions such as from day to night. These lights shall have a double-flash capability rated at approximately 80 double flashes per minute and produce a minimum 24 joules of flash energy at the highest power level setting.

Acceptable auxiliary warning light models shall provide sufficient light output to be clearly recognizable at a minimum distance of 1750 feet.

Mount all auxiliary warning light devices intended to function as the auxiliary warning light system or as an element thereof on vehicles and equipment at locations no less than 3 feet above the ground and in conspicuous locations to provide visibility to approaching motorists.

Auxiliary warning light devices and/or models that mount in the locations of the standard vehicle lighting system are unacceptable as the specified auxiliary warning light system due to restrictive simultaneous visibility capabilities from multiple sight angles. However, auxiliary warning light devices that mount in the standard vehicle lighting system locations are acceptable as supplements to the specified lighting devices mounted in locations that do meet the minimum height requirements and provide simultaneous visibility capabilities from multiple sight angles.

Standard vehicle hazard warning lights are only permitted as supplements to the specified auxiliary warning light devices.

(C) General Requirements for Providing and Maintaining Traffic Control Devices in the Work Zone (Section 602) –

Sub-section 602.4 Construction (paragraph 8) -

Mount flat sheet signs straight and level and with the face of the signs perpendicular to the surface of the roadway. This requirement applies to flat sheet signs whether they are portable or have the embedded supports. Mount advance construction signs 2 feet from the edge of a paved shoulder or the

face of a curb, or if no paved shoulder exists, 6 feet to 12 feet from the edge of an adjacent travel lane to the nearest edge of the signs. The mounting height of single signs mounted on ground embedded sign supports is no less than 7 feet or no greater than 8 feet from the bottom edge of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present. Any secondary sign on the same assembly has a minimum mounting height of 6 feet from the ground to the bottom edge of the secondary sign. Ensure that signs mounted on portable sign supports, including advance construction signs, regulatory signs, warning signs, etc., have a minimum mounting height of 5 feet from the ground to the bottom edge of the sign. Provide special sign mounting assemblies, when necessary, in areas of double-layered guardrail, concrete median barrier, or bridge parapet walls.

(D) Category I Traffic Control Devices (Section 603) –

Sub-section 603.2.2 Oversized Traffic Cones (paragraph 6) -

Reflectorize each oversized traffic cone with 4 retroreflective bands: 2 orange and 2 white retroreflective bands. Alternate the orange and white retroreflective bands, with the top band always being orange. Make each retroreflective band not less than 6 inches wide. Utilize Type III – Microprismatic retroreflective sheeting for retroreflectorization on all projects let to contract after May 1, 2010 unless otherwise specified. Separate each retroreflective band with not more than a 2-inch non-reflectorized area. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the cone surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

Sub-section 603.2.3 Portable Plastic Drums (paragraph 3) -

Reflectorize each drum with Type III – Microprismatic retroreflective sheeting: 2 orange and 2 white retroreflective bands, 6 inches wide on all projects let to contract after May 1, 2010 unless otherwise specified. Alternate the orange and white retroreflective bands with the top band always being orange. Ensure that any non-reflectorized area between the orange and white retroreflective bands does not exceed 2 inches. Do not splice the retroreflective sheeting to create the 6-inch retroreflective bands. Apply the retroreflective sheeting directly to the drum surface. Do not apply the retroreflective sheeting over a pre-existing layer of retroreflective sheeting.

(E) Category II Traffic Control Devices (Section 604) –

Sub-section 604.2.1 Type I and Type II Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle in the direction of passing traffic. The stripes shall be 6 inches wide.

Sub-section 604.2.2 Type III Barricades (paragraph 3) -

Reflectorize these barricades with Type VIII or IX Prismatic retroreflective sheeting on all projects let to contract after May 1, 2012 unless otherwise specified. Ensure that the retroreflective sheeting has alternate orange and white stripes sloping downward at a 45-degree angle. Apply the sloping orange and white stripes in accordance with the requirements of the Plans, SCDOT Standard Drawings and the MUTCD. The stripes shall be 6 inches wide.

(F) **Temporary Concrete Barrier** (Sub-section 605.2.3.2) –

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 6) -

Previously used temporary concrete barrier walls are subject to inspection and approval by the RCE before use. Ensure that previously used temporary concrete barrier walls are in good condition. Defects to a temporary concrete barrier wall that may disqualify a section of wall for use include gouges, cracks, chipped, or spalled areas. A defect that exposes reinforcing steel warrants immediate disqualification. A disqualification grade type defect shall consist of measurements in excess of 1 inch, entirely or partially within the boundaries of the end connection areas and the drainage slot areas as illustrated in the "Standard Drawings for Road Construction", and/or in excess of 4 inches for all areas beyond the end connection areas. To warrant disqualification, these measurements shall exceed the specified dimensions in all three directions, width, height, and depth. A defect that exceeds the specified dimensions in only one or two of the three directions does not warrant disqualification.

Temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel may be repaired in accordance with the following requirements. Repair is prohibited on temporary concrete barrier walls with defects 6 inches or greater in all three directions, width, height, and depth.

For repair of temporary concrete barrier walls with defects less than 6 inches in all three directions, width, height, and depth that do not expose reinforcing steel, repair the defect with a premanufactured patching material specifically fabricated for patching structural concrete. The strength of the patch must meet or exceed the design strength of the class 3000 concrete of the temporary concrete barrier wall. Perform the repair procedures in accordance with all requirements and instructions from the manufacturer of the patch material. Use a bonding compound between the patch material and the concrete unless specifically stated by the manufacturer that a bonding compound is not required. If the manufacturer states that application of a bonding compound is optional, SCDOT requires application of a bonding compound compatible with the patch material. If cracking occurs within the patched area, remove the patch material completely and repeat the repair process. The contractor shall submit documentation stating all repairs have been conducted in accordance with these requirements prior to installing any temporary concrete barrier walls with repairs. Utilization of temporary concrete barrier walls with repairs shall require approval by the RCE prior to installation.

The Contractor shall submit certification documents for the patch material utilized for repairs to the Engineer prior to placing temporary concrete barrier walls that have been repaired on the project site.

Sub-section 605.2.3.2 Temporary Concrete Barrier (paragraph 5) -

In regard to projects let to contract after January 1, 2017, ALL NCHRP Report 350 compliant temporary concrete barrier walls placed on a project site SHALL comply with the requirements for the recessed approval stamp as directed by the SCDOT Standard Drawings. Those NCHRP Report 350 compliant temporary concrete barrier walls with the original recessed approval stamp that reads "SCDOT 350" will continue to be acceptable on projects let to contract after January 1, 2017. However, those temporary concrete barriers with the "SCDOT 350" identification plate attached to the side of the barrier walls with mechanical anchors previously grandfathered will no longer be acceptable on projects let to contract after January 1, 2017.

(G) Construction Signs (Sub-section 605.4.1.1) –

On all projects relative to **interstate highways** let to contract after January 1, 2016, all signs attached to portable sign supports on and/or adjacent to **interstate highways** shall be rigid. Fabricate each of these rigid signs from an approved aluminum laminate composite rigid sign substrate approved by the Department. Utilization of signs fabricated from roll-up fabric substrates attached to portable sign supports installed on and/or adjacent to **interstate highways** will no longer be acceptable on projects let to contract after January 1, 2016.

ONLY those portable sign supports specified and approved for support of rigid signs fabricated from approved aluminum laminated composite rigid sign substrates and included on the Approved Products List for Traffic Control Devices in Work Zones, latest edition, are acceptable. To facilitate location of acceptable portable sign supports, the listing of portable sign supports is now separated into two (2) sections; "Portable

Sign Supports for Use with Roll-Up Signs ONLY" and "Portable Sign Supports for Use with Roll-Up Sign Substrates and Rigid Sign Substrates".

The trade names of the approved aluminum laminate composite rigid sign substrates are "Acopan", "Alpolic", "Dibond" and "Reynolite". These rigid sign substrates are restricted to thicknesses no greater than 2 millimeters.

Rigid signs fabricated from standard aluminum sign blanks or any other rigid material other than Acopan, Alpolic, Dibond or Reynolite are PROHIBITED for attachment to portable sign supports. However, rigid signs fabricated from standard 0.080 and 0.100 inches thick aluminum sign blanks will continue to be acceptable for mounting on ground mounted sign supports.

Signs fabricated from roll-up fabric substrates approved by the Department will continue to be acceptable for use on and/or adjacent to secondary and primary roadways unless otherwise directed by the Department.

The minimum mounting height of signs mounted on these portable sign supports shall continue to be 5 feet from the ground to the bottom edge of the sign except where a minimum 7 foot mounting height is required in accordance with the standard specifications, the standard drawings, these special provisions and the MUTCD, latest edition.

(H) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.2.2.2.3.3 Color (paragraph 1) -

Use industrial grade enamel paint for cover of the metal aspects of the unit. Provide and attach supplemental striping to the rear face of the unit with a minimum Type III high intensity retroreflective sheeting unless otherwise directed by the Department. Utilize an alternating 4 to 8 inch black and 4 to 8 inch yellow 45-degree striping pattern that forms an inverted "V" at the center of the unit that slopes down and to the sides of the unit in both directions from the center.

(I) Truck-Mounted Attenuator (Sub-section 605.4.2.2) –

Sub-section 605.4.2.2 Truck-Mounted Attenuators (paragraph 6) -

A direct truck mounted truck mounted attenuator is mounted and attached to brackets or similar devices connected to the frame of a truck with a minimum gross vehicular weight (GVW) of 15,000 pounds (actual weight) unless otherwise directed. A trailer towed truck mounted attenuator is towed from behind and attached via a standard pintle hook / hitch to the frame of a truck with a minimum gross vehicular weight (GVW) of 10,000 pounds (actual weight) unless otherwise directed.

Each truck utilized with a truck mounted attenuator shall comply with the manufacturer's requirements to ensure proper operation of the attenuator. The minimum gross vehicular weight (GVW) (actual weight) for each truck shall comply with these specifications unless otherwise directed within the "Remarks" column of the *Approved Products List For Traffic Control Devices in Work Zones* in regard to specific requirements for the device in question.

If the addition of supplemental weight to the vehicle as ballast is necessary, contain the material within a structure constructed of steel. Construct this steel structure to have a minimum of four sides and a bottom to contain the ballast material in its entirety. A top is optional. Bolt this structure to the frame of the truck. Utilize a sufficient number of fasteners for attachment of the steel structure to the frame of the truck to ensure the structure will not part from the frame of the truck during an impact upon the attached truck mounted attenuator. Utilize either dry loose sand or steel reinforced concrete for ballast material within the

steel structure to achieve the necessary weight. The ballast material shall remain contained within the confines of the steel structure in its entirety and shall not protrude from the steel structure in any manner.

(J) Trailer-Mounted Changeable Message Signs (Sub-section 606.3.2) -

Sub-section 606.3.2.7 Controller (paragraphs 1-4) -

The controller shall be an electronic unit housed in a weatherproof, rust resistant box with a keyed lock and a light for night operation. Provide the unit with a jack that allows direct communications between the on-board controller and a compatible personal computer. The unit shall have a LCD display screen that allows the operator to review messages prior to displaying the message on the sign.

The controller shall have the capability to store 199 factory preprogrammed messages and up to 199 additional messages created by the user in a manner that does not require a battery to recall the messages. Also, the controller shall allow the operator the capability to program the system to display multiple messages in sequence.

Provide the controller with a selector switch to allow the operator to control the brightness or intensity level of the light source of the sign panel. The selector switch shall include "bright," "dim" and "automatic" modes; inclusion of additional modes is permissible. When the selector switch is in the "automatic" mode, a photosensitive circuit shall control the brightness or intensity level of the light source in response to changes in ambient light such as from day to night and other various sources of ambient light.

Equip each sign with remote communications capabilities, such as utilization of cellular telephone or internet browser technology, to allow the operator to revise or modify the message selection from the office or other remote location. Also, provide protection to prohibit unauthorized access to the controller, (i.e. password protection).

Sub-section 606.5 Measurement (paragraph 2) -

- Trailer-mounted changeable message signs are included in the lump sum item for Traffic Control in accordance with **Subsections 107.12** and **601.5** of the "2007 Standard Specifications for Highway Construction". No separate measurement will be made for trailer-mounted changeable message signs unless the contract includes a specific pay item for trailer-mounted changeable message signs.
- The Contractor shall provide, install, operate, and maintain the trailer-mounted changeable message sign per traffic control set-up as directed by the Plans, the "Standard Drawings for Road Construction", these Special Provisions, the Specifications, and the Engineer.

Sub-section 606.6 Payment (paragraph 2) -

In addition to **Subsections 107.12** and **601.6**, the payment for Traffic Control is full compensation for providing, installing, removing, relocating, operating, and maintaining trailer-mounted advance warning arrow panels and trailer-mounted changeable message signs as specified or directed and includes providing the units' primary power source; repairing or replacing damaged or malfunctioning units within the specified time; providing traffic control necessary for installing, operating, and maintaining the units; and all other materials, labor, hardware, equipment, tools, supplies, transportation, incidentals, and any miscellaneous items necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other items of the Contract.

Sub-section 606.6 Payment (paragraph 3) -

Disregard this paragraph unless the Contract includes a specific pay item for trailer-mounted changeable message signs.

(K) **Temporary Pavement Markings (Sub-section 609.4.1) –**

Sub-section 609.4.1.1.1 Application Requirements General (in addition to paragraph 3) -

On two-lane two-way roadways, apply and place temporary or permanent pavement markings, as specified hereupon, prior to the end of each day's work or shift or reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines on edge lines and solid center lines and 4-inch wide by 10 feet long broken lines with a 30-foot gap for broken center lines and lane lines unless otherwise specified. The center line pavement markings shall be either double yellow solid lines, yellow broken lines or an appropriate combination of a yellow solid line and yellow broken lines for passing / no passing zones. Placement of a singular yellow solid line for a center line pavement marking is unacceptable. The edge line pavement markings shall be a white solid line.

On multilane primary and secondary roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 4-inch wide solid lines, utilized for edge lines and solid center lines, and 4-inch wide by 10 feet long broken lines with a 30-foot gap, utilized for lane lines and turn lanes, unless otherwise specified. The center line pavement markings shall be either double yellow solid lines or an appropriate combination of a yellow solid line and 4-inch wide by 10 feet long yellow broken lines for two-way left turn median areas. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas. The lane lines between travel lanes and turn lanes shall be 4-inch wide by 10 feet long white broken lines with a 30-foot gap.

However, on two-lane two-way and multilane primary and secondary roadways, application of a 4-inch wide solid line utilized for an edge line adjacent to an earth shoulder, white or yellow, may be delayed up to 72 hours after eradication of the original line when the length of eradicated line at a single location is no longer than 250 feet. In the event of multiple locations along the same line, each location must be separated from the adjacent location by no less than 250 feet with a cumulative total distance of eradicated line of no more than 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location. If the length of eradicated line exceeds 250 feet at any single location, the distance interval between multiple adjacent locations is less than 250 feet or a cumulative total distance of multiple locations of eradicated line exceeds 1300 feet within any continuous 1 (one) mile length of roadway measured from a selected location, replace the eradicated line(s) prior to reopening the adjacent travel lane to traffic.

On interstate roadways, apply and place temporary or permanent pavement markings, as specified hereupon, to the travel lanes prior to reopening a closed travel lane to traffic. These pavement markings shall include 6-inch wide solid lines, utilized for edge lines, and 6-inch wide by 10 feet long white broken lines with a 30-foot gap, utilized for lane lines between travel lanes and auxiliary lanes, unless otherwise specified. The right edge line pavement markings shall be a white solid line and the left edge line shall be a yellow solid line except in areas where the travel lanes separate to create a gore type situation and then the color schemes shall comply with SCDOT application practices for gore areas.

On all roadways, apply and place white stop bars and white triangle yield bars in all locations where previous stop bars and triangle yield bars have been eradicated by the work. Apply and place white stop bars and white triangle yield bars at intersections controlled by stop and yield signs within 72 hours of the eradication of the original pavement marking. Apply and place white stop bars at signalized intersections controlled by traffic control signals and at railroad crossings prior to reopening a closed travel lane to traffic.

Within the limits of existing turn lanes on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work unless otherwise directed by the RCE. Apply and place white arrows within 72 hours of the eradication of the original pavement markings. However, in regard to newly constructed turn lanes, apply and place white arrows the within turn lanes as directed by the RCE.

Within the limits of existing lane-drop sites on all roadways, apply and place white arrows in all locations where previous arrows have been eradicated by the work prior to the end of each day's work or shift or reopening the closed travel lane to traffic. In regard to newly constructed lane-drop sites, apply and

place white arrows within the travel lane to be terminated prior to opening the travel lane to traffic and as directed by the RCE.

(L) Temporary Pavement Markings (Sub-section 609.4.1) –

Sub-section 609.4.1.1.1 Application Requirements General (Revision to paragraph 8) -

On two-lane, two-way roadways, passing zones may be eliminated within the work zone through application of 4-inch double yellow centerline pavement markings if determined feasible and directed to do so by the Plans and/or the RCE. Apply no passing zone markings as specified by the Plans, the Specifications, the MUTCD and the RCE.

(M) Flagging Operations (Sub-section 610.4.1) –

Sub-section 610.4.1.1 Flagging Operations (paragraph 1) -

Use a flagging operation to control the flow of traffic when two opposing directions of traffic must share a common travel lane. A flagging operation may be necessary during a lane closure on a two-lane two-way roadway, an intermittent ramp closure or an intermittent encroachment of equipment onto a portion of the roadway. Utilize flagging operations to direct traffic around work activities and maintain continuous traffic flow at reduced speeds when determined to be appropriate by the RCE. As stated above, flagging operations shall direct traffic around the work activities and maintain continuous traffic flow, therefore, stopped traffic shall not be required to stop for time durations greater than those listed below unless otherwise directed by the RCE. Begin measurement of the time interval immediately upon the moment the Flagger rotates the Stop/Slow paddle to display the "Stop" condition to the approaching motorists.

LENGTH OF CLOSURE	MAXIMUM TIME DURATION FOR STOPPED TRAFFIC
1 MILE or LESS	5 Minutes
1 to 2 MILES	7 ½ Minutes

If the work activities require traffic to be stopped for periods greater than 5 to 7 ½ minutes as stated above, consider alternate work methods, conducting work activities during times of lowest traffic volumes such as during the hours of darkness or complete road closure with detour installation.

(N) Paving and Resurfacing (Sub-section 611.4.1) –

Sub-section 611.4.1.2 Requirements (paragraph 8) -

Whenever travel lanes with acceptable grade elevation differences are open to traffic, provide "Uneven Lanes" signs (W8-11-48) or "Uneven Pavement" signs (W8-11A-48). Reflectorize these signs with a fluorescent orange colored prismatic retroreflective sheeting unless otherwise specified. Install these signs adjacent to roadways with uneven pavement surfaces between travel lanes or between travel lanes and the adjacent paved shoulders. Install these signs at intervals no greater than 2600 feet.

WATER AND SEWER

Technical Specifications



June, 2021

These technical specifications include references to construction, testing and materials standards of various organizations. Note that all references, herein, apply unless they are superseded by any relevant or applicable requirements of SCDOT, SCDHEC, York County or any other Authorities having jurisdiction where the work is taking place.

dhec

DRINKING WATER AND RECREATIONAL WATER PROTECTION
WATER AND SEWER CONSTRUCTION ONLY
(Subject to any provisions which may appear in the construction permit)

Final written approval for operation must be obtained from DHEC after completion of construction.

Approved for:

Water Permit SS-000106
Wastewater Permit SS-02164
Date 6/08/2021
Reviewer Maia Milenkova

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* Denotes Pump Station Standard Specifications.
SC DHEC requires the submission of a separate set of project specific Pump Station Specifications for each project. Division 43 represent York County's Specifications for Sewer Pump Stations but they are not part of the overall SC DHEC approved Specifications.

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required for demolition, removal, and disposal Work.
   2. The Work under this Section includes, but is not necessarily limited to:
      a. Demolition and removal of existing materials and equipment as shown or indicated in the Contract Documents. The Work includes demolition of piping, paving, curbs, sidewalks, gutters, fencing and similar existing facilities.
      b. For pump station Work, this may also include demolition of structural concrete, foundations, walls, doors, windows, structural steel, metals, roofs, masonry, attachments, appurtenances, electrical and mechanical systems and equipment, demolition and removal of all Underground Facilities underneath, and above-grade piping and utilities in, the building(s) and structures shown or indicated for demolition, unless the Underground Facilities or above-grade facilities are shown or indicated as to remain.
   3. Demolitions and removals specified under other Sections shall comply with requirements of this Section.
   4. Perform demolition Work within areas shown or indicated.
   5. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition.

B. Coordination:
   1. Comply with Section 01 14 16, Coordination with Owner's Operations.
   2. Review procedures under this and other Sections and coordinate the Work that will be performed with or before demolition and removals.

C. Related Sections:
   1. Section 01 73 29, Cutting and Patching.
   2. Section 31 11 00, Clearing and Grubbing.
   3. Section 31 23 16.26, Rock Removal.

1.2 QUALITY ASSURANCE

A. Qualifications:
   1. Electrical Removals: Entity and personnel performing electrical removals shall be electrician legally qualified to perform electrical construction and electrical work in the jurisdiction where the Site is located.
   2. Plumbing Removals: Entity and personnel performing plumbing removals shall be plumber legally qualified to perform plumbing construction and plumbing work in the jurisdiction where the Site is located.

B. Regulatory Requirements:

1. Demolition, removal, and disposal Work shall be in accordance with 29 CFR 1926.850 through 29 CFR 1926.860 (Subpart T - Demolition), and all other Laws and Regulations.
2. Comply with requirements of authorities having jurisdiction.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Procedure Submittals:
      a. Demolition and Removal Plan: Not less than ten days prior to starting demolition Work, submit acceptable plan for demolition and removal Work, including:
         1) Plan for coordinating shut-offs, capping, temporary services, and continuing utility services.
         2) Other proposed procedures as applicable.
         3) Equipment proposed for use in demolition operations.
         4) Recycling/disposal facility(ies) proposed, including facility owner, facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
         5) Planned demolition operating sequences.
         6) Detailed schedule of demolition Work in accordance with the accepted Process Schedule.
   2. Qualifications Statements:
      a. Name and qualifications of entity performing electrical removals, including copy of licenses required by authorities having jurisdiction.
      b. Name and qualifications of entity performing plumbing removals, including copy of licenses required by authorities having jurisdiction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

A. Protection of Surrounding Areas and Facilities:
   1. Perform demolition and removal Work in manner that prevents damage and injury to property, structures, occupants, the public, and facilities. Do not interfere with use of, and free and safe access to and from, structures and properties.
   2. Closing or obstructing of roads, drives, sidewalks, and passageways adjacent to the Work is not allowed unless indicated otherwise in the Contract Documents. Conduct the Work with minimum interference to vehicular and pedestrian traffic.
   3. Provide temporary barriers, lighting, sidewalk sheds, and other necessary protection.
   4. Repair damage to facilities that are to remain.

B. Existing Utilities: In addition to requirements of the General Conditions and Division 01 Specifications, do the following:

1. Should uncharted or incorrectly charted Underground Facilities be encountered, CONTRACTOR responsibilities shall be in accordance with the General Conditions. Cooperate with utility owners in keeping adjacent services and facilities in operation.
2. Sanitary Sewer: Before proceeding with demolition, locate and cap all sewer lines and service laterals discharging from the building or structure being demolished.
3. Storm Water: Existing storm water system shall remain in place until demolitions of existing building or structure is completed. Upon completing demolition, cut and cap storm sewer laterals at locations shown on the Drawings. Remove existing storm water piping and related structures between points of cutting, and backfill, restore to grade, and stabilize the area over the removed facilities.
4. Water Piping: Before proceeding with demolition, locate and cap all potable and non-potable waterlines and service laterals serving the building or structure being demolished.
5. Other Utilities: Before proceeding with demolition, locate and cap as required all other utilities, such as fuel and gas; heating, ventilating, and air conditioning; electric; and communications; and service laterals serving the building or structure being demolished.
6. Shutdown of utility services shall be coordinated by CONTRACTOR, assisted by OWNER as required relative to contacting utility owners.

C. Remediation:
1. Prior to performing demolition Work that disturbs Asbestos, remove and dispose of Asbestos in accordance with Section 01 74 19, Construction and Demolition Waste Management.
2. Prior to performing demolition Work involving lead-based paint, remediate lead in accordance with Section 01 74 19, Construction and Demolition Waste Management.

3.2 DEMOLITION – GENERAL

A. Locate construction equipment used for demolition Work and remove demolished materials and equipment to avoid imposing excessive loading on adjacent facilities, and Underground Facilities.

B. Pollution Controls:
1. Use water sprinkling, temporary enclosures, and other suitable methods to limit emissions of dust and dirt to lowest practical level. Comply with Section 01 57 19, Temporary Environmental Controls, and Laws and Regulations.
2. Do not use water when water may create hazardous or objectionable conditions such as icing, flooding, or pollution.
3. Clean adjacent structures, facilities, properties, and improvements of dust, dirt, and debris caused by demolition Work, in accordance with the General Conditions.

C. Comply with Section 01 73 29, Cutting and Patching.

D. Building or Structure Demolition:
1. Unless otherwise approved by ENGINEER, proceed with demolition from top of building or structure to the ground. Complete demolition Work above each floor or tier before disturbing supporting members of lower levels.
2. Demolish concrete and masonry in small sections.
3. Remove structural framing members and lower to ground using hoists, cranes, or other suitable methods. Do not throw or drop to the ground.

4. Break up and remove foundations and slabs-on-grade unless otherwise shown or indicated as remaining in place.

E. Demolition of Site Improvements:
   1. Pavement, Sidewalks, Curbs, and Gutters: Demolition of asphalt or concrete pavement, sidewalks, curbs, and gutters, as applicable, shall terminate at cut edges. Edges shall be linear and have a vertical cut face.
   2. Fencing, Guardrails, and Bollards: Remove to the limits shown or indicated on the Drawings. Completely remove below-grade posts and concrete.
   3. Manholes, Vaults, Chambers, and Handholes: Remove to the limits shown or indicated on the Drawings and in accordance with Part 3 of this Section.
   4. Underground Facilities Other than Manholes, Vaults, Chambers, and Handholes: Remove to the extent shown or indicated on the Drawings. Unless otherwise shown or indicated, cap ends of piping to remain in place in accordance with the "Mechanical Removals" Article in this Section.
   5. Landscaping: Comply with Section 31 11 00, Clearing and Grubbing.

F. Salvage and Ownership:
   1. Refer to Section 01 11 13, Summary of Work, for requirements on salvage, ownership, and handling of equipment and materials removed during demolition and removal Work.
   2. Materials and equipment to remain OWNER's property shall be carefully removed and appropriately handled by CONTRACTOR to avoid damage and invalidation of warranties in effect, and shall be cleaned and stored at the Site (or other site specified in the Contract Documents) at place designated by ENGINEER or OWNER.

G. Finishing of Surfaces Exposed by Removals: Unless otherwise shown or indicated in the Contract Documents, surfaces exposed by removals, and that will remain as finished surfaces, shall be repaired and re-finished with materials that match existing adjacent surface, or as otherwise approved by ENGINEER.

3.3 ABANDONMENT OF EXISTING MANHOLES

A. Plug both influent and effluent lines inside the manhole with watertight masonry.

B. Fill manhole with non-compressible material (#67 stone or as approved), to a point three feet (3'-0") below the finish grade.

C. Remove remainder of manhole.

D. Fill excavation to finish grade with suitable soil compact in place.

3.4 ABANDONMENT OF MAINS AT MANHOLES WHICH REMAIN IN SERVICE

A. Completely disconnect main to be abandoned from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry.

B. Rebuild the invert to conform with the standard details.

3.5 ABANDONMENT OF EXPOSED PIPE

A. Remove exposed sections of abandoned mains to a point not less than 5 feet into the adjacent banks.

B. Plug the remaining ends of the pipe with watertight masonry.

C. Remove completely concrete piers and collars in the creek channel.

D. Remove concrete piers, steel piers and collars not located in the creek channel to a point three feet (3'-0") below the finish grade.

3.6 ABANDONMENT OF EXISTING PUMP STATIONS

A. Salvage and transport pumps, motors, controls, etc. to the sewer maintenance yard in New Heritage.

B. Plug all influent and effluent pipes with watertight masonry.

C. Fill the pipe chamber and wetwell (if abandoned) with noncompressible material (#67 stone or as approved), to a point three feet (3'-0") below the finish grade.

D. Remove the remainder of the structure and fill the excavation to finish grade with suitable soil compacted in place.

E. Remove all above ground structures associated with the pump station, including fencing and the access road, and restore the area.

3.7 STRUCTURAL REMOVALS

A. Remove structures to lines and grades shown or indicated, unless otherwise directed by ENGINEER. Where limits are not shown or indicated, limits shall be four inches outside item to be installed. Removals beyond limits shown or indicated shall be at CONTRACTOR's expense and such excess removals shall be reconstructed to satisfaction of ENGINEER without additional cost to OWNER.

B. Recycling and Reuse of Demolition Materials:
   1. All concrete, brick, tile, masonry, roofing materials, reinforcing steel, structural metals, miscellaneous metals, plaster, wire mesh, and other items contained in or upon building or structure to be demolished shall be removed, transported, and disposed of away from the Site, unless otherwise approved by ENGINEER.
   2. Do not use demolished materials as fill or backfill adjacent to structures, in pipeline trenches, or as subbase under structures or pavement.

C. After removing concrete and masonry walls or portions thereof, slabs, and similar construction that ties into the Work or to existing construction, neatly repair the junction point to leave exposed only finished edges and finished surfaces.

D. Where equipment or material anchored to concrete or masonry are removed and anchors are not to be re-used, remove the anchors to not less than 1.5 inches beneath surface of concrete or masonry member. Repair the resulting hole, using repair mortar for concrete and grout for masonry, to be flush with the surface. Alternately, when the anchor is stainless

steel, the anchor may be cut flush with the surface of the concrete or masonry, when so approved by ENGINEER.

E. Where anchoring materials, including bolts, nuts, hangers, welds, and reinforcing steel, are required to attach the Work to existing construction, provide such materials under this Section, unless specified elsewhere in the Contract Documents.

3.8 MECHANICAL REMOVALS

A. Mechanical demolition and removal Work includes dismantling and removing existing piping, ductwork, pumps, equipment, tanks, and appurtenances as shown, indicated, and required for completion of the Work. Mechanical removals include cutting and capping as required, except that cutting of existing piping and ductwork to make connections is included under Section 01 14 16, Coordination with Owner's Operations; Section 01 73 29, Cutting and Patching; and applicable Sections of Division 40, Process Integration.

B. Demolition and Removals of Piping, Ductwork, and Similar Items:
   1. Purge piping and tanks (as applicable) of chemicals or fuel (as applicable) and make safe for removal and capping. Remove to the extent shown or indicated existing process, water, waste and vent, chemical, gas, fuel, and other piping. Remove piping to the nearest solid piping support, and provide caps on ends of remaining piping. Where piping to be demolished passes through existing walls to remain, cut off and cap pipe on each side of the wall.
   2. Caps, Closures, Blind Flanges, and Plugs:
      a. Provide closure pieces, such as blind flanges and caps, where shown or required to complete the Work.
      b. Where used in this Section, the term "cap" means the appropriate type closure for the piping or ductwork being closed, including caps, blind flanges, and other closures.
      c. Caps shall be compatible with the piping or ductwork to which the cap is attached, fluid-tight and gastight, and appropriate for the fluid or gas conveyed in the pipe or duct.
      d. Unless otherwise shown or indicated, caps shall be mechanically fastened, fused, or welded to pipe or duct. Plug piping with means other than specified in this Section only when so shown or indicated in the Contractor Documents or when allowed by ENGINEER.
   3. When Underground Facilities are altered or removed, properly cut and cap piping left in place, unless otherwise shown or indicated.
   4. Remove waste and vent piping, and ductwork to extent shown and cap as required. Where demolished vent piping, stacks, and ductwork passes through existing roofing, patch the roof with the same or similar materials. Completed patch shall be watertight and comply with roofing manufacturer's recommendations.
   5. Modifications to potable water piping and other plumbing and heating system work shall comply with Laws and Regulations. All portions of potable water system that have been modified or opened shall be hydrostatically tested and disinfected in accordance with the Contract Documents, and Laws and Regulations. Hydrostatically test other, normally-pressurized, plumbing piping and heating piping.

C. Equipment Demolition and Removals:

1. To the extent shown or indicated, remove existing process equipment; pumps; storage tanks; hoisting and conveying equipment; heating, ventilating, and air conditioning equipment; generators; and other equipment.
2. Where required, disassemble equipment to avoid imposing excessive loading on supporting walls, floors, framing, facilities, and Underground Facilities. Disassemble equipment as required for access through and egress from building or structure. Disassembly shall comply with Laws and Regulations. Provide required means to remove equipment from building or structure.
3. Remove control panels, operator stations, and instruments associated with equipment being removed, unless shown or indicated otherwise.
4. Remove fuel appurtenances as applicable, including fuel storage tanks. Dispose of tank contents in accordance with Laws and Regulations.
5. Remove equipment supports as applicable, anchorages, base, grout, and piping. Remove anchorage systems in accordance with the “Structural Removals” Article in this Section. Remove small-diameter piping back to header unless otherwise indicated.
6. Remove access platforms, ladders, and stairs related to equipment being removed, unless otherwise shown or indicated.
7. Equipment Salvage: The following entities may be interested in salvaging equipment to be removed under the Contract:
    a. Project Development Services, The Woodlands, Texas.

3.9 ELECTRICAL REMOVALS

A. Electrical demolition Work includes removing existing transformers, distribution switchboards, control panels, motors, starters, conduit and raceways, cabling, poles and overhead cabling, panelboards, lighting fixtures, switches, and miscellaneous electrical equipment, as shown, specified, or required.

B. Remove existing electrical equipment and fixtures to avoid damaging systems to remain, to keep existing systems in operation, and to maintain integrity of grounding systems.

C. Remove or modify motor control centers and switchgear as shown or indicated. Modified openings shall be cut square and dressed smooth to dimensions required for installation of equipment.

D. Disconnect and remove motors, control panels, and other electrical gear where shown or indicated. Motors, microprocessors and electronics, other electrical gear to be reused shall be stored in accordance with Section 01 66 00, Product Storage and Handling Requirements.

E. Cables in conduits to be removed shall be removed back to the power source or control panel, unless otherwise shown or indicated. Verify the function of each cable before disconnecting and removing.

F. Conduits, raceways, and cabling shall be removed where shown or indicated. Abandoned conduits concealed in floor, ceiling slabs, or in walls shall be cut flush with the slab or wall (as applicable) at point of entrance, suitably capped, and the area repaired in a flush, smooth manner acceptable to ENGINEER. Exposed conduits, junction boxes, other electrical appurtenances, and their supports shall be disassembled and removed. Repair all areas of the Work to prevent rusting on exposed surfaces.

G. Conduits in Underground Facilities not scheduled for reuse shall be suitably capped watertight where each enters building or structure to remain.

H. Where shown or indicated, remove direct burial cable. Openings in buildings for entrance of direct burial cable shall be patched with repair mortar or other material approved by ENGINEER for this purpose and made watertight.

I. Existing poles and overhead cables shall be removed or abandoned as shown and specified. Existing substation(s) and poles owned by electric utility will be removed by the electric utility. Completely remove from the Site poles not owned by electric utility and shown or indicated for removal. Make necessary arrangements with electric utility for removal of utility company's transformers and metering equipment after new electrical system has been installed and energized.

J. Lighting fixtures, wall switches, receptacles, starters, and other miscellaneous electrical equipment, not designated as remaining as OWNER's property, shall be removed and properly disposed off-Site as required.

3.10 DISPOSAL OF DEMOLITION DEBRIS

A. Remove from the Site all debris, waste, rubbish, and material resulting from demolition operations and equipment used in demolition Work. Comply with the General Conditions and Section 01 74 19, Construction and Demolition Waste Management.

B. Transportation and Disposal:
   1. Non-hazardous Material: Properly transport and dispose of non-hazardous demolition debris at appropriate landfill or other suitable location, in accordance with Laws and Regulations. Non-hazardous material does not contain Asbestos, PCBs, Petroleum, Hazardous Waste, Radioactive Material, or other material designated as hazardous in Laws and Regulations.
   2. Hazardous Material: When handling and disposal of hazardous materials is included in the Work, properly transport and dispose of hazardous materials in accordance with the Contract Documents and Laws and Regulations.

C. Submit to ENGINEER information required in this Section on proposed facility(ies) where demolition material will be recycled. Upon request, ENGINEER or OWNER, shall be allowed to visit recycling facility(ies) to verify adequacy and compliance status. During such visits, recycling facility operator shall cooperate and assist ENGINEER and OWNER.

END OF SECTION

SECTION 03 00 05

CONCRETE

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
   2. The Work includes:
      a. Providing concrete consisting of portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
      b. Fabricating and placing reinforcing, including ties and supports.
      c. Design, erection, and removal of formwork.
      d. Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.

C. Classifications of Concrete:
   1. Class “A” concrete shall be steel-reinforced and includes all concrete unless otherwise shown or indicated, and includes the following:
      a. Structural concrete for load bearing walls.
      b. Columns.
      c. Beams.
      d. Elevated floor slabs.
      e. Unlined or uncoated water/liquid containment structures.
   2. Class “B” concrete shall be placed without forms or with simple forms, with little or no reinforcing and includes the following:
      a. Concrete fill.
      b. Duct banks.
      c. Unreinforced encasements.
      d. Curbs and gutters.
      e. Sidewalks.
      f. Thrust blocks.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 224R, Control of Cracking in Concrete Structures.
   2. ACI 301, Specifications for Structural Concrete for Buildings.
   3. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   4. ACI 305R, Specification for Hot Weather Concreting.
   5. ACI 306R, Cold Weather Concreting.
   6. ACI 309R, Guide for Consolidation of Concrete.
   7. ACI 318, Building Code Requirements for Structural Concrete and Commentary.

8. ACI 347, Guide to Formwork for Concrete.
9. ACI SP-66, ACI Detailing Manual.
10. ASTM A82/A82M, Specification for Steel Wire, Plain, for Concrete Reinforcement.
11. ASTM A185/A185M, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
12. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
13. ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
14. ASTM C33/C33M, Specification for Concrete Aggregates.
15. ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
16. ASTM C42/C42M, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
17. ASTM C94/C94M, Specification for Ready-Mixed Concrete.
18. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
19. ASTM C143/C143M, Test Method for Slump of Hydraulic-Cement Concrete.
20. ASTM C150/C150M, Specification for Portland Cement.
21. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
22. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
23. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
24. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. ASTM C494/C494M, Specification for Chemical Admixtures for Concrete.
26. ASTM C579, Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
27. ASTM C881/C881M, Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
28. ASTM C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
29. ASTM D1752, Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM E96/E96M, Test Methods for Water Vapor Transmission of Materials
31. ASTM E154, Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
32. CRD-C 572, U. S. Army Corps of Engineers Specification for Polyvinylchloride Waterstops.
33. CRSI 1MSP, Manual of Standard Practice.

1.3 QUALITY ASSURANCE

A. Laboratory Trial Batch:
   1. Employ independent testing laboratory currently certified by the Cement and Concrete Reference Laboratory and experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
   2. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
   3. Laboratory personnel shall be ACI-certified.
   4. Perform the following testing on each trial batch:
      a. Aggregate gradation for fine and coarse aggregates.
      b. Slump.
      c. Air content.

d. Compressive strength based on three cylinders each tested at seven days and at 28 days.

5. Submit for each trial batch the following information:
   a. Project identification name and number (if applicable).
   b. Date of test report.
   c. Complete identification of aggregate source of supply.
   d. Tests of aggregates for compliance with the Contract Documents.
   e. Scale weight of each aggregate.
   f. Absorbed water in each aggregate.
   g. Brand, type, and composition of cementitious materials.
   h. Brand, type, and amount of each admixture.
   i. Amounts of water used in trial mixes.
   j. Proportions of each material per cubic yard.
   k. Gross weight and yield per cubic yard of trial mixtures.
   l. Measured slump.
   m. Measured air content.
   n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
      b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
      c. Concrete placement drawings showing the location and type of all joints.
      d. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams of bent bars, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing.
   2. Product Data:
      a. Manufacturer’s specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
   3. Samples:
      a. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources, and descriptions.

B. Informational Submittals: Submit the following:
   1. Site Quality Control Submittals:
      a. Report of testing results for testing of field concrete cylinders for each required time period. Submit within 24 hours after completion of associated test. Test report shall include results of all testing required at time of sampling.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transportation, Delivery, and Handling:

1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
3. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.
4. Deliver grout materials from manufacturers in unopened containers that bear intact manufacturer labeling.
5. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage:
1. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
2. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
3. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
4. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.
5. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Provide the type of cement required by the environmental conditions and exposures defined by ASTM C150/C150M:
1. Type I/ Type IA: Normal/ Normal, air-entraining.
2. Type II/ Type IIA: Moderate sulfate resistance/ Moderate sulfate resistance, air-entraining.

B. Aggregates: ASTM C33/C33M.
1. Fine Aggregate: Clean, sharp, natural sand, manufactured sand or a combination thereof free of loam, clay, lumps, and other deleterious substances. Dune sand and bank run sand are unacceptable.
   a. Shall conform to the sieve analysis in accordance with ACI Standards with the following exceptions:
      1) The percent passing a No. 50 sieve shall not exceed 6%.
      2) The percent passing a No. 100 sieve shall be 0%.
2. Coarse Aggregate:
   a. Clean, uncoated, processed, uniformly and evenly graded aggregate containing no clay, mud, loam, or foreign matter.
   b. Coarse aggregate shall comply with the following:
      1) Sound, crushed, angular granitic stone.

2) Washed gravel, either natural or crushed. Slag, pit gravel, bank-run gravel, smooth or rounded stone are not allowed.

c. Coarse Aggregate Size:
1) Reinforced Concrete: ASTM C33/C33M, Nos. 57 or 67, unless otherwise approved by ENGINEER.
2) Unreinforced Slabs or Pavement: ASTM C33/ C33M, No. 467.

C. Water: Clean, potable.

D. Admixtures:
1. Air-Entraining Admixture: ASTM C260.
2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
3. Water Reducing and Set-Adjusting Admixtures: ASTM C494/C494M, Types D and E.
4. High Range Water-Reducing Admixture: ASTM C494/C494M, Type F/G.
5. Use only admixtures that have been tested and approved in the mix designs.
6. Do not use calcium chloride in excess of 1% by cement weight. If concrete is used with reinforcing steel, no calcium chloride shall be used.
7. Do not use other admixtures containing chloride ions.

2.2 CONCRETE MIX

A. General:
1. Normal weight: 145 pounds per cubic foot.
2. Use air-entraining admixture in all concrete unless restricted by the manufacturer for floor hardness treatments or coating systems if specified. Provide not less than four percent, nor more than six percent, entrained air for concrete.

B. Proportioning and Design of Class “A” Concrete Mix:
1. Minimum compressive strength at 28 days: 4,500 psi.
2. Maximum water-cement ratio by weight: 0.42.
3. Minimum cement content: 564 pounds per cubic yard.

C. Proportioning and Design of Class “B” Concrete Mix:
1. Minimum compressive strength at 28 days: 3,500 psi.
2. Maximum water-cement ratio by weight: 0.50.
3. Minimum cement content: 517 pounds per cubic yard.

D. Slump Limits:
1. Proportion and design mixes to result in concrete slump at point of placement of not less than three inches and not more than five inches.
2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed eight inches at point of placement.

E. Adjustment of Concrete Mixes:
1. Concrete mix design adjustments may be requested by CONTRACTOR when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.
2. Submit for ENGINEER’s approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
3. Implement adjusted mix designs only after ENGINEER’s approval.

4. Adjustments to concrete mix designs shall not result in additional costs to OWNER.

2.3 FORM MATERIALS

A. Provide form materials of wood, plywood, metal or material approved by Engineer with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be responsible for designing the formwork system to resist all applied loads including the pressures from fluid concrete and construction loads, including vibration during placement and rate of speed at which forms are to be filled.

B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.

C. Unexposed Concrete Surfaces: Material to suit project conditions.

D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.

E. Form Ties:
   1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of ENGINEER.
   2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of concrete. Unless otherwise shown or indicated, provide form ties that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.
   3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with waterstops.
   4. Wire ties are unacceptable.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.

B. Welded Wire Fabric: ASTM A185/A185M.

C. Steel Wire: ASTM A82/A82M.

D. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.
   1. Use wire bar-type supports complying with CRSI MSP1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
   2. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.
   3. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless steel legs in accordance with CRSI MSP1.
   4. Provide precast concrete supports over waterproof membranes.

E. Adhesive Dowels:

1. Dowels:
   a. Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
2. Adhesive:
   a. Adhesive system shall use two-component adhesive mix.
   b. Epoxy adhesives shall comply with physical requirements of ASTM C881/C881M, Type IV, Grade 2 and 3, Class A, B, and C, except gel times.
   c. Adhesives shall have a current evaluation report by ICC Evaluation Service for use in both cracked and uncracked concrete with seismic recognition for SDC A through F as tested and assessed in accordance with ICC-ES AC308.
   d. Adhesives shall have minimum bond strength and minimum design bond strength (bond strength multiplied by strength reduction factor) in accordance with Table 03 00 05-A:

TABLE 03 00 05-A:
ADHESIVE BOND STRENGTH [1,2]

Anchor	Uncracked Concrete		Cracked Concrete	
Rod Diameter / Dowel Size	**Bond Strength (psi)**	**Design Bond Strength (psi)**	**Bond Strength (psi)**	**Design Bond Strength (psi)**
3/8-inch / #3	2040	1300	1090	700
1/2-inch / #4	1920	1200	920	560
5/8-inch / #5	1830	1150	710	390
3/4-inch / #6	1760	1050	710	460
7/8inch / #7	1670	900	610	340
1-inch / #8	1650	1050	850	460
- / #9	1900	1000	800	400
1.25-inch/ #10	1580	1000	730	400

Table Notes:
1. Bond strengths listed for hammer-drilled, dry hole.
2. Bond strengths listed for maximum short term concrete temperature of 110 degrees F and maximum long term concrete temperature of 75 degrees F.

2.5 RELATED MATERIALS

A. Waterstops:
   1. PVC Waterstops:
      a. Manufacturers: Provide products of one of the following:
         1) W.R. Meadows, Inc.
         2) Greenstreak Plastic Products Company.
         3) Or equal.
      b. Waterstops shall comply with CRD-C 572. Do not use reclaimed or scrap material.
      c. Minimum Thickness: 3/8-inch.
      d. Provide waterstops with minimum of seven ribs equally spaced at each end on each side with the first rib located at the edge. Each rib shall be minimum 1/8-inch in height.
      e. Construction Joints: Waterstops shall be six-inch wide flat-strip type.
      f. Expansion Joints: Waterstops shall be nine-inch wide centerbulb type.
   2. Hydrophilic Waterstops:
      a. Products and Manufacturers: Provide one of the following:

1) Duroseal Gasket, by BBZ USA, Inc.
2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
3) Hydrotite, by Greenstreak Plastic Products Company.
4) Or equal.

b. Hydrophilic waterstop materials shall be bentonite-free and shall expand by minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
c. Waterstop material shall be composed of resins and polymers that absorb water and cause a completely reversible and repeatable increase in volume.
d. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
e. Select material in accordance with manufacturer's recommendations for type of liquid to be contained.
f. Minimum cross-sectional dimensions: 3/16-inch by 3/4-inch.
g. Location of hydrophilic waterstops shall be as shown or indicated on the Drawings, or where approved by ENGINEER.
h. Hydrophilic Sealant: Shall adhere firmly to concrete, metal, and PVC in dry or damp condition and be indefinitely elastic when cured.
1) Products and Manufacturers: Provide one of the following:
a) Duroseal Paste, by BBZ USA, Inc.
b) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
c) Hydrotite, by Greenstreak Plastic Products Company.
d) Or equal.

B. Membrane-Forming Curing Compound: ASTM C309, Type II.

C. Epoxy Bonding Agent:
1. Two-component epoxy resin bonding agent.
2. Products and Manufacturers: Provide one of the following:
a. Sikadur 32, Hi-Mod LPL, by Sika Corporation.
b. Eucopoxy LPL, by the Euclid Chemical Company.
c. Or equal.

D. Epoxy-Cement Bonding Agent:
1. Three-component blended epoxy resin-cement bonding agent.
2. Products and Manufacturers: Provide one of the following:
a. Sika Armatec 110 EpoCem, by Sika Corporation.
b. Duralprep A.C., by Euclid Chemical Company.
c. Or equal.

E. Preformed Expansion Joint Filler:
1. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

F. Joint Sealant and Accessories:
1. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.6 GROUT

A. Non-shrink Grout:

1. Pre-packaged, non-metallic, cementitious grout requiring only the addition of water at the Site. In accordance with ASTM C1107.
2. Minimum 28-day Compressive Strength: 7,500 psi.
3. Bond Strength: 1,350 to 1,700 psi.
4. Percent Expansion: 0.25% to 0.75%.
5. Products and Manufacturers: Provide one of the following:
    a. NS Grout by Euclid Chemical Company.
    b. Set Grout by Master Builders, Inc.
    c. Embeco 636 by Master Builders, Inc.
    d. d. NBEC Grout by Five Star Products, Inc.
    e. Or equal.

2.7 MORTAR

A. Mortar uses in sanitary sewer manholes shall be hydraulic cement mortar in accordance with ASTM C-398.

B. Mortar used in water meter vaults and water valve vaults shall be Type M in accordance with ASTM C-270.

PART 3 EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the substrate and the conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 FORMWORK

A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.

C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.

D. Removing Formwork:
1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to ENGINEER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
3. Removal time for formwork is subject to ENGINEER's acceptance. Forms shall be left in place for a minimum of 7 days.

4. Repair form tie-holes following in accordance with ACI 301.
5. Do not remove formwork and backfill before end of curing period without approval of Engineer. In such cases where Engineer approves early removal of forms, newly-exposed surfaces shall be cured in accordance with Part 3 of this specification.

3.3 REINFORCING, JOINTS, AND EMBEDDED ITEMS

A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP1, for details and methods of placing and supporting reinforcing.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.
   1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
   2. Do not secure reinforcing to formwork using wire, nails or other ferrous metal. Metal supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.

D. Provide sufficient quantity of supports of strength required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars, as shown on the Drawings.

F. Install welded wire fabric in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.

G. Do not place concrete until reinforcing is inspected and ENGINEER indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph shall be rejected. Notify ENGINEER in writing at least two working days prior to proposed concrete placement.

H. Joints:
   1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
   2. In walls, locate joints at a maximum spacing of 40 feet and approximately 12 feet from corners.
   3. In foundation slabs and slabs-on-grade, locate joints at intervals of approximately 40 feet.
   4. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.

5. Locations of joints shall be in accordance with the Contract Documents and as approved by ENGINEER in the Shop Drawings.
6. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously-placed concrete to amplitude of 1/4-inch.

I. Installation of Embedded Items: Do not embed in concrete uncoated aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.

J. Adhesive Dowels:
1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in hole drilled into hardened concrete. Comply with adhesive system manufacturer's installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following.
2. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Holes shall not be more than 1/4-inch greater than nominal bar diameter, and hole depth shall not be less than twelve times nominal bar diameter. Hammer-drill holes. Cored holes are not allowed.
3. Embedment depths shall be based on concrete compressive strength of 2,000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
4. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by ENGINEER.
5. Before setting adhesive dowel, hole shall be free of dust and debris using method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
6. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.
7. Twist dowels during insertion into partially-filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.4 CONCRETE PLACING

A. Site Mixing: Use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.

B. Ready-Mixed Concrete: Comply with ASTM C94/C94M.

C. Concrete Placing:
1. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
2. Do not begin placing concrete until work of other trades affecting concrete is completed.
3. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.

4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
5. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
6. Complete concrete placing within 90 minutes of addition of water to the dry ingredients.

D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly-spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.

E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
1. In hot weather comply with ACI 305R.
2. In cold weather comply with ACI 306R.

3.5 QUALITY OF CONCRETE WORK

A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.

B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.

C. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.

D. Repair, removal and replacement of defective concrete directed by ENGINEER shall be at no additional cost to OWNER.

3.6 CURING

A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 7 hours. Continue curing by using moisture-retaining cover or membrane-forming curing compound, or by keeping exposed surfaces moist continuously for entire curing period. Cure formed surfaces by moist curing until formwork is removed. Provide protection, as required, to prevent damage to exposed concrete surfaces. Total curing period shall not be less than seven days. Curing methods and materials shall be compatible with scheduled finishes.

3.7 FINISHING

A. Slab Finish:
1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Use a wood float only. Check and level surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, granular

texture. Slab surfaces shall receive a float finish. Provide additional trowel finishing as required in this Section.

2. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
3. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten-foot straightedge. Grind smooth surface defects that would telegraph through applied floor covering system.
4. Use trowel finish for the following:
   a. Interior exposed slabs, unless otherwise shown or indicated.
   b. Apply non-slip broom finish, after troweling, to exterior concrete slab and elsewhere as shown.

B. Apply chemical floor hardener to exposed interior concrete floor areas when cured and dry, in accordance with hardener manufacturer's instructions.

C. Formed Finish:
1. Provide smooth form concrete finish at exposed surfaces. Use largest practical form panel sizes to minimize form joints. Exposed surfaces include interior water-contacting surfaces of tanks, whether or not directly visible. All surfaces shall be considered as exposed, unless buried or covered with permanent structural or architectural material. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/8-inch in height. Where surface will be coated or will receive further treatment, remove all fins flush with concrete surface.
2. Provide rough form finish at all unexposed surfaces. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/2-inch in height.

3.8 GROUT PLACING

A. Place grout as shown and indicated, and in accordance with grout manufacturer's instructions and recommendations. If grout manufacturer's instructions conflict with the Contract Documents, notify ENGINEER and not proceed until obtaining ENGINEER's clarification.

B. Dry-packing is not allowed, unless otherwise indicated.

C. Manufacturers of proprietary grout materials shall make available upon 72 hours notice the services of qualified, full-time, factory-trained employee to aid in ensuring proper use of grout materials at the Site.

D. Placing grout shall comply with temperature and weather limitations described in Article 3.4 of this Section.

3.9 FIELD QUALITY CONTROL

A. Site Testing Services:
1. Employ independent testing laboratory to perform field quality control testing for concrete. ENGINEER will direct where samples are obtained.
2. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.

3. Provide curing and necessary cylinder storage in accordance with Section 01 45 29, Testing Laboratory Services.

B. Quality Control Testing During Construction:
   1. Perform sampling and testing for field quality control during concrete placing, as follows:
      a. Sampling Fresh Concrete: ASTM C172.
      b. Slump: ASTM C143/C143M; one test for each concrete load at point of discharge.
      c. Concrete Temperature: ASTM C1064/C1064M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
      d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
      e. Unit Weight: ASTM C138/C138M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
      f. Compression Test Specimens:
         1) In accordance with ASTM C31/C31M, make one set of compression cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design placed each day. Each set shall be four standard cylinders, unless otherwise directed by ENGINEER.
         2) Cast, store, and cure specimens in accordance with ASTM C31/C31M.
      g. Compressive Strength Tests:
         1) In accordance with ASTM C39/C39M; one specimen tested at seven days, and three specimens tested at 28 days.
         2) Concrete that does not comply with strength requirements shall be considered as defective Work.
      h. Submit test results from certified by testing laboratory to ENGINEER within 24 hours of completion of test.
      i. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, CONTRACTOR shall employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42/C42M and the following:
         1) Testing of Adhesive Dowels: CONTRACTOR shall employ testing agency to perform field quality control testing of drilled dowel installations. After adhesive system manufacturer's recommended curing period and prior to placing connecting reinforcing, proof-test for pullout ten percent of adhesive dowels installed. Adhesive dowels shall be tensioned to 60 percent of specified yield strength. Where dowels are located less than six bar diameters from edge of concrete, ENGINEER shall determine tensile load required for test. If one or more dowels fail, retest all dowels installed for the Work. Dowels that fail shall be reinstalled and retested at CONTRACTOR's expense.

END OF SECTION

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish miscellaneous metal fabrications including surface preparation and shop priming.
   2. The Work also includes:
      a. Providing openings in miscellaneous metal fabrications to accommodate the Work under this and other Sections, and attaching to miscellaneous metal fabrications all items such as sleeves, bands, studs, fasteners, and all items required for which provision is not specifically included under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the Work to be installed with, or attached to, miscellaneous metal fabrications Work.
   2. Hot-dip Galvanizing: Coordinate with steel fabricator detailing for and fabrication of assemblies to be hot-dip galvanized, to minimize distortion during galvanizing process.

C. Related Sections:
   1. Section 03 00 05, Concrete.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI A14.3, Ladders – Fixed –Safety Requirements.
   2. ANSI Z359.1, Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components.
   3. ASTM A36/A36M, Specification for Carbon Structural Steel.
   4. ASTM A53/A53M, Specification for Pipe Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   5. ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   6. ASTM A153/A153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   7. ASTM A240/A240M, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
   8. ASTM A320/A320M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
   9. ASTM A384/A384M Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
   10. ASTM A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   11. ASTM A572/A572M, Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   12. ASTM A793, Specification for Rolled Floor Plate, Stainless Steel.
   13. ASTM A992/A992M, Specification for Structural Steel Shapes.

14. ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
15. ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
16. ASTM B211, Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
17. ASTM B221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
18. ASTM B308/B308M, Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
19. ASTM B429, Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
20. ASTM B632/B632M, Specification for Aluminum-Alloy Rolled Tread Plate.
21. AWS D1.1/D1.1M, Structural Welding Code – Steel.
22. AWS D1.2/D1.2M, Structural Welding Code – Aluminum.
23. AWS D1.6, Structural Welding Code – Stainless Steel.
24. NAAMM, Metal Finishes Manual.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Welding:
      a. Qualify welding processes and welding operators in accordance with AWS D1.1/D1.1M, D1.2/D1.2M, or D1.6, as applicable.
      b. When requested by ENGINEER, provide certification that each welder employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within previous 12 months. Ensure that all certifications are current.

B. Regulatory Requirements: Conform to the following:
   1. 29 CFR 1910, Occupational Health and Safety Standards.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Fabrication and erection details for assemblies of miscellaneous metal Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings and templates for locating and installing miscellaneous metal items and anchorage devices.
   2. Product Data:
      a. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal Work.

B. Informational Submittals: Submit the following:
   1. Test and Evaluation Reports:
      a. Mill test report that indicate chemical and physical properties of each type of material, when requested by ENGINEER.
   2. Qualifications Statements:
      a. Copies of welder's certifications, when requested by ENGINEER.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in other construction in ample time to prevent delaying the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel:
   1. W-Shapes and WT-Shapes: ASTM A992/A992M.
   2. S-Shapes and Channels: ASTM A572/A572M, Grade 50.
   3. Hollow Structural Sections: ASTM A500, Grade B.
   4. Angles, Plates, Bars: ASTM A36/A36M.
   5. Steel Pipe: ASTM A53/A53M, Grade B.

B. Aluminum:
   1. Aluminum Shapes: ASTM B308/B308M, Alloy 6061-T6, ASTM B 221, Alloy 6061-T6.
   2. Aluminum Tubes and Pipes: ASTM B429, Alloy 6061-T6.
   3. Aluminum Bars and Rod: ASTM B211, Alloy 6061-T6.
   4. Aluminum Plates: ASTM B209, Alloy 6061-T6.

C. Stainless Steel:
   1. Plates and Sheets: ASTM A240/A240M, Type 304L or Type 316 stainless steel.
   2. Submerged or Intermittently Submerged: Type 316 stainless steel.
   3. Non-submerged: Type 304L stainless steel.

D. Stainless Steel Fasteners and Fittings: ASTM A 320/A 320M, Type 304L or Type 316 Stainless Steel.

E. Zinc-coated Hardware: ASTM A153/A153M.

2.2 MISCELLANEOUS METAL ITEMS

A. Shop Assembly:
   1. Pre-assemble items in the shop to the greatest extent possible to minimize field-splicing and field-assembly of units at the Site. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Aluminum Ladders:
   1. Fabricate ladders for locations shown or indicated with dimensions, spacing, details, and anchorages as shown and specified. Comply with OSHA 29 CFR 1910 and ANSI A14.3, except as otherwise shown or specified.
      a. Unless otherwise shown, provide 1.5-inch diameter continuous side rails, spaced at least 1.5 feet apart.
      b. Provide extruded square rungs, spaced maximum of 12 inches on centers, with non-slip surface on top of each rung. Adhesive strips for non-slip surfaces are not acceptable.

2. Fit rungs in centerline of side rails, plug weld, and grind smooth on outer rail faces.
3. Support each ladder at top and bottom and at intermediate points spaced not more than five feet on centers.
4. Use welded or bolted brackets, designed for adequate support and anchorage, and to hold ladder clear of wall surface with minimum of seven inches between wall and centerline of rungs.
5. Unless otherwise shown or approved by ENGINEER, extend rails 3.5 feet above top rung, and return rails to wall or structure, unless other secure handholds are provided. If adjacent structure does not extend above top rung, goose-neck extended rails back to structure to provide secure ladder access.
6. Use extruded aluminum conforming to alloy and temper 6061-T6.

C. Shelf Angles:
1. Provide structural steel shelf angles of sizes shown, for attachment to concrete or masonry construction. Provide slotted holes to receive 3/4-inch bolts, spaced not more than six inches from ends and not more than 2.0 feet on centers, unless otherwise shown.
   a. Provide galvanized shelf angles on outdoor construction.
2. Provide wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

D. Aluminum Stair Nosings:
1. Manufacturers: Provide products of one of the following:
   a. Supergrit Type 241BF by Wooster Products, Inc.
   b. Or equal.
2. Fabricate extruded aluminum nosing of sizes and configurations as shown on the Drawings.
   a. Unless otherwise shown, provide ribbed abrasive filled type, using black abrasive filler.
3. Provide anchors for embedding in concrete, either integral or applied to treads, as standard with manufacturer.

E. Bollards:
1. Provide Schedule 80 galvanized steel pipe filled with concrete as shown on the Drawings. Paint as required in accordance with manufacturer's paint standards. Unless otherwise shown or specified, finish-paint bollard "Safety Yellow."

F. Miscellaneous Framing and Supports:
1. Provide miscellaneous metal framing and supports that are not part of structural steel framework and are required to complete the Work.
2. Fabricate miscellaneous units to sizes, shapes, and profiles shown on the Drawings or, if not shown, of required dimensions to receive adjacent grating, plates, tanks, doors, and other work to be retained by the framing.
3. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all-welded construction using mitered corners, welded brackets, and splice plates and minimum number of joints for field connection.
4. Cut, drill, and tap units to receive hardware and similar items to be anchored to the Work.
5. Furnish units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units are to be installed after concrete is placed.
   a. Except as otherwise shown, space anchors, 2.0 feet on centers, and provide units the equivalent of 1.25-inch by 1/4-inch by eight-inch strips.
   b. Galvanize exterior miscellaneous frames and supports.

c. Where shown or indicated, galvanize miscellaneous frames and supports that are not to be installed outdoors.

6. Miscellaneous steel framing and supports shall be hot-dip galvanized and finish-painted, unless otherwise shown or indicated.
7. Surface preparation and painting of galvanized surface shall conform to manufacturer's painting standards.

G. Fasteners and Hardware: Provide Type 316 stainless steel fasteners for aluminum fabrications and zinc-coated hardware for galvanized fabrications, unless otherwise shown or specified.

2.3 FINISHING

A. Surface Preparation and Shop Priming: Perform surface preparation and apply primer coat to miscellaneous metal fabrications in the shop. Conform surface preparation and shop priming to manufacturer's standards.

B. Galvanizing:
1. Galvanizing of fabricated steel items shall comply with ASTM A123/A123M.
2. Details of fabrication of steel items and assemblies to be hot-dip galvanized shall conform to recommendations of ASTM A384/A384M to minimize the potential for distortion.

C. Aluminum Finish: Provide an Architectural Class 1 anodized finish, AA-M32C22-A41, as specified in NAAMM Metal Finishes Manual. Color of finish shall be as approved by ENGINEER.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections:
1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures complying with the Contract Documents.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions under which the Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install miscellaneous metal fabrications accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork where fabrications are to be built into concrete, masonry, or other construction.

B. Anchor securely as shown and as required for the intended use, using concealed anchors where possible.

C. Fit exposed connections accurately together to form tight, hairline joints. Field-weld steel connections that are not to be exposed joints and cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1/D1.1M, D1.2/D1.2M and D1.6, as applicable to the material being welded. Grind steel joints smooth and touch-up shop paint coat. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Protection of Aluminum from Dissimilar Materials:
   1. Coat surfaces of aluminum that will contact dissimilar materials such as concrete, masonry, and steel, in accordance with manufacturer's coating standards.

END OF SECTION

SECTION 05 56 00

METAL CASTINGS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install metal castings.
   2. Castings include metal items that are not part of miscellaneous metal fabrications or metal systems in other Specifications Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before metal castings Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM A48/A48M, Specification for Gray Iron Castings.
   2. ASTM A126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   3. ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have at least five years experience manufacturing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all frame, lid or cover and grate products included in this Section regardless of component manufacturer, from a single castings manufacturer.
   2. Castings manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. Components shall be constructed for specified service conditions and shall be integrated into overall assembly by castings manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Fabrication and installation of all casting assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.
   2. Product Data:

a. Copies of manufacturer's catalog information for the products proposed for use, specifications, load tables, dimension diagrams, anchor details, and installation instructions.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Furnish certification, signed by authorized officer of CONTRACTOR and notarized, stating that all components are furnished by the same manufacturer.
      b. Manufacturer's certification that the casting or lot of castings was made, sampled, tested and inspected in accordance with ASTM A48.
   2. Qualifications Statements: Submit qualifications for the following:
      a. Manufacturer, when required by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver products to the Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work.
   2. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:
   1. Protect materials from corrosion and deterioration.
   2. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide products from the following manufacturers:
   1. Neenah Foundry Company.
   2. EJ (formerly East Jordan Ironworks).
   3. Or equal.

B. Material: ASTM A48/A48M, Class 35 B.

C. Products:
   1. Round Manhole Frame with Solid Lid.
   2. Round Manhole Frame with Solid Bolted Lid.
   3. Round Manhole Frame with Solid Lid – Flush Top.
   4. Catch Basin Frame with Grate.
   5. Curb Inlet Frame Grate and Curb Box.
   6. Valve Box Frame and Lid.

2.2 FABRICATION

A. Fabrication, General:

1. Castings shall be of uniform quality, free of sand holes, gas holes, shrinkage cracks, and other surface defects.
2. Castings shall be ground smooth and well-cleaned by shot blasting in the shop.
3. Design and fabricate round frames and covers to prevent rocking and rattling under traffic loads that will be imposed in actual use.
4. Fabricate castings true to pattern so that component parts fit together.
5. Each casting shall be identifiable and, depending on its size, shall indicate the following: name of producing foundry, ASTM material designation, individual part number, and cast or heat date. Castings shall include all lettering shown or indicated on the Drawings.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Comply with casting manufacturer's printed instructions and the Contract Documents. Where castings are installed on precast concrete, fabricated fiberglass, or other fabricated products, install casting in accordance with requirements of manufacturer of product on which casting will be installed.

B. Set castings accurately to required location, alignment, and elevation, plumb, level, true and free of rack, measured from established lines and levels. Where applicable, brace temporarily or anchor temporarily in formwork.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install joint sealants.
   2. Extent of each type of calking and sealant is shown or indicated and includes the following:
      a. Interior and exterior joints in equipment and construction systems not filled by another material, and that are not required to be open for operation.
      b. Exposed-to-view joints of all fire-rated sealants.
      c. Joints specified to be recalked.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before joint sealants.
   2. Coordinate final selection of joint sealants so that materials are compatible with all calking and sealant substrates specified.

C. Related Sections:
   1. Section 03 00 05, Concrete.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM C510, Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
   2. ASTM C661, Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
   3. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
   4. ASTM C794, Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
   5. ASTM C920, Specification for Elastomeric Joint Sealants.
   6. ASTM C1021, Practice for Laboratories Engaged in Testing Building Sealants.
   7. ASTM C1087, Test method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   8. ASTM C1193, Guide for Use of Joint Sealants.
   9. ASTM C1247, Practice for Durability of Sealants Exposed to Continuous Immersion in Liquids.
   10. BAAQMD Regulation 8, Rule 51.
   11. FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
   12. FS TT-S-00230 Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
   13. NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.
   14. SCAQMD Rule 1168.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Installer:
      a. Engage a single installer, approved by product manufacturer, regularly engaged in calking and sealant installation and with successful experience in applying types of products required, and who employs only tradesmen with specific skill and successful experience in the type of Work required.
   2. Testing Laboratory:
      a. Furnish services of independent testing laboratory qualified according to ASTM C1021, for conducting testing required.

B. Component Supply and Compatibility:
   1. Obtain materials only from manufacturers who will, if required:
      a. Test joint sealants for compatibility with substrates for conformance with FS-TT-S-00227, and recommend remedial procedures as required.
   2. Before purchasing each sealant, investigate its compatibility with joint surfaces, joint fillers, and other materials in joint system. Provide products that are fully compatible with actual installation condition, verified by manufacturer's published data or certification, and as shown on approved Shop Drawings and other approved submittals.

C. Product Testing: Provide test results of laboratory pre-construction compatibility and adhesion testing, as specified in Article 3.1 of this Section, by qualified testing laboratory, based on testing of current sealant formulations within a 36-month period preceding the Notice to Proceed for the Work.
   1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920 and, where applicable, to other standard test methods.
   2. Test other joint sealants for compliance using specified post-construction field adhesion test.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule of joint sealants installation, indication each specific surface where calking or sealants are to be provided and the material proposed for each application.
   2. Product Data:
      a. Copies of manufacturer's data sheets including color charts, specifications, recommendations, and installation instructions for each type of sealant, calking compound, and associated miscellaneous material required. Include manufacturer's published data, indicating that each product complies with the Contract Documents and is intended for the applications shown or indicated.
      b. Product test reports.
   3. Samples:
      a. Each type of actual cured material of each calking and sealant specified, in each of manufacturer's standard colors.
      b. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is responsibility of CONTRACTOR.

B. Informational Submittals: Submit the following:
   1. Certificates:

a. Certify that materials are suitable for intended use and materials meet or exceed requirements of the Contract Documents.
b. Certification from manufacturer that products furnished are appropriate for surfaces and conditions to which they will be applied.
c. Certify that applicator is approved by manufacturer.

2. Field Quality Control Submittals:
   a. Results of tests on job mock-ups.
   b. Pre-construction and post-construction field test reports.
   c. Compatibility and adhesion test reports.
   d. Contractor's Field Test Report Logs:
      1) Indicate time present at the Site.
      2) Include observations and results of field tests, and document compliance with manufacturer's installation instructions and supplemental instructions provided to installers.
3. Qualifications: Submit qualifications for:
   a. Installer.
   b. Testing laboratory (if not already submitted under Section 01 45 29, Testing Laboratory Services).

C. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data:
   a. Recommended inspection intervals.
   b. Instructions for repairing and replacing failed sealant joints.
2. Warranty: Submit written warranties as specified in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 65 00, Product Delivery Requirements, and Section 01 66 00, Product Storage and Handling Requirements, and the following:
1. Delivery of Products:
   a. Deliver products in calking and sealant manufacturer's original unopened, undamaged containers, indicating compliance with approved Shop Drawings and approved Sample color selections.
   b. Include the following information on label:
      1) Name of material and Supplier.
      2) Formula or Specification Section number, lot number, color and date of manufacture.
      3) Mixing instructions, shelf life, and curing time, when applicable.
2. Storage of Products:
   a. Do not store or expose materials to temperature above 90 degrees F or store in direct sunlight.
   b. Do not use materials that are outdated as indicated by shelf life.
   c. Store sealant tape in manner that will not deform tape.
   d. In cool or cold weather, store containers for sixteen hours before using in temperature of approximately 75 degrees F.
   e. When high temperatures prevail, store mixed sealants in a cool place.
3. Handling:
   a. Do not open containers or mix components until necessary preparatory Work and priming are complete.

1.6 JOB CONDITIONS

A. Environmental Conditions:
   1. Do not install joint sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
   2. Proceed with the Work when forecasted weather conditions are favorable for proper cure and development of high-early bond strength.
   3. Where joint width is affected by ambient temperature variations, install elastomeric sealants when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
   4. When high temperatures prevail, avoid mixing sealants in direct sunlight.
   5. Supplemental heat sources required to maintain both ambient and surface temperatures within the range recommended by manufacturer for material applications are not available at the Site.
   6. Provide supplemental heat and energy sources, power, equipment, and operating, maintenance, and temperature monitoring personnel.
   7. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas of calking, sealants, and painting Work, and areas where OWNER's personnel or construction personnel may work. Properly locate and vent such heat sources to outdoors so that joint sealants and other Work are unaffected by exhaust.

1.7 WARRANTY

A. Provide written warranty, signed by manufacturer and CONTRACTOR, agreeing to repair or replace sealants that fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified in approved Shop Drawings and other submittals, as an inherent quality of material for exposure indicated.
   1. Provide manufacturer warranty for period of one year from date of Substantial Completion of joint sealants Work.
   2. Provide installer warranty for period of two years from date of Substantial Completion of joint sealants Work.

PART 2 PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Provide elastomeric joint sealants for interior and exterior joint applications that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. VOC Performance Criteria:
   1. VOC content of sealants used shall comply with current VOC content limits of SCAQMD Rule 1168. Sealants used as fillers shall comply with or exceed requirements of BAAQMD Regulation 8, Rule 51.
      a. Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.

C. Provide colors selected by ENGINEER from calking and sealant manufacturer's standard and custom color charts. "Or equal" manufacturers shall provide same generic products and colors as available from manufacturers specified.

2.2 MATERIALS

A. Exterior and Interior Horizontal and Vertical Joints; Submerged and Intermittently Submerged in Potable Water or Water That Will be Treated to Become Potable:
   1. Two-component Polyurethane Sealant:
      a. Products and Manufacturers: Provide one of the following:
         1) Sikaflex- 2c NS by Sika Corporation.
         2) Or equal.
      b. Two-component, moisture cured, gun grade, polyurethane sealant, complying with:
         1) FS TT-S-00227E, Type II, Class A; ASTM C920, Type M, Grade NS, Class 25.
         2) Adhesion-in-Peel, FS TT-S-00227E, ASTM C794 (Minimum five pounds per linear inch with no adhesion failure): 18 pounds.
         3) Hardness (Standard Conditions), ASTM C661: 25 (Shore A).
         4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
         5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
         6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
         7) VOC Content: 220 g/L, maximum.
         8) Listed in NSF/ANSI 61

B. Exterior and Interior Horizontal and Vertical Joints; Submerged and Intermittently Submerged in Wastewater:
   1. Two-component Polyurethane Sealant:
      a. Products and Manufacturers: Provide one of the following:
         1) Sikaflex- 2c NS by Sika Corporation.
         2) Vulkem 227 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
         3) Or equal.
      b. Polyurethane based, two-component elastomeric sealant complying with:
         1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
         2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 18 lbs.
         3) Hardness (Standard Conditions), ASTM C661: 25 (Shore A).
         4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
         5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
         6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
         7) VOC Content: 220 grams per liter, maximum.

C. Exterior and Interior Vertical Joints; Non-submerged:
   1. Two-component Polyurethane Sealant:
      a. Products and Manufacturers: Provide one of the following:
         1) Sikaflex- 2c NS by Sika Corporation.
         2) Dymeric 240 FC by Tremco Sealant/Waterproofing Division of RPM International, Inc.

3) Or equal.

b. Polyurethane based, two-component elastomeric sealant complying with:
   1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
   2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 10 pounds.
   3) Hardness (Standard Conditions), ASTM C661: 25 to 35 (Shore A).
   4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
   5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
   6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
   7) VOC Content: 100 g/L, maximum.

D. Exterior and Interior Horizontal Joints; Non-submerged:
   1. Two-component Polyurethane Sealant:
      a. Products and Manufacturers: Provide one of the following:
         1) Sikaflex- 2c SL by Sika Corporation.
         2) THC/900 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
         3) Or equal.
      b. Polyurethane based, two-component elastomeric, self-leveling sealant complying with the following:
         1) FS TT-S-00227E, Type I (self-leveling) Class A. and ASTM C920, Type M, Grade P, Class 25
         2) Water Immersion Bond, FS TT-S-00227E: Elongation of 50 percent with no adhesive failure.
         3) Hardness (Standard Conditions), ASTM C661: 35 to 45.
         4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
         5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
         6) VOC Content: 165 g/L, maximum.

E. Miscellaneous Materials:
   1. Joint Cleaner: As recommended by calking and sealant manufacturer.
   2. Joint Primer and Sealer: As recommended for compatibility with calking and sealant by calking and sealant manufacturer.
   3. Bond Breaker Type: Polyethylene tape or other plastic tape as recommended for compatibility with calking and sealant by calking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of calking and sealant. Provide self-adhesive tape where applicable.
   4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended for compatibility with calking and sealant by calking and sealant manufacturer. Provide size and shape of rod that will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly-compressible backer to minimize possibility of sealant extrusion when joint is compressed.
   5. Low-temperature Catalyst: As recommended by calking and sealant manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and conditions under which calking and sealant Work will be performed, and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work and performance of sealants. Do not proceed with calking and sealant Work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Protection: Do not allow joint sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or calking and sealant materials.

B. Joint Surface Preparation:
   1. Clean joint surfaces immediately before installing sealant compound. Remove dirt, weakly adhering coatings, moisture and other substances that would interfere with bonds of sealant compound as recommended in sealant manufacturer's written instructions as shown on approved Shop Drawings.
   2. If necessary, clean porous materials by grinding, sandblasting, or mechanical abrading. Blow out joints with oil-free compressed air or by vacuuming joints prior to applying primer or sealant.
   3. Roughen joint surfaces on vitreous coated and similar non-porous materials, when sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce a dull sheen.
   4. Concrete Joint Preparation: Refer to Section 03 00 05, Concrete.

C. Mixing:
   1. Comply with sealant manufacturer's written instructions for mixing multi-component sealants.
   2. Thoroughly mix components before use.
   3. Add entire contents of activator can to base container. Do not mix partial units.
   4. Mix contents for minimum of five minutes or as recommended by sealant manufacturer, until color and consistency are uniform.

3.3 INSTALLATION

A. Install joint sealants after adjacent areas have been cleaned and before joint has been cleaned and primed, to ensure calking and sealant joints will not be soiled. Replace calking and sealant joints soiled after installation.

B. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or indicated in the Contract Documents.

C. Prime or seal joint surfaces as shown on approved Shop Drawings and approved other submittals. Do not allow primer or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to applying sealants.

D. Apply masking tape before installing primer, in continuous strips in alignment with joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.

E. Confirm that compressible filler is installed before installing sealants.

F. Do not install sealants without backer rods and bond breaker tape.

G. Roll back-up rod stock into joint to avoid lengthwise stretching. Do not twist, braid, puncture, or prime backer rods.

H. Employ only proven installation techniques that will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

I. Install sealants to depths recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of bead.
   1. For horizontal joints in sidewalks, pavements, and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.
   2. For vertical joints subjected to normal movement and sealed with elastomeric sealants and not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.

J. Remove excess and spillage of compounds promptly as the Work progresses.

K. Cure calking and sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high-early bond strength, internal cohesive strength, and surface durability.

3.4 EXISTING JOINTS

A. Mechanically remove existing sealant and backer rod.

B. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface.

C. Conduct laboratory pre-construction compatibility and adhesion testing on joint surfaces in accordance with Part 3 of this Section.

D. Allow joint surfaces to dry before installing new sealants.

3.5 FIELD QUALITY CONTROL

A. Water Leak Testing: Field test for water leaks as follows:
   1. Flood the joint exposure with water directed from a 3/4-inch diameter garden hose, without nozzle, held perpendicular to wall face, two feet from joint and connected to water system

with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.

2. Test approximately five percent of total joint system, in locations that are typical of every joint condition, and that can be inspected easily for leakage on opposite face. Conduct test in presence of ENGINEER, who will determine actual percentage of joints to be tested and actual period of exposure to water from hose, based on extent of observed leakage or lack of observed leakage.
3. Where nature of observed leaks indicates potential of inadequate joint bond strength, ENGINEER may direct that additional testing be performed at a time when joints are fully cured, and before Substantial Completion.

3.6 ADJUSTING AND CLEANING

A. Where leaks and lack of adhesion are evident, replace sealant.

B. Clean adjacent surfaces of sealant and soiling resulting from the Work. Use solvent or cleaning agent recommended by sealant manufacturer. Leave all finish Work in neat, clean condition.

C. Protect sealants during construction so that they will be without deterioration, soiling, or damage at time of readiness for final payment of the Contract.

3.7 PROTECTION

A. During and after curing period, protect joint sealants from contact with contaminating substances and from damage resulting from construction operations or other causes, so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

END OF SECTION

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals required to perform clearing and grubbing as shown and specified in the Contract Documents.
   2. The Work includes removing from the Site and disposing of trees, stumps, brush, roots, shrubs, vegetation, logs, rubbish, and other objectionable material.
   3. Pay all costs associated with transporting and disposing of debris resulting from clearing.
   4. Limits of Clearing and Grubbing: Clear and grub the areas shown or indicated on the Drawings.

B. Related Sections and Details:
   1. Section 02 41 00, Demolition.
   2. York County Engineering Standards 16-series Standard Details.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with Laws and regulations for environmental requirements, disposal of debris, burning debris on Site, and use of herbicides.
   2. Coordinate clearing work with York County and other authorities having jurisdiction, including Utility providers.

1.3 SUBMITTALS

A. Action Submittals: Submit the following
   1. Shop Drawings:
      a. Plan for removing trees and other large vegetation not explicitly shown or indicated for removal in the Contract Documents.
      b. Plan showing proposed limits of clearing and grubbing, if different from clearing and grubbing limits shown or indicated in the Contract Documents.

1.4 WARRANTY

A. CONTRACTOR shall warrant that Work performed under this Section will not permanently damage trees, shrubs, turf, and plants designated to remain, or other adjacent work, facilities, or property. If damage resulting from CONTRACTOR's operations becomes evident during the correction period, CONTRACTOR shall replace damaged items and property at no additional cost to OWNER.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

A. Protection:
   1. Throughout the Project, protect existing site improvements, including streets, drives, and Underground Facilities to remain (if any), and adjacent property and structures. Repair damage caused by CONTRACTOR to original condition or replace in kind, to satisfaction of ENGINEER, at no additional cost to OWNER.
   2. Protect trees, shrubs, vegetation, and grassed areas to remain by providing temporary fencing, barricades, wrapping, or other methods shown, specified, or accepted by ENGINEER. Correct at CONTRACTOR's expense damage caused by CONTRACTOR outside the limits of clearing Work.
   3. Do not remove trees without approval of ENGINEER, unless shown or indicated for removal.
   4. Do not locate construction equipment, stored materials, or stockpiles within drip line of trees and vegetation to remain.

B. Site Preparation:
   1. Obtain, pay costs associated with, and comply with applicable permits required for clearing and grubbing Work. Do not begin clearing and grubbing Work to acquiring all applicable permits.
   2. Delineation of Clearing and Grubbing Limits:
      a. Locate and clearly flag trees and vegetation to remain, and other materials to remain in the clearing and grubbing limits. Locate and clearly flag salvable vegetation to be relocated.
      b. Provide flagging to delineate limits of areas to be cleared or grubbed. Review at Site with ENGINEER before commencing removal of trees, vegetation, and other materials to be removed.
      c. Replace flagging that is lost, removed, or destroyed, until clearing and grubbing Work is complete and ENGINEER allows removal of flagging.
   3. Erosion and Sediment Controls:
      a. Provide applicable erosion and sediment controls before commencing clearing and grubbing Work.
      b. Comply with York County Engineering Standards 16-series Standard Details and related Standard Details and erosion control requirements and rules and regulations.
      c. Continue providing erosion and sediment controls as clearing and grubbing Work progresses to previously uncleared, ungrubbed areas of the Site.

3.2 CLEARING AND GRUBBING

A. Clearing and grubbing shall be performed along the project at the locations designated on the drawings or as directed by the Engineer.

B. Conduct operations in a manner so as to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage to adjacent property.

C. Exercise extreme caution in order not to clear and grub areas outside of the construction right-of-way.

D. Remove and dispose of all trees not reserved by the property owner, shrubs, stumps, roots, brush, tree laps, logs, rubbish, undergrowth, and debris within limits of clearing and grubbing shown or indicated in the Contract Documents, unless otherwise shown or indicated.

E. Any areas of growth or individual trees which are to be preserved due to their desirability for landscape or erosion control purposes will be designated on the drawings or by the ENGINEER.

F. Maintenance of cleared and grubbed areas include:
   1. Clean-up of overgrown areas.
   2. Continuous weeding, brush cutting, and pruning for all areas within the contract site that has been cleared and/or grubbed. This shall take place from the Notice to Proceed until the final approval of the contract. This work is to be accomplished regardless of the phase of work in progress or any delays caused by weather, utilities, or property acquisitions.
   3. CONTRACTOR is to provide for bush-hogging or weed-eating certain areas within the public access or easements that have become overgrown as directed by the ENGINEER. This includes any staging areas being used by the CONTRACTOR for the duration of the contract.

G. Trees and Shrubs Improperly Destroyed or Damaged:
   1. For each tree or shrub to remain that is destroyed or damaged beyond repair by CONTRACTOR, provide two replacements of the same species at locations to be designated by ENGINEER.

H. Trees and shrubs to remain that have been damaged or require trimming shall be protected, treated and repaired under the direction of a qualified arborist, or other professional with qualifications acceptable to ENGINEER.

I. Salvable Vegetation:
   1. Trees, shrubs, and other vegetation requiring removal to facilitate the Work, and that will be transplanted elsewhere at the Site, shall be carefully balled and burlapped or placed in temporary pots, and stored at the Site in an acceptable area. Work involving removing and relocating trees, shrubs, and other vegetation shall be under the direction of qualified arborist acceptable to ENGINEER, or other professional acceptable to ENGINEER, hired by CONTRACTOR.

J. Disposal of Cleared and Grubbed Materials:
   1. Dispose at appropriate off-Site location trees, stumps, rubbish, debris, and other cleared and grubbed material. Cleared or grubbed materials may remain at the Site only when allowed in the Contract Documents or when approved by ENGINEER in writing. Do not use cleared or grubbed material as fill, backfill, or in embankments.
   2. Dispose of cleared and grubbed material in accordance with Laws and Regulations.
   3. Do not burn clearing debris at the Site, unless approved by OWNER and authorities having jurisdiction. If burning is permitted, comply with requirements of authorities

having jurisdiction and Laws and Regulations. If burning is permitted at the Site, also comply with OWNER's requirements.

K. Removal of Site Improvements: Comply with Section 02 41 00, Demolition.

3.3 TOPSOIL REMOVAL

A. Existing topsoil to be removed is defined as friable, clay loam, surface soil present in depth of at least four inches. Topsoil shall be free of subsoil, clay lumps, stones, and other objects over two-inch diameter and other objectionable material.

B. Stripping:
   1. Strip topsoil to depths encountered, in manner that prevents intermingling of topsoil with underlying subsoil or other objectionable material. Remove heavy growths of grass and vegetation from areas before stripping.
   2. Do not strip topsoil from within drip line of each tree to remain as part of the completed Project.

C. Stockpile topsoil in storage stockpiles in areas shown, or where otherwise accepted by ENGINEER. Construct storage piles so that surface water drains freely. Stabilize large topsoil piles with a cover crop and mulch, and provide silt fencing around perimeter of pile to prevent topsoil erosion and sedimentation; silt fencing shall be in accordance with York County Engineering Standard Details 16.03 and 16.03A and rules and regulations. Cover smaller topsoil stockpiles, when used, with reinforced fabric to prevent windblown dust. Topsoil in excess of the quantity required for the finished Project shall remain property of OWNER.

3.4 ENVIRONMENTAL PROTECTION AND RESTORATION

A. South Carolina Department of Health and Environmental Control.

B. South Carolina Department of Natural Resources.

C. US Army Corps of Engineers.

D. US Department of the Interior.

E. York County Environmental Compliance or local Authority Having Jurisdiction.

END OF SECTION

SECTION 31 23 05

EXCAVATION AND FILL

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals required to perform all excavating, filling, and grading, and disposing of earth materials as shown, specified, and required for construction of structures, Underground Facilities, roads, and other facilities required to complete the Work.
   2. Preparation of subgrade for slabs and pavements is included under this Section.
   3. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof, except rock requiring drilling, blasting or special equipment for removal which is under Section 31 23 16.26, Rock Removal.

B. Related Sections:
   1. Section 03 30 05, Concrete.
   2. Section 31 23 16.26, Rock Removal.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 522R, Pervious Concrete.
   2. ANSI/AISC 360, Specification for Structural Steel for Buildings.
   3. ASTM C29/C29M, Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate.
   4. ASTM C33/C33M, Specification for Concrete Aggregates.
   5. ASTM C94/C94M, Specification for Ready-Mixed Concrete.
   6. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   7. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
   8. ASTM C150/C150M, Specification for Portland Cement.
   9. ASTM C595/C595M, Specification for Blended Hydraulic Cements.
   10. ASTM C618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   11. ASTM C989, Specification for Slag Cement for Use in Concrete and Mortars.
   12. ASTM D422, Test Method for Particle-Size Analysis of Soils.
   13. ASTM D448, Classification for Sizes of Aggregate for Road and Bridge Construction.
   14. ASTM D698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)).
   15. ASTM D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   16. ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   17. ASTM D2216, Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

18. ASTM D4253, Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
19. ASTM D4254, Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
20. ASTM D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
21. ASTM D4832, Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
22. ASTM D6023, Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM).
23. ASTM D6103, Test Method for Flow Consistency of Controlled Low Strength Material (CLSM).
24. ASTM D6938, Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
25. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
26. South Carolina Department of Transportation Qualified Products Listings and Policies for Construction and Maintenance Materials.
27. Work Area Traffic Control Handbook (WATCH).
28. York County Ordinance 154.110.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:
   1. “Subgrade” is the uppermost surface of native soil material unmoved from cuts; the bottom of excavation.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Professional Engineer:
      a. Engage a registered professional engineer legally qualified to practice in the same jurisdiction as the Site and experienced in providing engineering services of the kind indicated.
      b. Responsibilities include but are not necessarily limited to:
         1) Reviewing system performance and requirements shown or indicated in the Contract Documents.
         2) Preparing written requests for clarifications or interpretations of performance and requirements for submittal to ENGINEER by CONTRACTOR.
         3) Preparing or supervising the preparation of design calculations and related submittals verifying compliance of the system with the requirements of the Contract Documents.
         4) Signing and sealing all calculations, drawings, and submittals prepared by professional engineer.
         5) Certifying that:
            a) it has performed the design of the system in accordance with the performance requirements stated in the Contract Documents, and
            b) the said design conforms to Laws and Regulations, and to the prevailing standards of practice.

B. Quality Assurance Testing:
   1. OWNER typically retains 3rd party for Quality Control testing on capital projects. Specific Quality Assurance Testing requirements and procedures shall be established on a Project-by-Project basis.
   2. Materials used in the Work may require testing and retesting, as directed by ENGINEER, during the Project. Allow free access to material stockpiles and facilities at all times. Tests, including retesting of rejected materials and installed Work, shall be performed by OWNER and at OWNER'S expense.

C. Regulatory Requirements:
   1. Perform excavation work in compliance with requirements of authorities having jurisdiction and Laws and Regulations, including:
      a. OSHA, 29 CFR Part 1926, Section .650 (Subpart P – Excavations).
   2. Obtain required permits and approvals for excavation and fill Work, including work permits from right-of-way owners and permits from environmental authorities having jurisdiction over discharge of water from excavations.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Procedure Submittals:
      a. Excavation Plan: Prior to starting excavation operations, submit written plan to demonstrate compliance with OSHA 29 CFR Part 1926.650. As a minimum, excavation plan shall include:
         1) Name of CONTRACTOR's "competent person" in responsible charge of excavation and fill Work.
         2) Excavation method(s) and additional items to be included in the Work, as listed in Paragraph 1.5.A.2.a of this Section.
         3) Copies of "manufacturer's data" or other tabulated data if protective system(s) are designed on the basis of such data.
         4) Copies of required permits and approvals, from authorities having jurisdiction and affected utility owners, for excavation methods proposed.
      b. Proposed compaction procedure and compaction equipment proposed for use. Where different procedures or equipment will be used for compacting different types of material or at different locations at the Site, indicate where each procedure and equipment item will be used.
   2. Excavation Support Plan and Related Information Prepared by CONTRACTOR's Professional Engineer:
      a. CONTRACTOR and CONTRACTOR's professional engineer shall prepare the following for submittal:
         1) Sheeting and bracing, or other protective system(s) required.
         2) Dewatering system.
         3) Cofferdams.
         4) Underpinning.
      b. Drawings and calculations shall be prepared by professional engineer qualified in the specialty involved. ENGINEER's review and acceptance of submittal does not imply approval by ENGINEER of the associated Work. CONTRACTOR shall be solely responsible for designing, installing, operating and maintaining the system(s) required to satisfactorily perform all necessary sheeting, bracing, protection, underpinning, and dewatering.

3. Delivery Tickets:
    a. Copy of delivery ticket for each load of aggregate and borrow material delivered to the Site. Each delivery ticket shall indicate project and contract by name and number, date, material type, department of transportation item number when applicable, and quantity delivered.
4. Quality Assurance Test Results Submittals:
    a. Submit results of quality assurance testing performed by in accordance with Paragraph 1.4.B of this Section, unless included as part of another submittal under this Section. Submit results for the following quality assurance testing:
        1) Tests on borrow fill material.
        2) Optimum moisture – maximum dry density curve for each type of fill material.
5. Qualifications Statements:
    a. Professional engineer.

1.6 SITE CONDITIONS

A. Subsurface Information: The Project Manual indicates information available relative to subsurface conditions at the Site. Such information and data is not intended as a representation or warranty of continuity of conditions between soil borings or test pits, nor of groundwater levels at dates and times other than date and time when measured, nor that purpose of obtaining the information and data were appropriate for use by CONTRACTOR. OWNER will not be responsible for interpretations or conclusions drawn therefrom by CONTRACTOR.

B. Soil borings and other exploratory operations may be made by CONTRACTOR, at no additional cost to OWNER. Coordinate CONTRACTOR-performed test borings and other exploratory operations with OWNER and utility owners as appropriate. Perform such explorations without disrupting or otherwise adversely affecting operations of OWNER or utility owners. Comply with Laws and Regulations relative to required notifications.

C. Existing Structures:
1. The Contract Documents show or indicate certain structures and Underground Facilities adjacent to the Work. Such information was obtained from existing records and is not guaranteed to be correct or complete. CONTRACTOR shall explore ahead of the excavation to determine the exact location of all existing structures and Underground Facilities. Existing structures and Underground Facilities shall be supported and protected from damage by CONTRACTOR. Immediately repair and restore existing structures and Underground Facilities damaged by CONTRACTOR without additional cost to OWNER.
2. Movement or operation of construction equipment over Underground Facilities shall be at CONTRACTOR's sole risk and only after CONTRACTOR has prepared and submitted to ENGINEER and utility owners (as applicable), and received acceptance therefrom, a plan describing CONTRACTOR's analysis of the loads to be imparted and CONTRACTOR's proposed measures to protect structures and Underground Facilities during the Project.
3. Coordinate with utility owners for shut-off of services in active piping and conduits. When required by utility owner, OWNER will assist CONTRACTOR with utility owner notifications. Completely remove buried piping and conduits indicated for removal and not otherwise indicated as being abandoned or to remain in place.

4. In general, service lines and laterals to individual houses and businesses are not shown; however, CONTRACTOR shall assume that a service exists for each utility owner to each house, business, and property.
5. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when such interruption is indicated in the Contract Documents or when allowed in writing by ENGINEER after acceptable temporary utility services are provided by CONTRACTOR for the affected structure or property.

PART 2 PRODUCTS

2.1 MATERIALS

A. Select Fill:
   1. Material shall be well-graded, crushed aggregate, free of organic material. Material shall be Coarse Aggregate No. 57 in accordance with the Coarse Aggregate Gradation Table in the appendix of the SCDOT Standard Specifications for Highway Construction.

B. General Fill:
   1. Material shall be free of: roots, vegetative matter, waste, construction material, rock larger than ¾ cubic foot, debris, waste, frozen materials, organic material, and other deleterious matter. Small rock shall not exceed 10% of the fill material.
   2. Fill shall have a liquid limit not greater than 45, and plasticity index not greater than 25, or as directed by ENGINEER.
   3. Previously-excavated materials complying with the Contract Documents requirements for general fill may be used for general fill.
   4. When on-Site materials are found unsuitable for use as general fill, provide select fill or approved off-Site general fill materials. Prior to using off-Site material as general fill, furnish submittal for and obtain ENGINEER's approval of the material proposed for use.

C. Subbase Material:
   1. Material shall be naturally- or artificially-graded mixture of natural or crushed gravel or crushed stone. Crushed slag is unacceptable. Material shall be coarse aggregate obtained from sources listed on the most recent edition of SCDOT Qualified Products List 2.
   2. Crushed Recycled Concrete Subbase Material:
      a. CONTRACTOR may use crushed recycled concrete material as subbase material.
      b. Recycled concrete material shall be crushed and screened and shall comply with subbase gradation requirements of this Section. Before using in the Work, remove existing reinforcing steel from recycled concrete material.
      c. Crushed recycled concrete material shall not contain chloride ions or aggregates susceptible to alkali-silica reaction.
      d. The pH of recycled concrete material shall not exceed 11.

D. Drainage Fill:

1. Material shall be washed, uniformly-graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing 1.5-inch sieve and not more than five percent passing a No. 4 sieve.

E. Pipe Bedding Material:
   1. Aggregate material shall be angular, clean washed, crushed stone and gravel, free of: debris, waste, frozen materials, organic material and other deleterious matter. Material shall be Size No. 67 (or, No. 57, for sewer lines) in accordance with ASTM D448 and South Carolina Department of Transportation Standard Specifications.

F. Stone Stabilization Material:
   1. Stone stabilization material shall be angular, clean washed No. 67 stone in accordance with ASTM D448.

2.2 SOURCE QUALITY CONTROL

A. Perform quality assurance testing, and submit results to ENGINEER, in accordance with the 'Quality Assurance" Article in Part 1 of this Section.

PART 3 EXECUTION

3.1 INSPECTION

A. Provide ENGINEER with sufficient notice and with means to examine areas and conditions under which excavating, filling, and grading will be performed. ENGINEER will advise CONTRACTOR in writing when ENGINEER is aware of conditions that may be detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 TEST PITS

A. General:
   1. In advance of the construction, excavate, make observations and measurements, and fill test pits to determine conditions or location of the existing Underground Facilities and structures. Perform all work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, filling, and replacing pavement for test pits. CONTRACTOR shall be responsible for the definite location of each existing Underground Facility involved within the area of excavation for the Work. Exercise care during such location work to avoid damaging and disrupting the affected Underground Facility or structure. CONTRACTOR shall be responsible for repairing, at his expense, damage to Underground Facility or structure caused during the Work.

3.3 PREPARATION

A. Do not burn clearing debris at the Site unless approved by OWNER and authorities having jurisdiction. If burning is permitted, comply with requirements of authorities having jurisdiction and Laws and Regulations. If burning is permitted at the Site, also comply with OWNER's requirements.

B. Use of Explosives:
   1. Do not bring explosives to the Site or use explosives without written consent of OWNER and authorities having jurisdiction. Obtaining such written consent will not relieve CONTRACTOR of responsibility for injury or damage caused by CONTRACTOR's blasting operations. Submit to ENGINEER copies of written consent and permits for blasting. When permitted, blasting shall comply with Section 31 23 16.26, Rock Removal. CONTRACTOR is solely responsible for handling, storing, and using explosive materials when use of explosives is permitted.

C. Dust Control:
   1. Control objectionable dust caused by CONTRACTOR's operation of vehicles and equipment, clearing, and other actions. To minimize airborne dust, apply water or use other methods subject to ENGINEER's acceptance and approval of authorities having jurisdiction.

D. Maintenance and Protection of Traffic:
   1. Maintain traffic in accordance with the most recent edition of the Watch Area Traffic Control Handbook.

3.4 DEWATERING

A. Dewatering – General:
   1. Provide and maintain adequate drainage and dewatering equipment to remove and dispose of all surface water and ground water entering excavations, or other parts of the Work and work areas. Keep each excavation dry during excavation, subgrade preparation, and continually thereafter until the structure to be built therein is acceptable to ENGINEER and backfilling operations are completed and acceptable to ENGINEER.
   2. Keep all working areas at the Site free of surface water at all times. Provide temporary drainage ditches and temporary dikes, and provide required temporary pumping and other work necessary for diverting or removing rainfall and all other accumulations of surface water from excavations and fill areas. Perform diversion and removal of surface water in manner that prevents accumulation of water behind permanent or temporary structures and at any other locations in the construction area where such accumulations may be detrimental.
   3. Water used for working or processing, resulting from dewatering operations, or containing oils or sediments that will reduce the quality of the surface water or groundwater downstream of the point of discharge, shall not be directly discharged. Divert such waters through temporary settling basin or filter before discharging to surface water, groundwater, or drainage routes.
   4. CONTRACTOR shall be responsible for condition of piping, conduits, and channels used for drainage and such piping, conduits, and channels shall be clean and free of sediment.
   5. Remove water from excavations as fast as water collects.

B. Temporary Dewatering System:
   1. CONTRACTOR shall design, provide, and operate dewatering system to include sufficient trenches, sumps, pumps, hose, piping, well points, deep wells, and similar facilities, necessary to depress and maintain groundwater level 1'-0" below the base of each excavation during all stages of construction operations.

2. Design and operate dewatering system to avoid settlement and damage to existing structures and Underground Facilities.
3. Groundwater table shall be lowered in advance of excavation for a sufficient period of time to allow dewatering of fine grain soils.
4. Maintain groundwater level at excavations two feet below lowest subgrade excavation until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural groundwater.
5. Operate dewatering system continuously, 24 hours per day, seven days per week. Provide standby pumping facilities and personnel to maintain the continued effectiveness of the system. Do not discontinue dewatering operations without first obtaining ENGINEER's acceptance for such discontinuation.
6. If, in ENGINEER's opinion, the water levels are not being lowered or maintained as required, provide additional or alternate temporary dewatering devices as necessary, at no additional cost to OWNER.
7. Locate elements of temporary dewatering system to allow continuous dewatering operation without interfering with the Work to the extent practicable.
8. Where portions of dewatering system are located in the area of permanent construction, submit to and obtain ENGINEER's acceptance of details of proposed methods of constructing the Work at such location. Control of ground water shall continue until the permanent construction provides sufficient dead load to withstand hydrostatic uplift of the normal groundwater, until concrete has attained sufficient strength to withstand earth and hydrostatic loads, and until waterproofing Work is completed.
9. Perform pumping of water from excavations in a manner that prevents carrying away of unsolidified concrete materials, and that avoids damaging the subgrade.
10. Before discontinuing dewatering operations or permanently allowing rise of groundwater level, prepare computations to demonstrate that structures affected by the water level rise are protected by fill or other means to sustain uplift. Use a safety factor of 1.25 when preparing such calculations.

C. Disposal of Water Removed by Dewatering System:
1. CONTRACTOR's dewatering system shall discharge to a suitable location acceptable to OWNER, in accordance with Laws and Regulations.
2. Convey water from excavations in closed conduits. Do not use trench excavations as temporary drainage ditches.
3. Dispose of water removed from excavations in a manner that does not endanger health and safety, property, the Work, and other portions of the Project.
4. Dispose of water in manner that causes no inconvenience to OWNER, others involved in the Project, and adjacent and downstream properties.

3.5 EXCAVATION

A. Perform all excavation required to complete the Work as shown, specified, and required. Excavations shall include removing and handling of earth, sand, clay, gravel, hardpan, soft, weathered or decomposed rock, pavements, rubbish, and other materials within the excavation limits. Where the excavation includes rock that requires drilling, blasting, or specialized equipment for removal, remove rock in accordance with Section 31 23 16.26, Rock Removal.

B. Excavation Protection:

1. Provide excavation protection system(s) in accordance with Laws and Regulations to prevent injury to persons and property, including Underground Facilities.
2. Excavation Less Than Five Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.
3. Excavations Greater Than Five Feet Deep: Excavations in stable rock may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.
4. Provide and maintain excavation protection system(s) in accordance with submittals accepted by ENGINEER and required under Paragraph 1.5 of this Section.

C. Maintain excavations in dry condition in accordance with “Dewatering” Article in Part 3 of this Section.

D. Elevation of bottom of footings shown is approximate. ENGINEER may direct such minor changes in dimensions and elevations as may be required to secure a satisfactory footing.

E. When excavations are made below required grades without written order of ENGINEER, fill such excavations with compacted select fill material, as directed by ENGINEER, at CONTRACTOR’s expense.

F. Extend excavations sufficiently on each side of structures, footings, and similar construction to allow setting of forms, installation of shoring and bracing, and the safe sloping of banks, as necessary.

G. Subgrades – General:
1. Subgrades shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Subgrades that are otherwise solid but become soft or mucky on top due to construction operations shall be reinforced with course aggregate material obtained from sources listed on the most recent edition of SCDOT Qualified Products List 2. Finished elevation of stabilized subgrades shall not be above subgrade elevations shown.
2. If, in ENGINEER’s opinion, subgrade becomes softened or mucky because of construction delays, failure to dewater properly, or other cause within CONTRACTOR’s control, subgrade shall be excavated to firm material, trimmed, and backfilled with select fill material at CONTRACTOR’s expense.

H. Proofrolling Subgrades:
1. Prior to placing fill or constructing pavements or slabs, proofroll the subgrade surface with sufficient proofrolling apparatus. Before starting proofrolling, submit to and obtain acceptance from ENGINEER of proofrolling apparatus and procedure to be used.
2. Proofrolling operations shall be made in the presence of ENGINEER. Notify ENGINEER at least 24 hours in advance of start of proofrolling operations.
3. Subgrades displaying pronounced elasticity or deformation, deflection, cracking, or rutting shall be stabilized as directed by ENGINEER. Unsuitable materials shall be undercut to the depth directed by ENGINEER and replaced with select fill material. Other suitable stabilization methods may be directed by ENGINEER.

I. Pipe Trench Preparation:
   1. Not more than 100 feet of trench may be opened in advance of installing pipe in trench unless prior approval is given by the ENGINEER.
   2. Trench width shall be minimized to greatest extent practical, and shall comply with the following:
      a. Trench width shall be sufficient to provide space for installing, jointing and inspecting piping. Refer to Drawings for trench requirements.
      b. Waterlines:
         1) Maximum allowable trench width at the top of pipe shall be equal to the pipe barrel OD plus sixteen inches, unless otherwise shown or indicated.
         2) Prior approval of County Inspector is required to deviate from this; if no prior approval is received, bedding shall be installed per ENGINEER's direction and at Contractor's expense.
      c. Sewer lines: Maximum allowable trench width at the top of pipe shall be:
         1) For 8"-15" pipe, the maximum trench width at the top of pipe shall be nominal pipe size plus 30 inches.
         2) For 18"-30" pipe, the maximum trench width at the top of pipe shall be nominal pipe size plus 36 inches.
         3) For 36" and larger pipe, the maximum trench width at the top of pipe shall be nominal pipe size plus 42 inches.
         4) Prior approval of ENGINEER is required to deviate from maximum allowable widths. Such deviation requiring an increase in bedding and/or change in pipe class will be installed at Contractor's expense.
      d. Trench width shall be sufficient for shoring and bracing, or shielding and dewatering.
      e. Do not use excavating equipment that requires the trench to be excavated to excessive width.
   3. Depth of trench shall be as shown or indicated. If required and approved by ENGINEER in writing, depths may be revised.
   4. Where ENGINEER considers existing material beneath bedding material unsuitable, remove and replace such unsuitable material with select fill material.

J. Excavated Materials to be Used as Fill:
   1. Stockpile excavated materials that are acceptable for use as fill.
   2. As excavation proceeds, keep stockpiles of excavated materials suitable for use as fill separate from unsuitable materials and waste materials.
   3. Place, grade, and shape stockpiles for proper drainage.
   4. Locate and retain soil materials away from edge of excavations.
   5. Dispose of excess soil material and waste materials as specified in this Section.
   6. Stockpiled excavated soils for use as select fill or general fill shall be tested and classified by laboratory as on-Site select fill or on-Site general fill. Perform required quality assurance testing for material verification on stockpiled materials as soon as possible to demonstrate compliance of excavated materials with the Contract Documents.

3.6 UNAUTHORIZED EXCAVATION

A. All excavations outside lines and grades shown or indicated and that are not approved by ENGINEER, together with removing and disposing of the associated material, shall be at

CONTRACTOR's expense. Fill unauthorized excavations with properly-compacted select fill material at CONTRACTOR’s expense.

3.7 EROSION AND SEDIMENT CONTROLS

A. Provide temporary erosion and sediment controls in accordance with York County Engineering Standards 16-series Standard Details and related Standard Details and erosion control requirements. When applicable, also comply with requirements of the erosion and sediment control plan approved by authorities having jurisdiction.

3.8 SHEETING, SHORING, AND BRACING

A. General:
   1. Design and provide sheeting, shoring, bracing, cofferdams, and similar excavation supports as shown, specified, and required for the Work.
   2. Clearances and types of temporary sheeting, shoring, bracing, and similar excavation supports, insofar as they may affect the finished character of the Work and the design of sheeting to be left in place, will be subject to the ENGINEER’s approval; but CONTRACTOR is responsible for adequacy of all sheeting, shoring, bracing, cofferdams, and similar excavation supports.
   3. Materials:
      a. Previously-used materials shall be in good condition, and shall not be damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary sheeting, shoring, and bracing.
      b. All steel work for sheeting, shoring, bracing, cofferdams and other excavation supports, shall be in accordance with ANSI/AISC 360, except that field welding will be allowed.
      c. Provide permanent steel sheet piling or pressure-creosoted timber sheet piling where subsequent removal of sheet piling might allow lateral movement of soil under adjacent structures
   4. As excavation progresses, carry down shoring, bracing, cofferdams, and similar excavation supports to required elevation at bottom of excavation.
   5. Comply with Laws and Regulations regarding sheeting, shoring, bracing, cofferdams, and similar excavation supports.
   6. Maintain sheeting, shoring, bracing, bracing, and other excavation supports in excavations regardless of time period excavations will be open.
   7. Unless otherwise shown, specified, or directed, remove materials used for temporary construction when the Work is completed. Perform such removal in manner not injurious to the structures and Underground Facility, their appearance, and adjacent construction.

B. Sheeting Left in Place:
   1. Materials: Steel sheeting shown or indicated to be left in place shall consist of rolled sections of continuous interlocking type. Steel sheeting material designated to be left in place shall be new. Type and design of the sheeting and bracing shall comply with the above requirements for steel work for all sheeting and bracing.
   2. Installation:
      a. Steel sheeting to be left in place shall be driven straight to lines and grades as shown, indicated, or directed. Piles shall penetrate into firm materials with secure

interlocking throughout pile's entire length. Damaged piling having faulty alignment shall be pulled and replaced by new piling.

b. Type of guide structure used and method of driving steel sheeting to be left in place shall be determined by CONTRACTOR's professional engineer. Jetting is not allowed.

3. Cut off at elevations shown, indicated, or directed by ENGINEER sheeting left in place and remove cut off pilings from the Site.
4. Clean wales, braces, and all other items to be embedded in the permanent structure, and ensure that concrete surrounding the embedded element is sound and free of air pockets and harmful inclusions. Provisions shall include the cutting of holes in the webs and flanges of wale and bracing members, and welding of steel diaphragm waterstops perpendicular to the centerline of brace ends that are to be embedded.
5. Subsequent to removing the inside face forms, and when removal of bracing is allowed, cut back steel at least two inches inside the wall face and patch opening with concrete repair mortar in accordance with Section 03 00 05, Concrete. Concrete shall be thoroughly worked beneath wales and braces, around stiffeners, and at other place where voids may be formed.
6. Portions of sheeting or soldier piles and breast boards that are in contact with structure foundation concrete shall be left in place, together with wales and bracing members that are cast into foundation or superstructure concrete.

C. Removal of Sheeting and Bracing:
1. Remove sheeting and bracing from excavations, unless otherwise directed by ENGINEER in writing. Perform removal to avoid damaging the Work and adjacent construction. Removal shall be equal on both sides of excavation to ensure no unequal loads on structures and Underground Facilities.
2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete, until the following conditions are satisfied:
   a. Concrete has cured for not less than seven days.
   b. Wall and floor framing, up to and including grade level floors, is in place.

3.9 TRENCH SHIELDS

A. Excavation of earth material below bottom of trench shield shall not exceed the limits established in Laws and Regulations.

B. When using a shield for installing piping:
1. Portions of trench shield extending below the mid-diameter of an installed, rigid pipe, such as prestressed concrete pipe and other types of rigid pipe, shall be raised above the pipe's mid-diameter elevation prior to moving the shield along the trench for further construction.
2. Bottom of shield shall not at any time extend below mid-diameter of installed pipe that is flexible or has flexing capability, such as steel, ductile iron, PVC, CPVC, polyethylene, and other pipe that has flexing capability.

C. When using a shield for installing structures, bottom of the shield shall not extend below the top of the bedding for the structures.

D. When removing the shield or moving the shield ahead, exercise extreme care to prevent moving piping, structures, and other Underground Facilities, and prevent disturbance of

bedding material for piping, structures, and other Underground Facilities. When piping, structures, or Underground Facilities are disturbed, remove and reinstall the disturbed items in accordance with the Contract Documents.

3.10 FILL AND COMPACTION – GENERAL PROVISIONS

A. Provide and compact all fill required for the finished grades as shown and as specified in this Section.

B. Place fill in excavations as promptly as progress of the Work allows, but not until completing the following:
   1. ENGINEER's authorization after observation of construction below finish grade, including dampproofing, waterproofing, perimeter insulation, and similar Work.
   2. Inspection, testing, approval, and recording of locations of Underground Facilities.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and filling of voids with satisfactory materials.
   5. Removal of trash and debris.
   6. Permanent or temporary horizontal bracing is in place on horizontally-supported walls.
   7. Field testing of tanks, Underground Facilities including piping and conduits, and water-retaining structures.

C. Fill that includes organic materials or other unacceptable material shall be removed and replaced with approved fill material in accordance with the Contract Documents.

D. Placement – General:
   1. Place fill to the grades shown or indicated. Bring up evenly on all sides fill around structures and Underground Facilities.
   2. Fill areas shall be undercut and proof-rolled as directed by ENGINEER.
   3. Place fill materials at moisture content and density as specified in Table 31 23 05-A of this Section and this Article's requirements on compaction density. Furnish and use equipment capable of adding measured amounts of water to the fill materials to bring fill materials to a condition within required moisture content range. Furnish and use equipment capable of discing, aerating, and mixing the fill materials to ensure reasonable uniformity of moisture content throughout the fill materials, and to reduce moisture content of borrow materials by air drying, when necessary. When subgrade or lift of fill materials requires moisture-conditioning before compaction, fill material shall be sufficiently mixed or worked on the subgrade to ensure uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess of specified limit shall be dried by aeration or stockpiled for drying.
   4. Perform compaction with equipment suitable for the type of fill material placed. Select and use equipment capable of providing the minimum density required in the Contract Documents. Use light compaction equipment, with equipment gross weight not exceeding 7,000 pounds within horizontal distance of ten feet from the wall of completed, below-grade structures. Furnish and use equipment capable of compacting in restricted areas next to structures and around piping and Underground Facilities. Effectiveness of the equipment selected by CONTRACTOR shall be tested at start of compacted fill Work by constructing a small section of fill within the area where fill will be placed. If tests on the test section of fill indicate that required compaction is not obtained, do one or more of the following: increase the amount of coverages, decrease the lift thicknesses, or use different compactor equipment.

5. Place fill materials in horizontal, loose lifts, not exceeding specified uncompacted thickness. Place fill in a manner ensuring uniform lift thickness after placing. Mechanically compact each lift, by not less than two complete coverages of the compactor. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of compactor's compacting surface. Compaction of fill materials by inundation with water is unacceptable.
6. Do not place fill materials when standing water is present on surface of the area where fill will be placed. Do not compact fill when standing water is present on the fill to be compacted. Do not place or compact fill in a frozen condition or on top of frozen material. Fill containing organic materials or other unacceptable material previously described shall be removed and replaced prior to compaction.
7. If required densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly-functioning compaction equipment, CONTRACTOR shall perform all work required to provide the required densities. Such work shall include, at no additional cost to OWNER, complete removal of unacceptable fill areas and replacement and re-compaction until acceptable fill is provided.
8. Repair, at CONTRACTOR's expense, observed or measured settlement. Make repairs and replacements as required within 30 days after being so advised by ENGINEER.

E. Fill Against Concrete:
1. Placing fill against concrete below finished grade is not allowed until the concrete has attained its specified strength, as determined by duration of concrete curing and testing of field-cured concrete cylinders. Requirements for strength and curing time are in Section 03 00 05, Concrete.
2. Elevation of fill placed against concrete walls shall not differ by more than two feet on each side of walls, unless walls are adequately braced or all floor framing is in place up to and including grade level slabs.
3. Backfill structural foundation units as soon as practicable, in accordance with this Section, after concrete has gained sufficient strength to avoid damage, to avoid ponding of surface water and accumulation of debris.
4. Where fill is placed against waterproofed surface, exercise care that waterproofing material is not damaged.

F. Fill in Electrical Ductbank Trenches:
1. Provide general fill for full depth of electrical ductbank trench, below and above electrical ductbank. Where one ductbank passes beneath another pipe or ductbank, provide select fill to the elevation of the bottom of upper ductbank or pipe, as applicable.
2. Placing and compacting fill in electrical ductbank trenches shall comply with requirements of Paragraph "G. Fill in Pipe Trenches", of this Article.

G. Fill in Pipe Trenches:
1. Place pipe bedding material in pipe trenches in horizontal layers, and thoroughly compact each layer before the next layer is placed.
2. Piping Installed in Fills Above Pre-construction Grade:
   a. Prior to installing piping, place the fill in accordance with the Contract Documents until the fill reaches a minimum elevation two feet higher than the top of piping to be installed. Excavate the trench; install the piping and backfill. Subsequently provide the remainder of the fill required for the Work.

3. Piping trenches may be backfilled prior to testing of piping, unless nature of the test requires observation of pipe during testing. Do not construct building or structure over piping until piping has been successfully tested and passed.
4. Pipe Bedding: Pipe bedding material shall be as indicated on the Drawings or as directed by the ENGINEER and in accordance with York County Standard Drawing Detail No. 15.02.
    a. Place loose backfill by hand around the pipe and completely under the pipe haunches in uniform layers not to exceed 6 inches in depth.
    b. Place each layer and then carefully and uniformly tamp with mechanical tamp, so that the pipe is not damaged nor the alignment disturbed.
    c. Depending upon soil and ground water conditions, greater depths (undercut) may be required to create a stable condition.
    d. When the bottom of the trench is not sufficiently stable to prevent vertical or lateral displacement of the pipe after installation, stone stabilization shall be installed to develop a nonyielding foundation for the bedding and pipe. When such conditions are encountered, the trench shall be excavated to a depth determined by the ENGINEER, and #67 crushed stone shall be placed
5. Placing and Compacting Pipe Trench Fill: Unless otherwise shown, placement and compaction of pipe trench fill materials shall comply with the following:
    a. Pipe bedding material shall be spread and the surface graded to provide a uniform and continuous support beneath piping at all points between bell holes or pipe joints. Slight disturbance of installed pipe bedding material surface during withdrawal of pipe slings or other lifting tackle is acceptable.
    b. After each pipe's bedding material has been graded, and the piping has been aligned, joined in accordance with the Contract Documents, and placed in final position on bedding material, provide and compact sufficient pipe trench fill material under and around each side of the pipe and back of the bell or end thereof to hold piping in proper position and maintain alignment during subsequent pipe jointing and embedment operations. Deposit and compact pipe trench fill material uniformly and simultaneously on each side of piping to prevent lateral displacement of piping. Place and compact pipe trench fill material to an elevation 12 inches above top of pipe, unless otherwise shown or specified.
    c. Each layer of pipe trench fill material shall be compacted by at least two complete coverages of all portions of surface of each lift using appropriate compaction equipment.
    d. Method of compaction and compaction equipment used shall be appropriate for material to be compacted and shall not transmit damaging shocks to the piping.

H. Temporary Pavement:
1. Place 1-1.5 inches of temporary asphalt concrete pavement immediately after filling excavations in paved roadways and other paved areas that will remain for permanent use.
2. Maintain surface of paved area over the fill in good and safe condition during progress of the Work, and promptly fill depressions over and adjacent to the fill area caused by settlement of fill.
3. Permanent replacement pavement shall be equal to that of the existing roadways, unless otherwise shown or specified.

I. Subbase Placement:
1. Provide subbase material where shown to the limits shown or indicated.

2. Place subbase material in compacted lifts not exceeding depth of six inches each.

J. Drainage Fill Placement:
   1. Provide drainage fill material where shown to the limits shown or indicated.
   2. Place drainage fill material in compacted layers of uniform thickness not exceeding depth of six inches each. Compact lifts of drainage fill using suitable compaction equipment.

K. Compaction Density Requirements:
   1. Compaction required for all types of fills shall be in accordance with Table 31 23 05-A of this Section. Moisten material or aerate the material as necessary to provide the moisture content that will facilitate obtaining the required compaction.

TABLE 31 23 05-A
REQUIRED MINIMUM DENSITY

Material	Percent Compaction (ASTM D698)	Uncompacted Lift (inches)
General Fill		
More than five feet below final grade	100	8
Less than five feet below final grade	95	8
Select Fill		
Below concrete slabs or mats	100	8
Below pavement and sidewalks	100	12
Behind concrete walls	95	8
Subbase Material		
Below pavement and sidewalks	100	12
All other locations	100	8
Pipe Bedding Material		
Below structures or pavement	100	8
All other locations	95	6
Drainage Fill	N/A	6

   2. Fill shall be wetted and thoroughly mixed to achieve optimum moisture content plus-or-minus three percent, with the following exceptions:
      a. On-site clayey soils: Optimum to plus three percent.
   3. Replace natural, undisturbed soils or compacted soil subsequently disturbed or removed by construction operations with materials compacted as indicated in Table 31 23 05-A of this Section.
   4. Field quality control testing for density; to verify that specified density was obtained, will be performed during each day of compaction Work. Responsibility for field quality control testing is specified in the “Field Quality Control” Article in Part 3 of this Section.
   5. When field quality control testing indicates unsatisfactory compaction, provide additional compaction necessary to obtain the specified compaction. Perform additional compaction Work at no additional cost to OWNER until specified compaction is obtained. Such work includes complete removal of unacceptable (as determined by

ENGINEER) fill areas and replacement and re-compaction until acceptable fill is provided in accordance with the Contract Documents.

L. Replacement of Unacceptable Excavated Materials: In cases where over-excavation to replace unacceptable soil materials is required, backfill the excavation to required subgrade with select fill material and thoroughly compact in accordance with Table 31 23 05-A and the associated “Compaction Density Requirements” in this Article. Slope the sides of excavation in accordance with the maximum inclinations specified for each structure location.

3.11 GRADING

A. General:
   1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
   2. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free of irregular surface changes, and shall comply with the following:
   1. Grassed Areas or Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than one inch above or below the required subgrade elevations.
   2. Sidewalks: Shape surface of areas under sidewalks to line, grade, and cross section, with finish surface not more than one inch above or below the required subgrade elevation.
   3. Pavements: Shape surface of areas under pavement to line, grade, and cross section, with finish surface not more than 1/2-inch above or below the required subgrade elevation.

C. Grading Surface of Fill Under Concrete Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a ten-foot straight edge.

D. Compaction:
   1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.12 PAVEMENT SUBBASE COURSE

A. Comply with York County Ordinance 154.110.

B. General:
   1. Place subbase material, in layers of specified thickness, over ground surface to support pavement base course.
   2. After completing filling and grading, shape and compact pavement subgrade to an even, firm foundation in accordance with this Section. Remove unsuitable subgrade

materials, including soft materials, boulders, vegetation, and loose stones, and replace with compacted fill material as directed by ENGINEER.

C. Grade Control:
   1. During construction, maintain lines and grades including crown and cross-slope of subbase course.

D. Placing of Pavement Subbase Course:
   1. Place subbase course material on prepared subgrade in layers of uniform thickness, in accordance with indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placing operations.
   2. Compaction and Grade Control: Comply with compaction requirements for excavation and fill in this Section, and the following requirements:
      a. Compaction with roller shall begin at the sides of the area to be paved and continue toward the center. Continue compaction until there is no movement of the course ahead of the roller.
      b. After compaction of top lift of pavement subbase, provide and uniformly spread pipe bedding material and screenings compacted, on the surface, and sweep using gang-dragged broom, followed by compaction.
      c. After rolling, check for grade with a line not less than 40 feet in length; depression over 1/2-inch deep shall be filled to satisfaction of ENGINEER.
   3. After completing compaction, other than that necessary for bringing material for the next course, do not haul or drive over the compacted subbase.
   4. Do not install pavement subbase in excess of 500 feet in length without compacting to prevent softening of the subgrade.
   5. If subgrade material becomes churned up into or mixed with the subbase material, remove the mixed material and replace with clean, compacted subbase material.

E. Shoulders:
   1. Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials placed in such quantity to compact to thickness of each lift of subbase material.
   2. Compact and roll not less than 12-inch width of shoulder simultaneously with compacting and rolling of each lift of subbase material.

3.13 DISPOSAL OF EXCAVATED MATERIALS

A. General:
   1. CONTRACTOR shall haul away material removed from excavations that does not comply with requirements for fill, or is in excess of the quantity required for fill.
   2. Disposal of materials shall be in compliance with Laws and Regulations, at no additional cost to OWNER.

3.14 TEMPORARY BARRIERS

A. Provide temporary barrier surrounding excavations and excavation work areas to provide temporary protection to persons and property. Barrier shall have openings only at vehicular, equipment, and worker access points.

B. Minimum Material Requirements for Temporary Barriers:

1. Temporary barrier shall not be less snow fence-type fencing, four feet high.
2. Fence shall be constructed of vertical hardwood slats measuring not less than 1.5 inches by 1/4-inch interwoven with strands of horizontal wire, or shall be of equivalent plastic construction.
3. Posts:
    a. Posts shall be steel, either “U”-, “Y”-, “T”-shaped, or channel section.
    b. Posts shall have a nominal weight of not less than 1/3-pound per linear foot, exclusive of the anchor.
    c. Posts shall have tapered anchors weighing not less than 0.67 pounds, each firmly attached by means of welding, riveting or clamping.
    d. Posts shall have corrugations, knobs, notches, or studs placed and constructed to engage a substantial number of fence line wire in the proper position.
    e. Provide each post with sufficient quantity of galvanized wire fasteners or clamps, of not less than 0.120-inch diameter, for attaching fence wire to post.

3.15 FIELD QUALITY CONTROL

A. Site Tests: OWNER will employ a testing laboratory to perform field quality control testing. Specific Quality Assurance Testing requirements and procedures shall be established on a Project-by-Project basis.
    1. Responsibilities and Duties of CONTRACTOR:
        a. Use of testing laboratory shall in no way relieve CONTRACTOR of the responsibility to provide materials and Work in full compliance with the Contract Documents.
        b. To facilitate testing laboratory, CONTRACTOR shall advise OWNER at least two days in advance of filling operations to allow for completion of field quality control testing and for assignment of personnel.
        c. It shall be CONTRACTOR’s responsibility to accomplish the specified compaction for fill and other earthwork. CONTRACTOR shall control construction operations by confirmation tests to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the Contract Documents relative to compaction, control.

END OF SECTION

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to perform rock removal required for the Work, including disposing of excavated rock material.
   2. Obtain permits required by authorities having jurisdiction for rock removal Work, including transporting, storing, and using blasting materials.
   3. Perform rock removal Work in compliance with Laws and Regulations applicable permits, and requirements of authorities having jurisdiction.

B. Coordination:
   1. Review procedures under this and other Sections and coordinate the Work that must be performed with or before rock removal.

C. Related Sections:
   1. Section 31 23 05, Excavation and Fill.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. United States Bureau of Mines (USBM), Report of Investigations (RI) 8507.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:
   1. “Rock removal” is removal of igneous, metamorphic, or sedimentary rock or stone; boulders over two cubic yards in volume in open areas and boulders over one cubic yard in volume in trenches; and mass concrete; that cannot be removed using rippers or other mechanical methods and therefore requires drilling and blasting or use of large excavator-mounted pneumatic breakers. The following material will not be measured nor allowed for payment as rock removal:
      a. Soft, weathered or disintegrated rock that can be removed by normal excavating equipment, including bulldozers with rippers and large trackhoes with rock teeth or rock buckets.
      b. Loose or previously blasted rock.
      c. Broken stone in rock fills.
      d. Rock or stone that falls into the excavation from outside limits of excavation shown or indicated in the Contract Documents.
      e. Boulders that can be removed without drilling, blasting, or pneumatic breakers.
      f. Pavements, sidewalks, and gutters of concrete, asphalt, or masonry.
   2. “Trenches” means excavations having vertical sides whose depth exceeds its width, made for Underground Facilities and drainage beds.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Professional Engineer:
      a. CONTRACTOR or blasting Subcontractor shall retain a registered professional engineer legally qualified to practice in South Carolina. Professional engineer shall have at least five years experience conducting preblast surveys, structural evaluations, and structural condition assessments.
      b. Responsibilities include:
         1) Preparing or supervising preparation of preblast survey.
         2) Preparing written requests for clarifications or interpretations of the Contract Documents for submittal to ENGINEER by CONTRACTOR.
         3) Signing and sealing preblast survey report.
         4) Performing condition assessments of structures damaged by blasting.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Test and Evaluation Reports:
      a. Rock surface survey information, in accordance with Part 3 of this Section.
      b. Preblast survey report, in accordance with Part 3 of this Section.
      c. Blasting records, when requested by ENGINEER, in accordance with Part 3 of this Section.
      d. Vibration and overpressure monitoring results, in accordance with Part 3 of this Section.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

A. Top-of-Rock Survey:
   1. Prior to blasting and rock removal, CONTRACTOR shall survey and measure the elevation of the top of rock to determine the in-place quantity of rock to be excavated.
   2. Uncover rock to be excavated in sections or areas acceptable to ENGINEER for surveying.
   3. Submit to ENGINEER field notes, site plan showing rock elevations measured, cross-sections of rock surface when necessary or required by ENGINEER, and detailed estimation of quantity of rock to be excavated.

3.2 PREBLAST SURVEY

A. General:
   1. Preblast survey shall be performed or supervised by CONTRACTOR's or Subcontractor's professional engineer qualified in accordance with Part 1 of this Section.
   2. Complete preblast survey before starting blasting and rock removal.
   3. Preblast Survey Limits:

a. Preblast survey shall document the preblast condition, defects, and other physical factors that could reasonably be affected by blasting, of all existing residences; commercial, industrial, and institutional buildings; water supply wells; Underground Facilities and above-ground utilities; and other structures within the greater of the following distances from the limits of rock removal Work to be performed by blasting: 500 feet, or limit required in Laws and Regulations.
b. Preblast survey shall include structures such as dams, ponds and reservoirs, cisterns, structures of historical significance, and structures with unusually costly or vulnerable contents.
c. Preblast survey shall document the species and sensitivity of livestock and other animals that could be affected by blasting.

4. If, during the Work, CONTRACTOR is requested by a property owner or tenant to view alleged damage to property, CONTRACTOR shall give written notice to OWNER prior to visiting to the property.

B. Preparation for Preblast Survey:
1. Contact all owners and tenants, or their legal representative, of properties within limits of preblast survey to obtain permission to conduct preblast survey of the associated property. If property owner and tenant (if any) does not grant permission to conduct preblast survey, contact property owner and tenant (if any) a second time by registered mail (return receipt requested). Second request for permission to conduct preblast survey shall include description of preblast survey to be performed and purpose of preblast survey. At least 72 hours prior to starting blasting, provide to authority having jurisdiction, in writing, names and addresses of property owners and tenants (if any) who refuse access for preblast survey.
2. Notify property owners and tenants at least 48 hours prior to conducting preblast survey.
3. Not less than 48 hours before conducting blasting, submit preblast survey report as specified in Paragraph 3.2.D of this Section.

C. Method:
1. Buildings, Structures, Underground Facilities, and Above-ground Utilities:
a. Include in preblast survey detailed examination of interior and exterior of structures, Underground Facilities, and above-ground utilities located within specified limits of preblast survey.
b. Underground Facilities: With owner of Underground Facility, document condition of access points such as chambers, manholes, and vaults. Televise the underground pipes or conduits as noted in the Drawings.
c. Obtain color photographs, video, and prepare sketches and written descriptions to document the condition of areas within specified limits of preblast survey.
d. Document evident structural faults or deficiencies and recent repairs.
2. Wells: Include in preblast an assessment of water supply wells located within specified limits of preblast survey, including:
a. Information on well's date of construction, depth, method of construction, yield, water quality, and other existing available data. Obtain information from owner of well and installer (if known).
b. Perform short-duration pump test on each well utilizing existing pump serving the associated well. Activate pump, measure volume of water and drawdown in the well for period of one-hour or less until approximate steady state conditions are achieved. Use data obtained from these measurements to estimate approximate yield of each well.

c. Upon completion of specified short-duration pump test, obtain groundwater sample from well and submit to water quality laboratory certified by authority having jurisdiction for potable water wells. Cost of laboratory testing shall be paid by CONTRACTOR. Laboratory shall analyze samples for iron, manganese, total dissolved solids, turbidity and total coliform using methods acceptable to authority having jurisdiction for potable water wells.

D. Survey Report:
   1. General:
      a. Prepare written report summarizing results of preblast survey.
      b. Not less than 48 hours before blasting, submit two copies of completed preblast survey report to each authority having jurisdiction for their reference, if required. Submit one copy of preblast survey to OWNER, two copies to ENGINEER, and retain one copy at the Site.
      c. CONTRACTOR's or Subcontractor's professional engineer shall sign and seal final preblast survey report.
   2. Contents: Preblast survey report shall contain the following:
      a. Location and description of each property within or partially within the specified preblast survey limits.
      b. Descriptions of conditions of buildings, structures, Underground Facilities, above-ground utilities, wells, and other elements included in the preblast survey.
      c. Summary of visual observations and inspections.
      d. Color photographs, sketches, and video as appropriate.
      e. All data, results, and yield estimates developed from water supply well assessments.
   3. Photographic Documentation: Provide video to present supplemental information, as required. Include in photographs and video (where appropriate) a scale to indicate dimensions. Label photographs with name of the professional engineer responsible for preblast survey, name of property owner, and sufficient information to determine the location of the image. Include in preblast survey report one print of each photograph and include discs with video and electronic copies of photographs.
   4. CONTRACTOR's or Subcontractor's professional engineer shall report all findings that, in professional engineer's opinion, indicate that building, structure, Underground Facility, above-ground utility, or well will be adversely affected by the rock removal and blasting Work.

3.3 BLASTING AND ROCK REMOVAL

A. Notify the York County Department of Fire Safety – Fire Prevention Section or the York County Fire Administrator and obtain blasting permits prior to commencing any blasting operations.

B. Perform blasting in accordance with Laws and Regulations relative to blasting, storage and use of explosives, and rock removal.

C. Perform rock removal adjacent to Underground Facilities and above-ground utilities and life-safety facilities with utmost care, after properly notifying and coordinating with utility owners, life-safety facility owners, and authorities having jurisdiction.

D. Perform blasting to avoid endangering persons or property, and damaging or weakening adjacent foundations, structures, sheeting, bracing, and other facilities. Cover or otherwise suitably confine blasting.

E. CONTRACTOR shall be fully responsible for injury and damage caused by blasting, and shall repair or replace all injury and damage immediately, as accepted by ENGINEER at no additional cost to OWNER.

F. Limit Criteria for Blasting Vibration, Particle Velocity, and Airblast Overpressure:
   1. Amount of vibration, frequency and overpressure generated by blasting shall not exceed limits in Laws or Regulations, and limits established by authorities having jurisdiction.
   2. Maximum peak particle velocity (PPV) shall not exceed limits indicated in Figure B-1, Appendix B, of the USBM RI 8507.
   3. Peak airblast overpressure measured at location of nearest occupied, above-ground structure (considering wind direction) shall not exceed 0.014 psi.

G. Keep records of all blasts, including: date; location, depth, number, and diameter of drill holes; type and amount of explosive; and other pertinent data. Submit records to ENGINEER when requested.

H. Removal by Methods Other than Blasting:
   1. Where conditions of hazard exist, or clearances with existing facilities, piping, or structures are very small, or where the potential for damage to persons or property is strong, perform rock removal by means other than blasting.
   2. Blasting is not allowed except in areas where so allowed by Fire Department Blasting Permit as issued by the Office of State Fire Marshal.

I. Removal and Disposal of Rock:
   1. Remove blasted or broken rock from excavations with suitable equipment.
   2. Do not use excavated rock as backfill. Dispose of excavated rock off the Site at CONTRACTOR's expense in compliance with Laws and Regulations.

3.4 SITE QUALITY CONTROL

A. Blast Monitoring:
   1. Perform seismic blast monitoring in accordance with Laws and Regulations.`
   2. Monitor blasting to allow evaluation of compliance with the limitations specified in the Contract Documents. At minimum, monitor each blast as follows:
      a. Blast Monitoring Zone: Monitor vibrations at exterior walls of all structures within 500 feet of each blast.
      b. If no structures are located within specified blast monitoring zone, monitor vibrations at three equally spaced radial points located at perimeter of specified blast monitoring zone.
      c. Monitor overpressures for all structures within specified blast monitoring zone.
   3. Submit vibration and overpressure monitoring results to ENGINEER within 24 hours of blasting. CONTRACTOR's monitoring does not relieve CONTRACTOR of responsibility for controlling vibration and overpressure during blasting.

3.5 UNAUTHORIZED ROCK REMOVAL

A. Rock removal outside the limits shown or indicated in the Contract Documents or that is not approved by ENGINEER, including removal, disposal, and backfill, will be at CONTRACTOR's expense.

B. Fill unauthorized excavation below pipe or foundation with compacted select backfill as directed by ENGINEER in writing, at no additional cost to OWNER. Backfill other unauthorized excavation as specified in Section 31 23 05, Excavation and Fill.

END OF SECTION

SECTION 31 37 00

RIPRAP

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals required to furnish and install riprap at locations shown or indicated in the Contract Documents.

B. Coordination:
   1. Review procedures under this and other Sections and coordinate the Work that must be performed with or before riprap.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 31 11 00, Clearing and Grubbing.
   3. Section 31 23 05, Excavation and Fill.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM C127, Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
   2. NSSGA-293, Aggregate Handbook.
   3. South Carolina Department of Transportation (SCDOT) Qualified Products Listings and Policies for Construction and Maintenance Materials.
   4. South Carolina Department of Transportation Standard Specifications for Highway Construction.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Riprap Supplier:
      a. Supplier of riprap and other materials furnished under this Section shall be certified by the SCDOT for furnishing such materials for SCDOT highways.

B. Regulatory Requirements:
   1. Reference Specifications and Details:
      a. Comply with applicable requirements of SCDOT Standard Specifications for Highway Construction.

1.4 SUBMITTALS

A. Acton Submittals: Submit the following:
   1. Product Data:
      a. Source or quarry name, gradation, and other information required by ENGINEER. Submit for each source of material proposed.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Where material is specified according to reference specification item number, submit copy of Supplier's valid certification from entity issuing the reference specification, and associated certification of material conformance with the reference specifications.

PART 2 PRODUCTS

2.1 MATERIAL

A. Riprap: Material shall comply with Section 804 of SCDOT Standard Specifications for Highway Construction, Class B and shall be obtained from sources listed on the most recent edition of SCDOT Qualified Products List 2.

B. Width and thickness of each stone shall not be less than one-third the length of the stone.

PART 3 EXECUTION

3.1 PREPARATION

A. Clear ground surface of brush, trees, stumps, and other objectionable material, and dress to a smooth surface. Clearing and grubbing, where required, shall comply with Section 33 11 00, Clearing and Grubbing.

B. Remove all soft or spongy material to depth shown or indicated on the Drawings or as directed by ENGINEER, and replace with acceptable material. Excavation, removal of unsuitable material if any, and backfilling shall comply with Section 31 23 05, Excavation and Fill.

3.2 INSTALLATION

A. Riprap Placing:
   1. Minimum total thickness of riprap shall be as specified in Article 2.1 of this Section.
   2. Place riprap stones so that weight of stone is carried by underlying material and not by adjacent stones. Carefully place the stones on geosynthetics, where required, to produce an even distribution of pieces, with minimum of voids and without damaging the geosynthetic. Place the full-course thickness in one operation while preventing segregation and avoiding displacing of underlying material. Do not place stones in layers, by dumping into chutes, or by other methods that cause segregation or damage to geosynthetic, if any. When necessary, rearrange individual stones for uniform distribution.
   3. Riprap may be placed using equipment, and placing shall produce an installation of firm and solid riprap. Level the top surface of riprap to required alignment and slope by hand-placing stones to fill large voids and to make surface even.
   4. On slopes, place the largest stones at the bottom. Riprap shall be properly sized to form compact, solid blanket to protect the slope or channel, as applicable.
   5. Rip-rap shall be installed no steeper than a 2:1 slope except when specifically approved by the Engineer. On such slopes, do not use rounded boulders or cobbles without grouting stones in place.

6. Grouting: Where grouting of riprap is required, comply with the following:
    a. When stones are in place, completely fill spaces between stones with “grout fill” material in accordance with Section 03 00 05, Concrete.
    b. ENGINEER may direct that occasional spaces be left ungrouted for relief of hydrostatic pressure. Chink ungrouted spaces with spalls of suitable size.
    c. Do not grout riprap in freezing weather.
    d. Clean exposed surface of stones to remove accumulation of grout.
    e. Keep grouted riprap moist for seven days after grouting. Suitable grout curing compound may be employed when approved by ENGINEER.
7. When existing riprap is in proximity to riprap provided under this Section, place riprap to conform as closely as practicable in size and character to existing riprap.
8. Unless otherwise indicated, existing riprap removed to facilitate other Work shall be reinstalled or replaced at no additional cost to OWNER.
9. In locations where a creek bank is eroded near a sewer line, before placing riprap, place compacted fill material along the creek bank in order to maintain 3 feet of cover over the sewer line.

END OF SECTION

SECTION 31 62 16.16

STEEL H-SECTION PILES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, and test steel H-section piles.
   2. Extent of steel H-section piling is shown on the Drawings.
   3. Included are:
      a. Furnishing, driving, cutting off, and all other steel H-section piling Work.
      b. Providing openings in and attachments to steel H-section piling to accommodate the Work under this and other Sections, and providing for steel H-section piling all items required for which provision is not specifically included under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before steel H-section piling Work.

C. Related Sections:
   1. Section 31 23 05, Excavation and Fill.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM A572/A572M, Specification for High-Strength Low-Alloy Columbium- Vanadium Structural Steel.
   2. ASTM D1143/D1143M, Test Method for Deep Foundations Under Static Axial Compressive Load.
   3. ASTM D3689, Test Methods for Deep Foundations Under Static Axial Tensile Load.
   4. ASTM D3966, Test Methods for Deep Foundations Under Lateral Load.
   5. ASTM D4945, Test Method for High-Strain Dynamic Testing of Piles.
   6. ASTM D7091, Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
   7. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
   8. ASTM E376, Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Examination Methods.
   9. AWS D1.1/D1.1M, Structural Welding Code – Steel.
   10. International Building Code.
   11. Ozone Transport Commission (OTC) Architectural and Industrial Maintenance Coatings.
   12. SSPC-PS 11.01, Black (or Dark Red) Coal Tar Epoxy Polyamide Painting System.
   13. SSPC-SP 1, Solvent Cleaning.
   14. SSPC-SP 10/NACE No. 2, Near White Blast Cleaning.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Welders and Welding Processes:
      a. Qualify welding processes and welding operators in accordance with AWS D1.1/D1.1M, Section 5, Qualification.
      b. Each welder employed on or to be employed for the Work shall possess current AWS certification in the welding process with which welder will be working. Certifications shall be current and valid throughout the Work.
   2. Surveyor:
      a. Engage a registered professional land surveyor legally qualified to practice in the same jurisdiction as the Site, and experienced in providing surveying services of the kind indicated.
      b. Responsibilities include but are not necessarily limited to:
         1) Performing or supervising performance of field survey work to check lines and elevations of steel H-section piling, before proceeding with construction of pile caps.
         2) Submit to CONTRACTOR field survey reports.
   3. Professional Engineer:
      a. Retain the services of a registered professional engineer, legally qualified to practice in the same jurisdiction as the Site, to design all required static load-testing apparatus, including loaded members, support frames, loading procedures, and test movement recording devices. Test beams, load platforms, and support structures, as required, shall have sufficient size, strength, and stiffness to prevent excessive deflection and instability up to the maximum anticipated load.
      b. Responsibilities include but are not necessarily limited to:
         1) Reviewing load testing criteria stated in the Contract Documents.
         2) Preparing or supervising preparation of design calculations and related drawings, Shop Drawings, and loading procedures.
         3) Signing and sealing all calculations, design drawings, and Shop Drawings.
         4) Certifying that:
            a) it has performed the design of the loading apparatus in accordance with design criteria stated in the Contract Documents, and
            b) said design complies with Laws and Regulations, and complies with prevailing standards of practice.
   4. Dynamic Pile Testing Consultant:
      a. Retain the services of a dynamic pile testing consultant to provide necessary equipment, and perform dynamic testing and wave equation analysis to determine the ultimate pile capacity of dynamically-tested piles as indicated in the Contract Documents.
      b. Dynamic pile testing consultant shall be a professional engineer legally qualified to practice in same state as the Site and shall have a minimum of five years experience with dynamic pile testing, data interpretation, and wave equation analysis.
      c. Responsibilities include but are not necessarily limited to:
         1) Preparing or supervising preparation of the dynamic pile testing plan.
         2) Preparing or supervising the preparation of test set-ups.
         3) Performing or supervising performance of testing, interpretation, and engineering analysis of test data, and preparing test reports.
         4) Signing and sealing the dynamic pile testing report.
   5. Pile Installer:
      a. Engage an experienced pile installer possessing a minimum of five years experience installing piles similar to those required in this Section, to perform all H-section pile driving indicated in the Contract Documents.

6. Static Load Test Application and Recording of Data:
    a. Maintain presence of experienced employees at all times during steel H-section pile Work to perform the required loading and recording of data during static load testing. Individuals responsible for the Work shall have a minimum of five years of experience in similar projects.

B. Regulatory Requirements:
1. If coatings are required, comply with VOC content limits of OTC Model Rule for Architectural and Industrial Maintenance Coatings:
    a. Industrial Maintenance Coatings: 340 grams per liter.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings: Submit the following in advance of start of pile driving:
    a. Drawings showing location of all piles. Assign an identification number to each pile coinciding with identification number used in driving record of each pile. Shop Drawings shall include anticipated driving sequence for the Work.
    b. Complete data on type of pile proposed, including pile installation procedures.
    c. Submit detailed drawings of pile splices. Clearly indicate welds using standard AWS notations and symbols, and clearly show or indicate size, length, and type of each weld, as applicable.
    d. Submit detail of pile tension connection. Clearly indicate welds using standard AWS notations and symbols, and clearly show or indicate size, length, and type of each weld, as applicable.
2. Product Data:
    a. Copies of manufacturer’s specifications and installation instructions for products listed below.
        1) Welding electrodes and rods.
        2) Protective coating manufacturer’s technical information and test performance data, including paint analysis, VOC and chemical component content in comparison to maximum allowed by the Contract Documents, and application instructions. Submit proof of acceptability of proposed application techniques by paint manufacturer selected.

B. Informational Submittals: Submit the following:
1. Certificates.
    a. Welders’ certifications.
    b. Laboratory test reports and other data as required to demonstrate compliance with these Specifications for the products listed below:
        1) Structural steel of each type, including certified copies of mill reports covering chemical and physical properties.
2. Complete data on hammer and other driving equipment to be utilized, including results of drivability studies.
3. Pile Load Test Plan:
    a. Submit pile load test plan, including complete data on test pile instrumentation, load application, apparatus for recording movement, and protection of testing apparatus, at least 30 days prior to installing the first test pile. ENGINEER's acceptance of pile load test plan shall not relieve CONTRACTOR of responsibility for structural and operational adequacies of the testing system.

1) Dynamic load test requirements included in the pile load test plan shall be prepared by CONTRACTOR's dynamic pile load testing consultant.

b. Calibration curve for jack and gauge to be used for static load testing, to demonstrate compliance with required ASTM standards, certified by testing laboratory.

c. Calibration statements for equipment to be used to obtain dynamic measurements, record, reduce and display data to demonstrate compliance with ASTM D4945, certified by testing laboratory.

4. Field Quality Control Submittals:
   a. Static Load Test Reports: Within two days of completing test, submit test report for each pile test, in accordance with Article 3.6 of this Section.
   b. Dynamic Test Report: Submit dynamic test report, including wave equation analysis, within seven days after completing tests.
   c. Coating Test Reports: Submit test report within two days of completing holiday tests and dry film thickness tests.
5. Driving Records:
   a. Within two days of driving, submit copies of driving record of each pile, including the following information:
      1) Project name, Contract number, report date, date of pile driving.
      2) CONTRACTOR and Subcontractor names.
      3) Pile location and number.
      4) Pile section designation.
      5) Starting and finishing driving times.
      6) Type and size of hammer.
      7) Pile driving cap type.
      8) Ground, tip, and butt elevation. Indicate butt elevation before and after cut-off.
      9) Total pile pay length.
      10) Locations of splices, if any.
      11) Continuous record of number of blows for each foot of penetration and for each inch of penetration in the last foot of penetration.
      12) Data on and description of unusual occurrences, if any, during pile driving.
6. Qualifications Statements.
   a. Land surveyor.
   b. Professional engineer.
   c. Dynamic pile testing consultant.
   d. Pile installer.
   e. Qualifications of each individual employed to perform static load test application and recording of data.

C. Closeout Submittals: Submit the following:
   1. Field survey reports showing exact location of each steel H-section pile as driven, including record drawings and data showing final position of top of each pile. Include location of rejected piles.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Except for piles to be used for testing, materials ordered or delivered to the Site prior to verification of assumed pile length are at CONTRACTOR's risk.
   2. After pile lengths are verified, deliver materials to Site in such quantities and at such times to ensure continuity of pile driving operations in accordance with the Progress Schedule accepted by ENGINEER.

B. Storage: Store piles in orderly groups above ground on blocks to minimize potential for distortion.

C. Handling:
   1. Lift piles using a cradle or multiple point pick-up to ensure that the maximum permissible camber or sweep is not exceeded due to insufficient support. Point pick-up devices shall be of the type that clamps to both pile flanges at each pick-up point.
   2. Holes may be burned in the flanges or webs of piles above the cut off length for lifting piles into the leads.
   3. Do not drag piles across the ground.
   4. Piles with excessive camber or sweep will be rejected.

1.6 SITE CONDITIONS

A. Site Information:
   1. Information on subsurface conditions is available in the reports listed in the Supplementary Conditions.
   2. Additional test borings and other exploratory operations may be made by CONTRACTOR at no additional cost to OWNER, provided such operations are acceptable to ENGINEER.

B. Line and Level:
   1. Using reference points and engineering surveys provided by OWNER, establish and locate all other lines and levels and is responsible for the correct location and deviation of all piles.
   2. Install piles at the proper locations and orientation shown or indicated in the Contract Documents.

PART 2 PRODUCTS

2.1 MATERIALS

A. H-Section Piles:
   1. Provide structural H-section shapes, complying with ASTM A572/A572M, Grade 50, of the sizes shown or indicated on the Drawings.

2.2 PROTECTIVE COATINGS

A. Coating Material:
   1. Surface Preparation: Refer to Paragraph 3.2.A of this Section.
   2. Shop Applied Coating and Field Touch-Up Materials:
      a. Coal Tar Epoxy Polyamide:
         1) System: SSPC-PS 11.01.
         2) Material: SSPC Paint 16.
      b. Products and Manufacturers: Provide one of the following:
         1) Hi-Mil Sher-Tar Epoxy B69B40/B60V40, manufactured by Sherwin Williams Company.
         2) Hi-Build Tneme-Tar, Series 46H-413, manufactured by Tnemec Company, Inc.
         3) Or equal.

2.3 PILE TENSION CONNECTIONS

A. Provide steel H-section piling with tension connections to the pile cap as shown on the Drawings.

B. Pile tension connections shall comply with the details on the Drawings.

2.4 DRIVING EQUIPMENT

A. General:
   1. Drive piles with a drop, single- or double-acting steam, air, or diesel hammer. Use a hammer with sufficient energy to drive piling to required tip elevation without damaging the pile. Operate double-acting hammer, if used, at full-rated pressure and speed during final driving of pile. When using single-acting hammer, maintain valve mechanism as recommended by manufacturer so that length of stroke is maintained. Equip diesel hammers, when used, with chambers and gages arranged so that precise energy information can be read and recorded. Hammer shall be in good operating condition at all times during driving.
      a. Size or capacity of hammers shall be as recommended by hammer manufacturer for the total pile mass weight and character of soil formation to be penetrated.
      b. Perform drivability studies that are based on wave equation analysis. Drivability study shall demonstrate hammer can successfully drive the piles to the anticipated pile tip elevations and with sufficient energy to produce design pile capacity without damage to the pile and without excessive blow count.
      c. Provide further wave equation analysis at no cost to OWNER if hammer system is replaced or modified.

B. Driving Caps:
   1. Equip hammer with cushioned or blocked driving cap, conforming to pile shape, with loss of hammer energy kept to a minimum. Keep bearing surfaces of driving cap true and smooth.
      a. Driving cap shall be consistent with the wave equation analysis.

C. Pile Driving Leads:
   1. Use fixed or rigid type pile driving leads that will hold pile firmly in position and in axial alignment with hammer. Free-swinging leads are unacceptable. Extend leads to within two feet of elevation at which pile enters ground.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which steel H-section piling will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Inspect piles for excessive camber and sweep, and for damage before transporting pile materials from storage area to driving location, and inspect immediately prior to placing pile material in the driving leads. Measure camber and curvature in the pile in direction normal to the

pile flanges, with the pile flange laying on the surface; measure the distance between the flange base at mid-length of pile and the flat surface. Measure sweep and curvature in the pile in direction parallel to the pile flanges with the pile flange tips laying on a flat surface; measure the distance between flange tips at mid-length of the pile and the flat surface. Maximum acceptable camber or sweep is two inches over the length of the pile.

3.2 PROTECTIVE COATINGS

A. Provide protective coating for pilings in corrosive soils, pilings exposed above-ground or if otherwise indicated in the Drawings.

B. Cleaning and Preparation of Coated or Painted Surfaces:
   1. Solvent Cleaning:
      Remove visible oil, grease and other contaminants by solvent cleaning in accordance with SSPC-SP 1.
   2. Blast Cleaning:
      a. After solvent cleaning, complete surface preparation by near-white blast cleaning in accordance with SSPC-SP 10/NACE No. 2. Remove residual dust from blasted surface by blowing with dry, oil-free air, vacuuming, or sweeping.
      b. Comply with paint manufacturer's recommendations for type and size of abrasive to provide surface profile that complies with manufacturer's painting system requirements.

C. Mixing:
   1. Mix and prepare paint products in accordance with paint manufacturer's product literature and manufacturer's preparation instructions.

D. Application:
   1. Apply coating to blast-cleaned steel in accordance with paint manufacturer's written instructions.
   2. Coal-tar Epoxy: Apply by spraying one coat to total minimum dry film thickness of 16 mils and maximum dry film thickness of 20 mils.
   3. Provide finish coating that is generally smooth and free of projections that can be removed by abrasion. Remove sharp edges and repair areas in accordance with paint manufacturer's directions.

E. Field Touch-Up:
   1. Touch-up damaged shop-applied paint using materials as specified under Article 2.2 of this Section in accordance with paint manufacturer's instructions.

3.3 PREPARATION FOR PILE INSTALLATION

A. Preparation of Site:
   1. Do not drive piles until earthwork in the area where piles will be installed has been performed as follows:
      a. Excavation, fill, and earthwork shall be in accordance with Section 31 23 05, Excavation and Fill.
      b. Excavation: Stop excavating at elevation six inches to twelve inches above bottom of footing before piles are driven. Final excavation to required elevation of footing bottoms shall be after piles are installed and tested.
      c. Fills: Construct and compact fills to elevation shown.

2. Do not drive pile within 15 feet of concrete or masonry structure that has not attained its full design strength.

B. Pile Length Markings:
   1. Mark length of pile by painting the number of feet from pile tip at five foot intervals and painting a horizontal line, at 12-inch intervals, starting 15 feet below pile cut-off.

C. Welding:
   1. Perform manual arc welding using shielded metal arc method or submerged arc method complying with AWS D1.1/D1.1M.
   2. Use oxygen-gas or oxygen-arc methods for field cutting steel, complying with AWS D1.1/D1.1M.

D. Splices:
   1. In general, use only one splice per length of pile.
      a. Piles that have not reached required tip elevation or refusal blow count when the top has been driven to cutoff elevation shall be spliced as shown and driven to sufficient depth to develop the required tip elevation or refusal blow count.
   2. Clean surfaces to be welded of rust, scale, oil, paint, and foreign material. Use only pile members with identical cross-sections for splicing.
   3. When possible, make splices before starting driving operations. If welded splice is required during driving operation, make splice when top of driven pile portion is at least three feet above ground, to allow inspection of welded connection during welding and during subsequent driving. Length of pile to be spliced shall be secured in proper alignment to avoid eccentricity.
   4. Splices shall be 100 percent butt welded, producing a straight pile alignment through splice and developing full bending strength and axial load strength of pile.
   5. After splices are made, inspected, and acceptable to ENGINEER, touch-up and repair protective coatings on piles using same material used in shop-applied paint or coating systems, in accordance with manufacturer's instructions.

E. Pre-drilling:
   1. Pre-drilled holes for pile installation are allowed only when approved by geotechnical engineer or ENGINEER of record.

F. Jetting:
   1. Jetting and spudding of piles is not allowed.

3.4 DRIVING PILES

A. Protection:
   1. Protect structures, Underground Facilities, and other construction from damage caused by pile driving operations.
   2. When structures are adjacent to pile driving operations, before commencing pile driving, provide surveyed elevation benchmarks on structure at locations directed by ENGINEER. Record and report the elevation of each benchmark after driving each pile and at least twice a day while pile driving is in progress. Should benchmark readings indicate displacement, halt pile driving operations until corrective action is provided acceptable to ENGINEER.

B. General:

1. Provide written notice prior to beginning construction on steel piles to OWNER and ENGINEER. Don't perform any pile driving without Inspector present.
2. Perform pile driving in an orderly sequence, progressing in one direction across each foundation element. Do not install piles in area surrounded by previously driven piles. Drive piles only in ENGINEER's presence.
3. Continuously drive each pile at location indicated, to the required tip elevation and driving resistance established by driving and loading of test piles and load testing analysis.
    a. Piles shall be driven to resistance or pile refusal criteria provided by the geotechnical engineer or as indicated on the Drawings.
4. Carefully maintain center of gravity for each group or cluster of piles to comply with locations shown.
5. Carefully plumb leads and pile before driving. During driving prevent and correct tendency of piles to twist or rotate.
6. When handling and driving long piles, take special precautions to prevent overstress or leading away from true position.

C. Obstructions:
1. Should an obstruction including, but not limited to, boulders, rock, rubble, fill, or existing foundations be encountered that prevents driving of pile to its required tip elevation or final driving resistance, threaten pile damage, or cause pile to drift from required location, cease driving operation and contact ENGINEER immediately. ENGINEER will determine corrective measures, including, but not necessarily limited to, pile relocation and pile cap design modifications required to accommodate the obstruction. Corrective measures due to obstructions, including cost of redesign, will be paid by OWNER via a Change Order or other method in accordance with the Contract Documents.

D. Driving Tolerances:
1. Drive piles within the following maximum tolerances:
    a. Location: Three inches from location indicated for center of gravity of each single pile or pile groups; one inch for piles under walls.
    b. Plumbness: Maintain one inch in ten feet from vertical, or a maximum of four inches, measured when the pile is above ground, in the leads.
    c. Batter Angle: Maximum one inch in ten feet from required angle as shown on the Drawings, measured when pile is above ground and in the leads.

E. Cutting-Off:
1. Cut off tops of driven piles square with pile axis and at elevations indicated, using cutting torch or other acceptable method.
2. Piles driven below required cutoff elevation are not acceptable and shall be replaced at no additional cost to OWNER.
3. Recoat cut off tops of piles that have protective coating. Touch-up and repair protective coatings on piles using same material used in shop-applied coating systems, in accordance with paint manufacturer's instructions.

3.5 REPAIRS AND CORRECTIONS

A. Corrective Action:
1. ENGINEER may survey piles at any time. If heave or other discrepancy is detected, re-drive or replace the pile or piles at no additional cost to OWNER.

2. As soon as possible after completing pile driving, prepare an accurate survey by licensed surveyor. Partial surveys of piles at cutoff elevation can be submitted as driving proceeds to expedite the Work.
3. ENGINEER will check piling and determine acceptability. If unacceptable, ENGINEER will advise CONTRACTOR what additional piles shall be provided or other corrective measures to be taken.
4. ENGINEER will provide redesign, as required, for corrections required for piles driven out of location. Corrective measures, including cost of redesign, shall be paid by CONTRACTOR via Change Order.

B. Damaged or Misdriven Piles:
1. Damaged piles and piles driven outside required driving tolerances, piles that are too short to develop the required final driving resistance or required tip elevation, or that otherwise do not comply with the Contract Documents, are considered defective and are unacceptable.
2. Damaged piles shall include, but not necessarily be limited to, piles that are bent, buckled, fabricated without complying with tolerances in the Contract Documents, or piles fabricated with defects that may weaken the pile, as determined by ENGINEER.
3. Replace damaged or misdriven piles as directed by ENGINEER at no additional cost to OWNER. ENGINEER will provide redesign, as required, for corrections required for damaged or misdriven piles. Corrective measures, including cost of redesign, shall be paid by CONTRACTOR via Change Order
    a. When possible, withdraw rejected piles and replace with new piles. Withdrawal method shall be submitted to ENGINEER for approval.
    b. If withdrawal of damaged or misdriven pile is impossible or impractical, cut off pile below the limits of the structure, and install required additional piles and other corrective measures, such as modifications to the cast-in-place concrete pile cap, as required by ENGINEER's redesign.

C. Heaved Piles:
1. Using data provided by CONTRACTOR, ENGINEER will determine whether a driven pile has lifted from its original seat during driving of adjacent piles. If uplift occurs, re-drive affected piles to a tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.

D. Cost of ENGINEER's Redesign:
1. Piling driven incorrectly, or in position other than that shown on the Contract Documents ("out of position"), or that is otherwise defective, shall be corrected as directed by ENGINEER and as described in this Section. For such piles, CONTRACTOR shall pay OWNER for cost of engineering, Resident Project Representative, and inspection services associated with evaluating and correcting incorrectly installed, out-of-position, or defective piles.
2. ENGINEER will record time of ENGINEER and ENGINEER's consultants and expenses required, if any, for evaluating defective piles and redesigning piling, foundations, and other related structural elements and in making revisions to the Contract Documents.
3. Cost of services of ENGINEER and ENGINEER's consultants shall be based on a charge of 3.0 times direct salary cost of each employee and 1.1 times the cost of expenses.

3.6 FIELD QUALITY CONTROL

A. Furnish, install, and load-test piles to verify design pile lengths and loads to be tested by the specified test method indicated by the geotechnical engineer. Provide complete testing materials and equipment as required. Perform tests in presence of ENGINEER.

B. Test piles used for determining lengths of piles may be located, cut off, and become part of the foundation system if test piles comply with requirements of the Contract Documents. Test piles which aren't to be incorporated in the completed structure shall be removed to at least 2 feet below the surface of the ground or the stream bed, and the remaining hole backfilled with earth or other suitable material.

C. Test Piles shall be as shown on the Drawings.

D. Driving Test Piles:
   1. Use test piles of same size and design as required, and drive with appropriate pile driving equipment operating at rated driving energy required for driving permanent piles.
   2. Drive test piles at locations designated by ENGINEER in the same manner as required for permanent piles.

E. Pile Design Load:
   1. Design load per pile shall be as shown on the Drawings.

F. Dynamic Testing of Piles (Bearing):
   1. CONTRACTOR's dynamic pile testing consultant shall perform dynamic pile testing in accordance with ASTM D4945.
   2. Perform dynamic pile testing using a pile driving analyzer (PDA) on three bearing piles. Perform dynamic testing as a minimum during the final five feet of piling driving.
   3. Restrike test piles with concurrent PDA testing after a minimum waiting period as approved by the ENGINEER.
   4. Perform wave equation analysis (two, minimum) using the field-measured data from the three test piles.
   5. CONTRACTOR's dynamic pile testing consultant shall certify that all dynamic testing was performed correctly and submit a signed and sealed written report upon the completion of testing. Submitted dynamic testing report shall include field information required for driving reports under the Submittals Article of this Section, detailed test procedures, dynamic pile test results, including results from wave equation analyses, and provide recommendations for production pile installation.
   6. Dynamic testing report prepared by CONTRACTOR's dynamic pile testing consultant shall be submitted for review by the ENGINEER not less than 10 days prior to commencing production pile Work.
   7. Based on observations and results of dynamic testing, ENGINEER will indicate minimum pile tip elevations or blow count criteria to be used during driving of production piles.

G. Static Test Loads:
   1. Static tension, compression, and lateral test load for individual piles shall be two times the required design load.

H. Static Compression Load Testing:
   1. Load and test piles to determine and record the load-movement relationship of the test piles under vertical compression load complying with ASTM D1143/D1143M.
   2. Apply compression load by hydraulic jacks acting against anchored reaction frame. Testing apparatus shall comply with ASTM D1143/D1143M. Provide the necessary framing at each

load test to allow ENGINEER unrestricted safe access to pile instrumentation at all times during the load test. Hydraulic jacks, gauges, transducers, and load cells shall comply with ASTM D1143/D1143M. Submit certified calibration curve for the jack and gauge to be used in the testing.

3. Apply minimum specified test load in accordance with Procedure B of ASTM D1143/D1143M.
4. Record pile movement using a reference system constructed independently of the pile and loading apparatus and firmly embedded in the ground at locations clear of load supports, and clear of the zone of influence of the pile loadings and reaction supports. Apparatus for measuring movement shall comply with ASTM D1143/D1143M. Provide equipment and personnel required to obtain the level observations required by the Contract Documents.
5. Protect load test set-up from inclement weather by tarpaulins and protective ditches and, if protection from freezing weather is necessary, provide temporary space heaters.

I. Static Tension Load Testing:
1. Load and test piles to determine and record the load-movement relationship of the test piles under vertical tension load in accordance with ASTM D 3689.
2. Apply tensile load by hydraulic jacks supported on test beams. Testing apparatus shall comply with ASTM D3689. Provide necessary framing at each load test to allow ENGINEER unrestricted safe access to pile instrumentation at all times during load test. Hydraulic jacks, gauges, transducers, and load cells shall comply with ASTM D3689. Submit certified calibration curve for the jack and gauge to be used during testing.
3. Apply the minimum specified test load in accordance with Procedure B of ASTM D3689.
4. Record pile movement using a reference system constructed independently of the pile and loading apparatus and firmly embedded in the ground at locations clear of load supports, and clear of zone of influence of pile loadings and reaction supports. Apparatus for measuring movement shall comply with ASTM D3689. Provide equipment and personnel necessary to obtain the level observations required by the Contract Documents.
5. Protect load test set-up from inclement weather by tarpaulins and protective ditches and, if protection from freezing weather is necessary, provide temporary space heaters.

J. Static Lateral Load Testing:
1. Load and test piles to determine and record the load-movement relationship of test piles under lateral load, complying with ASTM D3966.
2. Apply lateral load by hydraulic jacks acting against a reaction system. Testing apparatus shall comply with ASTM D3966. Provide the necessary framing at each load test to allow ENGINEER unrestricted safe access to pile instrumentation at all times during load test. Hydraulic jacks, gauges, transducers, and load cells shall comply with ASTM D3966. Submit certified calibration curve for the jack and gauge to be used during testing.
3. Test piles as free-head piles. Apply minimum specified test load in accordance with Procedure A of ASTM D3966. Direction of test for the H-piles shall be in the weak axis.
4. Record pile movement using reference system constructed independently of the pile and loading apparatus, firmly embedded in the ground at locations clear of load supports and clear of zone of influence of pile loadings and reaction supports. Apparatus for measuring movement shall comply with ASTM D3966. Provide equipment and personnel necessary to obtain the level observations required by the Contract Documents.
5. Protect load test set-up from inclement weather by tarpaulins and protective ditches and, if protection from freezing weather is necessary, provide temporary space heaters.

K. Static Load Test Reports:

1. Prepare reports for each test pile. Reports shall indicate results of load testing and include all field information required for pile driving reports under the Submittals Article of this Section.

L. Static Load Test Acceptance Criteria:
   1. Static tests shall be acceptable when results indicate compliance with acceptance criteria in the International Building Code, Section 1810.3.3.1.3, Load Test Evaluation Methods.

M. Engage an independent testing and inspection agency to inspect welded splices and to perform tests and prepare test reports.
   1. Testing agency shall conduct and interpret tests, prepare and state in each report of results whether test specimens comply with the Contract Documents and specifically state all deviations.
   2. Welded splices: Notify testing agency three days in advance of starting driving operations. Testing agency will be present on Site for the first day of driving operations to visually inspect field welded splices. Frequency and number of subsequent visits shall be determined by ENGINEER.
      a. Where visually-defective welds are evident, further test welds using non-destructive methods. If welds are determined to be acceptable, CONTRACTOR shall pay for non-destructive testing. When welds are defective, CONTRACTOR shall pay for non-destructive testing.
      b. Correct, or remove and replace, defective Work as directed by ENGINEER.
      c. CONTRACTOR shall pay for corrections and subsequent tests required to determine weld compliance with the Contract Documents.

N. Prior to pile driving, test the coating system for presence of holidays. Use low-voltage holiday detector of less than 90 volts in accordance with manufacturer's instructions.
   1. If holidays are detected, repair by surface treatment and application if additional paint in accordance with paint system manufacturer's recommendations. Retest coating after repair.
   2. After repair of holidays, measure dry film thickness using magnetic dry film thickness gauge in accordance with ASTM D7091 and ASTM E376.

END OF SECTION

SECTION 32 12 00

FLEXIBLE PAVING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install flexible, hot-mix, hot-laid, asphalt concrete pavement.
   2. The Work includes:
      a. Preparation such as saw cutting, milling where shown or indicated, cleaning, and other preparation for installing flexible pavements.
      b. Providing asphalt concrete paving materials.
      c. Providing tack coat material.
      d. Providing pavement markings where shown or indicated.
      e. Providing quality controls and testing.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before flexible paving Work.

C. Related Sections:
   1. Section 31 23 05, Excavation and Fill.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AASHTO M320, Specification for Performance-Graded Asphalt Binder.
   2. AASHTO MP1a, Specification for Performance-Graded Asphalt Binder.
   3. AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
   4. ASTM C1371, Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
   5. ASTM C1549, Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
   6. ASTM D242/D242M, Specification for Mineral Filler For Bituminous Paving Mixtures.
   7. ASTM D692/D692M, Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
   8. ASTM D946/D946M, Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
   9. ASTM D977, Specification for Emulsified Asphalt.
   10. ASTM D1073, Specification for Fine Aggregate for Bituminous Paving Mixtures.
   11. ASTM D1188, Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
   12. ASTM D2726, Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
   13. ASTM D2950, Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
   14. ASTM D3549, Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

15. ASTM D6690, Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
16. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
17. ASTM E408, Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
18. ASTM E1918, Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
19. ASTM E1980, Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
20. FS TT-P-115, Paint, Traffic, Highway, White and Yellow.
21. South Carolina Department of Transportation (SCDOT) Qualified Products Listings for Construction and Maintenance Materials.
22. South Carolina Department of Transportation Standard Specifications for Highway Construction.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Asphalt Concrete Production Facility:
      a. Production facility for asphalt concrete, tack coat materials, and other bitumastic materials shall be certified by the SCDOT for furnishing such materials for SCDOT highways.
   2. CONTRACTOR’s Testing Laboratory:
      a. Retain the services of independent testing laboratory to perform testing and determine compliance with the Contract Documents of the materials provided under this Section.
      b. Do not employ the same laboratory hired by OWNER for field quality control testing under the “Field Quality Control” Article of this Section.
      c. Testing laboratory shall comply with ASTM E329 and requirements of Section 01 45 29, Testing Laboratory Services.
      d. Testing laboratory shall be experienced in the types of testing required.
      e. Selection of testing laboratory is subject to ENGINEER's acceptance.

B. Regulatory Requirements:
   1. Reference Specifications and Details:
      a. Comply with applicable requirements of SCDOT Standard Specifications for Highway Construction or other Authorities Having Jurisdiction where the Work takes place.
   2. Obtain required highway and street rights-of-way work permits.
   3. Jurisdiction:
      a. Paved areas to be constructed are jurisdiction of OWNER or SCDOT.

C. Quality Assurance Testing:
   1. Quality assurance testing is in addition to source quality control testing, when required, and field quality control testing required under Article 3.4 of this Section.
   2. Materials used in the Work may require testing and retesting, as directed by ENGINEER, during the Project. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be performed at OWNER's expense, including retesting of rejected materials and installed Work, shall be performed at CONTRACTOR’s expense.
   3. CONTRACTOR’s Quality Assurance Testing Laboratory Scope:
      a. Use of testing laboratory shall not relieve CONTRACTOR of responsibility for providing materials and the Work in compliance with the Contract Documents.

b. Quality assurance testing laboratory shall perform the following, unless evidence of material compliance with reference specifications indicated in Paragraph 1.3.B of this Section, is submitted to ENGINEER by CONTRACTOR and asphalt concrete production facility:
   1) Test in accordance with reference specifications indicated in Article 1.3 of this Section. In lieu of quality assurance testing submit evidence and certification of material compliance with reference specifications. When evidence of conformance submitted is not acceptable to ENGINEER, perform quality assurance testing.

c. To facilitate testing services, CONTRACTOR shall:
   1) Secure and deliver to testing laboratory and ENGINEER (when requested by ENGINEER) representative Samples of materials that CONTRACTOR proposes to furnish and that are required to be tested.
   2) Furnish such labor as is necessary to obtain and handle Samples at the Site or at asphalt concrete production facility and other material sources.
   3) Advise testing laboratory and ENGINEER sufficiently in advance of operations to allow for completion of quality assurance tests and for the assignment of personnel.

1.4 SUBMITTALS

A. The Submittals required in 1.4.B and 1.4.C apply to non-SCDOT work. Any work involving SCDOT roads are subject to SCDOT submittal procedures.

B. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit the proposed asphalt concrete mix design for each asphalt concrete material, and other bituminous materials, required under this Section, providing complete data on materials, including location in the Work, source, material content and percentages, temperatures and all other pertinent data. Indicate proportion of bituminous material from reclaimed asphalt pavement.
      b. Proposed gradation for each aggregate to be used in flexible paving. Submit gradation test results for the same material furnished on a previous project. Indicate the proportion of reclaimed asphalt pavement.
      c. In lieu of the information required under Paragraphs 1.4.B.1.a and 1.4.B.1.b, above, submit certificates of compliance with the reference specifications indicated in Part I of this Section, for each for the following:
         1) Each mix design required.
         2) Bituminous materials required.
         3) Aggregates to be used in flexible paving, from each material source and each required gradation.
         4) Density of uncompacted asphalt concrete material.
         5) Density of previously-compacted, previously-tested asphalt concrete material.
         6) Density and voids analysis for each asphalt concrete material test specimen.
         7) Evidence of asphalt concrete plant inspection and compliance with the reference specifications indicated in Part I of this Section.
         8) Proportion of reclaimed asphalt pavement in bituminous materials and aggregate.
   2. Product Data:
      a. Manufacturer's complete product data on all pavement marking materials proposed for use, including product literature, specifications, and recommended application techniques and other installation data.

C. Informational Submittals: Submit the following:
   1. Quality Assurance Test Data Submittals and Source Quality Control Submittals:
      a. Submit for quality assurance tests and source quality control tests required.
   2. Delivery Tickets:
      a. Submit copy of delivery ticket for each load of asphalt concrete, tack coat materials, and other materials obtained from asphalt concrete production facility, signed by CONTRACTOR
   3. Field Quality Control Submittals:
      a. Submit results of required field quality control testing.
   4. Qualifications:
      a. Asphalt concrete production facility, when required by ENGINEER.
      b. CONTRACTOR's testing laboratory, when required by ENGINEER.

1.5 SITE CONDITIONS

A. Weather Limitations:
   1. Temperature:
      a. For base course and binder course paving lifts equal to or greater than two inches thickness, atmospheric temperature shall be 40 degrees F and rising.
      b. For surface course paving or other pavement courses in lifts less than two inches thick, temperature of surface on which pavement is to be placed shall be 50 degrees F or greater.
   2. Prohibitions:
      a. Do not place flexible paving materials when weather is foggy or during precipitation.
      b. Do not place flexible paving materials when the base on which the material will be placed contains moisture in excess of optimum.
      c. Place flexible paving materials only when ENGINEER concurs that weather conditions are suitable.

PART 2 PRODUCTS

2.1 SYSTEM PERFORMANCE

A. System Description:
   1. Provide subbase course of the thickness shown on the Drawings, in accordance with Section 31 23 05, Excavation and Fill.

2.2 ASPHALT CONCRETE MIXES

A. Asphalt Concrete Mixtures: Provide the following materials designed and manufactured in accordance with reference specifications indicated in Part I of this Section:
   1. Base Course: Comply with Section 309 of SCDOT Standard Specifications for Highway Construction.
   2. Binder Course: Comply with Section 402 of SCDOT Standard Specifications for Highway Construction and obtain from sources listed on the most recent edition of SCDOT Qualified Products List 37.
   3. Surface Course (Wearing Course, Top Course): Comply with Section 403 of SCDOT Standard Specifications for Highway Construction.

2.3 BITUMINOUS MATERIALS

A. Bituminous Materials for Asphalt Concrete:
   1. Bituminous materials for asphalt concrete shall comply with Section 401 of the SCDOT Standard Specifications for Highway Construction, for the asphalt concrete mixes specified.

2.4 AGGREGATES IN FLEXIBLE PAVEMENTS

A. Aggregates for Asphalt Concrete – General:
   1. Aggregate materials used in flexible pavement shall be in accordance with Section 401 of the SCDOT Standard Specifications for Highway Construction, for the asphalt concrete mix designs indicated.

2.5 PAVEMENT MARKING MATERIALS

A. Material: Pavement marking materials shall be in accordance with Section 625 for fast dry waterborne paint markings, Section 626 for epoxy pavement markings, and Section 627 of the SCDOT Standard Specifications for Highway Construction for thermoplastic pavement markings.

B. Colors:
   1. Roadway Center Markings Between Opposing Traffic Lanes: Yellow.
   2. Roadway Side Striping: White, unless otherwise shown or specified. On roads with divided median, right-side striping of each direction shall be white, and left-side striping shall be yellow.
   3. Roadway Miscellaneous Lane Markings (turn lane arrows and text): White.
   4. No-Parking Areas: Yellow.
   5. Handicap Parking Spaces: Unless otherwise indicated with signs, provide handicap symbol on pavement with white paint on blue background.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the subbase and base on which flexible paving will be installed. Notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Do not place materials on subgrades, or subbase that is muddy or has water thereon.

3.2 PREPARATION

A. Preparation: Before starting installation of flexible paving, perform the following:
   1. Grade Control: Establish and maintain throughout flexible paving installation the required lines and grades, including crown and cross-slope for each asphalt concrete course during construction operations.

2. Prepare subgrade and provide subbase for flexible pavement in accordance with Section 31 23 05, Excavation and Fill. Before installing flexible pavement, obtain ENGINEER's concurrence that subgrade and subbase are suitable for installing flexible pavement.
3. Coordinate placement of flexible pavement with York County Ordinance No. 154 and the Work including drainage structures, manholes, valve boxes, and similar items.
4. Provide appropriate maintenance and protection of traffic measures during placement of pavement.

B. Milling:
1. Perform milling of existing pavement where shown or indicated.
2. "Milling" consists of the milling, shaping, and removing portions of existing surfaces by cold milling process and subsequent cleaning.
3. Milling Equipment:
   a. Milling machines shall be power-operated, self-propelled machines capable of removing the desired thickness of existing surfaces. Machines shall have sufficient power, traction, and stability to accurately maintain depth of cut and slope. Machines shall produce a finished profile and cross slope to within 1/4 inch of that required and shall produce uniform surface texture free of gouges and ridges greater than 3/8-inch deep.
   b. Machines shall be equipped with a means to control dust and other particulate matter created by the cutting action.
   c. Provide equipment that removes milled material as quickly as the rate of milling.
   d. Use vacuum trucks, street sweepers or power brooms to clean milled surfaces.
4. Milling Operations:
   a. Perform milling to so that, when final course of pavement is placed, required elevations and grades are provided. Where required, establish a taut reference string line to control line and grade of milling.
   b. Minimize the time between milling and placement of pavement over milled surface.
   c. Areas not accessible to the milling machine, such as around or adjacent to drainage structures, manholes, curbs, and transverse joints on structures, may be removed by a small milling machine, handwork or other method acceptable to ENGINEER.
   d. Remove milled material as soon as it is milled. Remove fines and other material prior to opening milled area to traffic. Control objectionable dust emissions. When traffic has been allowed into milled area or when more than 48 hours have elapsed since milling, clean the milled area again prior to applying tack coat.
   e. Maintain drainage to drainage inlets and other drainage structures in a manner acceptable to ENGINEER.
   f. Properly dispose of milled material at a location away from the Site.

C. Surface Preparation:
1. Repair surface defects in existing pavement to provide uniform surface to receive new pavement.
2. Provide crack sealant to completely fill cracks more than 1/16-inch wide in areas shown or indicated on the Drawings.
3. Clean existing surfaces over which asphalt concrete pavement will be installed, by removing from the surface foreign material, excess asphalt concrete, excess joint sealant, and crack filler, and other undesirable matter.
4. Provide tack coat as indicated in Part 3 of this Section.

3.3 INSTALLATION OF FLEXIBLE PAVING

A. General:
   1. Provide final pavement surfaces of uniform texture, at required grades and cross-sections.
   2. Construct roadways to the lines, grades, and typical sections shown or indicated.

B. Installation of Asphalt Concrete:
   1. Asphalt concrete mixture shall be transported to the site of paving and placed as soon as possible after mixing.
   2. Placement of each asphalt concrete course shall be completed over the full width of the section under construction during each day's paving operations.
   3. Spread and finish asphalt concrete courses by means of self-propelled mechanical spreading and finishing equipment. Compacted thickness of layers placed shall not exceed 150 percent of specified thickness unless approved in writing by ENGINEER.
   4. Compaction:
      a. Rollers:
         1) Use sufficient rolling equipment to satisfactorily compact and finish the quantity of asphalt concrete placed. There shall be not less than two rollers on the Project at all times. When acceptable to ENGINEER, one of the rollers may be a pneumatic-tire roller.
         2) During rolling operations, roller speed shall not exceed three miles per hour. When sufficient number of rollers is not available, reduce the quantity of asphalt concrete placed to accommodate the available rollers' speed.
         3) Required rollers shall be at the Site, in acceptable operating condition, prior to placing of asphalt concrete.
         4) Use of vibratory rollers in lieu of steel-wheeled rollers is acceptable, however when thickness of asphalt concrete is one-inch or less, rolling shall be in the static mode.
      b. Rolling of initially-placed asphalt concrete material, or breakdown rolling, shall begin as soon as the asphalt concrete mixture will bear the roller without undue displacement.
      c. Rolling shall be longitudinal, overlapping on successive trips by not less than one-half roller rear wheel width, and not more than three-quarters of roller rear wheel width. Alternate trips of the roller shall be of slightly different lengths.
      d. At all times, roller motion shall be slow enough to avoid displacing the asphalt concrete.
      e. Operate rollers continuously from breakdown of laid asphalt concrete through finish rolling.
      f. Perform finish rolling using a steel-wheeled roller or a vibratory steel-wheel roller operating in the static mode.
      g. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
      h. At each location not accessible to roller, thoroughly compact asphalt concrete with tampers and finish, where necessary, with a hot smoothing iron to provide uniform, smooth layer over the entire area so compacted.
   5. Each compacted asphalt concrete course shall be within plus or minus 1/4-inch of the indicated thickness.
   6. Placement of Adjacent Strips of New Asphalt Concrete:
      a. When more than one width of asphalt concrete material will be placed, a six-inch wide strip of asphalt concrete adjacent to the area on which the future material is to be placed shall not be rolled until such future material is placed.
      b. Do not leave the unrolled strip unrolled for more than two hours after placement, unless the six-inch unrolled strip is first heated with a joint heater.

c. After the first strip or width of asphalt concrete is compacted, place, finish, and compact the second width or strip as required for the first width, except that rolling shall be extended to include the six-inch strip of the first width not previously compacted.

C. Construction Joints:
1. Construction joints shall be made in such a manner as to ensure a neat junction, thorough compaction, and bond throughout.
2. Provide a transverse joint extending over the full width of the strip being laid and at right angles to its centerline at end of each workday and at other times when the placement of hot-mix asphalt concrete will be suspended for a period of time that will allow asphalt concrete mixture to chill.
3. Thoroughly compact by rolling the forward end of a freshly laid strip of asphalt concrete before the asphalt concrete mixture becomes chilled. When the Work is resumed, the end shall be cut vertically for the full depth of the layer.

D. Joining of Pavements:
1. When pavement is to join existing or previously-laid pavement, the existing or previously-laid pavement shall be neatly and carefully edged to allow for overlapping and feathering of the subsequent course of asphalt concrete material.
2. Where new pavement is to meet existing pavement, the existing pavement shall be sawcut and notched.
3. Where new pavement will meet existing asphalt pavement, remove existing pavement 12 inches onto undisturbed existing pavement course at edges where new pavement will meet existing pavement.
4. Tack Coat:
a. Provide tack coat material at the following locations:
1) At edges where new pavement will connect to existing or previously-installed pavement.
2) On surface of existing or previously-installed pavement course over which new pavement will be installed, prior to placement of the subsequent pavement course. Tack coat may be deleted when a succeeding layer of asphalt pavement is being applied over a freshly-placed asphalt pavement course that has been subjected to very little or no traffic, with approval of ENGINEER
3) Where new pavement will abut curbing, concrete gutters, drainage structures and frames, manhole cover frames, valve boxes, and similar items.
b. Tack Coat Installation: Install tack coat immediately prior to installing pavement. Place pavement while tack coat is wet. Apply tack coat in accordance with reference specifications indicated in Part I of this Section.

E. Curing:
1. Do not allow traffic onto pavement until directed by ENGINEER. Traffic will not be allowed on new asphalt concrete pavement until surface temperature is less than 140 degrees F.
2. Hold construction traffic on new pavement to a minimum as acceptable to ENGINEER.

F. Asphalt Concrete Curbs: Provide extruded asphalt curbs of the height and profile indicated on the Drawings.

G. Defective Pavement Work:

1. When directed by ENGINEER, remove and replace defective flexible paving Work. Cut out such areas of defective pavement and fill with fresh asphalt concrete materials, compacted to required density.

3.4 ADJUSTING

A. Frames and Covers:
   1. Set frames of drainage structures, manholes, valve boxes, and similar items to final grade. Adjust frames of existing structures and frames furnished under other Sections. Frames shall be substantially similar elevation to finished surface course of pavement.
   2. Replace covers and gratings of existing structures immediately following adjusting associated frames. Install covers and gratings of structures provided under the Project as quickly as possible.
   3. Where there is a delay between adjusting of frames and installation of surface course, provide temporary bituminous material around perimeter of each frame to smooth vehicle access over the frame. Maintain and repair temporary bituminous material as required until placement of surface course. Remove temporary bituminous material before installing surface course.

B. Pavement Adjustment:
   1. Repair or replace in manner acceptable to ENGINEER areas of pavement that are observed to pond or collect water.

3.5 CLEANING

A. Cleaning: After completing the paving operations, clean surfaces of excess or spilled bituminous materials, excess asphalt concrete, and foreign matter.

3.6 PROTECTION

A. Protect finished pavement until pavement has become properly hardened and cool.

B. Cover openings of drainage structures, manholes, valve boxes, and similar items in the paved area until permanent coverings are provided.

3.7 PAVEMENT MARKINGS

A. Pavement Markings: Provide pavement markings where shown or indicated.
   1. Preparation:
      a. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
      b. Do not begin marking bituminous concrete pavement until approved by ENGINEER.
      c. When reflective glass beads are required, mix with paint prior to paint application.
   2. Application:
      a. Using mechanical equipment, provide uniform, straight edges in two separate coats. Apply in accordance with paint manufacturer's recommendations.

END OF SECTION

SECTION 32 92 00

LAWNS AND MEADOWS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install all lawns and meadows.
   2. Extent of lawns and meadows is shown.
   3. Types of products required include the following.
      a. Topsoil.
      b. Lawn grass seed.
      c. Meadow grass seed mixture.
      d. Wildflower meadow seed mixture.
      e. Inorganic soil amendments.
      f. Organic soil amendments.
      g. Fertilizers.
      h. Mulches.
      i. Erosion-control materials.
      j. Accessories.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, lawns and meadows.

C. Related Sections:
   1. Section 31 11 00, Clearing and Grubbing.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. Association of Official Analytic Chemists, (AOAC).
      a. Official Methods of Analysis of AOAC International.
   2. Association of Official Seed Analysts, (AOSA).
      a. Journal of Seed Technology; Rules for Testing Seeds.
   3. American Society of Agronomy, (ASA).
      a. Reference No. 1 - Methods of Soils Analysis, Soil Science Society of America, Incorporated.
   4. American Society for Testing and Materials, (ASTM).
      a. ASTM B 221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
      b. ASTM C 602, Specification for Agricultural Liming Materials.
      c. ASTM D 75, Practice for Sampling Aggregates.
      d. ASTM D 977, Specification for Emulsified Asphalt.
      e. ASTM D 2487, Practice for Classification of Soils for Engineering Purposes (United Soil Classification System).
      f. ASTM D 5268, Specification for Topsoil Used for Landscape Purposes.

g. ASTM E 329, Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

5. South Carolina Department of Transportation (SCDOT).
   a. Qualified Products List 88.
   b. Supplemental Technical Specification SC-M-810-4.
6. South Carolina Department of Health and Environmental Control (SCDHEC) Storm Water Management BMP Handbook, Appendix C.

1.3 DEFINITIONS

A. The term “finish grade” shall be used to describe the finished surface elevation of planting soil.

B. The term “manufactured topsoil” shall be used to describe soil produced off-Site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil acceptable as a component of loam.

C. The term “loam” shall be used to describe topsoil that has been mixed with additional organic and inorganic additives, as specified.

D. The term “percentage pure live seed” shall be defined as the percent (%) purity multiplied by percent (%) germination divided by 100 to equal the percent pure live seed (PLS) and shall be calculated for all seed lots using each seed lots own unique purity and germination test results. A PLS pound shall be defined as the bulk weight of seed required to equal one pound of 100 percent pure, germinated seed.

E. The term “subgrade” shall be used to describe the surface of subsoil remaining after completing excavation; or the top surface of a fill or backfill immediately beneath topsoil and which has not been tested for acceptable use as topsoil.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Engage a single landscape installer skilled, trained and with successful and documented experience in the planting of lawns and meadows and with specific skill and successful experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit names and qualifications to ENGINEER along with the following information on a minimum of three successful projects:
      a. Names and telephone numbers of owner, architects or engineers responsible for projects.
      b. Approximate contract cost of the lawns and meadows.
      c. Amount of area installed.
   2. Installer’s Site Supervisor: Require installer to maintain an experienced full-time landscape supervisor on-Site during the time of preparation for, and planting of, lawns and meadows. Supervisor shall have achieved landscape or horticultural certification acceptable to governing authorities having jurisdiction at the Site.
   3. Ratio of laborers to certified landscape supervisors shall not exceed 12 to one. Certified landscape supervisor shall be on-Site throughout the day-to-day performance of the Work of this Section.

4. Application of herbicides, chemicals and insecticides shall be done by personnel licensed to perform such applications by governing authorities having jurisdiction at the Site and in accordance with each manufacturer's instructions provided on each product label.

B. Soil-Testing Laboratory Qualifications:
   1. An independent laboratory, recognized by governing authorities having jurisdiction at the Site, with the experience and capability to conduct testing indicated and that specializes in types of soil tests to be performed.
   2. To qualify for approval, an independent testing agency shall demonstrate to ENGINEER'S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work, in accordance with ASTM E 329.

C. References: Comply with the applicable references in Article 1.2.

D. Soil Analysis: Furnish report of soil analysis to ENGINEER, prepared by a qualified soil-testing laboratory, stating percentages of organic matter; mechanical gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious materials content; pH; and mineral and plant-nutrient content of soil. Chemical analysis shall include tests for percentages of nitrate nitrogen, ammonium nitrogen, phosphorus, potassium, calcium, iron, manganese, copper, zinc, extractable aluminum, and total soluble salts.
   1. Existing On-Site Soil:
      a. Separate soil stockpiled and proposed for use as topsoil for lawns and meadows into 1000 cubic yard piles and label with a numbering system used to reference all soil samples and test results.
      b. Obtain a one cubic foot representative sample for each 1000 cubic yards of soil stockpiled on-Site proposed for use as topsoil for lawns and meadows, in compliance with ASTM D 75 and Appendixes, for securing samples from stockpiles.
      c. Place samples taken from each stockpile, into separate clean, new and previously unused, containers and mix thoroughly. Maintain separation and legible labeling of each sample taken from each stockpile, throughout the process of mixing, drying and delivering to soil analysis laboratory. Label samples on outside of container.
      d. Take one cup of soil from each container and allow to dry at room temperature. Once dry, place each one-cup sample in a separate, accurately labeled, new and previously unused one-cup sized plastic container, seal tightly and deliver to soil testing laboratory.
      e. Report suitability of soil as a topsoil component for lawn and meadow plant growth. State recommended quantities of nitrogen, phosphorus, secondary and micronutrients, potash and soil amendments to be added to produce satisfactory topsoils. Include calculations, types of fertilizer and recommendations for application rates in either gallons or pounds per cubic foot of soil.
      f. In addition, all on-Site soil that will be used as topsoil shall be provided with additional compost and peat moss amendments specified, whether or not testing indicates positive need for such amendments, for such material to be used as loam.
   2. Manufactured Imported Topsoil:

a. Test each 1000 cubic yards of manufactured topsoil at the proposed source. In addition, after ENGINEER'S approval of manufactured topsoil based on results and recommendations of soil testing reports, test each 1000 cubic yards of manufactured topsoil that is delivered to the Site for conformance to results and recommended modifications of approved soil test reports. Manufactured topsoil that differs from proposed source material, after modification according to recommendations of soil test reports, shall be rejected for use in the Work.
b. Obtain a one cubic foot representative sample for each 1000 cubic yards of manufactured topsoil proposed for lawn and meadow Work, in compliance with ASTM D 75 and Appendixes, for securing samples from stockpiles.
c. Place samples taken from each stockpile into separate clean, new and previously unused, containers and mix thoroughly. Maintain separation and legible labeling of each sample, taken from each stockpile, throughout the process of mixing, drying and delivering to soil analysis laboratory. Label samples on outside of container.
d. Take one cup of topsoil from each container and allow to dry at room temperature. Once dry, place each one-cup sample in a separate, accurately labeled, new and previously unused one-cup sized plastic container, seal tightly and deliver to soil testing laboratory.
e. Report suitability of manufactured topsoil as a component for lawn and meadow plant growth. State recommended quantities of nitrogen, phosphorus, secondary and micronutrients, potash and soil amendments to be added to produce satisfactory manufactured topsoil. Include calculations, types of fertilizer and recommendations for application rates in either gallons or pounds per cubic foot of manufactured topsoil.
f. Organic component of manufactured topsoil shall be obtained from compost and peat moss amendments specified, for such material to be used as loam.

E. Source Quality Control:
1. Analysis and Standards: Package all products with manufacturer's certified analysis performed in accordance with methods established by AOAC, wherever applicable, or as specified.
2. Provide manufactured imported topsoil from a commercial processing facility specializing in the manufacture of topsoil.
3. Seed that has been stored at temperatures, or under conditions not recommended by the seed supplier, or has become wet, moldy, or otherwise damaged, shall not be acceptable. The PLS for each seed lot shall be 75 percent, minimum.
4. Certify that all seed has been stored under conditions recommended by the seed supplier and has not been subjected to conditions damaging to PLS percentages.
5. Seed may be mixed by an approved method on-Site or at the seed supplier's facilities. If the seed is mixed on-Site, each variety shall be delivered in the original containers and shall bear the supplier's certified analysis. Where seed is mixed by the seed supplier, provide ENGINEER with the seed supplier's certified statement as to the composition of the mixture.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
a. Schedule for lawn and meadow-planting showing anticipated planting dates for each type of Work.

2. Product Data:
    a. Manufacturer's product data, specifications and installation instructions for all required materials.
    b. Composition and analysis of commercial fertilizers and all purchase receipts showing the total quantity actually purchased for this Project.
    c. Proportions of each component contained in hydro seed mixture. Identify number of pounds of each component required for each 100 gallons of water. Include the number of square feet of lawn, grass meadow or wildflower meadow mixture that can be installed with each full tank of hydro seed mixture.
    d. PLS for each type of seed and each seed lot. Include bulk weight of seed required to equal one pound of 100 percent pure, germinated seed.
3. Samples:
    a. Submit 12-inch by 12-inch sheet of erosion control fabric with manufacturer's selections of standard biodegradable filler papers, and yarns.

B. Informational Submittals: Submit the following:
1. Certificates:
    a. Certification of Grass and Wildflower Seed: For each grass-seed monostand and seed mixture, furnish seed supplier's certification stating the botanical and common name, and percentage by weight of each species and variety, and percentage of purity, germination and weed seed. Include the year of production and date of packaging. Certify that seed has been stored in compliance with all recommendations of the seed supplier.
    b. Certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's certified analysis for soil amendments and fertilizer materials. For standard products submit other data substantiating that materials comply with specified requirements.
2. Test Reports: Submit the following:
    a. Soil analysis reports for existing soil and imported manufactured topsoil, as specified. Include recommendations for remediating existing soil into acceptable topsoil.
3. Qualifications Data: Submit qualifications data for the following:
    a. Landscape installer.
    b. Landscape supervisor.
    c. Testing agency.
4. Source Quality Control Submittals
    a. Written statement providing the location from which manufactured topsoil is to be obtained and the names and addresses of the suppliers.

C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data:
    a. Submit recommended procedures to be established by OWNER for the maintenance of lawns and meadows for one full year. Submit prior to expiration of required maintenance period.
2. Warranty Documentation:
    a. Submit written warranty, signed by CONTRACTOR and landscape installer, as specified.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
   1. Do not deliver seed until Site conditions are ready for installation.
   2. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery.
   3. Deliver seed in undamaged, original containers, sealed by the supplier and indicating compliance with approved Shop Drawings.
   4. Inspect lawn and meadow materials upon arrival at Site. Immediately and permanently remove unacceptable materials from Site.

B. Storage of Materials:
   1. Store and cover materials to prevent deterioration. Remove packaged materials that become wet or show deterioration or water marks from the Site.
   2. Seed that becomes wet, moldy or damaged during the time of storage on-Site or that has been damaged during transit is not acceptable.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Proceed with and complete lawn and meadow planting as rapidly as portions of the Site become available, working within the seasonal limitations for each type of lawn, grass and wildflower planting required.
   2. Proceed with planting only when current and forecasted weather conditions are favorable to successful planting and establishment of lawns and meadows.
      a. Do not spread seed when wind velocity exceeds five miles per hour.
      b. Do not plant when drought, or excessive moisture, or other unsatisfactory conditions prevail.
   3. Herbicides, chemicals and insecticides shall not be used on areas bordering wetlands.

B. Scheduling:
   1. Coordinate planting with specified extended service periods to provide required service from date of Substantial Completion. Plant during one of the following periods:
      a. Permanent Seeding:
         1) Comply with recommendations of supplier.
      b. Temporary Seeding:
         1) Comply with recommendations of supplier.
   2. Do not begin lawn and meadow planting until water, acceptable for use and adequate in supply, is available on-Site and can be successfully transported to the areas of Work. Coordinate provision of adequate and acceptable water supply with Project Schedule.
   3. Do not proceed with installation of loam until all subgrade utility services have been installed, are operating successfully and have been approved by ENGINEER.

C. Pre-installation Conference:
   1. Prior to commencement of lawn and meadow planting and associated Work, CONTRACTOR shall schedule and meet at the Site with the landscape installer, the installers of other Work in and around lawn and meadow areas that follows the lawn and meadow Work, including fencing Work; and ENGINEER and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to the lawn and meadow Work, including the following:
      a. Review Project requirements and the Contract Documents.

b. Review required submittals, both completed and yet to be completed.
c. Review availability of water and methods of delivery.
d. Review status of below-grade work and required access during lawn and meadow planting and establishment.
e. Review Project Schedule and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
f. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
g. Review procedures required for protection of lawns and meadows during the remainder of the construction period.
h. Review required inspection, testing, and certifying procedures.

2. Record the discussions of the Pre-installation Conference and the decisions and agreements or disagreements reached, and furnish a copy of the record to each party attending.
3. Record all revisions or changes agreed upon, reasons therefor, and parties agreeing or disagreeing with them.
4. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

1.8 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents.

B. Special Warranties: Warranty lawns and meadows through the specified extended service period.

1.9 EXTENDED SERVICE

A. Extended Lawn Service:
1. Begin extended service immediately after each lawn area is acceptably established. Provide extended service for not less than the following periods:
2. Seeded Lawns: Sixty days from date after lawn areas are acceptably established.
a. When full service period has not elapsed before end of planting season, or if lawn is not acceptably established, continue service during next planting season.
3. Service lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
a. In areas where mulch has been disturbed by wind or extended service operations, add new mulch. Anchor as required to prevent displacement.
4. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources. Keep newly germinated plants uniformly moist to a depth of 4-inches, applied at a minimum rate of 1-inch per week, or greater as required to maintain minimum moisture depth specified. Provide and maintain watering gages and soil moisture probes until end of maintenance period.
a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

b. After plants have their first true leaves and grasses show mature blades, watering shall be performed to provide moisture to a depth of 6-inches, and not performed again until top 1-inch of loam has dried.

5. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass-leaf height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height:
   a. Bent Grass: Mow to 1/2-inch high or less.
   b. Bermuda Grass: Mow 1/2 to 1-inch high.
   c. Carpet, Centipede, Perennial Rye and Zoysia Grasses: Mow 1 to 2-inches high.
   d. Kentucky Bluegrass and Buffalo, Annual Rye and Chewings Red Fescue Grasses: Mow 1-1/2 to 2-inches high.
   e. Bahia, Turf-Type Tall Fescue and St. Augustine Grasses: Mow 2 to 3-inches high.
6. Lawn Fertilization: Apply fertilizer after initial mowing and when grass is dry.
   a. Use fertilizer that will provide actual nitrogen of at least one pound for each 1000 square feet of lawn area.
7. After seed has passed its expected germination period, reseed all areas and parts of areas that fail to show a uniform stand of grass. Reseed repeatedly until all areas are covered with grass.

B. Extended Meadow Service:
1. Begin extended service immediately after each meadow area is satisfactorily established and continue for not less than 40 days.
2. Service meadow by watering, weeding, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch.
3. Watering: Provide and maintain temporary piping, hoses, and meadow- watering equipment to convey water from sources. Keep meadow uniformly moist to a depth of 6-inches. Provide and maintain watering gages and soil moisture probes until end of maintenance period.
   a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
   b. Water meadow at a rate in accordance with supplier's written recommendations. Water at controlled rates that are less than the rate at which the soil can absorb water to prevent runoff.
   c. After plants have their first true leaves and grasses show mature blades, perform watering to provide moisture to a depth of 8-inches, and do not perform again until top 1-inch of loam has dried.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil:
1. All soil accepted as topsoil, whether obtained from on-Site or off-Site sources, shall comply with specified topsoil analysis.

2. Provide fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth; free of any admixture of subsoil, clods of hard earth, plants or roots, sticks, stones larger than 1-inch in diameter, or other extraneous material harmful to plant growth, in compliance with ASTM D 5268. Provide topsoil with the following analysis:
    a. 3/4-inch mesh: 100 percent passing.
    b. No. 4-sieve: 90 to 100 percent passing.
    c. No. 200-sieve: 0 to 10 percent passing.
    d. Clay content of material passing No. 200-sieve not greater than 60 percent, as determined by hydrometer tests.
    e. pH-adjusted with ferrous sulphate or ground limestone to provide pH 5.5 to pH 7.0 at time of installation of lawns, grass and meadow areas, unless particular species of grass or wildflower stand requires a different pH to meet its growing needs.
    f. Electrical conductivity of a 1:2 soil-water suspension shall not exceed 1.0 milliohm per centimeter and with less than 200 parts per million of extractable aluminum.
    g. Cation Exchange Capacity: 5, minimum.
    h. Organic content not less than five percent, as determined by ignition loss of oven-dried samples passing No. 10-sieve (Muffle Furnace Temperature: 110 plus or minus five degrees C for eight hours).
    i. Free of pests and pest larvae.
3. Topsoil Source: Reuse surface soil stockpiled on-Site, where possible. Verify suitability of stockpiled surface soil to produce topsoil, as specified. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    a. Supplement acceptable on-Site soil with manufactured topsoil from off-Site sources, when quantities available on-Site are insufficient to complete the Work.

B. Lawn Grass Seed:
1. Lawn Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by AOSA. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, specified.
2. Seed Species: Provide seed in compliance with SCDHEC Storm Water Management BMP Handbook Appendix C for turf-type grasses.

C. Meadow Grass Seed:
1. Tall Grassy Meadow with Minor Forbs: Provide a mixture of fresh, clean, new-crop seed complying with the tolerance for purity and germination established by AOSA. Provide seed of each species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed specified.
2. Seed Species: Provide seed in compliance with SCDHEC Storm Water Management BMP Handbook Appendix C .

D. Wildflower Meadow Seed:
1. Wildflower Meadow with Minor Grasses: Provide a mixture of fresh, clean, new-crop seed complying with the tolerance for purity and germination established by AOSA. Provide seed of each grass and forb species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed specified.
2. Seed Species: Seed of grass and forb species as follows, with not less than 80.0 percent germination, not less than 80 percent pure seed, and not more than 1.0 percent weed seed by weight:

a. Provide seed in compliance with Table 1 of SC-M-810-4 for legumes.

E. Inorganic Soil Amendments:
   1. Ground Oolitic Limestone: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
      a. Class: Class T, with a minimum 99 percent passing through No. 8-sieve and a minimum 75 percent passing through No. 60-sieve.
   2. Perlite: Agricultural-grade, expanded pumice.
   3. Agricultural Gypsum: Commercial-grade and finely ground, containing a minimum of 90 percent calcium sulfate.
   4. Grit Aggregate: Commercial-grade filter sand consisting of hard, durable rounded grains of quartz or other rock that do not compact to a solid mass when wet, with a pH in the range required for topsoil. Provide clean, washed, natural or manufactured aggregate, free of toxic materials, salt and other chemical contamination.

F. Organic Soil Amendments:
   1. Compost: Well-composted, stable, weed-free organic matter, produced by the aerobic decomposition of organic residues; pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch screen; soluble salt content of 5 to 10 decisiemens/meter; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
      a. Organic Matter Content: 50 to 60 percent of dry weight.
      b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
   2. Peat: Partially decomposed stems and leaves of several species of sphagnum moss; finely divided or granular texture. Supply shredded material, free from lumps, wood, roots, stones, decomposed collodial residue and other extraneous foreign matter, capable of passing through a 1/2-inch screen, which can easily be incorporated with the soil. Supply material, which has been conditioned in storage piles after excavation for at least six months, including one freezing and thawing period. Supply peat humus with the following analysis:
      a. Not less than 90 percent organic matter by weight on an ovendry basis.
      b. pH range of 3.4 to 4.8.
      c. Moisture content 35 percent at time of incorporation into soil.
      d. Water absorbing ability 150 percent to 350 percent by weight.
   3. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
   4. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

G. Fertilizers:
   1. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of four percent nitrogen and 20 percent phosphoric acid.
   2. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
   3. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

a. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports.

4. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   a. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

H. Mulches:
1. Straw Mulch: Provide air-dry, clean, mildew- and certified seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
2. Peat Mulch: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
3. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch screen; soluble salt content of 5 to 10 decisiemens/meter; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   a. Organic Matter Content: 50 to 60 percent of dry weight.
   b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
4. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
5. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
6. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant- growth or germination inhibitors.

I. Erosion-Control Materials:
1. Erosion-Control Blankets: 100 percent biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended 6-inches long steel wire staples.
2. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 pounds per cubic yard, with 50 to 65 percent open area. Include manufacturer's recommended 6-inches long steel wire staples.

J. Accessories:
1. Provide herbicides, chemicals and insecticides as needed for disease, fungus or pest control. All herbicides, chemicals and insecticides shall be bear approval labels indicating they are approved by the United States Department of Agriculture for the intended uses and application rates.
2. Post Emergent Crab Grass and Plantain Chemical: Provide recommended post emergent crab grass and plantain control throughout the maintenance period to ensure germinated and established lawns free of crab grass and other undesirable grasses and forbs.
3. Wood Edging: Of sizes shown, and wood stakes as follows:
   a. Species: All Heart Redwood or Western Red Cedar, All Heart.
   b. Stakes: Same species as edging, 1-inch by 2-inches by 18-inches long in nominal size, with galvanized nails for anchoring edging.

4. Steel Edging: Standard commercial steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
    a. Edging Size: 1/4-inch wide by 5-inches deep.
    b. Stakes: Tapered steel, a minimum of 15-inches long.
    c. Accessories: Standard tapered ends, corners, and splicers.
    d. Finish: Zinc-coated.
    e. Paint Color: Black.
5. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221, alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.
    a. Edging Size: 3/16-inches wide by 5-1/2-inches deep.
    b. Stakes: Aluminum, ASTM B 221, alloy 6061-T6, approximately 1-1/2- inches wide by 12-inches long.
    c. Finish: Black anodized.
6. Polyethylene Edging: Standard black polyethylene edging, V-lipped bottom horizontally grooved, extruded in standard lengths, with 9-inch steel angle stakes.
    a. Edging Size: 0.07-inch wide by 5-inches deep.
    b. Top Profile: Round top; 1/2-inch diameter.

K. Water: Acceptable for lawn and meadow application and containing no material harmful to plant growth and establishment.

2.2 LOAM MIXES

A. Follow recommendations of soil-testing laboratory for modifying on-Site soil and manufactured soil, for use as topsoil.

B. On-Site soil and manufactured soil that has been provided with all inorganic soil amendments and fertilizers recommended by soil-testing laboratory, and acceptable for use as topsoil, shall be mixed with an additional organic soil amendment mix in a ratio of two parts topsoil to one part organic soil amendment mix, by volume.
    1. Prepare soil amendment mix by combining 40 percent compost, 40 percent peat moss, ten percent wood derivatives, five percent well-rotted manure and five percent grit aggregate, by volume.

C. Loam: Thoroughly blend topsoil with organic soil amendment mix and use as planting media for all lawn and meadow Work.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which lawn and meadow Work is to be performed, and notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Thoroughly blend and mix loam before spreading. Incorporate fertilizers, and ground limestone or acidulant, after spreading, as specified, and at rates recommended by soil-testing laboratory.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding overspray.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Perform percolation tests on existing subgrade and placed fills prior to fine grading.
   1. Perform percolation testing of subgrades and placed fills to determine whether or not the subgrade will drain properly. Perform percolation tests in accordance with the following procedure:
      a. Dig a hole in the subgrade that is 4-inches in diameter and 12-inches deep.
      b. Fill the hole with water and wait for the water to completely drain from the hole.
      c. Immediately refill the hole with water and measure the rate of fall in the water level.
   2. In the event that water drains at a rate less than 1-inch in one hour, excavate soil to a minimum depth of 24-inches, and deeper, as necessary to break the compaction. Backfill, recompact and retest each area so prepared to confirm drainage rates exceed one inch in one hour.
   3. Perform minimum of one soil percolation test for every 10,000 square feet of lawn and meadow area.

E. Excavate or fill subgrade, as required, to bring subgrade to elevations shown. Maintain all angles of repose. Confirm that subgrade is at proper elevations and that no further earthwork is required to bring the subgrade to proper elevations. Provide subgrade elevations that slope parallel to finished grade and towards subsurface drains shown.

F. Remove all construction debris, trash, rubble and all extraneous materials from subgrade. In the event that fuels, oils, concrete washout or other material harmful to plant growth or germination have been spilled into the subgrade, excavate the subgrade sufficiently to remove all such harmful materials and fill with approved fill, compacted to the required subgrade compaction level.

3.3 FINE GRADING

A. Immediately prior to dumping and spreading loam, clean subgrade of all stones greater than 2-inches and all other extraneous matter. Remove all such material from Site. Notify ENGINEER that subgrade has been cleaned, and obtain approval prior to spreading loam.

B. Do not attempt to spread excessively wet, muddy or frozen loam. Do not spread loam more than five days before seeding or planting.

C. Spread loam to a depth of 6-inches but not less than required to meet finish grades after light rolling and natural settlement.
   1. Spread approximately one-half the thickness of required loam depth. After spreading loam, rototill, disk or harrow loam and subgrade to bring top 2-inches of subgrade upward into loam layer, so that there is a transitional layer between loam and subgrade.
   2. Spread remainder of loam to required finish grades.
   3. Compact each lift sufficiently to reduce settling, but not enough to prevent the movement of water and feeder roots through loam. After compaction spread loam should offer firm, even resistance when a soil sampling tube is inserted.
   4. Phase the placement of the final lift so that wheeled vehicles do not have to travel over areas where final lifts are already in-place.
   5. Spread and compact to a smooth, uniform surface plane, to within plus or minus 1/2-inch of finish elevations. Roll and rake and remove all ridges, and fill depressions, as required. Remove all stones larger than 1-inch in any dimension and all sticks, roots, trash and other extraneous matter.
   6. Perform percolation tests as for subgrades, except limit depth of holes to 2/3 the depth of loam layer.

D. Spread ground limestone or acidulant and fertilizer, as specified. Mix ground limestone with dry loam before spreading fertilizer and work lightly into the top 4-inches of loam by harrowing or tilling at least three days before applying commercial fertilizers.

E. Grade planting areas to smooth, even surface with loose, uniformly fine texture. Remove all stones and extraneous material in excess of 1-inch diameter. Roll, rake and remove ridges and fill depressions, as required to meet finish grades.

F. Moisten prepared areas before seeding. Water thoroughly and allow surface moisture to dry before planting. Do not create a muddy loam condition.

G. Prior to seeding or planting, restore loam to specified condition, if eroded or otherwise disturbed.

3.4 CONVENTIONAL SEEDING

A. General: Maintain grade stakes until removal is mutually agreed upon by all parties concerned.

B. Rake or harrow all seedbeds immediately prior to seeding to produce a rough, grooved surface, no deeper than 1-inch. Seed only when seedbed is in a friable condition and not muddy or hard.

C. Sow seed using a spreader or seeding machine.

D. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.

E. Sow lawn grass seed mixture at the rate of not less than required by SCDHEC Storm Water Management BMP Handbook Appendix C .

F. Sow meadow grass with minor forbs seed mixture at the rate of not less than required by SCDHEC Storm Water Management BMP Handbook Appendix C.

G. Sow wildflower meadow with minor grasses seed mixture at the rate of not less than 19-pounds per acre.

H. Cultipacker, or approved similar equipment, may be used to cover the seed and to firm the seedbed in one operation. In areas inaccessible to cultipacker:
   1. Rake the seed lightly into top 1/8-inch of loam, roll in two directions with a water ballast roller, weighing not less than 100 pounds per linear foot.
   2. Take care during raking that seed is not raked from one spot to another.
   3. Protect seeded areas against erosion by spreading specified mulch after completion of seeding operations.
      a. Protect seeded areas against hot, dry weather or drying winds by applying peat moss mulch not more than 24 hours after completion of seeding operations. Presoak and scatter evenly to a depth of from 1/8-inch to 3/16-inches thick and roll to a smooth surface. Do not mound.
      b. For slopes no steeper than one on six, spread straw mulch to form a continuous loose blanket not less than 1-1/2-inch deep over seeded areas at the approximately rate of two tons-per acre.
         1) Anchor mulch by spraying with asphalt emulsion at the rate of ten to 13-gallons per 1000 square feet.
         2) Place mulch with equipment that will blow or eject, by means of a constant air stream, controlled quantities of the mulch and asphalt in a uniform pattern over the specified area. If the mulch is excessively cut or broken, take measures to reduce the cutting or breakage. Introduce the asphalt into the air stream by means of a spray arranged so that it will partially coat the mulch with a spotty asphalt tack prior to the depositing of the mulch covering. Rate of application not less than 75-gallons per ton of mulch.
      c. Protect seeded areas, with slopes exceeding one on six, by providing erosion-control fiber mesh and where slopes exceed one on four, by providing erosion-control blankets. Install erosion-control materials according to manufacturer's written instructions and as follows:
         1) Vertically down slope without stretching fabric.
         2) Install hold down staples three per square yard minimum in center of fabric or as required to hold and shape the fabric to the contours of the slope. Install hold down staples along edges and overlaps of fabric at 9 inches on centers minimum, or as required to hold and shape the fabric to the contours of the slope.
         3) Lap fabric 4-inches minimum and turn edges of fabric into 8-inch deep by 16-inch wide earth trench and fill trench with earth.

I. Using a uniform fine spray, thoroughly and evenly water seeded areas. Provide adequate water to moisten seedbed to a depth of 2-inches.
   1. Repeat this process when peat mulch color lightens. Maintain all seedbeds in a uniformly moist condition, conducive to seed germination and plant establishment, as specified.

J. Reseed areas that remain without mulch for longer than three days.

K. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

L. Prevent foot or vehicular traffic, or the movement of equipment, over the mulched areas. Reseed areas damaged as a result of such activity.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

B. Mix slurry with asphalt-emulsion tackifier.

C. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-pounds per acre dry weight, but not less than the rate required to obtain specified seed-sowing rate so that the seed comes into direct contact with loam.

D. Apply slurry cover coat of fiber mulch at a rate of 1000-pounds per acre.

3.6 RECONDITIONING EXISTING LAWNS AND MEADOWS

A. Recondition existing lawn and meadow damaged by CONTRACTOR'S operations, including areas used for storage of materials or equipment and areas damaged by movement of vehicles. Recondition existing lawns and meadow areas where minor regrading is required.

B. Recondition other existing lawn and meadow areas shown.

C. Provide fertilizer, seed and soil amendments, as specified for new lawn and meadow, and as required to provide satisfactorily reconditioned lawns and meadows. Provide new loam as required to fill low spots and meet new finish grades.

D. Till stripped, bare, and compacted areas thoroughly to a depth of 12-inches.

E. Remove diseased or unsatisfactory lawn and meadow areas; do not bury into soil. Remove topsoil containing extraneous materials resulting from CONTRACTOR'S operations including oil drippings, stone, gravel and other construction materials.

F. In areas approved by ENGINEER, where substantial lawns and meadows remain (but are thin), mow, dethatch, core aerate and rake. Fill low spots, remove humps, cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers, as required. Apply a seedbed mulch, if required, to maintain moist condition.

G. Water newly planted areas and keep moist until new lawns and meadows are established, as specified.

3.7 ACCEPTANCE CRITERIA FOR LAWNS AND MEADOWS

A. Lawn and meadow Work will be considered acceptable when:

1. Seeded Lawn: When a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 square feet and bare spots not exceeding 5-inches by 5-inches.
2. Seeded Meadow: When a healthy, uniform, close stand of meadow grass and forbs has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 20 square feet and bare spots not exceeding 12-inches by 12-inches.

3.8 CLEANUP AND PROTECTION

A. Promptly remove soil and debris, created by lawn and meadow Work, from paved areas. Clean wheels of vehicles before leaving Site to avoid tracking soil and loam onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout extended service period and remove when service period ends. Treat, repair or replace damaged lawns and meadows.

C. Remove erosion-control measures after lawn and meadow extended service period ends.

D. Take all precautions to ensure that hydroseed slurry is only placed on the areas designated. Completely clean any overspray, on areas not designated to receive slurry.

3.9 INSPECTION AND ACCEPTANCE

A. Where lawns and meadows do not comply with specified acceptance criteria, reestablish lawns and meadows and continue extended service period until lawns and meadows comply with criteria for acceptance.

3.10 DEMONSTRATION

A. Engage installer’s Site supervisor to train and instruct OWNER’S personnel in the proper maintenance of lawns and meadows and procedures to be performed throughout the year for proper care and maintenance of lawn and meadows.
   1. Include instructions and training on reconditioning established lawns and meadow and sources of lawn and meadow materials.
   2. Schedule training with OWNER, through ENGINEER, with at least seven days' advance notice.

B. Review Operation and Maintenance information and be sure all instructions are clearly understood by OWNER’S personnel and are supplemented with additional information, clarifications and instructions, as required.

C. Provide minimum of two, nonconsecutive, full days on-Site training time during day shift normal working hours.

END OF SECTION

SECTION 33 05 05

BURIED PIPING INSTALLATION

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to install and test all buried piping, fittings, and specials. The Work includes the following:
      a. All types and sizes of buried piping, except where buried piping installations are specified under other Sections.
      b. Unless otherwise shown or specified, this Section includes all buried piping Work required, beginning at the outside face of structures or structure foundations, including piping beneath structures, and extending away from structures.
      c. Work on or affecting existing buried piping.
      d. Installation of all jointing and gasket materials, specials, couplings, harnessed and flanged adapters, sleeves, tie rods, cathodic protection, and other Work required for a complete, buried piping installation.
      e. Supports, restraints, and thrust blocks.
      f. Pipe encasements, with the exception of piping embedded in concrete within a structure or foundation specified under Section 40 05 05, Exposed Piping Installation.
      g. Field quality control, including testing.
      h. Cleaning and disinfecting.
      i. Incorporation of valves, meters, and special items shown or specified into piping systems in accordance with the Contract Documents and as required.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before buried piping Work.
   2. Coordinate with appropriate piping Sections of Division 40, Process Integration.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 31 23 05, Excavation and Fill.
   3. Section 40 05 19, Ductile Iron Process Pipe.
   4. Section 40 05 31, Thermoplastic Process Pipe.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASME Boiler and Pressure Vessel Code.
   2. ASME B31.3, Process Piping.
   3. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
   4. ASTM A377, Specification for Ductile Iron Pressure Pipe
   5. ASTM B32, Specification for Solder Metal.
   6. ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
   7. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.

8. ASTM F1417, Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.
9. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
10. ANSI/AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.
11. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
12. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
13. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
14. ANSI/AWWA C651, Disinfecting Water Mains.
15. AWWA M23, PVC Pipe – Design and Installation.
16. AWWA M41, Ductile-Iron Pipe and Fittings.
17. ASCE 37, Design and Construction of Sanitary and Storm Sewers.
18. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including:
      a. York County.
      b. South Carolina Department of Transportation.
      c. South Carolina Department of Health and Environmental Control.
   2. Obtain required permits for Work in roads, rights-of-way, railroads, and other areas of the Work.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Laying schedules for piping with restrained joints.
      b. Details of piping, specials, joints, harnessing and thrust blocks, and connections to piping, structures, equipment, and appurtenances.
   2. Product Data:
      a. Manufacturer's literature and specifications, as applicable, for products specified in this Section.
   3. Testing Procedures:
      a. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER's approval prior to commencing testing.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.
   2. Field Quality Control Submittals:
      a. Results of each specified field quality control test.

C. Closeout Submittals: Submit the following:
   1. Record Documentation:

a. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.
b. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
c. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.
d. Conform to Section 01 78 39, Project Record Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.

B. Storage:
1. Store materials to allow convenient access for inspection and identification. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
2. Pipe and fittings other than PVC and CPVC may be stored outdoors without cover. Cover PVC and CPVC pipe and fittings stored outdoors.

C. Handling:
1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.
2. Avoid unnecessary handling of pipe.
3. Keep pipe interiors free from dirt and foreign matter.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Piping materials are specified in the Buried Piping Schedule at end of this Section. Piping materials shall conform to Specifications for each type of pipe and piping appurtenances in applicable Sections of Division 40, Process Integration.

B. General:
1. Pipe Markings:
a. Factory-mark each length of pipe and each fitting with designation conforming to those on approved laying schedules.

b. Manufacturer shall cast or paint on each length of pipe and each fitting pipe material, diameter, and pressure or thickness class.

C. Polyethylene Encasement:
1. Polyethylene may be supplied in tubes or sheets.
2. Polyethylene encasement materials shall be in accordance with ANSI/AWWA C105.

D. Cathodic Protection:
1. Bonding Cables: Bonding cable and test lead wires shall be not less than No. 6 AWG, Type CP copper cathodic protection cable, with low density, high molecular weight polyethylene insulation.
2. Test Lead Stations: Provide test lead stations where shown and indicated in the Contract Documents. Standard connection boxes for test lead stations shall be plastic terminal boxes, 18 inches long and five-inch inside diameter, with locking cast iron lid with "CP TEST" cast into cover. Inside terminal box shall be terminal block with seven terminals. Terminal box shall be manufactured by C.P. Test Services "NM-7" or equal.

2.2 BURIED PIPING IDENTIFICATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:
1. Tracer tape shall be of inert, acid- and alkali-resistant, polyethylene, four mils thick, six inches wide, suitable for direct burial. Tape shall be capable of stretching to twice its original length.
2. Message shall read, "CAUTION [insert customized name of pipe service, i.e., "POTABLE WATER", "SANITARY SEWER", "REUSE WATER", or other service as appropriate, as indicated in the Buried Pipe Schedule at the end of this Section] PIPE BURIED BELOW", with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet. Tape shall be custom colored as follows:
a. Blue, for water pipelines.
b. Green, for sewer pipelines.
3. Manufacturer: Provide products of one of the following:
a. Brady Corporation.
b. Seton Identification Products.
c. Marking Services, Inc.
d. Or equal.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:
1. Tape shall be of inert, acid- and alkali-resistant, polyethylene, five mils thick, six inches wide, with aluminum backing, and have 15,000 psi tensile strength and 80 percent elongation capability. Tape shall be suitable for direct burial.
2. Message shall read, "CAUTION [insert customized name of pipe service, i.e., "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other appropriate service, as indicated in the Buried Pipe Schedule at the end of this Section] PIPE BURIED BELOW" with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet. Tape shall be custom colored as follows:
a. Blue, for water pipelines.
b. Green, for sewer pipelines.
c. Purple, for reuse pipelines.
3. Manufacturer: Provide products of one of the following:
a. Brady Corporation.
b. Seton Identification Products.

c. Marking Services, Inc.
d. Or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
1. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.
2. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from ENGINEER before proceeding.
3. ENGINEER will observe excavations and bedding prior to laying pipe by CONTRACTOR. Notify ENGINEER in advance of excavating, bedding, pipe laying, and backfilling operations.
4. Minimum Cover Over Buried Water Piping and Sewer Force Mains:
   a. Provide minimum cover of 30-inches, unless pipe material is ductile iron or other approved material and insulated to prevent freezing, or otherwise shown or approved by ENGINEER.
   b. For all crossings of water courses:
      1) Provide minimum cover under channel bed of 36-inches.
      2) Provide ductile iron pipe with restrained joints.
   c. For crossing of water courses greater than 15-feet in width:
      1) Provide easily-accessible valves which allow for isolating the section for testing and repair.
      2) Provide a blow-off on the side opposite the supply side. Direct blow-off away from any streams.
5. Minimum Cover Over Buried Sewer Piping:
   a. Provide minimum cover of 36-inches and maximum cover of 16-feet over PVC pipe. Provide ductile iron pipe if less than 36-inches or greater than 16-feet of cover.
6. Earthwork is specified in Section 31 23 05.
7. Excavation in excess of that required or shown, and that is not authorized by ENGINEER shall be filled at CONTRACTOR's expense with granular material furnished, placed, and compacted in accordance with Section 31 23 05, Excavation and Fill.
8. Comply with NFPA 24 for "Outside Protection", where applicable to water piping systems used for fire protection.

B. Manufacturer's Installation Specialist:
1. Provide services of competent installation specialist of pipe manufacturer when pipe installation commences for:
   a. Thermoplastic pipe.
2. Retain installation specialist at the Site for minimum of 1 day (eight hours per day at the Site) or until competency of pipe installation crew has been satisfactorily demonstrated.

C. Separation of Sewers and Potable Water Piping:
1. Horizontal Separation:
   a. Where possible, existing and proposed potable water mains and service lines, and sanitary and storm sewers shall be separated horizontally by clear distance of at least ten feet.

b. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench and with bottom of potable water main at least 18 inches above top of sewer.
c. Exception:
1) Where it is not possible to provide minimum horizontal separation between water main and sanitary sewer main as described above, construct potable water main and sewer of ceramic epoxy-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.
2) Where it is not possible to provide minimum horizontal distance between water main and storm sewer or catch basin, provide ductile iron with joints as far as possible from the storm sewer or catch basin
d. Install sewer lines, manholes, pump stations and force mains at least 100-feet from public water supply wells and at least 20-feet from any other potable water well.
e. Install water mains no less than 25-feet from any portion of a waste-water tile-filed or spray-field.

2. Vertical Separation:
a. a. Sewer Main Crossing over Water Main:
1) Provide minimum vertical distance of 18-inches between outside of potable water main and outside of sewer when sewer crosses over potable water main.
2) Provide cement-lined ductile iron sewer and water mains for a distance of 10-feet on each side of the point of crossing, with valves as far as possible from the crossing. Provide valves on sewer and water mains that comply with drinking water standards.
3) Hydrostatically test water main and sewer as specified in this Section, prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.
b. Sewer Main Crossing under Water Main:
1) Provide minimum vertical distance of 18-inches between outside of potable water main and outside of sewer when sewer crosses under potable water main.
2) If less than 18-inches of vertical separation is possible, provide water main ceramic epoxy-lined ductile iron sewer main for a distance of 10-feet on each side of the point of crossing, with joints as far as possible from the crossing.
c. Provide adequate structural support where potable water main crosses sewer. At minimum, provide compacted select backfill for ten feet on each side of crossing.
d. PVC Water Main Crossing Other Buried Pipeline Utilities:
1) Provide minimum vertical distance of 12-inches and Type 5 bedding for water main. If this requires water main deeper than 5-feet, DIP (or brass or stainless for 2” mains) may be installed with less than 12-inches clearance provided 3-feet cover is provided for water main.

D. Plugs:
1. Temporarily plug installed pipe at end of each day of work, during lunch, or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
2. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.
3. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.
4. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to ENGINEER.

E. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings.
   1. Trench excavation and backfill, and bedding materials shall conform to Section 31 23 05, as applicable.
   2. Where ENGINEER deems existing bedding material unsuitable, remove and replace existing bedding with approved granular material furnished, placed, and compacted in accordance with Section 31 23 05, Excavation and Fill. Payment for additional excavation and providing granular material will be made under the unit price payment items in the Contract.
   3. Where pipe is installed in rock excavation, Type 5 bedding or bedding as directed by ENGINEER shall be installed.
   4. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.
   5. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.
   6. Do not lay pipe until ENGINEER approves bedding condition.
   7. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

F. Laying Pipe:
   1. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:
      a. Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41, ASTM A377
      b. Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55.
      c. Sanitary and Storm Sewers: ASCE 37.
   2. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by ENGINEER. Remove and reinstall pipes that are not installed correctly.
   3. Slope piping uniformly between elevations shown.
   4. Keep groundwater level in trench at least 12-inches below bottom of trench before laying pipe. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.
   5. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by ENGINEER.
   6. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.
   7. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.
   8. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by ENGINEER.
   9. For copper tubing, snake piping in trench to compensate for thermal expansion and contraction.
   10. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.
   11. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.
   12. Field cut pipe, where required, with machine specially designed for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be

tapered and sharp edges filed off smooth. Do not flame-cut pipe. When making connections to existing mains which require water mains to be removed from service, automatic traveling pipe cutting machines will be required on 16-inch and larger.

13. Do not place blocking under pipe, unless specifically approved by ENGINEER for special conditions.
14. Touch up protective coatings in manner satisfactory to ENGINEER prior to backfilling.
15. Notify ENGINEER in advance of backfilling operations.
16. On steep slopes, take measures acceptable to ENGINEER to prevent movement of pipe during installation.
17. Thrust Restraint: Where required, provide thrust restraint conforming to Article 3.3 of this Section.
18. Exercise care to avoid flotation when installing pipe in cast-in-place concrete, and in locations with high groundwater.

G. Polyethylene Encasement:
   1. Provide polyethylene encasement for ductile iron piping to prevent contact between pipe and surrounding bedding material and backfill.
   2. Polyethylene encasement installation shall be in accordance with ANSI/AWWA C105.

H. Jointing Pipe:
   1. Ductile Iron Mechanical Joint Pipe:
      a. Immediately before making joint, wipe clean the socket, plain end, and adjacent areas. Taper cut ends and file off sharp edges to provide smooth surface.
      b. Lubricate plain ends and gasket with soapy water or manufacturer's recommended pipe lubricant, in accordance with ANSI/AWWA C111, just prior to slipping gasket onto plain end of the joint assembly.
      c. Place gland on plain end with lip extension toward the plain end, followed by gasket with narrow edge of gasket toward plain end.
      d. Insert plain end of pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.
      e. Push gland toward socket and center gland around pipe with gland lip against gasket.
      f. Insert bolts and hand-tighten nuts.
      g. If deflection is required, make deflection after joint assembly and prior to tightening bolts. Alternately tighten bolts approximately 180 degrees apart to seat gasket evenly. Bolt torque shall be as follows:

Pipe Diameter (inches)	Bolt Diameter (inches)	Range of Torque (ft-lbs)
3	5/8	40 to 60
4 to 24	3/4	60 to 90
30 to 36	1	70 to 100
42 to 48	1.25	90 to 120

      h. Bolts and nuts, except those of stainless steel, shall be coated with two coats, minimum dry film thickness of eight mils each, of high build solids epoxy or bituminous coating manufactured by Tnemec, or equal.
      i. Restrained mechanical joints shall be in accordance with Section 40 05 19, Ductile Iron Process Pipe.
   2. Ductile Iron Push-On Joint Pipe:

a. Prior to assembling joints, thoroughly clean with wire brush the last eight inches of exterior surface of spigot and interior surface of bell, except where joints are lined or coated with a protective lining or coating.
b. Wipe clean rubber gaskets and flex gaskets until resilient. Conform to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.
c. Insert gasket into joint recess and smooth out entire circumference of gasket to remove bulges and to prevent interference with proper entry of spigot of entering pipe.
d. Immediately prior to joint assembly, apply thin film of pipe manufacturer's recommended lubricant to surface of gasket that will come in contact with entering spigot end of pipe, or apply a thin film of lubricant to outside of spigot of entering pipe.
e. For assembly, center spigot in pipe bell and push pipe forward until spigot just makes contact with rubber gasket. After gasket is compressed and before pipe is pushed or pulled in the rest of the way, carefully check gasket for proper position around the full circumference of joint. Final assembly shall be made by forcing spigot end of entering pipe past gasket until spigot makes contact with base of the bell. When more than a reasonable amount of force is required to assemble the joint, remove spigot end of pipe to verify proper positioning of gasket. Do not use gaskets that have been scored or otherwise damaged.
f. Maintain an adequate supply of gaskets and joint lubricant at the Site when pipe jointing operations are in progress.

3. Ductile Iron Proprietary Joints:
   a. Install pipe that utilizes proprietary joints for restraint specified in Section 40 05 19, Ductile Iron Process Pipe, or other such joints, in accordance with manufacturer's instructions.
4. Thermoplastic Pipe Joints:
   a. Bell and Spigot Joints:
      1) Bevel pipe ends, remove all burrs, and provide a reference mark at correct distance from pipe end before making joints.
      2) Clean spigot end and bell thoroughly before making the joint. Insert O-ring gasket while ensuring that gasket is properly oriented. Lubricate spigot with manufacturer's recommended lubricant. Do not lubricate bell and O-ring. Insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.
5. Copper Tubing Joints:
   a. Soldered Joints:
      1) Assemble copper tubing with soldered joints. Solder shall be 95-5 tin-antimony solder conforming to ASTM B32.
      2) Ream or file pipe to remove burrs.
      3) Clean and polish contact surfaces of joints.
      4) Apply flux to both male and female ends.
      5) Insert end of tube into full depth of fitting socket.
      6) Heat joint evenly.
      7) Form continuous solder bead around entire circumference of joint starting at the bottom.
   b. Threaded Joints:
      1) When open flames for soldering are impractical, or at unions and connections to equipment and appurtenances, assemble copper tubing with flared ends as permitted by authority having jurisdiction.

2) Ends of tubing shall be flared at an angle of 45 degrees with flaring tool recommended by pipe manufacturer. Flaring tool shall have same outside diameter as tube to be flared.
3) Tubing to be flared shall be soft temper or annealed prior to flaring.
4) End of tube shall be cut square and reamed to remove burrs.
5) Tube that is out-of-round shall be resized back to round.
6) Clean and polish contact surfaces of joints using an abrasive cloth.
7) Place flare nut over the end of tube with threads closest to end being flared.
8) Insert appropriate length of tube between flaring bar of flaring tool and position the yolk with flaring cone over tube end and clamp yoke in place.
9) Turn handle of yolk clockwise without over-tightening. Cracked or deformed tubes will be rejected.
10) Do not apply jointing compounds to mating surfaces of flare fitting and flared tube end before attaching flare nut to threaded connection.

6. Mechanical Coupling Joints:
   a. Do not use sleeve couplings in water mains except for: connections to existing mains, connections between different pipe materials, or as necessary for repairs during pressure/leakage tests.
   b. Provide couplings for sewer lines 12-inches and smaller per Section 33 05 06, Couplings, Adapters and Specials.
   c. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with wire brush to remove foreign matter.
   d. Loosen the stainless steel clamping bands and remove clamps from coupling. Slide coupling over plain ends of pipes to be joined without using lubricants. Place clamps over each end of coupling at grooved section and tighten with torque wrench to torque recommended by manufacturer.

I. Backfilling:
1. Conform to applicable requirements of Section 31 23 05, Excavation and Fill.
2. Place backfill as Work progresses. Backfill by hand and use power tampers until pipe is covered by at least one foot of backfill.

J. Connections to Valves and Hydrants:
1. Install valves and hydrants as shown and indicated in the Contract Documents.
2. Provide suitable adapters when valves or hydrants and piping have different joint types.
3. Provide thrust restraint at all hydrants and at valves located at pipeline terminations.

K. Transitions from One Type of Pipe to Another:
1. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

L. Closures:
1. Provide closure pieces shown or required to complete the Work.

3.2 TRACER WIRE INSTALLATION

A. Detectable Underground Tracer Wire for Non-Metallic Pipelines:
1. Provide and install a 14-gauge solid copper wire on top of all new non-metallic pipeline.
2. Secure the wire to the pipe with duct tape near every bell and at the center of each pipe joint.
3. Fasten the wire securely to a cast iron fitting at each main line valve and to service lines.

B. Detectable Underground Tracer Wire for Hydrant Leads:
   1. Provide and install a 14-gauge solid copper wire around all new hydrant leads.
   2. Install wire around all horizontal portions of the hydrant lead, as well as the buried hydrant gate valve.
   3. Wrap the wire at frequency of no less than one revolution per linear foot of pipe.
   4. Fasten the wire securely to the 90-degree fittings at each end of the horizontal portion of hydrant lead.

3.3 THRUST RESTRAINT

A. Provide thrust restraint on pressure piping systems where shown or indicated in the Contract Documents.

B. Thrust restraint shall be accomplished by using restrained pipe joints. Concrete thrust blocks and/or harnessing buried pipe may be used if approved by the ENGINEER. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Buried Piping Schedule at the end of this Section.

C. If so approved, place concrete thrust blocks against undisturbed soil. Thrust blocks shall not be installed where undisturbed soil does not exist and/or where the Site consists of backfill material.

D. Restrained Pipe Joints:
   1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
      a. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system as specified in Section 40 05 19, Ductile Iron Process Pipe; lugs and tie rods; or other joint restraint systems approved by ENGINEER.
      b. Thermoplastic Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide tie rods across joint or other suitable joint restraint system, subject to the approval of ENGINEER.

E. Concrete Thrust Blocks:
   1. Provide concrete thrust blocks on pressure piping at changes in alignment of 15 degrees or more, at tees, plugs and caps, and where shown or indicated in the Contract Documents. Construct thrust blocks conforming to 03 00 05, Concrete.
   2. Install thrust blocks against undisturbed soil. Place concrete so that pipe and fitting joints are accessible for repair.
   3. Concrete thrust block size shall be as shown on the Drawings or as approved by ENGINEER.

F. Harnessed lengths of buried pipe shall be as shown on the Drawings.

3.4 WORK AFFECTING EXISTING PIPING

A. Location of Existing Underground Facilities:
   1. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.
   2. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

B. Taking Existing Pipelines and Underground Facilities Out of Service:
   1. Conform to Section 01 14 16, Coordination with Owner's Operations.
   2. Do not take pipelines or Underground Facilities out of service unless specifically listed in Section 01 14 16, Coordination with Owner's Operations, or approved by ENGINEER.
   3. Notify ENGINEER in writing prior to taking pipeline or Underground Facilities out of service. Shutdown notification shall be provided in advance of the shutdown in accordance with the General Conditions and Section 01 14 16, Coordination with Owner's Operations.

C. Work on Existing Pipelines or Underground Facilities:
   1. Cut or tap piping or Underground Facilities as shown or required with machines specifically designed for cutting or tapping pipelines or Underground Facilities, as applicable.
   2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
   3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.
   4. Conform to applicable requirements of Section 01 14 16, Coordination with Owner's Operations and Section 01 73 29, Cutting and Patching.

3.5 FIELD QUALITY CONTROL

A. General:
   1. Test all piping, except as exempted in the Buried Piping Schedule in this Section.
   2. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
   3. Conduct all tests in presence of ENGINEER.
   4. Remove or protect pipeline-mounted devices that could be damaged by testing.
   5. Provide all apparatus and services required for testing, including:
      a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
      b. Temporary bulkheads, bracing, blocking, and thrust restraints.
   6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
   7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into piping being tested. CONTRACTOR shall provide fluid for other types of testing required.
   8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
   9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of OWNER. Unless otherwise included in the Work, repair of existing piping or Underground Facilities will be paid as extra Work.

B. Test Schedule:
   1. Refer to the Buried Piping Schedule in this Section for type of test required and required test pressure.
   2. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.
   3. For piping not listed in Buried Piping Schedule in this Section:
      a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires separate test.

b. Use exfiltration testing, low-pressure air testing, or vacuum testing for other piping.
c. Disinfect for bacteriological testing piping that conveys potable water.

4. Test Pressure:
   a. Use test pressures listed in Buried Piping Schedule in this Section.
   b. If test pressure is not listed in Buried Piping Schedule, or if test is required for piping not listed in the Buried Piping Schedule, test pressure will be determined by ENGINEER based on maximum anticipated sustained operating pressure and methods described in applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:
1. Preparation for Testing:
   a. For thermoplastic pipe, follow procedures described in Section 7 of ANSI/AWWA Standard C605.
   b. For ductile iron pipe, follow procedures described in ANSI/AWWA Standard C600.
   c. Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.
   d. The maximum length pipe tested in one test shall be 5,000-feet.
2. Test Procedure:
   a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
   b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.
   c. Examine exposed joints and valves, and make repairs to eliminate visible leakage.
   d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
   e. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
   f. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure.
   g. Pump from test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.
3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of test pressure during timed test period. Allowable leakage rates for piping are:
   a. No Leakage: Pipe with fused, threaded, soldered, or brazed joints.
   b. Rates based on formula or table in ANSI/AWWA Manual M41:
      1) Metal pipe joined with rubber gaskets as sealing members, including the following joint types:
         a) Bell and spigot and push-on joints.
         b) Mechanical joints.
         c) Bolted sleeve type couplings.
         d) Grooved and shouldered couplings.
   c. Rates based on formula or table in ANSI/AWWA C605:
      1) Plastic pipe joined with O-ring gasket sealing members.

D. Exfiltration Testing for Manholes:
1. Test 25-percent of all manholes, as selected by ENGINEER.

2. Plug and bulkhead inlet and outlet pipes and lateral connections to manhole to be tested and admit fluid until the manhole is full.
3. Allow water level to saturate, then refill and mark the level of water.
4. Test duration shall be at least two hours.
5. Allowable leakage rate shall be 3-gallons per hour.

E. Gravity Sewer Pipe Leakage Testing
   1. After minimum 10-days following completion of backfill, determine level of the ground water table and submit to County Inspector. If level of ground water table is above the top of the pipe, test the sewer line for infiltration. Otherwise, use low pressure air test.
   2. Infiltration Test:
      a. Test up to 1-mile section of constant diameter pipe at a time.
      b. Isolate test section by installing suitable upstream watertight bulkheads.
      c. Take 6 readings at 5-minute intervals and use the average to determine rate of infiltration for the test section.
      d. Infiltration shall not exceed 100 gallons per day per inch-diameter per mile.
      e. Isolate and test any individual section between two manholes separately if so directed by ENGINEER.
      f. Facilitate York County Water/Sewer Department to use video equipment in any section to detect infiltration sources.
   3. Low Pressure Air Test:
      a. Plug and bulkhead ends and lateral connections of pipe segment to be tested.
      b. Required test pressure shall be increased by an amount equal to the elevation of groundwater above invert of lowest point of pipe segment being tested.
      c. Test in accordance with requirements of authority having jurisdiction.
      d. For thermoplastic pipe, use test procedures described in ASTM 1417.

F. Vacuum Testing:
   1. Plug and bulkhead ends and lateral connections of pipe segment or manhole to be tested.
   2. Following set-up of test apparatus, draw vacuum of ten inches of mercury on pipe segment or manhole being tested.
   3. Start test upon reaching specified test vacuum. Test duration shall be 15 minutes.
   4. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, pipe segment or manhole fails the test and shall be repaired and retested. If vacuum drop is less than one inch of mercury, pipe segment or manhole passes the test.

G. Vertical Deflection Test for Thermoplastic Pipe:
   1. Conduct vertical deflection test at least thirty days after backfill has been placed.
   2. Perform test using one of the following two methods
      a. Manually pull pin-type vertical gauge mounted on sled through pipe. Gauge shall be manufactured by Quality Test Products, or equal. Set gauge so that sled will stop if vertical deflection of pipe exceeds five percent. Excavate and re-install piping that fails deflection test, and retest.
      b. Use rigid ball or mandrel for deflection test, which shall have diameter of at least 95 percent of base inside diameter or average inside diameter of piping, depending on which is specified in applicable ASTM standard, including appendix, to which pipe is manufactured. Perform test without mechanical pulling devices. Re-install and retest pipe segments that exceed deflection of five percent.

H. Bacteriological Testing:

1. Bacteriological testing for potable water lines, finished water lines, and other piping in accordance with the Buried Piping Schedule, is specified in Part 3 of this Section.

3.6 CLEANING AND DISINFECTION

A. Cleaning, General: Clean pipe systems as follows:
   1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.
   2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.
   3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.

B. Disinfection:
   1. Disinfect all potable and finished water piping.
   2. Suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by ENGINEER.
      a. Prior to disinfection, clean piping as specified and flush thoroughly.
      b. Conform to procedures described in ANSI/AWWA C651. Use continuous feed method of disinfecting, unless alternative method is acceptable to ENGINEER.
   3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for redisinfection will be paid by CONTRACTOR to OWNER at water utility's standard rates.
   4. Chlorine shall be provided by CONTRACTOR.
   5. Bacteriologic tests shall be performed by CONTRACTOR. Provide certified test laboratory report to OWNER.
   6. Chlorine concentration in water entering the piping shall be between 50 and 100 ppm, such that minimum residual concentration of 25 mg/L remains after 24-hour retention period. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.
   7. After required retention period, flush chlorinated water to closed drain line, unless otherwise acceptable to ENGINEER. Properly dispose of chlorinated water in accordance with Laws and Regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

3.7 CATHODIC PROTECTION

A. General:
   1. Provide cathodic protection for buried steel pipelines.
   2. Provide insulated joint at each of the following:
      a. Connection to steel water tanks and each branch connecting to a water line.
      b. Connection between concrete pipe and steel pipe, and between ductile iron pipe and steel pipe.
      c. Connection through wall.
      d. Where indicated.
   3. Provide electrical bond across all other gasketed steel pipe joints.
   4. Provide test lead stations for monitoring electrical currents on pipeline at locations shown and indicated in the Contract Documents.

B. Details of Cathodic Protection:
   1. Insulated Joints: Where shown or indicated in the Contract Documents, provide insulated flange type joints. After joint is made, provide exterior coating around joint as specified for piping being joined.
   2. Electrical Bond Across Rubber Gasket Joints: Provide two electrical bonding cables across each rubber-gasketed bell and spigot joint. Before exterior coating is applied to bell and spigot joints, two small areas of metal shall be exposed on each side of joint, one on spigot ring and one on bell. Thoroughly clean each area and bond two cathodic protection cables to pipe, one on each side of joint. Bond each cable by thermite process. Coat completed connections and exposed metal as specified for exterior coating of pipe being joined.
   3. Electrical Bond Across Mechanical Couplings: Provide two electrical bonding cables across each mechanical coupling. Before the exterior coating is applied to mechanical couplings, expose two small areas of metal on pipe surface on each side of coupling, on middle ring and on each follower ring of coupling. Thoroughly clean each area and bond two cathodic protection cables to pipe, one on each side of joint and to middle ring and follower rings of mechanical coupling. Bond each cable by thermite process. Coat completed connections and exposed metal as specified for exterior coating of pipe being joined.
   4. Electrical Bond Across Valves and Flanges: Provide two electrical bonding cables across valves and flanged connections other than insulated flange type joints. Provide electrical bond as specified for bond across rubber gasket joints.
   5. Test Lead Stations: Provide test lead stations where shown and indicated in the Contract Documents. Terminate test lead on ground surface in standard connection box at a protected location acceptable to ENGINEER.

3.8 SCHEDULES

A. Schedules listed below, following the “End of Section” designation, are part of this Specification section.
   1. Table 33 05 05-A, Buried Piping Schedule.

END OF SECTION

TABLE 33 05 05-A, BURIED PIPING SCHEDULE

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test	Remarks

The following abbreviations are used in the Buried Piping Schedule.

A. Service Abbreviations

Service	Abbrev		Service	Abbrev.
Sanitary Sewer	SAN		Wastewater	WW
Storm Sewer	ST		Chlorine Solution	CLS
Sanitary Force Main	SFM		Sodium Hypochlorite	NAOCL
Raw Water	RW		Plant Effluent Water	PEW
Potable Water	PW		Drain	DR
County Water	CW		Chlorine Gas	CLG

B. Material Abbreviations

Material	Abbrev		Material	Abbrev.
Ductile Iron	DI		Polyvinyl Chloride	PVC
Cast Iron	CI		Copper	C
Chlorinated Polyvinyl Chloride	CPVC			

C. Lining/Coating Abbreviations

Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Asphaltic Coated	AC
Painted	P		Polyethylene Wrapped	PEW
Ceramic Epoxy	CE			

D. Joint Abbreviations

Joint Type	Abbrev		Joint Type	Abbrev.
Bell and Spigot	BS		Restrained Mech. Joint	RMJ
Restrained Bell and Spigot	RBS		Soldered	Sd
Push-on Joint	POJ		Threaded	Thd
Restrained Push-on Joint	RPOJ		Split Flexible Coupling	SPFC
Mechanical Joint	MJ		Plasticized PVC Coupling	PPVC
Sleeve-type Flexible Coupling	SLFC			

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ( )		Process Air Pipe Test (test pressure in psig)	PA ( )
Exfiltration	EX		Vacuum Test	VAC
Low-pressure Air Sewer Test	AIR		Disinfection and Bacteriological Testing	DBT
Vertical Deflection	VD		No Test Required	NR

SECTION 33 05 06

COUPLINGS, ADAPTERS AND SPECIALS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all couplings, adapters, and specials for process piping.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before couplings, adapters, and specials for process piping Work.

C. Related Sections:
   1. Section 33 05 05, Buried Piping Installation
   2. Section 40 05 05, Exposed Piping Installation.
   3. Section 40 05 19, Ductile Iron Process Pipe.
   4. Section 40 05 31, Thermoplastic Process Pipe.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
   2. ASME B31, Standards of Pressure Piping.
   3. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
   4. AWWA C606, Grooved and Shouldered Joints.
   5. ASTM C1173, Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
   6. ASTM D2000, Standard Classification System for Rubber Products in Automotive Systems.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer shall have at least five years experience producing substantial similar products to those specified and shall be able to provide documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain each type of coupling, adapter, and special for process piping product included in this Section, regardless of component manufacturer, from a single couplings, adapters, and specials manufacturer.
   2. Supplier shall prepare, or review, and approve all submittals for components furnished under this Section.

3. Components shall be suitable for specified service conditions and be integrated into overall assembly by the Supplier.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit piping layout Shop Drawings in accordance with Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
   2. Product Data:
      a. Submit product data on each type of coupling, expansion joint, and other piping specialties and accessories, including gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.
   3. Tapping Plan: Submit a complete tapping plan including, but not limited to, the following elements:
      a. Sequence and schedule of tapping operation.
      b. Means and methods of installing tap machine, sleeves and valves including area of excavation needed for tapping machine and method for supporting pipe and valve during tapping operation.
      c. Identify necessary coordination with other elements of work.
      d. Other elements of operation for safe and complete installation of tapped system.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. When requested by ENGINEER submit certificate attesting to compliance with standards referenced in this Section, signed by manufacturer.
   2. Manufacturer's Instructions:
      a. Provide instructions for handling, storing, installing, and adjusting of products.
   3. Source Quality Control:
      a. When requested by ENGINEER, submit results of source quality control tests.
   4. Qualifications Statements:
      a. Submit qualifications of manufacturer when requested by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 33 05 05, Buried Piping Installation.

PART 2 PRODUCTS

2.1 COUPLINGS

A. Sleeve-type (Transition), Flexible Couplings, for water pipe 16-inches diameter and smaller:
   1. Pressure and Service: Same as connected piping.
   2. Products and Manufacturers: Provide products of one of the following:
      a. Style 253, as manufactured by Dresser Piping Specialties, part of Dresser, Inc.
      b. Style 441, by Smith Blair, Inc.
      c. Or equal.
   3. Material: Ductile Iron.
   4. Gaskets: O-ring type gaskets at each end of the sleeve.

5. Bolts and Nuts: Alloy steel, corrosion resistant, primer-coated. For buried or submerged applications, provide stainless steel bolts complete with washers complying with ASTM F593, AISI Type 316 and with nitrided stainless nuts.
6. Harnessing:
    a. Harness couplings to restrain pressure piping. For pipelines that will be under pressure, test pressures are specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
    b. Tie adjacent flanges with bolts of corrosion-resistant alloy steel. Provide flange-mounted stretcher bolt plates to be designed by manufacturer, unless otherwise approved. For buried or submerged applications, provide external bolting and other hardware of Type 316 stainless steel, including tie bolts, bolt plates, lugs, nuts, and washers.
    c. On plain-end piping, for harnessing couplings, provide anchor restraint system such as Dresser Piping Specialties STAR Anchor Style 443, or equal.
    d. Conform to dimensions, size, spacing, and materials for lugs, bolts, washers, and nuts as recommended by manufacturer and approved by ENGINEER for pipe size, wall thickness, and test pressure required. Provide minimum 5/8-inch diameter bolts.
7. Remove pipe stop(s) if used, unless otherwise shown or specified.

B. Sleeve-type (Transition), Flexible Couplings, for water pipe greater than 16-inches diameter:
1. Pressure and Service: Same as connected piping.
2. Products and Manufacturers: Provide products of one of the following:
    a. Style 253, as manufactured by Dresser Piping Specialties, part of Dresser, Inc.
    b. Style 441, by Smith Blair, Inc.
    c. Or equal.
3. Material: Steel.
4. Gaskets: O-ring type gaskets at each end of the sleeve.
5. Bolts and Nuts: Alloy steel, corrosion resistant, primer-coated. For buried or submerged applications, provide stainless steel bolts complete with washers complying with ASTM F593, AISI Type 316 and with nitrided stainless nuts.
6. Harnessing:
    a. Harness couplings to restrain pressure piping. For pipelines that will be under pressure, test pressures are specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
    b. Tie adjacent flanges with bolts of corrosion-resistant alloy steel. Provide flange-mounted stretcher bolt plates to be designed by manufacturer, unless otherwise approved. For buried or submerged applications, provide external bolting and other hardware of Type 316 stainless steel, including tie bolts, bolt plates, lugs, nuts, and washers.
    c. On plain-end piping, for harnessing couplings, provide anchor restraint system such as Dresser Piping Specialties STAR Anchor Style 443, or equal.
    d. Conform to dimensions, size, spacing, and materials for lugs, bolts, washers, and nuts as recommended by manufacturer and approved by ENGINEER for pipe size, wall thickness, and test pressure required. Provide minimum 5/8-inch diameter bolts.
7. Remove pipe stop(s) if used, unless otherwise shown or specified.

C. Transition Couplings for gravity sewer pipe:

1. Provide mechanical couplings for gravity sewer pipe in accordance with ASTM C1173 and CSA B602.
2. Pressure and Service: Same as connected piping.
3. Products and Manufacturers: Provide products of one of the following:
   a. Fernco, Strong Back.
   b. Mission.
   c. Romac.
   d. Gladding-Mcbean Repair
   e. Or equal.
4. Material: Stainless steel shield and a molded in busing.
5. Gaskets: Manufactured to meet the requirements of ASTM D 5926 or compounded for water and sewer service in accordance with ASTM D2000 MAA 610.
6. Clamps: Manufactured to meet the requirements of CSA B602. Clamp Housing and Clamp Band 301 Stainless Steel. Clamp Screw 305 Stainless Steel.

2.2 MISCELLANEOUS SPECIALTIES AND ACCESSORIES

A. Dielectric Connections:
   1. General: Where copper pipe connects to steel pipe, cast-iron pipe, or ductile iron pipe, provide either dielectric union or an insulating section of rubber or plastic pipe. When used, insulating section shall have minimum length of 12 pipe diameters.
   2. Manufacturers: Provide products of one of the following:
      a. Epco Sales, Inc.
      b. Watts Regulator Company.
      c. Capitol Manufacturing Company.
      d. Wilkins, a Zurn Company.
      e. Or equal.
   3. Ratings:
      a. Dielectric Unions: Rated for 250 psi, ANSI B16.39.
      b. Flanges: 175 psi, ANSI 16.42 (Iron), ANSI 16.24 (Bronze)
   4. Insulating Sections: Rated for same pressure as associated piping test pressure. Material shall be suitable for the application and service.
   5. Bodies and flanges, and bolts and nuts shall be steel with galvanized coating. Provide nylon insulator, brass tailpiece and EPDM gaskets.

2.3 METER SETTERS

A. General: Provide horizontal inlet and outlet meter setter, lock wing ground key angle meter valve with meter flange on inlet and angle dual check valve with meter flange on outlet. Provide bypass with lock wing ball valve and check valve.

B. Products and Manufacturers: Provide the following:
   1. Mueller Company LLC, Model H-1423-2N.
   2. Or equal.

C. Dimensions: 1-1/2” shall be 12” high by 12-1/4” length and 2” shall be 12” high by 17-1/4” length.

2.4 SERVICE SADDLES

A. Brass Service Saddles on PVC Mains:

1. General: Provide service saddle as single strap design manufactured in bronze with corporation thread outlet.
2. Manufacturers: Provide products of one of the following:
   a. Ford S-70.
   b. McDonald 3801 or 3805.
   c. Mueller H-13000 series.
   d. Romac 101B.
   e. Power Seal 3401.
   f. Or equal.

B. Ductile Iron Service Saddles:
1. General: Provide service saddle manufactured in ductile iron with corporation thread outlet.
2. Manufacturers: Provide products of one of the following:
   a. Double Strap:
      1) Ford F202.
      2) Smith-Blair 313.
      3) JCM Industries 402.
      4) Romac 202U.
      5) PowerSeal 3413DI.
      6) Or equal.
   b. Stainless Steel Strap:
      1) Ford FCD202.
      2) Smith-Blair 317.
      3) JCM Industries 405.
      4) Romac 202S.
      5) PowerSeal 3417DI.
      6) Or equal.

C. Stainless Steel Service Saddles:
1. General: Provide service saddle manufactured in stainless steel with corporation thread outlet.
2. Manufacturers: Provide products of one of the following:
   a. Ford FS323.
   b. Romac 304.
   c. Or equal.

2.5 METER BOXES

A. General: Provide meter boxes for all meters as required.

B. Manufacturers: Provide products of one of the following:
1. Size of meter ¾", residential, provide box manufactured of polyethylene plastic using the structural foam method of construction. The cover shall be manufactured of cast iron (LYLV244-233-LL-G as manufactured by Ford Meter Box Company, or equal).
2. Size of meter ¾", irrigation, provide box manufactured of polyethylene plastic using the structural foam method of construction. The cover shall be two piece, lock down, manufactured of cast iron (DG218-243 as manufactured by Ford Meter Box Company, or equal).

3. Size of meter 1”, provide box manufactured of cast iron. The cover shall be lock down, manufactured of cast iron (LYLBB144-444-G-NL as manufactured by Ford Meter Box Company, or equal).
4. Size of meter 1-1/2” and 2”, provide box manufactured of polymer concrete meeting ANSI/SCTE-77 Tier 22 (Model 1730 as manufactured by Oldcastle Infrastructure, or equal).

2.6 PAINTING

A. Shop Painting:
   1. Clean and coat ferrous metal surfaces of products in the manufacturer’s shop in accordance with the following
      a. For Submerged items: Prime Coat, first coat, and second coat of paint shall be Dura-Plate 235 Multipurpose Epoxy B67-235 B67V235 Hardener
         1) Dry Mills: 4-6 mils for each coat
      b. For Non-Submerged Items: Prime Coat and first coat of paint shall be Dura-Plate 235 Multipurpose Epoxy B67-235 B67V235 Hardener. The Second coat shall be Hi-Solids Polyurethane B65-300 Series Color, B60V30 Hardener or Acrolon 218 HS Acrylic Polyurethane B65-600 Series B65V600 Hardener.
         1) Prime Coat, Dry Mills: 4-6 Mils.
         2) First Coat, Dry Mills: 4-6 Mils.
         3) Second Coat, Dry Mills: 3-4 Mils.
   2. Coat machined, polished and non-ferrous surfaces bearing surfaces and similar unpainted surfaces with corrosion prevention compound that shall be maintained during storage and until products are placed into operation.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect materials for defects in material and workmanship. Verify compatibility of products with pipe, fittings, valves, and appurtenances.

3.2 INSTALLATION

A. Installation:
   1. Install piping specialties in accordance with the Contract Documents and manufacturer’s instructions.
   2. For buried installations, refer to Section 33 05 05, Buried Piping Installation.
   3. For exposed installations, refer to Section 40 05 05, Exposed Piping Installation.

B. Adjust joints as required to ensure that expansion joints will be fully extended when ambient temperature is at minimum operating temperature, and fully compressed at maximum operating temperature for the system in which expansion joints are installed.

END OF SECTION

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all precast and cast-in-place manholes.

B. General:
   1. Manholes and structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as directed by ENGINEER.
   2. Cast-iron frames, grates and covers shall be the standard frame and grate or cover unless otherwise shown and shall be as specified in Section 05 56 00, Metal Castings.
   3. Concrete for cast-in-place manholes and structures and for inverts in precast and masonry manholes and structures shall be Class “A” and shall conform to the requirements specified under Section 03 00 05, Concrete.
   4. All manholes and structures shall be precast construction, unless otherwise shown. All sanitary or process manholes and structures carrying untreated wastewater shall be PVC lined or coated with Saueriesen or Sewer Shield 100 or Tnemec Perma-Shield 431.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 05 56 00, Metal Castings.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Society for Testing and Materials, (ASTM).
      a. ASTM A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
      b. ASTM C32, Specification for Sewer and Manhole Brick (made from Clay or Shale).
      c. ASTM C398, Standard Practice for Use of Hydraulic Cement Mortars in Chemical-Resistant Masonry.
      d. ASTM C443, Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
      e. ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections.
      f. ASTM C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
   2. American Water Works Association, (AWWA).
      a. AWWA C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
      b. AWWA C302, Reinforced Concrete Pressure Pipe, Non-cylinder Type, for Water and Other Liquids.
   3. National Precast Concrete Association
      a. Manhole Invert Channels; Tech Notes.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit drawings showing design and construction details of all precast concrete and cast-in-place manholes and structures, including details of joints between the manhole bases and riser sections and stubs or openings for the connections.
      b. Submit drawings for slab and wall reinforcing for 6-foot diameter and larger manholes for approval.
      c. Submit drawings of strap on vents, mountings straps and anchor
   2. Submit manufacturer's certification for 1,000-pound pull-out test for each manhole step with each shipment. Certification shall include manhole location, date of test and results.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE MANHOLES AND STRUCTURES

A. Precast manholes and structures shall conform to the details shown. Provide cast-in-place concrete bases if shown on the drawings.

B. Except where otherwise specified precast manhole components shall consist of reinforced concrete pipe sections especially designed for manhole construction and manufactured in accordance with ASTM C 478, except as modified herein.

C. Precast, reinforced concrete manhole bases, riser sections, flat slabs and other components shall be manufactured by wet cast methods only, using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.

D. Joints between manhole components shall be the tongue and groove type and shall conform to ASTM C443. Joints shall be sealed by employing a single, continuous rubber O-ring gasket and shall conform to ASTM C443 or with butyl rubber sealants conforming with ASTM C990. Butyl rubber sealant shall be "Rubber Seal" as manufactured by Ru Van, Inc., or approved equal. The circumferential and longitudinal steel reinforcement shall extend into the bell and spigot ends of the joint without breaking the continuity of the steel. Joints between the base sections, riser sections and top slabs of manholes 72-inches in diameter and less shall be rubber and concrete joints. Joints for manhole components greater than 72-inches in diameter shall be provided with steel bell and spigot rings.

E. All precast manhole components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum earth cover loading of 130 pounds per cubic foot, an HL-93 wheel loading, and an allowance of 30 percent in roadways and 15 percent in rights-of-way for impact. Manhole bases shall have two cages of reinforcing steel in their walls, each of the area equal to that required in the riser sections. Wall thickness shall be a minimum of $1/12^{th}$ of the inside diameter of the manhole and not be less than 5-inches. Concrete top slabs shall not be less than 8-inches thick.

F. Lifting holes, if used in manhole components, shall be tapered, and no more than two shall be cast in each section. Expansion grout shall be furnished to seal the lifting holes. The lifting holes shall be made to be sealed by expansion grout from the outside face of the section only.

G. The point of intersection (P.I.) of the sewer pipe centerlines shall be marked with 1/4-inch diameter steel pin firmly enclosed in the floor of each manhole base and protruding approximately 1-inch above the finished floor of the base.

H. Mark date of manufacture and name or trademark of manufacturer on inside of each section.

I. The barrel of the manhole shall be constructed of various lengths of riser pipe manufactured in increments of one foot to provide the correct height with the fewest joints. Openings in the barrel of the manholes for sewers or drop connections will not be permitted closer than one foot from the nearest joint. Special manhole base or riser sections shall be furnished as necessary to meet this requirement.

J. A precast slab or eccentric or concentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover.

K. Eccentric cones with bolt down frame and cover shall have a minimum vertical height, as measured from the top of the cone to the bottom of the bell, of 32-inches. Eccentric cones without bolt down frame and cover to be installed flush to finish grade shall have a minimum vertical height of 24-inches.

L. Concentric cones with a vertical height of 20-inches may be used on 4-foot diameter manholes less than 5-feet deep.

M. Transition cone sections for an eccentric transition from a 60-inch riser to a 48-inch cone section shall be placed directly beneath the 48-inch cone.

N. Transition slabs for 6-foot diameter and larger manholes to be buried shall be placed a minimum of 5-feet above the invert shelf. Flat top slabs for 6-foot and larger diameter manholes shall not be used if manhole is located within pavement or maintained lawns.

O. Connectors between manholes and pipe shall be standard mechanical boot type connectors, conforming to ASTM C923, which allow for the expansion ring at the manhole wall to be completely seated in a vertical plane. Compression type connectors shall not be used.
   1. Approved Manufacturers of mechanical boot type connectors include:
      a. Quik-LOK by A-LOK Products, Inc.
      b. G-3 by A-LOK Products, Inc.
      c. Or Approved Equal.

P. Grading Rings: Modular precast concrete and lined with same materials as manhole.

Q. Flexible Joints: Comply with ASTM C923.

2.2 MASONRY COMPONENTS

A. Masonry Work, where shown or otherwise approved by ENGINEER, shall conform to the following:
   1. Brick shall conform to the requirements of: ASTM C32, Grade MS for manhole brick.
   2. Mortar shall be portland cement 1:3 mix and in accordance with ASTM C398.
   3. Cement shall be Type II portland cement as specified for concrete masonry.

2.3 MISCELLANEOUS METALS

A. Metal frames and covers and similar required items shall be provided as shown and in accordance with Section 05 56 00, Metal Castings.

2.4 DROP CONNECTIONS

A. Drop connections for manholes and structures shall be constructed where shown or directed by the ENGINEER and shall conform to the design and details shown. Concrete for pipe encasement shall be Class “B” as specified under Section 03 00 05, Concrete. Concrete shall be bonded to manhole in the manner shown or otherwise approved by ENGINEER.

B. Pipe for inside drop connections shall be SDR 35 PVC.

C. Drop connections shall not enter the manhole in the cone section.

D. Outside drops shall only be installed to address elevation differences of minimum 2-feet. The influent pipe of an outside drop shall be a minimum pipe length of 18-feet.

E. Inside drop connections shall only be installed when safety considerations or work space limitations preclude installing an outside drop connection, and with Engineer approval. Inside drops shall not be installed on 4-foot diameter manholes.

2.5 MANHOLE STEPS

A. Provide access steps on all manholes with eccentric cones.

B. Steps shall be copolymer polypropylene and conform to ASTM C478 and current OSHA regulations.

C. Steps and common straight wall of manholes with eccentric cones and flat slab tops shall be located over widest shoulder of manhole invert.

2.6 MANHOLE VENT PIPES

A. Furnish 5-inch welded steel vent pipes as shown on the drawings. Unless otherwise specified, vent pipe shall be Schedule 40, grade “B” steel in conformance with ASTM A139, with minimum yield strength of 35,000 pounds per square inch.

B. Vent pipes shall have inside coal tar lining of minimum 0.094-inch thickness in conformance with AWWA C203. Alternatively, a coal tar epoxy lining of minimum 0.024-inch dry film thickness may be used. Coal tar epoxy lining shall be: Kloppers No. 300M, Americoat No. 78, Carboline-Carbomastic No. 14, or Equal.

C. The outside surface of vent pipes shall be sand or grit blasted to commercial standard and have 1 coat of zinc chromate primer applied in conformance with Federal Specification TT-86A. Vent pipes shall be finished with 2 evenly applied coats of rust-inhibiting enamel paint. Paint to be: Kloppers Glamortex No. 501 olive green enamel, Southern Coatings Rustolay No. 5037 garden green enamel, or Equal.

D. Vent pipes shall be flanged by plain end and cast in place with bolt holes in flange straddling the vent center lines.

E. 5-inch diameter steel vent pipe shall be furnished with compatible, coated flange and all necessary hardware for bolted attachment.

PART 3 EXECUTION

3.1 MANHOLE BASES

A. Cast-in-place bases shall be placed on suitable foundations after the pipes are laid. They shall be cast monolithically to an elevation at least 12-inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed. Base, walls and bottom shall be at least of the thickness shown and reinforced to withstand the loads to be expected. Connections for sewer pipes shall conform to the details shown.

B. Precast bases shall be set on a crushed stone or crushed gravel or concrete foundation as shown. Precast bases shall be set at the proper grade and carefully leveled and aligned.

3.2 PRECAST MANHOLE SECTIONS

A. Set sections vertical with steps and sections in true alignment. The base of the bell or groove end at joints between components shall be buttered with 1:2 cement-sand mortar to provide a uniform bearing between components. All joints shall be sealed with cement mortar inside and out and troweled smooth to the contour of the wall surface. Raised or rough joint finishes will not be accepted.

B. Install sections, joints and gaskets in accordance with manufacturers recommendations.

C. Lifting holes shall be plugged with expansion grout from the outside of the barrel prior to backfilling.

3.3 MANHOLE CHANNELS

A. All invert channels through manholes and structures shall be constructed of Class “A” concrete. Channels shall be properly formed to the sizes, cross sections, grades and shapes shown or as ordered. Benches shall be built up to the heights shown or as directed by the ENGINEER and given a uniform wood float finish. Care shall be taken to slope all benches for proper drainage to the invert channel.

3.4 GRADING RINGS

A. Grading rings shall be used for all precast manholes, where required. Stacks or grade rings shall be a maximum of 21-inches in height, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the stack or grade rings shall be such as required to bring the manhole frame to the proper grade. Brick shall not be used to adjust rim elevations of above-grade manholes.

B. Each grade ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

C. The outside grading rings shall be neatly plastered with 1/2-inch of cement mortar as the Work progresses.

3.5 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be anchored to manhole with Red Jacket masonry anchors (or Equal) and thoroughly sealed to concrete with tar sealant putty.

B. Anchor sleeve threaded stud and nut shall be stainless or galvanized steel.

C. Provide bolt down covers as indicated on the Drawings.

3.6 STUBS FOR FUTURE CONNECTIONS

A. As shown or required for connections, cast iron sleeves, bell end tile, ductile iron or reinforced concrete pipe stubs with approved watertight plugs shall be installed in manholes and structures. Where pipe stubs, sleeves or couplings for future connections are shown or directed by the ENGINEER, CONTRACTOR shall provide all materials and labor in order to complete the Work.

3.7 FALSE WALLS

A. False walls shall be constructed in manholes when shown on the Drawings. Holes of the appropriate size shall be cored or blocked out in the manhole wall at the elevation and alignment shown on the Plans. A four-inch thick masonry wall shall be constructed in the opening. Inverts shall be constructed to match proposed pipe elevations and alignments and permit installation of the future extension without demolition work other than removal of the false wall

3.8 GRADING AT MANHOLES AND STRUCTURES

A. All manholes and structures in unpaved areas shall be built, as shown or directed by the ENGINEER, to an elevation higher than the original ground. The ground surface shall be graded to drain away from the manhole. Fill shall be placed around manholes to the level of the upper rim of the manhole frame, and the surface evenly graded on a 1 to 5 slope to the existing surrounding ground, unless otherwise shown or directed by the ENGINEER. The slope shall be covered with 4-inches of topsoil, seeded and maintained until a satisfactory growth of grass is obtained.

B. Manholes and structures in paved areas shall be constructed to meet the final surface grade. In paved areas on State Highways, all manholes and structures shall be 1/2-inch below final wearing surfaces. Manholes and structures shall not project above finished roadway pavements.

C. CONTRACTOR shall be solely responsible for the proper height of all manholes and structures necessary to reach the final grade at all locations. CONTRACTOR is cautioned that ENGINEER'S review of Shop Drawings for manhole components will be general in nature and CONTRACTOR shall provide an adequate supply of random length precast manhole riser sections to adjust any manhole to meet field conditions for final grading.

3.9 MANHOLE WATERTIGHTNESS

A. All manholes and structures shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to ENGINEER'S

approval. Manhole testing shall conform to the requirements of Section 33 05 05, Buried Piping Installation.

3.10 FLEXIBLE PIPE JOINT AT MANHOLE BASE

A. Provide a flexible joint between each pipe entering and exiting the manhole. This may be accomplished by the installation in the manhole base of the bell end of a pipe or by other means subject to approval of ENGINEER. Joints shall be similar to the approved pipe joints. The joint into the manhole base shall be completely watertight.

3.11 PIPE JOINT AT MANHOLE BASE

A. Pipe openings shall be maximum 3-inches larger than outer diameter of pipe.

B. Openings shall be reinforced with minimum 2-square inches of steel bent to a 90-degree angle.

C. Pipe shall be centered about opening and supported by a concrete collar 12-inches greater than the outer diameter of the pipe. Collar shall extend 12-inches from the outside of the manhole wall. Collar shall be reinforced from the outside to become an integral part of the manhole invert or to a point flush with the inside wall of the manhole.

END OF SECTION

SECTION 33 05 23.17

UTILITY BORING AND JACKING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
1. Design, furnish and install the proposed piping alignment by jacking and boring construction methods, as shown on the Drawings and conform to this specification. The work includes, but not limited to, survey, design, excavation, dewatering, removal of all materials encountered in the jacking and boring operations, disposal of all material not required in the work, grouting bulkheads, testing, cleaning, restoration, and incidentals as shown on the Drawings and as specified herein.
2. Install all jointing and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other Work required to complete the jack and bore, or tunneling installations.
3. The jacking and boring construction method shall consist of pushing (jacking) the casing pipe into the earth with a boring auger rotating with the casing/pipe to remove the spoil. The operations are to be completed while simultaneously providing ground stabilization techniques. Include provisions for preventing uncontrolled inflow of loose or saturated soils.
4. Provide additional geotechnical/subsurface investigations required to establish the appropriate parameters (i.e., limiting pressures, setback distances, depth of cover, etc.) for completing the design of the jacking and alignment, as specified herein.
5. OWNER is responsible for obtaining the required general construction permits, easements, and approvals from the South Carolina Department of Transportation (SCDOT), York County, and any respective property owners within the alignment. When encasement pipe is installed in the state rights-of-way, the entire installation shall be as required by SCDOT.

B. Coordination:
1. Review installation procedures under other Sections and other contracts and coordinate with the Work that is related to this Section.
2. Coordinate construction activities with the respective authorities.

C. Related Sections:
1. Section 31 23 05, Excavation and Fill.
2. Section 33 05 05, Buried Piping Installation.
3. Section 40 05 19, Ductile Iron Process Pipe.
4. Section 40 05 31, Thermoplastic Process Pipe.

1.2 REFERENCES

A. Standards referenced in this Section are:
1. ASTM A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
2. ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
3. ANSI/AWWA C151, Ductile Iron Pipe, Centrifugally Cast.
4. ANSI/AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances.

1.3 QUALITY ASSURANCE

A. Demonstrate expertise in “trenchless” methods by providing a list of five (5) utility references for which similar work has been performed in the last two years. The references should include a name and telephone number where contact can be made to verify the CONTRACTOR’s capability. Provide documentation showing successful completion of the projects used for reference. Conventional trenching experience will NOT be considered applicable.

B. All supervisory personnel must be adequately trained and have at least ten years of experience in jack and boring operations. Submit the names and resumes of all supervisory field personnel prior to the start of construction.

C. ENGINEER will base the review of submitted details and data on the requirements of the completed work, safety of the work in regard to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the CONTRACTOR in any way of the CONTRACTOR’s responsibilities under the contract.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Jacking and Boring Plan describing the equipment, methods, operational procedures, construction sequence, contingency plans, and other items of concern to be performed during the jacking and boring construction.
   2. Project Safety Plan, including, but not limited to, monitoring for gases encountered, hazardous chemical list, and all MSDS and technical data sheets.
   3. Submit site layout, equipment arrangement, and entry/exit pits drawings and technical specifications of the machine and equipment (including any modifications) proposed.
   4. Submit Construction drawings, Specifications, and Contingency plans on the following items:
      a. Complete details of the site clearing, excavation, drainage, security, and equipment mobilization including, but not limited to, the methods, procedures and equipment arrangement to be used during the construction.
      b. Complete details and drawings, and calculations of the significant factors and constraints associated with jacking and boring installations including, but not limited to, fluid pressures, jacking forces, pipe capacities, jacking and receiving pits shoring design, etc.
      c. Provide plan and profile of the proposed jacking and boring alignments, indicating depth, angle of deflection, and radius of all pipe bends along the alignment.
      d. Complete details of the grouting techniques/methods to be utilized for filling grout into the annulus between the adjacent soils and the outside of the casing piping, including but not limited to, fitting procedures, equipment, pumping procedures, fluid pressures, mixtures and plug systems. Also include methods of monitoring and controlling the grouting pressures.
      e. Method of monitoring and controlling the specified line and grade of excavation including, but not limited to, the methods, procedures, reliability, and necessary ancillary equipment to be used during construction operations.
      f. Complete details of the groundwater control, launching seals, muck/spoils containment, dewatering, drying, and removal including, but not limited to, the methods, procedures, equipment, contingency plans and off-site disposal location.

g. Complete details of the casing and carrier piping capacities, maximum jacking loads, storage, assembly, and installation including, but not limited to, the methods, procedures, and equipment to be used.
h. The type of spoils separation system to be used.
i. Information regarding the inject lubricant to be used for the jacking portion of the Work.

B. Informational Submittals: Submit the following:
1. Certificates:
a. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.
2. Field Quality Control Methods: At least 10 days prior to the start of the jacking and boring, submit a description of quality control methods proposed to use during the operations to the ENGINEER. Describe:
a. Procedures for controlling and checking line and grade.
b. Field forms for establishing and checking line and grade.
3. Bring to the attention of the ENGINEER any known discrepancies with actual jacking and boring methods that will be performed. This shall be stated, in writing, to ENGINEER no later than the pre-construction meeting.

C. Closeout Submittals:
1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to boring and jacking Work. Submittal shall show actual location of all boring and jacking Work and appurtenances at same scale as the Drawings.
2. Show piping with elevations referenced to Project datum and dimensions from permanent structures.
3. Include profile drawings with boring and jacking record documents when the Contract Documents include boring and jacking profile drawings.
4. Submit record drawings prior to the time of Substantial Completion.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Do not place/store materials, equipment, or personnel on or around state roads.

B. Deliver materials to the site to ensure uninterrupted progress of the Work.

C. Handle all pipe, fittings, specials and accessories carefully with approved handling devices. Handling devices shall include ropes, fabric, or rubber-protected slings and straps. Chains, cables, or hooks inserted into the pipe ends shall NOT be used. Two slings spread apart shall be used for lifting each length of pipe. Do not drop or roll material off trucks.

D. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with the ground. Space pipe supports suitably and of such widths as not to allow deformation of the pipe at the point of contact with the supports.

E. Limit stacking of pipe to a height that will not cause deformation of the bottom pipes under anticipated temperature conditions.

F. Securely cap/plug all ends of stored piping to prevent entry of soil, debris, and vermin.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Jack and Boring System, General:
   1. The jack and boring system shall consist of, but not limited to, the following components:
      a. Jacking system suitable for forcing the casing through the embankment.
      b. Auger Boring and Spoil removal system.
      c. Pipe lubrication system.
   2. The excavation equipment and system shall be fully capable of excavating and removing all material that will be encountered during the construction operations.
   3. The automated spoil transportation system shall match the excavation rate to the rate of spoil removal, maintaining settlement or heave within tolerances specified herein.
      a. If a slurry spoil transportation system is used, the groundwater pressure may be managed by use of the slurry pumps (which may be variable speed), pressure control valves and a flow meter. A slurry bypass unit shall be included in the system to allow the direction of flow to be changed and isolated, as needed. A solids separation process shall be provided when using slurry transportation systems. The process shall be designed to provide adequate separation of the spoil from the slurry so that the clean slurry can be returned to the cutting head for reuse.
      b. If an Auger spoil transportation system is utilized, the groundwater pressures may be managed by controlling the volume of spoil removal with respect to the advance rate (Earth Pressure Balance Method) and the application of compressed air. In soils with excessive groundwater, approval of the ENGINEER shall be required for the earth pressure balance auger systems. Approval shall be based on the evaluation of the equipment's ability to balance soil and groundwater pressures at the face, stability of the soils and the significance of the groundwater present.

B. Pipe Jacking Equipment:
   1. The main jacks shall be mounted in a jacking frame and located in the drive (starting) shaft. The jacking frame successively pushes the steel casing pipes toward a receiving shaft. The jacking capacity shall be sufficient to push the auger/boring machine and/or length of casing piping through the ground.
   2. The main jacking equipment installed shall have a capacity greater than the anticipated jacking load. The hydraulic cylinder extension rate shall be synchronized with the excavation rate of the boring, which shall be determined by the specific soils conditions.
   3. The CONTRACTOR shall provide intermediate jacking stations when the total anticipated jacking force needed to complete the installation exceeds the designed maximum jacking force of the pipe.

C. Pipe Lubrication System:
   1. Utilize a pipe lubrication system when anticipated jacking forces on the pipe are expected to exceed the capacity of the main jacks or exceed the pipe design strength with the appropriate safety factor. A prior approved lubricant shall be injected at the rear of the auger, or boring machine and, if necessary, through the casing pipe walls to lower the friction developed on the surface of the pipe during jacking.

2.2 MATERIALS

A. Carrier Piping:
   1. Carrier piping used for the conveyance of water and wastewater shall refer to Sections 33 05 05, Buried Piping Installation, and 40 05 19, Ductile Iron Pipe, or 40 05 31, Thermoplastic Pipe, for material and installation specifications.
   2. All ductile iron carrier pipe installed with joint inside an encasement pipe must utilize rigid restrained joints.
      a. Approved Manufacturers:
         1) US Pipe Mech-Lok.
         2) US Pipe MJ Harness-Lok.
         3) Approved equal.
   3. All PVC carrier pipes shall have restrained joints with a working pressure at least equal to that of the PVC pipe on which it is to be installed and a minimum safety factor of 2:1.
      a. Approved Manufactures:
         1) EBAA Iron, Inc. Series 2000PV ductile iron MEGALUG retainers with Mega-Bond Coating System.
         2) Approved equal.

B. Steel Casing Piping:
   1. Casing pipe and joints shall be constructed so as to prevent leakage of any substance from the casing throughout its length.
   2. Use only new, welded or seamless steel pipe per ASTM A-139, Grade B. Casing minimum thickness to be as shown on the Drawings. The casing wall thickness shall be designed to accommodate the maximum jacking load allowed, as well as the expected earth and live loads.
   3. Joints in steel casing pipe shall be butt-welded joints, conforming to the requirements of AWWA C206. Pipe 36 inches in diameter and larger shall be welded both inside and outside of the pipe/casing.
   4. After welding, the joint and the surrounding damaged or uncoated area shall be coated with the same material and to the same thickness as the shop applied coating.
   5. All steel casing pipe and welds shall meet or exceed either the site-specific regulatory agency's requirement, or the manufacturer's minimum wall thickness to meet or exceed the greater of either: installation (jacking), loading, or carrier load requirements.
   6. The size (diameter) of the steel casing shall be as shown on the Drawings.
   7. All steel pipes shall be designed for the external and internal loads to which they will be subjected. Steel casing shall meet ASTM specifications and be designed to meet or exceed a minimum live load of a Cooper E-80 loading. The loading consists of 80 kip (356 kN) axle loads spaced 5-feet (1.5 m) on centers.

C. Annular Spacers
   1. Support carrier pipe within the steel casing by means of annular spacers. Casing spacers shall prevent the carrier pipe from floating, and shall electrically insulate the carrier pipe from the casing.
   2. The annular spacers shall be made of non-corrodible materials such as HDPE or stainless steel.
   3. For steel spacers, runners shall be made of polyethylene to provide dielectric insulation between the spacer and the carrier pipe.
   4. Spacers shall be installed at minimum one behind the bell end and one in the center of each 18-ft or 20-ft joint of carrier pipe in accordance with the manufacturer's recommendations.
   5. Verify size, position, spacing, and configuration of spacers with manufacturer. Final spacer installation shall be based on approved submittal.

6. Verify the tolerances of the casing spacer are compatible with the carrier pipe's outside diameter including provisions for the pipe to be slightly out-of-round.
7. Wooden skids are not acceptable.

D. Grout (Annular Backfill, between casing and adjacent soils):
1. Grout shall consist of one (1) part Portland cement, three (3) parts sand and the minimum amount of water necessary to obtain the desired consistency; and all grout mixtures shall contain 2% of bentonite by weight of the cement.
2. If voids are encountered or occur outside the encasement pipe, grout connections shall be provided and regularly spaced at 10-feet on center in the top section of the encasement pipe.

E. Casing End Seals
1. Seals shall be standard wrap-around end seals, manufactured of synthetic rubber, with self-curing rubber sealing strips.
2. The end seals shall be provided with 316- stainless steel bands and clamps.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
1. Provide notice of intent to begin Bore and Jack operations to ENGINEER prior to beginning any Work in roadway or railway rights-of-way. Acknowledgement of intent must be received no less than 5 working days before Work begins.
2. Comply with the lawful requirements of SCDOT, York County, public agencies, and owners of public utilities or other facilities respecting the safeguarding of structures and improvements that might be endangered by the jacking and boring, or microtunneling construction operations.
3. Install the required steel casing by means of jacking and boring as shown, specified herein, and as recommended by the pipe manufacturer.
4. The jacking and boring operation, along with the installation of the casing pipe, shall be done simultaneously and continuously until the casing pipe is in final position.
5. CONTRACTOR shall be responsible for the CONTRACTOR's means and methods of jacking and boring, and shall ensure the safety of the work, the CONTRACTOR'S employees, the public, and adjacent property, whether public or private.
6. Maintain traffic flow at all times during the progress of the work. CONTRACTOR shall provide adequate signs, barricades, flag persons, lights and other control devices in accordance with the provisions and requirements of the SCDOT standards. No lanes of traffic shall be closed without prior approval.
7. Provide erosion and sediment control to minimize erosion and the transport of sediment beyond the limits of the work area.
8. Anticipate that portions of the jacking and boring excavation will be below the groundwater table and dewatering will be required.
9. Comply with all local, state, and federal laws, rules, and regulations at all times to prevent pollution of the air, ground, and water.
10. Locate, mark and protect existing utilities and facilities in the work area. Perform test pits as required.

11. If there is a conflict between manufacturer's recommendations and the Drawings or Specifications, request instructions from ENGINEER in writing, before proceeding.

B. Jacking and Boring Operations:
   1. Provide and maintain adequate boring equipment and install support systems as required.
   2. The boring operations shall consist of excavating the embankment material ahead of the casing, removing excavated material through the pipe and forcing the pipe through the embankment with jacks into the spaced provided. No jetting, sluicing, or wet boring is permitted.
   3. Required launching and receiving pits/shafts shall be excavated and maintained to the minimum dimensions necessary to perform the operations and allow for safe working practices.
   4. The pits or shafts shall be adequately barricaded, sheeted, braced, dewatered, and ventilated as required, in accordance with applicable specifications and regulations.
   5. CONTRACTOR to use thrust blocks designed to distribute loads in a uniform manner so that any deflection of the thrust block is uniform and does not impart excessive load on the shaft itself or cause the jacking frame to become misaligned.
   6. Position jacks so that the resultant force is applied along the centerline of the casing pipe, and force is applied evenly to the entire end of the pipe.
   7. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage.
   8. CONTRACTOR to monitor and control the jacking pressure/force applied to ensure that pipe manufacturer’s recommended limits are not exceeded.
   9. CONTRACTOR responsible for all testing, survey, and documentation of the pre/post construction site conditions, in which to provide as a basis of comparison for the post construction conditions to be evaluated.
   10. Once jacking has begun, the operation must continue without interruption, insofar as practical, to prevent the pipe from becoming firmly set in the embankment.

C. Steel Casing Installation
   1. The installation of the casing shall be in accordance with manufacturer’s recommendations and subject to the approval of the agency having jurisdiction.
   2. The casing pipe shall be adequately protected to prevent crushing or other damage under the jacking pressures. Provide timbers for cushioning between the pipe pushed end and the jacking equipment.
   3. The casing installation shall produce NO upheaval, settlement, cracking, movement, or distortion of the existing roads.
   4. Install casing piping concurrent with the bore, as earth is removed.
   5. After the installation of the casing piping, the CONTRACTOR shall inject grout through the grout connections in such a manner as to completely fill all voids outside the casing pipe resulting from the jacking and boring operations. Grout pressure shall be controlled and monitored, so as to avoid deformation of the steel casing and avoid movement of the surrounding ground. After completion of the grouting operations, the grout connections shall be closed with cast-iron threaded plugs.

D. Carrier Pipe Installation
   1. All joints of the carrier piping, within the casing, shall be restrained in accordance with the Section 40 05 19, Ductile Iron Process Pipe or Section 40 05 31, Thermoplastic Process Pipe.
   2. Clean all dirt and debris from the casing piping.

3. Attach the centered/restrained casing spacers/guides to the carrier pipe sections, as required to prevent excessive sag, bending, shear stress and to support the pipe barrel in accordance with pipe manufacturer's recommendations. Piping is NOT to be supported by bells/joints.
4. Provide casing spacers at each joint, 6-inches from each side of joint, and at minimum 10-feet intervals, or as recommended by manufacturer. There shall be a minimum of two (2) casing spacers installed on each section of pipe.
5. Lubricant for pipe guides shall be drilling mud or flax soap. Petroleum, or Oil based products are NOT allowed.
6. The CONTRACTOR shall protect and preserve the interior surfaces of the steel casing from damage.
7. CONTRACTOR to provide casing end seals, and secure seals in place with stainless steel bands in accordance with the manufacturer's recommended procedures. The installation shall be watertight.

E. Transitions from One Type of Pipe to Another:
1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

3.2 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:
1. Locations of existing piping shown should be considered approximate. Determine the true location of existing piping to which connections are to be made, and location of other facilities which could be disturbed during earthwork operations, or which may be affected by CONTRACTOR'S Work in any way.
2. Conform to applicable requirements of the General Conditions, and Section 01 73 29, Cutting and Patching, pertaining to cutting and patching. Conform to applicable requirements of Section 01 14 16, Coordination with Owner's Operations, pertaining to connections to existing facilities.

END OF SECTION

SECTION 33 11 00

WATER SERVICES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install domestic water piping systems complete with accessories.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the domestic water piping systems Work.

C. Related Sections:
   1. Section 33 05 05, Buried Piping Installation.
   2. Section 40 05 19, Ductile Iron Process Pipe.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. ANSI A13.1, Scheme for Identification of Piping Systems.
   2. ANSI B16.15, Cast Copper Alloy Threaded Fittings: Classes 125 and 150.
   3. ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ANSI B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ASME B16.22).
   5. ANSI B16.23, Cast Copper Alloy Solder Joint Drainage Fittings: DWV.
   6. ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
   7. ANSI B16.29, Wrought Copper and Copper Alloy Solder-Joint Drainage Fittings: DWV.
   8. ANSI B16.39, Malleable Iron Threaded Pipe Unions: Classes 150, 250 and 350.
   9. ANSI B40.1, Gages – Pressure Indicating Dial - Elastic Element.
   10. ANSI H 23.1, Seamless Copper Water Tube, (ASTM B 88).
   11. ASSE 1013, Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
   12. ASSE 1018, Trap Seal Primer Valves – Water Supply Fed.
   13. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   14. ASTM B 32, Specification for Solder Metal.
   15. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
   16. ASTM B 88, Specification for Seamless Copper Water Tube.
   17. ASTM B 251, Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
   18. ASTM B 302, Specification for Threadless Copper Pipe, Standard Sizes.
   19. ASTM D 638, Test Method for Tensile Properties of Plastics.
   20. ASTM D 696, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics between - 30°C and 30°C with a Vitreous Silica Dilatometer.

21. ASTM D 746, Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
22. ASTM D 790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
23. ASTM D 1238, Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
24. ASTM D 1248, Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
25. ASTM D 1330, Specification for Rubber-Sheet Gaskets.
26. ASTM D 1505, Test Method for Density of Plastics by the Density-Gradient Technique.
27. ASTM D 1525, Test Method for Vicat Softening Temperature of Plastics.
28. ASTM D 1598, Test Method for Time-to-Failure of Plastic Pipe under Constant Internal Pressure.
29. ASTM D 1603, Test Method for Carbon Black in Olefin Plastics.
30. ASTM D 1693, Test Method for Environmental Stress-Cracking of Ethylene Plastics.
31. ASTM D 2240, Test Method for Rubber Property-Durometer Hardness.
32. ASTM D 2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
33. ASTM D 3261, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
34. ASTM D 3350, Specification for Polyethylene Plastics Pipe and Fittings Materials.
35. ASTM F 1248, Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.
36. AWWA C511, Reduced-Pressure Principle Backflow Prevention Assembly.
37. AWWA C701, Cold-Water Meters – Turbine Type, for Customer Service.
38. AWWA C703, Cold-Water Meters – Fire-Service Type.
39. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2-inch through 3-inch, for Water Service.
40. FS O-F-506, Flux, Soldering: Paste and Liquid.
41. FS WW-U-516, Unions, Brass or Bronze, Threaded Pipe Connections and Solder-Joint Tube Connections.
42. NSF/ANSI 14, Plastics Piping Components and Related Materials.
43. NSF/ANSI 61, Drinking Water System Components – Health Effects.
44. South Carolina Department of Health and Environmental Control (SCDHEC), Notice of Approved Backflow Prevention Assemblies.
45. SCDHEC, State Primary Drinking Water Regulation 61-58.

1.3 QUALITY ASSURANCE

A. Installer's Qualifications:
   1. Engage a single installer regularly engaged in domestic water piping installation and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER.
   2. Engage a single installer for the entire domestic water piping system with undivided responsibility for performance and other requirements.

B. Regulatory Requirements: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. National Electrical Code, (NEC).
   2. South Carolina Department of Health and Environmental Control (SCDHEC).

C. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single domestic water piping systems manufacturer.
   2. The domestic water piping systems manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the domestic water piping systems manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Manufacturer's literature, illustrations, specifications and engineering data.
      b. Flexible connections.
      c. Other technical data related to the specified material and equipment as requested by ENGINEER.
      d. Gasket material.

B. Informational Submittals: Submit the following:
   1. Qualifications Statements:
      a. Installer’s qualifications.

C. Project Closeout Submittals: Submit the following:
   1. Record Documentation:
      a. During progress of the Work keep an up-to-date set of the Drawings showing field and Shop Drawing modifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping Handling and Unloading:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to prevent delay of the Work.

B. Storage and Protection:
   1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
   2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer’s recommendations for long-term storage.

C. Acceptance at Site:
   1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer’s instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Copper Water Tube:
   1. Tube:
      a. Reference: ANSI H23.1, ASTM B 88.
      b. Type: K or L.
      c. Temper: Hard-drawn or soft-annealed.
   2. Fittings:
      a. Soldered, reference: ANSI B16.18 for cast copper alloy or ANSI B16.22 for wrought copper and copper alloy.
      b. Soldered, drainage, reference: ANSI B16.23 for cast copper alloy or ANSI B16.29 for wrought copper and copper alloy.
      c. Flared, reference: ANSI B16.26.
      d. Threaded, reference: ANSI B16.15.
   3. Joints:
      a. Sweat:
         1) Solder Metal: ASTM B 32, Type 95-5TA.
         2) Flux: FS O-F-506, Type 1.
   4. Unions:
      a. Reference: FS WW-U-516.
      b. Material: Bronze.
      c. Rating: 250 lb. W.O.G.

B. High-Density Polyethylene (HDPE) Piping:
   1. HDPE piping system shall be specifically designed, constructed and installed for the potable water service.
   2. Physical Properties:
      a. Materials used for the manufacture of polyethylene pipe and fittings shall meet the following physical property requirements:

Property	Unit	Test Procedure	Value
Material Designation	-	PPI/ASTM	-
PPI Material Listing	-	PPI TR-4	PE 3408
Material Classification	-	ASTM D 1248	III C 5 P34
Cell Classification	-	ASTM D 3350	345434C or 355434C
Density	g/cm3	ASTM D 1505	>0.941
Melt Index (E)	g/10 min	ASTM D 1238	<0.15
Flexural Modulus	psi	ASTM D 790	>110,000
Tensile Strength	psi	ASTM D 638	<160,000
ESCR (C)	hours	ASTM D 1693	3,000 to 3,500
HDB	psi	ASTM D 2837	1,600 @ 23°C
UV Stabilizer (C)	percent carbon black	ASTM D 1603	2 to 3
Elastic Modulus	psi	ASTM D 638	110,000
Brittleness Temperature F		ASTM D 746	<-180
Vicat Softening Temp F		ASTM D 1525	255
Thermal Expansion in/in/ F		ASTM D 696	8 x 10E-5
Hardness	Shore D	ASTM D 2240	64
Molecular Weight Category	-	-	Extra-High

b. There shall be no evidence of splitting, cracking or breaking when the pipe is tested in accordance with Article 2.1.B.4, below.
c. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. (Nominal RSC of Class 40 pipe = 40, etc.). The minimum RSC is 90 percent of the nominal.
d. The HDPE pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
e. Clean rework or recycled material generated by the manufacturer's own production may be used as long as the pipe or fittings produced meet all the requirements of this Section.

3. Pipe and Fittings:
   a. Dimensions:
      1) Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with AWWA C901. Standard laying lengths shall be 50 feet ± 2-inches.

2) Fitting Dimensions: Fittings such as couplings, wyes, tees, adapters, etc. for use in laying pipe shall have standard dimensions that conform to ASTM D 3261.

b. Pipe and fittings shall be produced from identical materials, meeting the requirements of this Section, by the same manufacturer. Special or custom fittings may be exempted from this requirement.

c. Pipe and fittings shall be pressure rated to meet the service pressure requirements specified by ENGINEER. Whether molded or fabricated, fittings shall be fully pressure rated to at least the same service pressure rating as the pipe to which joining is intended.

d. Molded fittings shall meet the requirements of ASTM D 3261 and this Section. At the point of fusion, the outside diameter and minimum wall thickness of fitting butt fusion outlets shall meet the diameter and wall thickness specifications of the mating system pipe. Fitting markings shall include a production code from which the location and date of manufacture can be determined. The manufacturer shall provide an explanation of the production codes used.

e. Reducing tees with branch diameters of 16-inches or less shall be saddle tees.

f. Marking:

1) Each standard and random length of pipe and fitting in compliance with this standard shall be clearly marked with the following information.

a) ASTM or AWWA Standard Designation.
b) Pipe Size.
c) Class and Profile Number.
d) Production Code.
e) Standard Dimension Ratio (SDR).

4. Source Quality Control:

a. At a minimum, incoming polyethylene materials shall be inspected for density in accordance with ASTM D 1505 and melt flow rate in accordance with ASTM D 1238. All incoming polyethylene materials shall be certified by the supplier. Certification shall be verified by CONTRACTOR and ENGINEER. Incoming materials shall be approved by Manufacturer's Quality Assurance Program before processing into finished goods.

b. Representative samples of polyethylene materials shall be tested against the physical property requirements required herein. Each extrusion line and molding machine shall be qualified to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D 1598.

c. Quality Assurance test for representative pipe and fitting samples shall include:

Test	Standard	Pipe	Fittings
Ring ESCR	ASTM F 1248	Yes	Not Applicable
Sustained pressure at 176°F/725 psi hoop stress (fo>100 h):	ASTM D 1598	Yes	Yes
Sustained pressure at 73°F/1,600 psi hoop stress (fo>1000 h):	ASTM D 1598	Yes	Yes

C. Dielectric Couplings:
    a. Refer to Section 33 05 06, Couplings, Adapters and Specials.

2.2 VALVES

A. Bronze Body Check Valves:
    1. Manufacturers: Provide products of one of the following:
        a. Ford Meter Box Company, Inc.
        b. Stockham Valves and Fittings Company.
        c. Lunkenheimer Company.
        d. Or equal.
    2. Type: Swing, regrinding bronze disc, screw-in cap.
    3. Materials: Brass and bronze.
    4. Rating: 150 lb. SWP.
    5. End Connections: Solder joint.

B. Bronze Body Ball Valves:
    1. Manufacturers: Provide products of one of the following:
        a. Stockham Valves and Fittings Company.
        b. Lunkenheimer Company.
        c. Or equal.
    2. Type: Non-blowout stem, adjustable packing gland, quarter turn, full port ball valve.
    3. Materials:
        a. Body: Cast bronze.
        b. Ball: Chrome plated brass.
        c. Packing and Seats: Teflon.
    4. Rating: 150 lb. SWP.
    5. End Connections: Screwed. Provide screwed to sweat adapters, where required.

C. Iron Body Gate Valves:
    1. Products and Manufacturers: Provide one of the following:
        a. Stockham Valves and Fittings, Fig. No. G-623.
        b. Lunkenheimer Company, Fig. No. 1430.
        c. American Cast Iron Pipe Company, Series 2500.
        d. M&H Valve Company, C509, C515.
        e. Mueller Company, LLC, 2360 Series.
        f. Or equal.
    2. Type: Rising stem, outside screw and yoke, solid wedge.
    3. Materials: Iron with bronze trim.
    4. Rating: 125 lb. SWP.
    5. End Connections: Threaded.

2.3 EQUIPMENT

A. Post Hydrants:
    1. Exposed Hose Connection, Non-Freeze Type:
        a. Manufacturers: Provide products of one of the following:
            1) Zurn Industries.

2) Or equal.
b. Type: Anti-siphon.
c. Materials:
1) Casing: Bronze.
2) Vacuum Breaker: Integral.
3) Threads: Two-inch hose thread outlet.
4) Wall Clamp: Adjustable with set screw.
5) Key: Removable tee handle type.
d. Connection: Two-inch sweat end inlet and 2-inch hose thread outlet, universal type.
e. Drain: 1/8-inch NPT drain hole.
f. Post Height to Hose Connection: 36-inches above finished ground elevation.

B. Backflow Preventers: 3/4-Inch to 2-Inches: Reduced Pressure Principle (RPP):
1. Products and Manufacturers: Provide from the most recent edition of SCDHEC List of Approved Backflow Prevention Devices, Reduced Pressure Principle Assemblies.
2. Type: Reduced pressure zone device with two independently acting check valves, together with an automatically operated pressure differential relief valve located between the two check valves.
3. Materials:
a. Body: Bronze.
b. Valve Discs: BUNA-N rubber.
c. Diaphragm: Silicone rubber or Buna-N rubber.
d. Springs: Stainless steel.
e. Screws: Stainless steel.
4. Maximum Working Pressure: 150 psi.
5. End Connections: Threaded.
6. Accessories:
a. Strainer with blow-off on inlet.
b. Ball valves on inlet and outlet.
c. Reduced pressure principle backflow preventer test kit for each unit furnished, provided in molded plastic carrying case with foam inserts.
7. References: ASSE 1013, AWWA C511 and authority having jurisdiction at the Site.

C. Backflow Preventers: 3-Inches and Larger: RPP:
1. Products and Manufacturers: Provide from the most recent edition of SCDHEC List of Approved Backflow Prevention Devices, Reduced Pressure Principle Assemblies.
2. Type: Reduced pressure zone device with two independently acting check valves, together with an automatically operated pressure differential relief valve located between the two check valves.
3. Materials:
a. Body: Bronze or cast-iron.
b. Valve Discs: Buna-N rubber.
c. Diaphragm: Silicon rubber or Buna-N rubber.
4. Maximum Working Pressure: 175 psi.
5. End Connections: Threaded or flanged.
6. Accessories:
a. Strainer with blow-off on inlet.
b. Outside screw and yoke gate valves on inlet and outlet.

c. Reduced pressure principle backflow preventer test kit for each unit furnished with carrying case, provided in molded plastic carrying case with foam inserts.

7. References: ASSE 1013, AWWA C511 and authority having jurisdiction at the Site

D. Backflow Preventers: DCV:
1. Products and Manufacturers: Provide from the most recent edition of SCDHEC List of Approved Backflow Prevention Devices, Double Check Valve Assemblies.
2. Type: Assembly of two single independently acting check valves with tight closing shut off valves at each end and suitable connections for testing the water tightness of each check valve.
3. Materials:
   a. Body: Bronze.
   b. Valve Discs: Silicon rubber.
   c. Springs: Stainless steel.
   d. Poppets: Glass-filled Celcon.
   e. Replaceable Seats: Glass-filled Noryl.
   f. Fasteners: Stainless steel.
   g. Test cocks: Bronze, four required.
4. Maximum Working Pressure: 150 psi.
5. End Connections: Threaded or Flanged.
6. Accessories:
   a. Ball valves or gate valves as shown on the drawings, on inlet and outlet with UL listed, FM approved tamper switches.
   b. DCV backflow preventer test kit provided in molded plastic carrying case with foam inserts for each unit furnished to be turned over to the OWNER.
      1) Products and Manufacturers: Provide one of the following:
         a) CMB Industries, Inc., Febco Division, Double Check Valve Backflow Prevention Assembly Differential Pressure Test Kit with carrying case.
         b) Watts Regulator, Backflow Preventer Test Kit with carrying case.
         c) Or equal.
7. Reference: Underwriters Laboratory listed, Factory Mutual approved.
8. Fire protection system backflow preventers shall be provided with a bypass assembly consisting of a water meter, approved double check valve backflow prevention assembly with shut-off valves and test cocks.

E. Water Meters for 3/4 - to 2-inch Water Services:
1. Type: Magnetic drive, disk water meter.
2. Products and Manufacturers: Provide one of the following:
   a. Mueller Systems LLC, MVR series.
   b. Neptune Technology Group Inc, T-10.
   c. Or equal.
3. Materials:
   a. Body: Bronze.
   b. Register: Brass.
4. Maximum Working Pressure: 150 psi.
5. End Connections: Threaded.
6. Meters shall conform to AWWA C701.

F. Water Meters for 3- and 4-inch Water Services:
1. Type: Magnetic drive, disk water meter.

a. Products and Manufacturers: Provide one of the following:
   1) Mueller Systems LLC, MVR series.
   2) Or equal.
b. Materials:
   1) Body: Bronze.
   2) Register: Brass.
c. Maximum Working Pressure: 150 psi.
d. End Connections: Flanged.
e. Meters shall conform to AWWA C701.

G. Water Meters for Fire-Services:
   1. Products and Manufacturers: Provide one of the following:
      a. Mueller Systems LLC, Model FM3.
      b. Or equal.
   2. Type: Magnetic drive, disk water meter.
   3. Materials:
      a. Body: Ductile iron or bronze.
   4. Size: 3-, 4-, 6-, 8- and 10-inch.
   5. Maximum Working Pressure: 175 psi.
   6. End Connections: Flanged.
   7. Meters shall conform to AWWA C703.

2.4 PIPE MARKING

A. Mark or label all materials with the following:
   1. Metal or alloy designation.
   2. Temper.
   3. Size and schedule.
   4. ASTM reference standard number.
   5. Name and location of supplier.

2.5 PAINTING

A. Piping and accessories shall be painted in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
   1. Install all items as shown, specified, and as recommended by the manufacturers.
   2. Request instructions from ENGINEER, in writing, when there is a conflict between the manufacturer's recommendations and the Contract Documents.
   3. Present conflicts between piping systems and/or equipment and/or structures to ENGINEER, in writing, who will determine corrective measures to be taken.
   4. Do not modify structures to facilitate installation of piping, unless specifically approved by ENGINEER.

5. Installation shall conform to requirements of all local and state codes.
6. Properly plug or cap the open ends of all piping at the end of each day's Work or other stopping point through construction. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical damage.
7. Refer to Section 33 05 05, Buried Piping Installation.

B. HDPE Piping:
   1. Heat Fusion of Pipe:
      a. HDPE pipe and fittings joints shall be heat fused by a qualified technician; trained by the manufacturer's representative in accordance with the manufacturer's recommended fusion procedures. Training must have occurred within the previous 12 months, or submittals verifying experience within the previous 12 months for all technicians performing heat fusion on polyethylene pipe and fittings.
      b. Weld in accordance with manufacturer's recommendation for butt fusion methods. Personnel operating fusion equipment shall be certified by the HDPE pipe manufacturer.
      c. The first butt fusion weld of each day's production welding and for each separate operator shall be tested by bent strap test method. No production welds shall be performed until successful completion of bent strap test.
      d. Butt fusion equipment for joining procedures shall be capable of meeting conditions recommended by HDPE pipe manufacturer including, but not limited to, temperature requirements, alignment, and fusion pressures. The equipment used for the heat fusion joints shall be capable of recording the heating and fusion pressures used to join the HDPE pipe, recording heater temperature, and storing this information for future retrieval (data logger). Each field fusion shall be recorded by such equipment and this information shall be made compiled into daily log reports. Log reports shall be submitted to CONTRACTOR and ENGINEER daily. Reports shall also include the results of the bent strap tests.
      e. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer's recommendations.
      f. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade. Shop Drawings shall address locations and deflections of required fittings to prevent installation that exceeds a greater degree of bending than the manufacturer's recommended minimum bending radius for each size and class of HDPE pipe.
      g. Do not subject pipe to strains that will overstress or buckle piping or impose excessive stress on joints.
      h. Branch saddle fusions shall be joined in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment shall be of size to facilitate saddle fusion within trench.
      i. Before butt fusing pipe, inspect each length for presence of dirt, sand, mud, shavings, and other debris or animals. Remove debris from pipe.
      j. Cover open ends of fused pipe at the end of each day's Work. Cap to prevent entry by animals or debris.
   2. Flange Jointing:
      a. Use on flanged pipe connection sections.
      b. Connect slip-on Type 316 stainless steel backup flanges with Type 316 stainless steel nuts and bolts.
      c. Butt fuse fabricated flange adapters to pipe.
      d. Observe following precautions in connection of flange joints.

1) Align flanges or flange/valve connections to provide tight seal. Require nitrile-butadiene gaskets if needed to achieve seal. Integral flange adapters and gaskets are required for flange/valve connections.
2) Place U.S. Standard round washers as may be required on some flanges in accordance with manufacturer's recommendations. Bolts shall be lubricated in accordance with manufacturer's recommendations.
3) Tighten flange bolts in sequence and accordance with manufacturer's recommendations. CAUTION: Do not over-torque bolts.

e. Pull bolt down by degrees to uniform torque in accordance with manufacturer's recommendation.
f. Install electrofusion couplers, where used, in accordance with manufacturer's specifications.

3. Pipe Placement:
a. Grade control equipment shall be of type to accurately maintain design grades and slopes during installation of pipe.
b. Dewatering: Remove standing water in trench before pipe installation.
c. Unless otherwise specifically stated, install pipe in accordance with manufacturer's recommendations.
d. Maximum lengths of fused pipe to be handled as one section shall be placed according to manufacturer's recommendations as to pipe size, pipe SDR, and topography so as not to cause excessive gouging or surface abrasion, but shall not exceed 400 feet.
e. Cap pipe sections longer than single joining (usually 50 feet) on both ends during placement, except during fusing operations.
f. Notify ENGINEER prior to installing pipe into trench and allow time for ENGINEER'S inspection.
1) Correct irregularities found during inspection.
g. Complete tie-ins within trench whenever possible to prevent overstressed connections.
h. Allow pipe sufficient time to adjust to trench temperature prior to testing, segment tie-ins or backfilling activity.
i. Pipe shall be snaked in trench to allow a minimum of 12-inches/100 feet for thermal contraction and expansion.
j. Allow extra length at future connection points to be cut to fit after backfill and prior to tie-in.

3.2 REDUCED PRESSURE ZONE BACKFLOW PREVENTION

A. Provide RPZ-BFP devices or air gap separation for high hazard cross connections, as defined by SCDHEC 61-58.7.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
1. Fill all systems and fully test all equipment, valves, etc. in operation.
2. Check for excessive vibration while all systems are operating.
3. Installed systems and components shall not be released to OWNER, unless all systems have been tested by the CONTRACTOR and approved by the ENGINEER.
4. Refer to 33 05 05, Buried Piping Installation, for buried piping disinfection and testing.

B. Inspection:
   1. Examine areas to receive piping, valves and accessories for:
      a. Defects that adversely affect execution and quality of the Work.
      b. Deviations beyond allowable tolerances for piping, valves and accessories.
      c. Start the Work only when conditions are satisfactory.
   2. The ENGINEER reserves the right to reject or authorize replacement of piping and accessories found to defective.

3.4 ADJUSTING AND CLEANING

A. Adjusting:
   1. Adjust all controls for proper settings.
   2. While system is operable balance all equipment, valves, etc. to achieve design conditions.

B. Cleaning:
   1. Thoroughly clean all piping, fittings, valves, and accessories prior to installation.
   2. Remove all dirt, rust, dust, etc. from piping in preparation for painting.
   3. Remove and dispose of all debris and waste from the Site resulting from installation.

C. Refer to Section 33 05 05, Buried Piping Installation.

3.5 MATERIAL SCHEDULES

A. Piping:
   1. Use types of pipe and fittings as specified below, unless otherwise specified or shown.
   2. All potable water piping 2-1/2-inches and smaller run underground shall be soft-annealed copper Type “K” copper tubing.
   3. All underground water piping 3-inches and larger shall be cement-lined ductile iron pipe with mechanical joints.
   4. All valves for copper or brass piping shall be bronze bodied, unless otherwise specified.
   5. All valves for ductile iron piping shall be iron bodied, unless otherwise specified.
   6. Use “wrought copper” fittings for copper tubing.
   7. Use “butt welded” fittings for welded steel pipe connections.

END OF SECTION

SECTION 33 31 01

SEWER LATERALS AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install wastewater sewer laterals and appurtenances.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the Work required under this Section.

C. Related Sections:
   1. Section 33 05 05, Buried Piping Installation.
   2. Section 33 05 06, Couplings, Adapters and Specials

1.2 REFERENCES

A. Standards which may be referenced in this Section are:
   1. AWWA M41, Ductile-Iron Pipe and Fittings.
   2. AWWA C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   3. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C151, Ductile-Iron Pipe, Centrifugally Cast.
   5. ASTM D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   6. ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems,
   7. ASTM D2665, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   8. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
   9. ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   10. ASTM D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   11. ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   12. ASTM F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
   13. ASTM F1417, Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.
   14. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
   15. NSF/ANSI Standard 14, Plastics Piping System Components and Related Materials.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall be able to provide evidence of at least five installations of substantially similar products in satisfactory operation for at least five years.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Product data sheet.
      b. Complete catalog information, including dimensions, weight, specifications, and identification of materials of construction of parts.

B. Informational Submittals: Submit the following:
   1. Certifications: Submit a certificate signed by the manufacturer of each product stating that the product complies with the applicable referenced standards.

1.5 DELIVERY, STORAGE AND HANDING

A. Packing, Shipping, Handling and Unloading:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work.

B. Storage and Protection:
   1. Protect materials from corrosion and deterioration.
   2. Store equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long-term storage.

PART 2 PRODUCTS

2.1 GENERAL

A. Sewer Laterals: Provide one of the following as conditions warrant:
   1. Less than 16-feet cover, SDR 35 with minimum ring stiffness of 46psi, or Schedule 40 PVC pipe conforming to ASTM D2665, NSF 14 and ASTM D2466.
      a. Fittings shall be socket type in accordance with ASTM D2466.
      b. Joining shall be through solvent cement in accordance with ASTM D2564.
   2. 16-feet of cover or greater, Ductile Iron pipe of pressure class 350 conforming to AWWA C151.
      a. Pipe interior shall have a cement-mortar lining of standard thickness according to AWWA C104.
      b. Pipe exterior shall have a bituminous coat a minimum of 1-millimeter thick.
      c. Joining shall be by rubber gaskets and in conformance with AWWA C111.
   3. Joints, PVC pipe joints shall be solvent cemented in accordance with ASTM D2855.

B. Sewer Lateral Wye Branches:
   1. Sewer lateral wye branches shall be the same type material as the sewer main, and shall conform to the applicable sewer pipe specifications.

C. Sewer Lateral Cleanouts: Provide cleanouts of same material as the lateral.

D. Sewer Lateral Cap: Provide HS-20 traffic-rated plugs.

E. Couplings: See Section 33 05 06, Couplings, Adapters and Specials.

F. Saddles:
   1. Provide saddles of ABS plastic, PVC, elastomeric PVC or approved equivalent.
   2. Connect saddles to vitrified clay pipe using epoxy sealant.
   3. Connect saddles to PVC pipe using a flat or profile gasket, as appropriate to the pipe, and minimum two stainless steel bands around the pipe and saddle.
   4. Connect the lateral to the saddle with a compression gasket, solvent weld adapter, and/or stainless steel band, as appropriate.

G. Sewer Cut-ins:
   1. Provide cast iron cut-ins where new sewer laterals are connected to existing sewer mains smaller than 36-inch (GENCO, Model D, Type K, DFW flexible saddle, pre-approved equivalent).
   2. For sewer cut-ins on 36-inch and larger sewer mains a Kor-N-Tee, Inserta-Tee or pre-approved equivalent shall be used.

PART 3 EXECUTION

3.1 INSTALLATION

A. 4-Inch and 6-Inch Laterals
   1. Connect laterals to the main with tees or wyes if the lateral is installed during construction with the main.
   2. Connect to existing mains with saddles placed in holes cored by an approved coring machine.
   3. Install laterals to the property line using 45-degree bends at the tee or saddle and pipe as shown in the Drawings.
   4. Install laterals that will discharge at terminal ends of the sewer main at 2% slope. Install all other laterals with a minimum slope of 1/8-inch per foot (1%).
   5. Cap the end of the lateral to be water/air tight.
   6. Encase all tees, saddles and bends shall be completely in #67 washed stone.
   7. Cut an “S” in the curb at the location where lateral crosses under curb.
   8. In subdivisions constructed without curb, paint a green “S” on the edge of pavement at the location where the lateral crosses under the edge of pavement.
   9. Connect to the sewer main all laterals except those serving lots adjacent to in line manholes or upstream from dead-end manholes in cul-de-sacs.
   10. Laterals connected to manholes shall be laid on a line from the center of the lot to the center of the manhole and shall extend not more than three inches inside the manhole wall.
   11. Manholes in cul-de-sacs shall have a maximum of 3 laterals. Any in line manhole shall have a maximum of 4 laterals.
   12. The lateral elevation entering the manhole shall match crown to crown with the main entering the manhole and a trough shall be formed for the lateral invert.
   13. Laterals that are connected to outfall lines shall enter the manhole at the shelf and an invert shall be formed to carry the lateral flow to the main invert.

14. Install laterals with a minimum of 4-feet of cover at the property line, unless otherwise approved by York County Water/Sewer Department. Install laterals with a maximum of 5-feet unless greater depth of the lateral installation is approved by a York County Inspector.

B. 8-Inch and Larger Laterals
   1. Connect 8-inch and larger diameter laterals to manholes with the lateral crown level with the crown of the main line pipe, or with outside drops, in accordance with the Drawings.
   2. When the lateral is the same diameter as the main line pipe, provide a drop of 0.2 feet in the manhole between the invert of the lateral and the invert of the main line pipe.
   3. Provide a minimum slope of 1/8-inch per foot (1%).

C. Install sewer laterals to be perpendicular to the mainline when possible.

D. Cleanouts shall be installed at the roadway right-of-way or easement line.

E. Install all sewer laterals and appurtenances in accordance with Section 33 05 05, Buried Piping Installation.

END OF SECTION

SECTION 40 05 05

EXPOSED PIPING INSTALLATION

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown, specified, and required to install and test all exposed piping, fittings, and specials. The Work includes the following:
      a. All types and sizes of exposed piping, except where exposed piping installations are specified under other Sections.
      b. Unless otherwise shown or specified, this Section includes all piping beginning at the outside face of structures or structure foundations and extending into the structure. Piping embedded in concrete within a structure or foundation shall be considered as exposed and is included herein. Piping that is permanently or intermittently submerged, or installed in sub-aqueous environments, is considered as exposed and is included in this Section.
      c. Work on or affecting existing exposed piping.
      d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all Work required for a complete exposed piping installation.
      e. Supports, restraints, and other anchors.
      f. Field quality control, including testing.
      g. Cleaning.
      h. Incorporation of valves, meters, and special items shown or specified into the piping systems per the Contract Documents and as required

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before exposed piping Work.
   2. Coordinate with appropriate piping Sections of Division 40.

C. Related Sections:
   1. Section 40 05 07, Pipe Hangers and Supports.
   2. Section 40 05 08, Wall Pipes, Floor Pipes and Pipe Sleeves.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASME Boiler and Pressure Vessel Code.
   2. ASME B31.3, Process Piping.
   3. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
   4. ASTM A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   5. ASTM B32, Specification for Solder Metal.
   6. ASTM D4174, Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems.
   7. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

8. ANSI/AWWA C600, Installation of Ductile Iron Water Mains and Their Appurtenances.
9. AWWA M41, Ductile-Iron Pipe and Fittings.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including:
      a. York County.
      b. South Carolina Department of Transportation.
      c. South Carolina Department of Health and Environmental Control.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Detailed drawings in plan and, as applicable, section.
      b. Details of piping, valves, supports, accessories, specials, joints, harnessing, and main anchor supports, and connections to existing piping, structures, equipment, and appurtenances.
      c. Laying schedules for piping with restrained joints.
   2. Testing Plans, Procedures, and Testing Limitations:
      a. Submit description of proposed testing methods, procedures, and apparatus, and obtain ENGINEER's approval prior to testing.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Submit a certificate, signed by manufacturer of each product, certifying that product complies with applicable referenced standards.
   2. Source Quality Control Submittals:
      a. Submit copies of testing report for each test.
   3. Site Quality Control Reports:
      a. Submit copies of testing report for each test.

C. Closeout Submittals: Submit the following:
   1. Record Documentation:
      a. Maintain accurate and up-to-date record documents showing field and Shop Drawing modifications. Record documents for exposed piping Work shall show actual location of all piping and appurtenances on a copy of the Drawings, unless otherwise approved by ENGINEER.
      b. Record documents shall show piping with elevations referenced to the project datum and dimensions from permanent structures. For straight runs of pipe provide offset dimensions as required to document pipe location.
      c. Include section drawings with exposed piping record documents when the Contract Documents include section Drawings.
      d. Conform to Section 01 78 39, Project Record Documents.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver products to Site to ensure uninterrupted progress of the Work.

2. Upon delivery, inspect pipe and appurtenances for cracked, gouged, chipped, dented, and other damage and immediately remove damaged products from Site.
3. Conform to requirements of Section 01 65 00, Product Delivery Requirements.

B. Storage:
1. Store products for convenient access for inspection and identification. Store products off the ground using pallets, platforms, or other supports. Protect packaged products from corrosion and deterioration.
2. Pipe and fittings materials may be stored outdoors without cover.
3. Conform to requirements of Section 01 66 00, Product Storage and Handling Requirements.

C. Handling:
1. Handle pipe, fittings, specials, and accessories carefully with approved handling devices. Do not drop or roll material of delivery vehicles. Do not otherwise drop, roll, or skid piping.
2. Avoid unnecessary handling of pipe.
3. Keep pipe interiors free of dirt and foreign matter.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage. Repair damaged coatings.
5. Conform to requirements of Section 01 65 00, Product Delivery Requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Piping materials are specified in the Exposed Piping Schedule at the end of this Section. Piping materials shall conform to Specification for each type of pipe and piping appurtenances in applicable sections of Division 40, Process Integration.

B. Markings and Identification:
1. Pipe Markings:
a. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the approved Shop Drawings.
b. Manufacturer shall cast or paint on each length of pipe and each fitting the pipe material, diameter, and pressure or thickness class.
2. Pipe Identification Markers and Arrows: Refer to Section 40 05 19, Ductile Iron Process Pipe.

C. Appurtenances: Provide products that comply with:
1. Section 40 05 07, Pipe Hangers and Supports.
2. Section 40 05 08, Wall Pipes, Floor Pipes and Pipe Sleeves.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Install piping as shown, specified and as recommended by the pipe and fittings manufacturer.
   2. If there is a conflict between manufacturer's recommendations and the Contract Documents, request in writing instructions from ENGINEER before proceeding.
   3. Provide pipe manufacturer's installation specialist at Site as specified on this Section.

B. Temporary Blind Flanges, Plugs, Caps, and Bulkheads:
   1. Temporarily plug installed pipe at the end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
   2. Install standard plugs in all bells at dead ends, tees, and crosses. Cap all spigot and plain ends.
   3. Fully secure and block blind flanges, plugs, caps, and bulkheads installed for testing, designed to withstand specified test pressure.
   4. Where plugging is required for phasing of Work or subsequent connection of piping, install watertight, permanent type blind flanges, plugs, caps, or bulkhead acceptable to ENGINEER.

C. Piping Installation:
   1. Conform to manufacturer's instructions and requirements of standards and manuals listed in this Section, as applicable:
      a. Ductile Iron Pipe: ANSI/AWWA C600, AWWA M41.
   2. Install straight runs true to line and elevation.
   3. Install vertical pipe truly plumb in all directions.
   4. Install piping parallel or perpendicular to walls of structures. Piping at angles and 45 degree runs across corners of structures will not be accepted unless specifically shown on the Contract Documents or approved by the ENGINEER.
   5. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.
   6. Install piping to leave all corridors, walkways, work areas, and similar spaces unobstructed. Unless otherwise approved by ENGINEER provide a minimum headroom clearance under piping and pipe supports of 7.5 feet. Clearances beneath piping shall be measured from the outermost edge of piping, flanges or other type of joint that extends beyond the nominal outside diameter of piping.
   7. Cutting: Cut pipe from measurements verified at Site. Field cut pipe, where required, with a machine specially designed for cutting type of pipe being installed. Make cuts carefully without damage to pipe, coating, or lining, and with a smooth end at right angles to axis of pipe. Cut ends of push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.

D. Jointing Pipe:
   1. General:

a. Make joints in accordance with pipe manufacturer's recommendations and Contract Documents.
b. Cut piping accurately and squarely and install without forcing or springing.
c. Ream out pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.
d. Remove all cuttings and foreign matter from inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.

2. Ductile Iron Flanged Joints:
   a. Assemble flanged joints using ring-type gaskets, with thickness as recommended by pipe manufacturer but not less than 1/8-inch thick, for raised-face flanges. Use full-face gaskets for flat-face flanges, unless otherwise approved by ENGINEER or recommended by pipe manufacturer. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.
   b. Tighten bolts in a sequence that provides equal distribution of bolt loads.
   c. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4-inch or fall short of the nut when fully taken up. Machine-cut ends of bolts to be neatly rounded. Do not use washers.
   d. Prior to assembly of flanged joints, lubricate bolt threads and gasket faces.
   e. Alternately tighten bolts 180 degrees apart to compress the gasket evenly.
   f. After assembly, coat all bolts and nuts, except stainless steel bolts and nuts, with coating appropriate for pipe and fittings being joined, as recommended by manufacturer.
3. Copper Tubing Joints:
   a. Soldered Joints:
      1) Assemble copper tubing with soldered joints. Solder shall be 95-5 tin-antimony solder conforming to ASTM B32.
      2) Ream or file pipe to remove burrs.
      3) Clean and polish contact surfaces of joints.
      4) Apply flux to both male and female ends.
      5) Insert end of tube into full depth of fitting socket.
      6) Heat joint evenly.
      7) Form continuous solder bead around entire circumference of joint starting at the bottom.
   b. Threaded Joints:
      1) When open flames for soldering are impractical, or at unions and connections to equipment and appurtenances, assemble copper tubing with flared ends as permitted by authority having jurisdiction.
      2) Ends of tubing shall be flared at an angle of 45 degrees with flaring tool recommended by pipe manufacturer. Flaring tool shall have same outside diameter as tube to be flared.
      3) Tubing to be flared shall be soft temper or annealed prior to flaring.
      4) Cut end of tube square and ream to remove burrs.
      5) Resize back to round tube that is out-of-round.
      6) Clean and polish contact surfaces of joints using an abrasive cloth.
      7) Place flare nut over end of tube with threads closest to end being flared.
      8) Insert appropriate length of tube between flaring bar of flaring tool and position yolk with flaring cone over tube end and clamp yoke in place.
      9) Turn handle of yolk clockwise without over-tightening. Cracked or deformed tubes will be rejected.

10) Do not apply jointing compounds to mating surfaces of flare fitting and flared tube end before attaching flare nut to threaded connection.

4. Mechanical Coupling Joints:
   a. Mechanical couplings include sleeve-type flexible couplings, split flexible couplings, and other mechanical couplings used.
   b. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with a wire brush to remove foreign matter.
   c. For mechanical couplings that incorporate gaskets, after cleaning apply lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.

E. Installing Valves and Accessories:
   1. Provide supports for large valves, flow meters, and other heavy items as shown or required to prevent strain on adjoining piping.
   2. Position flow measuring devices in pipe lines so that they have the amount of straight upstream and downstream runs recommended by the flow measuring device manufacturer, unless specific location dimensions are shown.
   3. Position swing check valves and butterfly valves so that they do not conflict with upstream and downstream elements of the piping system.

F. Unions:
   1. Install dielectric unions as specified in Section 33 05 06, Couplings, Adapters, and Specials**,** where dissimilar metals are connected, except for bronze or brass valves in ferrous piping.
   2. Provide a union downstream of each valve with screwed connections.
   3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

G. Transitions from One Type of Pipe to Another:
   1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

H. Closures:
   1. Provide closure pieces, such as blind flanges and caps, shown or required to complete the Work.

3.3 THRUST RESTRAINT

A. Provide thrust restraint on all pressure piping systems and where otherwise shown or specified.

B. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Exposed Piping Schedule at end of this Section.

3.4 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:
   1. Locations of existing piping shown on Drawings is approximate.

2. Determine the true location of existing piping to which connections are to be made, crossed, and that could be disturbed, and determine location of other facilities that could be affected by the Work.

B. Taking Existing Pipelines Out of Service:
   1. Conform to Section 01 14 16, Coordination with Owner's Operations.

C. Work on Existing Pipelines:
   1. Cut or tap pipes as shown or required with machines and tools specifically designed for cutting or tapping pipelines.
   2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
   3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.
   4. Conform to applicable requirements of Section 01 14 16, Coordination with Owner's Operations.

3.5 PAINTING

A. Surface preparation, priming, finish painting, and touch-up painting shall conform to the manufacturer's paint standards.

3.6 FIELD QUALITY CONTROL

A. Testing, General:
   1. Test all piping, except as exempted in the Exposed Piping Schedule.
   2. Notification:
      a. Notify ENGINEER at least 48 hours prior to testing.
      b. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
   3. Conduct all tests in presence of ENGINEER.
   4. Remove or protect pipeline-mounted devices that could be damaged by testing.
   5. Provide all apparatus and services required for testing, including:
      a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
      b. Temporary bulkheads, bracing, blocking, and thrust restraints.
   6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
   7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into the pipe being tested. CONTRACTOR shall provide fluid for other types of testing required.
   8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
   9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of ENGINEER or OWNER. Repair of existing piping will be paid as extra work unless otherwise specified.

B. Test Schedule:
   1. Refer to the Exposed Piping Schedule for type of test required and required test pressure.
   2. Unless otherwise specified, the required test pressures are at lowest elevation of pipeline segment being tested.

3. For piping not listed in Exposed Piping Schedule:
    a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig.
4. Test Pressure:
    a. Use test pressures listed in Exposed Piping Schedule.
    b. If test pressure is not listed in Exposed Piping Schedule, or if a test is required for piping not listed in the Exposed Piping Schedule, test pressure will be determined by the ENGINEER based on the maximum anticipated sustained operating pressure and the methods described in the applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:
1. Preparation for Testing:
    a. Follow procedures described in AWWA Manual M9. A wetting period is not required for pipe that is not cement mortar-lined.
    b. Prior to testing, ensure that adequate thrust protection is in place and all joints are properly installed.
    c. Piping for Hydraulic Fluid, Lube Oil, and Diesel Fuel: Hydrostatically test system using the fluid with which system will function permanently. Allowable leakage is zero. For fluid power systems, manufacturer shall supervise installation and testing of system components, including field piping.
2. Test Procedure:
    a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in the pipe being tested.
    b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.
    c. Examine joints and valves, and make repairs to eliminate visible leakage.
    d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
    e. Timed test period shall not begin until after the pipe has been filled, exposed to the required wetting period, air has been expelled, and pressure stabilized.
    f. Timed Test Period: After the stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. The test pressure shall then remain steady for one hour, indicating no leakage.
    g. Pump from a test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at fifteen minute intervals for duration of test.
3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of the test pressure during timed test period. Allowable leakage rates for piping are:
    a. No Leakage: Pipe with flanged, threaded, soldered, or brazed joints.
    b. Rates based on formula or table in AWWA Manual M41:
        1) Metal and fiberglass pipe joined with rubber gaskets as sealing members, including the following joint types:
            a) Bolted sleeve type couplings.

D. Process Air Pipe Testing:
1. General:
    a. Required test pressure is listed in Exposed Piping Schedule.
2. Preparation for Testing:

a. Provide temporary tie rods at expansion joints as required.
b. Verify that pipe supports, where present, are secure.
c. Test one pipe segment at a time. Use temporary blind flanges and isolators as required.
d. Install corporation cocks for filling and relieving air. Provide temporary automatic pressure relief valve and pressure gauge with range suitable for test pressure.

3. Test Procedure:
   a. Pressurize pipe segment being tested with air to the required test pressure. Maintain pressure for at least two hours.
   b. Apply a soapy water solution to all joints to check for leakage, indicated by presence of bubbles, while test pressure is maintained.
   c. Allowable Leakage: Zero
4. Repair and retest pipelines that fail the test.
5. After testing is complete remove temporary measures provided for testing and provide Type 304 stainless steel threaded plugs at taps used for testing.

3.7 CLEANING

A. Cleaning, General: Clean pipe systems as follows:
   1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in a manner approved by ENGINEER, prior to placing in service.
   2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.

B. Cleaning of Hydraulic and Fluid Power Oil Systems: Upon completion of field piping, but before connection to control components, hydraulic and fluid power oil systems shall be flushed and cleaned by circulating special flushing oil through the system. Flushing oil and procedures shall comply with ASTM D4174. System shall be cleaned such that internal contamination of system, when tested using procedures specified in SAE J1227, Section 2.3, shall not exceed the Allowable Cleanliness Level (ACL). Unless otherwise specified, ACL value shall be established by manufacturer of major hydraulic system components in accordance with SAE J1227, Section 9.1.

3.8 EXPOSED PIPING SCHEDULE

A. The schedules listed below, following the “End of Section” designation, are a part of this Specification section.
   1. Table 40 05 05-A, Exposed Piping Schedule.

END OF SECTION

TABLE
40 05 05-A, EXPOSED PIPING SCHEDULE

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test	Remarks

The following abbreviations are used in the Exposed Piping Schedule.

A. Service Abbreviations

Service	Abbrev.		Service	Abbrev.
Sanitary Force Main	SFM		Fuel Oil	FO
Wastewater	WW			

B. Material Abbreviations

Material	Abbrev		Material	Abbrev.
Ductile Iron	DI			
Copper	C			

C. Lining/Coating Abbreviations

Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Painted	P
Ceramic Epoxy	CE			

D. Joint Abbreviations

Joint Type	Abbrev		Joint Type	Abbrev.
Soldered	Sd		Flanged	Flg
Brazed	Bz		Flanged Adapter	FA

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ( )		Exfiltration Test	EX

SECTION 40 05 07

PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified and required to design, furnish, and install all hangers, supports and appurtenances necessary to complete the Work.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the pipe hangers and supports Work.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 05 50 13, Miscellaneous Metal Fabrications.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Society for Testing and Materials, (ASTM).
      a. ASTM A 575, Specification for Steel Bars Carbon, Merchant Quality, M-Grades.
      b. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
   2. Federal Specification, (FS).
      a. S A-A-1192, Hangers, Pipe.
   3. Manufacturers Standardization Society of the Valve and Fittings Industry, (MSS).
      a. MSS SP 58, Pipe Hangers and Supports-Materials, Design and Manufacture.
      b. MSS SP 69, Pipe Hangers and Supports - Selection and Application.
   4. Underwriters' Laboratories, Inc., (UL).
      a. UL 203, Pipe Hanger Equipment for Fire Protection Service.

1.3 QUALITY ASSURANCE

A. Each type of pipe hanger or support shall be the product of one manufacturer.

B. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single pipe hangers and supports manufacturer.
   2. The pipe hangers and supports equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the pipe hangers and supports equipment manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Detailed drawings showing all hangers and supports for each piping system specified. Shop Drawings shall show location, installation, material, loads or forces, and deflection of all hangers and supports.
      b. Each pipe system shall be analyzed for all loads and forces on the hangers and supports. Provide calculations of reaction forces to the structure to which they are fastened. Provide confirmation that hanger systems comply with support requirements and codes.
      c. Submit and coordinate these with Shop Drawings required for all piping systems.
   2. Product Data:
      a. Submit manufacturers' catalogs, literature, and engineering data on all hangers and supports. Load ratings, materials and installation shall be consistent with the recommendations of the MSS SP 58, MSS SP 69 and Federal Specification A-A-1192.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.

B. Storage and Protection:
   1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
   2. Store materials in covered storage off the ground and prevent condensation.

C. Acceptance at Site:
   1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GENERAL

A. Hangers and supports shall meet with the following requirements:
   1. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.
   2. Generally, run piping in groups where practicable and parallel to building wall. Provide minimum clearance of 1-inch between pipe and other work.
   3. Install hangers or supports at all locations where pipe changes direction.
   4. All hangers and supports shall be capable of adjustment after placement of piping.

5. Different types of hangers or supports shall be kept to a minimum.
6. All suspended or supported ductile iron pipe shall have a hanger or support adjacent to each hub.
7. Support vertical piping at each floor and between floors by stays or braces to prevent rattling and vibration.
8. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.
9. Maximum support spacing unless otherwise shown or approved for standard weight ductile iron pipe shall be as follows:
    a. Exposed pressure pipe shall not span longer than 12-feet without appropriate support.
    b. Exposed soil pipe shall not span longer than 10-feet without appropriate support.
    c. Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.
    d. Pipe hanger and support selection shall be as shown and in this Section.
10. Where proper hanger or support spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and pipes suspended there from.
11. Supports and hangers shall be of a material that is compatible with the fluid being conveyed in such pipe being supported.
12. Anchors for pipe support systems shall be compatible or protected by a coating system which is compatible with the fluid being conveyed in such pipe being supported.

B. Expansion compensation shall be designed for individual exposed piping systems with the following Design Criteria:
1. $\Delta L = L \times \Delta T \times \alpha$
    a. Where ΔL = pipe length change (inches).
    b. L = pipe length between anchors (inches).
    c. ΔT = 100 (F).
    d. α = coefficient of thermal expansion (inches/inches/F).
2. Expansion compensation shall be designed as an integral part of the piping hanger, support and anchorage system.
3. Expansion compensation shall be achieved via expansion joints.

2.2 HANGERS AND SUPPORTS

A. Hangers and supports where shown shall be in accordance with detail drawings. Hangers and supports not shown shall be in accordance with MSS SP 58.

B. Products and Manufacturers: Provide products from one of the following:
1. Anvil International, Inc.
2. Elcen Metal Products Co.
3. Cooper Industries, B-Line.
4. Unistrut Corporation.
5. Or equal.

2.3 ACCESSORIES

A. Hanger rods shall be made from ASTM A 575, with square head nut on top and running thread on bottom end.

B. Concrete Inserts:
   1. Concrete inserts shall be MSS SP 58 malleable Type 18.
   2. Concrete inserts shall be of the continuous type capable of supporting the amount of force as shown on the Drawings.
   3. Manufacturers: Provide products of one of the following:
      a. Unistrut Corporation, Wayne, Michigan.
      b. Elcan Metal Products, Company, Franklin Park, Illinois.
      c. B-Line.
      d. Anvil International, Inc.
      e. Or equal.

C. Steel Beam Clamps:
   1. Steel beam clamps shall be of malleable iron and conform to MSS SP 58.

D. Inserts for Pipe Insulation:
   1. Insulated pipe, larger than 1-1/2-inches in diameter, shall be supported by a rigid insert to protect the insulation. A steel metal saddle of sufficient gauge to carry the weight of the pipe and its fluid without deforming shall extend 2-inches minimum on each side of the rigid insert. The joints between insert and insulation shall be sealed before saddle is installed. Sizes up to 6-inches IPS shall be MSS SP 58, Type 40, and for sizes over 10-inches shall be MSS SP 58, Type 39.

E. Brackets:
   1. Brackets for wall mounting shall conform to: MSS SP 58 Type 32 for medium welded steel bracket, Type 33 for heavy welded steel bracket and Type 34 for side beam support.

F. Fabricated Pipe Rack:
   1. Pipes shall be supported and anchored to the fabricated pipe rack as shown. Clamps, rollers, and supports for piping shall conform to the general requirements of MSS SP 69.

2.4 PAINTING

A. Clean and prime ferrous metal surfaces in the shop.

B. Field painting shall conform to manufacturer recommendations.

PART 3 EXECUTION

3.1 INSTALLATION

A. Locate hangers, supports, and accessories to support piping, valves, and at all concentrated loads.

B. Locate hangers, supports, and accessories within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.

C. Locate hanger, supports to prevent vibration or swaying and to provide for expansion and contraction.
   1. Temperature differential specified in this Section.
   2. Support piping independently so that equipment is not stressed by piping weight or expansion.
   3. Uncoated Hangers, Rods and Supports: Dip in zinc chromate primer before installation.
   4. Hanger types for horizontal piping, except as noted and shown:
      a. Forged steel adjustable clevis type, rod support for all services.
      b. Slide Bases:
         1) Pipe stand, brackets, trapeze or other equivalent structural support.
         2) For piping 2-inches or larger.
      c. For pipe and covering provide:
         1) Saddles for rollers or slide bases.
         2) Protective shields or saddles for all other types of supports.
      d. Threaded Steel Rods:
         1) Two inch vertical adjustment with two nuts each end for positioning and locking.
         2) Size hanger rods according to the schedule below, unless otherwise noted:

Nominal Pipe (Inches)	Rod Diameter (Inches)
2 and less	3/8
2-1/2 to 3-1/2	1/2
4	5/8
6	3/4
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

         3) For Double Rod Hangers: One size smaller than above.
         4) Connection to Structure for Piping to 2-Inches: Concrete inserts, or expansion shields in shear into sides of beams.
         5) Connection to Structure for Piping 2-1/2-Inch or Larger: Concrete inserts, beam clamps or suitable bridging.
   5. Vertical Piping:
      a. Base Support: Base elbow or welded equivalent.
         1) Bearing plate on structural support.
      b. Guides not to exceed:
         1) 25 feet for piping to 2-inches.
         2) 36 feet for piping 2-1/2-inches or larger.
      c. Top Support:
         1) Special hanger or saddle in horizontal connection.
         2) Provisions for expansion.
      d. Intermediate Supports: Steel pipe clamp at floor.
         1) Bolted and welded to pipe.

2) Extension ends bearing on structural steel or bearing plates.

e. For Multiple Pipes: Coordinate guides, bearing plates and accessory steel.

D. Install items to be embedded before concrete placement.

E. Fasten embedded items securely to prevent movement during concrete placement.

F. Install hangers and support units on piping systems in accordance with manufacturer's recommendations.

G. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations.

H. Bring all pipe systems up to operating pressures and temperatures. Cycle systems to duplicate operating conditions. Correct all support malfunctions.

END OF SECTION

SECTION 40 05 08

WALL PIPES, FLOOR PIPES, AND PIPE SLEEVES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all floor pipes, pipe sleeves, wall pipes, other wall pieces, and escutcheons to complete the Work.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate with the installation of floor pipes, pipe sleeves, wall pipes, other wall pieces and escutcheons that must be installed with or within formwork, walls, partitions, ceilings and panels.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 07 92 00, Joint Sealants.
   3. Section 33 05 05, Buried Piping Installation.
   4. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American National Standards Institute, (ANSI).
      a. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
      b. ANSI B16.4, Gray-Iron Threaded Fittings.
   2. American Water Works Association, (AWWA).
      a. AWWA C104 (ANSI A21.4), Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
      b. AWWA C110 (ANSI A21.10), Ductile-Iron and Gray-Iron Fittings, for Water.
      c. AWWA C111 (ANSI A21.11), Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
      d. AWWA C115 (ANSI A21.15), Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
      e. AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast, for Water.
      f. AWWA C200, Steel Water Pipe 6-Inches and Larger.

1.3 QUALITY ASSURANCE

A. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single wall pipes, floor pipes and pipe sleeves manufacturer.
   2. The wall pipes, floor pipes and pipe sleeves manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.

3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the wall pipes, floor pipes and pipe sleeves manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Detailed drawings and data on all wall and floor pipe, and pipe sleeves. Submit and coordinate these with Shop Drawings required for all piping systems.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wall and Floor Pipes:
   1. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by ENGINEER.
   2. End Connections: As shown.
   3. Thickness: Same as specified for the piping connected to wall or floor pipe.
   4. Collars: Provide collars at mid-point of wall for anchorage and watertightness.
   5. Pipes ends shall be flush with wall face, unless otherwise shown.
   6. Drill and tap flanged ends and mechanical joint bells for studs. Provide studs of same material as connected piping, except submerged and buried studs shall be of Type 316 stainless steel.

B. Pipe Sleeves:
   1. Ferrous and Plastic Pipe: Use standard weight stainless steel pipe, unless otherwise shown.
   2. Copper Pipe: Use Type K hard drawn copper pipe, unless otherwise shown.

C. Cast Wall Sleeves:
   1. Material: Ductile iron furnished with integral wall collar.
   2. Dimensions: As required for mechanical joint pipe to pass through sleeve. Length as required.

D. Link Seals: Provide link type mechanical seals suitable for 20 psi working pressure, corrosive service and accessible from one side, with glass-reinforced nylon pressure plate and stainless steel bolts and nuts.
   1. Products and Manufacturers: Provide one of the following:
      a. Link-Seal, as manufactured by Thunderline Corporation.
      b. Or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Wall and Floor Pipes: Install as shown and in accordance with approved Shop Drawings.

B. Pipe Sleeves:
1. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs, unless otherwise shown.
2. Extend all sleeves through floor slabs a minimum of 2-inches above finished floor.
3. Anchor sleeves to concrete and masonry walls as shown or otherwise approved.
4. All sleeves through walls shall be flush with wall face.
5. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
6. Use link type seals to seal sleeve against hydrostatic pressure. Size sleeves to provide annular space required to suit the link type mechanical seals that are used.
7. Do not install sleeves and pipes through structural members, unless specifically shown and approved by ENGINEER.
8. Size sleeves to provide annular space as follows:

Pipe Size	Sleeve ID Minus Pipe Or Insulation OD
Less than 2-inches	1/2-inches to 3/4-inches
2-inches to 4-inches	3/4 inches to 1-1/4-inches.
6-inches to 12-inches	1-1/4 inches to 2-inches
Over 12-inches	2-inches to 3-inches

END OF SECTION

SECTION 40 05 19

DUCTILE IRON PROCESS PIPE

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish ductile iron pipe and fittings.
   2. Extent of piping is shown on the Drawings. Piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, specify pipe service, diameter, material, lining, coating, pressure rating, joint type, and testing required.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before ductile iron pipe Work.

C. Related Sections:
   1. Section 31 23 05, Excavation and Fill.
   2. Section 33 05 05, Buried Piping Installation.
   3. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series.
   2. ANSI B18.2.2, Square and Hex Nuts. (Inch Series).
   3. ASTM A193, Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   4. ASTM A194, Specification for Carbon Steel and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
   5. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   6. ASTM A354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.
   7. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
   8. ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.
   9. ASTM C283, Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
   10. ASTM D714, Test Method for Evaluating Degree of Blistering of Paints.
   11. ASTM D792, Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
   12. ASTM D5162, Discontinuity (Holiday) Testing of Non-Conductive Protective Coating on Metallic Substrates.
   13. ASTM E96, Test Methods for Water Vapor Transmission of Materials.
   14. ASTM G14, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).
   15. ASTM G62, Test Methods for Holiday Detection in Pipeline Coatings.
   16. ASTM G95, Test Methods for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).
   17. ANSI/AWWA C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
   18. ANSI/AWWA C110, Ductile Iron and Gray Iron Fittings for Water.

19. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
20. ANSI/AWWA C115, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.
21. ANSI/AWWA C151, Ductile Iron Pipe, Centrifugally Cast, for Water.
22. ANSI/AWWA C153, Ductile Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch for Water Service.
23. ANSI/AWWA C606, Grooved and Shouldered Type Joints.
24. European Standard (EN), EN 598: Ductile Iron Pipe, Fittings, Accessories and Their Joints for Sewerage Applications.
25. MSS-SP 60, Connecting Flange Joint Between Tapping Sleeves and Tapping Valves.
26. NACE RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
27. NAPF 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
28. NSF/ANSI 61, Drinking Water System Components - Health Effects.
29. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
30. SSPC Painting Manual, Volume 1, Para. XIV.
31. SCDHEC, State Primary Drinking Water Regulation 61-58.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Manufacturer shall have a minimum of five years successful experience producing ductile iron pipe and fittings and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.
      b. Lining and coating products shall be manufactured by a firm with a minimum of five years successful experience in protecting pipelines exposed to the specified service conditions, and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.
      c. When not applied by the manufacturer, lining and coating Subcontractor shall have a minimum of five years successful experience in the application of the specified linings and coatings for similar applications for the specified service, and shall be able to show evidence of at least five installations in satisfactory operation in the United States.

B. Supply and Compatibility:
   1. Unless otherwise approved, obtain all pipe, fittings, and appurtenances included in this Section from a single ductile iron pipe manufacturer.
   2. Ductile iron pipe manufacturer shall review and approve or prepare all Shop Drawings and other submittals for pipe, fittings, and appurtenances furnished under this Section.
   3. Pipe, fittings, and appurtenances shall be suitable for the specified service and shall be integrated into overall piping system by ductile iron pipe manufacturer.
   4. Ductile iron pipe manufacturer shall be responsible for all products and all factory-applied linings and coatings, whether installed at pipe manufacturer's facility or at manufacturer's Supplier's facility.

C. Regulatory Requirements:

1. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable, shall be certified by an accredited organization in accordance with NSF/ANSI 61 as being suitable for contact with potable water, and shall comply with requirements of authorities having jurisdiction at Site.

1.4 SUBMITTALS

A. Action Submittals: Submit the following with Shop Drawings required under Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation:
   1. Shop Drawings:
      a. Detailed drawings and data for pipe, fittings, gaskets, appurtenances, linings, and coatings.
   2. Samples:
      a. Submit Sample of pipe and fitting with each type of lining, for use at the Site to verify continuity, surface gloss, and color, as applicable, via visual inspection.
   3. Test Procedures: For linings and coatings in pipe and fittings.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Submit certificate signed by manufacturer of each product that product conforms to applicable referenced standards and the Contract Documents.
   2. Source Quality Control Submittals:
      a. Submit results of specified shop tests for pipe, fittings, linings, and coatings.
      b. Lining and coating test coupons.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

B. Handling of Pipe and Fittings Lined with Ceramic Epoxy: Lifting devices shall not come into contact with lined surfaces. Use hooks, forks, chains, straps, and other lifting devices only on exterior of pipe and fittings. Pipe and fittings with damaged lining shall be replaced regardless of cause of damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. General:
   1. Piping systems shall be suitable for their intended use.
   2. Joints shall be as specified in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation. If not specified, provide flanged joints for exposed piping and push-on or mechanical joints for buried piping. Provide couplings on pipe with plain or grooved ends where shown or where approved by ENGINEER.

B. Ductile Iron Pipe, Joints, and Fittings:
   1. Flanged Pipe: Fabricate in accordance with ANSI/AWWA C115.
      a. Pressure Rating: As specified in piping schedule in Section 40 05 05, Exposed Piping Installation. If not otherwise specified, use Special Thickness Class 53 for three-inch

to 54-inch diameter pipe and Pressure Class 350 for 60-inch and 64-inch diameter pipe.

2. Non-Flanged Pipe: Conform to ANSI/AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.
   a. Pressure Class: As specified in piping schedules in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation. If not otherwise specified, use Pressure Class 350 for 12-inch and smaller diameter pipe and Pressure Class 250 for 16-inch and larger diameter pipe .
   b. Special Thickness Class: As specified in piping schedules in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation.
3. Pipe Joints:
   a. Flanged Joints: Conform to ANSI/AWWA C110 and ANSI/AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure specified in piping schedule in Section 40 05 05, Exposed Piping Installation.
      1) Gaskets: Unless otherwise specified, gaskets shall be at least 1/8-inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.
      2) Bolts: Comply with ANSI B18.2.1.
         a) Exposed: ASTM A307, Grade B.
         b) Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.
      3) Nuts: Comply with ANSI B18.2.2.
         a) Exposed: ASTM A563, Grade A, Heavy hex.
         b) Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.
   b. Mechanical Joints: Comply with ANSI/AWWA C111 and ANSI/AWWA C151, capable of meeting pressure rating or special thickness class, and test pressure specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
      1) Glands: Ductile iron.
      2) Gaskets: Plain tip.
      3) Bolts and Nuts: High strength, low alloy steel.
      4) Manufacturers: Provide products of one of the following:
         a) Clow Water Systems Company.
         b) Atlantic States Cast Iron Pipe Company.
         c) Canada Pipe Company, Ltd.
         d) McWane Cast Iron Pipe Company.
         e) Pacific States Cast Iron Pipe Company.
         f) Griffin Pipe Products Co.
         g) American Cast Iron Pipe Co.
         h) U.S. Pipe and Foundry Co.
         i) Or equal.
   c. Push-On Joints: Comply with ANSI/AWWA C111 and ANSI/AWWA C151, capable of meeting pressure class or special thickness class, and test pressure specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
      1) Gaskets: Vulcanized SBR, unless otherwise specified.

2) Stripes: Each plain end shall be painted with a circular stripe to provide a guide for visual check that joint is properly assembled.
3) Products and Manufacturers: Provide one of the following:
    a) Tyton or Fastite Joint by Clow Water Systems, Atlantic States Cast Iron Pipe Company, Canada Pipe Company, Ltd., McWane Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, and Griffin Pipe Products Company.
    b) Fastite Joint by American Cast Iron Pipe Company.
    c) Tyton Joint by U.S. Pipe and Foundry Company.
    d) Or equal.

d. Grooved End Joints: Comply with ANSI/AWWA C606.
1) Gaskets: Flush seal type designed for ductile iron that complies with or exceeds requirements of ASTM D2000
2) Bolts and nuts: As specified for flanged joints.
3) Unless otherwise specified, grooved end couplings shall be rigid joint for exposed service and flexible joint for buried service.
4) Products and Manufacturers: Provide one of the following:
    a) Victaulic, Style 31.
    b) Or equal.

e. Restrained Joints: Restrained push-on joints shall be capable of being deflected after full assembly. Field cuts of restrained pipe are not allowed without approval of ENGINEER.
1) Products and Manufacturers: Provide restrained joints for mechanical joint piping by one of the following:
    a) Megalug, Series 1100, by EBBA Iron Sales, Inc.
    b) MJ Coupled Joint, by American Cast Iron Pipe Co.
    c) MJ Field Lok, by U.S. Pipe and Foundry Co.
    d) Or equal.
2) Products and Manufacturers: Provide restrained joints for push-on joint piping by one of the following:
    a) Lok-Ring Joint, or Flex-Ring Joint, by American Cast Iron Pipe Co.
    b) TR Flex Joint, by U.S. Pipe and Foundry Co.
    c) Or equal.

4. Flanged and Push-On Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111. For compact fittings, comply with ANSI/AWWA C153.
    a. Material: Ductile iron.
    b. Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe. All fittings, including glands and bolts, shall be manufactured in domestic foundries.
5. Mechanical Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111. For compact fittings, comply with ANSI/AWWA C153.
    a. Material: Ductile iron.
    b. Glands: Ductile iron.
    c. Pressure rating, gaskets, bolts, and nuts shall be as specified for mechanical joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of connected pipe.
    d. Mechanical Joint Bolt Holes: Orient bolt holes to straddle vertical centerline of fittings as shown on the Drawings.
    e. All fittings, including glands and bolts, shall be manufactured in domestic foundries.

C. Lining, General:
   1. Typical Service Conditions:

Property	Buried Water	Buried Sanitary	Force Mains
Fluid(s) Conveyed Through Pipe	Potable Water	Sanitary Waste Water	Sanitary Waste Water
Lining Type	Cement Mortar	Cement Mortar	Ceramic Epoxy

   2. Surface Preparation:
      a. Surface Preparation: Prepare surface in accordance with recommended method.
      b. Finished Surface Inspection: Lining applicator shall inspect finished surface prior to application to determine acceptability. If surface is unacceptable, repeat surface preparation as necessary.

D. Cement-mortar Lining:
   1. Where specified in piping schedules included with Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation, pipe and fittings shall be lined with bituminous seal coated cement-mortar lining in accordance with ANSI/AWWA C104.

E. Ceramic Quartz-Filled, Amine-Cured Novalac Epoxy Lining:
   1. Where specified in piping schedules included with Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation, pipe and fittings shall be factory lined with a quartz-filled, amine-cured, novalac, epoxy containing at least twenty percent by volume of ceramic quartz pigment.
   2. Ceramic epoxy lining shall have a permeability rating of zero when tested according to Method A of ASTM E96, Procedure A, with a test duration of thirty days.
   3. Conduct the following tests on coupons from factory lined ductile iron pipe:
      a. ASTM B117 Salt Spray (scribed panel): Results to equal zero undercutting after two years.
      b. ASTM G95 Cathodic Disbondment 1.5 volts at 77 degrees F: Results to equal no more than 0.5 mm undercutting after thirty days.
      c. Immersion Testing rated using ASTM D714.
         1) Twenty Percent Sulfuric Acid: No effect after two years.
         2) Twenty-five Percent Sodium Hydroxide at 140 degrees F: No effect after two years.
         3) Distilled Water at 160 degrees F: No effect after two years.
         4) Tap Water at 120 degrees F (scribed panel): Zero undercutting after two years, with no effect.
   4. Ceramic epoxy lining shall have abrasion resistance of no more than four mils loss after one million cycles, in accordance with ES EN 598, Section 7.8, Abrasion Resistance.
   5. Within eight hours of surface preparation, interior of pipe and fittings shall receive 40 mils dry film thickness, utilizing method recommended by lining manufacturer that will comply with requirements of this Section. Number of coats applied shall be as recommended by lining manufacturer. Minimum substrate and ambient temperature for lining application shall be 40 degrees F.
   6. Inspection and Certification:
      a. Check all ductile iron pipe and fitting linings for thickness using magnetic film thickness gage in accordance with method in SSPC PA 2 Film Thickness Rating.

b. Test interior lining of pipe barrels and fittings for pinholes with non-destructive, 2,500-volt test. Defects found shall be repaired in accordance with lining manufacturer's recommendations prior to shipment from lining applicator's factory.
c. Mark each pipe and fitting with date of application and its numerical sequence of application.

7. Products and Manufacturers: Provide one of the following:
   a. Protecto 401 Ceramic Epoxy.
   b. Tnemec Perma-Shield 431.
   c. Or equal.

F. Couplings:
1. Refer to Section 33 05 06, Couplings, Adapters and Specials.

G. Specials:
1. Transition Pieces:
   a. Provide suitable transition pieces (adapters) for connecting to existing piping.
   b. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.
2. Taps:
   a. Provide taps where shown or required for small-diameter piping or instrumentation connections.
   b. Provide corporation stops where shown or required.
   c. Allowable tap sizes are shown in Table 40 05 19-A. Provide tapping saddle with outlet joints conforming to requirements of this Section.

Table 40 05 19-A, Allowable Direct Tapping

Size (inch)	Pressure Class				
	150	200	250	300	350
	Maximum Allowed Direct Tap Size (inch)				
3	-	-	-	-	0.75
4	-	-	-	-	0.75
6	-	-	-	-	1
8	-	-	-	-	1
10	-	-	-	-	1
12	-	-	-	-	1.25
14	-	-	1.25	1.5	1.5
16	-	-	1.5	2	2
18	-	-	2	2	2
20	-	-	2	2	2
24	-	2	2	2	2

   d. For flanged connections on tapping saddle outlet branch, counterbore flange in accordance with MSS SP-60 dimensions. Inside diameter of outlet shall be 1/4-inch greater than nominal diameter.
3. Tangential Outlets:
   a. Provide tangential outlet fittings where shown or indicated.
   b. Weld-on fittings are acceptable.
   c. Flanged and grooved end joints are not allowed.

2.2 MARKING FOR IDENTIFICATION

A. In addition to identification markings specified in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify push-on joint and mechanical joint pipe with:
   1. Name or trademark of manufacturer.
   2. Weight, class or nominal thickness, and casting period.
   3. Country where cast.
   4. Year the pipe was produced.
   5. Letters “DI” or “Ductile” shall be cast or metal stamped

B. In addition to identification markings specified in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify flanged pipe with:
   1. Flange manufacturer’s mark, size, and letters “DI” cast or stamped on the flanges.
   2. Fabricator’s mark if other than flange manufacturer.
   3. Length and weight.

C. In addition to identification markings specified in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify fittings with:
   1. Manufacturer’s identification.
   2. Pressure rating.
   3. Nominal diameters of openings.
   4. Country where cast.
   5. Number of degrees or fraction of the circle on bends.
   6. Letters “DI” or “Ductile” cast on them.

2.3 EXTERIOR SURFACE PREPARATION AND COATINGS

A. General Coating Requirements:
   1. Coating types are specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

B. Exposed Pipe and Fittings:
   1. Surface Preparation:
      a. Initial Surface Inspection: Pipe and fitting manufacturer and coating applicator shall inspect surface to be coated and mutually determine recommended NAPF 500-03 surface preparation method.
      b. Surface Preparation: Prepare surface in accordance with recommended NAPF 500-03 method.
      c. Finished Surface Inspection: Prepared surfaces shall be inspected by coating applicator prior to application to determine acceptability of finished surface. If surface is unacceptable, repeat surface preparation and re-application as necessary.
   2. After recommended surface preparation, prime coat exterior ferrous metal surfaces of pipe and fittings in the shop.

C. Buried Pipe and Fittings:
   1. Asphaltic Coating: Where specified in piping schedule in Section 33 05 05, Buried Piping Installation, coat pipe and fittings with an asphaltic coating approximately one-mil thick, in accordance with ANSI/AWWA C151, ANSI/AWWA C115, ANSI/AWWA C110, and ANSI/AWWA C153, as applicable.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect piping to assure that piping is free from defects in material and workmanship. Verify compatibility of pipe, fittings, gaskets, linings, and coatings.

3.2 INSTALLATION AND FIELD QUALITY CONTROL

A. For buried piping installation and testing, refer to Section 33 05 05, Buried Piping Installation.

B. For exposed piping installation and testing, refer to Section 40 05 05, Exposed Piping Installation.

END OF SECTION

SECTION 40 05 31

THERMOPLASTIC PROCESS PIPE

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install thermoplastic piping and fittings.
   2. Extent of piping is shown and shall be in accordance with piping schedules in Section 33 05 05, Buried Piping Installation.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before thermoplastic piping Work.

C. Related Sections:
   1. Section 33 05 05, Buried Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AASHTO, Standard Specifications for Highway Bridges.
   2. ASTM D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   3. ASTM D1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
   4. ASTM D2464, Specification for Threaded Poly (Vinyl Chlorinated) (PVC) Plastic Pipe Fittings, Schedule 80.
   5. ASTM D2466, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   6. ASTM D2467, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   7. ASTM D2513, Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
   8. ASTM D2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   9. ASTM D2665, Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   10. ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   11. ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   12. ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   13. ASTM D3222, Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
   14. ASTM D3311, Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns.
   15. ASTM D4101, Specification for Polypropylene Injection and Extrusion Materials.

16. ASTM F437, Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
17. ASTM F439, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
18. ASTM F441, Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
19. ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
20. ASTM F656, Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
21. ASTM F679, Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
22. ASTM F1336, Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
23. ASTM F1674, Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
24. ASTM F1760, Specification for Coextruded Poly (Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content.
25. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.-12 In. (100 mm-300 mm), for Water Transmission and Distribution
26. AWWA C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In.-48 In. (350 mm-1,200 mm).
27. AWWA C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm).
28. NSF 14, Plastic Piping Systems Components and Related Material.
29. ANSI/NSF 61, Drinking Water System Components - Health Effects.
30. Standards of U.S. Food and Drug Administration.
31. SCDHEC, State Primary Drinking Water Regulation 61-58.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have a minimum of five years experience producing thermoplastic pipe and fittings substantively similar to the materials specified, and shall be able to submit documentation of satisfactory service in at least five completed installations in operation for at least five years each.
   2. Installer:
      a. Engage a single pipe installer who shall be responsible for all thermoplastic pipe Work, and who shall employ only tradesmen with specific skills and experience in the type of Work required.
      b. Installer shall have a minimum of five years experience installing thermoplastic pipe and fittings substantively similar to the materials specified and substantively similar to or larger than the scope of thermoplastic piping Work on the Project, and shall be able to submit documentation of satisfactory experience in at least five completed installations in operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all materials included in this Section, regardless of component Supplier, from a single thermoplastic pipe Supplier. All pipe of each material type shall be furnished by the same manufacturer.
   2. Thermoplastic pipe Supplier shall review and approve to prepare all Shop Drawings and other submittals for all materials furnished under this Section.
   3. Materials shall be suitable for specified service conditions and shall be integrated into overall assembly by thermoplastic pipe Supplier.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit piping layout Shop Drawings in accordance with Section 33 05 05, Buried Piping Installation.
   2. Product Data:
      a. Submit product data on pipe, fittings, gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Submit manufacturer's certificate of compliance standards referenced in this Section.
   2. Source Quality Control Submittals:
      a. When requested by ENGINEER, submit results of source quality control tests.
   3. Qualifications Statements:
      a. Submit qualifications of manufacturer when requested by ENGINEER.
      b. Submit qualifications of installer when requested by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 33 05 05, Buried Piping Installation.

PART 2 PRODUCTS

2.1 SERVICE CONDITIONS

A. General:
   1. Pipe materials shall be suitable for services intended. Refer to piping schedules in Section 33 05 05, Buried Piping Installation.
   2. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, and other defects. Unless otherwise shown or indicated, pipe shall be uniform in color, opacity, density, and other physical properties.
   3. Comply with NSF 14.
   4. Buried pipe shall be capable of withstanding external live load, including impact, equal to AASHTO H-20 loading, with cover shown or indicated on the Drawings.
   5. Pipe, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in ANSI/NSF 61 as being suitable for contact with potable water, and shall comply with requirements of the authorities having jurisdiction at the Site.

2.2 POLYVINYL CHLORIDE (PVC) PIPING

A. Buried PVC Gravity Sewer Pipe.
   1. Manufacturers: Provide products of one of the following:
      a. Ipex, Inc.
      b. Diamond Plastics Corp.
      c. Or equal.
   2. Material:
      a. Pipe shall comply with ASTM D3034 or ASTM F679 (as applicable).

b. Wall Thickness and Pipe Stiffness: Pipe stiffness shall be determined in accordance with test methods in ASTM D3034 or ASTM F679 (as applicable).
   1) Main Line: SDR 35, with minimum ring stiffness of 46 psi.
   2) Service Laterals: As specified in Section 33 31 01.

3. Fittings:
   a. Injection-molded, gasketed fittings shall comply with ASTM F1336, and ASTM D3034 or ASTM F679 (as applicable).
   b. Fabricated fittings shall comply with ASTM F1336.
   c. Unless otherwise shown or indicated, saddle wyes are unacceptable.
4. Joints:
   a. Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
   b. Jointing lubricant shall be as recommended by pipe manufacturer.
   c. Provide elastomeric gaskets complying with ASTM F477, and ASTM D3139 or ASTM D3212.

B. Buried PVC Pressure Pipe:
1. Manufacturers: Provide products of one of the following:
   a. Ipex, Inc.
   b. Diamond Plastics Corp.
   c. Or equal.
2. Material:
   a. Pipe shall comply with AWWA C900 or AWWA C905 (as applicable).
   b. Material shall comply with ASTM D1784.
   c. Wall Thickness:
      1) SDR 14 for 4-inch to 12-inch diameter pipe.
      2) SDR 21 for 14-inch to 48-inch diameter pipe.
   d. Fabricate pipe with cast-iron pipe equivalent outside diameter.
3. Fittings:
   a. Comply with AWWA C900, AWWA C905, or AWWA C907, as applicable.
4. Joints:
   a. Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
   b. Jointing lubricant shall be as recommended by pipe manufacturer.
   c. Provide elastomeric gaskets complying with ASTM F477 and ASTM D3139.
   d. Restrained Joints: Provide restrained joints where shown or indicated.
      1) Comply with Section 33 05 05, Buried Piping Installation.
      2) Proprietary Joint Systems: Comply with ASTM F1674. Provide restrained joint system by one of the following for bell and spigot joint PVC piping:
         a) Ebaa Iron Sales, Inc.: Series 1500 and Series 1600 Restraint Harness for C900 Pipe; Megalug Series 2500, 2800, and 1100HV Restraint Harness for C905 Pipe.
         b) PV-LOK Series, by Sigma Corp.
         c) Or equal.

C. PVC Drain, Waste, and Vent (PVC-DWV) Pipe.
1. Manufacturers: Provide products of one of the following:
   a. Chemtrol, manufactured by Nibco, Inc.
   b. Spears Manufacturing Company.

c. Or equal.
2. Material: In accordance with ASTM D1784. Unless otherwise shown or indicated, PVC-DWV pipe shall be:
   a. Type and Grade: Type 1, Grade 1.
   b. Wall Thickness: Schedule 40.
   c. Color: White.
3. Fittings: Manufactured in accordance with ASTM D2665 and ASTM D3311.
   a. Solvent weld.
   b. Spigot.
4. Joints:
   a. Solvent weld.
   b. Threaded.

2.3 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPING

A. CPVC Pipe – General Applications: Unless otherwise shown or indicated, CPVC pipe shall comply with the following:
   1. Manufacturers: Provide products of one of the following:
      a. Ipex, Inc.
      b. Spears Manufacturing Company.
      c. Or equal.
   2. Material: Comply with ASTM F441/F441M as having same outside diameter as iron pipe. Comply with the following:
      a. Type and Grade: Type IV, Grade 1.
      b. Wall Thickness: Schedule 80.
      c. Temperature Rating: Rated to 210 degrees F.
      d. Color: Gray.
      e. Manufacture pipe and fittings with minimum of two percent of titanium oxide for ultraviolet protection.
   3. Fittings: Type, grade, schedule, and color of fittings shall match the associated pipe.
      a. Solvent Welded: Fittings shall comply with F439 for socket type.
      b. Threaded: Shall comply with ASTM F437.
   4. Joints:
      a. Solvent Welded: Use primer and solvent cement recommended by CPVC pipe manufacturer. Primer shall be in accordance with ASTM F656, and solvent cement shall be in accordance with ASTM D2564.
      b. Threaded: Use 100 percent virgin polytetrafluoroethylene (Teflon or PTFE) tape for threaded fittings. Pipe shall not be threaded.

2.4 IDENTIFICATION

A. Pipe material identification requirements are in Section 33 05 05, Buried Piping Installation.

2.5 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Pipe manufacturer shall maintain continuous quality control program.
   2. Where applicable and when requested by ENGINEER, submit results of source quality control tests specified in reference standards.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect pipe materials for defects in material and workmanship. Verify compatibility of pipe and fittings.

3.2 INSTALLATION

A. For buried piping installation, refer to Section 33 05 05, Buried Piping Installation.

END OF SECTION

SECTION 40 05 53

PROCESS VALVES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install process valves and appurtenances, complete and operational.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before process valves Work.

C. Related Sections:
   1. Section 33 05 05, Buried Piping Installation.
   2. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Bearing Manufacturers Association (ABMA).
   2. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
   3. ANSI B16.34, Valves-Flanged, Threaded and Welding end. (ASME B16.34).
   4. ANSI/NSF 61 Drinking Water Components – Health Effects.
   5. API STD 594, Check Valves, Flanged Lug, Wafer and Butt-Welding.
   6. API STD 598, Valve Inspection and Testing.
   7. API STD 609, Butterfly Valves: Double Flanged, Lug-Type and Wafer-Type.
   8. ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   9. ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   10. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both.
   11. ASTM A240/A240M, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   12. ASTM A276, Specification for Stainless Steel Bars and Shapes.
   13. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   14. ASTM A351/A351M, Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts.
   15. ASTM A380, Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
   16. ASTM A536, Specification for Ductile Iron Castings.
   17. ASTM A564/A564M, Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.

18. ASTM A743/A743 M, Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
19. ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
20. ASTM B98/B98M, Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
21. ASTM B138/B138M, Specification for Manganese Bronze Rod, Bar and Shapes.
22. ASTM B265, Specification for Titanium and Titanium Alloy Strip, Sheet and Plate.
23. ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.
24. ASTM D429, Test Methods for Rubber Property - Adhesion to Rigid Substrates.
25. AWWA C502, Dry-Barrel Fire Hydrants.
26. AWWA C504, Rubber-Seated Butterfly Valves.
27. AWWA C508, Swing-Check Valves for Waterworks Service, 2-inch through 24-inch NPS.
28. AWWA C509, Resilient-Seated Gate Valves for Water Supply Service.
29. AWWA C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
30. AWWA C550, Protective Interior Coatings for Valves and Hydrants.
31. AWWA Manual M49, Butterfly Valves: Torque, Head Loss, and Cavitation Analysis.
32. FS TT-C-494, Coating Compound, Bituminous, Solvent Type, Acid-Resistant.
33. NEMA MG 1, Motors and Generators.
34. MSS SP-60, Connecting Flange Joints Between Tapping Sleeves and Tapping Valves.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have minimum of five years of experience producing substantially similar materials and equipment to that required and be able to provide evidence of at least five installations in satisfactory operation for at least five years.

B. Component Supply and Compatibility:
   1. Obtain each type of equipment and appurtenances included in this Section, regardless of the component manufacturer, from a single manufacturer of the type of process valve. For each type of valve, do not furnish valves of more than one manufacturer.
   2. Supplier of each type of equipment specified shall review and approve or prepare all Shop Drawings and other submittals for all components associated with the type of process valve Supplier is furnishing.
   3. Components shall be suitable for use in the specified service conditions. Components shall be integrated into the overall assembly by the process valve manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Installation drawings showing orientation of valve in both plan and elevation view. Drawings shall clearly identify valve and its appurtenances, including controls, actuators, valve stems, and other components. Show dimensions of valves and appurtenances in relation to piping and structural and architectural components, where applicable.
      b. Controls for and control characteristics of modulating valves.
      c. Calculations for sizing of operating mechanism with extension stems.
      d. Calculations for sizing of gear actuators.
   2. Product Data:

a. Product data sheets.
b. Complete catalog information, including dimensions, weight, specifications, and identification of materials of construction of all parts.
c. Corrosion resistance information to confirm suitability of valve materials for the application. Furnish information on chemical resistance of elastomers from elastomer manufacturer.
d. Cv values and hydraulic headloss curves.

3. Testing Plans:
   a. Submit plan for shop testing of each valve for which shop testing is specified, including testing plan's and test facility's limitations proposed.

B. Informational Submittals: Submit the following:
1. Certificates:
   a. Certificates of compliance with referenced standards, where applicable, including those of AWWA, NSF, and others required by ENGINEER.
2. Manufacturer Instructions:
   a. Submit manufacturer's instructions for handling, storing, and installing valves and appurtenances. Provide templates and setting drawings for valves and appurtenances that require anchor bolts or similar anchorages.
3. Source Quality Control Submittals:
   a. Submit copies of shop test results and inspection data, certified by manufacturer.
4. Field Quality Control Submittals:
   a. Submit results of field tests required.
5. Supplier's Reports:
   a. When requested by ENGINEER, submit written report of results of each visit to Site by Supplier's serviceman, including purpose and time of visit, tasks performed and results obtained.
6. Qualifications Statements:
   a. When requested by ENGINEER, submit manufacturer's qualifications demonstrating compliance with the Specifications, including list of existing installations with contact names and telephone number(s) for each.

C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data:
   a. Furnish operation and maintenance manuals in accordance with Section 01 78 23, Operations and Maintenance Data.
   b. Furnish in operations and maintenance manuals complete nameplate data for each valve.

D. Maintenance Material Submittals: Submit the following:
1. Spare Parts, Extra Stock Materials, and Tools:
   a. Spare Parts and Extra Stock Materials: Furnish as specified for each valve type.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete in ample time to prevent delaying the Work.

2. Inspect boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to materials and equipment. Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.
3. Conform to Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:
1. Keep products off ground using pallets, platforms, or other supports. Store equipment in covered storage and prevent condensation and damage by extreme temperatures. Store in accordance with manufacturer's recommendations. Protect steel, packaged materials, and electronics from corrosion and deterioration.
2. Conform to Section 01 66 00, Product Storage and Handling Requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Valves, General:
1. Provide each valve with manufacturer's name and rated pressure cast in raised letters on valve body.
2. Provide valves with brass or Type 316 stainless steel nameplate attached with Type 316 stainless steel screws. Nameplates shall have engraved letters displaying the following minimum information:
a. Valve size.
b. Pressure and temperature ratings.
c. Application (other than water and wastewater).
d. Date of manufacture.
e. Manufacturer's name.
3. Provide hydrants, gate valves larger than 6-inches and butterfly valves to turn counter-clockwise to open, unless otherwise specified. Provide gate valves smaller than 3-inches to turn clockwise to open.
4. Provide valves with permanent markings for direction to open.
5. Manually operated valves, with or without extension stems, shall require not more than 40-pound pull on manual operator to open or close valve against specified criteria. Gear actuator and valve components shall be able to withstand minimum pull of 200 pounds on manual operator and input torque of 300-foot pounds to actuator nut. Manual operators include handwheel, chainwheel, crank, lever, and T-handle wrench.

B. Valve Materials:
1. Valve materials shall be suitable for the associated valve's service or application, as shown.
2. Protect wetted parts from galvanic corrosion caused by contact of different metals.
3. Wetted components and wetted surfaces of valves used with potable water or water that will be treated to become potable shall conform to ANSI/NSF 61.
4. Clean and descale fabricated stainless steel items in accordance with ASTM A380 and the following:
a. Passivate all stainless steel welded fabricated items after manufacture by immersing in pickling solution of six percent nitric acid and three percent hydrofluoric acid. Temperature and detention time shall be sufficient for removing

oxidation and ferrous contamination without etching surface. Perform complete neutralizing operation by immersing in trisodium phosphate rinse followed by clean water wash.

b. Scrub welds with same pickling solution or pickling paste and clean with stainless steel wire brushes or by grinding with non-metallic abrasive tools to remove weld discoloration, and then neutralize and wash clean.

C. Valve Joints:
1. Exposed Valves: Unless otherwise specified, provide with flanged ends conforming to ANSI B16.1. Pressure class of flanges shall be equal to or greater than specified pressure rating of the associated valve.
2. Buried Valves: Unless otherwise specified, provide with mechanical joints, restrained or unrestrained, as required by piping with which valve is installed.
3. For stainless steel bolting, except where nitrided nuts are required, use graphite-free anti-seize compound to prevent galling. Strength of joint shall not be affected by using anti-seize compound.

2.2 RESILIENT-SEATED GATE VALVES

A. Manufacturers: Provide products of one of the following:
1. American Cast Iron Pipe Company, Series 2500 RW.
2. Clow Valve Co., Model 2638, Model 2639 or Model 2640.
3. Kennedy Valve Co., Model KS-FW or Model KS-RW.
4. M&H Valve Co., Style 4067 or Style 7000.
5. Mueller Co., 2361 Series or 2362 Series.
6. Or equal.

B. General:
1. Provide valves conforming to AWWA C509 or C515 and as specified in this Section.
2. Type:
a. Provide non-rising stem (NRS) valves for buried service.
b. Provide NRS valves for exposed service unless specified otherwise.
c. Provide position indicators for NRS valves used in exposed service.
3. Stem seals shall be of the “O” ring type, only.
4. Minimum Rated Working Pressure: 200 psig.
5. Maximum Fluid Temperature: 150 degrees F.
6. Provide valves with fully encapsulated resilient wedges, unless otherwise specified.
7. Gate valves on water mains shall be direct bury gate valves and shall be furnished with standard valves boxes set in concrete pads as specified in Section 03 00 05, Concrete.
8. Valve ends for buried valves shall be mechanical joint with necessary glands, gaskets and bolts furnished with the valve.
9. Valve ends for exposed valves shall be flange joint.

C. Materials of Construction: Shall conform to AWWA C509 or AWWA C515 and shall be as follows:
1. Valve Body, Bonnet, and Stuffing Box: Cast-iron.
2. Wedge: Cast-iron, symmetrically and fully encapsulated with molded rubber having minimum 1/8-inch thickness.
3. Stem: Manganese bronze.
4. Rubber Items: Buna-N or other synthetic rubber suitable for the application.

5. Internal and external bolting and other hardware including pins, set screws, plug, studs, bolts, nuts, and washers shall be Type 316 stainless steel.
6. Valves 3-inch and smaller may be of all bronze construction with iron pipe thread and screw ends and comply with AWWA C509 or C515 and ASTM B62.

D. Interior Coating:
1. Valves shall be coated inside. Steel, cast-iron and ductile iron surfaces, except machined surfaces, shall be epoxy coated in accordance with AWWA C550.

E. Testing:
1. Test valves in valve manufacturer's shop in accordance with AWWA C509 or AWWA C515.

F. Gear Actuators for Manually-operated Valves:
1. Provide valves with gear actuators conforming to AWWA C509 or AWWA C515.
2. Size gear actuators for maximum differential pressures of service requirements.
3. Valves 6-inches and larger shall be furnished with 2-inch square operating nuts.
4. Valves 3-inch and smaller shall be furnished with T-Head operating nuts, unless a hand wheel is specified.

2.3 BUTTERFLY VALVES

A. Manufacturers: Provide products of one of the following:
1. American Cast Iron Pipe Co.
2. Clow Valve Co.
3. Kennedy Valve Co.
4. Mueller Co.
5. Henry Pratt Co.
6. Or equal.

B. General:
1. Provide butterfly valves conforming to AWWA C504 and as specified herein.
2. Rated Working Pressure: 150 psig, Class 150B.
3. Maximum Fluid Temperature: 150 degrees F.
4. Valves shall provide drip-tight bi-directional shutoff at rated pressures.
5. Mount valve seats in valve body. Rubber seats for 24-inch diameter and larger valves shall be replaceable in the field.
6. Valves shall be capable of being maintained in open or partially open position for manual operation, and for automatic operation. When valve disc is maintained, there shall be no chatter or vibration of disc or operating mechanism.
7. Valve packing shall be replaceable without dismantling valve.
8. Disc shall be offset from shaft to provide uninterrupted 360-degree seat seal.

C. Materials of Construction: materials of construction shall conform to AWWA C504 and shall be as follows:
1. Body: Cast-iron, ductile iron, or alloy cast-iron.
2. Shaft: Type 316 stainless steel.
3. Discs:
   a. Valves Smaller than 30-inch Diameter: Cast-iron.
   b. Valves 30-inch Diameter and Larger: Ductile iron.

4. Seats: Buna-N or other synthetic rubber suitable for the application.
5. Seating Surfaces: Type 316 stainless steel.
6. Bearings:
   a. Valves Smaller than 24-inch Diameter: Nylon.
   b. Valves 24-inch Diameter and Larger: Fiberglass with Teflon lining.
7. Shaft Seals: Externally adjustable, material same as for seats. For services that are either buried or submerged, self-adjusting V-type chevron, material same as for seats.
8. Tapered Pins for Attachment of Shaft to Disc: Type 316 stainless steel.
9. Internal and external bolting and other hardware; including pins, set screws, studs, bolts, nuts, and washers shall be Type 316 stainless steel.

D. Interior Coating:
1. Valves shall be coated inside. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy-coated in accordance with AWWA C550.

E. Testing:
1. Test each valve in the manufacturer's shop in accordance with AWWA C504.

F. Gear Actuators for Manual Valves:
1. Provide gear actuators conforming to AWWA C540.
2. Gear actuators for valves 20-inch diameter and smaller shall be constructed for 150 psi differential pressure and 16 feet per second port velocity.
3. Gear actuators for valves 24-inch diameter and larger shall be constructed for maximum differential pressures and velocities as scheduled.
4. Butterfly valves shall be furnished with a manual operator equipped with a 2-inch square operating nut. The valve and operator shall be assembled for installation in a horizontal line with the main valve shaft horizontal and the operator shaft and operating nut aligned vertically to accept a valve key operated form the surface.

2.4 DETECTOR CHECK VALVES

A. Manufacturers: Provide products of one of the following:
1. Ames Co., Model 3000SS.
2. Febco, Model 800.
3. Watts, 007 Series.
4. Or equal.

B. General:
1. Provide valves conforming to AWWA C508 and as specified herein.
2. Type: Resilient-seated.
3. Rated Working Pressure: 175 psig.
4. Provide valves suitable for horizontal or vertical mounting.
5. Check valves shall have clear waterway with full-open area equal to nominal pipe size.
6. Provide check valves with outside adjustable weight and lever.
7. Provide valves larger than six-inch diameter with adjustable air cushion chambers.
8. Valve seats shall be mechanically attached and shall be field replaceable.
9. Four-inch through ten-inch detector check valves shall have flanged ends per ANSI B16.1, Class 125.
10. Valves shall be furnished with two tapped bosses on each side to permit installation of a metered bypass.

C. Materials of Construction: All materials of construction shall conform to AWWA C508 and shall be as follows:
   1. Body, Disc, Cover and Gland: Cast-iron or ductile iron.
   2. Disc Arm: Ductile iron.
   3. Hinge Shaft: Type 316 stainless steel or bronze.
   4. Hinge Shaft Bushings: Bronze, or Type 316 stainless steel for sewage service.
   5. Shaft End Plate: Type 316 stainless steel or bronze.
   6. Body Seat: Bronze.
   7. Follower Ring for Rubber Seat on Disc: Type 316 stainless steel or bronze.
   8. Disc Center Pin Assembly: Type 316 stainless steel or bronze.
   9. Air Cushion Chamber:
      a. Chamber and Plunger: Bronze.
      b. Linkages and Pins: Type 316 stainless steel or bronze.
      c. Air Check Valve and Tubing: Brass or stainless steel.
   10. Rubber Items:
      a. Applications Up to 180-degree F Fluid Temperature: Buna-N or other synthetic rubber suitable for the application.
      b. Applications 180-degrees F and Greater Fluid Temperature: Viton, or other synthetic rubber suitable for the application.
   11. Internal and external bolting and other hardware; including pins, set screws, studs, bolts, nuts, and washers shall be Type 316 stainless steel.
   12. Gland Packing: Graphite and Kevlar.

D. Interior Coating:
   1. Valves shall be coated inside. Cast-iron and ductile iron surfaces, except machined surfaces, shall be fusion-bonded epoxy coated in accordance with AWWA C550. Steel surfaces shall be hot-dip zinc galvanized or fusion-bonded epoxy coated.

E. Testing:
   1. Test each valve in manufacturer's shop in accordance with AWWA C508.
   2. Allowable Leakage at Rated Pressures: Zero.

2.5 FIRE HYDRANTS

A. Products and Manufacturers: Provide one of the following:
   1. Mueller, Model: Super Centurion 250 A-421.
   2. Or equal.

B. General:
   1. Provide fire hydrants conforming to AWWA C502, Underwriters' Laboratories-listed and Factory Mutual approved, and as specified herein.
   2. Rated Working Pressure: 175 psig, minimum.
   3. Rated Hydrostatic Test Pressure: 400 psig, minimum.
   4. Depth of Cover: Minimum 3-feet.
   5. Inlet: 6-inch mechanical joint.

C. Construction:
   1. Type: Three-way fire hydrants with two hose nozzles and one pumper nozzle.
   2. Nozzles:

a. Provide one minimum 5-inch Storz pumper nozzle and two 2.5-inch diameter hose nozzles with NFPA threads.
b. Nozzles shall be O-ring sealed, threaded, and retained with stainless steel locks. Nozzles shall be field replaceable.

3. Main Valve and Drainage Assembly:
   a. Opening: 4.5-inch minimum diameter.
   b. Main valve shall be compression type provided with upper and lower metal plates and lower valve plate nut.
   c. Barrel drainage shall be through dual drain valves. Opening and closing of main valve shall cause force-flush of dual drain ports.
   d. Main valve seat ring shall be easily replaceable from above-ground.
4. Provide an oil filled reservoir for lubrication of stem threads and bearing surfaces. Oil shall be U.S. Food and Drug Administration approved and ANSI/NSF 61-listed, and shall flow freely in temperature range of -60 to 158 degrees F.
5. Provide traffic flange in barrel and safety coupling in stem.
6. Inlet Connection: Six-inch diameter mechanical joint, restrained.
7. Operating Nut: 1.25-inch and pentagon-shaped.

D. Materials of Construction: Materials of construction shall conform to the requirements of AWWA C502 and shall be as follows:
1. Upper and Lower Barrels, Shoe, and Bonnet: Cast-iron.
2. Stem and Accessories:
   a. Upper and Lower Stems: Steel.
   b. Operating Nut: Bronze.
   c. Safety Coupling: Stainless steel.
3. Nozzles:
   a. Pumper and Hose Nozzles: Bronze.
   b. Nozzle Caps: Cast-iron.
   c. Cap Chains: Steel.
4. Main Valve Assembly:
   a. Main Valve: Rubber.
   b. Upper Valve Plate: Bronze.
   c. Lower Valve Plate and Nut: Cast-iron.
   d. Seat and receiving connection at base of hydrant: Bronze.
5. Drain Valves:
   a. Drain Ring Housing: Cast-iron.
   b. Drain Ring: Bronze.
6. O-ring Gaskets: Rubber.
7. External Assembly Bolts: Steel.
8. Internal Pins and Other Hardware: Stainless steel, ASTM A276.

E. Testing:
1. Test each fire hydrant in manufacturer’s shop in conformance with AWWA C502.

F. Interior Coating:
1. Hydrants shall be coated on the interior. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy coated in accordance with AWWA C550.

G. Exterior Painting:

1. All hydrants and any portion of hydrant assembly exposed to view shall be painted with minimum 2 even coats of white hydrant enamel paint.
2. Below- and above-ground painting shall be as specified under Article 2.11 of this Section and Article 2.12 of this Section.

H. Appurtenances for Hydrants:
1. Fire hydrant tees shall be Griffin Swivel hydrant Tee, Tyler 5-125 swivel hydrant tee or approved equal.
2. Piping extension for hydrant installations may be made with 6-inch ductile iron nipples with Tyler long swivel hydrant adapters, Megalug MJ Restraint, U.S. Pipe Field Lok Gaskets, Romac Grip Ring, or other approved method.

2.6 APPURTENANCES FOR EXPOSED METALLIC VALVES

A. General:
1. For valves located less than five feet above operating floor, provide levers on four-inch diameter quarter-turn valves, and provide handwheels on all other valves, unless otherwise shown or specified.
2. For valves located five feet or more above operating floor, provide chain operators.
3. Where indicated, provide extension stems and floorstands.

B. Handwheels:
1. Conform to applicable AWWA standards.
2. Material of Construction: Ductile iron or cast aluminum.
3. Arrow indicating direction of opening and word “OPEN” shall be cast on trim of handwheel.
4. Maximum Handwheel Diameter: 2.5 feet.

C. Crank Operator:
1. Crank operator shall be removable and fitted with rotating handle.
2. Maximum Radius of Crank: 15 inches.
3. Materials:
   a. Crank: Cast-iron or ductile iron.
   b. Handle: Type 304 stainless steel.
   c. Hardware: Type 304 stainless steel.

D. Extension Stems and Floor Stands for Gate Valves:
1. Conform to the applicable requirements of AWWA C501 for sizing of complete lifting mechanism.
2. Bench and Pedestal Floor Stands:
   a. For valves requiring extension stems, provide bench or pedestal floor stands with handwheel or crank as indicated. Provide provisions for using portable electric actuator for opening and closing of valves.
   b. Type: Heavy-duty with tapered roller bearings enclosed in a weatherproof housing, provided with positive mechanical seals around lift nut and pinion shaft to prevent loss of lubrication and to prevent moisture from entering housing. Provide lubrication fitting for grease. For valves conveying water that is potable or that will be treated to become potable, grease shall be food-grade and ANSI/NSF 61-listed. Base shall be machined.
   c. Materials of Construction:

1) Housing: Cast-iron, ASTM A126, Class B.
2) Lift Nut: Cast bronze, ASTM B98/B98M.
3) Grease Fitting: Stainless steel.
4) Bolting: Type 316 stainless steel.

3. Wall brackets for floor stands shall be Type 316L stainless steel construction.
4. Extension Stems:
   a. Materials of Stems and Stem Couplings: Type 316 stainless steel.
   b. Maximum Slenderness Ratio (L/R): 100.
   c. Minimum Diameter: 1.5-inch.
   d. Threads: Acme.
   e. Provide stem couplings where stems are furnished in more than one piece. Couplings shall be threaded and keyed or threaded and bolted and shall be of greater strength than the stem.
   f. Weld to bottom of extension stem a Type 316 stainless steel cap suitable for square end of valve stem.
5. Bottom Couplings: Ductile iron with Type 316 stainless steel pin and set screw.
6. Stem Guides:
   a. Material: Type 316 cast stainless steel with bronze bushing for stem. For submerged service, Type 316 cast stainless steel with stainless steel bushing for stem.
   b. Maximum Stem Length Between Guides: Seven feet.
   c. Stem guides shall be adjustable in two directions.
7. Furnish stem cover of clear butyrate plastic or Grade 153 Lexan with cast adapter for mounting cover to bench and floor stands. Provide stem cover with gasketing and breathers to eliminate water intrusion into operator and condensation within cover. Provide stem cover with mylar tape with legible markings showing valve position at one-inch intervals and open and close limits of valve.

E. Floor Boxes: Provide cast-iron floor boxes for valves that are to be operated from floor above valve. Boxes shall be equal in depth to floor slab. Boxes shall have cast-iron covers and be fitted with bronze bushing.

2.7 APPURTENANCES FOR BURIED METALLIC VALVES

A. Wrench Nuts:
   1. Provide wrench nuts on buried valves of nominal two-inch size, in accordance with AWWA C509.
   2. Arrow indicating direction of opening the valve shall be cast on the nut along with the word “OPEN”.
   3. Material: Cast-iron.
   4. Secure nut to stem by mechanical means.

B. Extension Stems for Non-Rising Stem Gate Valves and Quarter-turn Buried Valves:
   1. Provide extension stems to bring operating nut to six inches below valve box cover.
   2. Materials of Stems and Stem Couplings: Type 316 stainless steel.
   3. Maximum Slenderness Ratio (L/R): 100
   4. Provide top nut and bottom coupling of ductile iron or cast-iron with pins and set screws of Type 316 stainless steel.

C. Valve Boxes:

1. Valve boxes shall be as indicated and as required.
2. Type: Heavy-duty, suitable for highway loading, two-piece telescopic, and adjustable. Lower section shall enclose valve operating nut and stuffing box and rest on valve bonnet.
3. Material: Cast-iron.
4. Coating: Two coats of asphalt varnish conforming to FS TT-C-494.
5. Marking: As required for service.

2.8 TAPPING SLEEVES

A. Products and Manufacturers: Provide one of the following:
   a. Ford Fast.
   b. Romac STS420.
   c. Smith-Blair Model 663.
   d. JCM Industries Model 432.
   e. PowerSeal 3480AS.
   f. PowerSeal 3490AS.
   g. Or approved equal.

B. General:
   1. Application: Potable water service distribution water line.
   2. Tapping sleeves shall be stainless steel or epoxy-coated steel full gasket with wedge gaskets around tap openings.
   3. Stainless steel sleeves shall be 18/8, Type 304 stainless steel.
   4. Tapping sleeves shall include test plugs.
   5. Tapping sleeves 12-inch and smaller shall meet minimum working pressure requirement of 200 psi.
   6. Tapping sleeves 14-inch and larger shall meet minimum working pressure requirement of 150 psi.

C. Construction:
   1. Sleeve outlet flange shall be stainless steel and be Class D per AWWA C207 ANSI 150 pound drilling compatible with approved tapping valves.
   2. Flanged end shall feature lip in accordance with MSS SP-60.
   3. Sleeve gasket shall be of a grid pattern design and shall provide full circumferential sealing around the tapped pipe.
   4. All welds of tapping sleeve shall be passivated.
   5. Tapping valves shall conform to the specifications and approved brands as outlined in this Section.
   6. Tapping valves shall have oversized seat rings and feature one flanged end and one standard mechanical joint.

2.9 ANCHORAGES AND MOUNTING HARDWARE

A. General:
   1. Bolts, nuts, and washers shall be of ample size and strength for purpose intended. Anchorages in concrete shall be at least 5/8-inch diameter.
   2. Provide stem guide anchorages of required strength to prevent twisting and sagging of guides under load.

3. Materials: Provide bolts and washers of Type 316 stainless steel and nitrided nuts. Bolts shall have rolled threads. Bolts and nuts shall be electropolished to remove burrs.

2.10 TOOLS, LUBRICANTS, AND SPARE PARTS

A. Provide T-handle operating wrenches for buried valves as required by the County.

B. Lubricants: For valves, actuators, and appurtenances requiring lubricants, provide suitable lubricants for initial operation and for first year of use following Substantial Completion. Lubricants for equipment associated with conveying potable water or water that will be treated to become potable shall be food-grade and ANSI/NSF 61-listed.

C. Provide tools, spare parts, and maintenance materials.

2.11 PAINTING OF EXPOSED VALVES, HYDRANTS, AND APPURTENANCES

A. Exterior steel, cast-iron, and ductile iron surfaces, except machined surfaces of exposed valves and appurtenances, shall be finish painted in manufacturer's shop. Surface preparation, priming, finish painting, and field touch-up painting shall conform to the manufacturer's paint standards.

2.12 PAINTING OF BURIED VALVES

A. Exterior steel, cast-iron, and ductile iron surfaces, except machined or bearing surfaces of buried valves, shall be painted in valve manufacturer's shop with two coats of asphalt varnish conforming to FS TT-C 494.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment are to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Install valves and appurtenances in accordance with:
      a. Supplier's instructions and the Contract Documents.
      b. Requirements of applicable AWWA standards.
      c. Applicable requirements of Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
   2. Install valves plumb and level. Install all valves to be free from distortion and strain caused by misaligned piping, equipment, and other causes.

3. Position detector check valves and butterfly valves so that, when valve is fully open, valve disc does not conflict with piping system elements upstream and downstream of valve.

B. Exposed Valves:
   1. Provide supports for large or heavy valves and appurtenances as shown or required to prevent strain on adjoining piping.
   2. Operators:
      a. Install valves so that operating handwheels or levers can be conveniently turned from operating floor without interfering with access to other valves, piping, structure, and equipment, and as approved by ENGINEER.
      b. Avoid placing operators at angles to floors or walls.
      c. Orient chain operators out of way of walking areas.
      d. Install valves so that indicator arrows are visible from floor level.
      e. For motor-operated valves located lower than five feet above operating floor, orient motor actuator to allow convenient access to pushbuttons and handwheel.
   3. Floor Stands and Stems:
      a. Install floor stands as shown and as recommended by manufacturer.
      b. Provide lateral restraints for extension bonnets and extension stems as shown and as recommended by manufacturer.
      c. Provide sleeves where operating stems pass through floor. Extend sleeves two inches above floor.

C. Buried Valves:
   1. Install valve boxes plumb and centered, with soil carefully tamped to a lateral distance of four feet on all sides of box, or to undisturbed trench face if less than four feet.

D. Hydrants:
   1. Hydrant drains shall not be connected to, or located within 10 feet of, sanitary sewer systems.
   2. Install tracer wire per fire hydrant detail.

E. Tapping Sleeves:
   1. Place the lower half of the tapping sleeve under the pipe to be tapped. Support sleeve with blocks and place the gaskets. Place the upper half of the sleeve over the pipe, insert the bolts, rotate the sleeve to proper position and tighten the nuts evenly. Bolt tapping valve to the sleeve outlet, attach tapping machine to the valve, drill and tap central hole and cut outlet in main. After opening has been made, withdraw the drill, cut-out portion of pipe wall and the cutter and close tapping valve. Remove and temporary extension piping used to make connection.
   2. Coat threads on tapping sleeve bolts with anti-gall coating prior to installation.
   3. Leave newly-installed tapping sleeve and valve exposed for a minimum period of 24 hours to permit inspection of the joints and valve for leaks. Test at same hydrostatic pressure as that present in existing main.
   4. Correct all visible leaks, if any, at no additional cost to Owner. After such leaks have been sealed, again leave sleeve and valve exposed for a minimum period of 24 hours. Repeat this procedure until Engineer accepts installation and then commence backfilling.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
   1. Adjust all parts and components as required to provide correct operation of valves.
   2. Conduct functional field test on each valve in presence of ENGINEER to demonstrate that each valve operates correctly.
   3. Verify satisfactory operation and controls of motor operated valves.
   4. Demonstrate satisfactory opening and closing of valves at specified criteria requiring not more than 40 pounds effort on manual actuators.
   5. Test ten percent of valves of each type by applying 200 pounds effort on manual operators. There shall be no damage to gear actuator or valve.

B. Tests for Tapping Sleeves
   1. Perform hydrostatic and leakage tests on tapping sleeves in accordance with AWWA C600.
   2. All leaks and any defective material shall be repaired or replaced to the satisfaction of the Engineer and the tests repeated until the requirements of this specification are met.
   3. Furnish any special equipment required to conduct the test.
   4. If hydrants or other openings are not available for the purpose of expelling air, provide air releases of sufficient size (as determined by the Engineer) in accordance with the Drawings at the Contractor's expense.
   5. Test pressure shall be held for at least 2 hours at minimum 150% the maximum working pressure at the low point of the section being tested. If testing against butterfly valves, the differential pressure must not exceed 150 psi for valves rated at 150 psi.
   6. If the test cannot be executed with differential pressure of 150 psi, a 250 psi valve shall be specified.
   7. Differential test pressures against gate valves shall not exceed 200 psi.
   8. Allowable leakage shall be determined by AWWA C600.

END OF SECTION

SECTION 40 05 86

AIR VALVES FOR WATER AND WASTEWATER SERVICE

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, and test Air Valves for water and wastewater service complete with appurtenances.
   2. This Section does not include:
      a. Valves specified in other Sections
      b. Valves furnished with equipment
      c. Non-metallic valves.

B. Coordination:
   1. Review installation procedures for this and other Specification sections and coordinate Work that must be installed with or before Work under this Section.
   2. If this is a multiple-prime contract project, provide timely advance notification of schedule of work to other contractors who may need to install items at same time or before Work included in this Section.

C. Related Sections:
   1. Section 40 05 53, Process Valves

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI/AWWA C512, Air Release, Air Vacuum and Combination Air Valves for Waterworks Service
   2. ANSI/AWWA C550, Protective Interior Coatings for Valves and Hydrants.
   3. ANSI/NSF 61 Drinking Water Components – Health Effects

1.3 DEFINITIONS

A. The following definitions apply to this Section.
   1. Air Release Valve: A hydromechanical device designed to automatically release to atmosphere small pockets of air as they accumulate in a pipeline when pipeline system is full and operating under pressure.
   2. Air/Vacuum Valve: Direct-acting, float-operated, hydromechanical device designed to automatically release or admit large volumes of air during filling or draining of a pipeline or piping system. Valve will open to relieve negative pressures and will not reopen to vent air when system is full and under pressure.
   3. Air Valve: Valve of one of the following types: Air Release Valve, Air/Vacuum Valve, or Combination Air Valve.
   4. Maximum and Minimum Working Pressure: Pressure range at which valve is designed to function.

5. Orifice: Opening in valve mechanism through which air is expelled from or admitted into pipeline or piping system.
6. Valve Design Pressure: Maximum pressure to which a valve may be subjected without exceeding allowable stress of its components.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall be able to provide documentation of at least five installations of substantially similar equipment to that specified, in satisfactory operation for at least five years.

B. Component Supply and Compatibility:
   1. Valves of the same type, including specified accessories, shall be products of or furnished by a single air valve manufacturer.

C. Regulatory Requirements.
   1. Drinking Water Requirements: Valves that will be in contact with potable water or water that will be treated to become potable shall comply with ANSI/NSF 61 and the Safe Drinking Water Act.

1.5 SUBMITTALS

A. Action Submittals.
   1. Product Data: Submit the following for each type and size of valve specified:
      a. Product data sheet.
      b. Complete catalog information, including dimensions, weight, performance data, Orifice size, specifications, and identification of materials of each part.

B. Informational Submittals:
   1. Certifications:
      a. Submit a certificate signed by manufacturer of each product stating that product conforms to applicable referenced standards and specified requirements.
   2. Test Reports:
      a. Provide results of successful factory tests prior to shipping products to the Site.
   3. Manufacturer's Reports:
      a. Submit written report of results of each visit to Site by a manufacturer's serviceman, including purpose and time of visit, tasks performed, and results obtained.

C. Closeout Submittals.
   1. Operation and Maintenance Data:
      a. Submit complete operation and maintenance manual for all Air Valves in the Contract, including maintenance data and schedules in sufficient detail for disassembly and assembly of valve, and identifying parts that can be replaced.
      b. Furnish operation and maintenance manuals per Section 01 78 23, Operations and Maintenance Data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Prepare valves for shipping per Section 6.2 of ANSI/AWWA C512.
   2. Conform to Section 01 65 00, Product Delivery Requirements.

B. Acceptance at Site:
   1. Inspect all boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to products. Promptly remedy loss and damage to new condition per manufacturer's instructions.

C. Storage and Protection:
   1. Keep all products off ground using pallets, platforms, or other supports. Protect products from corrosion and deterioration.
   2. Conform to Section 01 66 00, Product Storage and Handling Requirements.

1.7 MAINTENANCE

A. Extra Materials (for capital projects):
   1. Furnish complete valves or sets of field replaceable parts for each type and size of valve installed, tagged and boxed for long-term storage as follows:

Quantity of Valves Installed	**Spare Valves (1) or Sets of Spare Parts (2)**
1 to 5	1
6 to 10	2
11 to 15	3
16 or more	5

Notes:
(1) For valves smaller than 4-inch diameter furnish complete valve instead of sets of spare parts. Complete valve does not include accessories that are not typically furnished with valve model.
(2) Set of field-replaceable spare parts includes one gasket and all field-replaceable seats and bushings.

PART 2 PRODUCTS

2.1 GENERAL

A. Extent:
   1. Provide valves included in this Section and as shown on the Drawings.

B. Requirements:
   1. Size: Air valve shall be sized per manufacturer's recommendations.
   2. Valve Design Pressure: Unless otherwise specified, Valve Design Pressure shall be equal to or exceed design pressure of pipe or equipment on which the valve is installed.
   3. Valve Type, Service, Inlet Size, Orifice Size, Accessories, and Required Features: Provide per the Drawings.

4. Materials: Air Valve materials shall be suitable for long-term use in the service specified.
5. Ends:
   a. Provide per the Drawings.
   b. Comply with valve connection requirements in Section 4.3 of ANSI/AWWA C512.
6. Operating Pressure Range: Valve Design Pressure shall be greater than the valve's Maximum and Minimum Working Pressure.
7. Air Valves in water service shall comply with ANSI/AWWA C512 unless otherwise shown or specified.
8. Air/ Vacuum Valves in wastewater service to be long body type, furnished with back flushing attachments.

C. Markings:
1. Mark valves per Section 6.1 of ANSI/AWWA C512.

D. Manufacturers:
1. Apco Valves.
2. Crispin Valves.
3. GA Industries.
4. Val-Matic Valve & Manufacturing Corporation.
5. Henry Pratt.
6. Or equal.

2.2 ACCESSORIES

A. Isolating Valves:
1. Provide isolating valves as shown in the Drawings.

B. Anti-Slam Devices for Water Service:
1. Provide anti-slam devices on inlet to air/vacuum valves where indicated.
2. Pressure rating of anti-slam device shall equal or exceed Valve Design Pressure of connected Air Valve.
3. Ends shall be as required for connecting to Air Valve.
4. Anti-slam devices shall be as normally furnished by specified Air Valve manufacturers and be cast iron or ductile iron with bronze or stainless steel disc and trim.

C. Back-flush Attachments for Wastewater Service:
1. Unless otherwise indicated, provide back-flush attachment for Air Valves.
2. Back-flush attachments shall be as normally furnished by specified Air Valve manufacturer. Provide ports in the Air Valve body for flushing and discharge, each with an isolating valve and quick-connect for attaching hoses.
3. Provide five-foot length of rubber hose with quick-connect for connecting to flushing discharge port.
4. Provide a plugged 2-inch diameter NPT port at bottom of Air Valve body for removal of solids.

D. Vacuum Check Valves:
1. Provide vacuum check valves for Air Release Valves where indicated.
2. Vacuum check valves shall be as normally furnished by Air Valve manufacturer.

E. Throttling Devices
   1. Provide throttling device on discharges of Air/Vacuum Valves where indicated.
   2. Throttling device shall have a field-adjustable Orifice and be as normally furnished by Air Valve manufacturer.

F. Inflow Prevention Devices for Water Service:
   1. Extent: Provide where indicated.
   2. Design: System shall allow connected Air Valve to function normally under normal (non-flooded) conditions.
   3. Size: Venting capacity shall be equal to or greater than connected Air Valve:
   4. Connections: Provide female threaded connections for Air Valve of 1 to 4 inches, and flat faced flanges drilled per ANSI B16.1 Class 125 for larger sizes.
   5. Products and Manufacturers: Provide products of one of the following:
      a. Val-Matic, Series 1300.
      b. Or equal.

2.3 FACTORY PAINTING

A. Interior Surfaces
   1. Extent: Paint ferrous surfaces except stainless steel surfaces.
   2. Paint: Paint shall be as normally provided by Air Valve manufacturer for the specified application, except for potable water service valves which shall be coated with paint complying with ANSI/AWWA C550 and ANSI/NSF-61.

B. Exterior Surfaces
   1. Exterior surfaces of cast-iron, ductile iron, and steel other than stainless steel, except machined surfaces of valves and appurtenances, shall be finish painted.
   2. Surface preparation, painting, and field touch-up painting shall be per manufacturer's paint standards.
   3. Furnish valve with only a prime coat if so indicated.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect Air Valves per Section 5 of ANSI/AWWA C512. Do not ship valves that are not successfully tested.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected.

B. Examine valves and remove packing and foreign materials from interior of valve. Report defects to ENGINEER

3.2 INSTALLATION

A. Install valves and appurtenances as shown on the Drawings and per Air Valve manufacturer's recommendations, approved Shop Drawings, and applicable codes and standards.

B. Install valves plumb and vertical.

C. Install with an isolating valve. Remove isolating valve's operating handle or lever and deliver to OWNER.

D. Adjust throttling devices, if provided, for smooth, non-slam and waterhammer-free operation.

END OF SECTION

SECTION 43 21 39

PUMPING STATION – SUBMERSIBLE TYPE WITH VALVE VAULT

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install submersible type pumping station with valve vault, complete and operational.

B. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 31 23 05, Excavation and Fill.
   3. Section 32 12 00, Flexible Paving.
   4. Section 32 92 00, Lawns and Meadows.
   5. Section 40 05 05, Exposed Piping Installation.
   6. Section 40 05 08, Wall Pipes, Floor Pipes and Pipe Sleeves.
   7. Section 40 05 19, Ductile Iron Process Pipe.
   8. Section 40 05 53, Process Valves.
   9. Section 43 21 39.13, Submersible Pumps.

1.2 SECTION INCLUDES

A. Submersible type pumping station with valve vault, and including:
   1. Excavating and backfilling.
   2. Wet well with resilient connectors, steel supports, electrical handhole, and vent.
   3. Valve vault with floor door, manhole steps, and vent.
   4. Anchor bolts and anchors.
   5. Submersible pumps with pump guide assemblies, pump access doors, and pump controls.
   6. Piping for pump discharges and drains.
   7. Asphalt pavement.
   8. Electrical.
   9. Painting.
   10. Landscaping.

1.3 SUBMITTALS

A. Provide Manufacturer Standard Submittal Drawings, Operating and Maintenance Instruction Manuals and Parts List to the Engineer. Standard Submittals shall consist of:
   1. Pump Performance Curves.
   2. Pump Outline Drawing.
   3. Station Drawing for Accessories.
   4. Electrical Motor Data.
   5. Control Drawing and Data.
   6. Access Cover Dimensions Minimum.
   7. Typical Installation Guides.

8. Technical Manuals.
9. Operation and Maintenance Manual.
10. Parts List.
11. Printed Warranty.
12. Manufacturer's Equipment Storage Recommendations.
13. Manufacturer's Standard Recommended Start-Up Form.
14. Certified Factory Test Pump Curve.

B. Furnish a manufacturer's affidavit indicating that the pipe, fittings, and valves have been manufactured and tested in accordance with requirements of the applicable referenced Standards, and the Project on which the material is to be used prior to construction.

1.4 DESIGN REQUIREMENTS

A. Design precast structures to meet loading requirements of AASHTO Classification H-20.

B. Minimum Lateral Earth Pressure: 60 pcf.

C. Design for groundwater level no more than 5 feet below grade.

1.5 QUALITY ASSURANCE

A. Precast Concrete Structures:
   1. Qualifications: The precaster shall be PCI-certified; design shall be sealed by a Professional Engineer licensed to practice in the State of South Carolina.
   2. Inspections: ENGINEER reserves the right to inspect the precasting facility prior to and during fabrication, and to collect samples of materials during the fabrication process for testing. Manufacturer shall accommodate facility inspection and sample collection.

B. Piping:
   1. Pipe and fittings to be appropriately marked for identification purposes.
   2. The materials and methods of manufacture, and completed pipes, fittings, and valves are subject to inspection and rejection at all times. OWNER and ENGINEER have the right to make inspections.
   3. Valve manufacturer's name, valve size, pressure rating, and direction of opening to be marked on valve.

PART 2 PRODUCTS

2.1 EXCAVATION AND FILL

A. Fill Materials: Follow Section 31 23 05, Excavation and Fill.

2.2 WET WELL

A. Walls:
   1. Precast reinforced concrete sections; comply with ASTM C478.
   2. Joints: Tongue and groove with rubber gaskets; comply with ASTM C443.

3. Flexible Plastic Gasket Material: Federal Specification SS-S-210A and AASHTO M-198B; Hamilton-Kent Manufacturing Company, Concrete Sealants, Inc., or as approved.

B. Top and Bottom Slabs: Class I concrete; follow Section 03 00 05, Concrete.

C. Concrete Fill: Class II concrete; follow Section 03 00 05, Concrete.

D. Resilient Connector: Comply with ASTM C923.
   1. Manufacturers:
      a. A-Lok Products, Inc., A-Lok Connector.
      b. National Pollution Control Systems, Inc., Kor-N-Seal.
      c. Or as approved.

E. Pipe Brace and Concrete Pipe Support Beam Angle:
   1. Structural steel; ASTM A36.
   2. Type 316 stainless steel expansion anchors.

F. Vent:
   1. Schedule 40 black steel pipe, ASTM A53, Grade B with welded or flanged joints; or ductile iron pipe, AWWA C150 and C151, Class 50 with flange joints. Provide required wall casting. Provide outlet with a bronze wire screen, 0.063-inch diameter wire, 2 mesh size, mechanically held in place between two flanges.

2.3 VALVE VAULT

A. Walls, Top and Bottom Slabs:
   1. Minimum compressive strength 5,000 psi at 28 days; air entrainment of 6 percent, ±1 percent; follow Section 03 00 05, Concrete.
   2. Reinforcing steel meeting ASTM A615 or A616, certified Grade 60.
   3. Welded wire fabric conforming to ASTM A185.
   4. Poured and vibrated and constructed using steel forms.
   5. Wall joints with tongue and groove design; sealed water-tight with gasket and polyurethane sealant.
   6. Wall penetrations for drain piping field-cored.

B. Floor Door and Drain Piping:
   1. Manufacturers:
      a. Babcock-Davis Hatchways, Series B-FGA-H.
      b. The Bilco Company, Type J-AL, H-20.
      c. Halliday Products, Inc., Series H1W.
      d. Or as approved.
   2. Load Rating: AASHTO H-20 wheel loading.
   3. Frame:
      a. Material: Extruded aluminum sections shaped to serve as a continuous drainage gutter with a 1-1/2 inch drain coupling.
      b. Anchors: Continuous anchor flange.
      c. Apply manufacturer's standard protective coating to surfaces of frame that will be in contact with concrete.
   4. Cover:

a. Material: 1/4 inch mill finish aluminum diamond plate, reinforced with stiffening ribs.
b. Hinges: Stainless steel; butt type with compression spring operators enclosed in telescopic tubes.
c. Hold Open Arm: Stainless steel; automatically locks door at 90 degree position; provide vinyl grip handle to release door for closing.
d. Lock: Stainless steel; slam type with fixed handle inside and removable key wrench outside.

5. Hardware and Fasteners: Type 316 stainless steel.
6. Accessories: Provide one key wrench for each door supplied.
7. Drain Piping: Follow paragraph 2.6.C in this Section.

C. Manhole Steps:
1. 1/2 inch diameter steel reinforcing rod continuous through entire length of legs and tread, encapsulated in a copolymer polypropylene plastic.
2. Provide steps with notched tread ridge and retainer lugs on each side of tread ridge.
3. Provide grab bar where indicated.

D. Vent: Schedule 40 black steel pipe, ASTM A53, Grade B, with welded or flange joints; or ductile iron pipe, AWWA C150 and C151, Class 50 with flange joints. Provide required wall casting. Provide outlet with a bronze wire screen, 0.063 inch diameter wire, No. 2 mesh size, mechanically held in place between two flanges.

E. Sump Drain Piping: Follow paragraph 2.6.C in this Section.

2.4 ANCHOR BOLTS AND EXPANSION ANCHORS

A. Anchor Bolts Cast-In-Concrete:
1. Comply with ASTM F593, Type 316 stainless steel.
2. 4 inch minimum hook.

B. Expansion Anchors:
1. Manufacturers:
a. Hilti Corporation, Kwik Bolt II.
b. ITW Ramset/Red Head, Trubolt Wedge Anchor.
c. The Powers Rawl Company, Inc., Power-Stud.
d. Or as approved.
2. Expansion Type: Comply with Federal Specification FF-S-325 Group II, Type 4, Class I.
3. Type 316 stainless steel.
4. Minimum Embedment: 4 inches, unless otherwise indicated.

2.5 SUBMERSIBLE PUMPS

A. Follow Section 43 21 39.13, Submersible Pumps; includes submersible pumps, pump guide assemblies, pump access doors, and pump controls.

2.6 PIPING

A. Piping Schedule:

Application	Material
Submersible pumps discharge to and including connection with force main	Ductile Iron
Valve Vault floor door drain to the sump	PVC
Valve Vault gravity sump drain to wet well	PVC

B. Ductile Iron Pipe and Fittings: Follow Section 40 05 19, Ductile Iron Process Pipe.
   1. Pipe:
      a. Buried: Designed in accordance with AWWA C150 and manufactured in accordance with AWWA C151; minimum Thickness Class 52, with polyethylene encasement; mechanical joint or push-on joint.
      b. Exposed: AWWA C115 flanged joint.
   2. Fittings: AWWA C110.
   3. Exterior Coating: Asphaltic material for buried and within wet well; factory-applied prime coat for all other. Buried fittings may be coated with a fusion-bonded epoxy coating in accordance with AWWA C116.
   4. Interior Lining: Ceramic epoxy lining, Protecto 401 Ceramic Epoxy.
   5. Joints:
      a. Mechanical and Push-On: AWWA C111, rubber gasket, with restrained joints.
         1) Restrained Push-On: Completely boltless; McWane Push-On Restrained Joint Pipe, U.S. Pipe TR Flex, American Flex-Ring, or as approved.
         2) Restrained Mechanical: EBAA Iron, Inc. MEGALUG with Mega-Bond Coating System, or as approved, of ductile iron, and with a working pressure of at least 250 psi, and a minimum safety factor of 2:1.
      b. Flanged: Appendix A of AWWA C115, and ANSI B16.1, Class 125; ductile iron flanges; zinc-plated bolts and nuts.
      c. Bolted Joints: Bolt length shall be such that all threads of the nut will be engaged.
   6. Wall Castings:
      a. Ductile iron; AWWA C110; coated and lined as specified for pipe.
      b. Provide with integral water stop.
      c. End Connections: As indicated on Drawings.
      d. Length: As required for wall thickness.
   7. Polyethylene Encasement: AWWA C105 polyethylene tube; 2 inch wide, plastic-backed adhesive tape, bond to both metal surfaces and polyethylene tube.
   8. Pipe, Fittings, and Appurtenances: Manufactured in United States.

C. PVC Pipe and Fittings:
   1. Pipe: ASTM D1785, Schedule 80.
   2. Joints:
      a. Socket: Solvent-welded.
      b. Threaded: Taper pipe threads.
      c. Flanged: One-piece solid design; compatible with ANSI B16.5, Class 160 metal flanges.
   3. Fittings:
      a. Socket: ASTM D2467.
      b. Threaded: ASTM D2464.
   4. Unions: O-ring seal type; transition type for joining dissimilar materials.

D. Valves:
   1. Plug Valves:
      a. Type: Non-lubricated eccentric plug with resilient plug facings.
      b. Body: Cast iron; ASTM A126, Class B.
      c. Seat: Raised seat with 1/8-inch welded overlay of 90 percent pure nickel. Screw-in seats are not acceptable.
      d. Plug: Cast iron; ASTM A126, Class B; cylindrical seating surface, faced with chloroprene or neoprene, as instructed by manufacturer based on type of service.
      e. Bearings: Stainless steel sleeve type, permanently lubricated. Non-metallic bearings are not acceptable.
      f. Shaft Seals: Multiple V-ring type, externally adjustable and repackable without removing bonnet.
      g. Operator: Valves less than 6 inches, lever actuator. Equip valves 6 inches and larger with gear actuators and handwheel. Enclose gearing in semi-steel housing; provide seals on all shafts; support actuator shaft on permanently lubricated bronze bearings.
      h. Manufacturers: DeZurik, PEC, or as approved.
   2. Swing Check Valves:
      a. Type: Full opening swing type with outside lever and weight, suitable for horizontal or vertical installation. Clapper to swing completely clear of waterway.
      b. Body: Cast Iron; ASTM A126, Class B.
      c. Clapper: For valve sizes as follows:
         1) 4 Inches and Smaller: Bronze.
         2) 6 Inches through 12 Inches: Cast iron with bronze face.
         3) 14 Inches and Larger: Cast iron with rubber face.
      d. Hinge Pin: Stainless steel.
      e. Outside Lever and Weight: Cast iron.
      f. Manufacturers:
         1) M&H Valve Company.
         2) Mueller Company.
         3) Or as approved.
   3. Ball Check Valves, Plastic:
      a. Type: True union design; suitable for horizontal or vertical installation.
      b. Body and Ball: PVC.
      c. Seats and Seals: EPDM or Viton as instructed by manufacturer for intended service.
      d. Manufacturers:
         1) Asahi/America.
         2) Chemtrol.
         3) Or as approved.

E. Pipe Sleeves:
   1. Material: Standard weight steel pipe or 18 gage galvanized steel.
   2. Integral waterstop collar.
   3. Size:
      a. Diameter: Large enough to allow for movement due to expansion and contraction. Allow for continuous insulation wrap.
      b. Length: Flush with wall or floor, unless otherwise indicated.

F. Mechanical Type Seal:

1. Manufacturers: Pipe Seal International, Link-Seal, service designation S; or as approved.
2. Design: Modular mechanical type, consisting of interlocking synthetic rubber links, shaped to fill the annular space between the pipe and sleeve.
3. Size: As instructed by manufacturer based on pipe size and opening size.
4. Sealing Element: EPDM rubber.
5. Pressure Plate: Glass-reinforced nylon plastic.
6. Bolts and Nuts: Type 304 stainless steel.

G. Pipe Couplings for Ductile Iron Pipe:
1. Manufacturers:
   a. Baker Coupling Company, Inc., Series 200.
   b. Dresser Industries, Style 38.
   c. Smith-Blair, Inc., 411.
   d. Or as approved.
2. Type: AWWA C219, bolted-gasketed sleeve type.
3. Components:
   a. Steel middle ring.
   b. Two steel followers.
   c. Two-rubber compound, wedge-shaped gaskets suitable for service intended.
   d. Track-head steel bolts and nuts.
4. Size: As instructed by manufacturer based on pipe diameter.
5. Finish: Factory-applied primer exterior; factory-applied epoxy coating interior.

H. Pipe Supports:
1. Concrete Beams: Follow Section 03 00 05, Concrete.
2. Concrete Piers: Class I concrete; follow Section 03 00 05, Concrete.

2.7 ASPHALT PAVEMENT

A. Comply with Section 32 12 00, Flexible Paving.

2.8 PAINTING

A. Manufacturers:
1. Carboline Company.
2. ICI Paints (Devoe Coatings).
3. The Sherwin-Williams Company.
4. Tnemec Company, Inc.
5. Or as approved.

B. Materials:
1. Coatings: Ready-mixed, except field-catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
2. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality. Use products compatible with painting materials and approved by paint manufacturer.

3. Paint materials and equipment shall be compatible in use.
4. Primer, Intermediate, and Finish coats shall all be from the same coatings manufacturer. Prime coats shall be compatible with and appropriate for use on surface to be coated.

C. Colors:
1. Colors will be selected by OWNER from manufacturer's standard colors.

D. Paint Systems: Paint systems of The Sherwin-Williams Company are listed. Equivalent systems of other manufacturers previously specified are acceptable.
1. Metal - Non-Submerged:
   a. Prime Coat: Recoatable Epoxy Primer B67 Series, B67V5 Hardener, 3-6 mils dft.
   b. First Coat: Hi-Solids Polyurethane B65-300 Series Color, B60V30 Hardener, 3-4 mils dft.
   c. Second Coat: Hi-Solids Polyurethane B65-300 Series Color, B60V30 Hardener, 3-4 mils dft.
2. Metal - Submerged:
   a. Prime Coat: Targuard Coal Tar Epoxy B69B60 / B69V60, 8-12 mils dft.
   b. First Coat: Targuard Coal Tar Epoxy B69B60 / B69V60, 8-12 mils dft.
3. Plastic and Fiberglass:
   a. Prime Coat: DTM Acrylic Gloss Coating B66-100 Series, 2.5-4 mils dft.
   b. First Coat: DTM Acrylic Gloss Coating B66-100 Series, 2.5-4 mils dft.
4. Concrete: Interior surfaces of the wet well shall be coated with a heavy duty, chemical resistant epoxy resin coating, suitable for raw wastewater service in accordance with coating manufacturer recommendations. Use bitumastic 300M by Carboline Company, TNEMEC Vinister Series 120-5001, or approved equal.

2.9 LANDSCAPING

A. Follow Section 32 92 00, Lawns and Meadows.

PART 3 EXECUTION

3.1 EXCAVATION AND FILL

A. Follow Section 31 23 05, Excavation and Fill.

3.2 WET WELL

A. Construct base; follow Section 03 00 05, Concrete.

B. Install wall sections plumb and level. Provide flexible plastic gasket material on the outside shoulder of all wall joints; install so as not to interfere with proper sealing of the rubber gaskets.

C. Place concrete fill in bottom of wet well.

D. Construct top slab; follow Section 03 00 05, Concrete.

E. Install pipe brace and concrete pipe support beam angle.

F. Install electrical handhole. Coat surfaces in contact with concrete with bituminous coating.

G. Install vent plumb and level.

3.3 VALVE VAULT

A. Place precast vault on original earth sub-base with a 6 inch stone leveling course, plumb and level.

B. Place concrete fill in bottom of vault and slope to sump.

C. Vent: Install plumb and level.

D. Floor Door:
   1. Comply with manufacturer's instructions.
   2. Install drain piping; follow paragraph 3.6 in this Section.

E. Install sump drain piping; follow paragraph 3.6 in this Section.

3.4 ANCHORS AND ANCHOR BOLTS

A. Use expansion anchors in precast and cast-in-place concrete.

3.5 SUBMERSIBLE PUMPS

A. Install pumps, guide assemblies, access doors, and controls; follow Section 43 21 39.13, Submersible Pumps.

3.6 PIPING

A. Examination:
   1. Verify location and elevation of wall castings and supports.
   2. Inspect linings for damage.
   3. Verify that polyethylene encasement is in place, where required, before backfilling.

B. Preparation:
   1. Clean gaskets and all surfaces in contact with gaskets; comply with manufacturer's instructions.
   2. Keep interior of pipe and fittings clean.
   3. Prepare piping connections to equipment with flanges.

C. Pipe, Fittings, Valves and Accessories:
   1. Install in accordance with manufacturer's instructions.
   2. Pipe Supports: Follow Sections 03 00 05, Concrete and as indicated on Drawings.
   3. Install wall castings in proper location and elevation before concrete and piping are in place. Boxing out of forms for later placement will not be permitted.
   4. Install bell and spigot pipe with bell end in the direction of laying the pipe.
   5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

6. Provide access to valves and fittings.
7. Tighten flanged joints with all bolts taking equal stress.
8. Install valves plumb and level, free from distortion and strain from misaligned piping or equipment.
9. Install polyethylene encasement for all buried ductile iron pipe, fittings, and appurtenances. Comply with AWWA C105 Method A and manufacturer's instructions. Completely tape all overlaps and seams. Repair all rips, punctures, and other damage to the polyethylene.

D. Pressure and Leakage Tests: Provide all labor and equipment and clean water to complete the following piping testing:
   1. Submersible Pump Discharge: Follow Section 40 05 05, Exposed Piping Installation.
   2. Drains: Demonstrate free to drain; correct for free drainage.

3.7 ASPHALT PAVEMENT

A. Prepare subgrade per Specification Section 31 23 05, Excavation and Fill.

B. Base Course: 8 inches thick of stabilized aggregate after compaction; two equal courses.

C. Surface Course: 2 inches of Asphaltic Concrete Surface Course (Type 1).

D. Pavement may be installed per alternate design if approved by ENGINEER.

3.8 PAINTING

A. Examination:
   1. Verify that surfaces are ready for application of materials in accordance with the product manufacturer's instructions.
   2. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.
   3. Measure moisture content of surfaces using appropriate method as instructed by the coating manufacturer. Do not apply finishes unless moisture content of surfaces are below the coating manufacturer's acceptable maximums.

B. Preparation:
   1. Mask nameplates, descriptive data on pumps, motors and other equipment.
   2. Correct defects and clean surfaces which affect the Work.
   3. Seal marks which may bleed through surface finishes with sealer instructed by paint manufacturer.
   4. If mildew is encountered, remove by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
   5. Where surfaces are coated with bituminous coating that is not compatible with paint material, remove bituminous coating with abrasive blasting.
   6. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply manufacturer's required primer.
   7. Uncoated Steel and Iron Surfaces:
      a. Welded areas shall be ground smooth per NACE Standard RP 0178.
      b. Use abrasives for blast cleaning that are clean, uniformly graded, and free of oil, soluble salts, chlorides, or foreign matter which could contaminate the blasted

surface. Size the abrasive to produce an anchor pattern profile height as required by the coating manufacturer.

c. Metal surfaces to be painted, and not factory-primed, shall be field-abrasive blasted in accordance with NACE-3 (SSPC-SP6), commercial blast, for non-immersion service; and in accordance with NACE-2 (SSPC-SP10), near-white blast, for immersion service, unless a higher degree of surface preparation is required by the manufacturer.

8. Shop-Primed Steel Surfaces:
   a. Remove loose primer and rust in accordance with SSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning. Feather edges to make touch-up patches inconspicuous. Clean surfaces in accordance with SSPC-SP1 Solvent Cleaning. Prime bare steel surfaces.
   b. Retouch damaged areas of shop-primed items with compatible primer.
   c. CONTRACTOR responsible for compatibility of shop primer with field-finish coats.
   d. Plastic and Fiberglass: Solvent-wipe and scuff sand; apply test sample prior to application to ensure adhesion.

C. Application:
1. Comply with manufacturer's instructions.
2. Do not thin materials, except to comply with manufacturer's instructions.
3. Apply coatings to all surfaces with special attention to hard-to-reach areas such as between the legs of back-to-back angles. Apply each coat to achieve the specified dry film thickness.
4. Do not apply finishes to surfaces that are not dry.
5. Deficiencies in film or coating thickness shall be corrected by the application of an additional coat(s) of material at the expense of CONTRACTOR.
6. Apply each coat to a uniform smooth finish.
7. Special attention shall be given to ensure that edges, corners, crevices and welds receive a film or coating thickness equivalent to that of adjacent surfaces. At no time will wet-on-wet applications be permitted. The finished surfaces shall be free from runs, drips, ridges, waves, laps, brush marks and variations in color, texture and finish.
8. Apply each coat of paint slightly darker than the preceding coat unless otherwise approved.
9. Sand surfaces lightly between coats as required to achieve required finish.
10. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

D. Painting Schedule:
1. Exposed piping, except not within wet well.
2. Structural steel.
3. Vents.
4. Wet well.

3.9 LANDSCAPING

A. Follow Section 32 92 00, Lawns and Meadows.

3.10 FIELD QUALITY CONTROL

A. Operational Test: Demonstrate that all pumping station equipment is electrically, mechanically, structurally, and otherwise acceptable, and that it is safe, in optimum working condition, and conforms to the specified operating conditions by supplying sufficient clear water and operating station through several pumping cycles. During operation 1) observe and record operation of pumps, discharge gage readings, amperage draw, pump controls and liquid level controls, 2) check calibration of instrumentation equipment, test manual control devices, and automatic control systems, and 3) be alert to any undue noise, vibration, or other operational problems.

END OF SECTION

SECTION 43 21 39.13

SUBMERSIBLE PUMPS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install submersible pump system, complete and operational.

B. Related Sections:
   1. Section 43 21 39, Pumping Station – Submersible Type with Valve Vault.

1.2 SECTION INCLUDES

A. Submersible pumps.

B. Pump guide assemblies.

C. Pump access doors.

D. Pump controls.

E. Standby generator.

1.3 REFERENCES

A. Standards referenced in this section are:
   1. International Standards Organization (ISO), ISO 8528, Reciprocating Internal Combustion Engine Driven Alternating Current Generator Sets.
   2. ISO 9001, Quality Management Systems – Requirements.
   3. NEMA MG-1, Motors and Generators.
   4. NFPA 30, Flammable and Combustible Liquids Code.
   5. NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
   6. NFPA 70, National Electrical Code.
   7. NFPA 70E, Electrical Safety in the Workplace.
   8. NFPA 110, Standard for Emergency and Standby Power Systems.
   9. UL 142, Steel Aboveground Tanks for Flammable and Combustible Liquids.
   10. UL 508, Safety Standard for Industrial Control Equipment.
   11. UL 2200, Standard for Safety Stationary Engine Generator Assemblies (rated 600 volts or less).

1.4 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Each pump shall be selected to perform under operating conditions based on, but not limited to:
   1. Capacity (GPM).
   2. Total Dynamic Head (ft).

3. Total Discharge Static Head (ft).

B. Site power furnished to pumping station shall be three phase, 60 hertz, 480 volts, four wire maintained within industry standards. Voltage tolerance shall be plus or minus 10 percent. Control voltage shall not exceed 120 volts nominal.

1.5 SUBMITTALS

A. Product Data
   1. Prior to fabrication, the project's contractor or developer's representative, shall submit three copies of the pumping station manufacturer's data for review and approval.
      a. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cut sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor data, pump characteristic curves showing the design duty point capacity (GPM), head (ft), net positive suction head required (NPSHr), and hydraulic brake power (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.
   2. Prior to fabrication, the project's contractor or developer's representative, shall submit three copies of the on-site generator manufacturer's data for review and approval.
   3. Prior to fabrication, the project's contractor or developer's representative, shall submit three copies of the SCADA system manufacturer's data for review and approval. The submittal data shall include, but not limited to, the RTU Communication's Study.

B. Operations and Maintenance Manuals
   1. Installation shall be in accordance with written instruction provided by the pumping station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.
   2. Electrical Documentation shall be specific to the pumping station and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:
      a. Functional description of each major component, complete with operating instructions.
      b. Instructions for operating pumps and pump controls in all modes of operation.
      c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
      d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
      e. Schematic diagram of the pump station circuits shall be in accordance with NMTBA and JIC standards. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station

operator, need not to be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

f. Mechanical layout drawing of the pumping station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions, which rely on vendor cut-sheets and literature, which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.6 QUALITY ASSURANCE

A. Upon request from the Engineer, the pumping station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment, and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

B. The pumps shall be heavy duty, electric submersible centrifugal non-clog units designed for handling raw, unscreened sewage and wastewater. The pumps shall be capable of pumping a 3.0" spherical solid.

C. The pumps provided shall be capable of operating in an ambient liquid temperature of 104° F as specified by the National Electrical Manufacturers Association (NEMA) and Factory Mutual (FM).

D. The pump and motor unit shall be suitable for continuous operation at full nameplate load while the motor is completely submerged, partially submerged or totally non-submerged. The use of shower systems, secondary pumps or cooling fans to cool the motor shall not be acceptable.

E. The pump, mechanical seals and motor unit provided under this specification shall be from the same manufacturer in order to achieve standardization of operation, maintenance, spare parts, manufacturer's service and warranty.

F. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment.

1.7 MANUFACTURER'S WARRANTY

A. The pumping station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below:

1. All equipment, apparatus, and parts furnished shall be warranted for one year, excepting only those items normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc. The pumping station manufacturer shall be solely responsible for warranty of the station and all components.

2. The pump shaft seal shall be warranted for a minimum of four years from date of shipment. Should the seal fail within the first year, the manufacturer shall furnish a new seal, without charge to the Owner, F.O.B factory. The warranty replacement cost for seals after the first year will be pro-rated as follows:

Failure Within	Percent New Price
2 Years	25%
3 Years	50%
4 Years	75%

3. Components failing to perform as specified by the Engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the Owner.

B. The warranty provided by the CONTRACTOR to the County shall become effective upon the issuance of a Permit to Operate by the SC DHEC.

1.8 UNITARY RESPONSIBILITY

A. In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these specifications that all system components be furnished by a single supplier (unitary source) approved by the County. The pumping station must be of standard catalog design, totally warranted by the manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Cover all generator air and exhaust openings with vapor inhibiting and water repellent material.
2. Deliver anchorage devices that are to be embedded in cast-in-place concrete in ample time to prevent delaying the Work.
3. Inspect equipment for shipping damage or loose parts upon delivery. Check for evidence of water that may have entered equipment during transit.
4. Notify ENGINEER of loss or damage to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

B. Handle equipment in accordance with manufacturer's instructions. Furnish at least one copy of instructions with equipment at time of shipment.

C. Storage:
1. Store equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.
2. Store materials for easy access for inspection and identification. Keep all materials off the ground, using pallets, platforms or other supports. Protect equipment from corrosion and deterioration.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide pumps and appurtenances as manufactured by Xylem Flygt Company.

2.2 SUBMERSIBLE PUMPS

A. Unit Base:
   1. The unit base shall comprise of a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel not less than 3-inch thick, and shall incorporate openings for access to all internal cavities to permit complete grouting of unit base after installation. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

B. Pump Design:
   1. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There should be no need for personnel to enter the wet-well.
   2. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact.

C. Pump Construction:
   1. Major pump components shall be of gray cast iron, ASTM-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities.
   2. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
   3. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
   4. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable.

D. Impeller:
   1. The impeller shall be semi-open, high efficiency multi-vane design with back swept non-clog design. Impeller material shall be 25% High Chrome Iron (ASTM A-532) (Alloy III A). The leading edge of the semi-open impeller shall be hardened to Rc60 or 650Brinell. It shall be balanced to ISO1940 Grade G6.3.
   2. Enclosed impeller shall be of gray cast iron, Class 35B, dynamically balanced to ISO1940 Grade G6.3, double shrouded non-clogging design having a long through-let

with out acute turns. Enclosed impeller shall be supplied with wear ring system to provide sufficient sealing between the volute and suction inlet.
3. The impeller shall be capable of handling 3-inch spherical solids, fibrous materials, heavy sludge and other matter found in wastewater.
4. Enclosed impellers shall be coated with acrylic dispersion zinc phosphate primer.

E. Motor
1. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type.
2. The stator windings and stator leads shall be insulated with moisture resistant Class H insulation rated for 180° C (356° F). The stator shall be dipped and baked three times or use trickle impregnation method to achieve Class H insulation and shall be heat-shrink fitted in to the stator housing.
3. The motor shall be designed for continuous duty handling pumped media of 40° C (104° F) and capable of up to 15 evenly spaced starts per hour.
4. The motor and pump shall be designed and assembled by the same manufacturer.
5. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

F. Data Plate: Fabricate data plate from corrosion-resistant metal and mechanically attach to pump. Engrave the plate with the following:
1. Manufacturer's name.
2. Pump size.
3. Serial number.
4. Motor horsepower, speed, and electrical information.
5. Impeller diameter.
6. Capacity and head.

2.3 PUMP GUIDE ASSEMBLIES

A. Pump guide assembly to consist of either guide rails, a self-aligning sliding bracket, upper guide bracket, intermediate guide brackets (as required by manufacturer), lifting chain, and discharge elbow.
1. Guide Rails and Guide Brackets: Type 304 stainless steel; rails designed to mount directly to discharge elbow at the floor and to the upper guide bracket at the top. Provide intermediate guide brackets for rail lengths over 15 feet.
2. Self-Aligning Sliding Bracket: Mounted on pump discharge with a machined mating flange which matches the discharge elbow. Sealing of the discharge connection is accomplished by a simple linear downward motion of the pump, culminating with the entire weight of the pumping unit supported entirely by the discharge elbow.
3. Lifting Rope: Stainless steel cable of sufficient length to extend from the pump in the lowest position in the wet well to the connection at the top of the wet well. Provide a device at the top of the wet well to attach the cable to when not in use. Size cable according to pump weight. Coordinate upper cable end terminating device with requirements for connecting to Owner's lifting equipment.
4. Discharge Elbow: Gray cast iron, ASTM A48, Class 30, designed to mount directly to wet well floor and to anchor and align guide rails with ANSI B16.1, Class 125 flange and a machined mating surface such that the pump to discharge connection is made without the need for nuts or bolts.

2.4 PUMP ACCESS DOORS

A. Load Rating: AASHTO H-20 wheel loading.

B. Frame:
   1. Material: Extruded aluminum sections shaped to serve as a continuous drainage gutter with a 1-1/2-inch drain coupling.
   2. Anchors: Continuous anchor flange.
   3. Apply manufacturer's standard protective coating to surfaces of frame that will be in contact with concrete.

C. Cover:
   1. Material: 1/4-inch mill finish aluminum diamond plate, reinforced with stiffening ribs.
   2. Hinges: Stainless steel; butt type with compression spring operators enclosed in telescopic tubes.
   3. Hold Open Arm: Stainless steel; automatically locks door at 90-degree position; provide vinyl grip handle to release door for closing.
   4. Lock: Stainless steel; slam type with fixed handle inside and removable key wrench outside.
   5. Protective Grating: Aluminum protective grating panel shall be a minimum of 3 inch (76mm) aluminum "I" bar grating with Safety Orange powder-coated finish. Grating shall be hinged with tamper proof stainless steel bolts, and shall be supplied with a positive latch to maintain unit in an upright position. Grating shall have a 6-in. (152mm) viewing area on each lateral unhinged side for visual observation and limited maintenance. A padlock hasp for owner-supplied padlock shall be provided.

D. Hardware and Fasteners: Type 316 stainless steel.

E. Accessories: Provide one key wrench for each door supplied.

2.5 PUMP CONTROLS

A. Control Panel:
   1. Electrical control equipment shall be mounted within a NEMA 4X stainless steel, dead front type, control enclosure. Door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs. All control devices and instruments shall be mounted using threaded fasteners, and shall be clearly labeled to indicate function.
   2. Front panel mounted devices shall be rated NEMA 4X and shall not compromise the NEMA 4X panel rating.
   3. Pump station controls shall conform to third party safety certification. The enclosure and all components mounted on the subpanel or control cover shall conform to UL descriptions and procedures. Control panel assembly panel shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction.
   4. Control panel components to be of highest industrial quality, secured to the back panel with machine screws and lock washers. Mounting holes shall be drilled and tapped; Self- tapping screws shall not be used to mount any component.
   5. A properly sized heavy-duty circuit breaker, with a minimum RMS interrupting rating of 14,000 amperes at 460 volts, shall be furnished for each pump motor. The circuit

breakers must be sealed by the manufacturer after calibration to prevent tampering. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A pad-lockable operator handle shall be secured on the exterior surface. Mechanical interlocks must prevent opening the door until circuit breakers are in the "OFF" position.

6. An open frame, across-the-line, NEMA rated magnetic starter with under-voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "0", "00", or fractional sizes are not acceptable. Power contacts to be double-break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils to be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability. Overload relays to be block-type with melting alloy spindles, having visual trip indication with trip free operation. Pressing the overload-reset lever shall not actuate the control contact until after the overload spindle has reset. Resetting the overload reset lever will cause a snap-action control and not convertible to automatic reset. Trip settings shall be governed by the heater element only, and not by adjustable settings. Heater elements must provide NEMA Class 20 trip times, selected in accordance with actual motor nameplate data. An overload-reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the control panel door.
7. The control panel shall be equipped with a secondary lightning arrestor to minimize damage to the pump motors and control from transient voltage surges. The arrestor shall utilize silicon-oxide varistors encapsulated in a non-conductive housing. The arrestor shall have a current rating of 60,000 Amps, a Joule rating of 1500.
8. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, low voltage, and voltage unbalance. An integral time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart when power conditions return to normal.
9. Control Circuits
    a. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.
    b. Pump mode selector switches shall permit manual start or stop of each pump set individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be heavy duty, oil-tight design with contacts rated NEMA A300 minimum.
    c. Pump alternator relay to be electro-mechanical industrial design. Relay contacts to be rated 10 amperes minimum at 120 volts non-inductive. A switch shall permit the station operator to select automatic alteration of pumps, to select pump set number one to be "lead" for each pumping cycle, or to select pump set number two to be "lead" pump for each pumping cycle.
    d. Six-digit elapsed time meter (non-reset type) shall be provided for each pump set to indicate total running time of each pump set in "hours" and "tenths of hours." A pilot light shall be wired in parallel to indicate that the motor is energized and should be running.
    e. A high pump temperature protection circuit shall override the level control and shutdown the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected

to a high pump temperature shutdown circuit. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the pump shutdown circuit to interrupt power to the motor. A visible indicator located on the control panel door shall indicate motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of the circuit is not acceptable.

f. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15-ampere thermal-magnetic circuit breaker.

2.6 AUXILIARY POWER TRANSFORMER CONTROLS AND ACCESSORIES

A. The lift station shall be equipped with a 3 KVA step-down transformer to supply 115-volt, AC, Single phase for the control and auxiliary equipment. The primary and secondary side of the transformer are to be protected by a thermal magnetic circuit breaker sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door, and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in “OFF” position.

B. All wiring, workmanship, and schematic wiring diagrams shall comply with Applicable standards and specifications of the National Electric Code (NEC). All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:

1.	Line and Load Circuits, AC or DC power	Black
2.	AC Control Circuit Less Than Line Voltage	Red
3.	DC Control Circuit	Blue
4.	Interlock Control Circuit from external source	Yellow
5.	Equipment Grounding Conductor	Green
6.	Current Carrying Ground	White
7.	How With Circuit Breaker Open	Orange

C. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16-gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14-gauge minimum. Motor branch wiring shall be 10-gauge minimum. Motor branch and other power conductors shall not be loaded above 60 degrees Celsius temperature rating, on circuits of 100 amperes or less, nor above 75 degrees Celsius on circuits over 100 amperes. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon-insulated shanks. All wires on the back panel shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel.

D. All wiring outside the panel shall be routed through conduit. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices. Factory installed conduit shall conform to following requirements:

1. All conduit and fittings to be UL listed.

2. Use PVC-coated rigid steel for exterior conduit runs in hazardous, wet, and corrosive locations.
3. Use PVC-coated rigid steel conduit for individual conduits direct buried in the ground.
4. Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
5. Conduit to be supported in accordance with articles 344 and 350 of the National Electric Code.
6. Conduit shall be sized according to the National Electric Code.

E. Station manufacturer shall ground all electrical equipment inside the pump station to the panel powering the equipment. The CONTRACTOR shall provide a minimum of one earth driven ground rod connection at the service entrance equipment in accordance with the National Electric Code (NEC) and local requirements.

F. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:
1. Equipment serial number
2. Supply voltage, phase and frequency
3. Current rating of the minimum main conductor
4. Electrical wiring diagram number
5. Motor horsepower and full load current
6. Motor overload heater element
7. Motor circuit breaker trip current rating
8. Name and location of equipment manufacturer

G. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified. Switches indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

H. Liquid Level Monitoring and Control
1. The level monitoring and control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.
2. The level monitoring and control system shall be capable of operating as a conductivity probe-type system for liquid level control and with a float-ball system for high and low level alarms, as manufactured by ITT Flygt, DEVAR Inc., or manufacturer approved equal by York County.
3. The level control system shall utilize the alternator relay to select first one pump set, then the second pump set, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.
4. The level control system shall be provided with pump start and stop delays to prevent simultaneous motor starts and to reduce the potential of hydraulic surges during motor shutdown. Motor starts shall also be sequenced to provide step loads on the generator.
5. The level control system shall utilize the conductivity probe-type system which shall continuously, monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the conductivity probe-type system shall start the motor for one pump set when the liquid level in the wet well rises to the “lead pump start level”. When the liquid is lowered to the “lead pump stop level”, the conductivity probe-type system shall stop these pumps. These actions shall

constitute one pumping cycle. Should the wet well level continue to rise, the conductivity probe-type system shall start the second pump set when the liquid reaches the “lag pump start level” so that all pumps are operating. These levels shall be adjustable as described below.

6. The conductivity probe-type system shall include integral components to perform all pressure sensing, signal conditioning. EMI and RFI suppression. DC power supply and 120 volt outputs. Components shall be solid state and shall be integrated with other components to perform as described below.
7. The conductivity probe-type system shall be capable of operating on a supply voltage of 108 volts to 132 volts AC, 60 hertz, in an ambient temperature range of –10 degrees Celsius (14 degrees Fahrenheit) through +55 degrees Celsius (131 degrees Fahrenheit). Control range shall be 0 to -----.0 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be retained using a non-volatile lithium battery backup.
8. The conductivity probe-type system shall consist of the following integral components: display, output relays:
    a. The conductivity probe-type system shall incorporate a digital back-lighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet-well, and the preset start and stop level for both lead and lag pump. The display shall include 20, 0.19 inch high alphanumeric characters calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot), with a full-scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.
    b. Level adjustments shall be electronic comparator set points to control the levels at which the lead and lag pumps start and stop. Each of the level settings shall be adjustable and accessible to the operator without opening the cover panel. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation.
    c. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be oil tight design with contacts rated NEMA A300 minimum.
    d. Station manufacturer will supply one 115-volt AC alarm light fixture with vapor-tight red glove, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be shipped loose for installation by the CONTRACTOR.
    e. Station manufacturer will supply one 115-volt AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rainwater from collecting in any part of the horn. The alarm horn will be shipped loose for installation by the CONTRACTOR.

2.7 TELEMETRY

A. Each pump station shall be supplied with a Supervisory Control and Data Acquisition (SCADA) Remote Terminal Unit (RTU). The work to be accomplished under this specification shall consist of furnishing the equipment necessary for modifying the existing automatic control and monitoring system. The equipment shall be designed, fabricated, programmed, tested, started-up, and warranted by a single supplier.

2.8 ON-SITE GENERATOR SYSTEM

A. General:
   1. All pump stations shall have an automatic standby power generation system conforming to these specifications.
   2. The system shall consist of a diesel-fueled standby generator in a weatherproof enclosure complete with all equipment and accessories required to automatically supply power to the pump station during a utility power failure.

> As an alternate to a diesel-fueled standby generator, the County may request the use of a natural gas fueled standby generator. The natural gas fueled standby generator shall meet all the following requirements as appropriate for a natural gas fueled engine.

B. Engine:

1. Engine block material	Cast Iron
2. Cylinder head material	Cast Iron
3. Crankshaft material	Hardened Steel
4. Pistons	Aluminum Alloy
5. Valve seats	Replaceable
6. Maximum Rated RPM	1800

C. Engine Governor:

1. Type	Mechanical
2. No-load to full load frequency regulation	5.0%
3. Steady state regulation	+/-0.33%
4. Overspeed shutdown	Automatic solid state

D. Engine Lubrication System:

1. Oil pump	Gear type
2. Oil filter	Full flow, cartridge
3. Low oil pressure shutdown	Automatic

E. Engine Cooling System:

1. Type of system	Pressurized, closed recovery
2. High temperature shutdown	Automatic
3. Low coolant level shutdown	Automatic
4. Fan	Pusher type with guard
5. Engine block heater	1,000 watts (min), 120 VAC, thermostatically controlled
6. Coolant	Water/ethylene glycol (-34° protection)

F. Engine Fuel System:

1. Fuel	#2 Diesel
2. Fuel filter	5 micron
3. Injection type	Direct
4. Fuel pump	Mechanical, engine driven
5. Fuel tank	integral, UL listed, double-walled, steel fuel storage
6. Fuel tank capacity	24 (min.) hours @ rated load

7. Fuel tank accessories — Fuel level indicator
8. Low fuel indicator switch (on at 20% capacity), Screened vent for double wall cavity, Drain port

G. Engine Exhaust System:
1. Silencer — Critical
2. Mounting — External with weather cap
3. Connection — Flexible stainless steel pipe

H. Engine Combustion Air Intake:
1. Air cleaner — Replaceable dry cartridge

I. Engine Electrical:
1. Starter motor — 12 or 24 volt
2. Battery charge alternator — 30 amps (min)
3. Crank limiter — Solid state
4. Battery — 2 - 12 volt (series or parallel, as appropriate)
5. Battery mounting — Rack inside enclosure
6. Polarity — Negative ground
7. Standby charger — 10 amp, automatic float

J. Generator:
1. The generator shall meet the following requirements:
   a. Generator Specifications**:**
      1) Generator type — 4 pole, revolving field
      2) Output — 12 lead, reconnectable
      3) Stator — "Skewed" design
      4) Housing — Drip proof design, self-ventilated
      5) Rotor insulation — Class F
      6) Stator insulation — Class F
      7) Bearings — Sealed, pre-lubed
      8) Engine coupling — Direct, flexible disc
      9) Protection — Output circuit breaker (manual reset)
   b. Excitation:
      1) Exciter type — Brushless
      2) Protection — Manual circuit breaker
   c. Regulation:
      1) Type — Solid state
      2) Regulation — +/-2% steady state
      3) Voltage adjustment — 5% - manual rheostat

K. Generator Set Controls
1. The engine-generator set shall be equipped with a control panel having the following features:
   a. Engine Controls & Indicators:
      1) Engine Gauges: — Oil pressure
         Coolant temperature
         Battery charging ammeter
      2) Annunciator: — Low oil pressure shutdown
         High temperature/low coolant

	level shutdown
	Overcrank shutdown
	Overspeed shutdown
	Low fuel
3) Engine hour meter	99,999.0 hour
4) Remote engine hour meter located at transfer switch	99,999.0 hour
5) Engine control switch	Off/Manual/Automatic

L. Generator Controls & Indicators:

1. Gauges	AC frequency
	Output voltage
	Output current
2. Gauge Selector switch	3 position with "off"
3. Manual voltage adjustment	Rheostat, 5% adj. range

M. Alarm Output Contacts
1. Generator Fail
2. Generator Operating
3. Low Fuel
4. Alarm output contacts are to be wired to the local monitoring RTU.

N. Generator Set Enclosure & Mounting
1. The engine-generator set shall be enclosed in a weatherproof housing which meets the following specifications:

a. Access panels	Lockable (keyed alike), hinged and removable
b. Hardware	Stainless steel
c. Finish	Baked enamel over zinc coated steel
d. Mounting	Welded steel base with vibration isolators
e. Mounting location	Top of fuel tank

O. Automatic Transfer Switch:
1. The automatic transfer switch to be supplied as part of the standby power system shall meet all applicable requirements set forth by the National Electrical Code and OSHA. The transfer switch shall also conform to the requirements as specified below:

a. Enclosure:	
1) Mounting type	Surface
2) Enclosure type	NEMA 3R, lockable
b. Electrical Ratings:	
1) Operating voltage	Compatible with station voltage
2) Operating current	No less than main disconnect
3) Withstand and closing rating	10,000 Amps, RMS, Symm. (min.)
4) Normal input connection	Service entrance rated
c. Transfer Switch:	
1) Operating mechanism	Single solenoid
2) Holding mechanism	Mechanical
3) Interlock	Mechanical and electrical
4) Contact material	Silver alloy
5) Neutral delay	0.1 – 10 sec.

d. Timer Setting Ranges:

1)	Utility dropout	70-95%
2)	Utility pick-up	70-95%
3)	Utility interrupt delay	0.1 – 10 sec.
4)	Engine min. run	5 – 30 min.
5)	Engine warm-up	5 – 180 sec.
6)	Return to utility delay	1 – 30 min.
7)	Engine cool-down	1 – 30 min.
8)	Standby voltage	70 – 90%
9)	Standby frequency	80 – 90%
10)	Exerciser	Once/week

e. Operation Selectors:

1)	Exercise	With/Without load
2)	Engine warm-up bypass	On/Off
3)	Neutral delay	On/Off
4)	Mode selector	Manual Test/Standby/Off

P. Standby Power System Capacity:

1. The standby power system shall be capable of providing continuous standby power for the wastewater pumping station. The generator set shall be capable of starting the two pump motor loads sequentially with the full miscellaneous load applied, with no more than 30% dip. **The *minimum* acceptable generator set rating shall be 25 KW for any station.** The CONTRACTOR shall coordinate the starting requirements of the exact pumps being furnished on the project with the generator set supplier to ensure the generator set has adequate motor starting capability.

Q. Installation:

1. The generator set shall be mounted and anchored to a reinforced concrete pad, located to provide adequate access for fueling and servicing. The exact dimensions of the pad, conduit entries and anchor bolts shall be based on the manufacturer's shop drawings. The pad shall have outer dimensions 1 foot greater than the footprint of the base tank, to provide 6 inch of exposure on all sides. The minimum thickness of the pad shall be 12 inch, with a single mat of #6 rebar, 12 inch OCEW and located in the lower third of the concrete thickness. The weight of the mounting pad shall be equal to or greater than the weight of the generator set. All exposed edges shall be chamfered or rounded with an edging tool.

R. Field Tests:

1. The CONTRACTOR shall provide start-up and testing services utilizing personnel specifically authorized to perform such services by the standby power system manufacturer. The start-up services shall be scheduled with the COUNTY with no less than three days notice. The start-up and testing service shall include a complete inspection of the installation, initial break-in of the engine, testing the system performance, and servicing the engine. The following tests shall be performed in the presence of the COUNTY or its representative:
   a. Generator output voltage unloaded and loaded, each phase, based on 2-hour load bank test.
   b. Voltage dip as loads are applied.
   c. Complete operating sequence (simulated utility power failure and restoration).
   d. Pressure test engine cooling system for leaks.

e. Test battery charging systems.
f. Test operation of all safety systems.
g. Upon completion of break-in and testing, the engine shall be serviced as follows:
1) Change engine oil and filter.
2) Verify anti-freeze protection (-34° F).
3) Refill fuel tank (tank shall be left full).
4) Check belt tension.
5) Check battery connections and state of charge.

2. During this start-up period, the COUNTY'S maintenance personnel shall be fully instructed in the proper maintenance of the standby power system.
3. All equipment and supplies for testing and service shall be provided by the CONTRACTOR.

S. Manufacturer:
1. The generator set, controls, and transfer switch shall be furnished by a single supplier. The generator set and accessory equipment shall be supplied by Caterpillar/Olympian, Onan/Cummings, Kohler, or approved equal.
2. The supplier shall be the authorized dealer of the engine-generator set manufacturer, and shall be fully qualified and authorized to provide service and parts for the engine and generator at any time during the day or night. Parts and service shall be available 24 hours per day 7 days a week, from a location within a 100-mile radius of the location of the installed generator set.

T. Shop Drawings:
1. Prior to purchase of stand-by power generation equipment, the CONTRACTOR shall submit not less than four (5) sets of data to the County Representative for approval, including equipment data, accessories, sizing calculations, etc., as may be appropriate to determine compliance with these Specifications.

U. Operating Instructions:
1. Six (6) complete copies of operating instructions and parts list shall be provided prior to acceptance of the unit. Parts list shall include schedule of type and quantity of parts recommended for stock.

V. Spare Parts:
1. The following spare parts shall be furnished:
a. Engine Fan & Accessory Drive Belts 1 sets
b. Oil, Fuel & Air Filters 2 sets
c. Spare Indicator Lamps & Fuses of each type used 2 sets
2. Spare parts shall be boxed and labeled with the pumping station identification.

W. Warranty:
1. The complete standby power generating system shall be warranted for one year after the acceptance of the sewer pump station by the COUNTY. The warranty shall cover all defects in equipment, parts, assembly and installation. The warranty shall be issued in writing by the supplier and delivered to the COUNTY Representative.

2.9 FACTORY INSPECTION

A. Perform motor and cable insulation test for moisture content and insulation defects.

B. Run pump dry to check for proper rotation and mechanical integrity.

C. Run pump submerged for 30 minutes in water.

D. Remove pump from water; perform motor and cable insulation test.

E. A written report on the above shall be prepared by the test engineer, certified and submitted to ENGINEER.

2.10 FACTORY PERFORMANCE TEST

A. Test each pump at the factory; submit certified performance curves to ENGINEER prior to shipment.

B. Test each pump at no less than three head conditions including shut-off head and design head.

C. Provide a standard NPSH curve based on testing of standard test pump.

2.11 SPARE PARTS

A. One spare fuse for each fuse in pump control panel.

B. One spare pilot light for each pilot light in pump control panel.

C. One spare float switch with length of integral cord sufficient to replace longest provided.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions.

B. Float Switches:
   1. Install float switches at elevations indicated.
   2. Install stainless steel cable and anchor assembly so that anchor freely hangs within 6 inches of well bottom, and so that float switches will be easily accessible for cleaning and replacement.
   3. Attach float switch cord to cable with nylon wire ties spaced 12 inches apart and starting 6 to 8 inches above top of switch.
   4. Terminate float wiring using normally open or normally closed configuration as required for proper operation. Cap the unused third wire in the junction box.

3.2 MANUFACTURER'S START-UP SERVICES

A. Provide a minimum of one 8-hour day of service.

END OF SECTION

Final Roadway Geotechnical Engineering Report (RGER)
Widening of US 21 Bypass and SC 51 From Springfield Parkway to the North Carolina Line
Fort Mill, York County, South Carolina
S&ME Project No. 1351-12-037

PREPARED FOR:

STV, Inc.
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730

PREPARED BY:

S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273

March 10, 2022

DocuSign Envelope ID: 2D6C32DC-6564-4BEB-BCA9-8ACCFE7C1B69

March 10, 2022

STV, Inc.
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730

Attention: Mr. Thomas Mastillone, P.E.
Project Manager

Reference: **Final Roadway Geotechnical Engineering Report (RGER)**
Widening of US 21 Bypass and SC 51 From Springfield Parkway to the NC Line
Fort Mill, York County, South Carolina
S&ME Project No. 1351-12-037

Dear Mr. Mastillone:

The purpose of this final roadway geotechnical engineering report (RGER) is to provide information that may be used in design of the roadway embankments associated with the widening of US 21 Bypass and SC 51 from Springfield Parkway to the North Carolina Line in Fort Mill, York County, South Carolina. Our services were performed in general accordance with the subcontract between STV, Inc. (STV) and S&ME, Inc. dated November 27, 2012, and subsequent Amendment 1, dated April 2014. This includes the associated scope of services for geotechnical investigations performed in general accordance with the SCDOT GDM 2010 version. The recommendations provided herein are in general accordance with the SCDOT Geotechnical Design Manual (GDM), Version 2.0, 2019 version. The recommendations of the report incorporate the engineering analyses conducted by our firm to the present time. The recommendations herein exclude the culverts and pavements which were addressed under separate cover.

We look forward to continuing our geotechnical engineering services on this important project. Please do not hesitate to contact us if you have questions or if we may be of any further assistance.

Sincerely,

S&ME, Inc.

DocuSigned by:
Thomas J. Daily
F29CA6BB83F449F...

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER NO. 35936 THOMAS J. DAILY

Thomas J. Daily, P.E.
Project Engineer
SC PE Registration No. 35936 3/10/2022

Luis A. Campos, P.E.
Project Engineer

SOUTH CAROLINA S & ME, INC. No. C00473 CERTIFICATE OF AUTHORIZATION

Senior Reviewed By: Kristen H. Hill, P.E.

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1.0 Introduction

This report summarizes the results of the geotechnical investigation conducted to date for the widening of US 21 Bypass and SC 51 from Springfield Parkway to the North Carolina Line. The project is located in Fort Mill, York County, South Carolina, as shown on the Site Plan attached as Figure 1 in Appendix I. The field work was performed in accordance with the 2010 GDM (current at the time); however, the recommendations/reporting presented in this Final Roadway Geotechnical Report (RGER) have been prepared in accordance with the 2019 GDM and includes final design recommendations.

The RGER applies to the design and construction of the roadway embankments and roadway at grade. The culverts design recommendations are included in Appendix VI of this report. The pavement design recommendations were submitted under separate cover. S&ME's scope of work relevant to the roadway embankment portion of the project included:

- Visits to the site by geotechnical personnel.
- Coordinating field exploration activities.
- Performing geotechnical and geophysical subsurface investigations.
- Conducting laboratory testing.
- Reviewing available geologic and geotechnical-related data.
- Conducting geotechnical analyses to assess the encountered subsurface conditions as they relate to their support for the planned roadway embankment regarding slope stability and settlement.
- Preparing this report (RGER) which presents the results of our analyses and our geotechnical recommendations for the planned roadway embankments.

Project design parameters and computations generally follow those described in the relevant sections of the 2019 South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual v2.0 (GDM), except where specifically described otherwise in the report text.

2.0 Project Description

2.1 Existing Conditions

2.1.1 US 21

From Springfield Parkway heading north to Lakes Boulevard, US 21 roadway consists of one (1), roughly twelve (12) foot wide northbound travel lane and one (1), roughly twelve (12) foot wide southbound travel lane. US 21 continues northward, turning into two (2), roughly twelve (12) foot wide northbound travel lanes and two (2), roughly twelve (12) foot wide southbound travel lanes from Lakes Boulevard to Springhill Farm Road.

Outside of the existing roadway shoulders, the existing roadway embankments are grassed or covered with heavy brush and trees, and generally appear to consist of slopes ranging from roughly 1H:1V to 6H:1V sloping up and down to the edge of right-of-way. Commercial and residential properties primarily border US 21.

2.1.2 SC 51

From the SC 51 and US 21 intersection eastward to the NC State Line, SC 51 roadway consists of one (1), roughly twelve (12) foot wide northbound/eastbound travel lane and one (1), roughly twelve (12) foot wide southbound/westbound travel lane.

Outside of the existing roadway shoulders, the existing roadway embankments are grassed or covered with heavy brush and trees, and generally appear to consist of slopes ranging from roughly 1.5:1V to 6H:1V sloping up and down to the edge of right-of-way. Commercial property primarily borders SC 51 for the area associated with this project.

2.2 Planned Development

This project is a Pennies for Progress project in York County, South Carolina that includes widening and realignment of approximately 2.9 miles of US 21 from SC Highway 460 (Springfield Parkway) to SC Highway 51 and SC Highway 51 from US 21 to the North Carolina and South Carolina border.

From our review of the plan, profile and cross section sheets contained in the *Proposed Plans for York County, US 21 from SC 460 (Springfield Pkwy) to 700 feet South of S-48 (Springhill Farm Road) and SC 51 from US 21 to the NC State Line*, prepared by STV, dated April 5, 2018 and design files dated March 8, 2021, the project includes adding a travel lane in each direction, adding a center turn lane, improvements to existing intersections and other impacted roadways, as well as the addition of sidewalks in each direction.

The roads and stations associated with the US 21 portion of the project are from Station 10+00 to Station 135+00. US 21 construction will require sliver fills, areas of minimal fills, and areas where up to 21 feet of new fill and up to 17 feet of cut in other areas to support the road widening. Proposed slopes along US 21 will be 2H:1V or flatter.

The stations associated with SC 51 for this project are from Station 295+62 to Station 340+00. SC 51 construction will require sliver fills, areas of minimal fills, and areas where up to 7 feet of new fill and up to 9 feet of cut in other areas to support the road widening. Proposed slopes along SC 51 will be 2H:1V or flatter.

Other roadways with intersection improvements included in this study are listed below:

- Springfield Parkway
- Mercantile Place
- Crescent Moon Drive
- Lakeview Road
- Amelia Drive
- Fern Forrest Court
- Lakeshore Drive
- Forrest Drive
- Embassy Drive
- Gold Hill Road
- Andrew L Tucker Road
- Old Nation Road
- Baxter Lane
- Garrison Farm Road
- Central Carolinas Parkway
- Regent Parkway
- Lakes Boulevard
- Flint Hill Road
- Retail Drive
- Terry's Road
- Springhill Farm Road

Other non-bridge structures will be created/modified to facilitate the additional lanes. The structures include 3 culvert extensions. The culvert improvements are planned at approximate stations US 21 33+80, US 21 41+06, and SC 51 316+23. Geotechnical recommendations for each culvert are included in Appendix VI of this report.

2.2.1 Realignments

This project involves several roadway realignments to improve intersections throughout the US 21 and SC 51 widening project. These areas are discussed in further detail below.

1. Gold Hill Road and Old Nation Road will be realigned to join US 21 as a Cross-Intersection at approximate Station 63+00 on the US 21 alignment. Gold Hill Road construction will require sliver fills, areas of minimal fills and areas where up to 28 feet of new fill and up to 13 feet of cut in other areas to support the realignment. Old Nation Road construction will require sliver fills, areas of minimal fills to support the realignment. The current intersection of Old Nation Road and US 21 will be configured to a cul-de-sac and rejoin the proposed Old Nation Road realignment as a T-Intersection.

2. The intersection of US 21 and SC Highway 51 will be configured to be a T-Intersection at approximate Station 129+00 on the US 21 alignment. The current intersection of SC 51 and US 21 will be configured to a cul-de-sac and rejoin the proposed SC 51 realignment as a T-Intersection at approximate Station 300+62.

3. Springhill Farm Road and Flint Hill Road will be realigned to join SC 51 as a Cross-Intersection at approximate Station 321+91 on the SC 51 alignment. Construction for these two realignments will require sliver fills and areas of minimal fills to support the realignment. The current intersection of Springhill Farm Road and SC 51 will be configured to a cul-de-sac. The current intersections of Springhill Farm Road and Flint Hill Road to SC 51 will be removed or abandoned.

3.0 Subsurface Exploration and Laboratory Testing

S&ME performed our subsurface explorations between May 18 and 22, 2015, July 25 through August 4, 2015, and December 15 through 21, 2015, conducting 81 standard penetration test (SPT) borings B-1 through B-11 (proposed roadways), C-1 through C-17 (existing intersecting roadways), R-1 through R-42 (existing alignment), and S-1 through S-11 (proposed structures). Hand augers with Dynamic Cone Penetrometer (DCP) testing were performed at six locations, HA-1 through HA-6, due to limited access. Rod soundings (RS-1 through RS-6) were also performed at the hand auger locations. Borings and testing were generally conducted at or near the proposed locations submitted to and approved by STV prior to the field exploration. Split-spoon, undisturbed and bulk samples were obtained, and laboratory testing was performed on selected samples.

In addition, asphalt cores were obtained at test locations C-1 through C-17, with Kessler Dynamic Cone Penetrometer (KDCP) testing of the base and subgrade. The pavement design recommendations were submitted under separate cover.

The approximate test locations are shown on the Test Location Plan (Sheets 1 through 13) in Appendix I. A summary table of the 87 test locations is included as Table 1 in Appendix IV and presents elevations, coordinates,

stationing, and offsets, which should be considered approximate. The elevations were interpolated from the topographic information provided by STV, the coordinates were measured in the field by an S&ME Staff Professional using a hand-held GPS unit, and the stations and offsets were determined based on plans provided by STV. Detailed graphical logs which describe the conditions and results at each test location are presented in Appendix IV.

SPT hammer energy measurements were previously performed with a Pile Driving Analyzer (PDA) on the drill rigs used to perform the borings on this project. The N-values indicated on the logs are field values and were not corrected for overburden stress, rod length, borehole diameter, or hammer efficiency. Hammer energy ratios are provided on the individual soil test boring records.

Following collection of the field-testing data, representative samples were returned to our laboratory for testing. The following table includes the quantity of testing relevant to the subject project:

Table 3-1: Laboratory Testing Quantity Table

Test Type	Quantity
Natural Moisture Content	91
Atterberg Limits	91
Full Sieve Analysis	6
Full Sieve Analysis w/Hydrometer	85
Standard Proctor	10
California Bearing Ratio	10
Consolidation	1
CU Triaxial	2
Organic Testing	3

Appendix IV presents a summary of the laboratory test results (Tables 2 through 5) and detailed results.

4.0 Subsurface Conditions

4.1 Area Geology

The project lies within the Piedmont Physiographic Province in York County, South Carolina. The Piedmont is bounded to the west by the mountains and east by the Coastal Plain physiographic provinces. The boundary separating the Piedmont and Coastal Plain is the fall line and the boundary separating the Blue Ridge Belt or more mountainous terrain is the Brevard Fault Zone. The Piedmont region was once a mountain range but through millions of years of erosion its terrain has been reduced to gently rolling hills and relatively flat areas. At the surface the Piedmont the soils are composed of residual soils. These are soils are derived from weathered in place crystalline rock. Through uplift and erosion these soils are continuously weathered and exposed at the surface. The residuum is typically finer grained and has a higher clay content near the surface because of advanced

weathering. Similarly, the soils typically become coarse grained with increasing depth because of decreased weathering. Piedmont residuum will often preserve the fabric (texture, appearance, foliations, etc.) of the parent crystalline rock that it is derived from and is called saprolite or described with the adjective, saprolitic. Beneath the residual soils lies a zone of partially weathered rock (PWR) that ranges in thickness from 1 to 15 feet. Underneath the PWR lies the parent bedrock or crystalline rock. The SPT test is used to determine where the zone of PWR begins and ends and where the crystalline rock (CR) boundary begins. The transition between hard/dense residual soils and PWR occurs at irregular depths due to variations in degree of weathering. Discontinuous lenses of PWR may be possible because of this and were observed in some locations along the project.

Geologically the project is located within the Charlotte Belt geologic province. The Charlotte Belt is mostly composed of plutonic bodies of rock with compositions ranging from granitic to gabbroic. These rocks were formed in the late Proterozoic to Cambrian periods during the Taconic orogeny when what is believed to be an exotic terrane in the form of a volcanic island arc was sutured to the North American craton. These rocks were later subjected to various degrees of metamorphism, folding and faulting during subsequent crustal reshaping and orogenic episodes. Rock types in this area are predominately composed of metavolcanics such as metagabbro and metadiorite and to a lesser extent biotite gneiss. The figure below shows a generalized geologic map of the Charlotte Belt in northeastern York County, SC and adjacent Mecklenburg County, NC from 'The Geology of the Carolinas' by Horton and Zullo (1991).

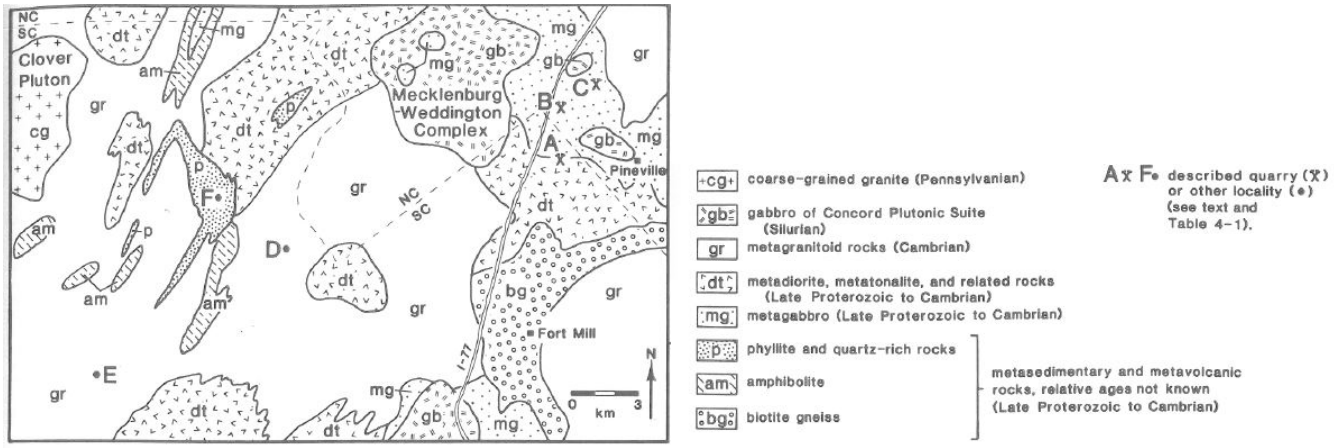


Fig. 4-3 from 'The Geology of the Carolinas' by Horton & Zullo (1991)

Water is typically present in the residual soils and within fractures in the PWR or underlying bedrock in the Piedmont. On upland ridges in the Piedmont, water may or may not be present in the residual soils above the PWR and bedrock. Alluvial soils, which have been transported and deposited by water, are typically found in floodplains and are generally saturated to within a few feet of the ground surface. Fluctuations in water levels are typical in residual soils and PWR in the Piedmont, depending on variations in precipitation, evaporation, and surface water runoff. Seasonal high-water levels are expected to occur during or just after the typically wetter months of the year (November through April).

4.2 Soil Properties

A summary of soil and rock strata encountered during the subsurface investigation for this project is shown in Table 4-1 and are further explained in the sections that follow.

Table 4-1: Summary of Soil and Rock Strata

Geotechnical Strata Designation	Depth Interval Range (feet)	USCS Soil Class or Rock Type	Range of Raw SPT N-values (bpf)	Soil and Rock Description
Existing Roadway Embankment Fill	0 to 30	SM, SC, ML, MH, CL, CH	3 to 27	Very loose to dense, moist to wet, fine to coarse sands, clayey sands and silty sands & soft to stiff, sandy silt, clayey silts, and clays.
Alluvium	4.5 to 19.5	SC, SM, CL	3 to 9	Very loose to dense, moist to wet, fine to coarse sands with trace to some non-plastic to medium plasticity fines, containing fine gravels and wood debris/organics. Contains some very soft, moist to wet, medium to high plasticity silts and clays with trace to some fine sands.
Piedmont Residuum	0 to 30	SM, SC, ML, MH, CL, CH	3 to 84	Medium dense to very dense, dry to wet, fine to coarse sands with little to some low to high plasticity fines. Contains some stiff to very hard, dry to moist, low to medium plasticity silts and clays with trace to some fine to medium sands. Some samples contain fine rock fragments and presented a relict rock structure.
Partially Weathered Rock (PWR)	4 to 37	SM, SC, ML	100+	Similar in consistency and appearance to overlying residuum but exhibited over 100 bpf

4.2.1 Surface Materials

Surface materials penetrated by the borings consisted of asphalt pavement where borings were performed within the existing roadway. Asphalt pavement thicknesses ranged from 2-12 inches, with base course materials approximately 3-8 inches. Also, concrete was beneath the asphalt in two borings (C-9 and C-17) measuring 7.5 and 9.5 inches thick.

4.2.2 *Roadway Embankment Fill*

The borings performed along or near the existing roadway encountered existing fill embankment materials beneath the pavement structure and roadway shoulders. Embankment fills extended to depths of 0 to 30 feet below the existing ground surface. The existing embankment fill materials generally consisted of fine to coarse sands with trace to some non-plastic to medium plasticity fines (SP, SP-SM, SM, SC, and SC-SM). Some of the sandy materials contained fine to coarse gravels.

Recovered samples of the existing embankment fill materials were brown, orange, and red in color and were generally moist to wet to the touch. Raw SPT N-values ranged from 3 to 27 blows per foot (bpf). Penetration resistances suggest very loose to medium dense relative densities in sandy soils.

Laboratory index testing was performed on selected samples from borings within the existing embankment fill. Moisture contents ranged from 2 to 39 percent. Soil specimens washed over a No. 200 sieve indicated 26 to 91 percent fines by weight. Atterberg limits testing resulted in liquid limits (LL) ranging from 22 to 83 and plasticity indexes (PI) ranging from 4 to 56.

One consolidated-undrained (CU) triaxial shear strength tests was performed on an undisturbed Shelby Tube sample in the embankment fill in boring number R-37. The triaxial shear strength test result is summarized in Table 4-2 and detailed results are presented in Appendix IV.

Table 4-2: Roadway Embankment Fill Triaxial Shear Strength Values

Boring No.	Sample No.	USCS Soil Type	Sample Depth (feet)	Total Strength Parameters		Effective Strength Parameters	
				c (psf)	ϕ (degrees)	c′ (psf)	ϕ’ (degrees)
R-37	UD-1	CL	13.5 – 15.5	0	15.6	0	37.7

4.2.3 *Alluvium*

Beneath the existing embankment fill materials, the borings along the alignment near existing streams and floodplains encountered alluvial deposits that extended to depths of 4 ½ to 19½ feet below the existing ground surface. Maximum penetrated thickness of alluvial soils in the borings was on the order of 10 feet. The alluvial deposits primarily consisted of fine to coarse sands with trace to some non-plastic to low plasticity fines (SP, SP-SM, SP-SC, SM, and SC) and some moderate to high plasticity clays and sandy clays (CL and CH). Recovered samples of the alluvial deposits were generally gray and brown in color and were moist to wet to the touch. Raw SPT N-values ranged from 3 to 9 bpf, indicating very loose to loose relative densities in the sandy deposits and soft to medium stiff consistencies in the clayey and silty deposits.

Laboratory index testing was performed on selected samples from borings within the alluvial deposits. Moisture contents ranged from 19 to 23 percent. Soil specimens washed over a No. 200 sieve indicated 44 to 72 percent fines by weight.

One consolidated-undrained (CU) triaxial shear strength tests was performed on an undisturbed Shelby Tube sample in the embankment fill in boring number R-41. The triaxial shear strength test result is summarized in Table 4-3 and detailed results are presented in Appendix IV.

Table 4-3: Alluvium Triaxial Shear Strength Values

Boring No.	Sample No.	USCS Soil Type	Sample Depth (feet)	Total Strength Parameters		Effective Strength Parameters	
				c (psf)	ϕ (degrees)	c′ (psf)	ϕ' (degrees)
R-41	UD-1	CH	13.5 – 15.5	530	11.5	40	37

One-dimensional consolidation (oedometer) test was conducted on an undisturbed sample of fine-grained soil recovered in Boring R-33 (23.5 to 25.8 feet), after the sample was trimmed and seated as described by ASTM D2435. The sample was loaded using the standard loading increment schedule per ASTM D2435. Consolidation of the sample under each increment/decrement of load was computed using the log-time method. A summary of the consolidation test result is presented in Table 4-4 and detailed results are presented in Appendix IV.

Table 4-4: Alluvium Consolidation Results

Boring No.	Sample No.	USCS Soil Type	Sample Depth (feet)	Moisture Content (%)	Percent Finer #200	Consolidation	
						P_c (ksf)	C_c
R-33	UD-1	SM	23.5-25.8	19.2	43.6	4.0	0.15

4.2.4 Piedmont Residuum/Partially Weathered Rock

Piedmont residual soils were encountered beneath the Alluvial and Embankment fill in the borings along the alignment. The residual Piedmont soils extend to depths of approximately 0 to 30 feet below the existing ground surface.

The residual Piedmont soils consisted of fine to coarse sands with little to some low to high plasticity fines (SM and SC) and low to medium plasticity silts and clays with trace to some fine to medium sands (ML). Some samples of the residuum contained fine rock fragments and presented a relict rock structure. Raw SPT N-values ranged from 3 to 84 bpf, indicating loose to very dense relative density in the sandy deposits and stiff to very hard in the silt deposits.

The term partially weathered rock (PWR) is applied to very dense or very hard Piedmont residuum that registers SPT N-values in excess of 100 blows per foot. Recovered samples of the PWR were generally similar in nature to the overlying Piedmont residuum. Layers of PWR were encountered within the residual strata in Borings S-6, C-4, R-6, R-9, and R-28 from depths of 17 to 27 feet. The PWR was underlain by medium dense to very dense Piedmont residual soils (N-values of 16 to 78 bpf) to the termination depths in borings R-6 and R-9.

Recovered samples of the Piedmont residuum and PWR were generally white, yellow, brown, and gray in color and were moist to wet to the touch. Raw SPT N-values ranged from 3 to 84 bpf, indicating very loose to very dense relative densities in the sandy soils and stiff to very hard consistencies in the silty soils.

Laboratory index testing was performed on selected samples from borings within the Piedmont residual soils. Moisture contents ranged from 17.9 to 29.3 percent. Soil specimens washed over a No. 200 sieve indicated 23.9 to 81.1 percent fines by weight. Atterberg limits testing resulted in LLs ranging from 34 to 59 and PIs ranging from 23 to 32.

4.2.5 Groundwater

Groundwater measurements were obtained at the time of and after approximately 24-hours in select borings. Due to the locations residing in an existing roadway, 24-hour ground water readings in some of the borings were not taken. Groundwater measurements were between 4± and 25± feet below ground surface. Groundwater levels are influenced by precipitation, long term climatic variations, and nearby construction. Measurements of ground water made at different times than our exploration may indicate ground-water levels substantially different than reported herein.

5.0 Seismic Considerations

As described in the GDM, evaluation of performance under the EEI or EEII limit states is not required for roadway embankments. In addition, there are no proposed bridges or earth retaining structures (ERS) within the project limits. Therefore, evaluation of performance under the EEI or EEII limit states is not required for this project.

6.0 Roadway Embankments

The following paragraphs include recommendations for site preparation, fill placement and compaction, and design and construction of embankments. If the construction scope is altered, the proposed embankment locations are changed, or if conditions are encountered during construction that differ from those encountered by the soil test borings, S&ME should be retained to review these recommendations based upon the new information and make any necessary changes.

6.1 Slope Stability Analyses

Based on Section 17.1 of the current GDM, embankments with heights of 10 feet or less and slopes 2H:1V or flatter do not require analysis. Slope stability analyses were performed using the computer program SLIDE Version 9 and Spencer circular and non-circular shear surfaces to find the critical shear surface and was performed in general accordance with Chapter 17 of the current GDM. Slope stability analysis outputs for the roadway embankments listed for the areas in Table 6-1 are included in Appendix II.

6.1.1 Fill Slopes

Soil test boring and laboratory testing results were incorporated into the soil parameters assumed for our Service Limit State analyses. Soil parameters assumed in global stability computations are included on the analysis

outputs in Appendix II. Our service limit state analyses considered the short-term (end-of-construction) condition as well as the long-term condition as defined in the GDM.

Soil parameters for the proposed embankment fill were conservatively estimated using the SCDOT *Borrow Materials Database Spreadsheet*, Version 2.0, dated December 6, 2018 for York County, assuming typical Upstate residual type soils and peak effective shear strengths. It was assumed that pore pressures induced by fill placement would have time to dissipate in the new fill soils. From our analyses, we provide the following results:

Table 6-1: Stability Analysis Summary

Alignment	Approximate Station	Slope (H:V)	Type	Approximate Height (feet)	Loading Condition	Resistance Factor	
						(computed)	(required)
US 21	23+50 LT	2:1	Fill Slope	19	Short-term	0.54	≤ 0.90
					Long-term	0.54	≤ 0.75
US 21	34+00 LT	2:1	Fill Slope	21	Short-term	0.60	≤ 0.90
					Long-term	0.61	≤ 0.75
US 21	34+00 RT	2:1	Fill Slope	19	Short-term	0.53	≤ 0.90
					Long-term	0.53	≤ 0.75
US 21	39+00 LT	2:1	Fill Slope	16	Short-term	0.55	≤ 0.90
					Long-term	0.60	≤ 0.75
US 21	41+50 LT	2:1	Fill Slope	13	Short-term	0.59	≤ 0.90
					Long-term	0.58	≤ 0.75
US 21	41+50 RT	2:1	Fill Slope	21	Short-term	0.59	≤ 0.90
					Long-term	0.61	≤ 0.75
US 21	43+50 RT	2:1	Fill Slope	16	Short-term	0.47	≤ 0.90
					Long-term	0.49	≤ 0.75
US 21	66+00 LT	2:1	Fill Slope	15	Short-term	0.43	≤ 0.90
					Long-term	0.45	≤ 0.75
US 21	67+00 LT	2:1	Fill Slope	19	Short-term	0.38	≤ 0.90
					Long-term	0.52	≤ 0.75
US 21	67+00 RT	2:1	Fill Slope	19	Short-term	0.38	≤ 0.90
					Long-term	0.36	≤ 0.75
US 21	68+00 LT	2:1	Fill Slope	11	Short-term	0.42	≤ 0.90
					Long-term	0.42	≤ 0.75
US 21	74+00 LT	2:1	Fill Slope	14	Short-term	0.28	≤ 0.90
					Long-term	0.40	≤ 0.75

From the above-summarized results, the computed resistance factors do not exceed the maximum resistance factor for roadway embankment in Table 9-5 of the GDM.

6.1.2 Cut Slopes

The following table identifies areas of cut slopes that are greater than 10 feet. Due to the existing heavily wooded and steeply sloped areas at the top of the cut slopes, drill rig access was restricted within the Right-of-Way, and the borings were not able to be performed for these areas during the exploration. However, no visible erosion or slope failure was present. The proposed cut slopes seem to be flatter than the existing slopes and S&ME believes the proposed slopes will meet the required resistance factors in Table 9-5 of the current GDM.

Table 6-2: Cut Slopes

Alignment	Approximate Begin Station	Approximate End Station	Slope (H:V)	Type
US 21	46+00 LT	52+00 LT	2:1	Cut Slope

6.2 Settlement Analysis

Fill placement of 10 feet or more is expected on some sections along US 21 to support the proposed roadway widening. In these areas, elastic compression and most consolidation settlements are expected to occur during embankment construction.

Settlement analysis for this project was performed for areas that were determined more susceptible to settlement based the amount of proposed fill and the underlying subsurface conditions. The areas were considered the critical sections for the project. Settlement analysis for this project was performed using the computer program Settle3 Version 5. Soil test boring and laboratory testing results were incorporated into the soil parameters for our analysis. The cohesive soil parameters and strength values used in the settlement analysis presented in Appendix III were estimated based on correlations from Chapter 7 of the GDM. The equations use to estimate the cohesive soil parameters and strength values are shown in Table 6-3 below. Settlement within the new fill under its own weight is estimated to be approximately 1 inch.

Table 6-3: Cohesive Soil Parameters for Settlement Analysis

Soil Parameter	Equation	Reference
Elastic Modulus (E_s)	56*($N^*_{1,60}$)	GDM Table 7-18
Compression Index (C_c)	0.014*(PI)	GDM Equation 7-89
Recompression Index (C_r)	0.1*C_c	GDM Section 7.13.2.2
Preconsolidation Stress (Pc)	$\frac{C}{(0.11 + 0.0037 * PI)}$	GDM Equation 7-93

Total settlement caused from the new fill was compared to performance limits provided in Tables 10-12 and 10-13 of the GDM. Settlement analyses are presented on the Settle3 output figures provided in Appendix III. From our analyses, we provide the following results:

Table 6-4: Settlement versus Performance Limits

Location of New Fill	EV-01A Settlement During Construction (inches)	EV-01B Total Post-Construction Settlement (inches)	EV-03 Longitudinal Differential Settlement (inches/50-ft)	EV-04 Transverse Differential Settlement (inches/5-ft)
US 21 Sta. 23+50 LT Slope	2.4	< 1	< 1	< 0.2
US 21 Sta. 34+00 LT Slope	1.4	< 1	< 1	< 0.2
US 21 Sta. 39+00 LT Slope	2.3	< 1	< 1	< 0.2
US 21 Sta. 67+00 LT Slope	2.0	< 1	< 1	< 0.2

From the above-summarized results, post-construction settlement of the embankments is anticipated to be minor and within GDM performance limits. As such, surcharging, wait periods, or the use of settlement plates following fill placement will not be needed to meet the objectives of the GDM. This assumes construction of the fill in accordance with SCDOT standard specifications for earthwork. Additional embankment fill due to long term settlement will not be required.

7.0 Earthwork Considerations

We assume the roadway subgrade, embankments, and cut slopes will be constructed in conformance with the SCDOT Standard Specifications for Highway Construction, 2007 edition, Division 200. Soils excavated during planned grading activities are Unclassified Excavation unless considered muck or rock excavation as described in Section 203.

7.1 Excavations

Based on the results of the soil test borings, we anticipate that the general excavation for this site will be in alluvial soils, fill and residual soils. Generally, these soils can be excavated using backhoes, trackhoes, front-end loaders, bull dozers and other types of typical earthmoving equipment. Partially weathered rock (PWR) was not encountered within anticipated excavation depths in any of the borings. However, the depth to, and thickness of, PWR, rock lenses or seams and bedrock, can vary dramatically in short distances and between boring locations; therefore, PWR, boulders or bedrock may be encountered during general excavation, excavation of footings and utilities at locations or depths between boring locations not encountered during this exploration.

All excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for site safety. This information is provided only as a service, and under no circumstances should S&ME be assumed to be responsible for construction site safety.

7.1.1 Muck Excavation

Based on the latest design files dated March 8, 2021 and provided by STV, some of the proposed roadway embankments will be constructed in or near isolated low-lying areas to support the planned roadway widening. The low-lying areas may consist of very loose to loose, wet alluvial soils, and standing water may be present at the existing ground surface and may require muck excavation. These soils may be unstable and may be difficult for conventional grading equipment to traverse without improvement. The contractor shall be prepared to provide equipment and perform temporary dewatering during construction. The areas where muck excavation may be required are identified in Table 7-1.

Table 7-1: Isolated Low-Lying Areas

Alignment	Begin Station	End Station	Direction	Begin Distance from Proposed Centerline (feet)	End Distance from Proposed Centerline (feet)	Estimated Depth Below Existing Ground Surface (feet)
US21*	33+00	34+50	Right	34	95	2
US21*	33+00	34+50	Left	53	100	2
US21*	40+50	43+50	Right	38	85	2
US21*	39+00	42+00	Left	39	82	2
US21	66+30	67+00	Right	36	71	2
US21	65+50	68+00	Left	52	103	2
SC51*	315+90	316+50	Left	24	63	2
SC51*	316+00	316+40	Right	24	66	2

*: Areas in the vicinity where proposed culverts extensions are planned.

As previously mentioned, there are three culvert extensions planned for the project. The table above summarizes the mucking required for the three culvert extensions; however, please refer to the Culvert Design Memos attached as appendices to this report, each dated August 5, 2021, for additional information.

Mucking and stabilization of these soils is required prior to placement of new embankment fill for the widened sections. The extent of undercutting or mucking will be dependent upon the prevailing weather conditions and the condition of the subgrade at the time of construction. Actual areas along the planned alignments requiring undercut or mucking are best determined in the field at the time of construction with joint consultation between the RCE and the Contractor.

7.2 Fill Soil Considerations

Borrow materials shall meet the requirements of subsection 203.2.1.8 of the Standard Specifications for York County.

The fill soil material properties used in slope stability analyses are provided in Table 7-2:

Table 7-2: Fill Material Properties Table

Soil Property	Value Used in Analysis
Effective Friction Angle, φ′	30°
Effective Cohesion, c′	300
Total Unit Weight, γ	120 pcf

All fill should be placed in uniform lifts of 8 inches or less (loose measure) and compacted to at least 95% of the standard Proctor maximum dry density. Existing slopes should be benched, and new fill should be "keyed" into the benched slope.

SCDOT specification 205.4.6 (Embankment Compaction) requires the Contractor to accomplish compaction by using suitable construction procedures while the material is at suitable moisture content. The contractor should implement procedures in the field to effectively control moisture content during placement. Permissible range of moisture content during placement will vary with soil classification, but silts or clays will need to be placed within -3 to +3 percent of the optimum moisture content.

7.3 Surface Preparation of Embankments

Embankments planned along existing embankment fills widened to accommodate the planned roadway alignment sections will require general preparation as described by the SCDOT standard specifications:

1. Clearing and Grubbing - Before starting embankment construction, clear and grub the embankment area according to Section 201 and install Drainage Structures according to the standard specifications.
2. Depressions and Undercut Areas - Fill depressions below the ground surface and undercut areas with suitable material. Remove unsuitable or unstable material and compact new fill according to Subsection 205.4.6 before beginning embankment construction.
3. Scarification and Other Preparation - Plow and scarify the entire area upon which the embankment is to be placed (except inundated areas) at least 6 inches deep.
4. Benching and Compaction of the Subgrade - Before placing the embankment, re-compact loosened soil to the approximate density of the underlying soil. Cut benches as specified in Subsection 205.4.4.
5. Compaction Under Shallow Fills - When the depth of fill and surfacing is 3 feet (1 m) or less, compact the original subgrade at least 1 foot deep to at least 95 percent of the maximum laboratory dry density as determined from representative samples of the compacted material. The in-place density of the compacted fill will be determined according to nuclear gage at random intervals.
6. Embankment Construction - Construct embankments in general accordance with specifications for materials, equipment, measurement, and payment provided in Section 205.

7.4 Shoulders and Slopes

Materials placed at the surface of shoulders and slopes may consist of materials removed from stockpiled soils stripped from within the right-of-way or from areas of roadway and drainage excavation. This may include friable materials capable of growing grass that resist erosion when compacted.

Due to the planned benching of the existing embankment slopes, existing subsurface utilities present along the existing alignment may be encountered. Existing utility lines located within right-of way and proposed excavation depths should be removed or plugged and relocated.

7.5 Removal / Undercut for Subgrade Stability

Based on the results of our laboratory testing and our visual classification, some of the soils encountered in the upper several feet in the borings were classified as A-7-5 and A-7-6 soils. The A-7-5 and A-7-6 soils are typically highly plastic and do not perform well as subgrade under pavement loadings. The areas that may require undercut are listed in Table 7-3 and Table 7-4. Undercut for subgrade stability is typically recommended to a depth of 1 to 3 feet below proposed subgrade elevations. Once areas are determined unsuitable and will require undercut, they should be replaced with acceptable fill. Actual undercutting, bridging, and/or geogrid quantities will be determined in the field at the time of construction by the RCE. Bridge lift materials should meet the latest *Bridge Lift Materials* Supplemental Specification, and geogrid should meet the latest *Geogrid Soil Reinforcement* Supplemental Specification. The stabilization methods used are best determined in the field at the time of construction.

Table 7-2: Areas of Possible Undercut – Mainlines

Alignment	Station	Referenced Boring
US21	17+50	R-1
US21	34+00	R-34
US21	38+68	R-5
US21	40+37	S-4
US21	45+85	B-1
US21	51+12	S-9
US21	53+11	S-10
US21	63+68	R-10

Alignment	Station	Referenced Boring
US21	66+01	R-40
US21	66+75	S-11
US21	67+00	R-41
US21	68+01	R-42
US21	73+68	R-12
US21	93+60	R-15
US21	103+66	R-17
SC51	318+60	R-28

Table 7-3: Areas of Possible Undercut – Secondary Roads

Alignment	Station	Referenced Boring
Lakeview Rd.	14+50	C-4
Fern Forest Ct.	11+52	C-6
Embassy	10+89	C-8
Garrison Farm Rd.	12+02	C-12
Lakes Blvd.	11+64	C-16

Alignment	Station	Referenced Boring
Flint Hill Rd.	12+01	C-17
Flint Hill Rd. 2	19+55	B-9
Springhill Farm Rd.	26+23	B-7
US21 Bus.	12+34	B-3
US21 Bus.	16+87	B-4

7.6 Erosion

The slopes of the new embankments and cut locations will be susceptible to erosion during rainfall events. Construction operations should be performed in a manner consistent with good erosion control practices that minimize soil erosion as described in Subsections 205.4.1, 205.4.1.2, and 205.4.7 of SCDOT Standard Specifications for Highway Construction, 2007 edition. We recommend diverting surface water runoff of slopes by use of berms along the crest and temporary drainage piping. We recommend the slopes be seeded and grassed as soon as practical to minimize the effects of erosion.

7.7 Cross-Line Pipes

Based off the provided plans dated April 5, 2018, provided by STV, Table 7-4 provides a summary of planned crossline pipes and provides details of pipe location, size, and length as indicated by the cross sections. Table 7-4 also list bearing soil type and SPT N-Values near the pipe invert elevations. Special excavation may be required to install some of these pipes where very dense soils or subsurface water is present. Table 7-4 does not list proposed culverts or the cross-line pipes on the proposed Gold Hill Road realignment.

Table 7-4: Summary of Crossline Pipes

Pipe Details	Approx. Station	Approx. Length (feet)	Invert Elev. at CL (feet)	Boring, Soil Description at Invert Elevation, and Estimate N-Value
(NP-106) 18" SWP	US21 31+68	40	593.0	C-4, Residual Clay (CL), N-Value = 13
(CLP-4) 36" SWP	US21 66+74	178	620.0	R-41, Alluvial Silty Clay (CH), N-Value = 5
(NP-518) 18" RCP	US21 68+57	52	628.5	R-11, Residual Sandy Clay (CL), N-Value = 7
(NP-519) 30" SWP	US21 73+47	30	632.8	R-12, Fill Sandy Clay (CL), N-Value = 8
(NP-618) 18" SWP	US21 92+88	30	643.3	R-15, Residual Sandy Silt (ML), N-Value = 10
(NP-702A) 18" SWP	US21 99+41	43	660.0	R-16, Fill Clayey Silt (MH), N-Value = 9
(NP-702) 18" SWP	US21 101+72	78	658.0	R-17, Residual Clayey Silt (MH), N-Value = 25
(NP-704A) 18" SWP	US21 105+12	31	664.0	R-17, Residual Clayey Silt (MH), N-Value = 8
(NP-710/715) 18" SWP	US21 106+98	72	665.0	R-18, Residual Clay (CH), N-Value = 27
(NP-801B) 18" SWP	US21 110+66	31	664.5	R-18, Residual Clay (CH), N-Value = 27
(NP-816) 18" SWP	US21 116+60	72	654.0	R-22, Residual Clayey Silt (MH), N-Value = 13
(EP-5) 18" SWP Ext.	US21 116+89	13	638.0	R-22, Residual Silty Sand (SM), N-Value = 9
(NP-812) 18" SWP	US21 121+94	172	645.0	R-21, Fill Clay (CH), N-Value = 10
(EP) 18" SWP Ext.	US21 122+75	8	638.9	R-21, Residual Clayey Silt (MH), N-Value = 12
(NP-906) 18" SWP	US21 130+80	172	640.5	B-10, Residual Sandy Silt (ML), N-Value = 9
(NP-910) 18" SWP	US21 134+08	87	637.5	B-10, Residual Sandy Silt (ML), N-Value = 8
(NP-1102) 30" SWP	SC51 315+96	72	594.0	R-28, PWR
(NP-1106) 24" SWP	SC51 316+83	72	594.5	R-28, PWR
(NP-1203) 18" SWP	SC51 337+50	72	614.8	R-32, Residual Silty Clay (CL), N-Value = 22
(CLP-7) 24" SWP	Lakeview Dr. 14+49	82	589.5	C-4, Residual Silty Sand (SM), N-Value = 19
(CLP-8) 18" SWP	Lakeview Dr. 12+89	65	583.0	C-7, Fill Sandy Clay (CL), N-Value = 17
(NP-234) 18" SWP	US 21 Bus. (Old Nation Rd.) 12+85	69	532.7	B-3, Residual Sandy Silt (ML), N-Value = 13
(NP-245A) 18" SWP	US 21 Bus. (Old Nation Rd.) 12+85	69	629.0	B-4, Fill Silty Clay (CH), N-Value = 6
(CLP-16) 18" SWP	Old Nation Rd. 13+28	53	629.3	C-9, Residual Clay (CH), N-Value = 7
(CLP-14) 18" SWP	Old Nation Rd. 17+23	55	627.0	C-10, Alluvial Silty Sand (SM), N-Value = 7
(CLP-12) 18" SWP	Baxter Lane 14+24	65	640.0	C-11, Residual Clayey Silt (MH), N-Value = 41
(NP-523) 18" RCP	Garrison Farm Rd. 11+00	38	640.0	C-12, Residual Clayey Silt (MH), N-Value = 14
(NP-620/622) 18" SWP	Regent Pkwy. 13+83	54	637.0	C-15, Residual Silty Sand (SM), N-Value = 26
(NP-1403) 30" RCP	Flinthill Rd. 12+50	39	661.7	C-17, Residual Clayey Silt (MH), N-Value = 16
(EP-9) 18" SWP Ext.	Terry's Rd. 11+88	11	660.5	R-19, Fill Silty Sand (SC-SM), N-Value = 12
(NP-1028) 18" SWP	Old SC 51 302+75	101	637.0	B-11, Residual Sandy Silt (ML), N-Value = 16
(NP-1121) 18" SWP	Springhill Farm Rd. 30+00	89	604.0	B-8, PWR
(CLP-17) 18" SWP	Springhill Farm Rd. Cul-De-Sac 23+36	109	615.0	R-30, Residual Sandy Silt (ML), N-Value = 29
(CLP-13) 18" SWP	Andrew L. Tucker Rd. 1+88	102	612.5	R-31, Residual Silty Sand (SM), N-Value = 22

Roadway widening of areas at the location of cross-line pipes NP-518 and NP-519 will require new embankment fill heights greater than 10 feet. Most of the settlement of the new fill and existing subsurface soils are expected to occur during construction of the new embankment with less than one inch of settlement to occur post-construction. The contractor shall consider an appropriate construction sequence for the installation of cross-lined pipes NP-518 and NP-519 to minimize the impact of settlement of the new pipes.

Other proposed crossline pipes will be installed in areas of the roadway embankment that require little to no fill to reach planned grade. Therefore, settlement is not considered an issue at these locations.

As mentioned in above sections, there are three culvert improvements planned at approximate stations US 21 33+80, US 21 41+06, and SC 51 316+23. Geotechnical recommendations for each culvert are included in Appendix VI of this report.

8.0 Recommended Plan Notes

Place the following notes on the Roadway Plans.

8.1 Embankments

Cut benches as specified in Subsection 205.4.4.

8.2 Borrow Materials

Borrow materials shall meet the requirements of subsection 203.2.1.8 of the Standard Specifications for York County.

8.3 Muck Excavation

The areas listed in the above Table 7-1 (Isolated Low-Lying Areas), have been identified as areas where muck excavation may be required. Areas along the planned alignments requiring undercut or mucking are to be determined in the field at the time of construction with joint consultation between the RCE, GEOR, and the Contractor.

Any additional areas that are discovered to deflect or settle may require muck excavation as directed by the RCE. The RCE will determine the lateral extent of the undercutting. The undercutting should not extend beyond the toe of slope. The final depth of muck excavation shall not exceed 5 feet, unless otherwise specified in the plans and/or Specifications. Contact the Geotechnical Engineer-of-Record (GEOR) if muck excavation needs to exceed 5 feet and it has not been previously specified in the plans or Specifications.

If the undercutting completely removes the materials identified as muck, then bridge lift materials may be placed directly on the firm materials.

If because of the depth of muck, muck materials must be left in place, place a stabilization geosynthetic meeting the requirements of SC-M-203-6, Geosynthetic Materials for Separation and Stabilization. After the placement of the initial bridge lift material, expose approximately 1 square foot of the geosynthetic for visual observation to

identify any damage caused by the placement of the bridge lift material. After ascertaining that the geosynthetic has not been damaged, replace the bridge lift material excavated to allow observation of the geosynthetic. If the geosynthetic appears to be damaged, expose a larger area and contact the GEOR for instructions. Any damaged areas shall be repaired by the Contractor at no expense to the Department.

Any ruts that develop in bridge lift materials shall be filled in with similar bridge lift materials. Do not blade down the ruts since this will decrease the thickness of the bridge lift.

In areas that require mucking or undercutting, borrow material soil may be placed as a bridge lift as long as the grade on which the material is being placed is at least 2 feet above the groundwater or surface water level. Place borrow material bridge lifts in single lift thicknesses no greater than 2 feet. Do not place a bridge lift consisting of borrow material within 3 feet of the base of the pavement section. Place only compacted borrow material soil or stone bridge lift within this zone.

In the event that groundwater/surface water does not allow backfilling with borrow material soil, use either No. 57 stone or granular bridge lift materials meeting the requirements of Bridge Lift Materials Supplement Specification. Place the bridge lift materials in single lifts not exceeding a 2-foot thickness. If additional compacted borrow material soil is needed to reach grade, place a geotextile for separation meeting the requirements of SC-M-203-6, Geosynthetic Materials for Separation and Stabilization between the stone bridge lift and the overlying compacted soil. After the placement of the initial lift of compacted material, expose approximately 1 square foot of the geosynthetic for visual observation to identify any damage caused by the placement of the compacted material. After ascertaining that the geosynthetic has not been damaged, replace and compact the material excavated to allow observation of the geosynthetic. If the geosynthetic appears to be damaged, expose a larger area and contact the GEOR for instructions. Any damaged areas shall be repaired by the Contractor at no expense to the Department.

The expected bid items associated with mucking and undercutting (i.e., mucking, bridge lift material, geogrid, and geotextile for separation of sub-grade and sub-base) are listed in Table 8-1. Do not purchase or stockpile these bid items on site without prior written approval from the RCE unless specific areas and details are defined in the plans.

Table 8-1: Expected Bid Items

Item No.	Pay Item	Inclusion Quantity
2034000	Muck Excavation	4650 CY
2036020	Geotextile, Separation	7000 SY
2037030	Geogrid, Stabilization	200 SY
2052010	Stone Bridge Lift Material	6500 tons

8.4 Earthborne Vibration Monitoring

Level 1 – York County has elected to not monitor the site; therefore, no Earth-borne Vibration Monitoring is required.

9.0 Closing

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

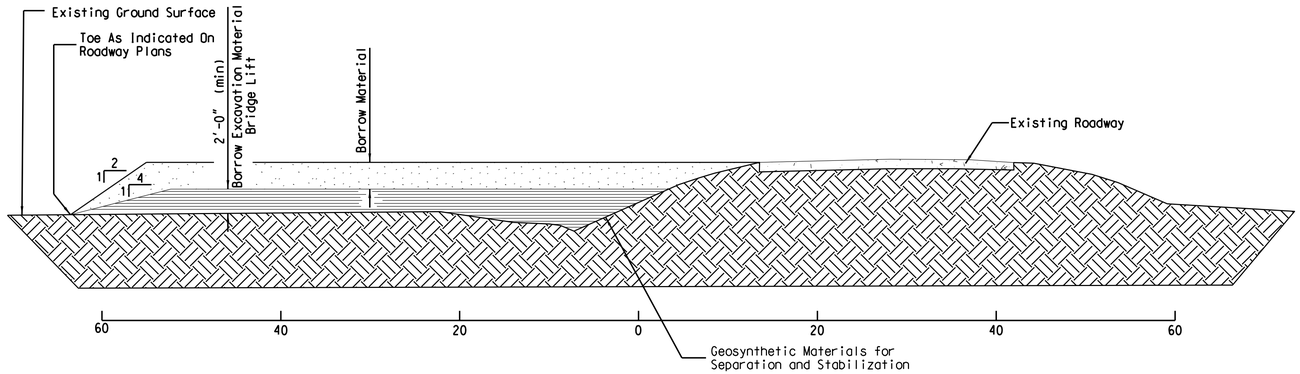
Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

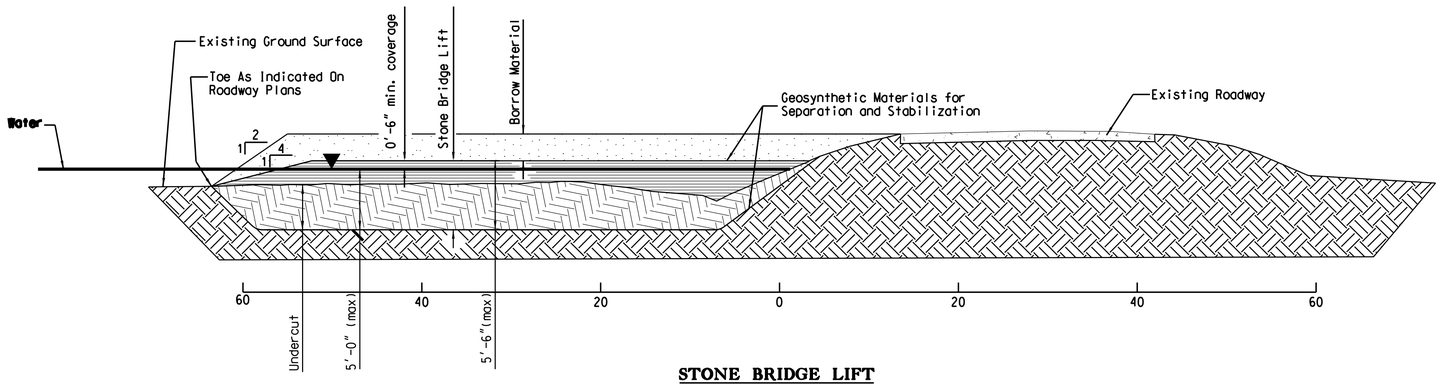
Appendices

Appendix I – G1 Sheet

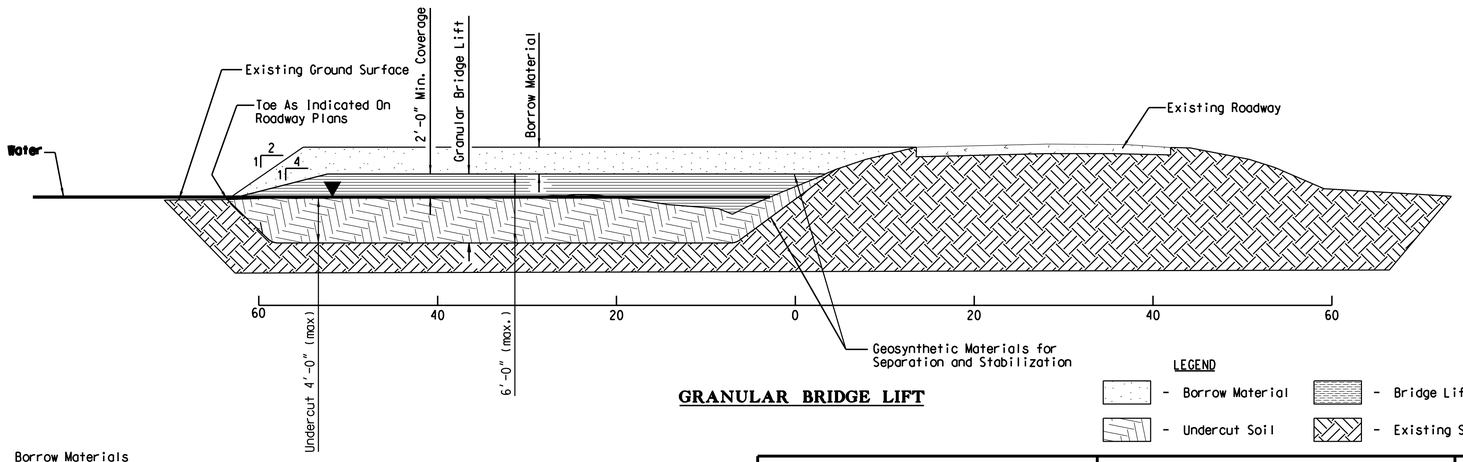
FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROAD / ROUTE NO.	SHEET NO.
	SC	YORK	0042332	US21 & SC 51	G1



BORROW EXCAVATION BRIDGE LIFT



STONE BRIDGE LIFT



GRANULAR BRIDGE LIFT

LEGEND

- Borrow Material
- Bridge Lift
- Undercut Soil
- Existing Soil

Borrow Materials

Borrow materials shall meet the requirements of subsection 203.2.1.8 of the Standard Specifications for York County.

Earthborne Vibration Monitoring

Level 1 York County has elected to not monitor the site; therefore, no Earth-borne Vibration Monitoring is required. York County assumes all risk for any potential damage.

Muck Excavation

The following approximate areas have been identified as requiring muck excavation in accordance with Pay Item 2034000. Areas along the planned alignments requiring undercut or mucking are to be determined in the field at the time of construction with joint consultation between the RCE, GEOR, and the Contractor:

ALIGNMENT	Begin Station	End Station	Direction	Begin Distance from Proposed Centerline, ft.	End Distance from Proposed Centerline, ft.	Estimated Depth Below Existing Ground Surface, ft.
US 21	33+00	34+50	RIGHT	34	95	2
US 21	33+00	34+50	LEFT	53	100	2
US 21	40+50	43+50	RIGHT	38	85	2
US 21	39+00	42+00	LEFT	39	82	2
US 21	66+30	67+00	RIGHT	36	71	2
US 21	65+50	68+00	LEFT	52	103	2
SC 51	315+90	316+50	LEFT	24	63	2
SC 51	316+00	316+50	LEFT	24	66	2

Additional areas discovered to deflect or settle may require muck excavation or undercutting as directed by the RCE. Lateral extent of undercutting to be defined by the staked toe line of the slope. The depth of undercutting or muck excavation to be determined by the RCE with consultation with the GEOR.

If the undercutting completely removes the materials identified as muck, then bridge lift materials may be placed directly on the firm materials.

Areas that cannot be stabilized by proof-rolling may optionally be stabilized by construction of a bridge lift. The bridge lift if performed must include a stabilization geosynthetic meeting the requirements of SC-M-203-1, Geosynthetic Materials for Separation and Stabilization at the base of the lift. After the placement of the initial bridge lift material, expose approximately 1 square foot of the geosynthetic for visual observation to identify any damage caused by the placement of the bridge lift material. After ascertaining that the geosynthetic has not been damaged, replace the bridge lift material excavated to allow observation of the geosynthetic. If the geosynthetic appears to be damaged, expose a larger area and contact the GEOR for instructions. Damaged areas shall be repaired by the Contractor at no expense to the Department.

Any ruts that develop in bridge lift materials shall be filled in with similar bridge lift materials. Do not blade down the ruts, since this will decrease the thickness of the bridge lift.

In areas that require mucking or undercutting, approved borrow material may be placed as a bridge lift as long as the grade on which the material is being placed is at least 2 feet above the groundwater or surface water level at the time of construction. Place borrow material bridge lifts in single lift thicknesses no greater than 2 feet. Do not place a bridge lift consisting of borrow material within 3 feet of the base of the pavement section. Place only compacted borrow material soil or stone bridge lift within this zone.

Contractor shall use either stone or granular bridge lift materials meeting the requirements of Bridge Lift Materials Supplement Specification. Place the bridge lift materials in single lifts not exceeding a 2-foot thickness. If additional compacted borrow material soil is needed to reach grade, place a geotextile for separation meeting the requirements of SC-M-203-1, Geosynthetic Materials for Separation and Stabilization between the stone bridge lift and the overlying compacted soil. After the placement of the initial lift of compacted material, expose approximately 1 square foot of the geosynthetic for visual observation to identify any damage caused by the placement of the compacted material. After ascertaining that the geosynthetic has not been damaged, replace and compact the material excavated to allow observation of the geosynthetic. If the geosynthetic appears to be damaged, expose a larger area and contact the GEOR for instructions. Any damaged areas shall be repaired by the Contractor at no expense to the Department.

The following quantities associated with mucking and undercutting, i.e. mucking, bridge lift material, geogrid, and geotextile for separation of sub-grade and sub-base, are for bid estimation purposes only. The Estimated Quantity is the total quantity estimated for a specific item to be used on the project, while the Inclusion Quantity is the additional quantity that may be required in areas not previously identified on the plans as needing the item. Do not purchase or stockpile these bid items on site without prior written approval from the RCE unless specific areas and details are defined in the plans.

Item No.	Pay Item	Quantity
2034000	Muck Excavation	4650 CY
2052010	Stone Bridge Lift Material	6500 TONS
2036020	Geotextile Separation	7000 SY
2037030	Geogrid, Stabilization	200 SY

Dewatering, if required, is incidental to muck excavation and shall not have a separate pay item.

Embankments

Transverse differential settlement should be anticipated between a widened portion of the embankment and the existing embankment. The widened embankment will induce loading on the existing embankment that will in turn cause settlement of the existing embankment. This settlement may potentially cause damage to the existing embankment. Damage is anticipated and the Contractor is responsible for maintaining the existing travel way. The GEOR will coordinate with Construction to determine the quantities required to maintain the existing travel way.

Cut benches as specified in Subsection 205.4.4.

9751 SOUTHERN PINE BLVD
CHARLOTTE, NC 28273
(704) 523-4726

S&ME Project No. 1351-12-037

SCALE: NOT TO SCALE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
4			
3			
2			
1			

PREPARED BY: TJD DATE 03-10-2022
REVIEWED BY: KHH DATE 03-10-2022

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
YORK COUNTY PROJECT ID: 11149-004

GEOTECHNICAL DETAILS SHEET
MUCK EXCAVATING

US 21 FROM SC 460 TO 700' SOUTH OF S-48
& SC 51 FROM US 21 TO THE NC STATE LINE

$$$$$$$$path$$$$$$$$filename$$$$$$$$
$$$$$$$$date$$$$

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROAD / ROUTE NO.	SHEET NO.
	SC	YORK	0042332	US21 & SC 51	G2

US21 CULVERTS AT STA. 33+80 & 41+06

A minimum of 18 inches of #57 Stone for bedding shall be placed under the culvert extensions, and a non-woven geotextile shall be placed so that the 57 Stone is separated on all sides from the surrounding and underlying soils.

If conditions are encountered that require mucking or undercutting use No. 57 stone as borrow material. The depth to which mucking or undercutting is required is dependent upon encountering a suitable bearing material within the excavation as determined by the Geotechnical Engineer of Record. When using No. 57 Stone to backfill undercut areas, use a non-woven geotextile to separate the No. 57 Stone from the surrounding soils. If muck excavation is required, refer to the Supplemental Specification for Muck Excavation.

Based on the borings and the culvert extension invert elevations, excavation into PWR and/or rock may be required during construction of the culvert extensions. Excavation into PWR and/or rock should be anticipated for the Station 33+80 culvert upstream and downstream extensions. Excavation into PWR and/or rock should be anticipated for the Station 41+06 culvert upstream extension.

Where PWR and Rock are encountered, excavation of these materials shall be paid as structure excavation.

SC51 CULVERT AT STA. 316+23

A minimum of 18 inches of #57 Stone for bedding shall be placed under the culvert extension, and a non-woven geotextile shall be placed so that the 57 Stone is separated on all sides from the surrounding and underlying soils.

If conditions are encountered that require mucking or undercutting use No. 57 stone as borrow material. The depth to which mucking or undercutting is required is dependent upon encountering a suitable bearing material within the excavation as determined by the Geotechnical Engineer of Record. When using No. 57 Stone to backfill undercut areas, use a non-woven geotextile to separate the No. 57 Stone from the surrounding soils. If muck excavation is required, refer to the Supplemental Specification for Muck Excavation.

Based on the borings and the culvert extension invert elevations, excavation into PWR and/or rock may be required during construction of the culvert extensions.

Where PWR and Rock are encountered, excavation of these materials shall be paid as structure excavation.

$$$$$$$$path$$$$$$$$filename$$$$$$$$
$$$$date$$$$

S&ME
9751 SOUTHERN PINE BLVD
CHARLOTTE, NC 28273
(704) 523-4726

S&ME Project No. 1351-12-037

SCALE: NOT TO SCALE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
4			
3			
2			
1			

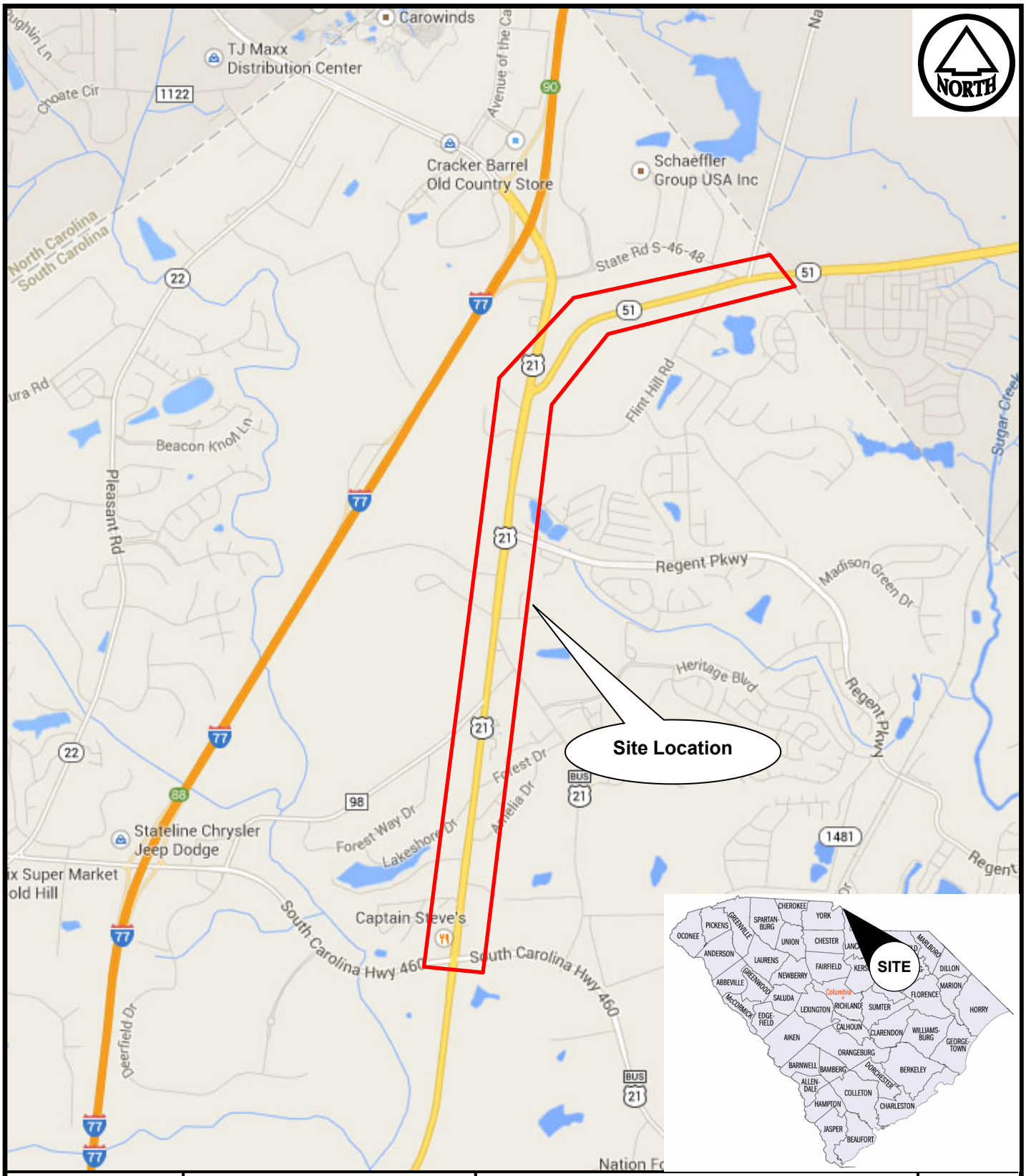
PREPARED BY: TJD DATE 03-10-2022
REVIEWED BY: KHH DATE 03-10-2022

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
YORK COUNTY PROJECT ID: 11149-004

GEOTECHNICAL CULVERT DETAILS SHEET
MUCK EXCAVATING

US 21 FROM SC 460 TO 700' SOUTH OF S-48
& SC 51 FROM US 21 TO THE NC STATE LINE

Appendix II – Figures



SCALE: NTS		**SITE VICINITY MAP** **HIGHWAY 21/51 WIDENING** YORK COUNTY, SOUTH CAROLINA	FIGURE NO. 1
DRAWN BY: JERW			
CHECKED BY: SSL			
DATE: 11/13/2015		PROJECT NO.: 1351-12-037	

Table 1 – Summary of Test Locations

Boring Number	Depth (feet)	Route	Station	Offset (feet)	Elevation (feet)	Coordinates	
						Latitude	Longitude
B- 1	30.0	Forest Dr	10+73	6 LT	596	35.064915	-80.936366
B- 2	29.8	Gold Hill Rd	57+05	135 LT	635	35.068036	-80.936605
B- 3	30	Proposed Rd	12+34	1 RT	637	35.069540	-80.935137
B- 4	27.3	Proposed Rd	16+87	2 LT	632	35.069320	-80.93365
B- 5	27.9	Old Nation Rd	11+85	1 LT	632	35.069957	-80.934144
B- 6	8.5	Springhill Farm Rd	N/A	N/A	622	35.090842	-80.925360
B- 7	11.3	Springhill Farm Rd	N/A	N/A	619	35.089932	-80.924403
B- 8	23.6	Springhill Farm Rd	N/A	N/A	614	35.088885	-80.924046
B- 9	20.7	Springhill Farm Rd	N/A	N/A	608	35.087610	-80.923736
B-10	21.6	SC 51	296+16	24 RT	648	35.087406	-80.932356
B-11	30	SC 51	299+48	26 RT	646	35.087172	-80.930926
C- 1	30	Springfield Pkwy	12+98	23 RT	606	35.056230	-80.938812
C- 2	30	Springfield Pkwy	18+10	26 LT	622	35.056512	-80.937131
C- 3	28.8	Mercantile	11+03	14 LT	604	35.060055	-80.936978
C- 4	30	Lakeview Rd	13+40	6 RT	595	35.061232	-80.937749
C- 5	30	Amelea Dr	11+07	7 LT	588	35.062217	-80.936646
C- 6	30	Rain Forest Ct	11+52	5 LT	589	35.063250	-80.936371
C- 7	30	Lakeshore Dr	12+54	5 RT	586	35.063849	-80.937189
C- 8	28.8	Emabssy Dr	10+89	3 LT	628	35.068005	-80.935856
C- 9	29.7	Old Nation Rd	15+10	5 RT	633	35.070774	-80.934524
C-10	30	Old Nation Rd	17+26	3 RT	633	35.071290	-80.934875
C-11	30	Baxter Ln	13+70	1 RT	645	35.073148	-80.935839
C-12	30	Baxter Ln	12+02	1 LT	647	35.072938	-80.934750
C-13	30	Central Carolinas Pkwy	11+11	8 RT	644	35.075060	-80.936112
C-14	30	Regent Dr.	11+62	13 LT	642	35.074963	-80.934581
C-15	30	Regent Pkwy	12+20	15 RT	644	35.076872	-80.934112
C-16	30	Lakes Blvd	11+64	13 LT	650	35.078905	-80.933997
C-17	30	Flint Hill Rd	12+01	7 LT	667	35.081915	-80.933249
R- 1	30	US 21	17+49	30 RT	613	35.057193	-80.937648
R- 2	30	US 21	23+68	29 LT	602	35.058902	-80.937597
R- 3	30	US 21	28+68	29 RT	600	35.060245	-80.937202
R- 4	30	US 21	33+64	17 LT	594.1	35.061618	-80.937168
R- 5	30	US 21	38+68	13 RT	587.6	35.062972	-80.936866
R- 6	30	US 21	43+66	11 RT	592.4	35.064334	-80.936671
R- 7	30	US 21	48+68	17 LT	606.5	35.065708	-80.936563
R- 8	30	US 21	53+57	31 RT	619	35.067066	-80.936184

Table 1 – Summary of Test Locations

Boring Number	Depth (feet)	Route	Station	Offset (feet)	Elevation (feet)	Coordinates	
						Latitude	Longitude
R- 9	30	US 21	58+68	26 LT	634	35.068445	-80.936177
R-10	29.5	US 21	63+68	28 LT	640	35.069810	-80.935985
R-11	30	US 21	68+68	30 RT	636	35.071153	-80.935590
R-12	30	US 21	73+68	15 LT	641.4	35.072526	-80.935549
R-13	30	US 21	78+38	31 RT	648	35.073801	-80.935194
R-14	30	US 21	88+44	21 LT	644.5	35.076580	-80.934971
R-15	30	US 21	93+60	14 LT	655.3	35.077956	-80.934743
R-16	30	US 21	98+40	32 RT	662	35.079257	-80.934377
R-17	30	US 21	103+66	52 LT	664	35.080721	-80.934380
R-18	30	US 21	109+85	38 RT	670.3	35.082343	-80.933720
R-19	30	US 21	113+68	25 LT	668.0	35.083409	-80.933703
R-20	30	US 21	118+68	56 RT	657	35.084745	-80.933076
R-21	30	US 21	123+68	25 RT	653.6	35.086062	-80.932835
R-22	30	SC 51	315+15	38 RT	658	35.084110	-80.933017
R-23	30	SC 51	310+66	8 LT	653	35.085074	-80.931886
R-24	30	SC 51	306+47	11 RT	647	35.086059	-80.931167
R-25	24.7	SC 51	304+00	30 RT	635	35.087284	-80.929736
R-26	30	SC 51	308+54	28 LT	621	35.087758	-80.92831
R-27	10.9	SC 51	313+58	9 LT	605.6	35.088053	-80.926684
R-28	28.9	SC 51	318+60	26 LT	600	35.088457	-80.925062
R-29	16.1	SC 51	323+61	28 LT	615	35.088810	-80.923448
R-30	13.7	SC 51	328+65	28 LT	619	35.089161	-80.921816
R-31	28.7	SC 51	333+61	26 LT	619	35.089473	-80.920195
R-32	23.4	SC 51	338+56	30 LT	620	35.089637	-80.918547
R-33	43.5	US 21	23+28	16 LT	607	35.058781	-80.937582
R-34	34.9	US 21	33+52	11 LT	594	35.061572	-80.937153
R-35	38.7	US 21	33+99	9 LT	594	35.061700	-80.937127
R-36	29.5	US 21	34+00	17 RT	593	35.061693	-80.937041
R-37	34	US 21	39+01	17 LT	587	35.063070	-80.936951
R-38	18.5	US 21	42+01	13 RT	598	35.063879	-80.936731
R-39	34.5	US 21	43+58	14 RT	592	35.064307	-80.936666
R-40	30.3	US 21	66+01	17 LT	637.7	35.070430	-80.935865
R-41	34.3	US 21	67+00	15 LT	636.6	35.070705	-80.935818
R-42	32	US 21	68+01	15 LT	636.2	35.070977	-80.935777
S- 1	29.9	US 21	23+00	15 LT	607	35.058710	-80.937577
S- 2	30	US 21	34+00	17 RT	593.4	35.061698	-80.937027

Table 1 – Summary of Test Locations

Boring Number	Depth (feet)	Route	Station	Offset (feet)	Elevation (feet)	Coordinates	
						Latitude	Longitude
S- 3	30	US 21	34+40	10 LT	593	35.061792	-80.937107
S- 4	28.8	US 21	40+37	17 LT	586.6	35.063448	-80.936882
S- 5	20.1	US 21	42+06	17 RT	588.5	35.063899	-80.936701
S- 6	30	US 21	45+10	31 LT	596.0	35.064745	-80.936737
S- 7	30	US 21	46+87	32 LT	604.2	35.065225	-80.936670
S- 8	30	US 21	49+12	29 LT	608.7	35.065841	-80.936570
S- 9	30	US 21	51+12	25 LT	613.3	35.066385	-80.936476
S-10	30	US 21	53+11	30 LT	619.2	35.066929	-80.936412
S-11	30	US 21	66+75	14 LT	637.0	35.070642	-80.935811
HA-1	10	US 21	23+00	59 LT	584	35.058711	-80.937773
HA-2	7.1	US 21	34+00	54 RT	575	35.061645	-80.936842
HA-3	8.1	US 21	34+40	74 LT	569	35.061822	-80.937328
HA-4	6.1	US 21	40+37	51 LT	571	35.063453	-80.937001
HA-5	3.8	US 21	42+06	54 RT	574	35.063890	-80.936591
HA-6	8.7	US 21	66+75	51 LT	622	35.070646	-80.935945

WIDENING OF US 21 BYPASS AND SC 51

MATCHLINE SHEET 2 - US21- STATION 20+00

SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
1

MATCHLINE SHEET 1-US21- STATION 20+00

MATCHLINE SHEET 3-US21- STATION 35+00

WIDENING OF US 21 BYPASS AND SC 51

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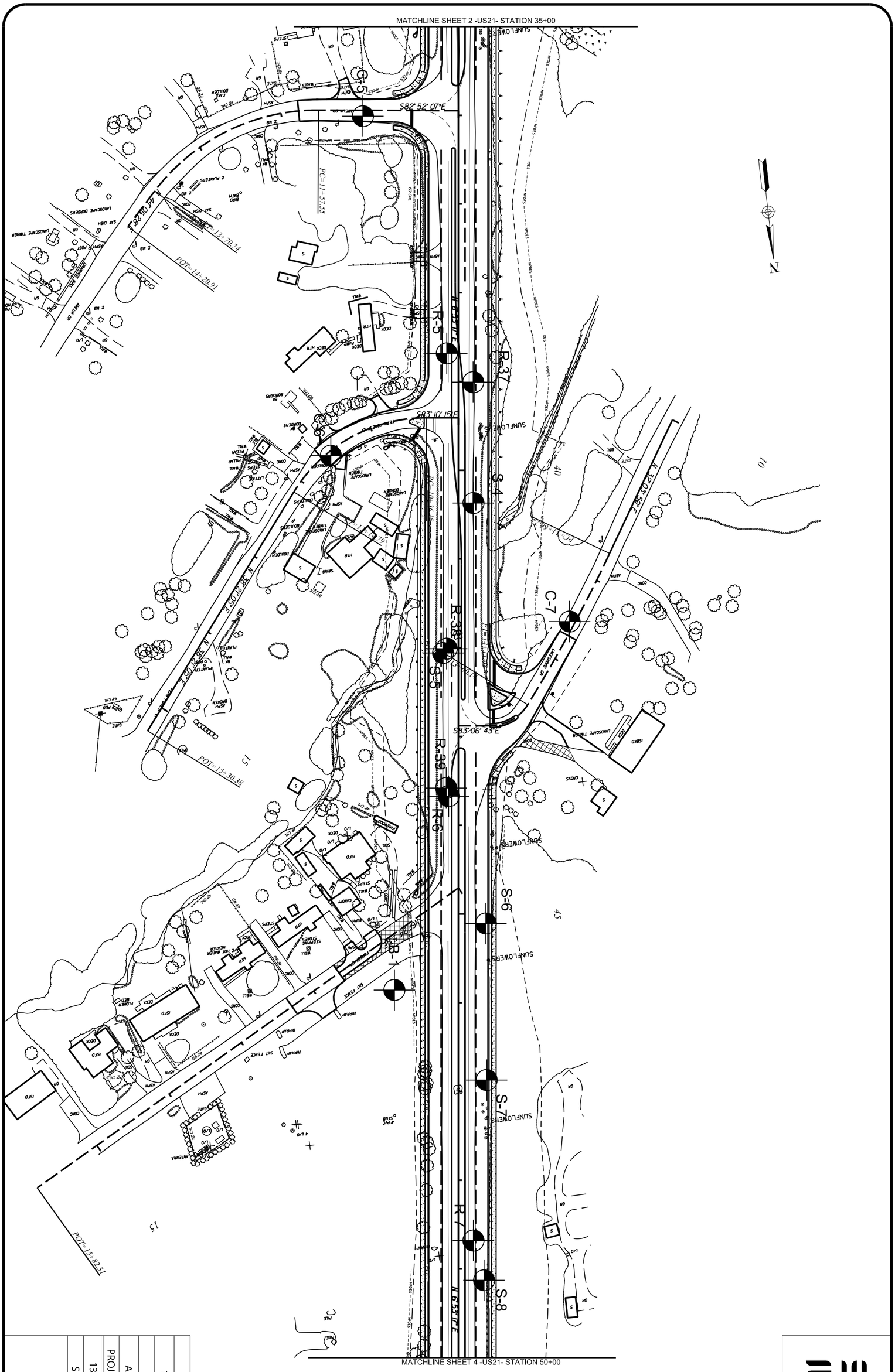
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
2



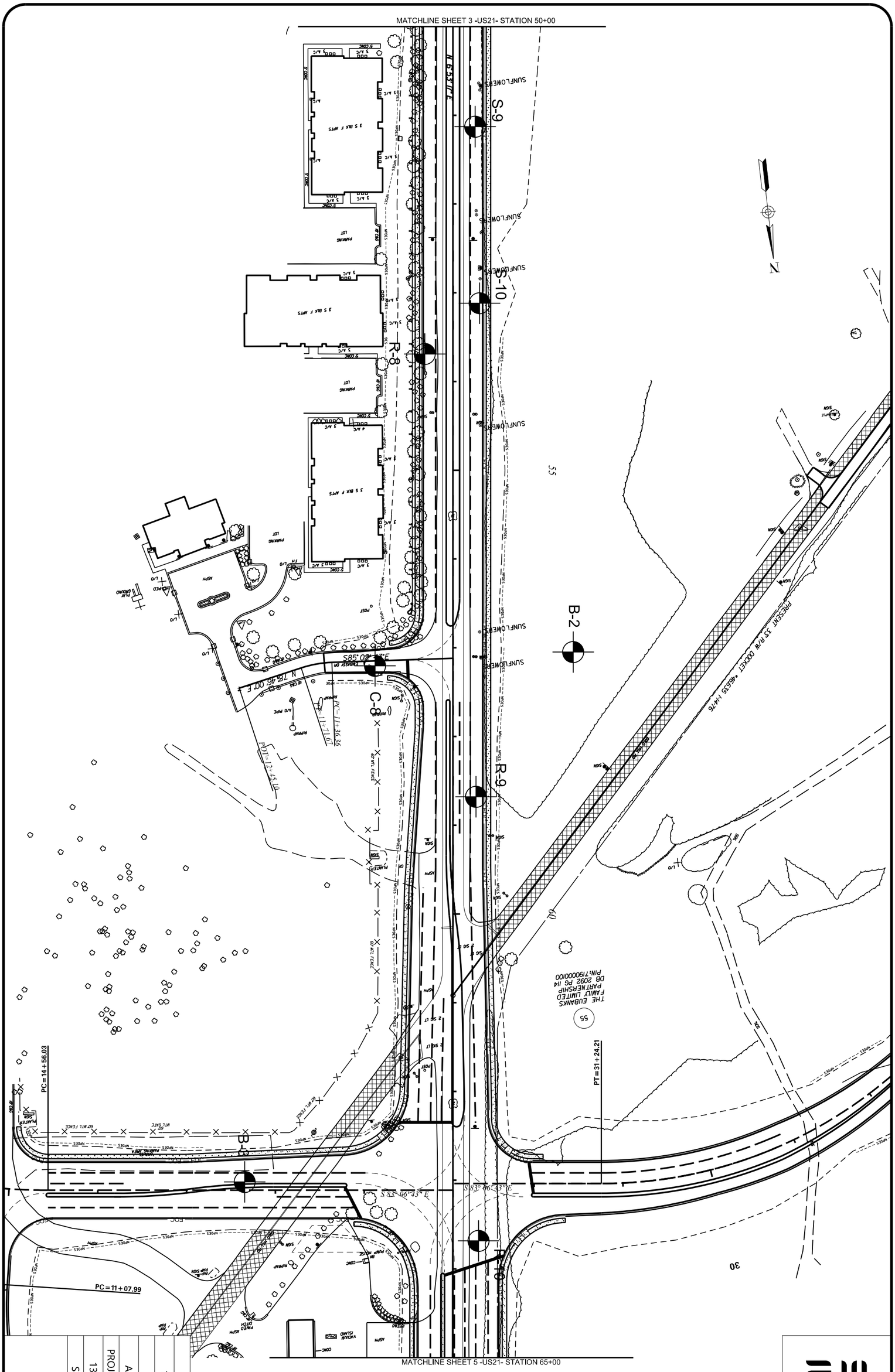
WIDENING OF US 21 BYPASS AND SC 51

SCALE: 1" = 100'

DATE: APRIL 2021

PROJECT NUMBER 1351-12-037

SHEET NO. 3



WIDENING OF US 21 BYPASS AND SC 51

SCALE:	1" = 100'
DATE:	APRIL 2021
PROJECT NUMBER	1351-12-037
SHEET NO.	4

WIDENING OF US 21 BYPASS AND SC 51

MATCHLINE SHEET 4 -US21- STATION 65+00

MATCHLINE SHEET 6 -US21- STATION 80+00

SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
5

MATCHLINE SHEET 5 -US21- STATION 80+00

MATCHLINE SHEET 7 -US21- STATION 95+00

WIDENING OF US 21 BYPASS AND SC 51

C-13

C-14

C-15

R-14

R-15

N 6°53'11" E

S 83°20'40" E

S 8°06'43" E

S 69°37'54" E

POT=12+68.62

PC=10+58.46

PT=

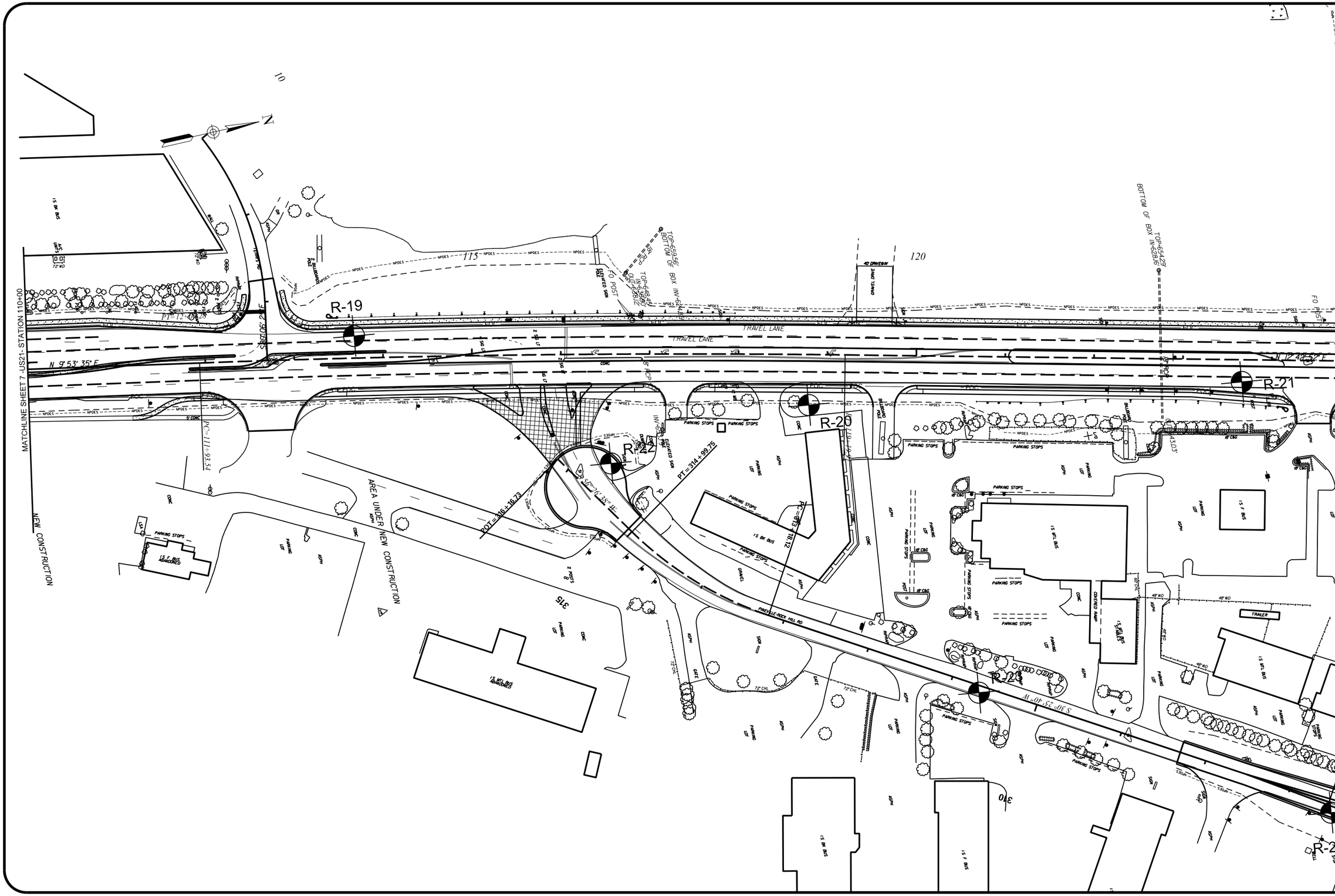
SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
6

WIDENING OF US 21 BYPASS AND SC 51

MATCHLINE SHEET 6 -US21- STATION 95+00

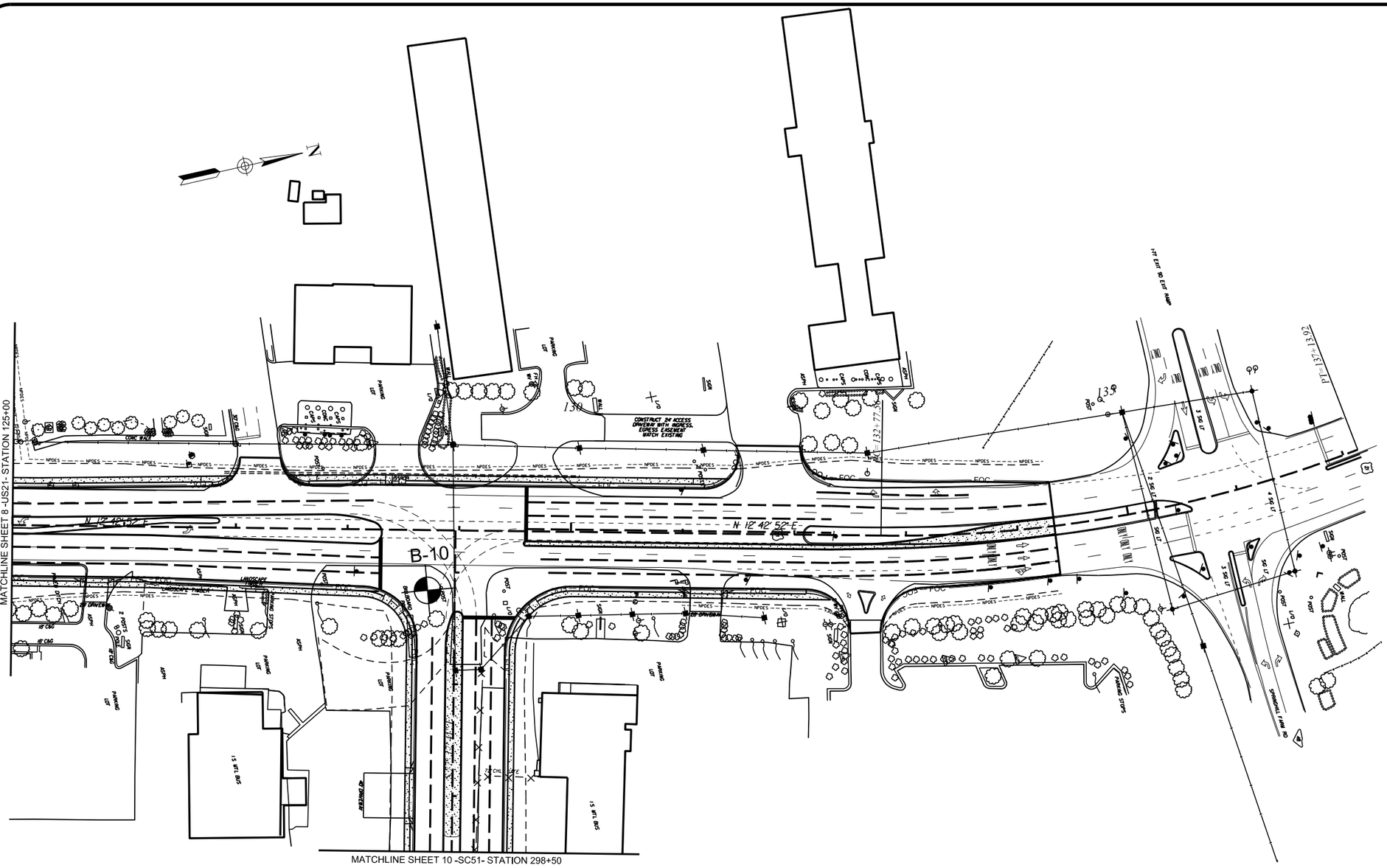
MATCHLINE SHEET 8 -US21- STATION 110+00

SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
7



WIDENING OF US 21 BYPASS AND SC 51

SCALE:	1" = 100'
DATE:	APRIL 2021
PROJECT NUMBER	1351-12-037
SHEET NO.	8


MATCHLINE SHEET 8 -US21- STATION 125+00
MATCHLINE SHEET 10 -SC51- STATION 298+50
B-10
N 12° 42' 52" E
CONSTRUCT 24' ACCESS DRIVEWAY WITH INGRESS, EGRESS EASEMENT MATCH EXISTING
PARKING LOT
PARKING STOPS
SPRINGHILL FARM RD
15 UFL BAS
SD8 UFL S1
2 POST SIGN
ASPH
NPDES
EOC
SOC
CONC WALK
LANDSCAPE ISLAND
TREE LINE
SIDEWALK
SIDEWALK RAMP
CONC CURB
CONC GUTTER
SHOULDER
CONC
SIDEWALK
SIDEWALK RAMP
SIDEWALK
SIDEWALK RAMP
SIDEWALK
SIDEWALK RAMP

WIDENING OF US 21 BYPASS AND SC 51

MATCHLINE SHEET 9 -SC51- STATION 298+50

MATCHLINE SHEET 11 -SC51- STATION 313+50

N

PC=298+86.66

PC=302+87.65

PT = 303+44.06

TOP=649.26'
ABANDONED
GREASE TRAP

300

305

310

R-24

R-25

R-26

R-27

PINEVALE-ROCK HILL RD

N 75° 15' 26" E

SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
10

WIDENING OF US 21 BYPASS AND SC 51

MATCHLINE SHEET 10 -SC51- STATION 313+50

MATCHLINE SHEET 12 -SC51- STATION 328+50

MATCHLINE SHEET 13 -SPRINGFIELD- STATION 28+00

PT = 28 + 56.91

PC = 17 + 95.26

PT = 21 + 69.05

B-8

B-9

R-28

R-29

315

320

325

30

20

N 75° 13' 31" E

S 61° 41' 14" E

S 14° 31' 34" E

FAIRVILLE-ROCK HILL RD

2 BILLBOARDS 2 POLES

2 BILLBOARDS POLE

1 S F BUS

1 S MTL BUS

1 S BK & MTL BUS

1 S F D

PARKING LOT

ASPH

CONC

GRAVEL

GATE

POST

SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
11

WIDENING OF US 21 BYPASS AND SC 51

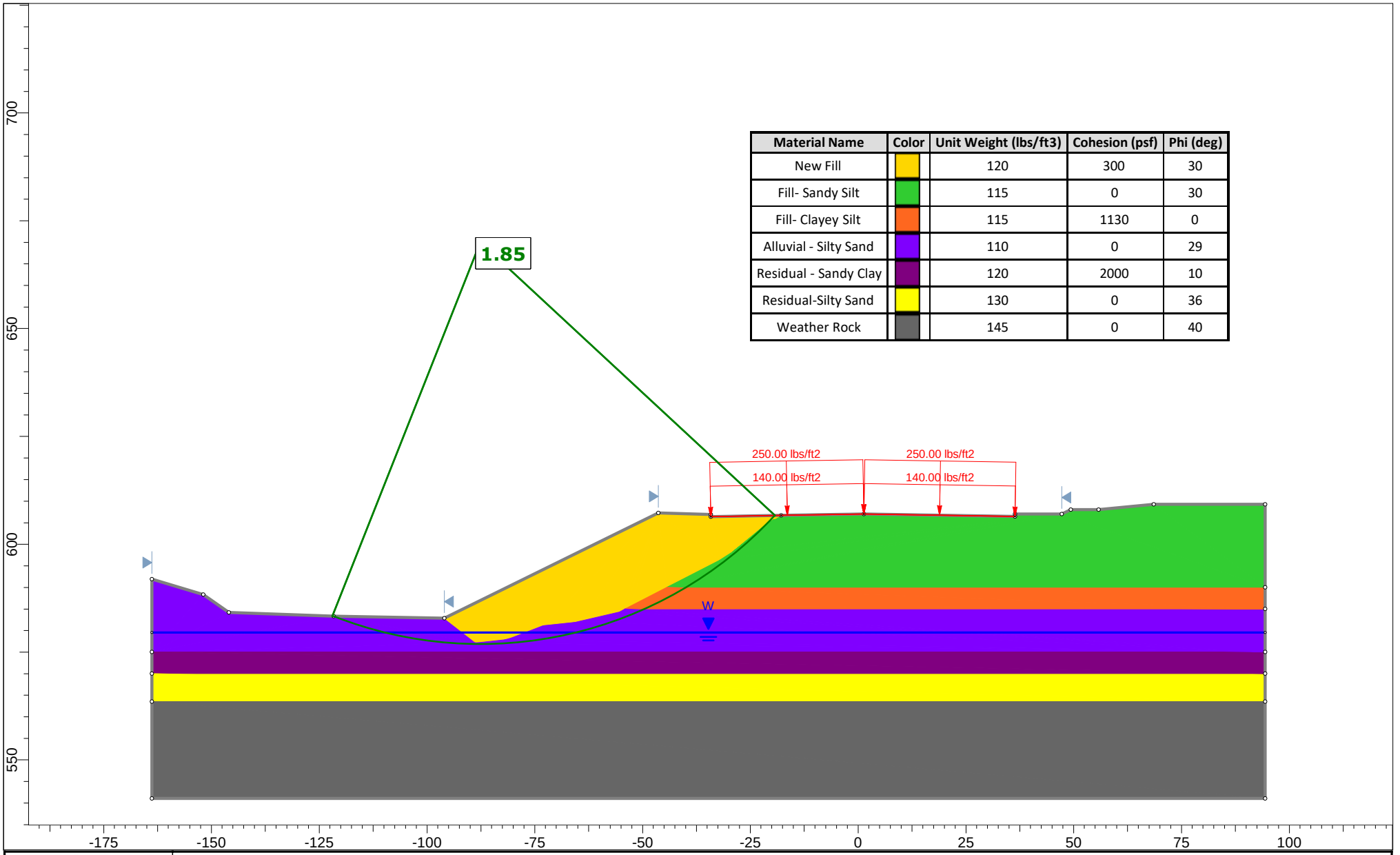
MATCHLINE SHEET 11 -SC51- STATION 328+50

SCALE:	
1" = 100'	
DATE:	
APRIL 2021	
PROJECT NUMBER	
1351-12-037	
SHEET NO.	
12	

WIDENING OF US 21 BYPASS AND SC 51

SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
SHEET NO.
13

Appendix III – Slope Stability Analysis Results

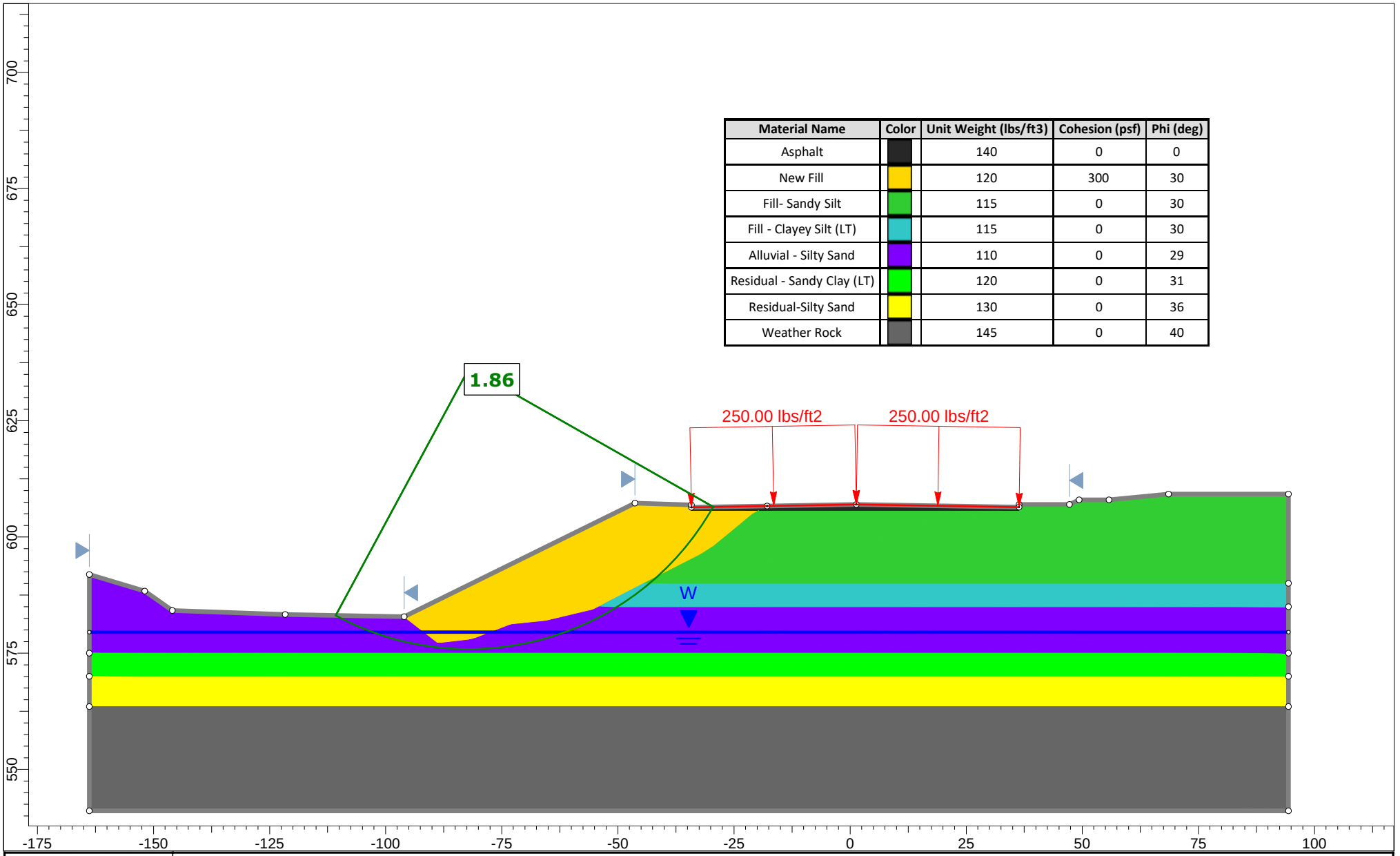


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill- Sandy Silt		115	0	30
Fill- Clayey Silt		115	1130	0
Alluvial - Silty Sand		110	0	29
Residual - Sandy Clay		120	2000	10
Residual-Silty Sand		130	0	36
Weather Rock		145	0	40

Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 23+50	File Name	US21 23+50.slmd	Date 4/28/2021	

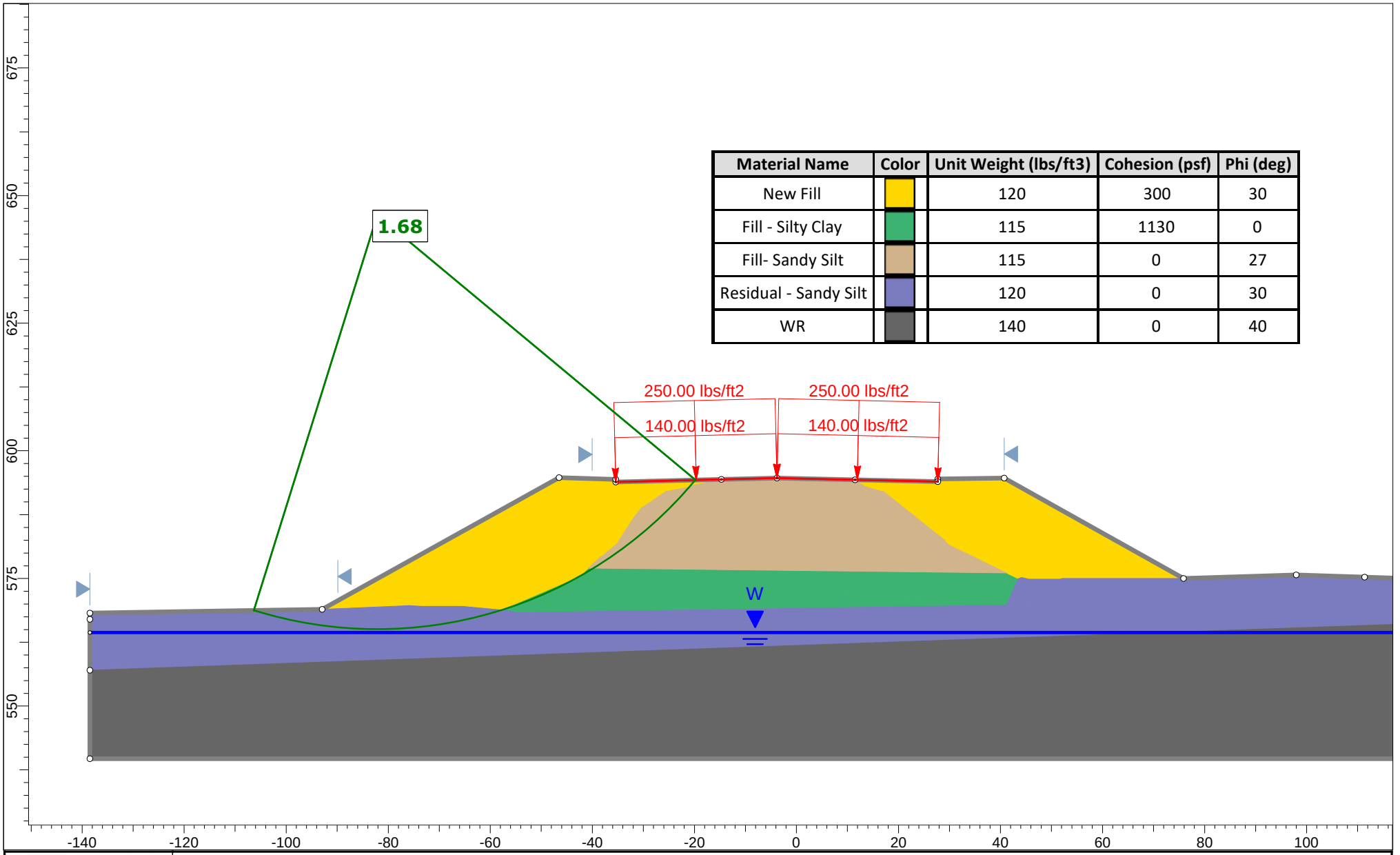
SLIDEINTERPRET 9.014

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill- Sandy Silt		115	0	30
Fill - Clayey Silt (LT)		115	0	30
Alluvial - Silty Sand		110	0	29
Residual - Sandy Clay (LT)		120	0	31
Residual-Silty Sand		130	0	36
Weather Rock		145	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 23+50	File Name	US21 23+50.slmd	Date 4/28/2021	

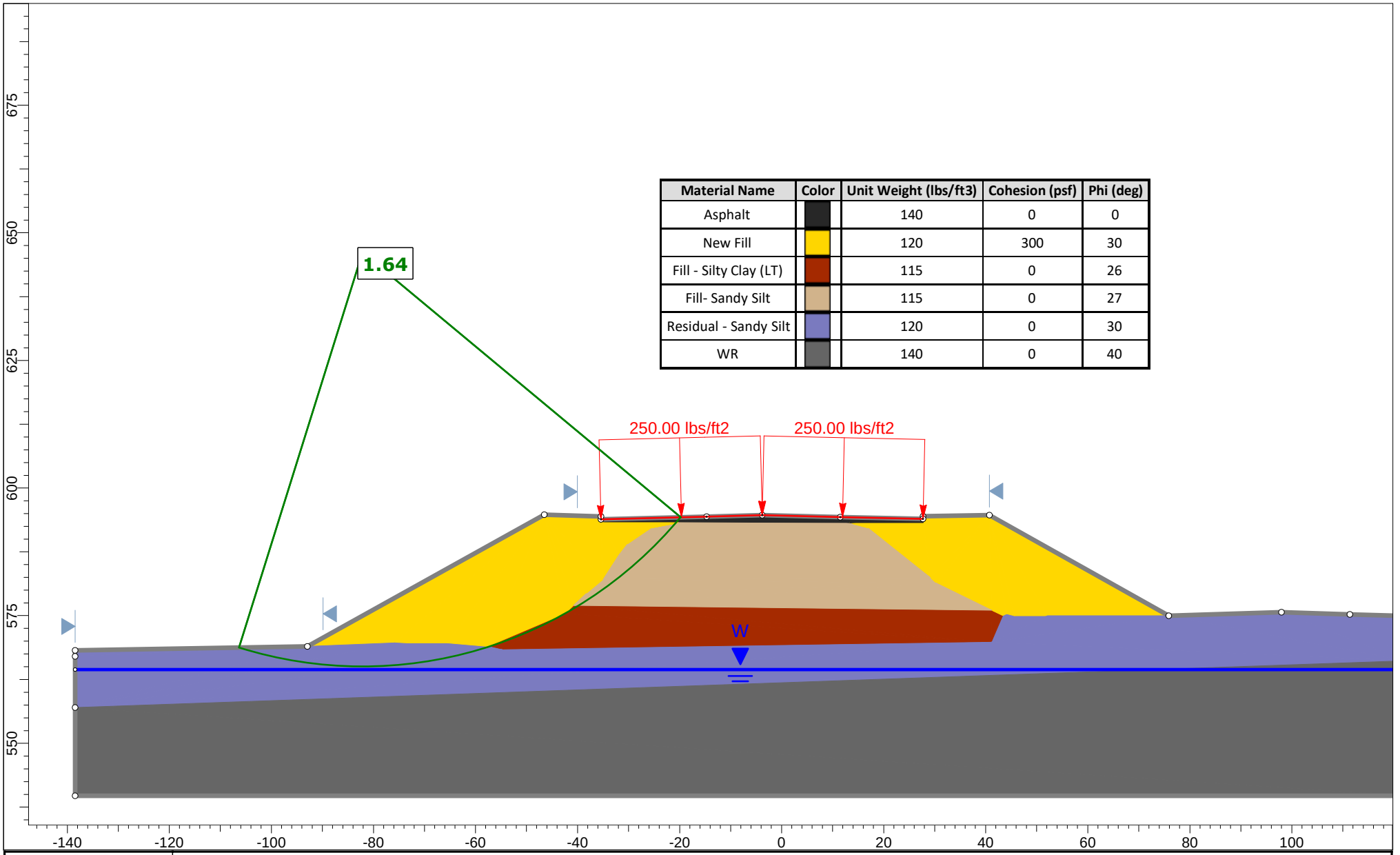
SLIDEINTERPRET 9.014



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Silty Clay		115	1130	0
Fill- Sandy Silt		115	0	27
Residual - Sandy Silt		120	0	30
WR		140	0	40

Project: US21 & SC 51			
Analysis: Global Stability		Description: End of Construction-Left	
Drawn By: Joey Daily	Project Number: US21 34+00	Company: S&ME	Figure: ?
Location: US21 34+00	File Name: US21 34+00.slmd	Date: 4/28/2021	

SLIDEINTERPRET 9.014

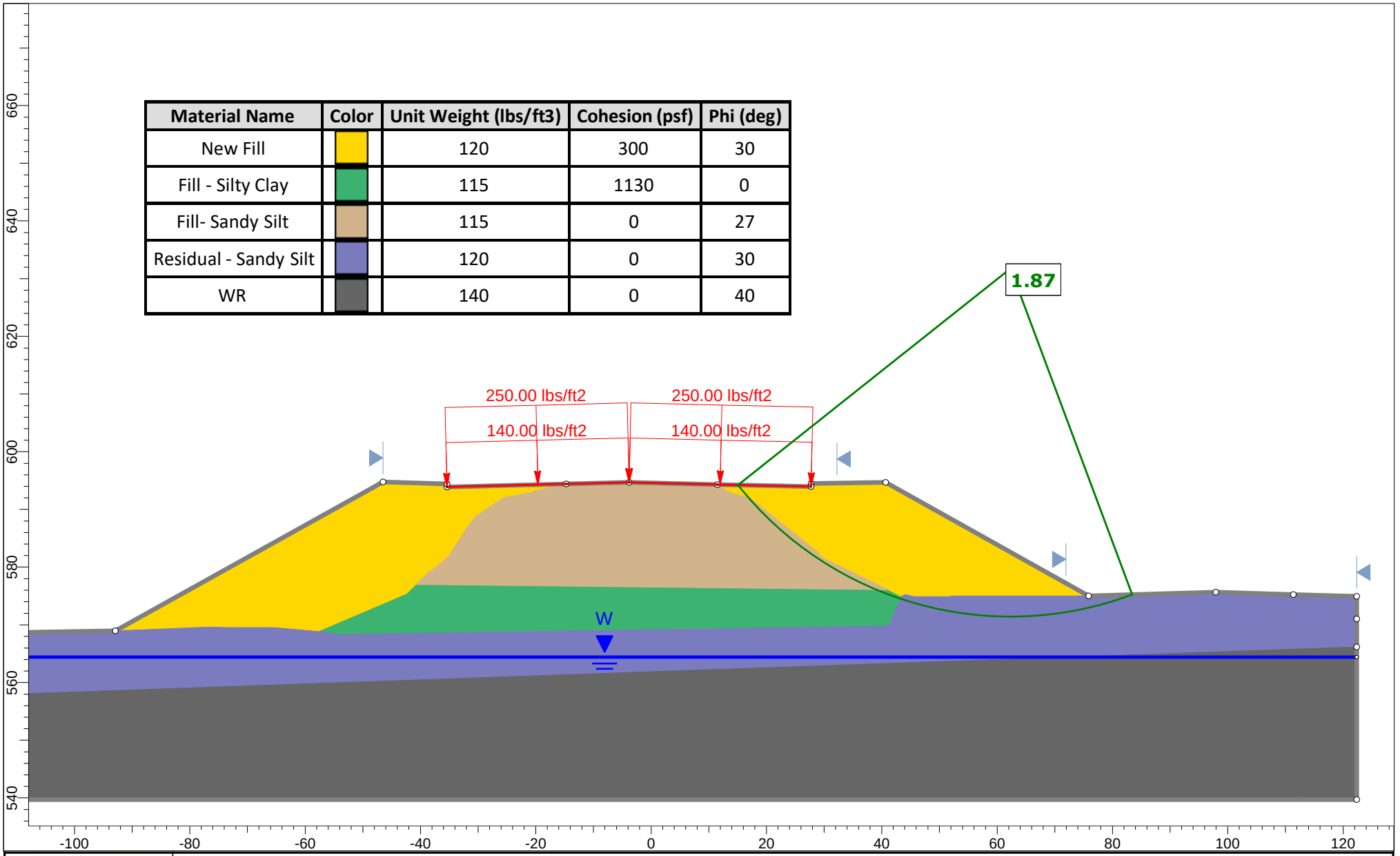


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Silty Clay (LT)		115	0	26
Fill- Sandy Silt		115	0	27
Residual - Sandy Silt		120	0	30
WR		140	0	40

Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term - Left
Drawn By	Joey Daily	Project Number	US21 34+00	Company S&ME	Figure ?
Location	US21 34+00	File Name	US21 34+00.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

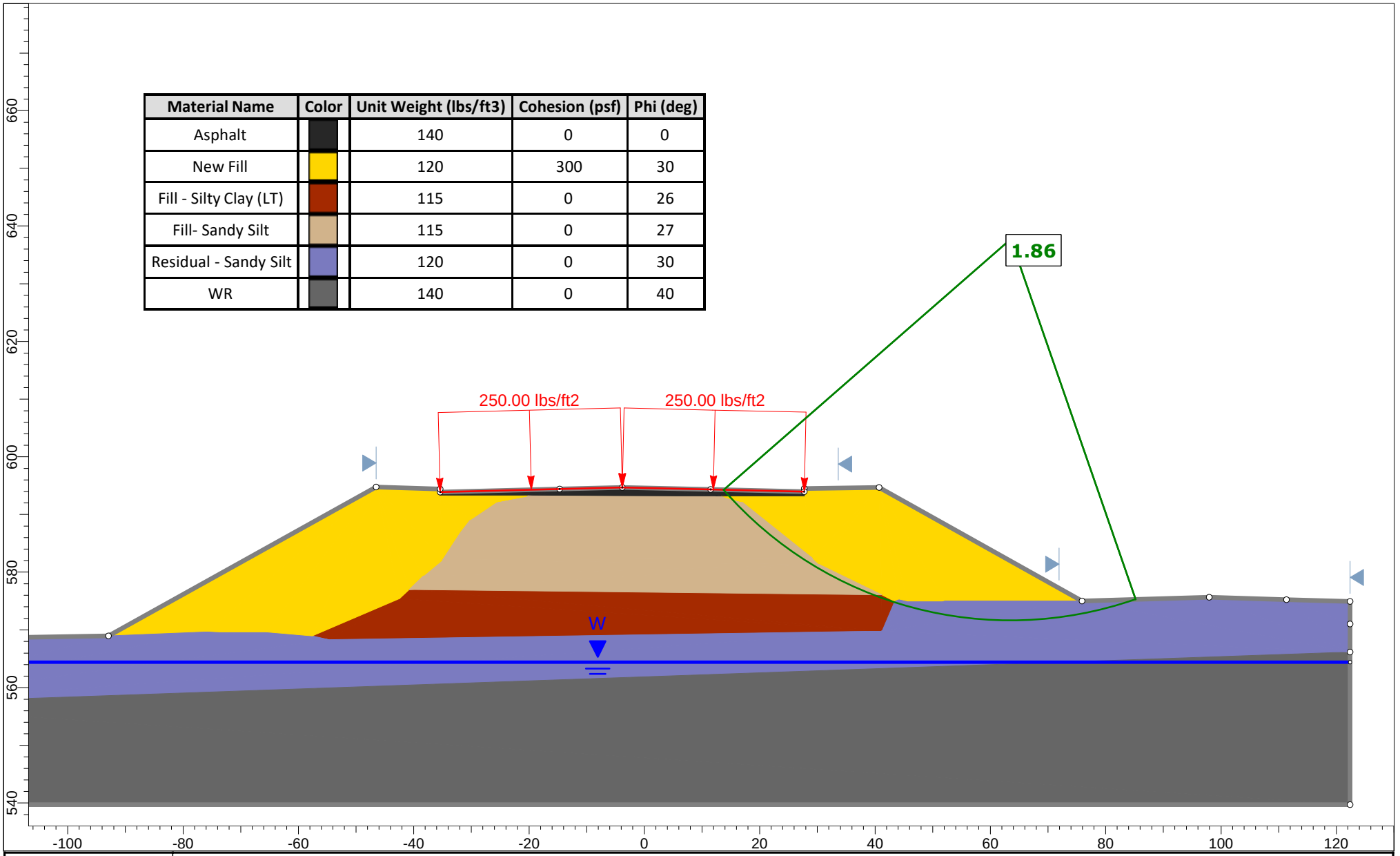
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Silty Clay		115	1130	0
Fill- Sandy Silt		115	0	27
Residual - Sandy Silt		120	0	30
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction - Right
Drawn By	Joey Daily	Project Number	US21 34+00	Company S&ME	Figure ?
Location	US21 34+00	File Name	US21 34+00.slmd	Date 4/28/2021	

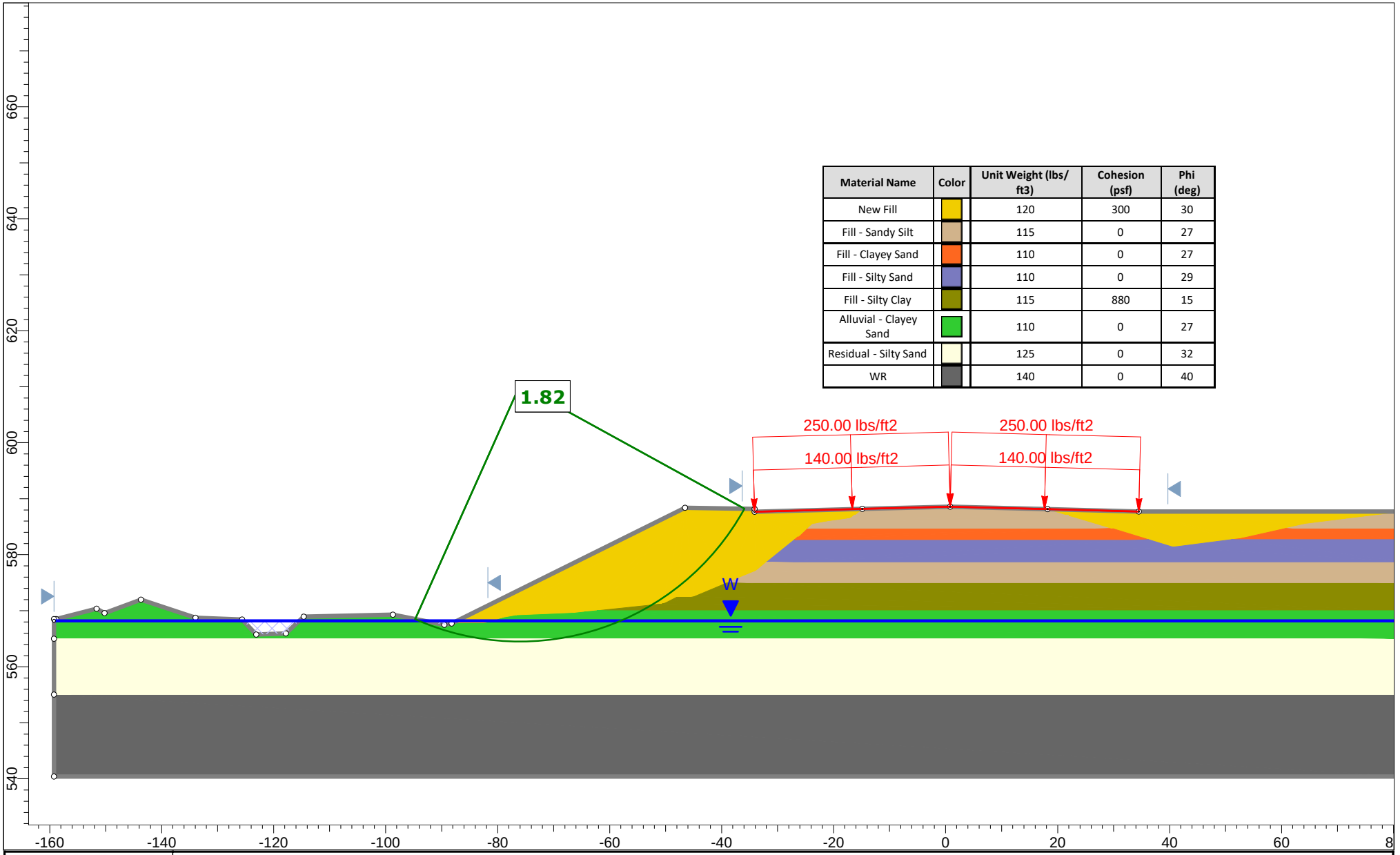
SLIDEINTERPRET 9.014

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Silty Clay (LT)		115	0	26
Fill- Sandy Silt		115	0	27
Residual - Sandy Silt		120	0	30
WR		140	0	40



Project	US21 & SC 51				
Analysis	Global Stability			Description	Long Term - Right
Drawn By	Joey Daily	Project Number	US21 34+00	Company	S&ME
Location	US21 34+00	File Name	US21 34+00.slmd	Date	4/28/2021
				Figure	?

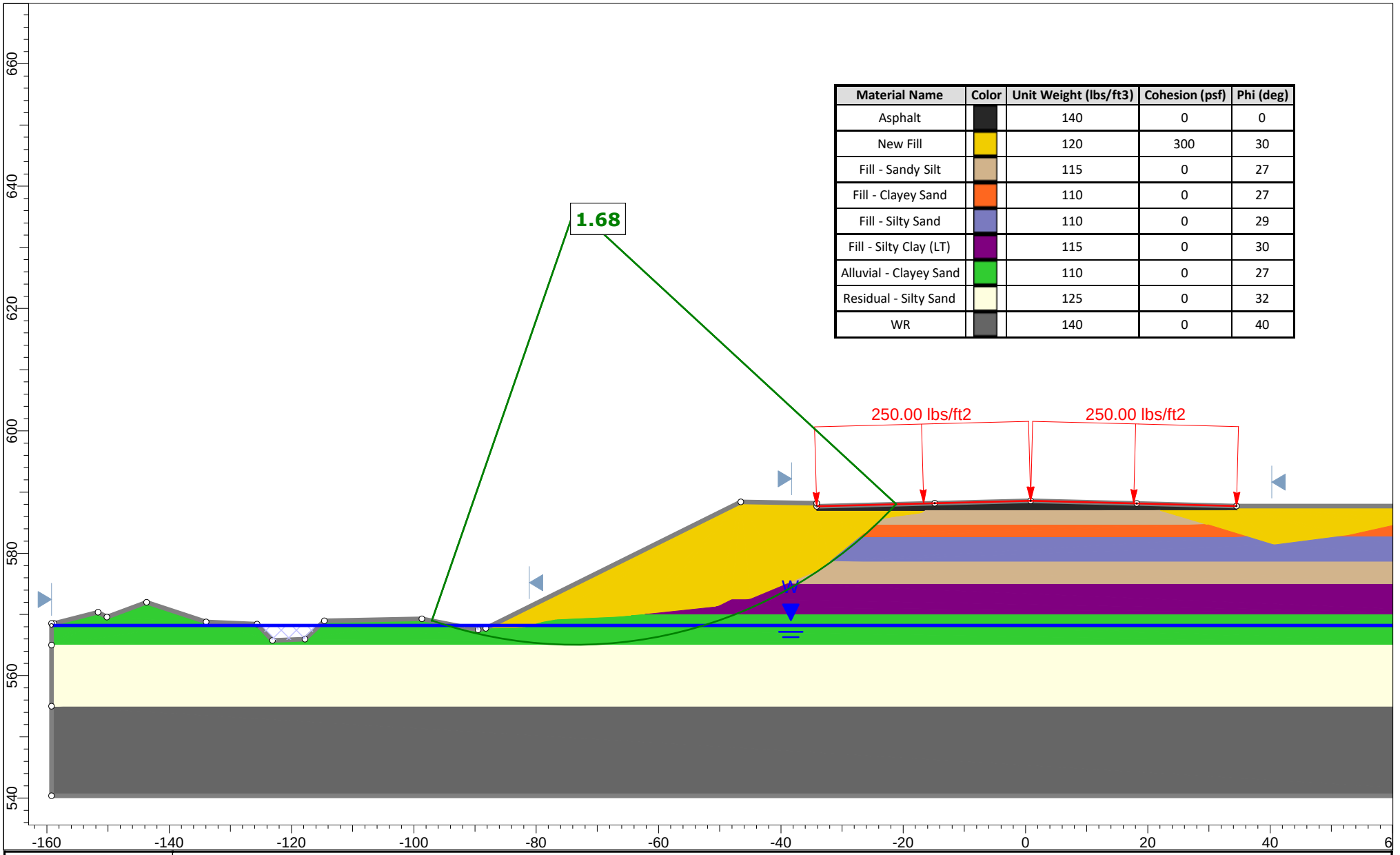
SLIDEINTERPRET 9.014



Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Sandy Silt		115	0	27
Fill - Clayey Sand		110	0	27
Fill - Silty Sand		110	0	29
Fill - Silty Clay		115	880	15
Alluvial - Clayey Sand		110	0	27
Residual - Silty Sand		125	0	32
WR		140	0	40

Project	US21 & SC 51			
Analysis	US21 39+00		Description	End of Construction
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 39+00	File Name	US21 39+00.slmd	Date 4/28/2021	

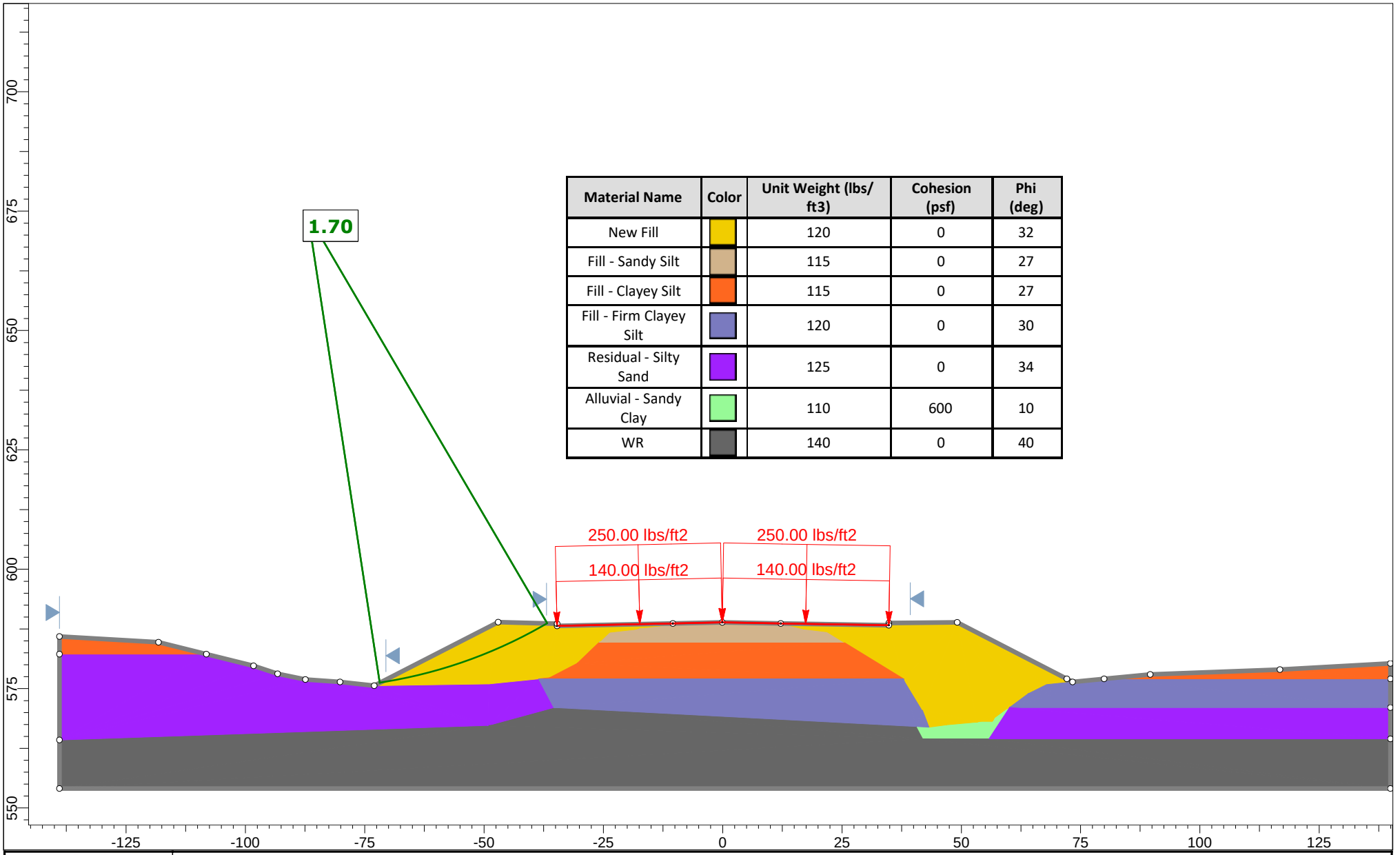
SLIDEINTERPRET 9.014



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Sandy Silt		115	0	27
Fill - Clayey Sand		110	0	27
Fill - Silty Sand		110	0	29
Fill - Silty Clay (LT)		115	0	30
Alluvial - Clayey Sand		110	0	27
Residual - Silty Sand		125	0	32
WR		140	0	40

Project	US21 & SC 51		
Analysis	US21 39+00	Description	Long Term
Drawn By: Joey Daily	Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 39+00	File Name: US21 39+00.slmd	Date: 4/28/2021	

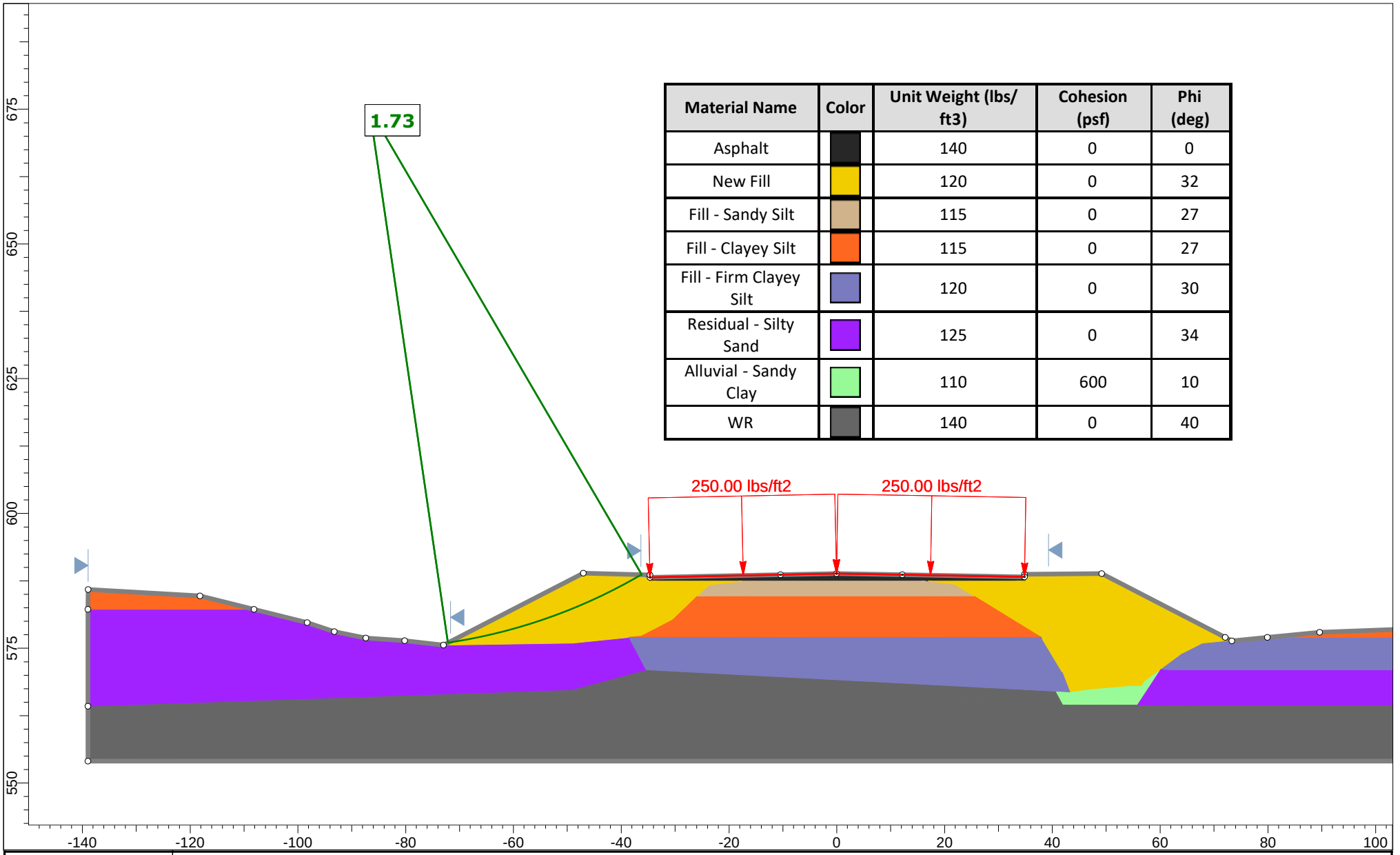
SLIDEINTERPRET 9.014



Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	0	32
Fill - Sandy Silt		115	0	27
Fill - Clayey Silt		115	0	27
Fill - Firm Clayey Silt		120	0	30
Residual - Silty Sand		125	0	34
Alluvial - Sandy Clay		110	600	10
WR		140	0	40

Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction - Left
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 41+50	File Name	US 41+50.slmd	Date 4/28/2021	

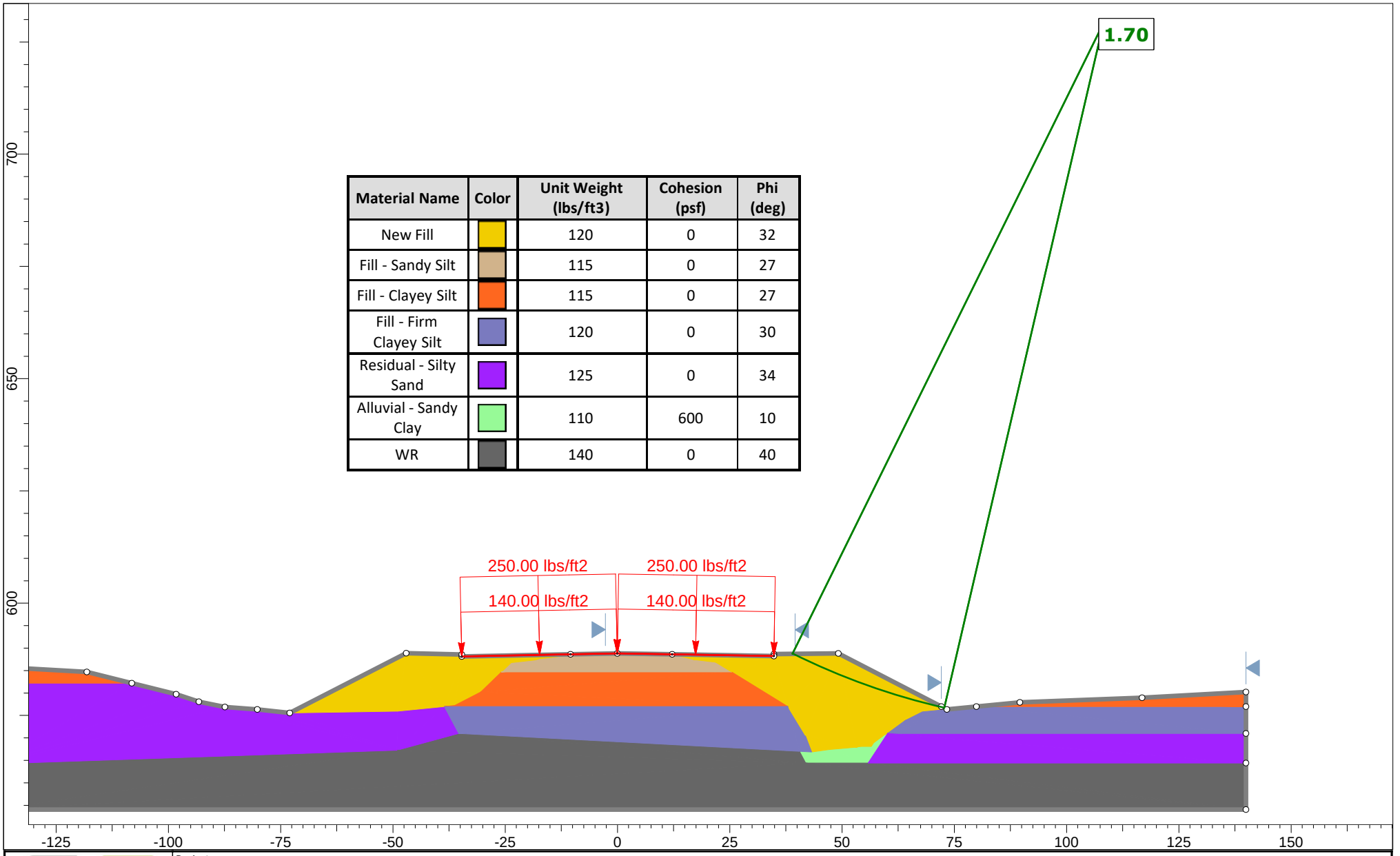
SLIDEINTERPRET 9.014



Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	0	32
Fill - Sandy Silt		115	0	27
Fill - Clayey Silt		115	0	27
Fill - Firm Clayey Silt		120	0	30
Residual - Silty Sand		125	0	34
Alluvial - Sandy Clay		110	600	10
WR		140	0	40

Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term - Left
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 41+50	File Name	US 41+50.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

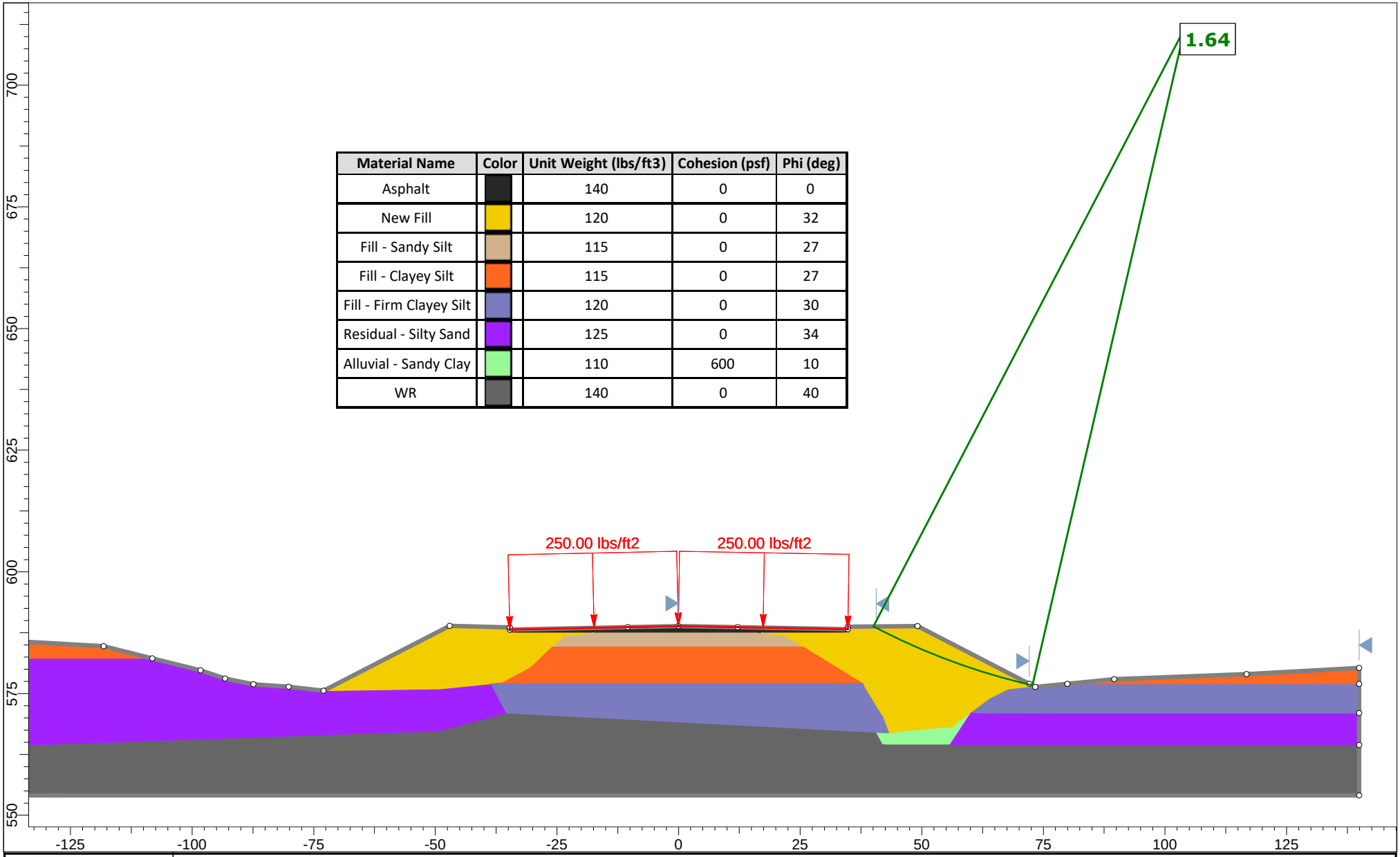


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	0	32
Fill - Sandy Silt		115	0	27
Fill - Clayey Silt		115	0	27
Fill - Firm Clayey Silt		120	0	30
Residual - Silty Sand		125	0	34
Alluvial - Sandy Clay		110	600	10
WR		140	0	40

Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Constuction - Right
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 41+50	File Name	US 41+50.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

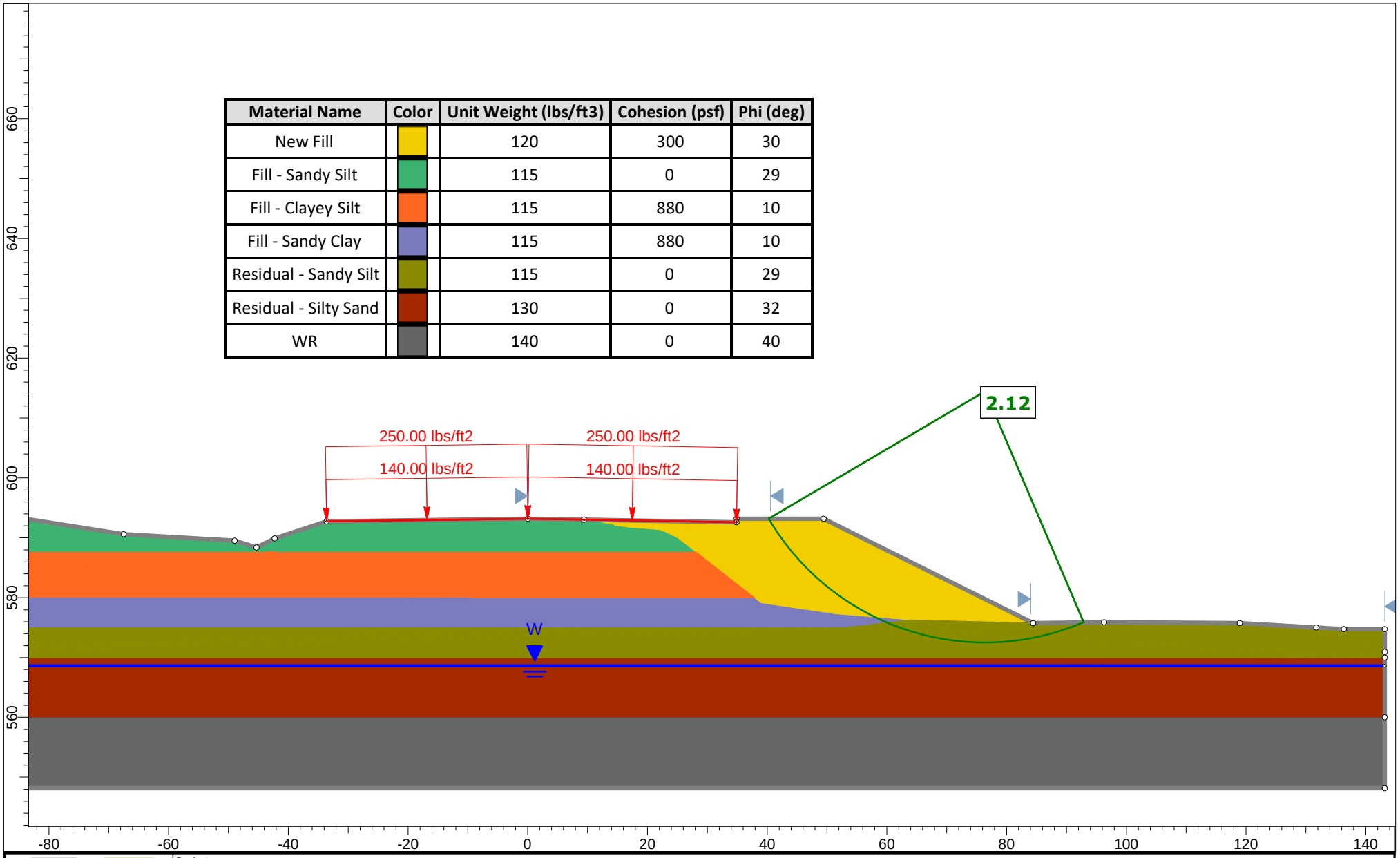
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	0	32
Fill - Sandy Silt		115	0	27
Fill - Clayey Silt		115	0	27
Fill - Firm Clayey Silt		120	0	30
Residual - Silty Sand		125	0	34
Alluvial - Sandy Clay		110	600	10
WR		140	0	40



Project: US21 & SC 51			
Analysis: Global Stability		Description: Long Term - Right	
Drawn By: Joey Daily	Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 41+50	File Name: US 41+50.slmd	Date: 4/28/2021	

SLIDEINTERPRET 9.014

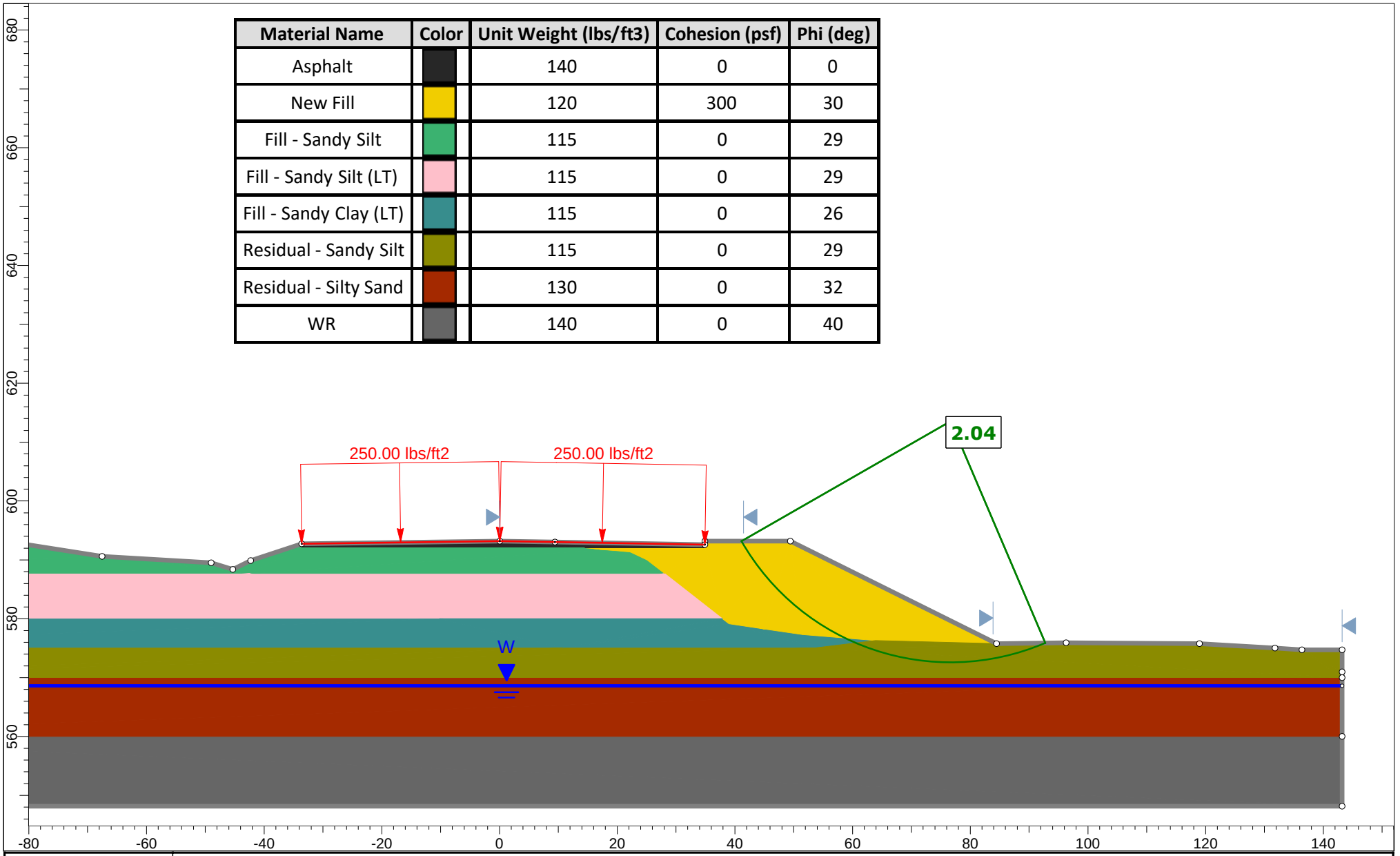
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Sandy Silt		115	0	29
Fill - Clayey Silt		115	880	10
Fill - Sandy Clay		115	880	10
Residual - Sandy Silt		115	0	29
Residual - Silty Sand		130	0	32
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME / Figure ?
Location	US21 43+50	File Name	US21 43+50.slmd	Date 4/28/2021

SLIDEINTERPRET 9.014

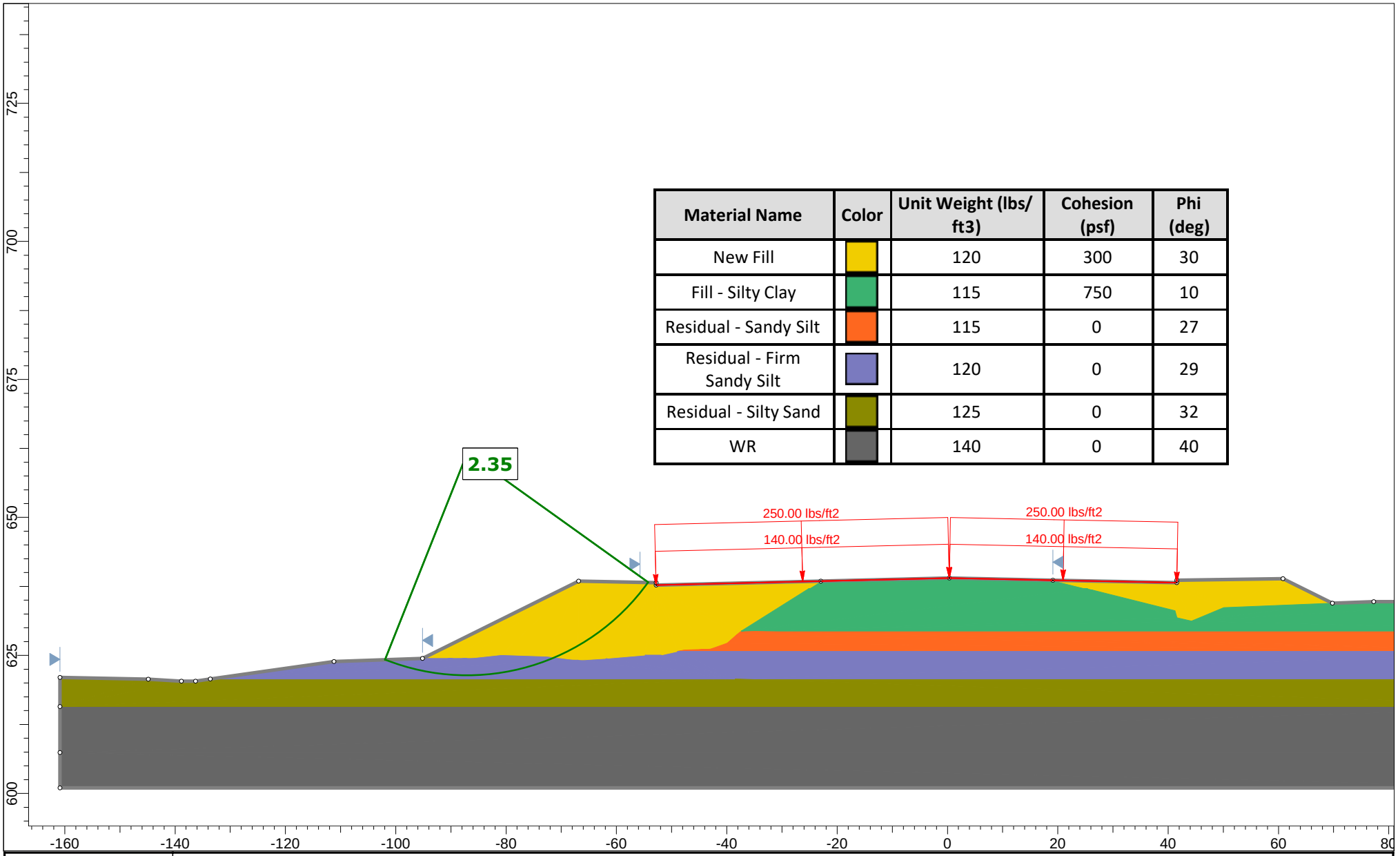
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Sandy Silt		115	0	29
Fill - Sandy Silt (LT)		115	0	29
Fill - Sandy Clay (LT)		115	0	26
Residual - Sandy Silt		115	0	29
Residual - Silty Sand		130	0	32
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 43+50	File Name	US21 43+50.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

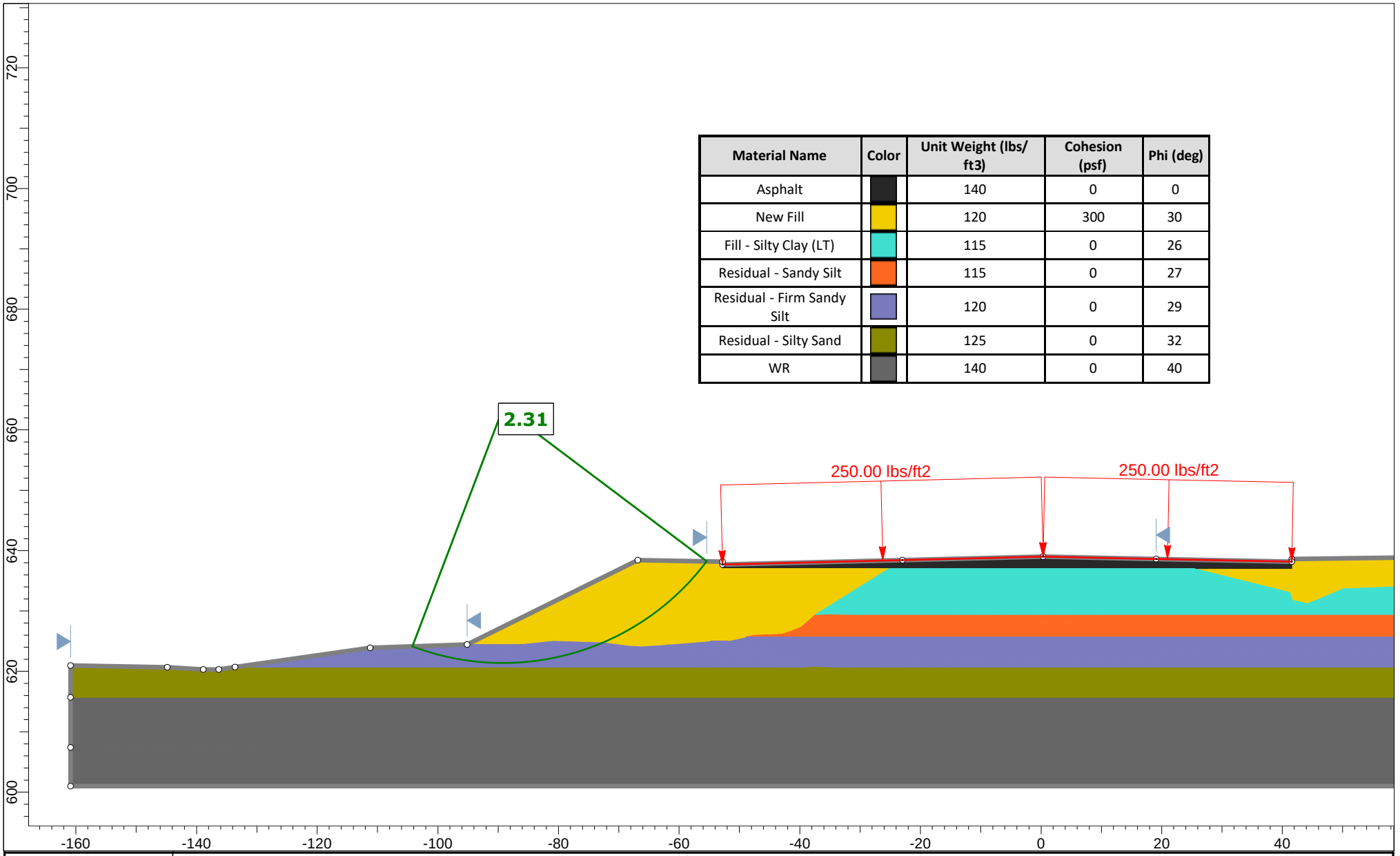
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Silty Clay		115	750	10
Residual - Sandy Silt		115	0	27
Residual - Firm Sandy Silt		120	0	29
Residual - Silty Sand		125	0	32
WR		140	0	40



Project	US21 & SC 51				
Analysis	Global Stability			Description	End of Construction
Drawn By	Joey Daily	Project Number	1351-12-037	Company	S&ME
Location	US21 66+00	File Name	US21 66+00.slmd	Date	4/28/2021
				Figure	?

SLIDEINTERPRET 9.014

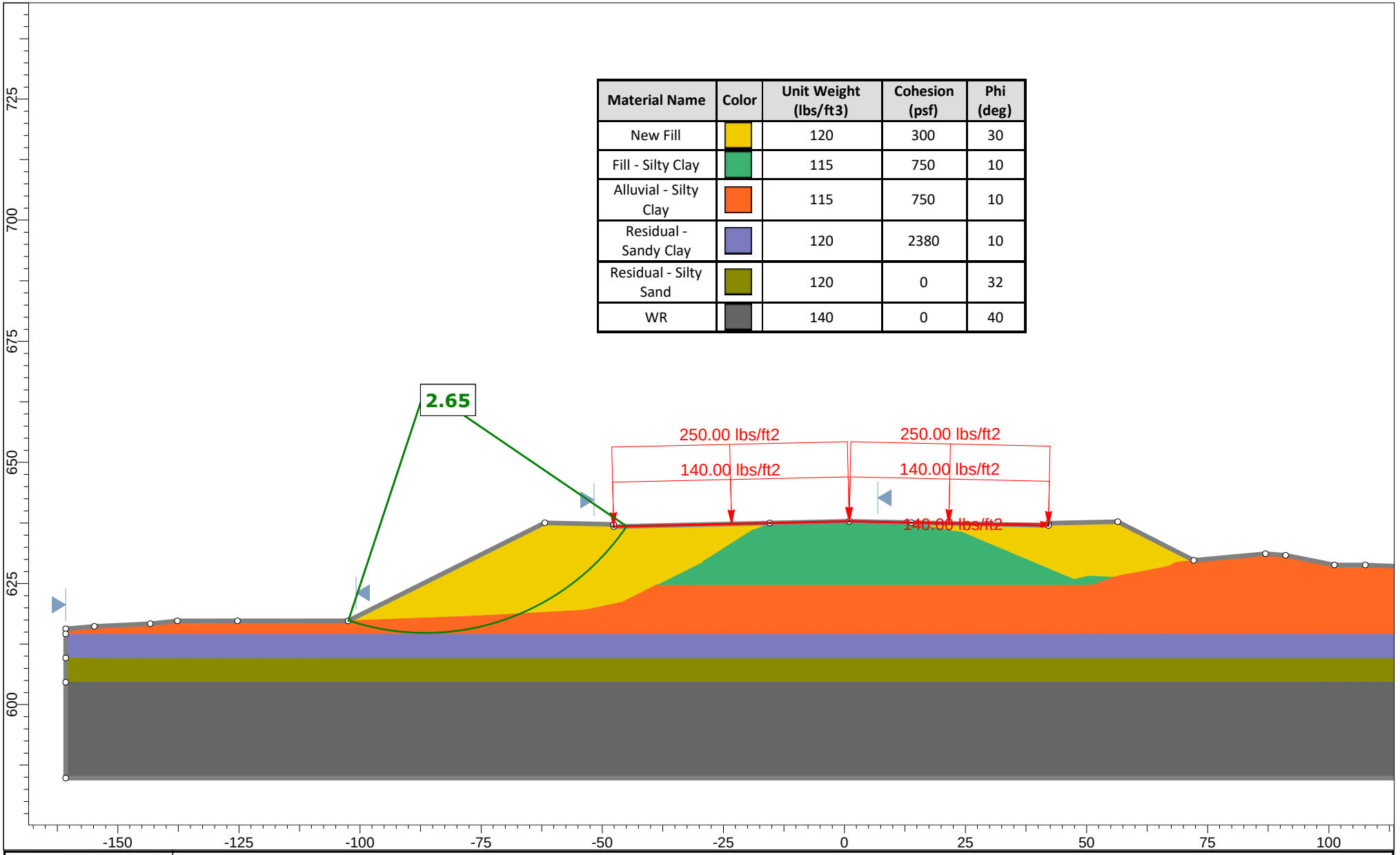
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Silty Clay (LT)		115	0	26
Residual - Sandy Silt		115	0	27
Residual - Firm Sandy Silt		120	0	29
Residual - Silty Sand		125	0	32
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 66+00	File Name	US21 66+00.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

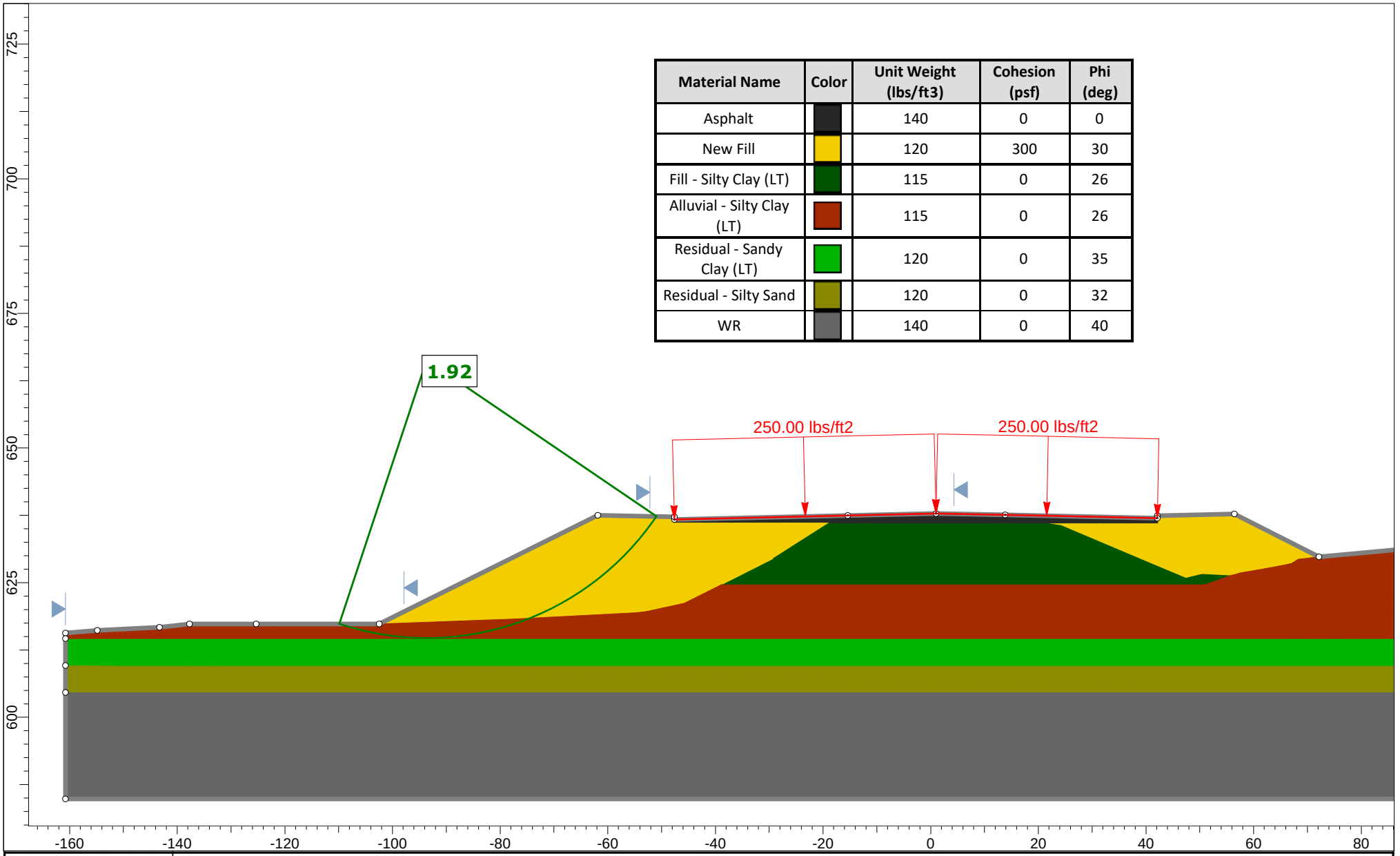
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Silty Clay		115	750	10
Alluvial - Silty Clay		115	750	10
Residual - Sandy Clay		120	2380	10
Residual - Silty Sand		120	0	32
WR		140	0	40



Project	US21 & SC 51		
Analysis	Global Stability	Description	End of Construction - Left
Drawn By	Joey Daily	Project Number	1351-12-037
Location	US 67+00	File Name	US21 67+00.slmd
Company	S&ME	Figure	?
Date	4/28/2021		

SLIDEINTERPRET 9.014

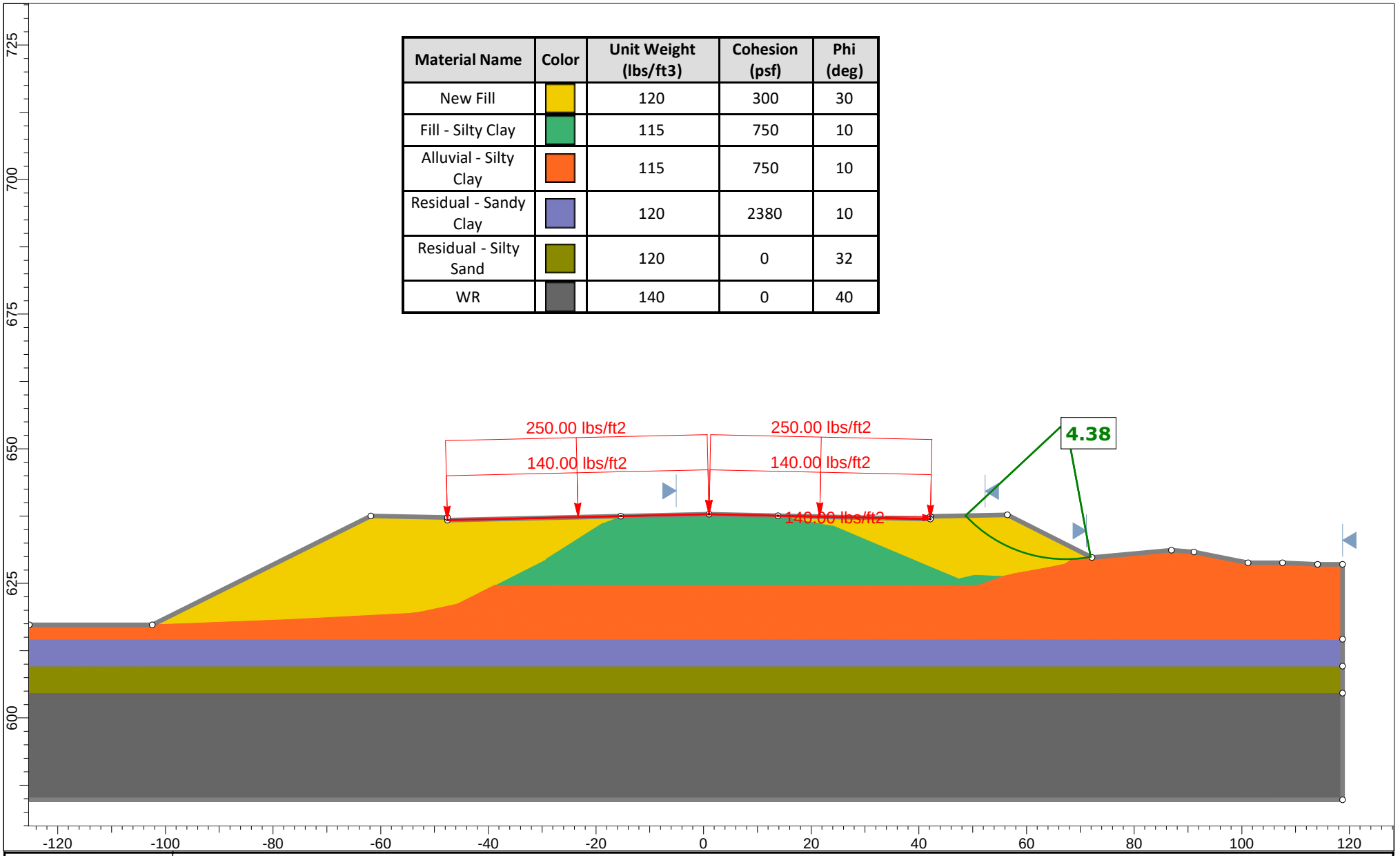
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Silty Clay (LT)		115	0	26
Alluvial - Silty Clay (LT)		115	0	26
Residual - Sandy Clay (LT)		120	0	35
Residual - Silty Sand		120	0	32
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term - Left
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US 67+00	File Name	US21 67+00.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

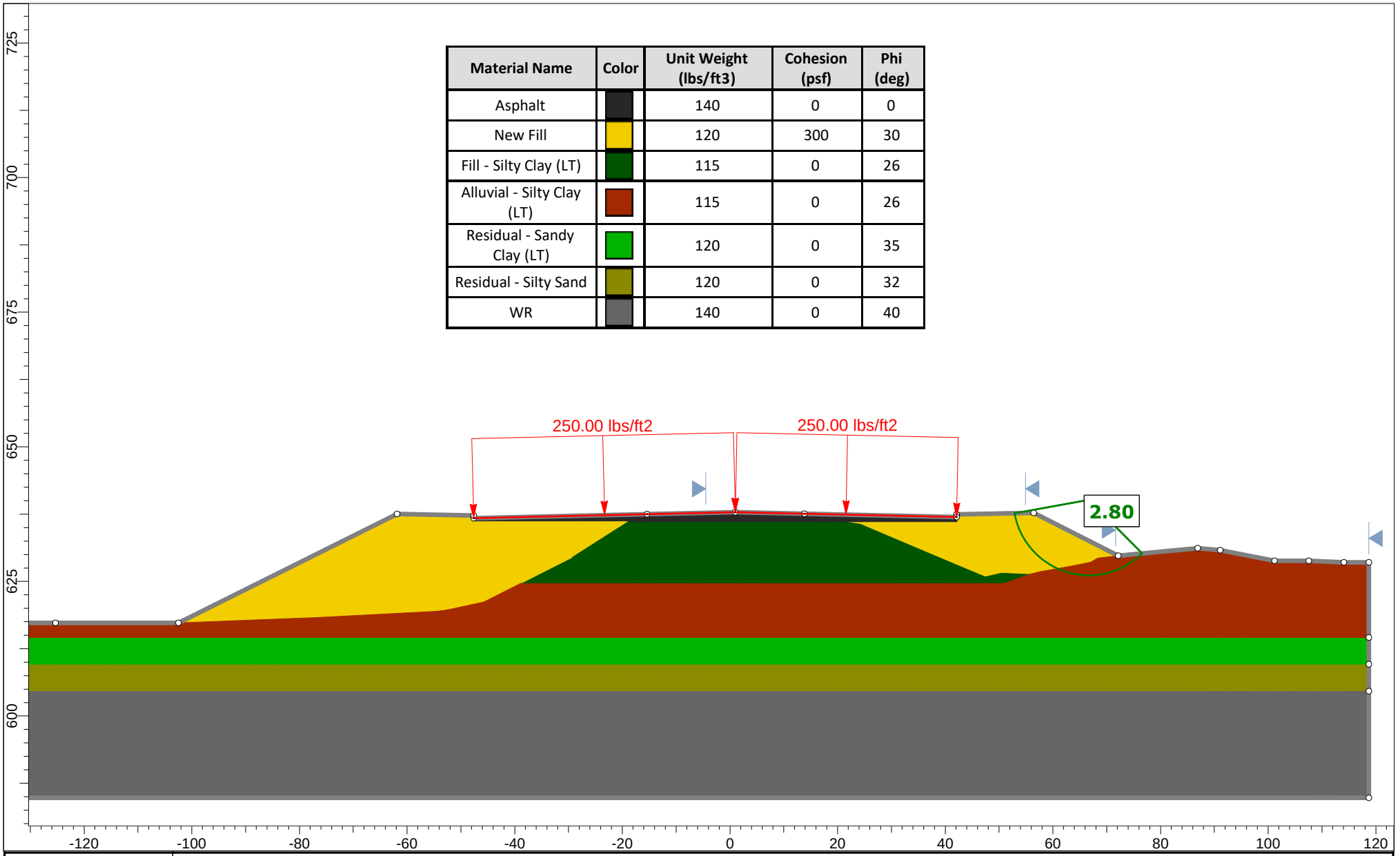
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Silty Clay		115	750	10
Alluvial - Silty Clay		115	750	10
Residual - Sandy Clay		120	2380	10
Residual - Silty Sand		120	0	32
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction - Right
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME / Figure ?
Location	US 67+00	File Name	US21 67+00.slmd	Date 4/28/2021

SLIDEINTERPRET 9.014

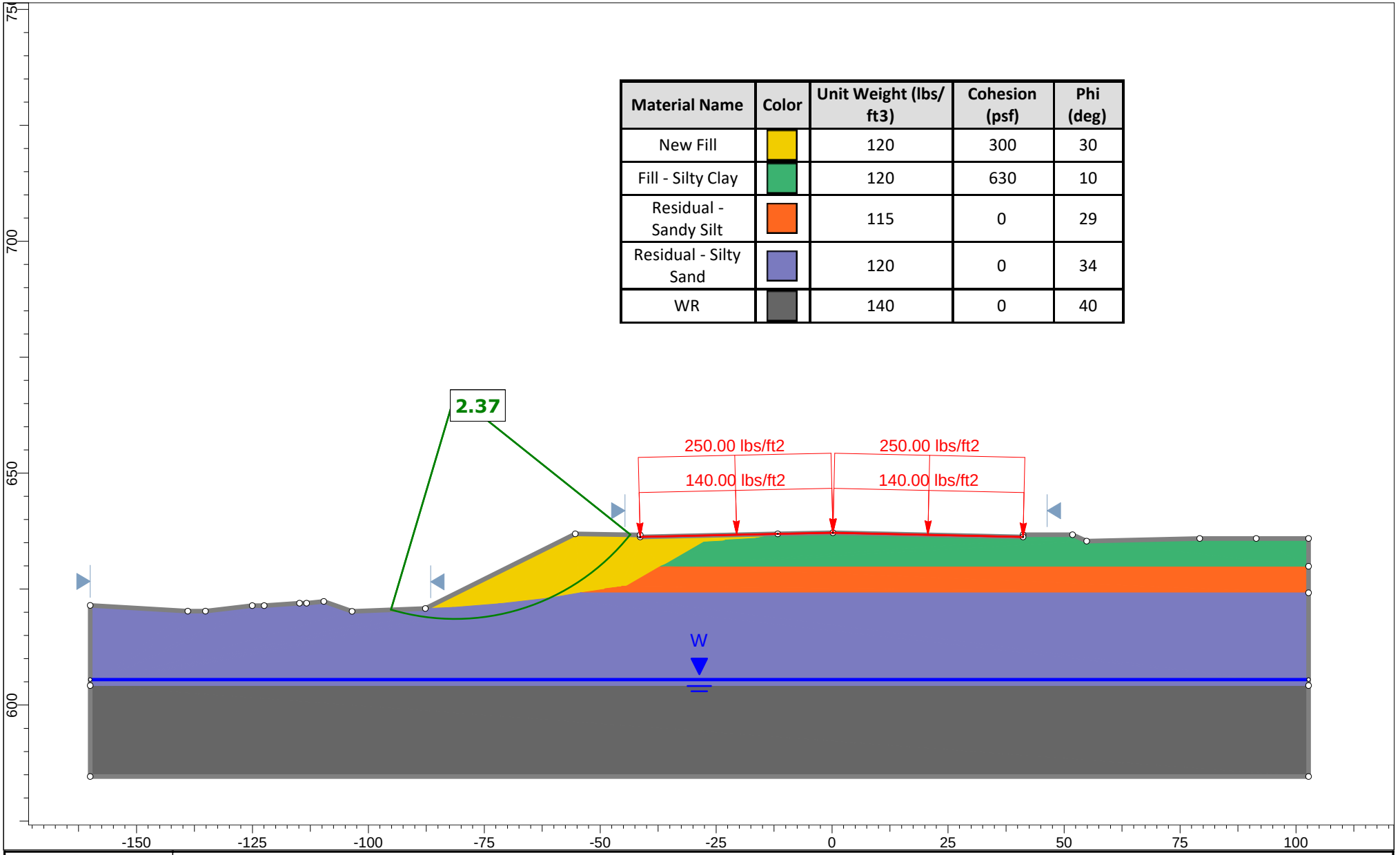
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Silty Clay (LT)		115	0	26
Alluvial - Silty Clay (LT)		115	0	26
Residual - Sandy Clay (LT)		120	0	35
Residual - Silty Sand		120	0	32
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term - Right
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME / Figure ?
Location	US 67+00	File Name	US21 67+00.slmd	Date 4/28/2021

SLIDEINTERPRET 9.014

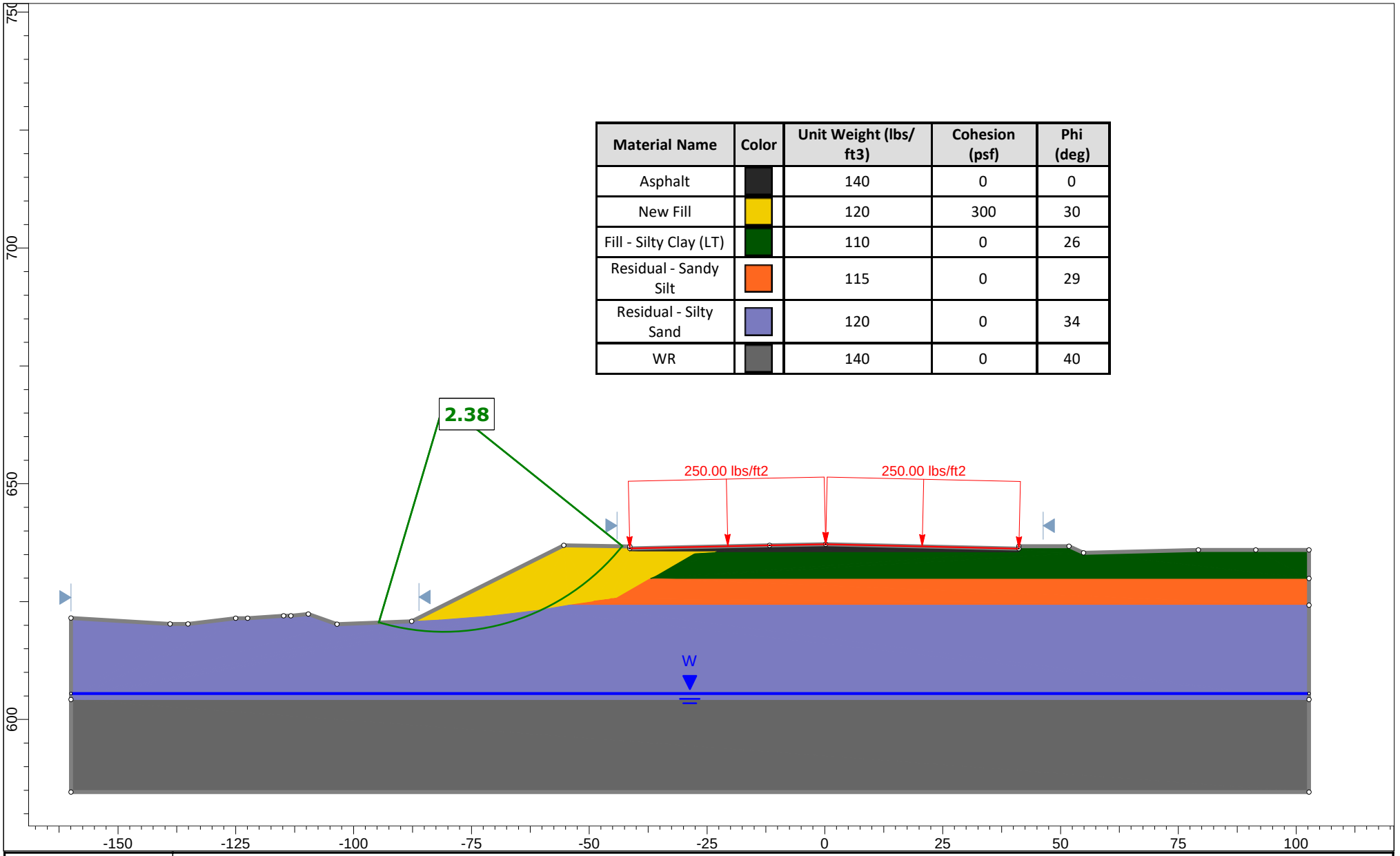
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Silty Clay		120	630	10
Residual - Sandy Silt		115	0	29
Residual - Silty Sand		120	0	34
WR		140	0	40



Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME / Figure ?
Location	US21 68+00	File Name	US21 68+00.slmd	Date 4/28/2021

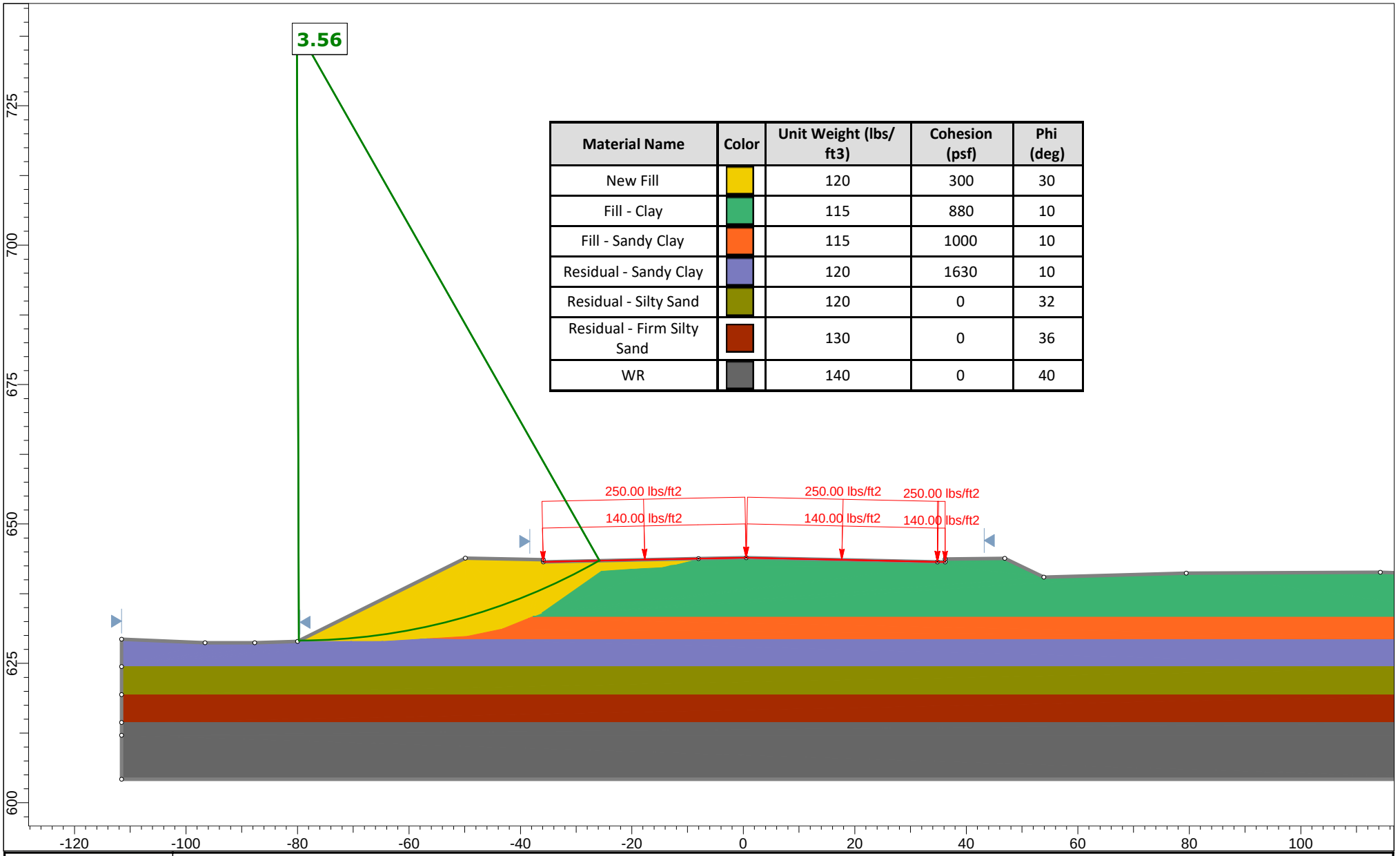
SLIDEINTERPRET 9.014

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Silty Clay (LT)		110	0	26
Residual - Sandy Silt		115	0	29
Residual - Silty Sand		120	0	34
WR		140	0	40



Project: US21 & SC 51			
Analysis: Global Stability		Description: Long Term	
Drawn By: Joey Daily	Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 68+00	File Name: US21 68+00.slmd	Date: 4/28/2021	

SLIDEINTERPRET 9.014

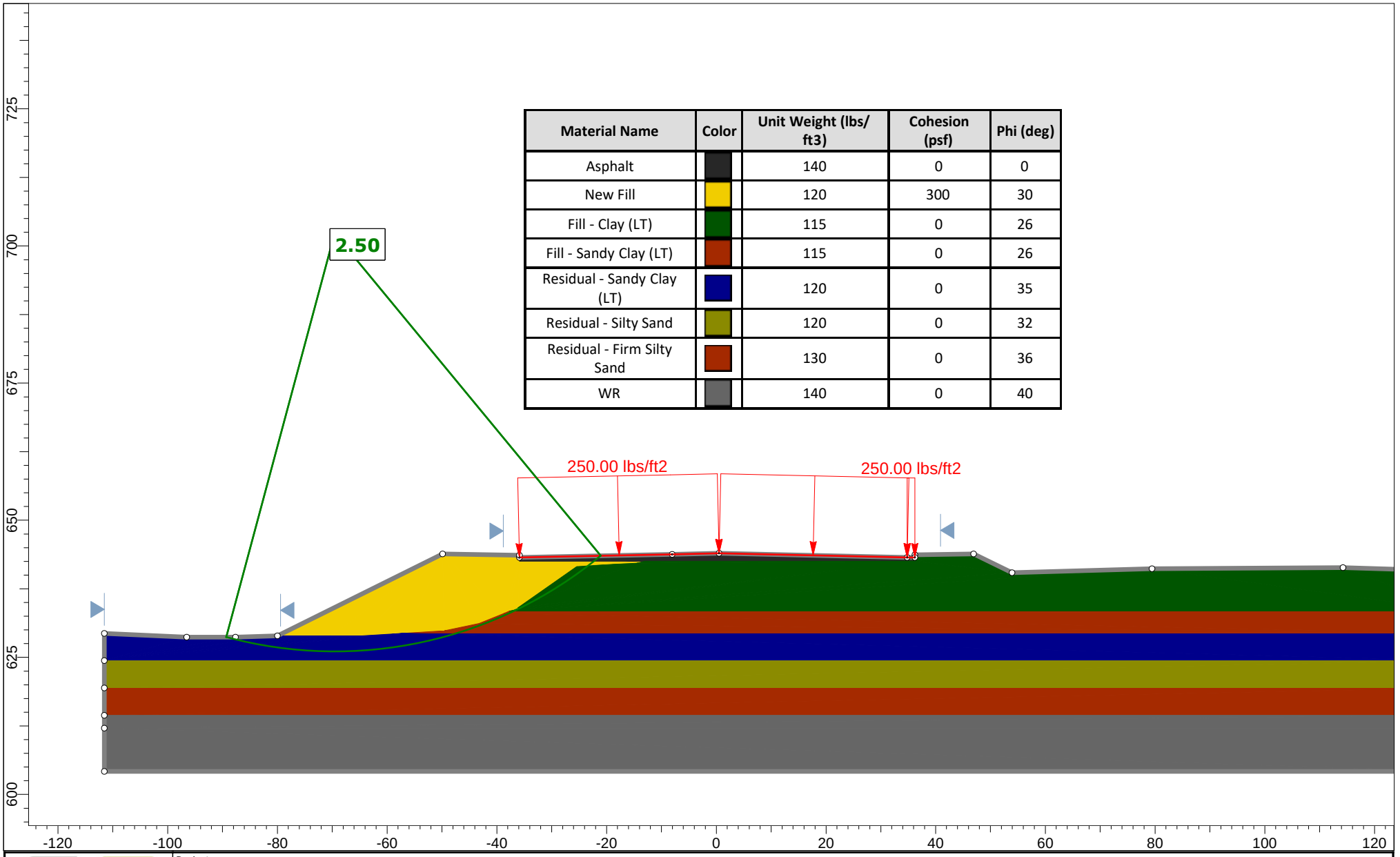


Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
New Fill		120	300	30
Fill - Clay		115	880	10
Fill - Sandy Clay		115	1000	10
Residual - Sandy Clay		120	1630	10
Residual - Silty Sand		120	0	32
Residual - Firm Silty Sand		130	0	36
WR		140	0	40

Project	US21 & SC 51			
Analysis	Global Stability		Description	End of Construction
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 74+00	File Name	US21 74+00.slmd	Date 4/28/2021	

SLIDEINTERPRET 9.014

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Asphalt		140	0	0
New Fill		120	300	30
Fill - Clay (LT)		115	0	26
Fill - Sandy Clay (LT)		115	0	26
Residual - Sandy Clay (LT)		120	0	35
Residual - Silty Sand		120	0	32
Residual - Firm Silty Sand		130	0	36
WR		140	0	40

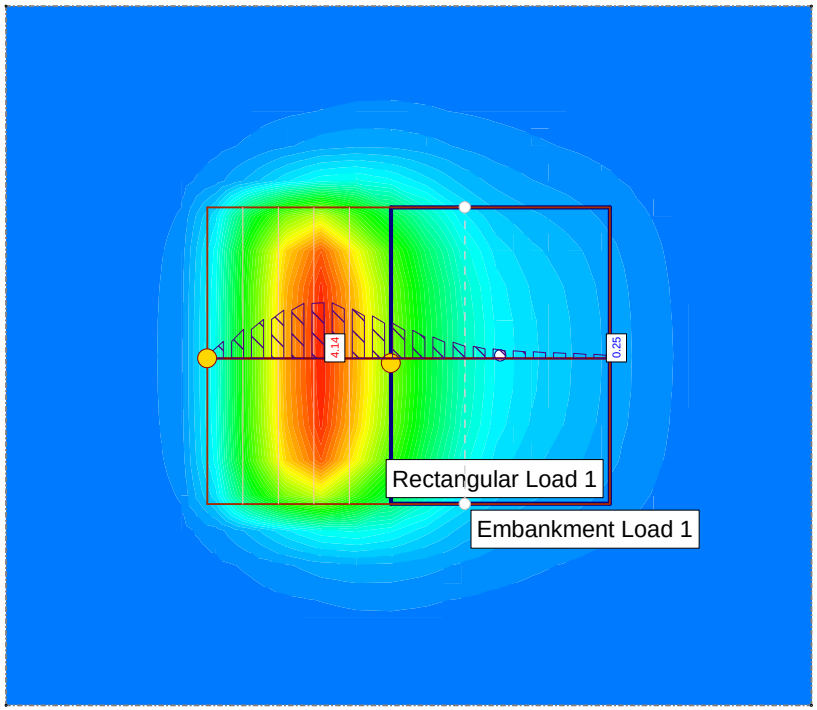


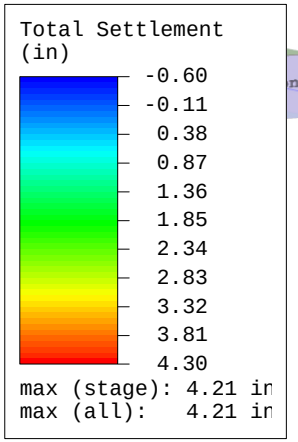
Project	US21 & SC 51			
Analysis	Global Stability		Description	Long Term
Drawn By	Joey Daily	Project Number	1351-12-037	Company S&ME	Figure ?
Location	US21 74+00	File Name	US21 74+00.slmd	Date 4/28/2021	

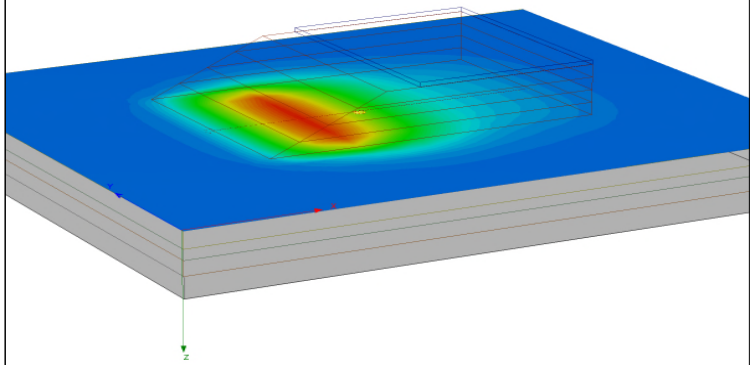
SLIDEINTERPRET 9.014

Appendix IV – Settlement Analysis Results

Material Name	Color	Unit Weight (kips/ft3)	Es (ksf)	Eur (ksf)	Cc	Cr	Pc (ksf)	e0	Cv (ft2/y)	Cvr (ft2/y)
Alluvial - Silty Sand		0.11	67	67	-	-	-	-	-	-
Residual - Sandy Clay		0.12	143	143	0.28	0.028	10	0.841	29.0626	29.0626
Residual - Silty Sand		0.131	785	785	-	-	-	-	-	-
Weathered Rock		0.14	-	-	-	-	-	-	-	-



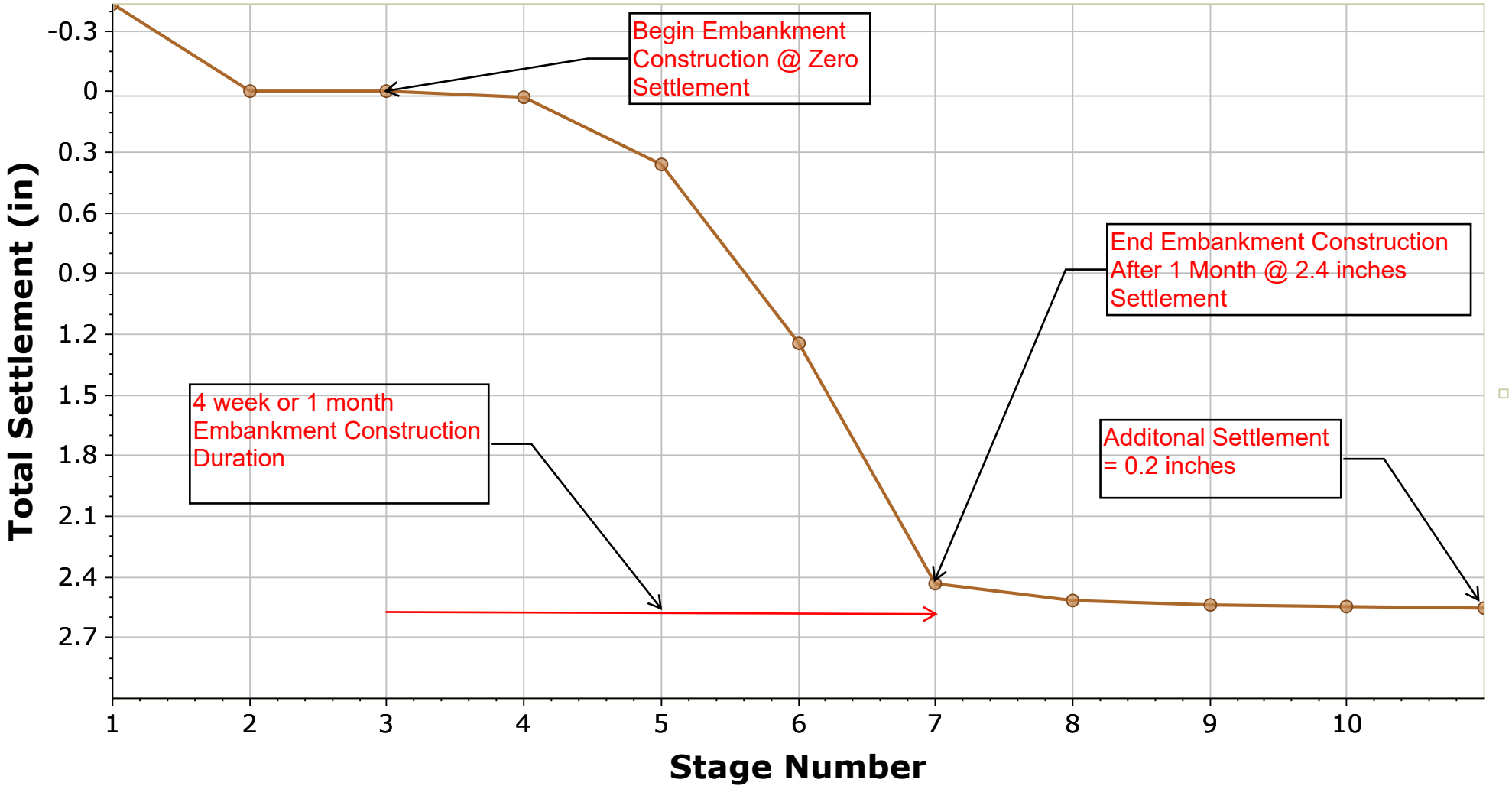




Project	SCDOT US21 & SC51			
Analysis	Settlement			
Drawn By: J. Daily		Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 23+50		File Name: US21 23+50.s3z	Date: 4/23/2021	

SETTLE3 5.010

Stage Number vs. Total Settlement

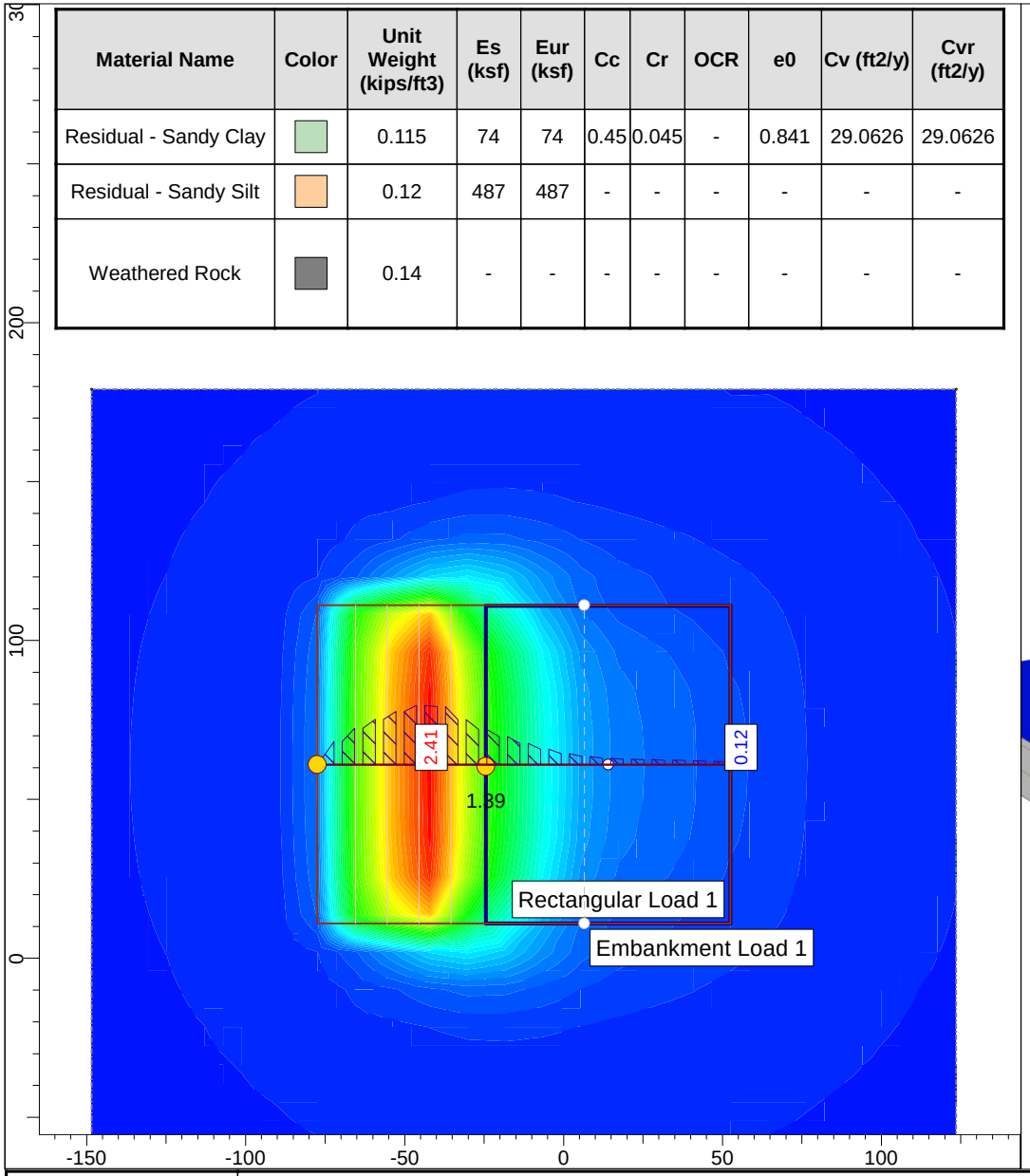


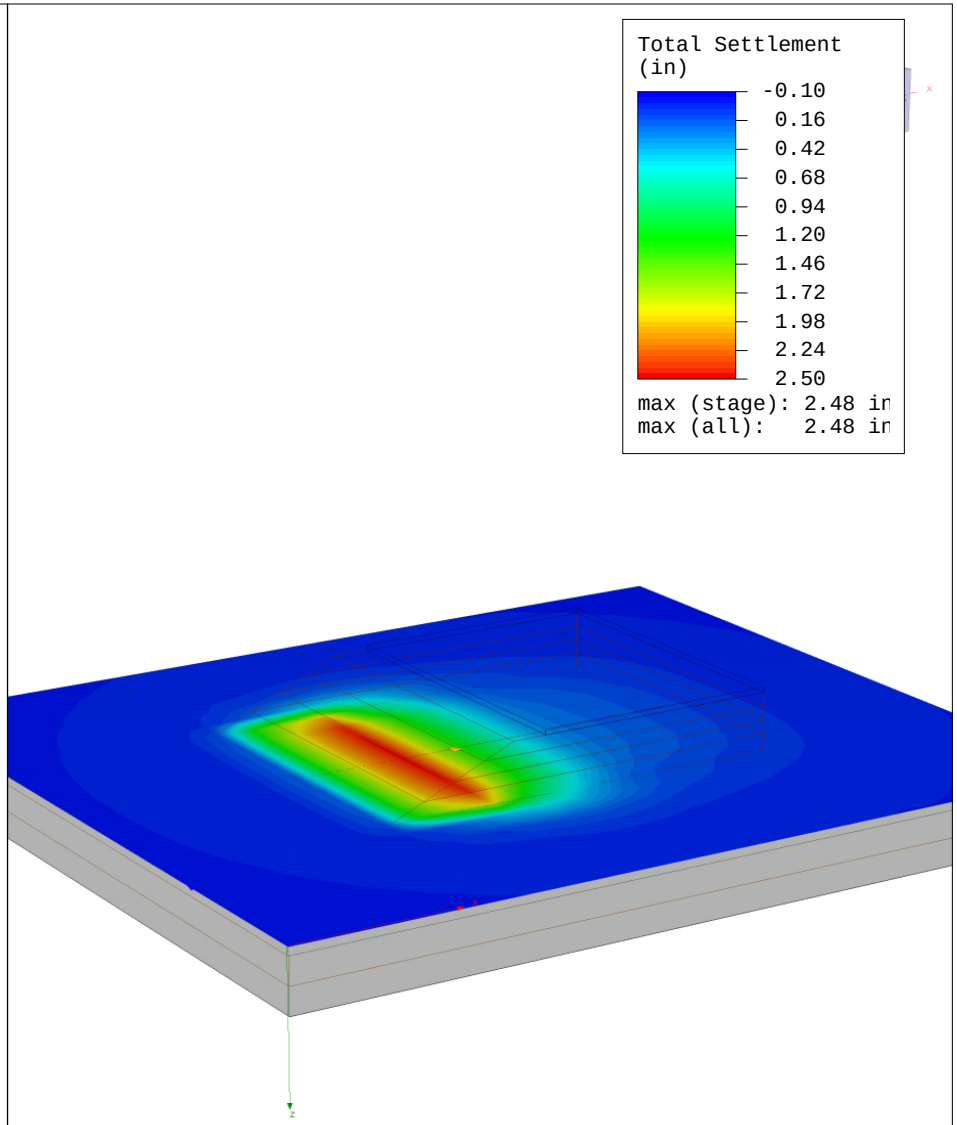
Reference Stage: Stage 3 = 240.1 mon
Total Settlement at Elevation = 0 ft

Project	SCDOT US21 & SC51			
Analysis	Settlement Under Edge of Pavement			
Drawn By: J. Daily		Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 23+50		File Name: US21 23+50.s3z	Date: 4/23/2021	

SETTLE3 5.010

Material Name	Color	Unit Weight (kips/ft3)	Es (ksf)	Eur (ksf)	Cc	Cr	OCR	e0	Cv (ft2/y)	Cvr (ft2/y)
Residual - Sandy Clay		0.115	74	74	0.45	0.045	-	0.841	29.0626	29.0626
Residual - Sandy Silt		0.12	487	487	-	-	-	-	-	-
Weathered Rock		0.14	-	-	-	-	-	-	-	-

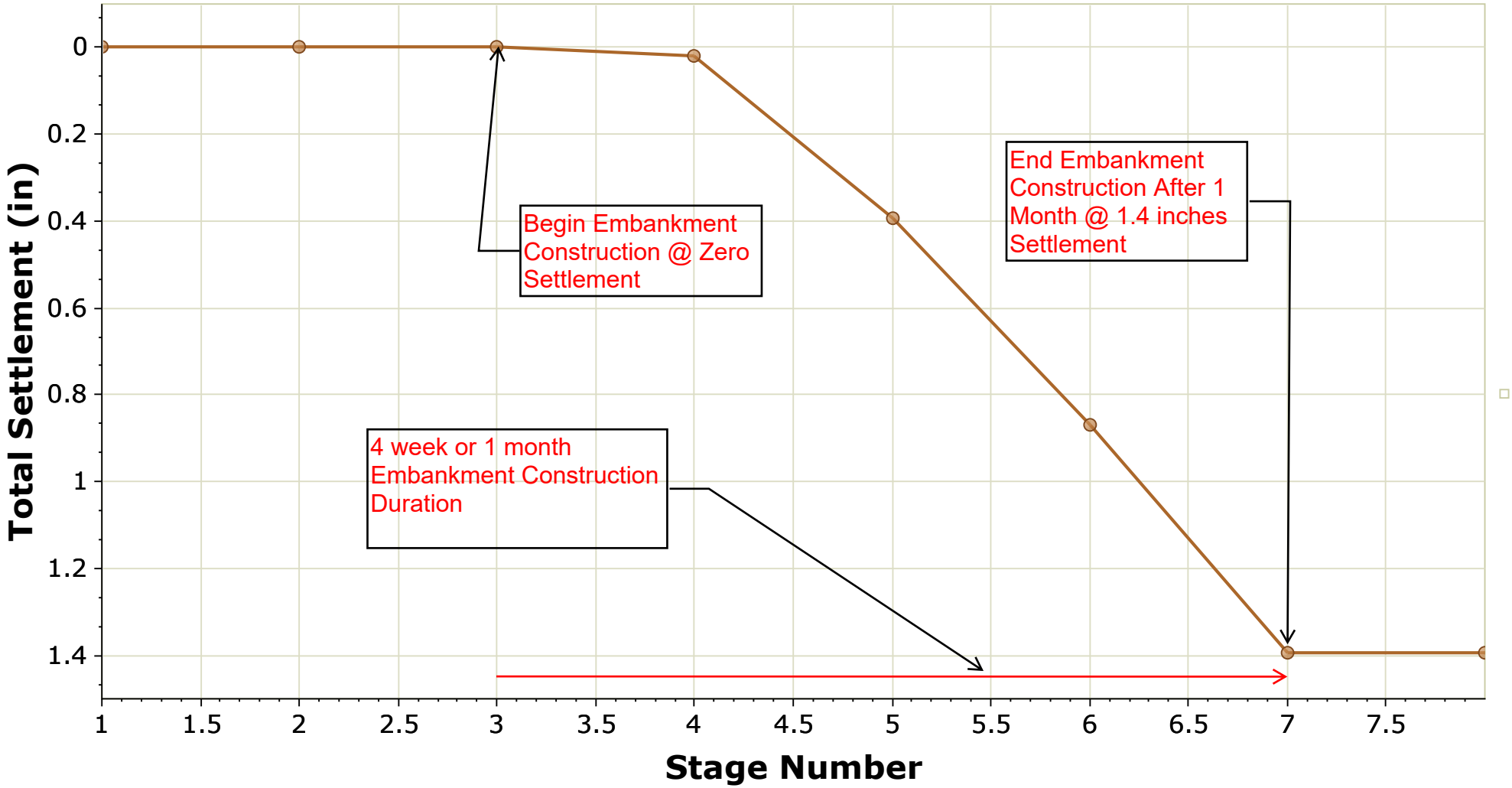




Project: SCDOT US21 & SC51			
Analysis: Settlement Under Edge of Pavement			
Drawn By: J. Daily	Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 34+00	File Name: US21 34+00.s3z	Date: 4/23/2021	

SETTLE3 5.010

Stage Number vs. Total Settlement

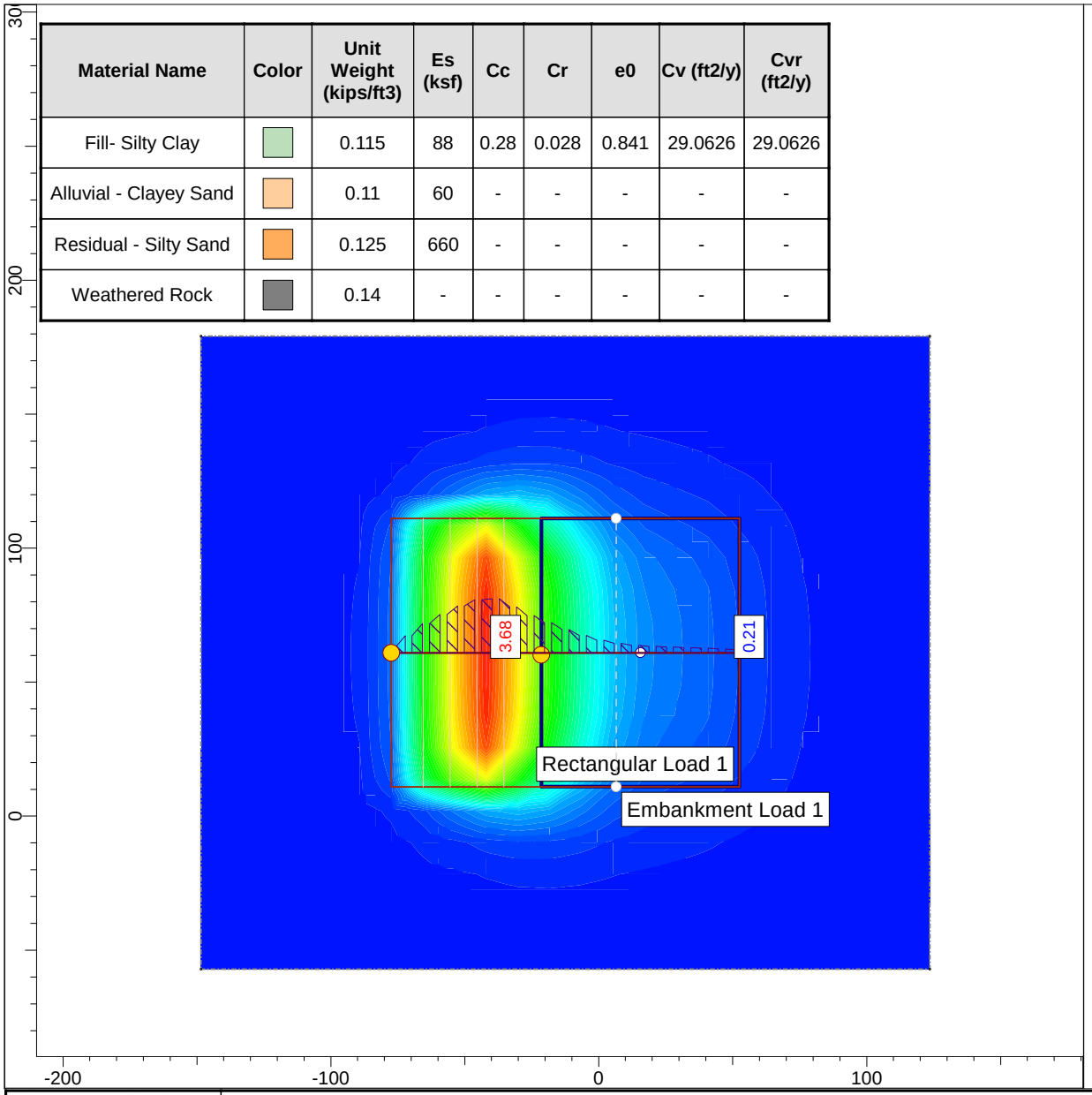


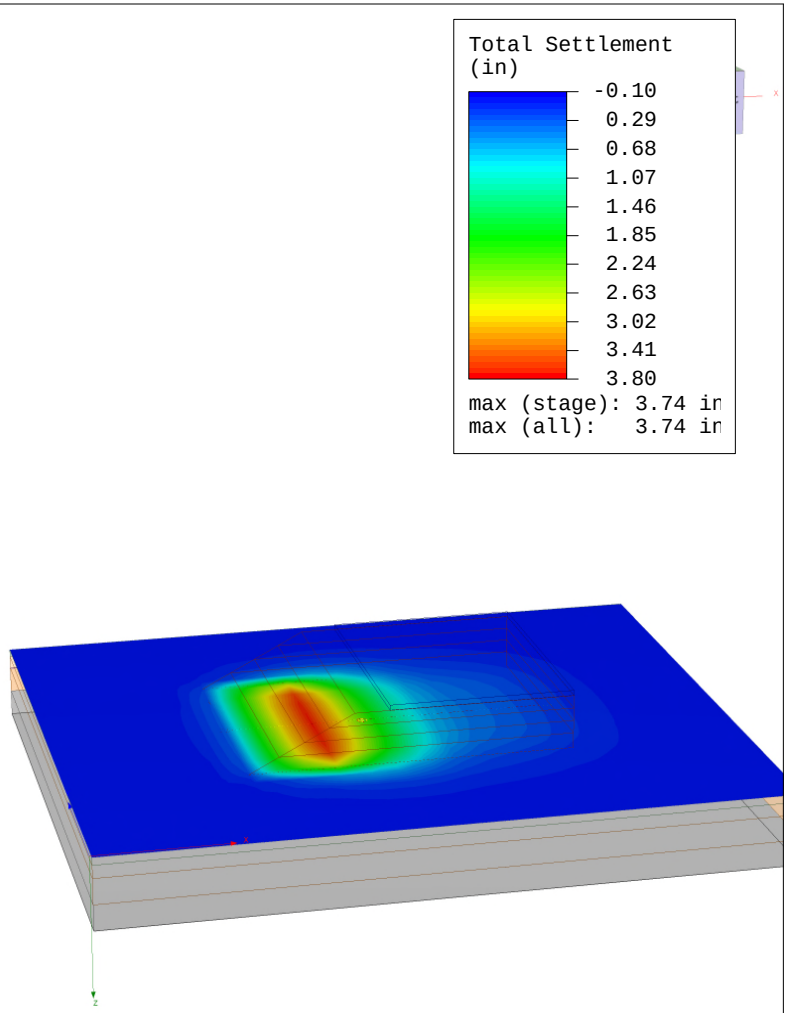
Reference Stage: Stage 3 = 240.1 mon
Total Settlement at Elevation = 0 ft

Project	SCDOT US21 & SC51			
Analysis	Settlement Under Edge of Pavement			
Drawn By: J. Daily		Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 34+00		File Name: US21 34+00.s3z	Date: 4/23/2021	

SETTLE3 5.010

Material Name	Color	Unit Weight (kips/ft3)	Es (ksf)	Cc	Cr	e0	Cv (ft2/y)	Cvr (ft2/y)
Fill- Silty Clay		0.115	88	0.28	0.028	0.841	29.0626	29.0626
Alluvial - Clayey Sand		0.11	60	-	-	-	-	-
Residual - Silty Sand		0.125	660	-	-	-	-	-
Weathered Rock		0.14	-	-	-	-	-	-

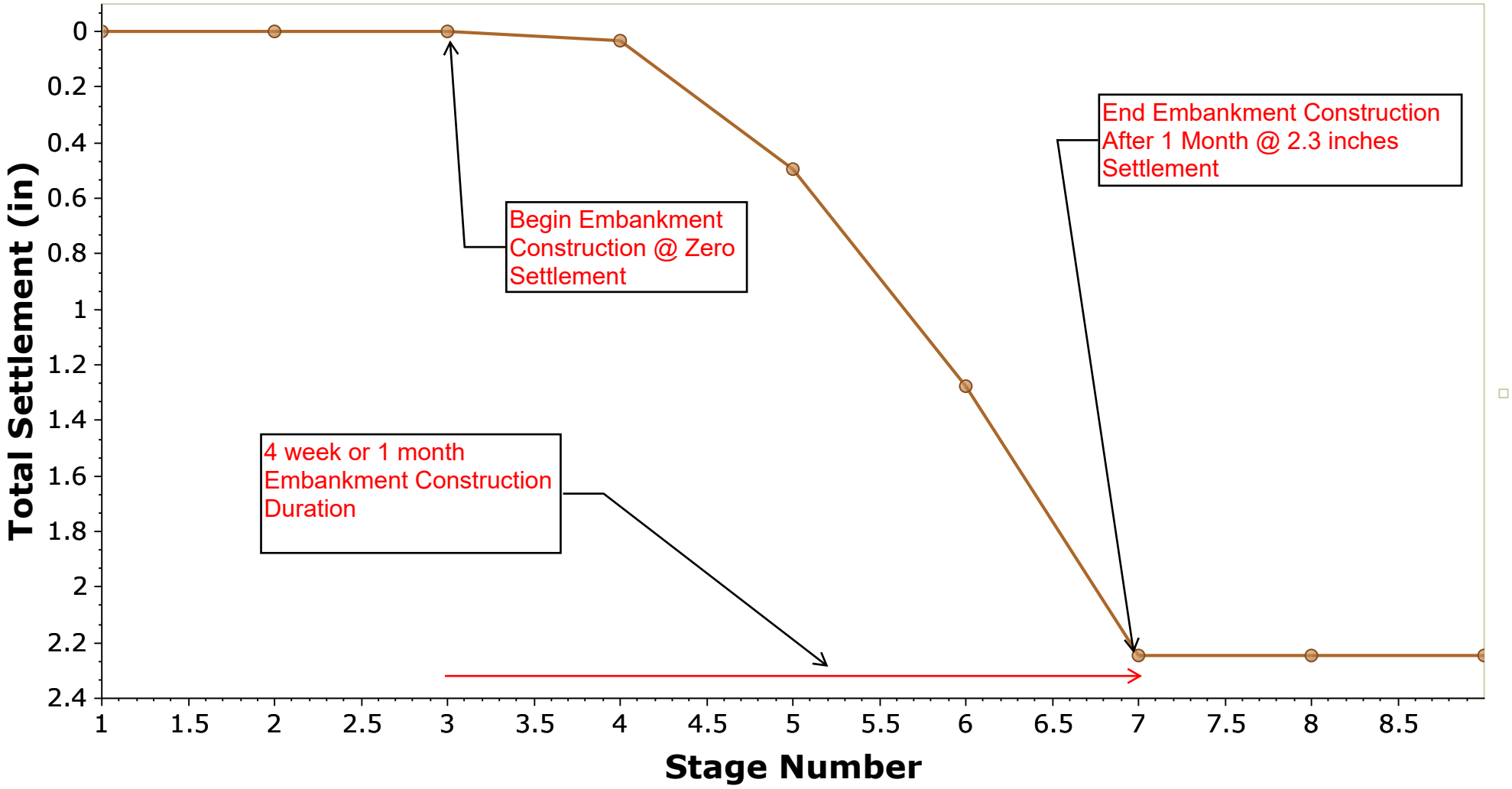




Project: SCDOT US21 & SC51			
Analysis: Settlement Under Edge of Pavement			
Drawn By: J. Daily	Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 39+00	File Name: US21 39+00.s3z	Date: 4/23/2021	

SETTLE3 5.010

Stage Number vs. Total Settlement

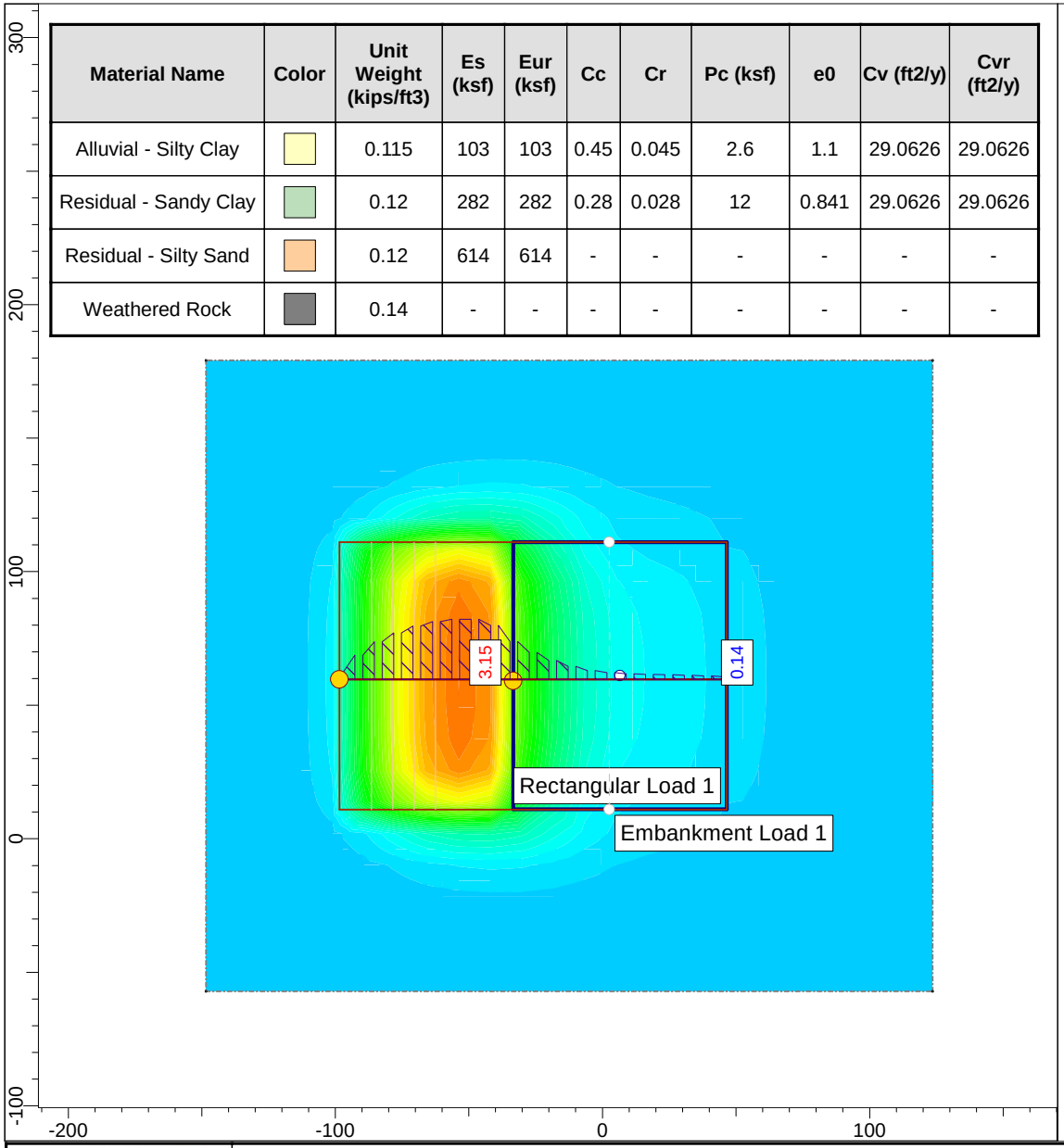


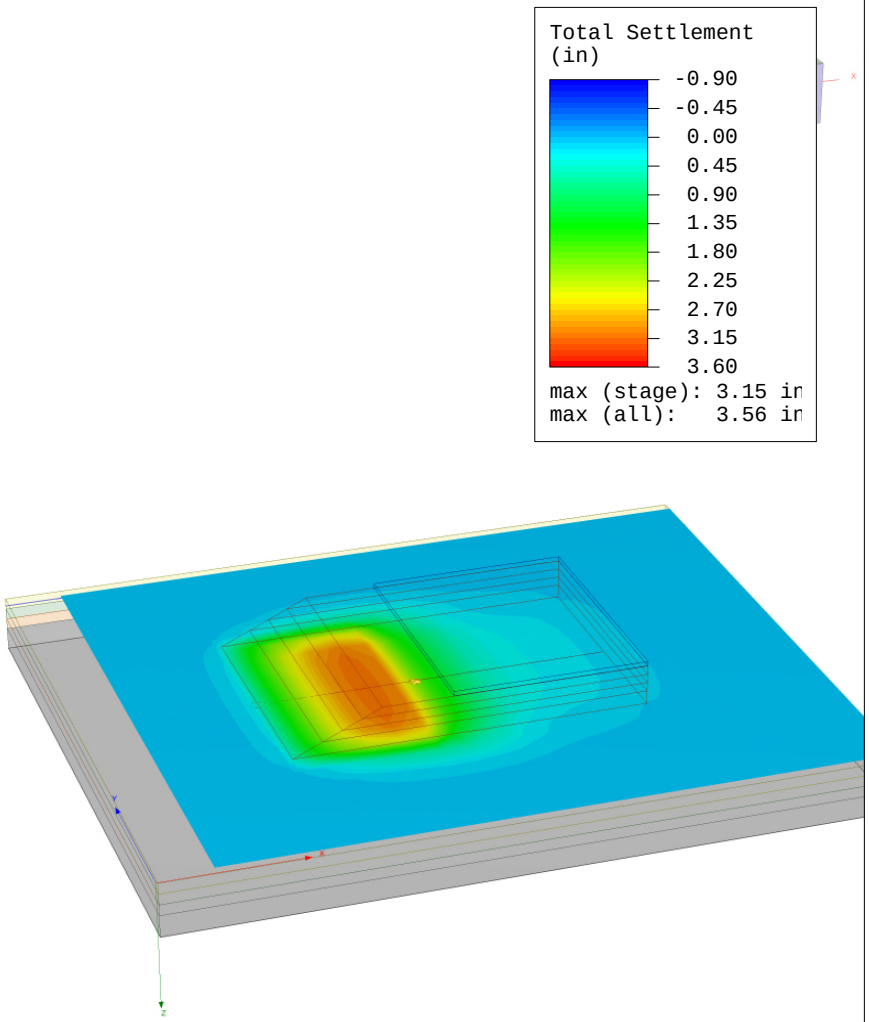
Reference Stage: Stage 3 = 240.1 mon
Total Settlement at Elevation = 0 ft

Project	SCDOT US21 & SC51			
Analysis	Settlement Under Edge of Pavement			
Drawn By: J. Daily		Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 39+00		File Name: US21 39+00.s3z	Date: 4/23/2021	

SETTLE3 5.010

Material Name	Color	Unit Weight (kips/ft3)	Es (ksf)	Eur (ksf)	Cc	Cr	Pc (ksf)	e0	Cv (ft2/y)	Cvr (ft2/y)
Alluvial - Silty Clay		0.115	103	103	0.45	0.045	2.6	1.1	29.0626	29.0626
Residual - Sandy Clay		0.12	282	282	0.28	0.028	12	0.841	29.0626	29.0626
Residual - Silty Sand		0.12	614	614	-	-	-	-	-	-
Weathered Rock		0.14	-	-	-	-	-	-	-	-

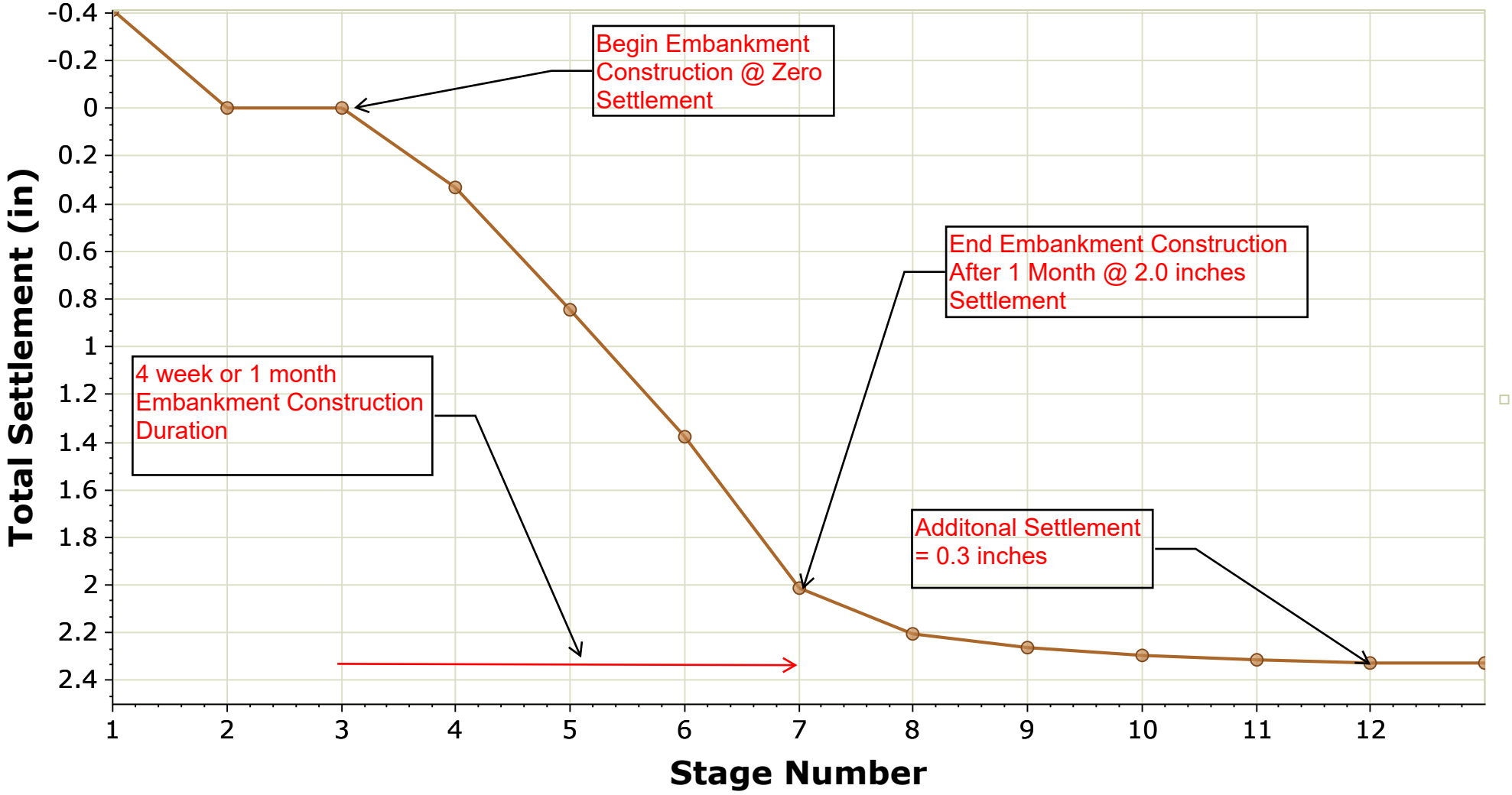




Project: SCDOT US21 & SC51			
Analysis: Settlement Under Edge of Pavement			
Drawn By: J. Daily	Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 67+00	File Name: US21 67+00.s3z	Date: 4/23/2021	

SETTLE3 5.010

Stage Number vs. Total Settlement



Reference Stage: Stage 3 = 240.1 mon
Total Settlement at Elevation = 0 ft

Project	SCDOT US21 & SC51			
Analysis	Settlement Under Edge of Pavement			
Drawn By: J. Daily		Project Number: 1351-12-037	Company: S&ME	Figure: ?
Location: US21 67+00		File Name: US21 67+00.s3z	Date: 4/23/2021	

SETTLE3 5.010

Appendix V – Laboratory and Boring Information

Table 2 – Split Spoon Samples – Classification Testing

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer	Soil Classification	
				LL	PI	#200	AASHTO	USCS
B-1	2.4 – 4	SS-2	28.0	60	30	74.6	A-7-5	CH
B-1	6.5 – 8	SS-4	28.0	38	16	55.7	A-6	CL
B-5	0.5 – 2	SS-1	30.6	72	36	82.2	A-7-5	MH
B-5	4.5 – 6	SS-3	30.7	75	40	81.3	A-7-5	CH
B-6	0.5 – 2	SS-1	6.7	NP	NP	38.7	A-4	SM
B-7	2.5 – 4	SS-2	4.3	NP	NP	30.9	A-2-4	SM
B-9	4.5 – 6	SS-2	10.9	62	29	76.1	A-7-5	MH
B-9	8.5 – 10	SS-5	10.9	NP	NP	35.8	A-4	SM
B-10	0.5 – 10	SS-1	21.4	64	42	65.9	A-7-6	CH
C-1	1.4 – 2.9	SS-1	1.5	NP	NP	26.1	A-2-4	SM
C-2	0.5 – 2	SS-1	12.3	49	33	62.3	A-7-6	CL
C-3	1.2 – 2.5	SS-1	17.9	41	7	52.5	A-5	ML
C-4	1-2.5	SS-1	20.3	45	22	58.4	A-7-6	CL
C-5	1-2.5	SS-1	27.3	62	26	89.5	A-7-5	MH
C-6	1-2.5	SS-1	14.7	41	20	64.3	A-7-6	CL
C-7	1-2.5	SS-1	5.7	36	19	63.4	A-6	CL
C-8	1.5 – 3	SS-1	26.4	49	22	68.8	A-7-6	CL
C-9	1.3 – 2.8	SS-1	35.1	83	56	90.9	A-7-6	CH
C-10	1-2.5	SS-1	15.0	28	10	31.1	A-2-4	SC
C-12	0.5 – 2	SS-1	18.1	75	44	81.9	A-7-5	CH
C-13	1-2.5	SS-1	22.7	49	12	63.8	A-7-5	ML
C-14	1-2.5	SS-1	16.2	37	12	60.0	A-6	ML
C-14	6.5 – 8	SS-4	11.4	37	9	62.0	A-4	ML
C-15	1-2.5	SS-1	32.1	85	48	87.5	A-7-5	CH
C-16	1-2.5	SS-1	24.6	71	28	88.6	A-7-5	MH
C-17	1.5 – 3	SS-1	11.4	31	16	57.5	A-6	CL
R-1	0.5 – 2	SS-1	23.1	53	25	58.6	A-7-6	CH
R-3	2.5 – 4	SS-2	20.8	42	15	49.8	A-7-6	SM
R-3	8.5 – 10	SS-5	19.2	39	15	42.8	A-6	SC
R-5	6.5 – 8	SS-4	25.0	44	16	44.9	A-7-6	SM
R-5	8.5 – 10	SS-5	19.5	41	20	57.8	A-7-6	CL
R-6	6.5 – 8	SS-4	24.2	60	30	77.4	A-7-5	CH
R-7	2.5 – 4	SS-2	14.3	32	7	49.3	A-4	SM

Table 2 – Split Spoon Samples – Classification Testing

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer	Soil Classification	
				LL	PI	#200	AASHTO	USCS
R-8	4.5 – 6	SS-3	24.1	50	26	59.6	A-7-6	CH
R-9	6.5 – 8	SS-4	27.7	63	32	76.8	A-7-5	CH
R-10	2.5 – 4	SS-2	33.4	54	24	68.5	A-7-5	MH
R-11	6.5 – 8	SS-4	18.2	46	19	50.7	A-7-6	CL
R-12	2.5 – 4	SS-2	4.4	51	31	56.2	A-7-6	CH
R-12	8.5 – 10	SS-5	11.9	36	18	59.9	A-6	CL
R-14	4.5 – 6	SS-3	10.2	22	10	31.6	A-2-4	SC
R-15	4.5 – 6	SS-3	25.1	71	32	74.7	A-7-5	MH
R-15	8.5 – 10	SS-5	12.3	50	20	57.2	A-7-5	MH
R-16	2.5 – 4	SS-2	25.5	77	35	85.1	A-7-5	MH
R-16	8.5 – 10	SS-5	15.5	53	9	73.1	A-5	MH
R-17	6.5 – 8	SS-4	41.1	71	26	95.8	A-7-5	MH
R-18	4.5 – 6	SS-3	22.4	73	40	75.4	A-7-5	CH
R-19	2.5 – 4	SS-1	3.6	22	4	29.4	A-2-4	SC-SM
R-19	8.5 – 10	SS-5	13.7	28	11	35.3	A-2-6	SC
R-20	0.5 – 2	SS-1	6.6	37	22	43.1	A-6	SC
R-21	8.5 – 10	SS-4	7.8	55	40	66.4	A-7-6	CH
R-22	4.5 – 6	SS-3	21.9	74	31	91.9	A-7-5	MH
R-23	2.5 – 4	SS-1	26.4	45	20	74.5	A-7-6	CL
R-23	8.5 – 10	SS-4	26.4	42	16	61.6	A-7-6	CL
R-24	8.5 – 10	SS-5	14.2	33	8	45.9	A-4	SM
R-25	4.5 – 6	SS-3	21.7	38	20	49.6	A-6	CL
R-27	4.5 – 6	SS-3	25.6	39	19	53.8	A-6	CL
R-29	0.5 – 2	SS-1	11.3	23	7	39.5	A-4	SC-SM
R-29	4.5 – 6	SS-3	14.2	26	2	34.1	A-2-4	SM
R-31	8.5 – 10	SS-5	7.4	NP	NP	27.5	A-2-4	SM
R-34	23.5 - 25	SS-8	18.3	31	14	48.2	A-6	SC
R-35	18.5 – 20	SS-7	29.3	62	32	68.8	A-7-5	CH
R-38	13.5 - 15	SS-6	39.4	70	34	80.0	A-7-5	MH
S-1	4.5 – 6	SS-3	20.4	36	7	41.8	A-4	SM
S-2	1-2.5	SS-1	32.0	67	39	79.8	A-7-6	CH
S-4	2.5 – 4	SS-2	21.1	53	28	58.6	A-7-6	CH
S-5	7.5 – 10	SS-5	38.7	50	18	69.6	A-7-5	MH

Table 2 – Split Spoon Samples – Classification Testing

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer	Soil Classification	
				LL	PI	#200	AASHTO	USCS
S-6	4.5 – 6	SS-3	19.9	34	12	51.1	A-6	CL
S-7	2.5 – 4	SS-2	28.7	46	8	64.2	A-5	ML
S-8	6.5 – 8	SS-4	11.5	28	2	38.3	A-4	SM
S-9	8.5 – 10	SS-5	18.1	35	4	51.2	A-4	ML
S-10	1-2.5	SS-1	25.1	62	35	79.3	A-7-6	CH
S-11	6.5 – 8	SS-4	16.1	51	32	60.3	A-7-6	CH
HA-1	6	SS-3	23.5	26	10	50.8	A-4	CL
HA-2	4	SS-1	62.1	36	6	43.3	A-4	SM
HA-3	6	SS-2	30.6	29	11	52.0	A-6	CL
HA-4	6	SS-2	25.4	38	12	28.2	A-2-6	SM
HA-5	2	SS-1	33.4	36	14	44.3	A-6	SC
HA-6	5	SS-3	26.5	41	22	63.5	A-7-6	CL

Table 3 – Split Spoon Samples – Organic Testing

Boring Number	Sample Depth (feet)	Sample No.	Percent Organic Matter (%)
R-18	0.5 – 2	SS-1	2.3
S-2	28.5-30	SS-9	1.4
S-5	18.5-20	SS-7	2.1

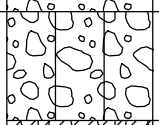
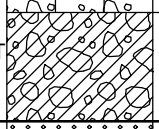
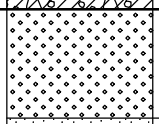
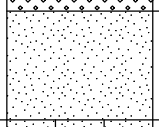
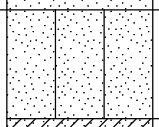
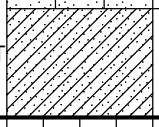
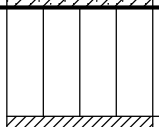
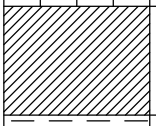
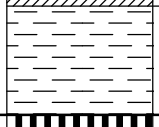
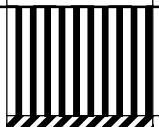
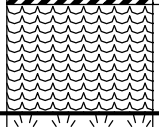
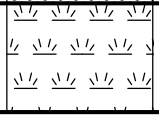
Table 4 – Bulk Samples – Classification Testing

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		Max. Dry Density (pcf)	Optimum Moisture (%)	CBR		
					LL	PI	AASHTO	USCS			% compaction	CBR at 0.1	Swell (%)
B-2	1 - 10	Bulk	31.8	75.7	66	32	A-7-5	MH	101.5	21.6	94.5	5.3	1.5
B-4	1 - 10	Bulk	35.8	67.2	59	38	A-7-6	CH	102.2	20.2	95.7	3.9	4.3
B-8	1 - 10	Bulk	8.6	51.2	23	11	A-6	CL	128.9	10.4	94.1	6.4	0.5
B-11	1 - 10	Bulk	21.4	68.0	47	23	A-7-6	CL	102.2	20.2	93.4	4.3	1.4
R-2	1 - 10	Bulk	20.7	55.6	49	28	A-7-6	CL	116.8	13.4	95.8	4.0	1.6
R-9	1 - 10	Bulk	26.3	72.5	59	34	A-7-6	CH	97.6	24.3	94.4	6.0	0.6
R-26	1 - 10	Bulk	17.2	48.2	34	18	A-6	SC	121.8	12.5	94.3	8.9	0.3
R-28	1 - 10	Bulk	21.9	39.5	37	18	A-6	SC	115.7	14.1	94.3	4.7	0.5
R-30	1 - 10	Bulk	14.6	57.2	34	18	A-6	CL	124.5	12.2	94.2	2.5	2.4
R-32	1 - 10	Bulk	13.0	51.1	30	16	A-6	CL	119.0	12.2	95.0	7.5	0.2

Table 5 – Shelby Tube Samples – Classification Testing

Boring Number	Sample Depth (feet)	Sample No.	Classification		Natural Moisture (%)	Percent Finer #200	Triaxial Shear Strength				Consolidation	
			AASHTO	USCS			Total		Effective		Pc (ksf)	Cc
							C(psf)	Φ (deg)	C(psf)	Φ (deg)		
R-33	23.5-25.8	UD-1	A-4	SM	19.2	43.6	N/A	N/A	N/A	N/A	4.0	0.15
R-37	13.5-15.5	UD-1	A-7-6	CL	18.1	63.8	0	15.6	0	37.7	N/A	N/A
R-41	13.5-15.5	UD-1	A-7-6	CH	23.4	71.9	530	11.5	40	37	N/A	N/A

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

USCS_LEGEND 1/30/21

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Forest Dr
Boring No.:	B- 1	**Boring Location:**	10+73	**Offset:**	6' LT	**Alignment:**	EX-FOREST
Elev.:	596.0 ft	**Latitude:**	35.06491481	**Longitude:**	-80.93636641	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 25 ft	**24HR**	22.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (3 inches)		0.5	SS-1	9	12	12	24
		RESIDUUM - very stiff, moist, red brown, CLAY (CH) (A-7-5), 60, 30, 30, 28.0%, 74.6%		2.5	SS-2	6	9	13	22
	4.3			4.5					
591.0		RESIDUUM - very stiff to hard, moist, brown tan, SANDY CLAY (CL) (A-6), 38, 22, 16, 28.0%, 55.7%			SS-3	8	10	11	21
				6.5	SS-4	8	11	17	28
				8.5	SS-5	6	12	18	30
586.0									
				13.5	SS-6	8	11	14	25
581.0									
				18.5	SS-7	6	8	12	20
576.0									
				23.5	SS-8	11	17	18	35
571.0									
				28.5	SS-9	12	13	16	29
566.0	30.0	Terminated at 30 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Gold Hill Rd
Boring No.:	B- 2	**Boring Location:**	57+05	**Offset:**	135' LT	**Alignment:**	US21
Elev.:	635.0 ft	**Latitude:**	35.06803568	**Longitude:**	-80.93660465	**Date Started:**	5/19/2015
Total Depth:	29.8 ft	**Soil Depth:**	29.8 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (3 inches)		0.5					
		RESIDUUM - very stiff, moist, red brown, CLAYEY SILT (MH) (A-7-5)			SS-1	5	7	11	18
				2.5	SS-2	5	8	12	20
630.0				4.5	SS-3	4	7	10	17
	6.3	RESIDUUM - stiff to very stiff, moist, orange tan, SANDY SILT (ML) (A-4)		6.5					
					SS-4	3	5	6	11
				8.5	SS-5	4	4	5	9
625.0									
				13.5	SS-6	3	3	5	8
620.0									
				18.5	SS-7	7	10	12	22
615.0									
				23.5	SS-8	5	8	9	17
610.0									
	27.0	PARTIALLY WEATHERED ROCK (PWR) - moist, brown tan, SANDY SILT (ML) (A-4)		28.5	SS-9	8	11	50/.3	100
605.0	29.8	Terminated at 29.8 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Proposed Rd
Boring No.:	B- 3	**Boring Location:**	12+34	**Offset:**	1' RT	**Alignment:**	US21B
Elev.:	637.0 ft	**Latitude:**	35.06954037	**Longitude:**	-80.93513665	**Date Started:**	5/20/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	25 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	RESIDUUM - very stiff, moist, red, CLAYEY SILT (MH) (A-7-5)		0.5					
					SS-1	5	7	9	16
	2.3	RESIDUUM - firm to stiff, moist, orange tan, SANDY SILT (ML) (A-4)		2.5					
					SS-2	4	5	6	11
				4.5					
632.0					SS-3	3	6	7	13
				6.5					
					SS-4	2	3	4	7
				8.5					
					SS-5	3	4	4	8
627.0									
				13.5					
					SS-6	3	3	5	8
622.0									
				18.5					
					SS-7	5	6	9	15
617.0									
				23.5					
					SS-8	5	6	7	13
612.0		▼							
	27.0	RESIDUUM - hard, moist, brown tan, SANDY SILT (ML) (A-4)		28.5					
					SS-9	11	26	27	53
607.0	30.0	Terminated at 30 feet. Topsoil was not encountered							

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

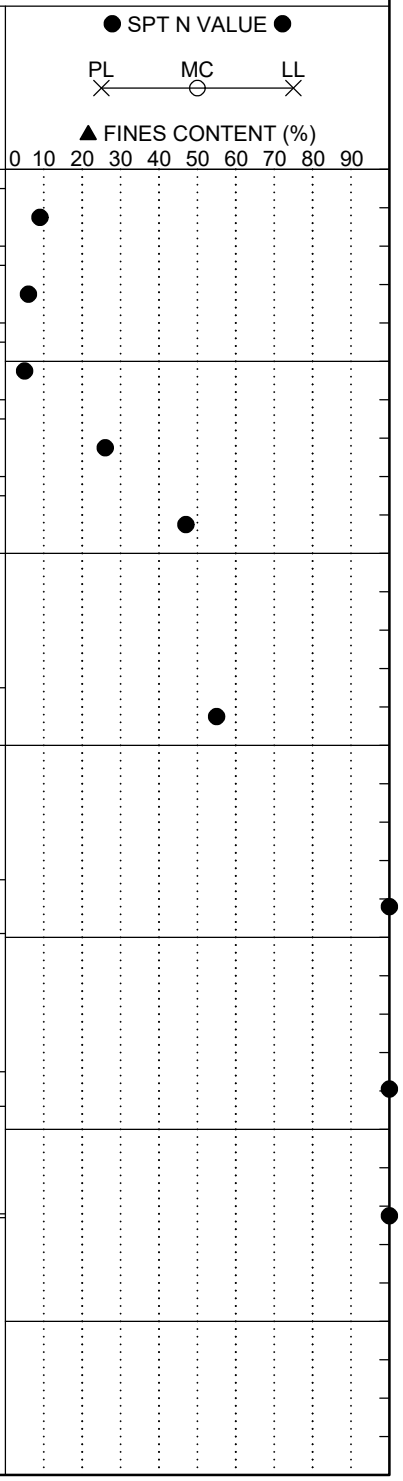
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Proposed Rd
Boring No.:	B- 4	**Boring Location:**	16+87	**Offset:**	2' LT	**Alignment:**	US21B
Elev.:	632.0 ft	**Latitude:**	35.06931982	**Longitude:**	-80.9336499	**Date Started:**	5/21/2015
Total Depth:	27.3 ft	**Soil Depth:**	27.3 ft	**Core Depth:**	ft	**Date Completed:**	5/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	9 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	FILL - stiff to firm, moist, red brown, SILTY CLAY (CH) (A-7-5)		0.5	SS-1	4	4	5	9
				2.5	SS-2	2	3	3	6
	4.3	ALLUVIAL - loose, wet, gray, fine to coarse, CLAYEY SAND (SC) (A-2-6)		4.5	SS-3	2	2	3	5
627.0	6.3	RESIDUUM - dense to very dense, dry, fine to coarse, SILTY SAND (SM) (A-2-4)		6.5	SS-4	5	9	17	26
				8.5	SS-5	15	22	25	47
622.0									
				13.5	SS-6	14	21	34	55
617.0	17.0	PARTIALLY WEATHERED ROCK (PWR) - moist, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)		18.5	SS-7	23	32	50/.4	100
612.0				23.5	SS-8	24	50/.4		100
607.0	27.3	Terminated at 27.3 feet due to **auger refusal**. Topsoil was not encountered		27.2	~~SS-9~~	~~50/.1~~			~~100~~
602.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Old Nation Rd
Boring No.:	B- 5	**Boring Location:**	11+85	**Offset:**	1' LT	**Alignment:**	OLDNACL
Elev.:	632.0 ft	**Latitude:**	35.06995741	**Longitude:**	-80.93414393	**Date Started:**	5/20/2015
Total Depth:	27.9 ft	**Soil Depth:**	27.9 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	13.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	RESIDUUM - stiff to firm, moist, red, CLAYEY SILT (MH) (A-7-5), 72, 36, 36, 30.6%, 82.2%		0.5	SS-1	3	4	5	9
				2.5	SS-2	3	3	4	7
627.0	4.5	RESIDUUM - firm, moist, red, SILTY CLAY (CH) (A-7-5), 75, 35, 40, 30.7%, 81.3%		4.5	SS-3	2	3	2	5
				6.5	SS-4	1	2	4	6
622.0	8.3	RESIDUUM - medium dense, moist, brown tan, SANDY SILT (ML) (A-4)		8.5	SS-5	3	6	11	17
				13.5	SS-6	8	12	15	27
617.0	17.0	PARTIALLY WEATHERED ROCK (PWR) - moist, brown gray, SANDY SILT (ML) (A-4)		18.5	SS-7	12	19	50/.3	100
612.0				23.5	SS-8	25	33	50/.3	100
607.0	27.8	Terminated at 27.8 feet due to **auger refusal**. Topsoil was not encountered.		27.8	SS-9	50/.1			100
602.0									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

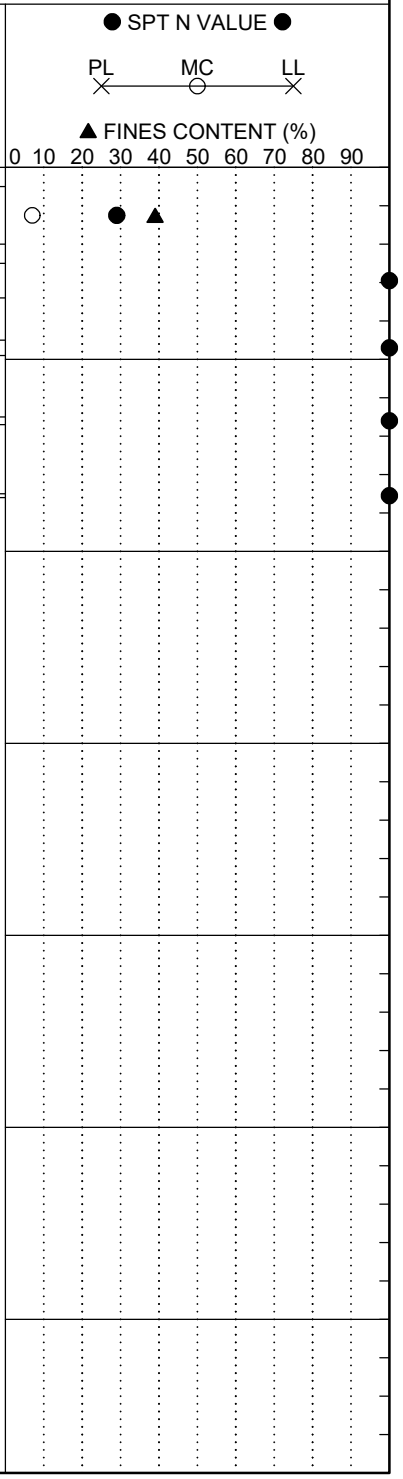
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Springhill Farm
Boring No.:	B- 6	**Boring Location:**	11+80	**Offset:**	40' RT	**Alignment:**	EX-SPRINGH
Elev.:	622.0 ft	**Latitude:**	35.0908416	**Longitude:**	-80.9253577	**Date Started:**	5/27/2015
Total Depth:	8.5 ft	**Soil Depth:**	8.5 ft	**Core Depth:**	ft	**Date Completed:**	5/27/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.2	TOPSOIL / ROOTMAT - (2 inches)		0.5	SS-1	6	9	20	29
	2.3	RESIDUUM - very stiff, dry, tan brown, fine, SILTY SAND (SM) (A-4), 0, 0, 0, 6.7%, 38.7%		2.5	SS-2	15	50/.4		100
617.0		PARTIALLY WEATHERED ROCK (PWR) - dry, gray, fine to medium, SILTY SAND (SM) (A-2-4)		4.5	SS-3	50/.4			100
				6.5	SS-4	50/.2			100
	8.5			8.5	SS-5	50/.1			100
612.0		Terminated at 8.5 feet due to **auger refusal**.							
607.0									
602.0									
597.0									
592.0									



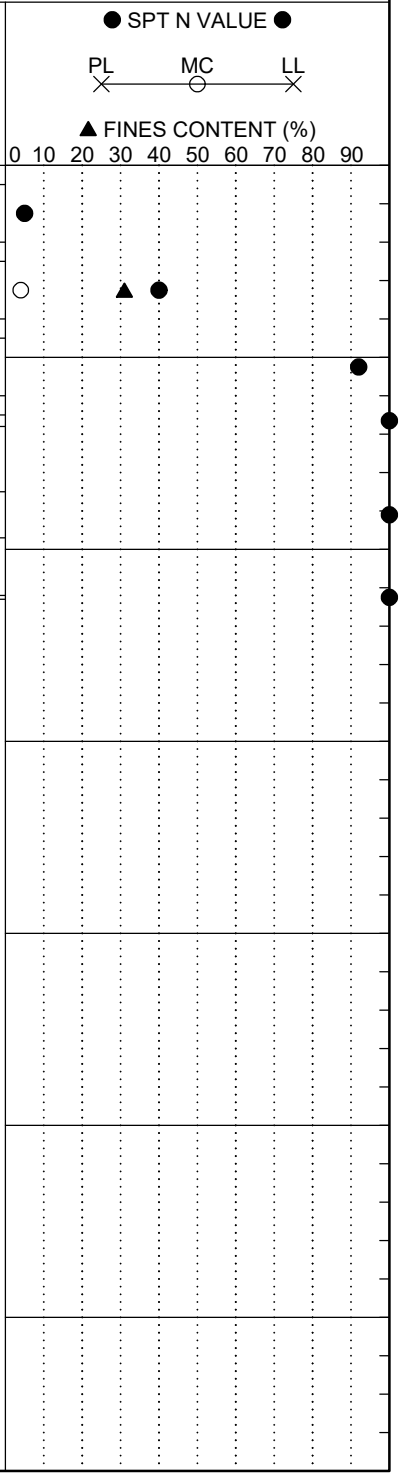
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Springhill Farm
Boring No.:	B- 7	**Boring Location:**	26+23	**Offset:**	65' RT	**Alignment:**	SPRINGHILL
Elev.:	619.0 ft	**Latitude:**	35.08993174	**Longitude:**	-80.92440263	**Date Started:**	5/27/2015
Total Depth:	11.3 ft	**Soil Depth:**	11.3 ft	**Core Depth:**	ft	**Date Completed:**	5/27/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (1 inch)		0.5	SS-1	3	2	3	5
	2.3	RESIDUUM - firm, moist, brown, SILTY CLAY (CH) (A-7-6)		2.5	SS-2	5	15	25	40
		RESIDUUM - dense, dry, brown tan, SILTY SAND (SM) (A-2-4), 0, 0, 0, 4.3%, 30.9%		4.5	SS-3	37	42	50/.5	92
614.0	5.5	PARTIALLY WEATHERED ROCK (PWR) - dry, gray, fine to medium, SILTY SAND (SM) (A-2-4)		6.5	SS-4	50/.3			100
				8.5	SS-5	15	26	50/.2	100
609.0	11.2			11.2	SS-6	50/.1			100
		Terminated at 11.2 feet due to **auger refusal**.							
604.0									
599.0									
594.0									
589.0									



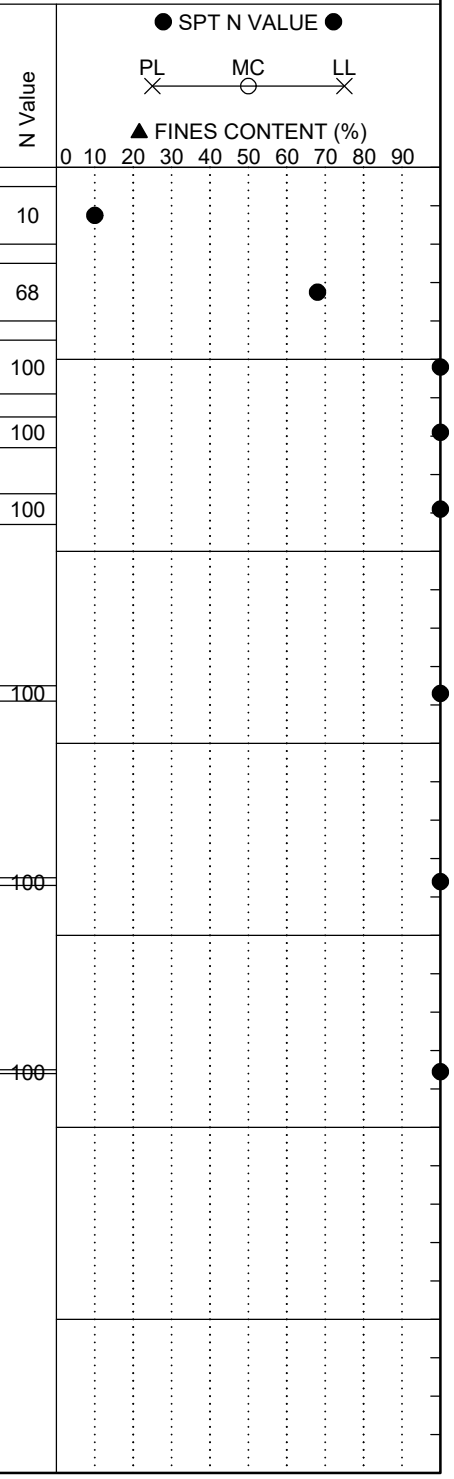
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Springhill Farm
Boring No.:	B- 8	**Boring Location:**	29+96	**Offset:**	3' LT	**Alignment:**	SPRINGHILL
Elev.:	614.0 ft	**Latitude:**	35.08888488	**Longitude:**	-80.92404595	**Date Started:**	5/22/2015
Total Depth:	23.6 ft	**Soil Depth:**	23.6 ft	**Core Depth:**	ft	**Date Completed:**	5/22/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** N/A	**24HR**	12 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (4 inches)		0.5	SS-1	4	4	6	10
	2.3	RESIDUUM - stiff, moist, gray, SILTY CLAY (CH) (A-7-6)		2.5	SS-2	27	33	35	68
	4.3	RESIDUUM - hard, dry, tan, SANDY SILT (ML) (A-4)		4.5	SS-3	24	33	50/.4	100
609.0		PARTIALLY WEATHERED ROCK (PWR) - moist, brown gray, SANDY SILT (ML) (A-4)		6.5	SS-4	38	50/.3		100
				8.5	SS-5	47	50/.3		100
604.0				13.5	SS-6	50/.4			100
599.0				18.5	SS-7	50/.2			100
594.0									
	23.6	Terminated at 23.6 feet due to **auger refusal**.		23.5	SS-8	50/.1			100
589.0									
584.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Flint Hill Rd
Boring No.:	B- 9	**Boring Location:**	19+55	**Offset:**	1' LT	**Alignment:**	SPRINGHILL
Elev.:	608.0 ft	**Latitude:**	35.08761003	**Longitude:**	-80.92373627	**Date Started:**	5/19/2015
Total Depth:	20.7 ft	**Soil Depth:**	20.7 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** N/A	**24HR**	14 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	TOPSOIL / ROOTMAT - (4 inches)	0.5	SS-1	5	6	7	13
		RESIDUUM - stiff, moist, orange tan, CLAYEY SILT (MH) (A-7-5), 62, 33, 29, 10.9%, 76.1%	2.5	SS-2	4	6	8	14
603.0			4.5	SS-3	4	7	7	14
	6.3	RESIDUUM - medium dense, moist, tan brown, fine to coarse, SILTY SAND (SM) (A-4), 0, 0, 0, 10.9%, 35.8%	6.5	SS-4	5	8	9	17
			8.5	SS-5	8	11	11	22
598.0								
			13.5	SS-6	7	7	18	25
593.0								
	17.0	PARTIALLY WEATHERED ROCK (PWR) - dry, tan, SANDY SILT (ML) (A-4)	18.5	SS-7	50/.3			100
588.0								
	20.7	Terminated at 20.7 feet due to **auger refusal**.						
583.0								
578.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

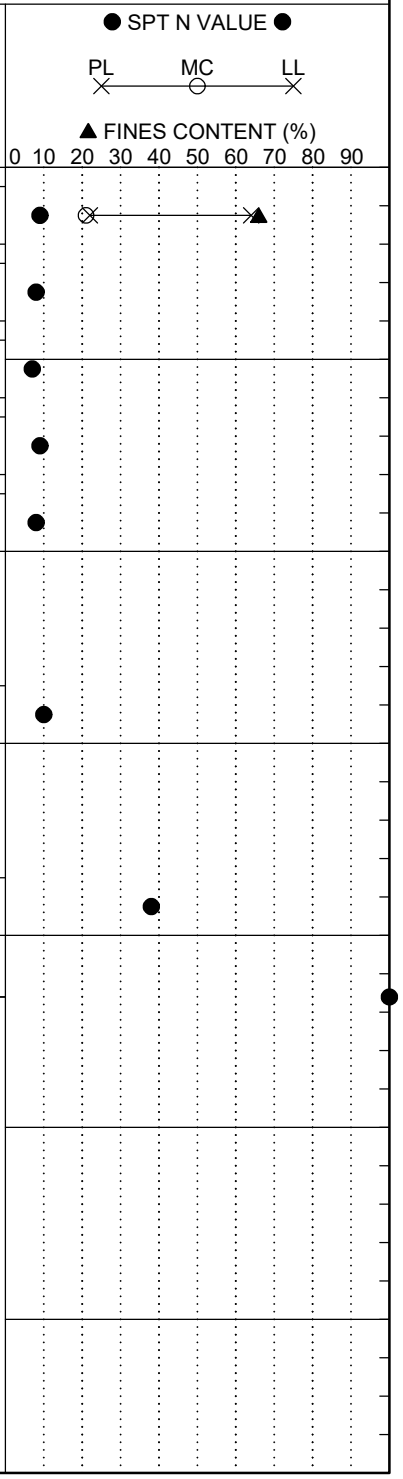
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	B-10	**Boring Location:**	296+16	**Offset:**	24' RT	**Alignment:**	SC51
Elev.:	648.0 ft	**Latitude:**	35.08740619	**Longitude:**	-80.93235575	**Date Started:**	5/27/2015
Total Depth:	21.6 ft	**Soil Depth:**	21.6 ft	**Core Depth:**	ft	**Date Completed:**	5/27/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (1 inch)		0.5	SS-1	4	4	5	9
	2.3	FILL - stiff, moist, orange brown, CLAY (CH) (A-7-6), 64, 22, 42, 21.4%, 65.9%		2.5	SS-2	3	3	5	8
	4.3	FILL - firm, moist, red brown, CLAYEY SILT (MH) (A-7-5)		4.5	SS-3	3	3	4	7
643.0		RESIDUUM - firm to hard, moist, orange brown, SANDY SILT (ML) (A-4)		6.5	SS-4	2	4	5	9
				8.5	SS-5	3	4	4	8
638.0				13.5	SS-6	3	5	5	10
633.0				18.5	SS-7	9	15	23	38
628.0									
	21.6	Terminated at 21.6 feet due to **auger refusal**.		21.6	~~SS-8~~	~~50/0~~			~~100~~
623.0									
618.0									



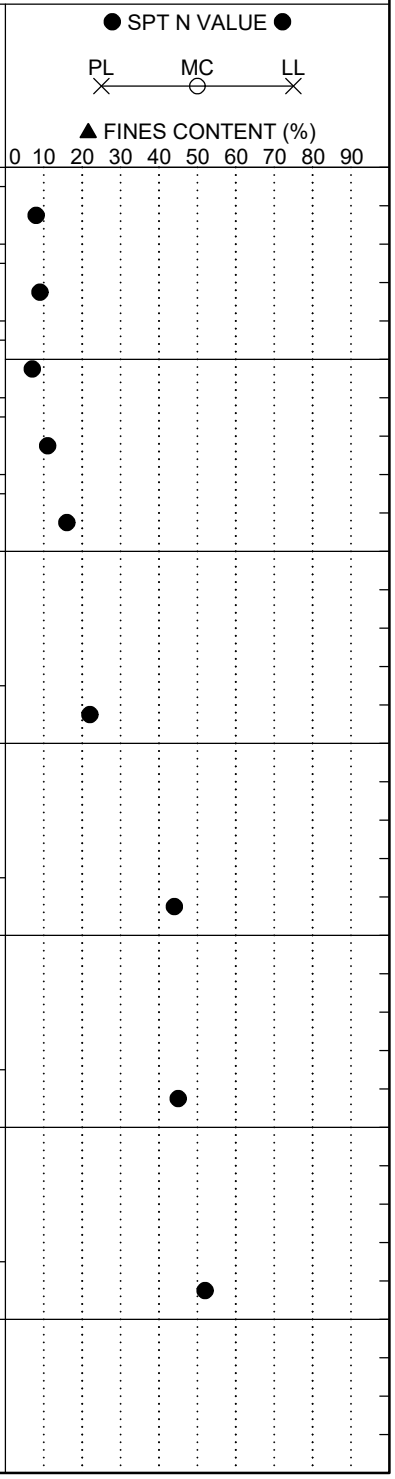
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	B-11	**Boring Location:**	300+48	**Offset:**	26' RT	**Alignment:**	SC51
Elev.:	646.0 ft	**Latitude:**	35.0871719	**Longitude:**	-80.93092552	**Date Started:**	5/19/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (4 inches)		0.5	SS-1	3	4	4	8
	1.3	FILL - firm, moist, orange brown, CLAY (CH) (A-7-6)							
	2.3	FILL - firm, moist, orange brown, SANDY CLAY (CL) (A-6)		2.5	SS-2	3	4	5	9
641.0		RESIDUUM - stiff to firm, moist, red brown, CLAYEY SILT (MH) (A-7-5)		4.5	SS-3	2	3	4	7
	6.3	RESIDUUM - stiff to hard, moist, orange brown, SANDY SILT (ML) (A-4)		6.5	SS-4	3	5	6	11
				8.5	SS-5	4	7	9	16
636.0									
				13.5	SS-6	7	11	11	22
631.0									
				18.5	SS-7	9	21	23	44
626.0									
				23.5	SS-8	23	22	23	45
621.0									
				28.5	SS-9	21	27	25	52
616.0	30.0	Terminated at 30 feet.							



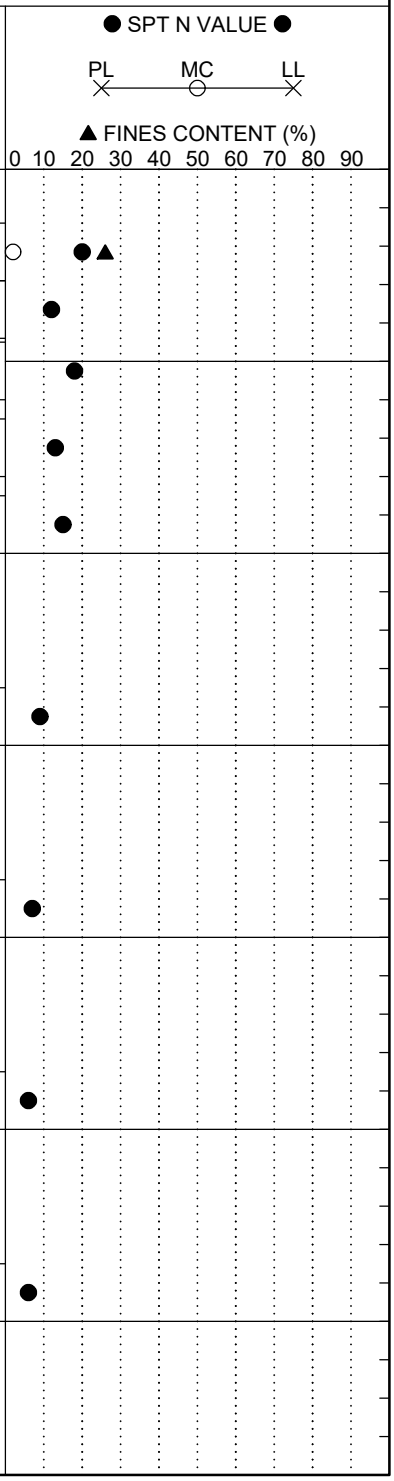
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Springfield Pkw
Boring No.:	C- 1	**Boring Location:**	12+98	**Offset:**	23' RT	**Alignment:**	SPRINGFIELI
Elev.:	606.0 ft	**Latitude:**	35.05622953	**Longitude:**	-80.93881176	**Date Started:**	7/30/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/30/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.8	ASPHALT - (8.75 inches)							
	1.4	AGGREGATE BASE COURSE - (8.25 inches)		1.4	SS-1	7	12	8	20
		FILL - medium dense, dry, brown tan white, fine to coarse, SILTY SAND (SM) (A-2-4), 0, 0, 0, 1.5%, 26.1%		2.9	SS-2	6	6	6	12
	4.0			4.5	SS-3	7	8	10	18
601.0		RESIDUUM - very stiff to stiff, moist, brown red, CLAYEY SILT (MH) (A-7-5)		6.5	SS-4	6	5	8	13
	8.0			8.5	SS-5	5	6	9	15
596.0		RESIDUUM - stiff to firm, moist, red orange, SANDY SILT (ML) (A-4)		13.5	SS-6	3	5	4	9
591.0				18.5	SS-7	3	3	4	7
586.0				23.5	SS-8	2	3	3	6
581.0				28.5	SS-9	2	3	3	6
576.0	30.0	Terminated at 30 feet							



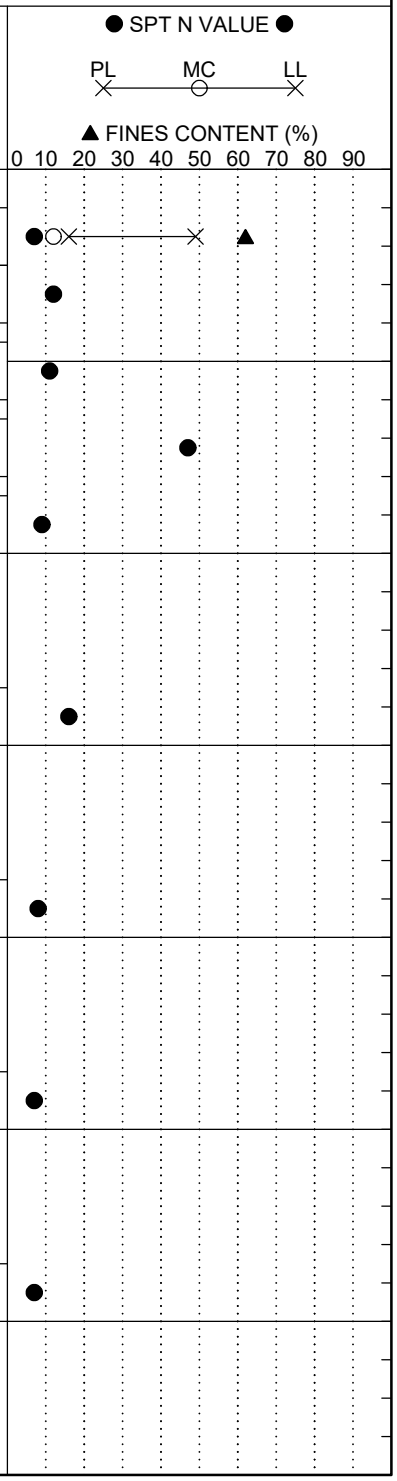
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Springfield Pkw
Boring No.:	C- 2	**Boring Location:**	18+10	**Offset:**	26' LT	**Alignment:**	SPRINGFIELI
Elev.:	622.0 ft	**Latitude:**	35.05651166	**Longitude:**	-80.93713109	**Date Started:**	7/30/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/30/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.8	ASPHALT - (9 inches)						
	1.1	AGGREGATE BASE COURSE - (4 inches)	1.0					
	2.0	FILL - firm to stiff, dry, brown gray, SANDY CLAY (CL) (A-7-6), 49, 16, 33, 12.3%, 62.3%	2.5	SS-1	4	2	5	7
				SS-2	6	6	6	12
617.0		FILL - medium dense, dry, brown orange, fine, SILTY SAND (SM) (A-2-4)	4.5	SS-3	6	5	6	11
	6.3	FILL - hard to stiff, moist, orange gray, fine, SANDY CLAY (CL) (A-6)	6.5	SS-4	29	28	19	47
			8.5	SS-5	4	5	4	9
612.0								
	12.0	RESIDUUM - very stiff, moist, red tan orange, CLAYEY SILT (MH) (A-7-5)	13.5	SS-6	5	7	9	16
607.0								
	17.0	RESIDUUM - firm, moist, orange tan, SANDY SILT (ML) (A-4), trace mica	18.5	SS-7	3	3	5	8
602.0								
	22.0	RESIDUUM - loose, dry, tan orange, fine, SILTY SAND (SM) (A-2-4)	23.5	SS-8	3	3	4	7
597.0			28.5					
				SS-9	3	3	4	7
592.0	30.0	Terminated at 30 feet						



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Mercantile
Boring No.:	C- 3	**Boring Location:**	11+03	**Offset:**	14' LT	**Alignment:**	MERCANTILE
Elev.:	604.0 ft	**Latitude:**	35.06005541	**Longitude:**	-80.93697812	**Date Started:**	5/22/2015
Total Depth:	28.8 ft	**Soil Depth:**	28.8 ft	**Core Depth:**	ft	**Date Completed:**	5/22/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 27.2 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	ASPHALT (4 inches)						
	1.2	AGGREGATE BASE COURSE (10 inches)	1.2					
		RESIDUUM - stiff to hard, moist, tan gray, SANDY SILT (ML) (A-5), 41, 34, 7, 17.9%, 52.5%		SS-1	6	6	4	10
			2.7	SS-2	3	3	5	8
			4.5					
599.0				SS-3	3	4	5	9
			6.5					
				SS-4	3	3	5	8
			8.5					
				SS-5	4	6	8	14
594.0								
			13.5					
				SS-6	5	9	15	24
589.0								
			18.5					
				SS-7	9	17	32	49
584.0								
	22.0	PARTIALLY WEATHERED ROCK (PWR) - moist, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5	SS-8	32	50/.4		100
579.0		▽						
	28.8		28.5	SS-9	50/.3			100
		Terminated at 28.8 feet due to **auger refusal**.						
574.0								

SPT N VALUE

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Lakeview Rd
Boring No.:	C- 4	**Boring Location:**	13+40	**Offset:**	6' RT	**Alignment:**	LAKEVIEW
Elev.:	595.0 ft	**Latitude:**	35.06123158	**Longitude:**	-80.93774904	**Date Started:**	8/5/2014
Total Depth:	29.4 ft	**Soil Depth:**	29.4 ft	**Core Depth:**	ft	**Date Completed:**	8/5/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.5	ASPHALT - (6 inches)		1.0					
		RESIDUUM - stiff, moist, orange gray tan, CLAY (CL) (A-7-6), 45, 23, 22, 20.3%, 58.4%		2.5	SS-1	3	6	7	13
					SS-2	6	6	7	13
	4.0	RESIDUUM - medium dense to dense, dry, white gray, fine, SILTY SAND (SM) (A-2-4)		4.5					
590.0					SS-3	10	10	9	19
				6.5					
					SS-4	3	8	12	20
				8.5					
					SS-5	16	16	16	32
585.0									
				13.5					
					SS-6	8	17	22	39
580.0									
	17.0	PARTIALLY WEATHERED ROCK (PWR) - dry, white gray, fine, SILTY SAND (SM) (A-2-4)		18.5					
					SS-7	24	60	40/.3	100
575.0									
	22.0	RESIDUUM - very dense, dry, white gray, fine, SILTY SAND (SM) (A-2-4)		23.5					
					SS-8	24	30	48	78
570.0									
	27.0	PARTIALLY WEATHERED ROCK (PWR) - dry, white gray, fine, SILTY SAND (SM) (A-2-4)		28.5					
	29.4				SS-9	49	50/.4		100
565.0		Terminated at 29.4 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Amelea Dr
Boring No.:	C- 5	**Boring Location:**	11+07	**Offset:**	7' LT	**Alignment:**	AMELIA
Elev.:	588.0 ft	**Latitude:**	35.06221725	**Longitude:**	-80.93664575	**Date Started:**	8/5/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/5/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 23.8 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									
	0.1	ASPHALT - (1.5 inches)								
	0.4	AGGREGATE BASE COURSE - (3.5 inches)		1.0						
	2.0	RESIDUUM - very stiff, moist, tan gray, CLAYEY SILT (MH) (A-7-5), 62, 36, 26, 27.3%, 89.5%			SS-1	3	8	9	17	
				2.5	SS-2	17	26	30	56	
583.0		RESIDUUM - very dense to dense, dry, tan white gray, fine, SILTY SAND (SM) (A-2-4)		4.5	SS-3	30	30	31	61	
				6.5	SS-4	10	16	16	32	
	8.0			8.5						
		RESIDUUM - medium dense to dense, dry, tan white gray, fine, SILTY SAND (SM) (A-2-4)			SS-5	11	12	15	27	
578.0										
				13.5	SS-6	10	12	16	28	
573.0										
				18.5	SS-7	12	20	15	35	
568.0										
	22.0									
		RESIDUUM - very dense, dry, tan white gray, fine, SILTY SAND (SM) (A-2-4)		23.5	SS-8	13	25	51	76	
563.0										
				28.5	SS-9	22	45	50	95	
558.0	30.0	Terminated at 30 feet								

SPT N VALUE ● PL × MC ○ LL × ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Rain Forest Ct
Boring No.:	C- 6	**Boring Location:**	11+52	**Offset:**	5' LT	**Alignment:**	FERNFORES
Elev.:	589.0 ft	**Latitude:**	35.06325004	**Longitude:**	-80.936371	**Date Started:**	8/5/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/5/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 24 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.2	ASPHALT - (2.75 inches)		1.0					
	0.6	AGGREGATE BASE COURSE - (4.75 inches)			SS-1	3	3	6	9
		RESIDUUM - stiff to very stiff, moist, red, CLAY (CL) (A-7-6), 41, 21, 20, 14.7%, 64.3%		2.5	SS-2	4	7	8	15
584.0				4.5	SS-3	11	12	12	24
	6.0	RESIDUUM - stiff to very stiff, moist, orange red tan, SANDY SILT (ML) (A-4), trace mica		6.5	SS-4	3	5	9	14
				8.5	SS-5	10	13	16	29
579.0									
	12.0	RESIDUUM - dense to medium dense, dry, orange white gray, fine to coarse, SILTY SAND (SM) (A-2-4)		13.5	SS-6	14	15	21	36
574.0									
				18.5	SS-7	7	8	10	18
569.0									
	22.0	PARTIALLY WEATHERED ROCK (PWR) - dry, orange white gray, fine to coarse, SILTY SAND (SM) (A-2-4)		23.5	SS-8	14	21	50/.2	100
564.0									
	25.8	Terminated at 25.8 feet due to **auger refusal**.		25.8	~~SS-9~~	~~50/0~~			~~100~~
559.0									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Lakeshore Dr
Boring No.:	C- 7	**Boring Location:**	12+54	**Offset:**	5' RT	**Alignment:**	LAKESHORE
Elev.:	586.0 ft	**Latitude:**	35.06384933	**Longitude:**	-80.93718914	**Date Started:**	8/6/2014
Total Depth:	28.5 ft	**Soil Depth:**	28.5 ft	**Core Depth:**	ft	**Date Completed:**	8/6/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 18 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.5	ASPHALT - 3.25 inches AGGREGATE BASE COURSE - 3 inches	1.0					
		FILL - stiff, dry, red, SANDY CLAY (CL) (A-6), 36, 17, 19, 5.7%, 63.4%	2.5	SS-1	6	7	8	15
				SS-2	5	7	10	17
	4.0	RESIDUUM - hard to very stiff, moist, red, SANDY CLAY (CL) (A-6)	4.5					
581.0				SS-3	16	18	20	38
			6.5					
				SS-4	5	9	11	20
	8.0	RESIDUUM - medium dense to very dense, dry, orange white gray, fine to coarse, SILTY SAND (SM) (A-2-4)	8.5					
				SS-5	7	10	14	24
576.0								
			13.5					
				SS-6	7	13	10	23
571.0								
		▽	18.5					
				SS-7	22	40	34	74
566.0								
	22.0	PARTIALLY WEATHERED ROCK (PWR) - dry, orange white gray, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5	SS-8	50/.4			100
561.0								
	28.5	Terminated at 28.5 feet due to **auger refusal**.	28.5	SS-9	50/0			100
556.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Embassy Dr
Boring No.:	C- 8	**Boring Location:**	10+89	**Offset:**	3' LT	**Alignment:**	EMBASSY
Elev.:	628.0 ft	**Latitude:**	35.06800509	**Longitude:**	-80.93585622	**Date Started:**	5/22/2015
Total Depth:	28.8 ft	**Soil Depth:**	28.8 ft	**Core Depth:**	ft	**Date Completed:**	5/22/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.7	ASPHALT (8.5 inches)		0.7					
		FILL - firm to stiff, moist, red brown, SANDY CLAY (CL) (A-7-6), 49, 27, 22, 26.4%, 68.8%		2.5	SS-1	3	3	5	8
					SS-2	2	3	5	8
				4.5					
623.0					SS-3	2	4	6	10
	6.3	RESIDUUM - very stiff to stiff, moist, red brown, CLAYEY SILT (MH) (A-7-5)		6.5					
					SS-4	4	7	9	16
				8.5					
					SS-5	5	7	8	15
618.0									
	12.0	RESIDUUM - stiff, moist, red orange, SANDY SILT (ML) (A-4)		13.5					
					SS-6	5	5	8	13
613.0									
				18.5					
					SS-7	4	4	5	9
608.0									
				23.5					
					SS-8	2	4	5	9
603.0									
	27.0	PARTIALLY WEATHERED ROCK (PWR) - moist, brown, SANDY SILT (ML) (A-4)		28.5	SS-9	50/.3			100
	28.8	Terminated at 28.8 feet.							
598.0									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

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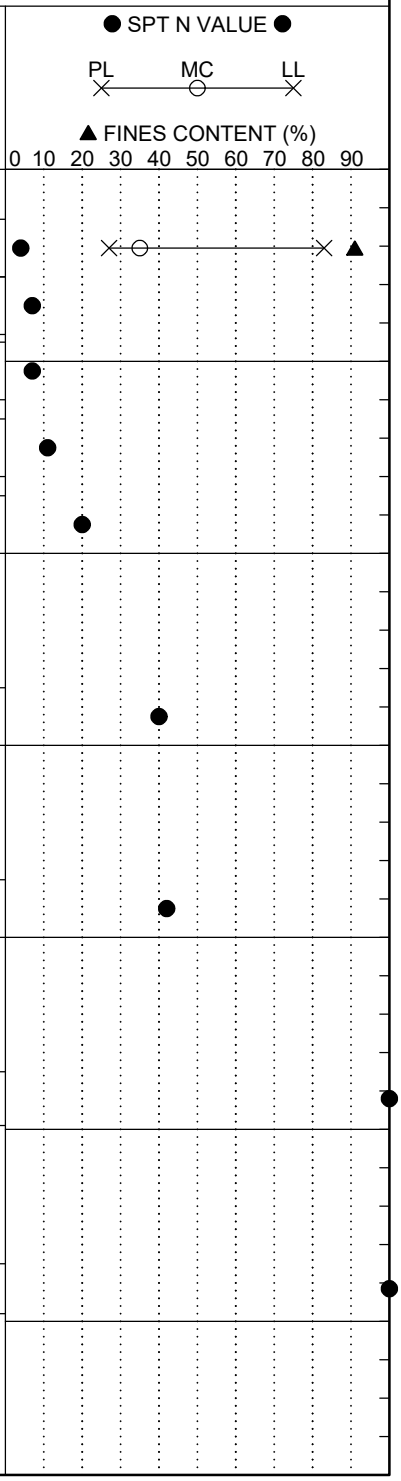
SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Old Nation Rd
Boring No.:	C- 9	**Boring Location:**	15+10	**Offset:**	5' RT	**Alignment:**	OLDNACL
Elev.:	633.0 ft	**Latitude:**	35.07077351	**Longitude:**	-80.93452423	**Date Started:**	5/21/2015
Total Depth:	29.7 ft	**Soil Depth:**	29.7 ft	**Core Depth:**	ft	**Date Completed:**	5/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.6	ASPHALT (7.5 inches)						
	1.3	CONCRETE (7.5 inches)	1.3					
		FILL - soft, wet, tan, CLAY (CH) (A-7-6)		SS-1	2	2	2	4
	2.8		2.8					
		RESIDUUM - firm, moist, tan, CLAY (CH) (A-7-6), 83, 27, 56, 35.1%, 90.9%		SS-2	2	3	4	7
	4.3		4.5					
628.0		RESIDUUM - firm to very stiff, moist, brown, SANDY SILT (ML) (A-4)		SS-3	2	3	4	7
			6.5					
				SS-4	4	4	7	11
			8.5					
623.0				SS-5	5	9	11	20
	12.0							
		RESIDUUM - hard, moist, brown, SANDY SILT (ML) (A-4)	13.5					
				SS-6	9	16	24	40
618.0								
			18.5					
				SS-7	14	16	26	42
613.0								
	22.0							
		PARTIALLY WEATHERED ROCK (PWR) - moist, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5					
				SS-8	14	26	50/.4	100
608.0								
			28.5					
				SS-9	16	38	50/.3	100
	29.8							
603.0		Terminated at 29.8 feet.						



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Old Nation Rd
Boring No.:	C-10	**Boring Location:**	17+26	**Offset:**	3' RT	**Alignment:**	OLDNACL
Elev.:	633.0 ft	**Latitude:**	35.0712929	**Longitude:**	-80.93487468	**Date Started:**	8/12/2014
Total Depth:	29.8 ft	**Soil Depth:**	29.8 ft	**Core Depth:**	ft	**Date Completed:**	8/12/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 27 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.8	ASPHALT - (9 inches)						
	1.2	AGGREGATE BASE COURSE - (5 inches)	1.0					
	2.5	FILL - loose, dry, brown, fine to coarse, CLAYEY SAND (SC) (A-2-4), 28, 18, 10, 15.0%, 31.1%	2.5	SS-1	5	3	3	6
				SS-2	2	2	1	3
628.0		ALLUVIAL - very loose to loose, wet, brown gray, fine, SILTY SAND (SM) (A-2-4)	4.5	SS-3	2	3	4	7
	6.3	ALLUVIAL - firm to stiff, moist, gray orange, CLAY (CH) (A-7-6)	6.5	SS-4	2	3	4	7
			8.5	SS-5	3	3	6	9
623.0								
	12.0	RESIDUUM - medium dense to dense, moist, gray brown white, fine to coarse, SILTY SAND (SM) (A-2-4)	13.5	SS-6	5	9	17	26
618.0								
			18.5	SS-7	10	20	22	42
613.0								
	22.0	RESIDUUM - very dense, moist, gray brown white, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5	SS-8	13	20	40	60
608.0								
	27.0	PARTIALLY WEATHERED ROCK (PWR) - dry, gray brown white, fine to coarse, SILTY SAND (SM) (A-2-4)	28.5	SS-9	18	41	50/.3	100
	29.8							
603.0		Terminated at 29.8 feet.						

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

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LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Baxter Ln
Boring No.:	C-11	**Boring Location:**	13+70	**Offset:**	1' RT	**Alignment:**	BAXTER
Elev.:	645.0 ft	**Latitude:**	35.07314771	**Longitude:**	-80.93583897	**Date Started:**	8/6/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/6/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.8	AGGREGATE BASE COURSE - (9 inches)		1.0					
	2.0	FILL - medium dense, dry , gray brown, fine to coarse, SILTY SAND (SM) (A-2-4)		2.5	SS-1	7	8	7	15
		RESIDUUM - very stiff to hard, dry, red orange, CLAYEY SILT (MH) (A-7-5)			SS-2	4	6	12	18
640.0				4.5	SS-3	14	21	20	41
	6.3	RESIDUUM - very stiff to stiff, dry, red orange, SANDY SILT (ML) (A-4)		6.5	SS-4	8	9	9	18
				8.5	SS-5	3	5	5	10
635.0									
				13.5	SS-6	5	6	6	12
630.0									
	17.0	RESIDUUM - medium dense, dry, tan white, fine to coarse, SILTY SAND (SM) (A-2-4)		18.5	SS-7	5	8	8	16
625.0									
				23.5	SS-8	6	7	9	16
620.0									
				28.5	SS-9	4	6	7	13
615.0	30.0	Terminated at 30 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

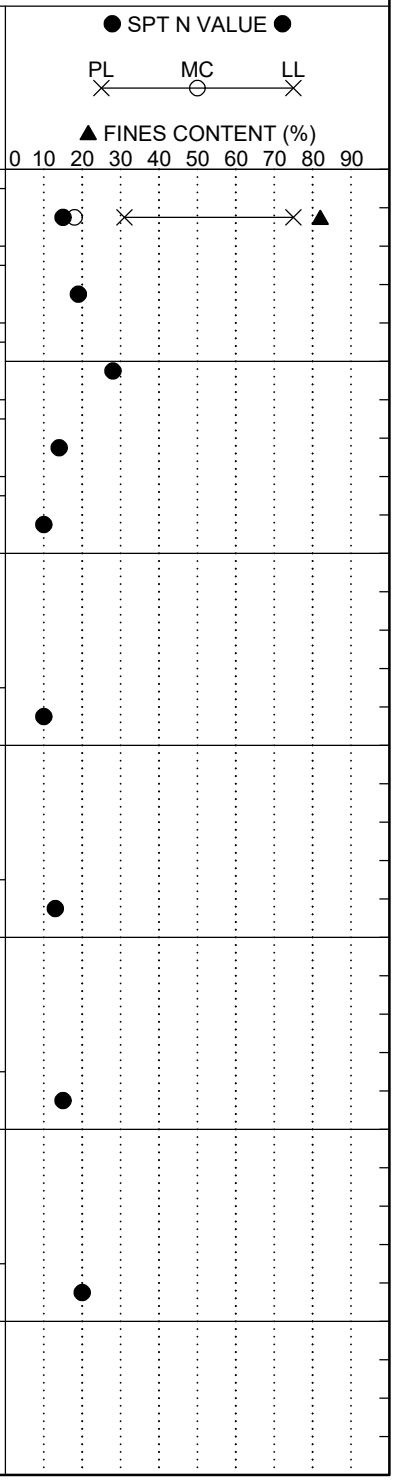
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Baxter Ln
Boring No.:	C-12	**Boring Location:**	12+02	**Offset:**	1' LT	**Alignment:**	GARRISONF
Elev.:	647.0 ft	**Latitude:**	35.07293837	**Longitude:**	-80.93474978	**Date Started:**	8/6/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/6/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.1	ASPHALT - (1.5 inches)	0.5					
	0.2	AGGREGATE BASE COURSE - (1.5 inches)		SS-1	4	5	10	15
		RESIDUUM - stiff to very stiff, dry, red, CLAY (CH) (A-7-5), 75, 31, 44, 18.1%, 81.9%	2.5	SS-2	6	8	11	19
	4.0		4.5					
642.0		RESIDUUM - very stiff to stiff, dry, red orange, CLAYEY SILT (MH) (A-7-5)		SS-3	13	13	15	28
			6.5	SS-4	3	6	8	14
	8.0		8.5					
		RESIDUUM - stiff, moist, gray white orange, SANDY SILT (ML) (A-4), trace mica		SS-5	4	5	5	10
637.0								
			13.5	SS-6	3	5	5	10
632.0								
			18.5	SS-7	4	5	8	13
627.0								
	22.0	RESIDUUM - medium dense, moist, orange tan white, fine, SILTY SAND (SM) (A-2-4)	23.5	SS-8	5	7	8	15
622.0								
			28.5	SS-9	5	8	12	20
617.0	30.0	Terminated at 30 feet.						



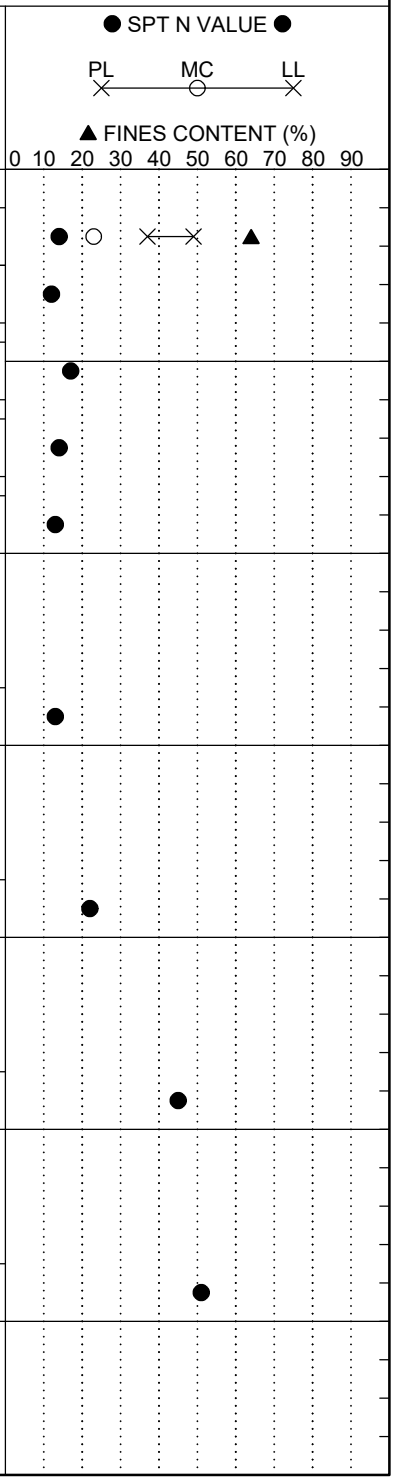
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Central Carolina
Boring No.:	C-13	**Boring Location:**	11+11	**Offset:**	8' RT	**Alignment:**	CENTRALCA
Elev.:	644.0 ft	**Latitude:**	35.0750626	**Longitude:**	-80.93611153	**Date Started:**	8/7/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/7/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.8	ASPHALT - 6 inches AGGREGATE BASE COURSE - 3 inches	1.0					
	2.5	RESIDUUM - medium dense, moist, tan white orange, SANDY SILT (ML) (A-7-5), 49, 37, 12, 22.7%, 63.8%	2.5	SS-1	5	6	8	14
			4.5	SS-2	5	6	6	12
639.0		RESIDUUM - very stiff to stiff, dry, gray white orange, SANDY SILT (ML) (A-4)		SS-3	8	8	9	17
			6.5	SS-4	5	6	8	14
			8.5	SS-5	5	5	8	13
634.0								
	12.0	RESIDUUM - medium dense, dry, gray white, fine to coarse, SILTY SAND (SM) (A-2-4)	13.5	SS-6	5	5	8	13
629.0								
			18.5	SS-7	9	9	13	22
624.0								
	22.0	RESIDUUM - dense to very dense, dry, gray white, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5	SS-8	12	19	26	45
619.0								
			28.5	SS-9	11	17	34	51
614.0	30.0	Terminated at 30 feet.						



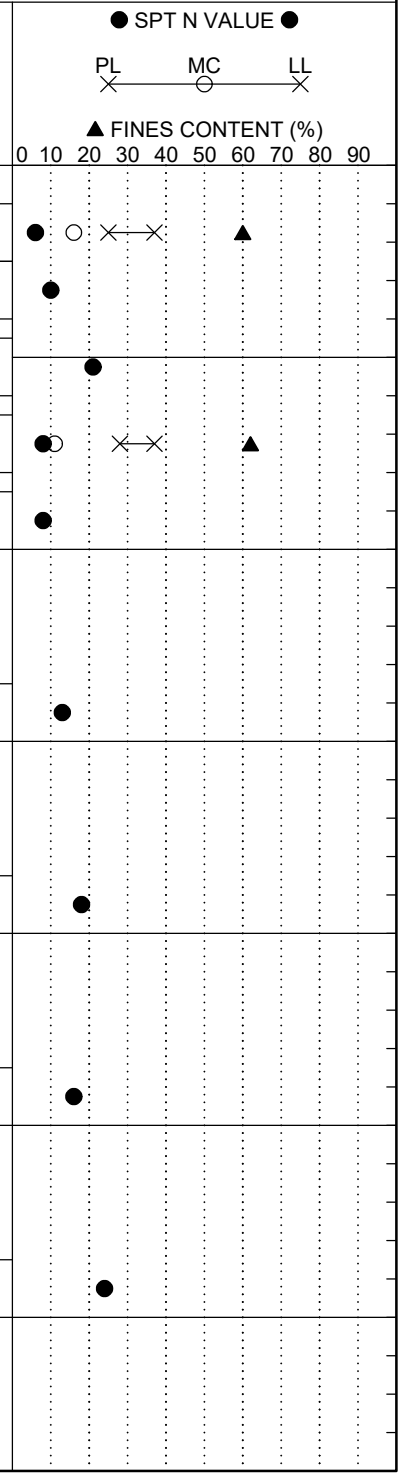
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Regent Dr.
Boring No.:	C-14	**Boring Location:**	11+62	**Offset:**	13' LT	**Alignment:**	REGENTDW
Elev.:	642.0 ft	**Latitude:**	35.07496292	**Longitude:**	-80.93458115	**Date Started:**	8/7/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/7/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.2	ASPHALT - (2.5 inches)						
	0.8	AGGREGATE BASE COURSE - (7 inches)	1.0					
		FILL - firm to stiff, moist, tan red, SANDY SILT (ML) (A-6), trace clay, trace gravel, 37, 25, 12, 16.2%, 60.0%	2.5	SS-1	3	3	3	6
				SS-2	3	4	6	10
	4.3		4.5					
637.0		FILL - very stiff, moist, tan red, SANDY SILT (ML) (A-6), trace clay, trace gravel		SS-3	8	9	12	21
	6.3		6.5					
		FILL - firm, moist, tan red, SANDY SILT (ML) (A-4), 37, 28, 9, 11.4%, 62.0		SS-4	3	4	4	8
			8.5					
				SS-5	3	4	4	8
632.0								
	12.0							
		RESIDUUM - stiff, dry, orange gray tan, SANDY CLAY (CL) (A-6)	13.5					
				SS-6	3	6	7	13
627.0								
	17.0							
		RESIDUUM - medium dense, dry, brown orange, fine, SILTY SAND (SM) (A-2-4)	18.5					
				SS-7	6	8	10	18
622.0								
			23.5					
				SS-8	5	7	9	16
617.0								
			28.5					
				SS-9	7	11	13	24
612.0	30.0							
		Terminated at 30 feet.						



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Regent Pkwy
Boring No.:	C-15	**Boring Location:**	12+20	**Offset:**	15' RT	**Alignment:**	REGENTPKW
Elev.:	644.0 ft	**Latitude:**	35.07687193	**Longitude:**	-80.93411184	**Date Started:**	8/7/2014
Total Depth:	21.6 ft	**Soil Depth:**	21.6 ft	**Core Depth:**	ft	**Date Completed:**	8/7/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.4	ASPHALT - (4.5 inches)						
	0.7	AGGREGATE BASE COURSE - (3.5 inches)	1.0					
	2.5			SS-1	2	5	6	11
		RESIDUUM - stiff, moist, red white, CLAY (CH) (A-7-5), 85, 37, 48, 32.1%, 87.5%	2.5	SS-2	7	11	12	23
	4.0		4.5					
639.0		RESIDUUM - very stiff, dry, tan white orange, SANDY SILT (ML) (A-4)		SS-3	12	13	16	19
		RESIDUUM - medium dense, dry, tan orange, fine, SILTY SAND (SM) (A-2-4)	6.5					
				SS-4	5	13	13	26
	8.3		8.5					
		RESIDUUM - very dense, dry, tan orange, fine, SILTY SAND (SM) (A-2-4)		SS-5	11	25	45	70
634.0								
	12.0							
		RESIDUUM - dense, dry, tan orange, fine, SILTY SAND (SM) (A-2-4)	13.5					
				SS-6	16	20	20	40
629.0								
			18.5					
				SS-7	11	17	17	34
624.0								
	21.6		21.6	SS-8	50/.1			100
		Terminated at 21.6 feet due to **auger refusal**.						
619.0								
614.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Lakes Blvd
Boring No.:	C-16	**Boring Location:**	11+64	**Offset:**	13' LT	**Alignment:**	LAKESBLVD
Elev.:	650.0 ft	**Latitude:**	35.07890474	**Longitude:**	-80.93399664	**Date Started:**	8/7/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/7/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.4	ASPHALT - (5 inches)		1.0					
	0.5	AGGREGATE BASE COURSE - (1.5 inches)		2.5	SS-1	4	4	8	12
		RESIDUUM - stiff to very stiff, moist, red orange, CLAYEY SILT (MH) (A-7-5), 71, 43, 28, 24.6%, 88.6%		4.5	SS-2	5	8	10	18
645.0	4.0	RESIDUUM - very stiff to stiff, dry, tan red orange, SANDY SILT (ML) (A-4), trace mica		6.5	SS-3	5	8	9	17
				8.5	SS-4	3	4	6	10
640.0				13.5	SS-5	4	4	6	10
					SS-6	3	4	5	9
635.0				18.5					
					SS-7	4	5	6	11
630.0				23.5					
					SS-8	5	6	7	13
625.0				28.5					
	27.0	RESIDUUM - medium dense, moist, tan white gray, fine, SILTY SAND (SM) (A-2-4)			SS-9	8	11	14	25
620.0	30.0	Terminated at 30 feet.							

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	Flint Hill Rd
Boring No.:	C-17	**Boring Location:**	12+01	**Offset:**	7' LT	**Alignment:**	FLINTHILL
Elev.:	667.0 ft	**Latitude:**	35.08191519	**Longitude:**	-80.93324906	**Date Started:**	8/12/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/12/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	ASPHALT - (3.5 inches)						
	1.1	CONCRETE - (9.5 inches)	1.5					
		FILL - firm to stiff, moist, brown, SANDY CLAY (CL) (A-6), 31, 15, 16, 11.4%, 57.5%		SS-1	9	7	6	13
			3.0	SS-2	2	2	3	5
	4.5		4.5					
662.0		RESIDUUM - very stiff to stiff, dry, red orange, CLAYEY SILT (MH) (A-7-5)		SS-3	5	6	10	16
			6.5					
				SS-4	3	7	7	14
	8.0		8.5					
		RESIDUUM - very stiff to stiff, dry, red orange, SANDY SILT (ML) (A-4)		SS-5	5	7	9	16
657.0								
			13.5					
				SS-6	3	4	6	10
652.0								
	17.0							
		RESIDUUM - firm, moist, red orange, SANDY SILT (ML) (A-4)	18.5					
				SS-7	3	3	4	7
647.0								
	22.0							
		RESIDUUM - loose, moist, white tan gray, fine, SILTY SAND (SM) (A-2-4)	23.5					
				SS-8	3	3	4	7
642.0								
			28.5					
				SS-9	3	4	5	9
637.0	30.0							
		Terminated at 30 feet.						

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 1	**Boring Location:**	17+49	**Offset:**	30' RT	**Alignment:**	US21
Elev.:	613.0 ft	**Latitude:**	35.05719321	**Longitude:**	-80.93764843	**Date Started:**	7/23/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/23/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (3 inches)		0.5					
		RESIDUUM - soft to firm, moist, orange brown, fine to coarse, SANDY CLAY (CL) (A-7-6), trace mica, manganese staining, 53, 28, 25, 23.1%, 58.6%			SS-1	1	2	2	4
				2.5	SS-2	2	1	2	3
608.0				4.5	SS-3	3	3	4	7
				6.5	SS-4	2	3	3	6
				8.5	SS-5	3	3	3	6
603.0									
				13.5	SS-6	3	3	3	6
598.0									
				18.5	SS-7	3	4	4	8
593.0									
	22.0	RESIDUUM - loose to medium dense, dry, white tan, fine, SILTY SAND (SM) (A-2-4), trace mica, manganese staining		23.5	SS-8	3	5	5	10
588.0									
				28.5	SS-9	4	5	13	18
583.0	30.0	Terminated at 30 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

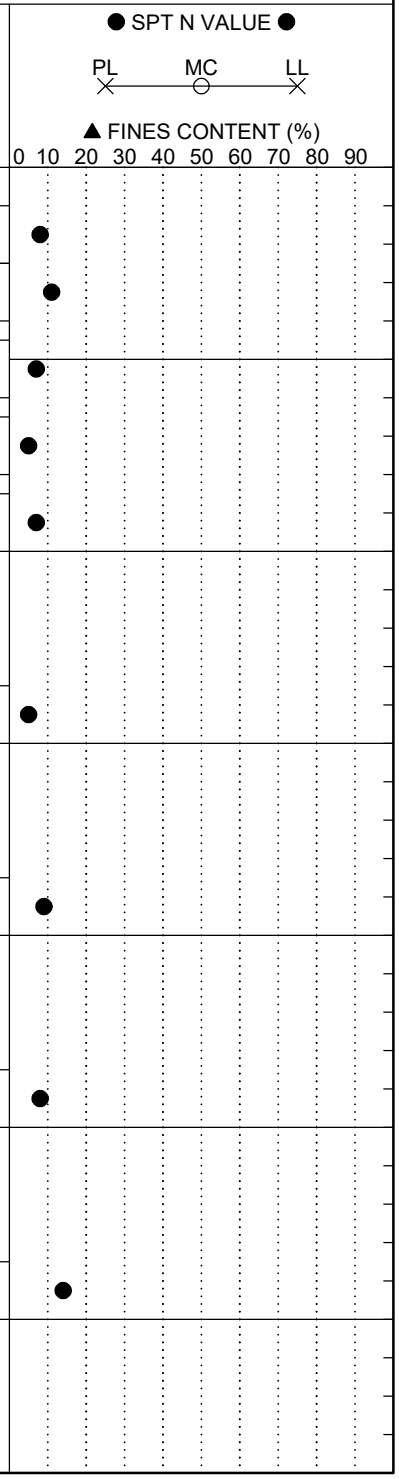
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 2	**Boring Location:**	23+68	**Offset:**	29' LT	**Alignment:**	US21
Elev.:	602.0 ft	**Latitude:**	35.05890192	**Longitude:**	-80.93759706	**Date Started:**	5/20/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.8	ASPHALT - (12 inches)		1.0					
	1.0	AGGREGATE BASE COARSE - (3 inches)			SS-1	4	4	4	8
		FILL - firm to stiff, moist, brown, SANDY CLAY (CL) (A-6)		2.5	SS-2	4	5	6	11
	3.5	FILL - firm, moist, orange brown, SANDY SILT (ML) (A-4)		4.5					
597.0					SS-3	2	3	4	7
	7.0			6.5					
		FILL - firm, moist, orange brown, CLAY (CH) (A-7-6)			SS-4	2	1	4	5
	8.3			8.5					
		FILL - firm, moist, red brown, SANDY CLAY (CL) (A-6)			SS-5	3	3	4	7
592.0									
				13.5					
					SS-6	2	2	3	5
587.0									
	17.0	FILL - stiff, moist, red orange, CLAYEY SILT (MH) (A-7-5)		18.5					
					SS-7	2	4	5	9
582.0									
	22.0	RESIDUUM - firm, moist, brown, SANDY CLAY (CL) (A-6)		23.5					
					SS-8	2	3	5	8
577.0									
	27.0	RESIDUUM - medium dense, moist, gray, fine to coarse, CLAYEY SAND (SC) (A-2-6)		28.5					
					SS-9	4	6	8	14
572.0	30.0	Terminated at 30 feet.							

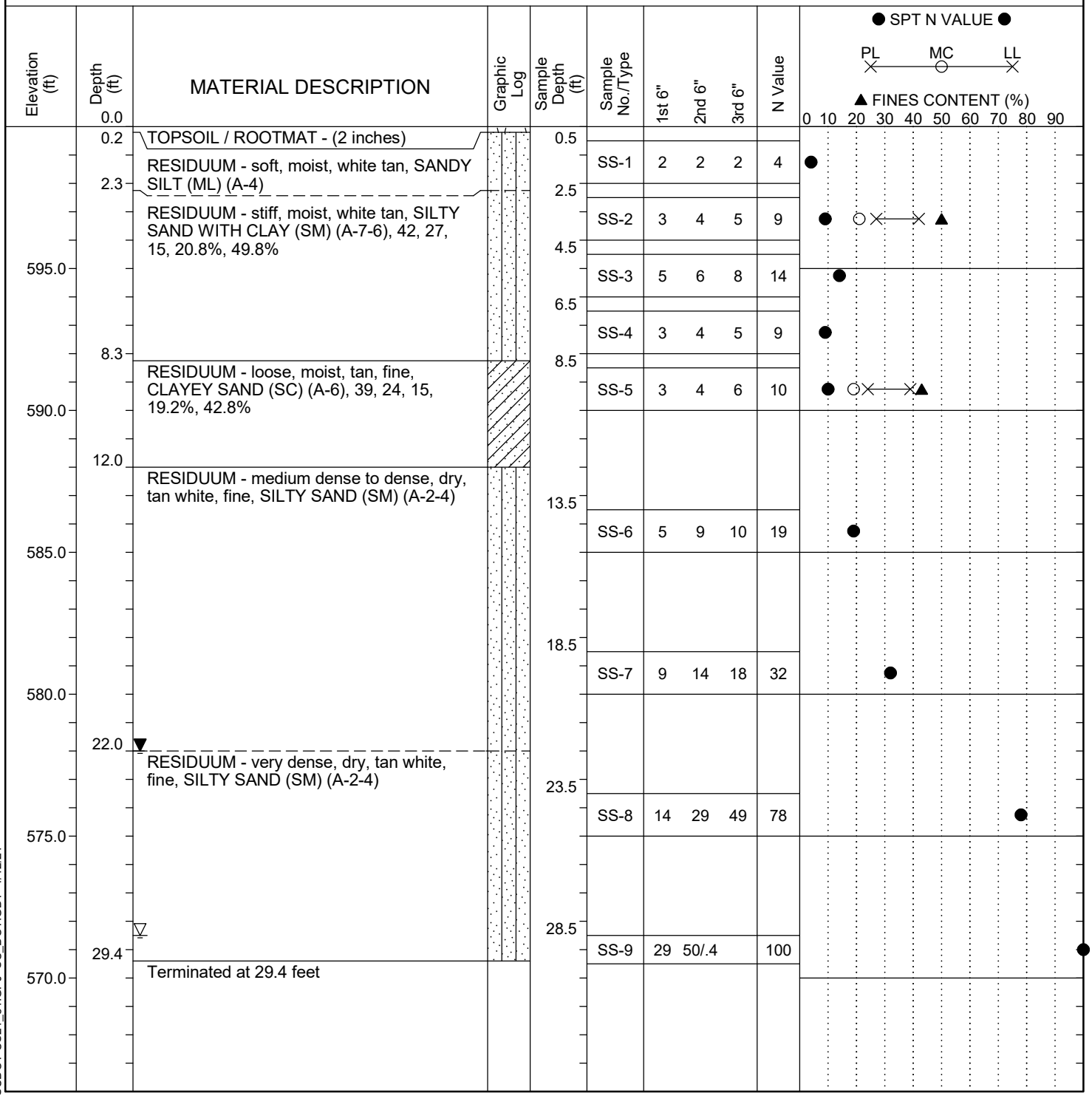


LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 3	**Boring Location:**	28+68	**Offset:**	29' RT	**Alignment:**	US21
Elev.:	600.0 ft	**Latitude:**	35.06024508	**Longitude:**	-80.93720183	**Date Started:**	7/23/2014
Total Depth:	29.4 ft	**Soil Depth:**	29.4 ft	**Core Depth:**	ft	**Date Completed:**	7/23/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 28.5 ft	**24HR**	22 ft



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 4	**Boring Location:**	33+64	**Offset:**	17' LT	**Alignment:**	US21
Elev.:	594.1 ft	**Latitude:**	35.0616177	**Longitude:**	-80.9371675	**Date Started:**	7/29/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/29/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.5	ASPHALT - (6 inches)		1.0					
	0.6	AGGREGATE BASE COURSE - (1.5 inches)			SS-1	3	3	3	6
	2.0	FILL - firm, moist, red, CLAYEY SILT (MH) (A-7-5)		2.5	SS-2	3	3	4	7
589.1		FILL - firm to stiff, moist, tan, SANDY SILT (ML) (A-4)		4.5	SS-3	3	4	5	9
				6.5	SS-4	3	3	3	6
				8.5	SS-5	3	4	4	8
584.1									
				13.5	SS-6	3	3	5	8
579.1									
	17.0	FILL - stiff, moist, gray, SANDY CLAY (CL) (A-6)		18.5	SS-7	3	5	5	10
574.1									
				23.5	SS-8	3	4	5	9
569.1									
				28.5	SS-9	3	5	5	10
564.1	30.0	Terminated at 30 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 5	**Boring Location:**	38+68	**Offset:**	13' RT	**Alignment:**	US21
Elev.:	587.6 ft	**Latitude:**	35.0629718	**Longitude:**	-80.9368658	**Date Started:**	7/23/2014
Total Depth:	29.3 ft	**Soil Depth:**	29.3 ft	**Core Depth:**	ft	**Date Completed:**	7/23/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 28.8 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.4	ASPHALT - (4.25 inches)	0.7					
	0.7	AGGREGATE BASE COURSE - (3.75 inches)		SS-1	4	4	6	10
		FILL - firm to stiff, moist, tan red brown, SILTY SAND (SM) WITH CLAY (A-7-6), 44, 28, 16, 25.0%, 44.9%	2.5	SS-2	3	3	3	6
582.6			4.5	SS-3	5	5	5	10
			6.5	SS-4	2	3	2	5
	8.3		8.5					
		FILL - firm, moist, brown gray, CLAY (CL) (A-7-6), 41, 21, 20, 19.5%, 57.8%		SS-5	2	3	3	6
577.6								
	12.0							
		RESIDUUM - medium dense to dense, dry, red brown orange, fine to coarse, SILTY SAND (SM) (A-2-4)	13.5	SS-6	8	11	15	26
572.6								
			18.5	SS-7	12	17	22	39
567.6								
	22.0							
		RESIDUUM - very dense, dry, red brown orange, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5	SS-8	19	24	27	51
562.6								
	27.0							
		PARTIALLY WEATHERED ROCK (PWR) - dry, gray brown white, fine to coarse, SILTY SAND (SM) (A-2-4)	28.5	SS-9	37	50/.3		100
	29.3							
557.6		Terminated at 29.3 feet						

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

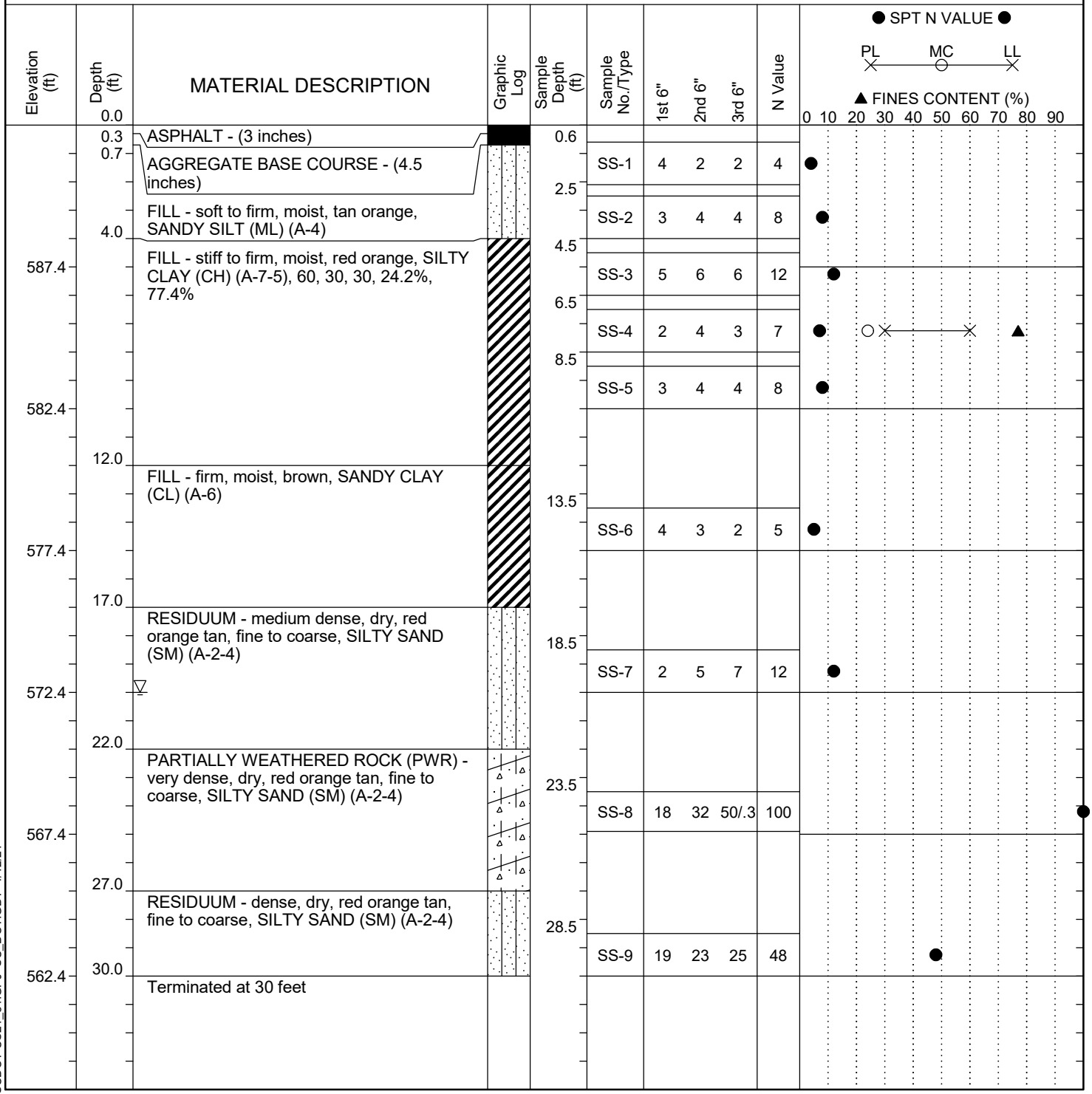
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 6	**Boring Location:**	43+66	**Offset:**	11' RT	**Alignment:**	US21
Elev.:	592.4 ft	**Latitude:**	35.0643343	**Longitude:**	-80.936671	**Date Started:**	7/23/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/23/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 20 ft	**24HR**	N/A



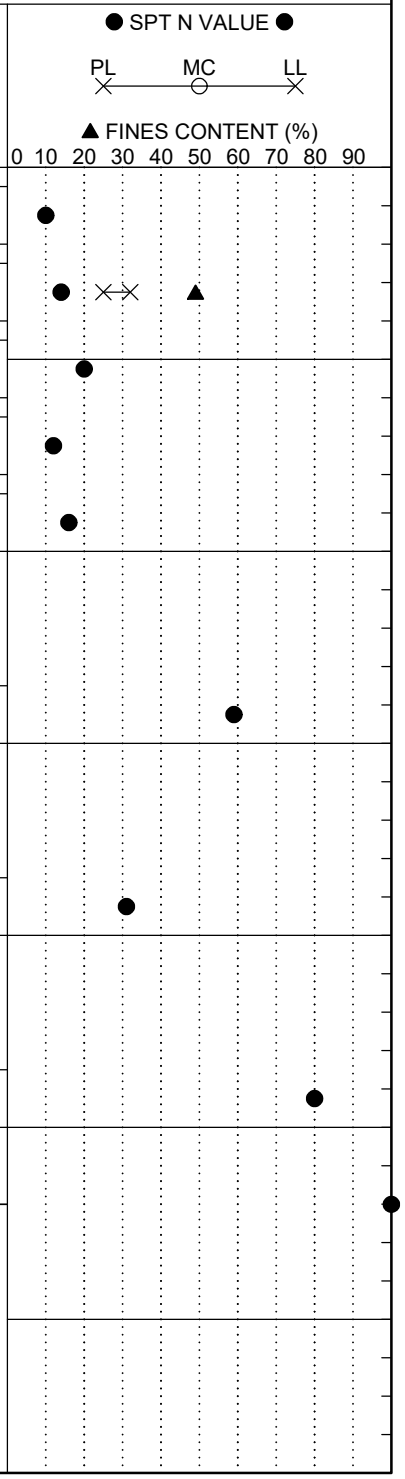
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 7	**Boring Location:**	48+68	**Offset:**	17' LT	**Alignment:**	US21
Elev.:	606.5 ft	**Latitude:**	35.0657078	**Longitude:**	-80.9365631	**Date Started:**	7/29/2014
Total Depth:	27 ft	**Soil Depth:**	27 ft	**Core Depth:**	ft	**Date Completed:**	7/29/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	ASPHALT - (4 inches)	0.5					
	0.6	AGGREGATE BASE COURSE - (3 inches)		SS-1	5	5	5	10
		RESIDUUM - loose to medium dense, dry, orange tan white, fine to coarse, SILTY SAND (SM) (A-4), 32, 25, 7, 14.3%, 49.3%	2.5	SS-2	5	6	8	14
601.5			4.5	SS-3	8	9	11	20
			6.5	SS-4	3	5	7	12
			8.5	SS-5	5	7	9	16
596.5								
	12.0	RESIDUUM - very dense to dense, dry, orange tan white, fine, SILTY SAND (SM) (A-2-4)	13.5	SS-6	16	25	34	59
591.5								
			18.5	SS-7	10	15	16	31
586.5								
			23.5	SS-8	16	26	54	80
581.5								
	27.0	Terminated at 27 feet	27.0	~~SS-9~~	~~50/0~~			~~100~~
576.5								



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 8	**Boring Location:**	53+57	**Offset:**	31' RT	**Alignment:**	US21
Elev.:	619.0 ft	**Latitude:**	35.06706573	**Longitude:**	-80.93618437	**Date Started:**	7/24/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/24/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (2 inches)		0.5					
		FILL - firm, moist, red, SANDY SILT (ML) (A-4)			SS-1	2	4	4	8
				2.5	SS-2	2	3	3	6
	4.0			4.5					
614.0		RESIDUUM - firm to stiff, moist, red brown, SILTY CLAY (CH) (A-7-6), 50, 24, 26, 24.1%, 59.6%			SS-3	5	5	5	10
				6.5	SS-4	2	2	3	5
				8.5	SS-5	4	6	4	10
609.0									
	12.0								
		RESIDUUM - stiff, moist, brown gray, SANDY CLAY (CL) (A-6)		13.5	SS-6	4	4	6	10
604.0									
	17.0								
		RESIDUUM - stiff to firm, moist, orange tan white, SANDY SILT (ML) (A-4)		18.5	SS-7	4	4	6	10
599.0									
				23.5	SS-8	4	4	4	8
594.0									
	27.0								
		RESIDUUM - loose, moist, tan orange white, fine, SILTY SAND (SM) (A-2-4)		28.5	SS-9	2	2	3	5
589.0	30.0								
		Terminated at 30 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R- 9	**Boring Location:**	58+68	**Offset:**	26' LT	**Alignment:**	US21
Elev.:	634.0 ft	**Latitude:**	35.06844479	**Longitude:**	-80.93617665	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	TOPSOIL - (3 inches)	0.5	SS-1	5	7	7	14
	2.3	FILL - stiff, moist, brown, SANDY CLAY (CL) (A-6)	2.5	SS-2	5	10	14	24
629.0		RESIDUUM - very stiff, moist, red brown, SILTY CLAY (CH) (A-7-5), 63, 31, 32, 27.7%, 76.8%	4.5	SS-3	6	9	15	24
			6.5	SS-4	8	13	17	30
			8.5	SS-5	5	8	10	18
624.0	12.0	RESIDUUM - stiff, moist, tan brown, SANDY SILT (ML) (A-4), trace mica	13.5	SS-6	2	5	7	12
619.0	17.0	RESIDUUM - very dense, dry, brown tan, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica	18.5	SS-7	10	30	34	64
614.0	22.0	PARTIALLY WEATHERED ROCK (PWR) - moist, brown tan, SANDY SILT (ML) (A-4)	23.5	SS-8	10	17	50/.2	100
609.0	27.0	RESIDUUM - medium dense, dry, brown tan, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica	28.5	SS-9	10	8	8	16
604.0	30.0	Terminated at 30 feet.						

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-10	**Boring Location:**	63+68	**Offset:**	28' LT	**Alignment:**	US21
Elev.:	640.0 ft	**Latitude:**	35.06981002	**Longitude:**	-80.93598517	**Date Started:**	5/26/2015
Total Depth:	29.5 ft	**Soil Depth:**	29.5 ft	**Core Depth:**	ft	**Date Completed:**	5/26/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL (4 inches)		0.5	SS-1	6	6	5	11
		FILL - stiff, moist, red brown, CLAYEY SILT (MH) (A-7-5), 54, 30, 24, 33.4%, 68.5%		2.5	SS-2	3	5	5	10
	4.3			4.5					
635.0		RESIDUUM - stiff to very stiff, moist, orange brown, SANDY SILT (ML) (A-4)			SS-3	3	4	5	9
				6.5	SS-4	5	7	8	15
				8.5	SS-5	5	6	8	14
630.0									
				13.5	SS-6	6	10	12	22
625.0									
				18.5	SS-7	5	7	10	17
620.0									
				23.5	SS-8	8	11	13	24
615.0									
	27.0	PARTIALLY WEATHERED ROCK (PWR) - moist, tan, SANDY SILT (ML) (A-4)		28.5	SS-9	17	50/.5		100
	29.5	Terminated at 29.5 feet.							
610.0									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-11	**Boring Location:**	68+68	**Offset:**	30' RT	**Alignment:**	US21
Elev.:	636.0 ft	**Latitude:**	35.07115317	**Longitude:**	-80.93558986	**Date Started:**	7/24/2014
Total Depth:	29.7 ft	**Soil Depth:**	29.7 ft	**Core Depth:**	ft	**Date Completed:**	7/24/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (3 inches)		0.5					
		FILL - medium dense, dry, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)			SS-1	9	8	4	12
	3.0			2.5					
		RESIDUUM - stiff to firm, moist, orange tan white, SANDY CLAY (CL) (A-7-6), trace mica, manganese staining, 46, 27, 19, 18.2%, 50.7%			SS-2	3	4	5	9
				4.5					
631.0					SS-3	5	5	5	10
				6.5					
					SS-4	3	3	4	7
				8.5					
					SS-5	3	4	5	9
626.0									
	12.0								
		RESIDUUM - very stiff, moist, orange tan white, SANDY SILT (ML) (A-4), trace mica, manganese staining		13.5					
					SS-6	6	10	13	23
621.0									
	17.0								
		RESIDUUM - medium dense to dense, moist, tan, fine to coarse, SILTY SAND (SM) (A-2-4)		18.5					
					SS-7	5	5	11	16
616.0									
				23.5					
					SS-8	7	15	22	37
611.0									
	27.0								
		PARTIALLY WEATHERED ROCK (PWR) - dry, tan, fine to coarse, SILTY SAND (SM) (A-2-4)		28.5					
	29.7				SS-9	27	49	50/.3	100
606.0		Terminated at 29.7 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-12	**Boring Location:**	73+68	**Offset:**	15' LT	**Alignment:**	US21
Elev.:	641.4 ft	**Latitude:**	35.0725257	**Longitude:**	-80.9355489	**Date Started:**	8/4/2014
Total Depth:	29.3 ft	**Soil Depth:**	29.3 ft	**Core Depth:**	ft	**Date Completed:**	8/4/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.4	ASPHALT - (5 inches)	1.0					
		FILL - firm, dry, red orange tan, CLAY (CH) (A-7-6), 51, 20, 31, 4.4%, 56.2%	2.5	SS-1	5	3	4	7
				SS-2	3	3	4	7
636.4			4.5	SS-3	3	3	4	7
			6.5	SS-4	3	2	3	5
	8.0	FILL - firm, moist, brown red, SANDY CLAY (CL) (A-6), 36, 18, 18, 11.9%, 59.9%	8.5	SS-5	4	4	4	8
631.4								
	12.0	RESIDUUM - stiff, moist, orange gray, SANDY CLAY (CL) (A-6)	13.5	SS-6	4	6	7	13
626.4								
	17.0	RESIDUUM - medium dense, dry, orange tan, fine, SILTY SAND (SM) (A-2-4)	18.5	SS-7	7	12	11	23
621.4								
	22.0	RESIDUUM - very dense, dry, orange tan, fine, SILTY SAND (SM) (A-2-4)	23.5	SS-8	11	23	45	68
616.4								
	27.0	PARTIALLY WEATHERED ROCK (PWR) - dry, orange tan, fine, SILTY SAND (SM) (A-2-4)	28.5	SS-9	40	50/.3		100
	29.3	Terminated at 29.3 feet.						
611.4								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-13	**Boring Location:**	78+38	**Offset:**	31' RT	**Alignment:**	US21
Elev.:	648.0 ft	**Latitude:**	35.0738012	**Longitude:**	-80.93519355	**Date Started:**	7/24/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/24/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (3 inches)		0.5					
	2.0	FILL - medium dense, dry, brown, fine to coarse, CLAYEY SAND (SC) (A-2-6)			SS-1	6	9	6	15
		RESIDUUM - stiff to very stiff, moist, red orange, CLAYEY SILT (MH) (A-7-5)		2.5	SS-2	4	5	7	12
643.0				4.5	SS-3	13	13	15	28
	6.0	RESIDUUM - firm to stiff, moist, red orange tan, SANDY SILT (ML) (A-4)		6.5	SS-4	3	5	6	11
				8.5	SS-5	4	4	7	11
638.0									
				13.5	SS-6	3	3	4	7
633.0									
				18.5	SS-7	3	3	3	6
628.0									
				23.5	SS-8	2	3	4	7
623.0									
				28.5	SS-9	3	6	9	15
618.0	30.0	Terminated at 30 feet							

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-14	**Boring Location:**	88+44	**Offset:**	21' LT	**Alignment:**	US21
Elev.:	644.5 ft	**Latitude:**	35.0765802	**Longitude:**	-80.934971	**Date Started:**	8/4/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/4/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 26.5 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.6	ASPHALT - (7 inches)		1.0					
	0.9	AGGREGATE BASE COURSE - (3.5 inches)			SS-1	5	4	3	7
		FILL - loose to medium dense, dry, gray red, fine, CLAYEY SAND (SC) (A-2-4), 22, 12, 10, 10.2%, 31.6%		2.5	SS-2	3	3	4	7
				4.5					
639.5					SS-3	8	6	5	11
	6.0	ALLUVIAL - very loose, wet, tan brown, fine, SILTY SAND (SM) (A-2-4)		6.5					
	8.0				SS-4	2	2	1	3
		RESIDUUM - firm, moist, gray orange white, SANDY CLAY (CL) (A-6)		8.5					
					SS-5	2	3	4	7
634.5									
	12.0	RESIDUUM - medium dense to dense, dry, tan orange white, fine, SILTY SAND (SM) (A-2-4)		13.5					
					SS-6	5	8	11	19
629.5									
				18.5					
					SS-7	13	17	16	33
624.5									
	22.0	PARTIALLY WEATHERED ROCK (PWR) - dry, tan orange white, fine, SILTY SAND (SM) (A-2-4)		23.5					
					SS-8	7	49	50/.2	100
619.5		▽							
	28.9			28.5	SS-9	50/.4			100
		Terminated at 28.9 feet.							
614.5									

SPT N VALUE ●

PL × MC ○ LL ×

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-15	**Boring Location:**	93+60	**Offset:**	14' LT	**Alignment:**	US21
Elev.:	655.3 ft	**Latitude:**	35.0779564	**Longitude:**	-80.9347427	**Date Started:**	8/4/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/4/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	ASPHALT - (4 inches)						
	0.6	AGGREGATE BASE COURSE - (3 inches)	1.0					
		RESIDUUM - stiff to very stiff, dry, red orange tan, CLAYEY SILT (MH) (A-7-5)	2.5	SS-1	4	5	5	10
	4.0			SS-2	6	8	11	19
650.3		RESIDUUM - hard to very stiff, moist, red orange, CLAYEY SILT (MH) (A-7-5), trace mica, 71, 39, 32, 25.1%, 74.7%	4.5	SS-3	13	15	20	35
			6.5	SS-4	5	7	12	19
	8.0		8.5	SS-5	6	6	7	13
645.3		RESIDUUM - stiff, dry, red orange, CLAYEY SILT (MH) (A-7-5), trace mica, 50, 30, 20, 12.3%, 57.2%						
	12.0		13.5	SS-6	4	4	6	10
640.3		RESIDUUM - stiff, dry, red tan, SANDY SILT (ML) (A-4), trace mica						
	17.0		18.5	SS-7	5	9	9	18
635.3		RESIDUUM - medium dense, dry, white gray, fine, SILTY SAND (SM) (A-2-4), trace mica						
			23.5	SS-8	9	9	12	21
630.3								
			28.5	SS-9	7	12	12	24
625.3	30.0	Terminated at 30 feet.						

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-16	**Boring Location:**	98+40	**Offset:**	32' RT	**Alignment:**	US21
Elev.:	662.0 ft	**Latitude:**	35.07925657	**Longitude:**	-80.93437733	**Date Started:**	7/28/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/28/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (3 inches)		0.5					
	2.0	FILL - stiff, dry, red brown, CLAYEY SILT (MH) (A-7-5)			SS-1	3	4	5	9
		RESIDUUM - very stiff, moist, red, CLAYEY SILT (MH) (A-7-5), 77, 42, 35, 25.5%, 85.1%		2.5	SS-2	8	10	12	22
657.0				4.5	SS-3	13	13	13	26
	6.0	RESIDUUM - stiff to firm, moist, red orange tan, CLAYEY SILT (MH) (A-5), 53, 44, 9, 15.5%, 73.1%		6.5	SS-4	3	5	5	10
				8.5	SS-5	3	4	4	8
652.0									
	12.0	RESIDUUM - stiff to firm, moist, red orange tan, SANDY SILT (ML) (A-4)		13.5	SS-6	3	4	5	9
647.0									
				18.5	SS-7	4	4	5	9
642.0									
				23.5	SS-8	2	3	3	6
637.0									
				28.5	SS-9	3	3	3	6
632.0	30.0	Terminated at 30 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

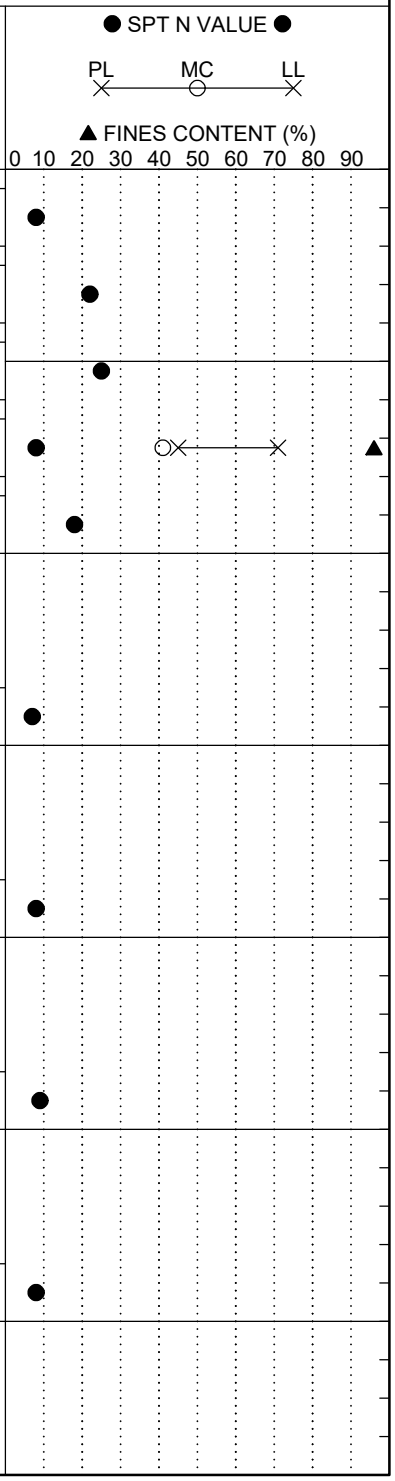
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-17	**Boring Location:**	103+66	**Offset:**	52' LT	**Alignment:**	US21
Elev.:	664.0 ft	**Latitude:**	35.08072078	**Longitude:**	-80.93437954	**Date Started:**	8/4/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	8/4/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.4	TOPSOIL / ROOTMAT - (2 inches)		0.5	SS-1	3	3	5	8
		RESIDUUM - firm to very stiff, dry, red orange, CLAYEY SILT (MH) (A-7-5), 71, 45, 26, 41.1%, 95.8%		2.5	SS-2	5	10	12	22
659.0				4.5	SS-3	9	12	13	25
				6.5	SS-4	3	3	5	8
				8.5	SS-5	8	9	9	18
654.0									
	12.0	RESIDUUM - firm to very stiff, dry, red orange tan, SANDY SILT (ML) (A-4), trace mica		13.5	SS-6	3	3	4	7
649.0									
				18.5	SS-7	3	4	4	8
644.0									
				23.5	SS-8	3	4	5	9
639.0									
				28.5	SS-9	2	4	4	8
634.0	30.0	Terminated at 30 feet.							



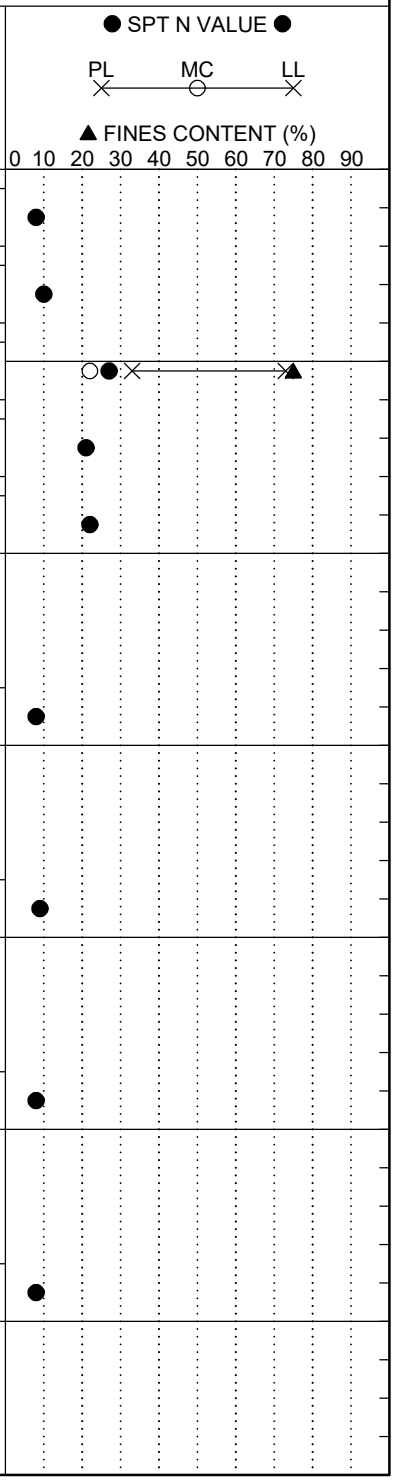
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-18	**Boring Location:**	109+85	**Offset:**	38' RT	**Alignment:**	US21
Elev.:	670.3 ft	**Latitude:**	35.082343	**Longitude:**	-80.9337201	**Date Started:**	7/25/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/25/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (4 inches)		0.5	SS-1	3	2	6	8
		FILL - firm to stiff, dry, red brown, SANDY CLAY (CL) (A-6), trace rootlets		2.5	SS-2	3	4	6	10
	4.0			4.5					
665.3		RESIDUUM - very stiff, dry, red tan, CLAY (CH) (A-7-5), 73, 33, 40, 22.4%, 75.4%			SS-3	9	12	15	27
				6.5	SS-4	6	8	13	21
	8.0			8.5					
		RESIDUUM - very stiff, moist, red, CLAYEY SILT (MH) (A-7-5)			SS-5	5	9	13	22
660.3									
	12.0								
		RESIDUUM - firm, moist, red tan, SANDY SILT (ML) (A-4)		13.5	SS-6	3	3	5	8
655.3									
	17.0								
		RESIDUUM - loose, moist, brown tan, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		18.5	SS-7	3	4	5	9
650.3									
				23.5	SS-8	3	4	4	8
645.3									
				28.5	SS-9	3	4	4	8
640.3	30.0	Terminated at 30 feet							



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-19	**Boring Location:**	113+68	**Offset:**	25' LT	**Alignment:**	US21
Elev.:	668.0 ft	**Latitude:**	35.0834088	**Longitude:**	-80.9337025	**Date Started:**	7/29/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/29/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	1.0	ASPHALT - (12 inches)						
	1.5	AGGREGATE BASE COURSE - (6 inches)						
		FILL - medium dense, dry, brown gray, fine to coarse, SILTY SAND (SC-SM) (A-2-4), trace fine gravel, 22, 18, 4, 3.6%, 29.4%	2.5	SS-1	9	12	15	27
663.0			4.5	SS-2	12	10	10	20
			6.5	SS-3	4	6	6	12
	8.3		8.5	SS-4	5	3	4	7
658.0		FILL - loose to medium dense, moist, brown gray, CLAYEY SAND (SC) (A-2-6), 28, 17, 11, 13.7%, 35.3%						
			13.5	SS-5	5	8	13	21
653.0								
	17.0		18.5	SS-6	8	11	16	27
		RESIDUUM - medium dense, dry, red orange, fine to coarse, CLAYEY SAND (SC) (A-2-6)						
648.0								
	22.0		23.5	SS-7	8	7	10	17
		RESIDUUM - medium dense, dry, tan orange white, fine, SILTY SAND (SM) (A-2-4), little fine quartz	26.0	SS-8	7	6	5	11
643.0			28.5	SS-9	5	5	6	11
	30.0							
638.0		Terminated at 30 feet						

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-20	**Boring Location:**	118+68	**Offset:**	56' RT	**Alignment:**	US21
Elev.:	657.0 ft	**Latitude:**	35.08474462	**Longitude:**	-80.9330764	**Date Started:**	7/28/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/28/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (2 inches)		0.5					
	2.0	FILL - loose, dry, brown gray, fine, CLAYEY SAND (SC) (A-6), 37, 15, 22, 6.6%, 43.1%			SS-1	3	3	2	5
		RESIDUUM - very stiff to hard, moist, red orange, CLAYEY SILT (MH) (A-7-5)		2.5	SS-2	6	8	10	18
652.0				4.5	SS-3	16	18	21	39
				6.5	SS-4	4	9	12	21
	8.0			8.5	SS-5	4	4	4	8
647.0		RESIDUUM - firm to very stiff, moist, orange tan, SANDY SILT (ML) (A-4)							
				13.5	SS-6	5	5	6	11
642.0									
				18.5	SS-7	6	6	8	14
637.0									
				23.5	SS-8	4	6	7	13
632.0									
				28.5	SS-9	4	7	9	16
627.0	30.0	Terminated at 30 feet							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

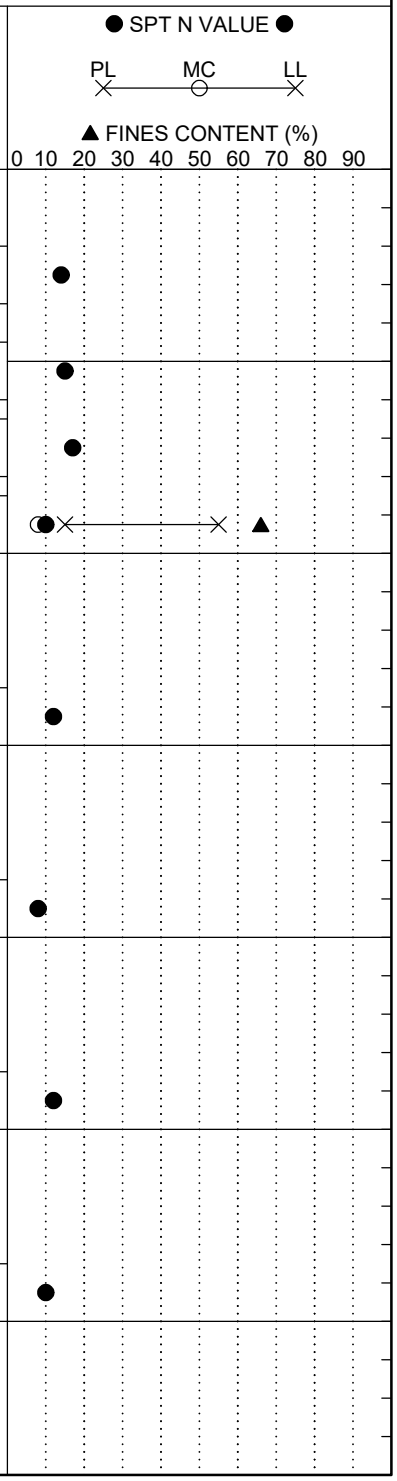
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-21	**Boring Location:**	123+68	**Offset:**	25' RT	**Alignment:**	US21
Elev.:	653.6 ft	**Latitude:**	35.0860621	**Longitude:**	-80.9328349	**Date Started:**	7/28/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/28/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	1.0	ASPHALT - (12 inches)						
	1.6	AGGREGATE BASE COURSE - (7 inches)						
		FILL - medium dense, moist, brown gray, fine, CLAYEY SAND (SC) (A-2-6)	2.0	SS-1	3	7	7	14
			4.5	SS-2	8	8	7	15
648.6	6.0							
		FILL - very stiff to stiff, dry, brown gray, CLAY (CH) (A-7-6) 55, 15, 40, 7.8%, 66.4%	6.5	SS-3	8	9	8	17
			8.5	SS-4	4	4	6	10
643.6								
	12.0							
		RESIDUUM - stiff, moist, red orange tan, CLAYEY SILT (MH) (A-7-5)	13.5	SS-5	3	5	7	12
638.6								
	17.0							
		RESIDUUM - firm to stiff, moist, orange tan white, SANDY SILT (ML) (A-4)	18.5	SS-6	5	3	5	8
633.6								
			23.5	SS-7	5	5	7	12
628.6								
			28.5	SS-8	3	4	6	10
623.6	30.0	Terminated at 30 feet						



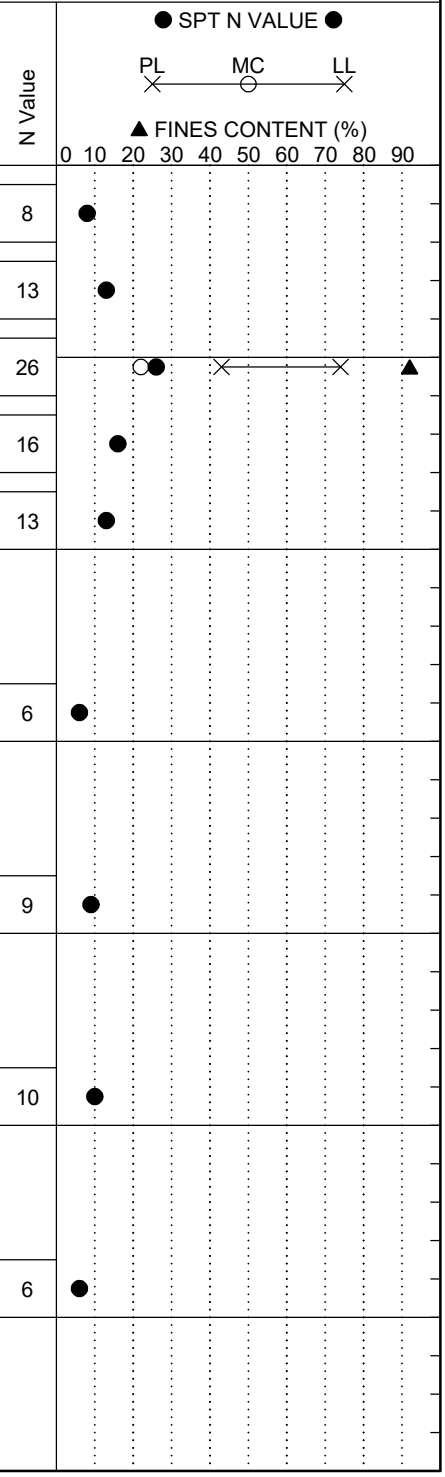
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-22	**Boring Location:**	315+15	**Offset:**	38' RT	**Alignment:**	SC51
Elev.:	658.0 ft	**Latitude:**	35.08411001	**Longitude:**	-80.93301674	**Date Started:**	7/28/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/28/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (3 inches)		0.5	SS-1	4	4	4	8
	2.0	FILL - loose, dry, gray, fine, SILTY SAND (SM) (A-2-4)		2.5	SS-2	5	6	7	13
653.0		RESIDUUM - very stiff to stiff, moist, red orange, CLAYEY SILT (MH) (A-7-5), 74, 43, 31, 21.9%, 91.9%		4.5	SS-3	10	13	13	26
	8.0			6.5	SS-4	4	6	10	16
		RESIDUUM - stiff to firm, moist, red orange tan, SANDY SILT (ML) (A-4)		8.5	SS-5	5	5	8	13
648.0									
				13.5	SS-6	3	3	3	6
643.0									
	17.0								
		RESIDUUM - loose, dry, white tan, fine, SILTY SAND (SM) (A-2-4)		18.5	SS-7	4	4	5	9
638.0									
				23.5	SS-8	4	4	6	10
633.0									
				28.5	SS-9	6	4	2	6
628.0	30.0								
		Terminated at 30 feet							



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-23	**Boring Location:**	310+66	**Offset:**	8' LT	**Alignment:**	SC51
Elev.:	653.0 ft	**Latitude:**	35.08507364	**Longitude:**	-80.93188638	**Date Started:**	7/25/2014
Total Depth:	29.3 ft	**Soil Depth:**	29.3 ft	**Core Depth:**	ft	**Date Completed:**	7/25/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 26.1 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	ASPHALT - (4 inches)								
	1.8	AGGREGATE BASE COURSE - (18 inches)								
		FILL - firm, moist, brown tan, SANDY CLAY (CL) (A-7-6), trace mica, 45, 25, 20, 26.4%, 74.5%		2.5	SS-1	3	3	5	8	
	4.0			4.5	SS-2	6	8	9	17	
648.0		RESIDUUM - very stiff to stiff, moist, brown tan gray, SANDY CLAY (CL) (A-7-6), trace mica, manganese staining, 42, 26, 16, 26.4%, 61.6%		6.5	SS-3	3	5	6	11	
				8.5	SS-4	3	4	6	10	
643.0				13.5	SS-5	3	4	6	10	
638.0				18.5	SS-6	3	3	6	9	
633.0										
	22.0	RESIDUUM - hard, moist, brown tan gray, SANDY SILT (ML) (A-4), trace mica, manganese staining		23.5	SS-7	12	15	16	31	
628.0										
	27.0	PARTIALLY WEATHERED ROCK (PWR) - dry, brown tan gray, fine, SILTY SAND (SM) (A-2-4), trace mica		28.5	SS-8	49	50/.3		100	
	29.3	Terminated at 29.3 feet.								
623.0										

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Page
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-24	**Boring Location:**	306+47	**Offset:**	11' RT	**Alignment:**	SC51
Elev.:	647.0 ft	**Latitude:**	35.08605946	**Longitude:**	-80.93116705	**Date Started:**	7/25/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	7/25/2014
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 45-B	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	77%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 25.6 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.6	ASPHALT - (7.25 inches)	0.5					
	1.0	AGGREGATE BASE COURSE - (4.75 inches)		SS-1	16	6	3	9
		RESIDUUM - stiff to very stiff, dry, orange tan, SANDY CLAY (CL) (A-6), trace mica	2.5	SS-2	3	4	5	9
642.0			4.5	SS-3	7	9	9	18
	6.0	RESIDUUM - firm to very stiff, dry, orange red tan, SANDY SILT (SM) (A-4), trace mica, 33, 25, 8, 14.2%, 45.9%	6.5	SS-4	2	3	5	8
			8.5	SS-5	6	7	11	18
637.0								
			13.5	SS-6	9	10	13	23
632.0								
	17.0	PARTIALLY WEATHERED ROCK (PWR) - moist, gray, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica	18.5	SS-7	18	32	50/.5	100
627.0								
			23.5	SS-8	49	50/.4		100
622.0		▽						
	28.5	Terminated at 28.5 feet due to **auger refusal**.	28.5	SS-9	50/0			100
617.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

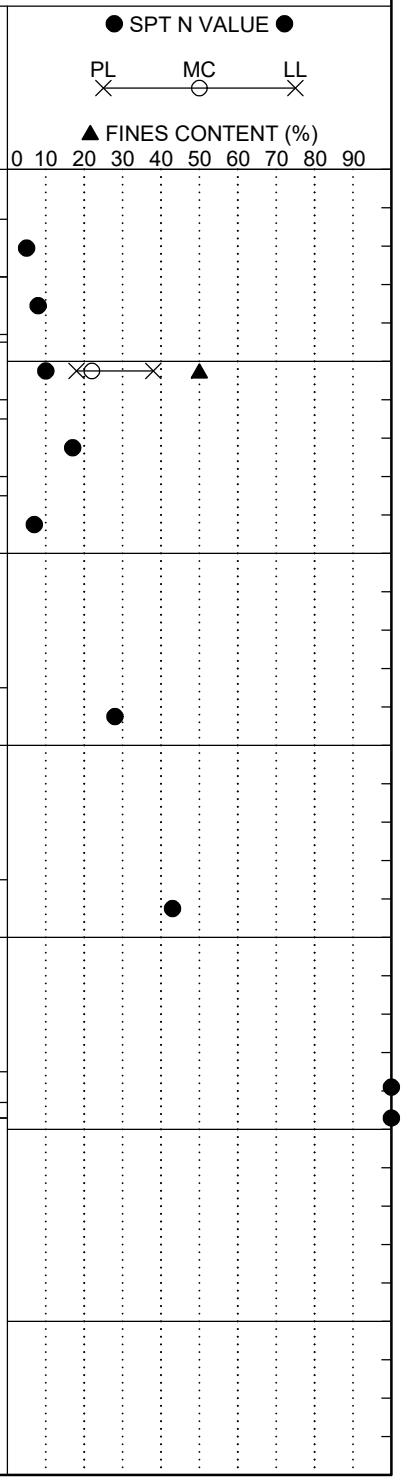
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-25	**Boring Location:**	304+00	**Offset:**	30' RT	**Alignment:**	SC51
Elev.:	635.0 ft	**Latitude:**	35.08728388	**Longitude:**	-80.92973564	**Date Started:**	5/19/2015
Total Depth:	24.7 ft	**Soil Depth:**	24.7 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	ASPHALT - (15 inches)	1.3					
	1.3							
	1.8	FILL - loose, moist, gray brown, fine to coarse, CLAYEY SAND (SC) (A-2-6)		SS-1	7	3	2	5
		RESIDUUM - firm to very stiff, moist, tan brown, SANDY CLAY (CL) (A-6), some rock fragments, 38, 18, 20, 21.7%, 49.6%	2.8	SS-2	3	3	5	8
			4.5					
630.0				SS-3	4	4	6	10
			6.5					
				SS-4	7	8	9	17
			8.5					
	9.0			SS-5	3	3	4	7
625.0		RESIDUUM - firm to very stiff, moist, tan brown, SANDY SILT (ML) (A-4)						
			13.5					
				SS-6	7	12	16	28
620.0								
	17.0							
		RESIDUUM - hard, moist, tan brown, SANDY SILT (ML) (A-4)	18.5					
				SS-7	13	20	23	43
615.0								
	22.0							
		PARTIALLY WEATHERED ROCK (PWR) - dry, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5					
				SS-8	47	50/.3		100
	24.7		24.7	~~SS-9~~	~~50/0~~			~~100~~
610.0		Terminated at 24.7 feet due to **auger refusal**.						
605.0								



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-26	**Boring Location:**	308+54	**Offset:**	28' LT	**Alignment:**	SC51
Elev.:	621.0 ft	**Latitude:**	35.08775832	**Longitude:**	-80.9283115	**Date Started:**	5/19/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 15.8 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL (3 inches)		0.5	SS-1	8	7	6	13
	2.3	FILL - medium dense, dry, tan brown, fine to coarse, SILTY SAND (SM) (A-2-4)		2.5	SS-2	3	2	3	5
		FILL - firm, moist, dark brown, SANDY CLAY (CL) (A-6)		4.5	SS-3	2	3	4	7
616.0	6.3	RESIDUUM - firm to very stiff, moist, tan brown, SANDY SILT (ML) (A-4), some coarse sand, trace rock fragments		6.5	SS-4	2	3	5	8
				8.5	SS-5	4	5	6	11
611.0				13.5	SS-6	6	7	9	16
606.0				18.5	SS-7	6	4	8	12
601.0				23.5	SS-8	5	9	9	18
596.0				28.5	SS-9	9	19	38	57
	29.0								
591.0	30.0	RESIDUUM - hard, moist, tan brown, SANDY SILT (ML) (A-4), some coarse sand, trace rock fragments							
		Terminated at 30 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

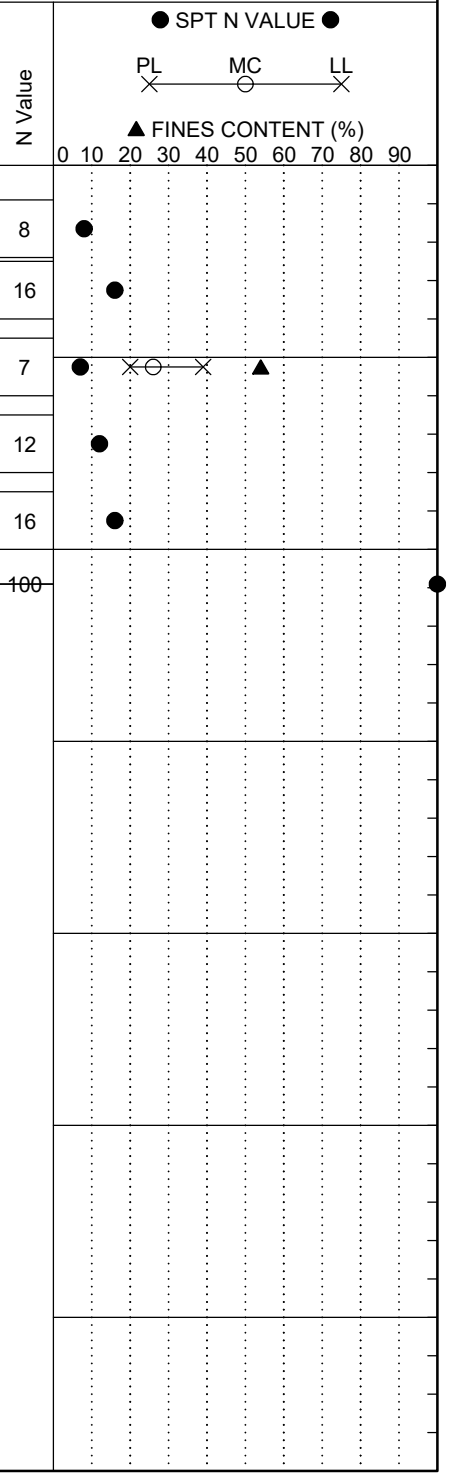
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-27	**Boring Location:**	313+58	**Offset:**	9' LT	**Alignment:**	SC51
Elev.:	605.6 ft	**Latitude:**	35.088053	**Longitude:**	-80.9266838	**Date Started:**	5/19/2015
Total Depth:	10.9 ft	**Soil Depth:**	10.9 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 10.6 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.9	ASPHALT - (11 inches)		0.9					
		RESIDUUM - firm to very stiff, moist, gray tan, SANDY CLAY (CL) (A-6), 39, 20, 19, 25.6%, 53.8%		2.5	SS-1	6	5	3	8
					SS-2	4	6	10	16
600.6				4.5	SS-3	2	3	4	7
				6.5	SS-4	4	5	7	12
				8.5	SS-5	6	7	9	16
595.6	10.9 ▽			10.9	~~SS-6~~	~~50/0~~			~~100~~
		Terminated at 10.9 feet due to **auger refusal**.							
590.6									
585.6									
580.6									
575.6									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-28	**Boring Location:**	318+60	**Offset:**	26' LT	**Alignment:**	SC51
Elev.:	600.0 ft	**Latitude:**	35.08845694	**Longitude:**	-80.92506234	**Date Started:**	5/19/2015
Total Depth:	28.9 ft	**Soil Depth:**	28.9 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 7 ft	**24HR**	4.2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.2	TOPSOIL / ROOTMAT - (2 inches)	0.5	SS-1	1	1	2	3
	2.3	ALLUVIAL - soft, wet, gray, SANDY CLAY (CL) (A-6)	2.5	SS-2	2	3	5	8
	4.3	RESIDUUM - firm, moist, orange tan, SANDY SILT (ML) (A-4)	4.5	SS-3	4	27	50/.3	100
595.0		PARTIALLY WEATHERED ROCK (PWR) - dry, white, fine to coarse, SILTY SAND (SM) (A-2-4)	6.5	SS-4	50/.4			100
	8.3	RESIDUUM - very stiff to hard, moist, gray brown, SANDY SILT (ML) (A-4)	8.5	SS-5	7	10	11	21
590.0			13.5	SS-6	13	12	13	25
585.0			18.5	SS-7	12	21	47	68
580.0	22.0	PARTIALLY WEATHERED ROCK (PWR) - dry, gray, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5	SS-8	27	50/.5		100
575.0			28.5	SS-9	50/.4			100
	28.9	Terminated at 28.9 feet.						
570.0								

SPT N VALUE

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

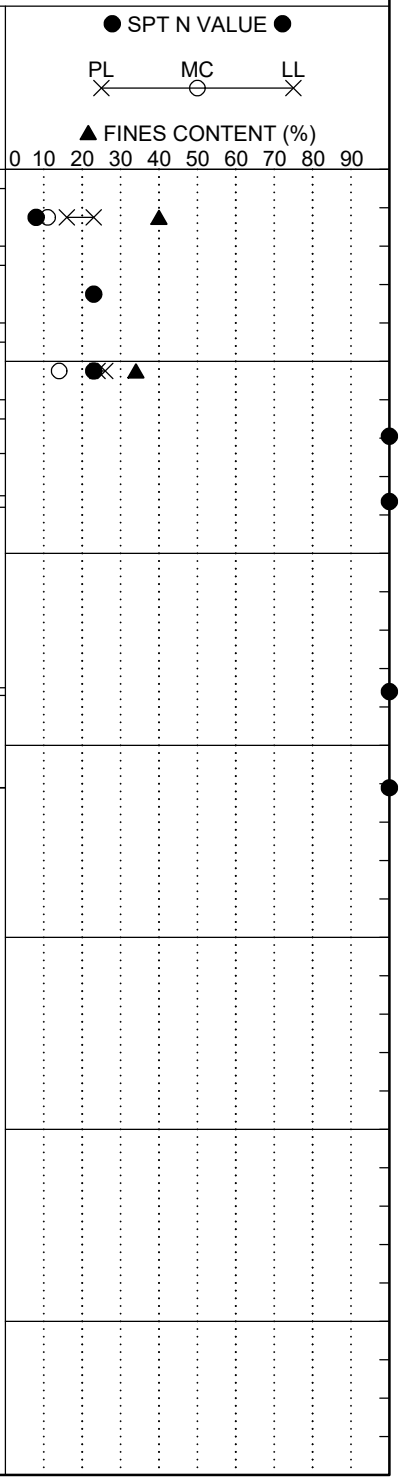
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-29	**Boring Location:**	323+61	**Offset:**	28' LT	**Alignment:**	SC51
Elev.:	615.0 ft	**Latitude:**	35.08881034	**Longitude:**	-80.92344776	**Date Started:**	5/19/2015
Total Depth:	16.1 ft	**Soil Depth:**	16.1 ft	**Core Depth:**	ft	**Date Completed:**	5/19/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 12.2 ft	**24HR**	8.9 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.5	TOPSOIL / ROOTMAT - (6 inches)		0.5	SS-1	7	4	4	8
	2.3	RESIDUUM - firm, moist, brown, fine to coarse, CLAYEY SAND (SC-SM) (A-4), 23, 16, 7, 11.3%, 39.5%		2.5	SS-2	5	10	13	23
610.0		RESIDUUM - medium dense, moist, brown, SILTY SAND (SM) (A-2-4), 26, 24, 2, 14.2%, 34.1%		4.5	SS-3	7	8	15	23
	6.3	PARTIALLY WEATHERED ROCK (PWR) - moist, tan gray, SANDY SILT (ML) (A-4)		6.5	SS-4	41	50/.4		100
605.0				8.5	SS-5	50/.3			100
				13.5	SS-6	50/.2			100
600.0	16.1	Terminated at 16.1 feet due to **auger refusal**.		16.1	SS-7	50/0			100
595.0									
590.0									
585.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-30	**Boring Location:**	328+65	**Offset:**	28' LT	**Alignment:**	SC51
Elev.:	619.0 ft	**Latitude:**	35.08916097	**Longitude:**	-80.92181647	**Date Started:**	5/22/2015
Total Depth:	13.7 ft	**Soil Depth:**	13.7 ft	**Core Depth:**	ft	**Date Completed:**	5/22/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	11 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL (3 inches)		0.5	SS-1	8	12	14	26
	2.3	RESIDUUM - medium dense, dry, tan, fine to coarse, CLAYEY SAND (SC) (A-2-6)		2.5	SS-2	9	13	16	29
		RESIDUUM - very stiff to hard, moist, tan, SANDY SILT (ML) (A-4)		4.5	SS-3	6	17	20	37
614.0				6.5	SS-4	7	12	12	24
				8.5	SS-5	9	9	12	21
609.0									
	12.0	PARTIALLY WEATHERED ROCK (PWR) - dry, gray, fine to coarse, SILTY SAND (SM) (A-2-4), some rock fragments		13.5	SS-6	50/.2			100
	13.7			13.7	SS-7	50/0			100
604.0		Terminated at 13.7 feet due to **auger refusal**.							
599.0									
594.0									
589.0									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-31	**Boring Location:**	333+61	**Offset:**	26' LT	**Alignment:**	SC51
Elev.:	619.0 ft	**Latitude:**	35.08947312	**Longitude:**	-80.92019522	**Date Started:**	5/22/2015
Total Depth:	28.7 ft	**Soil Depth:**	28.7 ft	**Core Depth:**	ft	**Date Completed:**	5/22/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	11 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	TOPSOIL (4 inches)	0.5	SS-1	7	8	10	18
		RESIDUUM - very stiff, dry, orange tan, SANDY SILT (ML) (A-4)	2.5	SS-2	4	9	10	19
614.0			4.5	SS-3	5	7	13	20
	6.3	RESIDUUM - medium dense to very dense, dry, tan, fine to coarse, SILTY SAND (SM) (A-2-4), 0, 0, 0, 7.4%, 27.5%	6.5	SS-4	14	13	9	22
			8.5	SS-5	15	20	28	48
609.0		▼						
			13.5	SS-6	33	34	36	70
604.0								
	17.0	PARTIALLY WEATHERED ROCK (PWR) - dry, brown, fine to coarse, SILTY SAND (SM) (A-2-4)	18.5	SS-7	38	50/.4		100
599.0								
			23.5	SS-8	50/.2			100
594.0								
	28.7		28.5	SS-9	50/.2			100
		Terminated at 28.7 feet due to **auger refusal**.						
589.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

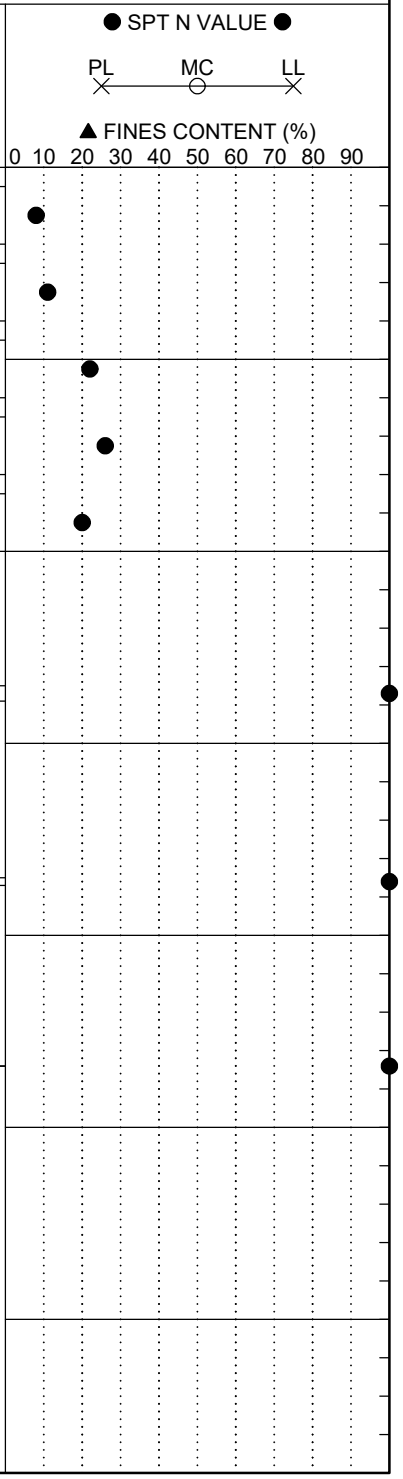
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	SC 51
Boring No.:	R-32	**Boring Location:**	338+56	**Offset:**	30' LT	**Alignment:**	SC51
Elev.:	620.0 ft	**Latitude:**	35.08963689	**Longitude:**	-80.91854736	**Date Started:**	5/22/2015
Total Depth:	23.4 ft	**Soil Depth:**	23.4 ft	**Core Depth:**	ft	**Date Completed:**	5/22/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	9 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	TOPSOIL (4 inches)	0.5	SS-1	5	4	4	8
		RESIDUUM - firm to very stiff, moist, tan, SILTY CLAY (CL) (A-6)	2.5	SS-2	3	3	8	11
615.0			4.5	SS-3	5	9	13	22
			6.5	SS-4	12	12	14	26
			8.5	SS-5	9	10	10	20
610.0	12.0	PARTIALLY WEATHERED ROCK (PWR) - dry, tan gray, fine to coarse, SILTY SAND (SM) (A-2-4)	13.5	SS-6	50/.4			100
605.0								
			18.5	SS-7	50/.2			100
600.0								
	23.4	Terminated at 23.4 feet due to **auger refusal**.	23.4	SS-8	50/0			100
595.0								
590.0								



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-33	**Boring Location:**	23+28	**Offset:**	16' LT	**Alignment:**	US21
Elev.:	607.0 ft	**Latitude:**	35.058781	**Longitude:**	-80.937582	**Date Started:**	12/21/2015
Total Depth:	43.5 ft	**Soil Depth:**	43.5 ft	**Core Depth:**	ft	**Date Completed:**	12/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 27.5 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.8	ASPHALT - (10 inches)		0.8					
		FILL - stiff to firm, moist, tan gray, SANDY SILT (ML) (A-4)		2.5	SS-1	10	7	6	13
					SS-2	2	4	4	8
602.0				4.5	SS-3	3	4	4	8
				6.5	SS-4	3	3	5	8
				8.5	SS-5	3	5	6	11
597.0									
				13.5	SS-6	3	3	4	7
592.0									
	17.0	FILL - stiff, moist, red orange, CLAYEY SILT (MH) (A-7-5)		18.5	SS-7	3	4	5	9
587.0									
	22.0	ALLUVIUM - very loose to loose, wet, gray to tan, fine to medium, SILTY SAND (SM) (A-4)		23.5	SS-8	WOH	1	2	3
582.0									
		▽		28.5	SS-9	3	3	3	6
577.0									
	32.0	RESIDUUM - very stiff, moist, orange tan, SANDY CLAY (CL) (A-6)		33.5					

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

Continued Next Page

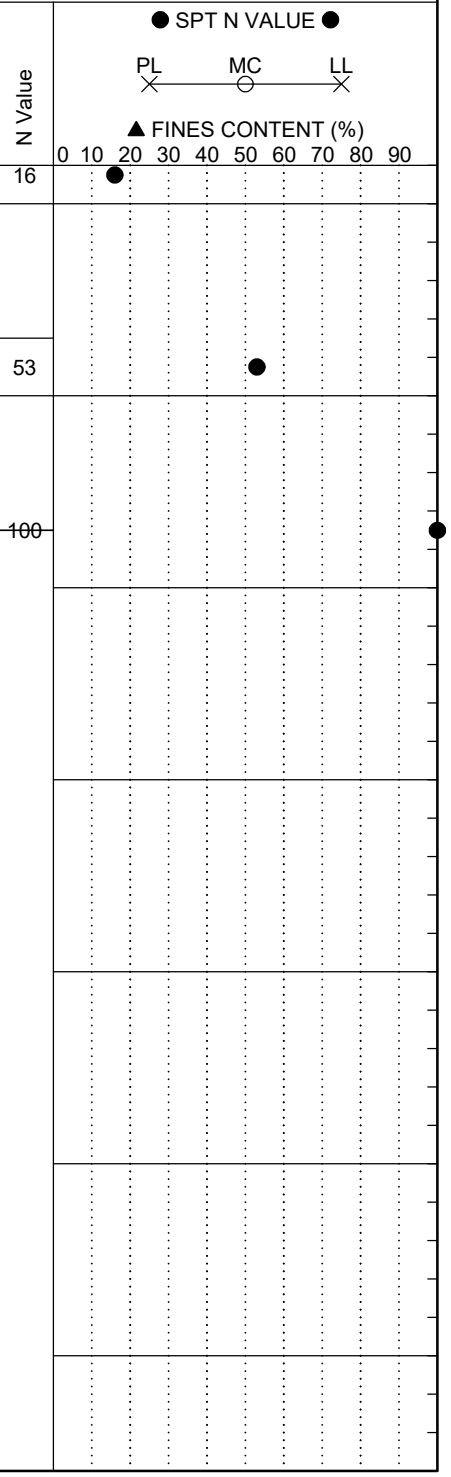
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-33	**Boring Location:**	23+28	**Offset:**	16' LT	**Alignment:**	US21
Elev.:	607.0 ft	**Latitude:**	35.058781	**Longitude:**	-80.937582	**Date Started:**	12/21/2015
Total Depth:	43.5 ft	**Soil Depth:**	43.5 ft	**Core Depth:**	ft	**Date Completed:**	12/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 27.5 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
572.0					SS-10	7	7	9	16
	37.0	RESIDUUM - very dense, moist, tan gray black, fine to coarse, SILTY SAND (SM) (A-2-4)		38.5	SS-11	27	25	28	53
567.0									
	43.5	Terminated at 43.5 feet.		43.5	~~SS-12~~	~~50/0~~			~~100~~
562.0									
557.0									
552.0									
547.0									
542.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-34	**Boring Location:**	33+52	**Offset:**	11' LT	**Alignment:**	US21
Elev.:	594.0 ft	**Latitude:**	35.061572	**Longitude:**	-80.937153	**Date Started:**	12/16/2015
Total Depth:	34.9 ft	**Soil Depth:**	34.9 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 25.2 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.5	ASPHALT - (5.5 inches)	0.6					
	0.6	AGGREGATE BASE COURSE - (2 inches)		SS-1	4	5	4	9
	2.3	FILL - stiff, moist, brown red, SILTY CLAY (CH) (A-7-6), trace mica	2.5	SS-2	3	5	5	10
589.0		FILL - stiff to firm, moist, tan brown gray, SANDY SILT (ML) (A-4), trace mica with some fine to coarse sand	4.5	SS-3	3	4	4	8
			6.5	SS-4	3	4	5	9
			8.5	SS-5	4	4	4	8
584.0								
			13.5	SS-6	3	4	4	8
579.0								
	17.0	FILL - firm, moist, orange brown, SILTY CLAY (CH) (A-7-6), trace mica	18.5	SS-7	2	3	4	7
574.0								
	22.0	FILL - stiff, moist, gray brown, CLAYEY SAND (SC) (A-6), trace mica, 31, 17, 14, 18.3%, 48.2%	23.5	SS-8	3	5	6	11
569.0		▽						
	27.0	ALLUVIUM - very loose, wet, gray, fine to medium, SILTY SAND (SM) (A-2-4)	28.5	SS-9	1	1	1	2
564.0								
	32.0	PARTIALLY WEATHERED ROCK - dry, white black brown, fine to coarse, SILTY SAND (SM) (A-2-4)	33.5					

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-34	**Boring Location:**	33+52	**Offset:**	11' LT	**Alignment:**	US21
Elev.:	594.0 ft	**Latitude:**	35.061572	**Longitude:**	-80.937153	**Date Started:**	12/16/2015
Total Depth:	34.9 ft	**Soil Depth:**	34.9 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 25.2 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
559.0	34.9	Terminated at 34.9 feet.			SS-10	31	41	50/.4	100
554.0									
549.0									
544.0									
539.0									
534.0									
529.0									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-35	**Boring Location:**	33+99	**Offset:**	9' LT	**Alignment:**	US21
Elev.:	594.0 ft	**Latitude:**	35.0617	**Longitude:**	-80.937127	**Date Started:**	12/16/2015
Total Depth:	38.7 ft	**Soil Depth:**	38.7 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 29.6 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.5	ASPHALT - (6.5 inches)		0.8					
	0.7	AGGREGATE BASE COURSE - (2 inches)			SS-1	3	4	4	8
	2.3	FILL - firm, moist, red brown, CLAYEY SILT (MH) (A-7-5)		2.5	SS-2	3	4	5	9
589.0		FILL - stiff to firm, moist, tan gray, SANDY SILT (ML) (A-4), trace mica with some fine to coarse sand		4.5	SS-3	4	4	6	10
				6.5	SS-4	4	5	5	10
				8.5	SS-5	3	4	4	8
584.0									
				13.5	SS-6	3	3	4	7
579.0									
	17.0	FILL - firm, moist, orange brown, SILTY CLAY (CH) (A-7-5), trace mica, 62, 30, 32, 29.3%, 68.8%		18.5	SS-7	2	3	4	7
574.0									
				23.5	SS-8	3	3	4	7
569.0									
	27.0	RESIDUUM - very stiff, moist, gray brown black, SANDY SILT (ML) (A-4), trace mica		28.5	SS-9	9	13	15	28
564.0		▽							
	32.0	RESIDUUM - dense, moist, gray brown black, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		33.5					

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-35	**Boring Location:**	33+99	**Offset:**	9' LT	**Alignment:**	US21
Elev.:	594.0 ft	**Latitude:**	35.0617	**Longitude:**	-80.937127	**Date Started:**	12/16/2015
Total Depth:	38.7 ft	**Soil Depth:**	38.7 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 29.6 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
559.0					SS-10	6	20	26	46	
	37.0	PARTIALLY WEATHERED ROCK - moist, gray bown black, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		38.5	SS-11	50/.2			100	
	38.7	Terminated at 38.7 feet.								
554.0										
549.0										
544.0										
539.0										
534.0										
529.0										

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-36	**Boring Location:**	34+00	**Offset:**	17' RT	**Alignment:**	US21
Elev.:	593.0 ft	**Latitude:**	35.061693	**Longitude:**	-80.937041	**Date Started:**	12/16/2015
Total Depth:	29.5 ft	**Soil Depth:**	29.5 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.7	ASPHALT - (7.5 inches)	0.8					
	2.4	FILL - firm, moist, red brown, CLAYEY SILT (MH) (A-7-5), trace mica	2.5	SS-1	3	4	3	7
		FILL - stiff to firm, moist, tan gray, SANDY SILT (ML) (A-4), trace mica with some fine to coarse sand		SS-2	3	4	5	9
588.0			4.5	SS-3	5	5	5	10
			6.5	SS-4	3	4	4	8
			8.5	SS-5	3	3	3	6
583.0								
			13.5	SS-6	3	2	3	5
578.0								
	17.0	FILL - firm, moist, red brown, CLAYEY SILT (MH) (A-7-5), trace mica	18.5	SS-7	3	3	4	7
573.0								
	22.0	RESIDUUM - stiff, moist, gray brown, SANDY SILT (ML) (A-4), trace mica	23.5	SS-8	5	6	8	14
568.0								
	27.0	PARTIALLY WEATHERED ROCK - moist, gray brown black, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica	28.5	SS-9	32	50/.5		100
	29.5	Terminated at 29.5 feet.						
563.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-37	**Boring Location:**	39+01	**Offset:**	17' LT	**Alignment:**	US21
Elev.:	587.0 ft	**Latitude:**	35.06307	**Longitude:**	-80.936951	**Date Started:**	12/16/2015
Total Depth:	34 ft	**Soil Depth:**	34 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 18.8 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.4	ASPHALT - (5 inches)		0.5	SS-1	2	4	5	9
	2.3	FILL - stiff, moist, brown gray, SANDY SILT (ML) (A-4), trace mica		2.5	SS-2	2	2	2	4
	4.3	FILL - very loose, moist, brown gray, fine to coarse, CLAYEY SAND (SC) (A-2-6), trace mica		4.5	SS-3	1	1	2	3
582.0		FILL - very loose to loose, moist, tan gray, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		6.5	SS-4	1	3	3	6
	8.3	FILL - soft, moist, orange tan, SANDY SILT (ML) (A-4), trace mica		8.5	SS-5	1	2	2	4
577.0									
	12.0	FILL - firm, moist, gray brown, SILTY CLAY (CL) (A-7-6)		13.5	SS-6	2	3	4	7
572.0									
	17.0	ALLUVIUM - very loose, wet, gray, fine to medium, CLAYEY SAND (SC) (A-2-6) ▽		18.5	SS-7	WOH	1	2	3
567.0									
	22.0	RESIDUUM - dense, moist, gray black, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		23.5	SS-8	4	12	19	31
562.0									
				28.5	SS-9	41	29	21	50
557.0									
	32.0	PARTIALLY WEATHERED ROCK - moist, gray black, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		33.5	SS-10	50/.5			100
	34.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-37	**Boring Location:**	39+01	**Offset:**	17' LT	**Alignment:**	US21
Elev.:	587.0 ft	**Latitude:**	35.06307	**Longitude:**	-80.936951	**Date Started:**	12/16/2015
Total Depth:	34 ft	**Soil Depth:**	34 ft	**Core Depth:**	ft	**Date Completed:**	12/16/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 18.8 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
552.0		Terminated at 34 feet.						
547.0								
542.0								
537.0								
532.0								
527.0								
522.0								

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-38	**Boring Location:**	42+01	**Offset:**	13' RT	**Alignment:**	US21
Elev.:	589.0 ft	**Latitude:**	35.063879	**Longitude:**	-80.936731	**Date Started:**	12/21/2015
Total Depth:	18.5 ft	**Soil Depth:**	18.5 ft	**Core Depth:**	ft	**Date Completed:**	12/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.4	ASPHALT - (4.5 inches)	0.6					
	0.6	AGGREGATE BASE COURSE - (3 inches)		SS-1	4	5	5	10
		FILL - stiff, moist, tan brown, SANDY SILT (ML) (A-4)	2.5	SS-2	4	5	5	10
	4.3		4.5					
584.0		FILL - firm, moist, red brown, CLAYEY SILT (MH) (A-7-5), trace mica		SS-3	2	2	3	5
			6.5	SS-4	2	2	4	6
			8.5	SS-5	1	3	4	7
579.0								
	12.0	FILL - firm, moist, dark brown, CLAYEY SILT (MH) (A-7-5), trace organics, 70, 36, 34, 39.4%, 82%	13.5	SS-6	3	3	3	12
574.0								
	18.0							
	18.5	PARTIALLY WEATHERED ROCK - No recovery	18.5	~~SS-7~~	~~50/0~~			~~100~~
569.0		Terminated at 18.5 feet.						
564.0								
559.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-39	**Boring Location:**	43+58	**Offset:**	14' RT	**Alignment:**	US21
Elev.:	592.0 ft	**Latitude:**	35.064307	**Longitude:**	-80.936666	**Date Started:**	12/21/2015
Total Depth:	34.5 ft	**Soil Depth:**	34.5 ft	**Core Depth:**	ft	**Date Completed:**	12/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 23.4 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	ASPHALT - (3.75 inches)		0.6						
	0.6	AGGREGATE BASE COURSE - (4 inches)			SS-1	4	3	2	5	●
		FILL - firm, moist, tan brown, SANDY SILT (ML) (A-4)		2.5	SS-2	3	3	5	8	●
	4.3			4.5						
587.0		FILL - stiff to firm, moist, red brown, CLAYEY SILT (MH) (A-7-5)			SS-3	3	4	5	9	●
				6.5	SS-4	2	4	2	6	●
				8.5	SS-5	3	4	4	8	●
582.0										
	12.0									
		FILL - firm, moist, dark brown, SANDY CLAY (CL) (A-6)		13.5	SS-6	3	4	3	7	●
577.0										
	17.0									
		RESIDUUM - stiff, moist, gray brown, SANDY SILT (ML) (A-4), trace mica		18.5	SS-7	3	4	5	9	●
572.0										
	22.0									
		RESIDUUM - very dense, moist, tan gray, fine to coarse, SILTY SAND (SM) (A-2-4) ▽		23.5	SS-8	14	24	34	58	●
567.0										
				28.5	SS-9	14	38	50/.5	100	●
562.0										
	32.0									
		PARTIALLY WEATHERED ROCK - moist, gray brown, fine to coarse, SILTY SAND (SM) (A-2-4)		33.5						

LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-39	**Boring Location:**	43+58	**Offset:**	14' RT	**Alignment:**	US21
Elev.:	592.0 ft	**Latitude:**	35.064307	**Longitude:**	-80.936666	**Date Started:**	12/21/2015
Total Depth:	34.5 ft	**Soil Depth:**	34.5 ft	**Core Depth:**	ft	**Date Completed:**	12/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 23.4 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	34.5				SS-10	20	50/.5		100
557.0		Terminated at 34.5 feet.							
552.0									
547.0									
542.0									
537.0									
532.0									
527.0									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

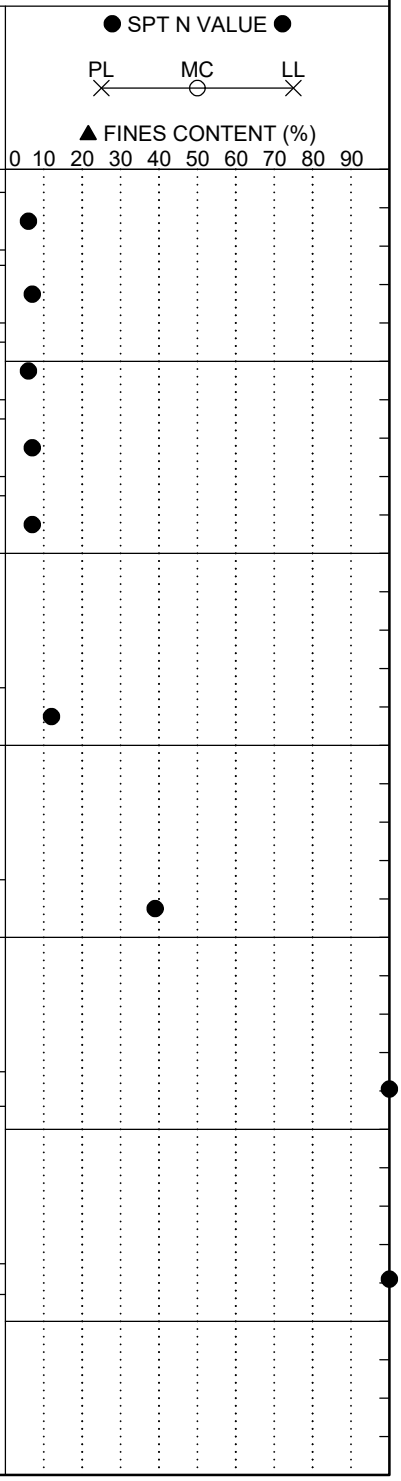
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-40	**Boring Location:**	66+01	**Offset:**	17' LT	**Alignment:**	US21
Elev.:	637.7 ft	**Latitude:**	35.0704298	**Longitude:**	-80.9358645	**Date Started:**	12/15/2015
Total Depth:	30.3 ft	**Soil Depth:**	30.3 ft	**Core Depth:**	ft	**Date Completed:**	12/15/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.2	ASPHALT - (2 inches)	0.6					
	0.6	AGGREGATE BASE COURSE - (5 inches)		SS-1	2	3	3	6
		FILL - firm, moist, brown, SILTY CLAY (CH) (A-7-6)	2.5					
				SS-2	2	4	3	7
			4.5					
632.7				SS-3	3	3	3	6
			6.5					
				SS-4	3	3	4	7
	8.3		8.5					
		RESIDUUM - firm, moist, brown, SANDY SILT (ML) (A-4), trace mica		SS-5	2	3	4	7
627.7								
	12.0							
		RESIDUUM - stiff, dry, gray tan, SANDY SILT (ML) (A-4), trace mica	13.5					
				SS-6	4	5	7	12
622.7								
	17.0							
		RESIDUUM - dense, dry, white tan, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica, trace rock fragments	18.5					
				SS-7	30	24	15	39
617.7								
	22.0							
		PARTIALLY WEATHERED ROCK - dry, tan gray, fine to coarse, SILTY SAND (SM) (A-2-4)	23.5					
				SS-8	30	50/.4		100
612.7								
			28.5					
				SS-9	25	50/.3		100
607.7	30.3							
		Terminated at 30.3 feet.						



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-41	**Boring Location:**	67+00	**Offset:**	15' LT	**Alignment:**	US21
Elev.:	636.6 ft	**Latitude:**	35.0707045	**Longitude:**	-80.9358175	**Date Started:**	12/15/2015
Total Depth:	34.3 ft	**Soil Depth:**	34.3 ft	**Core Depth:**	ft	**Date Completed:**	12/15/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.5	ASPHALT - (6 inches)		0.8						
	0.8	AGGREGATE BASE COURSE - (4 inches)			SS-1	2	2	3	5	●
		FILL - firm, moist, brown red, SILTY CLAY (CH) (A-7-6), trace mica		2.5	SS-2	2	2	3	5	●
631.6				4.5	SS-3	3	3	3	6	●
				6.5	SS-4	2	3	4	7	●
				8.5	SS-5	3	4	3	7	●
626.6	12.0	ALLUVIUM - firm, wet, gray brown, fine to medium, SILTY CLAY (CH) (A-7-6)		13.5	SS-6	3	3	2	5	●
621.6				18.5	SS-7	3	4	4	8	●
616.6	22.0	RESIDUUM - very stiff, moist, brown gray, SANDY CLAY (CL) (A-6)		23.5	SS-8	5	9	10	19	●
611.6	27.0	RESIDUUM - medium dense, moist, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4), trace mica		28.5	SS-9	6	8	18	26	●
606.6	32.0	PARTIALLY WEATHERED ROCK - dry, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)		33.5						

LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-41	**Boring Location:**	67+00	**Offset:**	15' LT	**Alignment:**	US21
Elev.:	636.6 ft	**Latitude:**	35.0707045	**Longitude:**	-80.9358175	**Date Started:**	12/15/2015
Total Depth:	34.3 ft	**Soil Depth:**	34.3 ft	**Core Depth:**	ft	**Date Completed:**	12/15/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	34.3	Terminated at 34.3 feet.			SS-10	25	50/.3		100	
601.6										
596.6										
591.6										
586.6										
581.6										
576.6										
571.6										

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	N. Bradley
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	R-42	**Boring Location:**	68+01	**Offset:**	15' LT	**Alignment:**	US21
Elev.:	636.2 ft	**Latitude:**	35.0709765	**Longitude:**	-80.9357772	**Date Started:**	12/15/2015
Total Depth:	32 ft	**Soil Depth:**	32 ft	**Core Depth:**	ft	**Date Completed:**	12/15/2015
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	92%
Core Size:	N/A	**Driller:**	J. Cain	**Groundwater:**	**TOB** 30.7 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.4	ASPHALT - (5 inches)		0.8					
	0.8	AGGREGATE BASE COURSE - (4.5 inches)			SS-1	2	4	4	8
		FILL - firm, moist, brown, SILTY CLAY (CH) (A-7-6), trace mica		2.5	SS-2	2	2	3	5
631.2				4.5	SS-3	2	2	3	5
	6.3	RESIDUUM - stiff, moist, brown tan, SANDY SILT (ML) (A-4), trace mica		6.5	SS-4	3	4	6	10
				8.5	SS-5	3	4	6	10
626.2									
	12.0	RESIDUUM - medium dense to dense, dry, gray brown, fine to coarse, SILTY SAND (SM) (A-2-4)		13.5	SS-6	8	9	10	19
621.2									
				18.5	SS-7	12	14	16	30
616.2									
				23.5	SS-8	8	11	14	25
611.2									
				28.5	SS-9	8	14	30	44
606.2		▽							
	32.0	Terminated at 32 feet due to **auger refusal**.		32.0	~~SS-10~~	~~50/0~~			~~100~~

SPT N VALUE ● PL × MC ○ LL × ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90

LEGEND

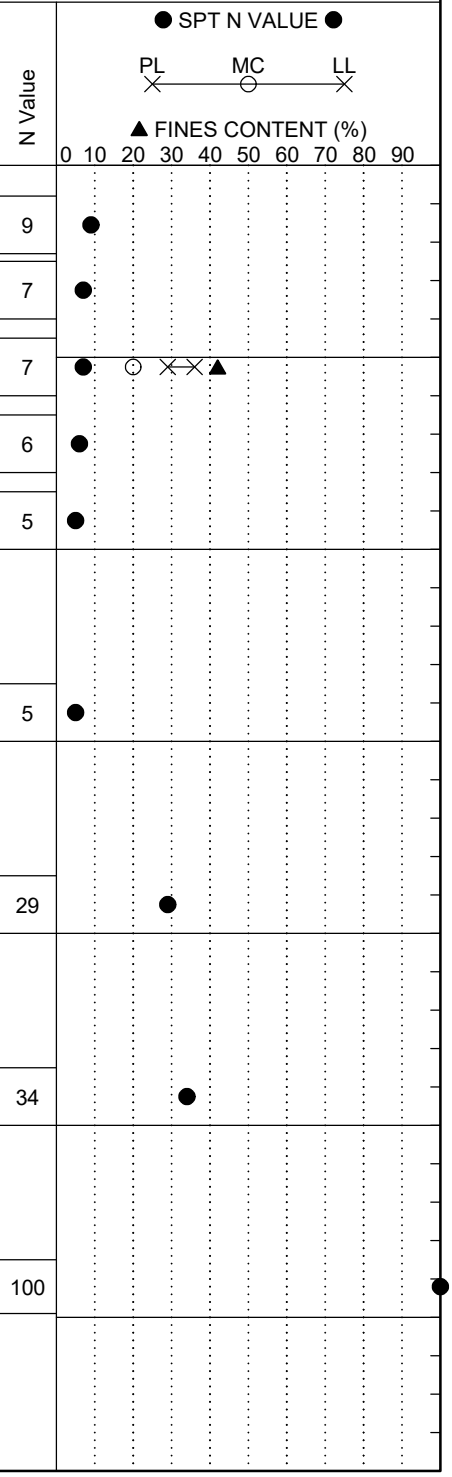
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 SCDOT US21_51.GPJ SC_DOT.GDT 4/12/21

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 1	**Boring Location:**	23+00	**Offset:**	15' LT	**Alignment:**	US21
Elev.:	607.0 ft	**Latitude:**	35.0587096	**Longitude:**	-80.9375772	**Date Started:**	5/20/2015
Total Depth:	29.9 ft	**Soil Depth:**	29.9 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.8	ASPHALT - (9 inches)	0.8					
	1.0	AGGREGATE BASE COURSE - (3 inches)						
		FILL - loose, moist, fine to coarse, gray brown, SILTY SAND (SM) (A-4), 36, 29, 7, 20.4%, 41.8%	2.5	SS-1	4	4	5	9
				SS-2	3	3	4	7
602.0			4.5	SS-3	2	3	4	7
			6.5	SS-4	2	3	3	6
			8.5	SS-5	3	2	3	5
597.0								
			13.5	SS-6	2	2	3	5
592.0								
	17.0	RESIDUUM - very stiff to hard, moist, orange brown, SANDY SILT (ML) (A-4)	18.5	SS-7	11	12	17	29
587.0								
			23.5	SS-8	14	17	17	34
582.0								
			28.5					
	29.5			SS-9	29	26	50/.4	100
577.0	29.9	PARTIALLY WEATHERED ROCK (PWR) - moist, tan, SANDY SILT (ML) (A-4)						
		Terminated at 29.9 feet.						



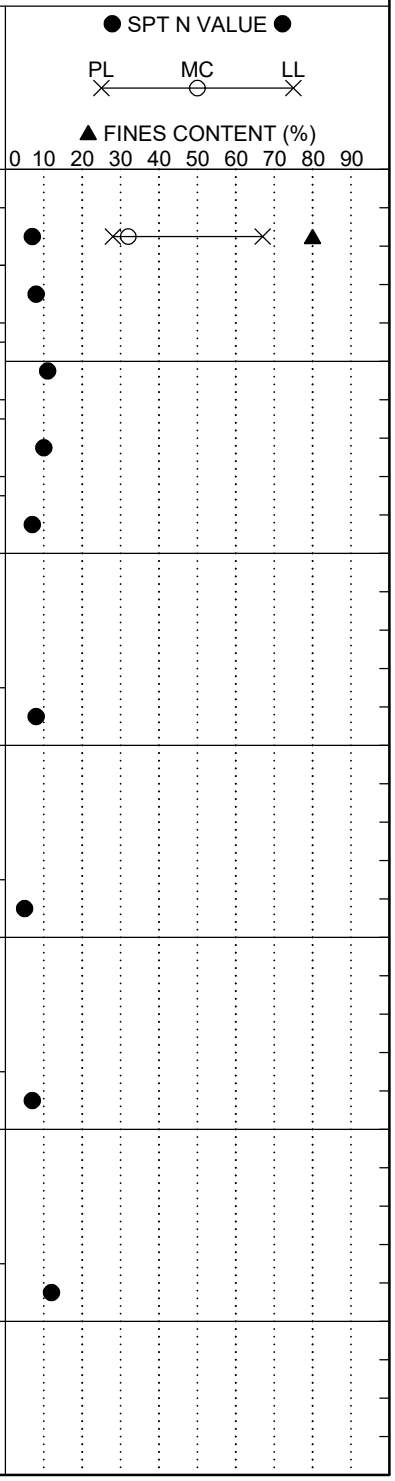
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 2	**Boring Location:**	34+00	**Offset:**	17' RT	**Alignment:**	US21
Elev.:	593.4 ft	**Latitude:**	35.0616982	**Longitude:**	-80.937027	**Date Started:**	5/20/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.8	ASPHALT - (9 inches)		1.0					
	1.0	AGGREGATE BASE COURSE - (3 inches)			SS-1	4	4	3	7
	2.5	FILL - firm, moist, red, CLAY (CH) (A-7-6), 67, 28, 39, 32.0%,79.8%		2.5	SS-2	2	3	5	8
588.4		FILL - firm to stiff, moist, tan brown, SANDY SILT (ML) (A-4)		4.5	SS-3	3	4	7	11
				6.5	SS-4	4	4	6	10
				8.5	SS-5	2	3	4	7
583.4									
				13.5	SS-6	2	3	5	8
578.4									
	17.0	FILL - firm, moist, red, CLAYEY SILT (MH) (A-7-5)		18.5	SS-7	2	3	2	5
573.4									
	22.0	FILL - firm, moist, gray, black, CLAY (CH) (A-7-6), trace organics (roots)		23.5	SS-8	2	3	4	7
568.4									
	27.0	RESIDUUM - stiff, moist, gray, SANDY CLAY (CL) (A-6)		28.5	SS-9	3	5	7	12
563.4	30.0	Terminated at 30 feet.							



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 3	**Boring Location:**	34+40	**Offset:**	10' LT	**Alignment:**	US21
Elev.:	593.0 ft	**Latitude:**	35.0617917	**Longitude:**	-80.9371071	**Date Started:**	5/20/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.8	ASPHALT - (10 inches)		0.8						
	2.3	FILL - stiff, moist, red tan, CLAYEY SILT (MH) (A-7-5)		2.5	SS-1	9	4	4	8	
		FILL - stiff to firm, moist, tan orange, SANDY SILT (ML) (A-4)		4.5	SS-2	2	3	3	6	
588.0				6.5	SS-3	4	5	6	11	
				8.5	SS-4	4	4	4	8	
583.0				13.5	SS-5	2	3	3	6	
					SS-6	3	3	4	7	
578.0				18.5						
					SS-7	2	2	4	6	
573.0				23.5						
	22.0	FILL - firm, moist, gray, SILTY CLAY (CH) (A-7-6)			SS-8	2	4	4	8	
568.0				28.5						
	27.0	RESIDUUM - hard, moist, gray, SANDY SILT (ML) (A-4)			SS-9	8	21	26	47	
563.0	30.0	Terminated at 30 feet.								

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 4	**Boring Location:**	40+37	**Offset:**	17' LT	**Alignment:**	US21
Elev.:	586.6 ft	**Latitude:**	35.0634481	**Longitude:**	-80.9368821	**Date Started:**	5/20/2015
Total Depth:	28.8 ft	**Soil Depth:**	28.8 ft	**Core Depth:**	ft	**Date Completed:**	5/20/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	1.0	ASPHALT - (12 inches)		1.0					
		FILL - firm to soft, moist, red tan, CLAY (CH) (A-7-6), 53, 25, 28, 21.1%, 58.6%		2.5	SS-1	3	3	2	5
					SS-2	2	2	2	4
	4.3			4.5					
581.6		FILL - soft to firm, moist, tan, SANDY SILT (ML) (A-4)			SS-3	2	1	2	3
				6.5					
					SS-4	2	1	3	4
				8.5					
					SS-5	3	3	5	8
576.6									
				13.5					
					SS-6	2	3	3	6
571.6									
	18.5			18.5					
		ALLUVIAL - soft, wet, gray, SANDY CLAY (CL) (A-6)			SS-7	1	2	1	3
566.6									
	22.0								
		RESIDUUM - very dense, moist, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)		23.5					
					SS-8	11	13	38	51
561.6									
	27.0								
		PARTIALLY WEATHERED ROCK (PWR) - moist, brown gray, fine to coarse, SILTY SAND (SM) (A-2-4)		28.5	SS-9	50/.3			100
	28.8								
556.6		Terminated at 28.8 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

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SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 5	**Boring Location:**	42+06	**Offset:**	17' RT	**Alignment:**	US21
Elev.:	588.5 ft	**Latitude:**	35.0638985	**Longitude:**	-80.9367013	**Date Started:**	5/21/2015
Total Depth:	19.7 ft	**Soil Depth:**	19.7 ft	**Core Depth:**	ft	**Date Completed:**	5/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	ASPHALT - (3 inches)	0.5	SS-1	4	4	4	8
	0.5	AGGREGATE BASE COURSE - 3 inches						
		FILL - firm to soft, moist, tan, SANDY SILT (ML) (A-4)	2.5	SS-2	2	2	3	5
583.5			4.5	SS-3	1	2	2	4
			6.5	SS-4	2	1	2	3
	8.3		8.5	SS-5	3	3	3	6
578.5		FILL - firm, wet, brown, CLAYEY SILT (MH) (A-7-5), 50, 32, 18, 38.7%, 69.6%						
			13.5	SS-6	2	2	4	6
573.5								
	17.0	ALLUVIAL - loose, wet, gray, fine to coarse, CLAYEY SAND (SC) (A-2-6), some wood fragments	18.5	SS-7	3	2	50/0	100
	19.5		19.7	SS-8	50/0			100
568.5	19.7	PARTIALLY WEATHERED ROCK (PWR) - moist, gray, fine to coarse, SILTY SAND (SM) (A-2-4)						
		Terminated at 19.7 feet due to **auger refusal**.						
563.5								
558.5								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 6	**Boring Location:**	45+10	**Offset:**	31' LT	**Alignment:**	US21
Elev.:	596.0 ft	**Latitude:**	35.0647447	**Longitude:**	-80.9367374	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 23.7 ft	**24HR**	22.4 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (1 inch)		0.5	SS-1	5	6	7	13
	2.3	FILL - stiff, moist, red brown, CLAYEY SILT (MH) (A-7-5)		2.5	SS-2	4	5	5	10
		RESIDUUM - stiff, moist, tan brown, SANDY CLAY (CL) (A-6), 34, 22, 12, 19.9%, 51.1%		4.5	SS-3	4	6	8	14
591.0				6.5	SS-4	5	6	8	14
				8.5	SS-5	5	6	7	13
586.0									
	12.0	RESIDUUM - medium dense to very dense, moist, brown tan, fine to coarse, SILTY SAND (SM) (A-2-4)		13.5	SS-6	8	12	12	24
581.0									
				18.5	SS-7	18	42	40	82
576.0									
	24.0	PARTIALLY WEATHERED ROCK (PWR) - moist, tan gray, SANDY SILT (ML) (A-4)		23.5	SS-8	20	49	50/.2	100
571.0									
	27.0	RESIDUUM - very dense, moist, brown tan, fine to coarse, SILTY SAND (SM) (A-2-4)		28.5	SS-9	23	27	57	84
566.0	30.0	Terminated at 30 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

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LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 7	**Boring Location:**	46+87	**Offset:**	32' LT	**Alignment:**	US21
Elev.:	604.2 ft	**Latitude:**	35.0652254	**Longitude:**	-80.9366702	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 25 ft	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	TOPSOIL / ROOTMAT - (1 inch)		0.5					
		FILL - firm, moist, red brown, SANDY SILT (ML) (A-5), 46, 38, 8, 28.7%, 62.4%			SS-1	5	4	4	8
				2.5					
	3.5				SS-2	3	2	3	5
		RESIDUUM - firm to stiff, moist, tan brown, SANDY SILT (ML) (A-4)		4.5					
599.2					SS-3	3	3	4	7
				6.5					
					SS-4	2	2	4	6
				8.5					
					SS-5	2	3	4	7
594.2									
				13.5					
					SS-6	2	3	4	7
589.2									
				18.5					
					SS-7	3	3	5	8
584.2									
				23.5					
					SS-8	3	5	7	12
579.2		▽							
				28.5					
	29.0				SS-9	7	15	22	37
574.2	30.0	RESIDUUM - hard, moist, tan brown, SANDY SILT (ML) (A-4)							
		Terminated at 30 feet.							

SPT N VALUE

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

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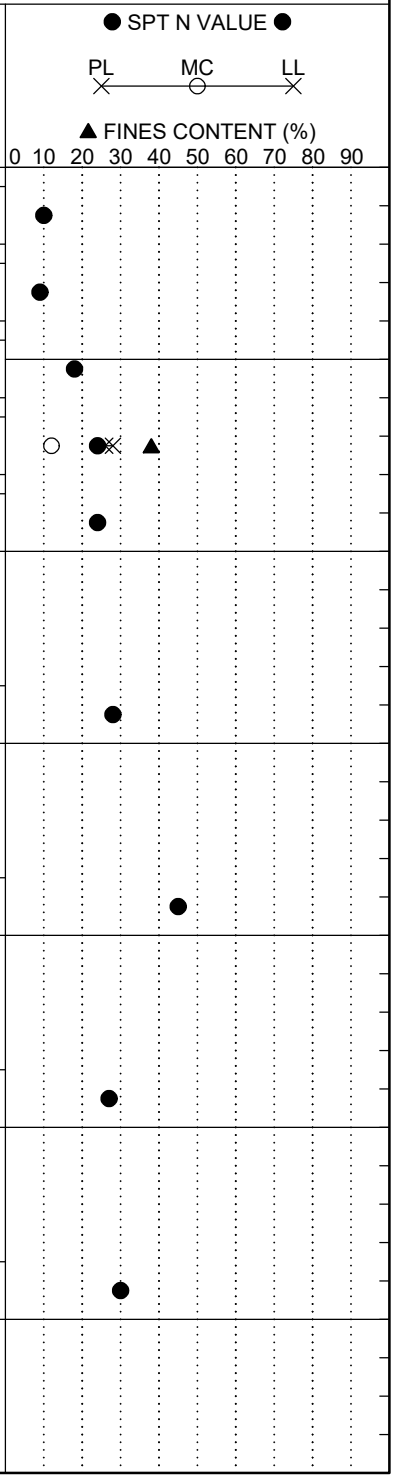
SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 8	**Boring Location:**	49+12	**Offset:**	29' LT	**Alignment:**	US21
Elev.:	608.7 ft	**Latitude:**	35.0658407	**Longitude:**	-80.9365695	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 24.7 ft	**24HR**	21.9 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0							
	0.3	TOPSOIL / ROOTMAT - (3 inches)	0.5	SS-1	8	5	5	10
	2.3	FILL - stiff, moist, red brown, CLAYEY SILT (MH) (A-7-5)	2.5	SS-2	3	5	4	9
603.7		RESIDUUM - loose to medium dense, dry, brown tan, fine to coarse, SILTY SAND (SM) (A-4), 28, 26, 2, 11.5%, 38.3%	4.5	SS-3	5	8	10	18
			6.5	SS-4	8	11	13	24
			8.5	SS-5	8	12	12	24
598.7								
			13.5	SS-6	8	12	16	28
593.7								
	17.0	RESIDUUM - dense to medium dense, dry, brown tan, fine to coarse, SILTY SAND (SM) (A-2-4)	18.5	SS-7	18	18	27	45
588.7								
			23.5	SS-8	12	14	13	27
583.7								
			28.5	SS-9	8	12	18	30
578.7	30.0	Terminated at 30 feet.						



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S- 9	**Boring Location:**	51+12	**Offset:**	25' LT	**Alignment:**	US21
Elev.:	613.3 ft	**Latitude:**	35.0663846	**Longitude:**	-80.9364756	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (3 inches)		0.5	SS-1	5	6	5	11
	2.3	FILL - stiff, moist, brown gray, CLAYEY SILT (MH) (A-7-5)		2.5	SS-2	2	3	3	6
		RESIDUUM - firm to stiff, moist, brown tan, SANDY SILT (ML) (A-4), 35, 31, 4, 18.1%, 51.2%		4.5	SS-3	2	2	3	5
608.3				6.5	SS-4	3	3	5	8
				8.5	SS-5	4	4	7	11
603.3									
				13.5	SS-6	2	3	8	11
598.3									
				18.5	SS-7	2	6	9	15
593.3									
	22.0	RESIDUUM - dense to medium dense, moist, gray brown, fine to coarse, SILTY SAND (SM) (A-2-4)		23.5	SS-8	11	19	28	47
588.3									
				28.5	SS-9	7	9	12	21
583.3	30.0	Terminated at 30 feet.							

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

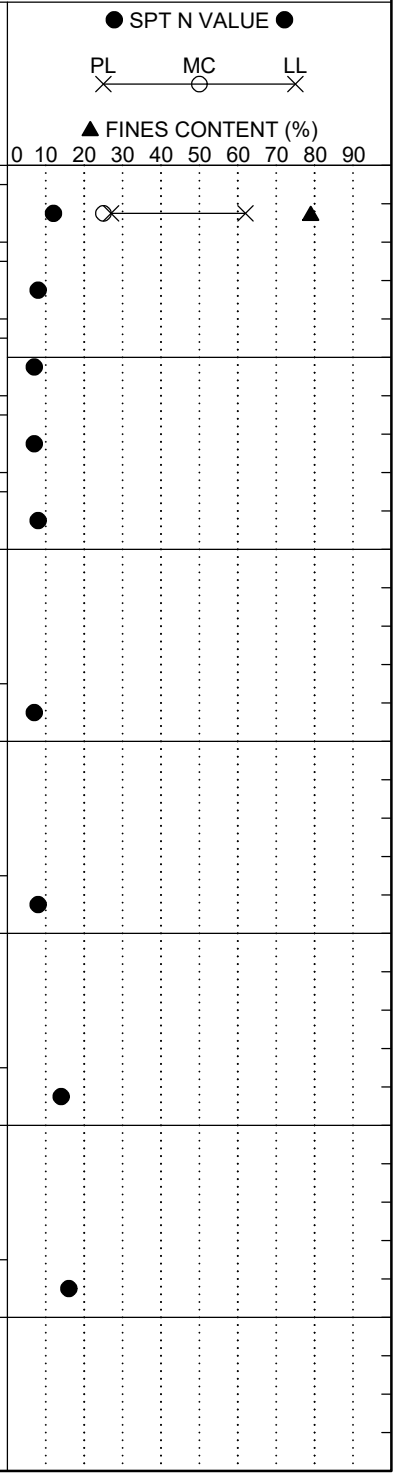
LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S-10	**Boring Location:**	53+11	**Offset:**	30' LT	**Alignment:**	US21
Elev.:	619.2 ft	**Latitude:**	35.0669285	**Longitude:**	-80.9364117	**Date Started:**	5/18/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/18/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	TOPSOIL / ROOTMAT - (3 inches)		0.5					
		FILL - stiff, moist, brown red, SILTY CLAY (CH) (A-7-6), 62, 27, 35, 25.1%, 79.3%			SS-1	5	6	6	12
	2.3			2.5					
		RESIDUUM - firm, moist, orange tan, SANDY SILT (ML) (A-4)			SS-2	2	4	4	8
				4.5					
614.2					SS-3	3	3	4	7
				6.5					
					SS-4	3	3	4	7
				8.5					
					SS-5	3	4	4	8
609.2									
	12.0								
		RESIDUUM - loose to medium dense, moist, tan, fine, SILTY SAND (SM) (A-2-4)		13.5					
					SS-6	2	3	4	7
604.2									
				18.5					
					SS-7	3	4	4	8
599.2									
				23.5					
					SS-8	5	7	7	14
594.2									
				28.5					
					SS-9	6	7	9	16
589.2	30.0								
		Terminated at 30 feet.							



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	00423322	**County:**	York	**Eng./Geo.:**	J. Wells
Site Description:	SC US 21/51 Widening (S&ME Project 1351-12-037)					**Route:**	US 21
Boring No.:	S-11	**Boring Location:**	66+75	**Offset:**	14' LT	**Alignment:**	US21
Elev.:	637.0 ft	**Latitude:**	35.0706423	**Longitude:**	-80.9358108	**Date Started:**	5/21/2015
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	ft	**Date Completed:**	5/21/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	2-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	G. Skoglund	**Groundwater:**	**TOB** 20.1 ft	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0	ASPHALT - (13 inches)		1.1					
	1.1	FILL - firm, moist, tan orange, SILTY CLAY (CH) (A-7-6), 51, 19, 32, 16.1%, 60.3%			SS-1	4	3	5	8
				2.6	SS-2	2	2	3	5
632.0				4.5	SS-3	3	2	4	6
				6.5	SS-4	2	4	4	8
				8.5	SS-5	3	3	4	7
627.0									
	12.0	ALLUVIAL - loose, wet, gray, fine to coarse, SILTY SAND (SM) (A-2-4)		13.5	SS-6	2	2	2	4
622.0									
	17.0	ALLUVIAL - loose, wet, gray, fine to coarse, CLAYEY SAND (SC) (A-2-6)		18.5	SS-7	1	1	2	3
617.0		▽							
				23.5	SS-8	2	1	3	4
612.0									
	27.0	RESIDUUM - hard, dry, tan, SANDY SILT (ML) (A-4)		28.5	SS-9	10	14	18	32
607.0	30.0	Terminated at 30 feet.							

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

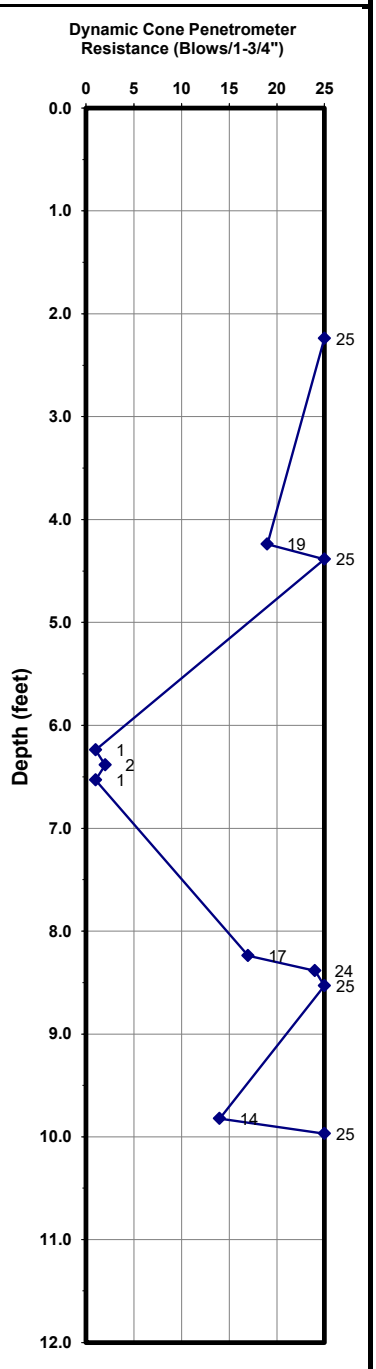
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

PROJECT:	US 21 and SC 51 York County, South Carolina S&ME Project No. 1335-12-037	BORING LOG:	HA-1

DATE PERFORMED: **7/16/2015**	ELEVATION: 584.0 **feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399. Ground surface elevation interpolated from provided cross sections and should be considered approximate.**
PERFORMED BY: JERW	BORING DEPTH: **10.0 feet**	
LAT: **35.058711**	WATER LEVEL: **7.4 feet**	
LONG: **-80.937773**	STATION: **23+00**	
ALIGNMENT: **US21**	OFFSET: **59 LT**	

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0.0-0.6	**Topsoil/Rootmat (7 inches)**
0.6-5.9	**FILL:** Brown Red, dry, Sandy **CLAY (CL), (A-6)**
5.9-9.1	**ALLUVIAL**: Gray, wet to saturated, fine to coarse, Sandy CLAY **(CL) (A-4)**
9.1-10.0	**RESIDUAL:** Brown Black, wet, fine to coarse, Clayey **SAND (SC), (A-2-6)**
	Hand Auger Terminated at 10.0 feet.



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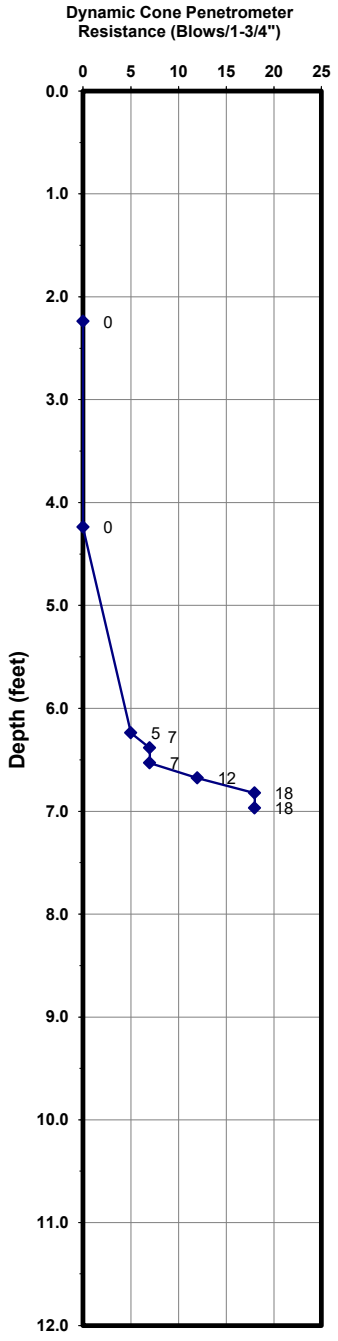
PROJECT:	US 21 and SC 51 York County, South Carolina S&ME Project No. 1335-12-037	BORING LOG:	HA-2

DATE PERFORMED:	**7/16/2015**	ELEVATION: **575.0** feet	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399. Ground surface elevation interpolated from provided cross sections and should be considered approximate.**
PERFORMED BY:	**JERW**	BORING DEPTH: **7.1 feet**	
LAT:	**35.061645**	WATER LEVEL: **2.1 feet**	
LONG:	**-80.936842**	STATION: **34+00**	
ALIGNMENT:	**US21**	OFFSET: **54 RT**	

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0.0-0.4	**Topsoil/Rootmat (5 inches)**
0.4-3.0	**ALLUVIAL:** Gray, saturated, **CLAY (CH) (A-7-6)**
3.0-6.5	**ALLUVIAL:** Gray, saturated, Fine to Coarse Silty **SAND (SM) (A-4)**
6.5-7.1	**RESIDUAL:** Tan Gray, wet, Sandy **SILT (ML) (A-4)**

Hand Auger Terminated/Refusal at 7.1 feet.



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PROJECT:	US 21 and SC 51 York County, South Carolina S&ME Project No. 1335-12-037	BORING LOG:	HA-3

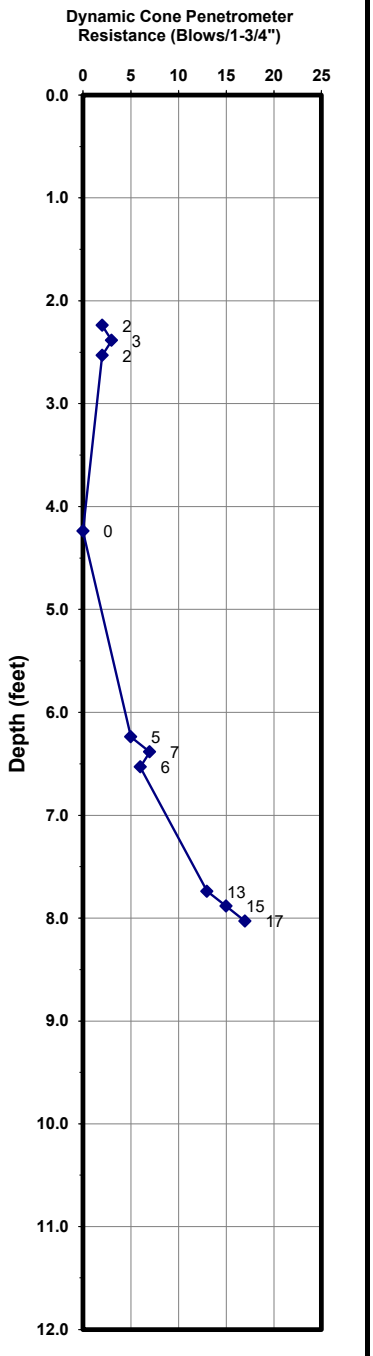
DATE PERFORMED:	**7/16/2015**	ELEVATION:	**569.0 feet**
PERFORMED BY:	JERW	BORING DEPTH:	**8.1 feet**
LAT:	**35.061822**	WATER LEVEL:	**2.8 feet**
LONG:	**-80.937328**	STATION:	**34+40**
ALIGNMENT:	**US21**	OFFSET:	**74 LT**

NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399. Ground surface elevation interpolated from provided cross sections and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0.0-0.4	**Topsoil/Rootmat (5 inches)**
0.4-8.1	**ALLUVIAL:** Gray, saturated, **CLAY (CL) (A-6)**

Hand Auger Terminated at 8.1 feet.



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PROJECT:	US 21 and SC 51 York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG:	HA-4

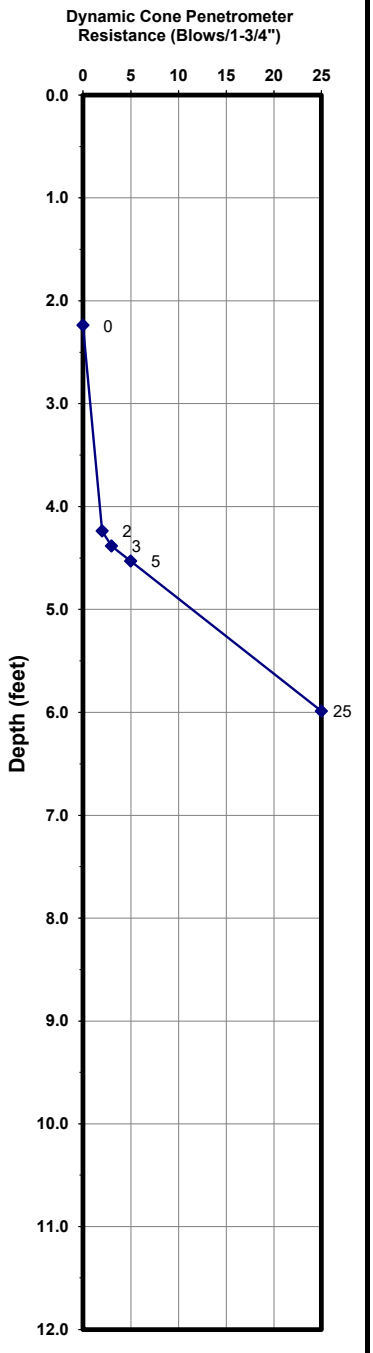
DATE PERFORMED:	**7/16/2015**	ELEVATION:	**571.0 feet**
PERFORMED BY:	JERW	BORING DEPTH:	**6.1 feet**
LAT:	**35.063453**	WATER LEVEL:	**0.5 feet**
LONG:	**-80.937001**	STATION:	**40+37**
ALIGNMENT:	**US21**	OFFSET:	**51 LT**

NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399. Ground surface elevation interpolated from provided cross sections and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0.0-5.0	**ALLUVIAL:** Gray Orange, saturated, fine to coarse Clayey SAND (SC) (A-2-6), trace trash (plastic bag)
5.0-6.1	**ALLUVIAL:** Gray, wet, fine to coarse Silty **SAND (SM) (A-2-6)**

Hand Auger Terminated at 6.1 feet.



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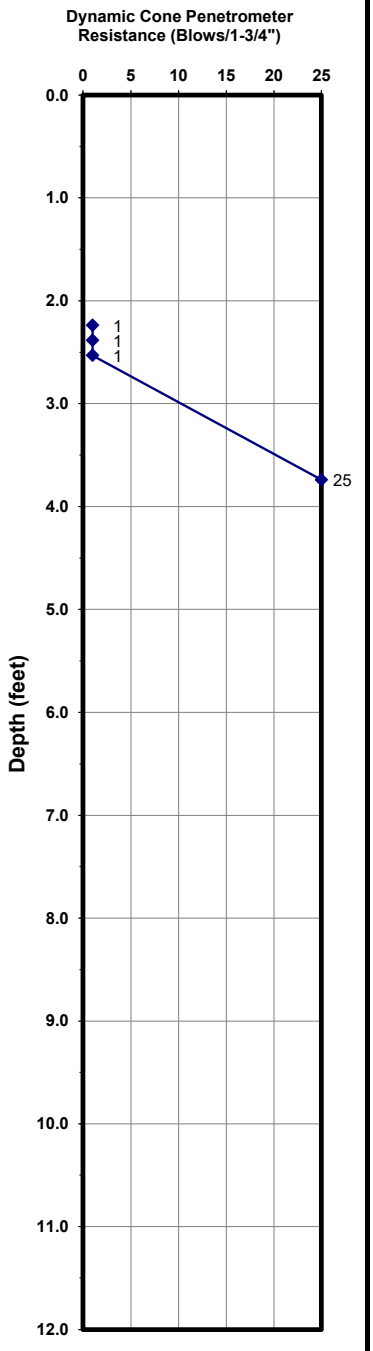
PROJECT:	US 21 and SC 51 York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG:	HA-5

DATE PERFORMED: **7/16/2015**	ELEVATION: **574.0 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399. Ground surface elevation interpolated from provided cross sections and should be considered approximate.**
PERFORMED BY: JERW	BORING DEPTH: 3.8 **feet**	
LAT: **35.06389**	WATER LEVEL: 2.9 **feet**	
LONG: **-80.936591**	STATION: **42+06**	
ALIGNMENT: **US21**	OFFSET: **54 RT**	

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0.0-0.2	**Topsoil/Rootmat (2 inches)**
0.2-1.7	**FILL:** Brown, dry, Sandy **CLAY (CL) (A-6)**
1.7-3.8	**ALLUVIAL:** Gray, wet to saturated, fine to coarse Clayey **SAND (SC) (A-6)**

Hand Auger Terminated at 3.8 feet.



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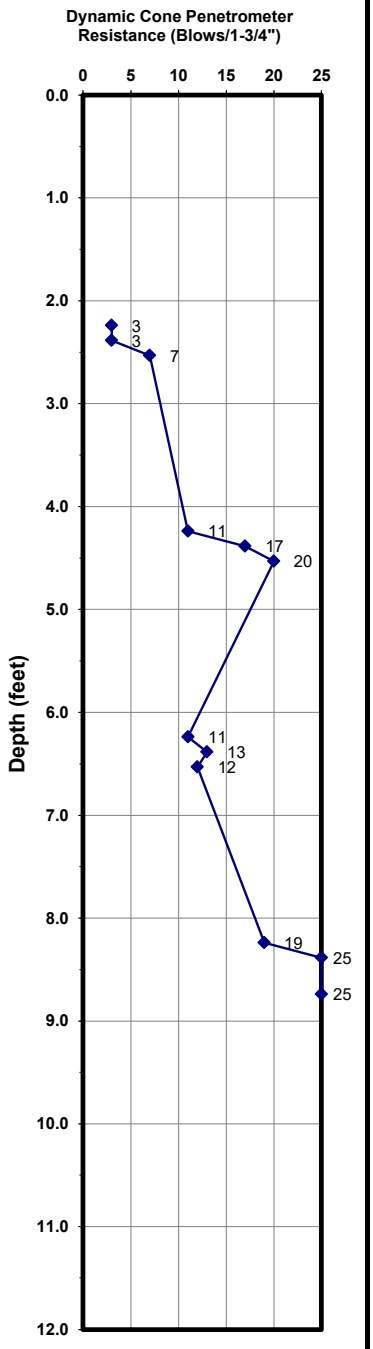
PROJECT:	US 21 and SC 51 York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG:	HA-6

DATE PERFORMED:	**7/16/2015**	ELEVATION:	**622.0 feet**
PERFORMED BY:	JERW	BORING DEPTH:	8.7 **feet**
LAT:	**35.070646**	WATER LEVEL:	4.5 **feet**
LONG:	**-80.935945**	STATION:	**66+75**
ALIGNMENT:	**US21**	OFFSET:	**51 LT**

NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399. Ground surface elevation interpolated from provided cross sections and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0.0-3.5	**ALLUVIAL:** Brown, moist, fine to coarse Clayey **SAND (SC) (A-2-6)**
3.5-5.2	**ALLUVIAL:** Brown tan, moist, Sandy **CLAY (CL) (A-6)**
5.2-8.7	**ALLUVIAL:** Gray brown, saturated, fine to coarse Sandy **CLAY (CL) (A-7-6)**
	Hand Auger Terminated at 8.7 feet.



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Particle Size Analysis of Soils

AASHTO T 88

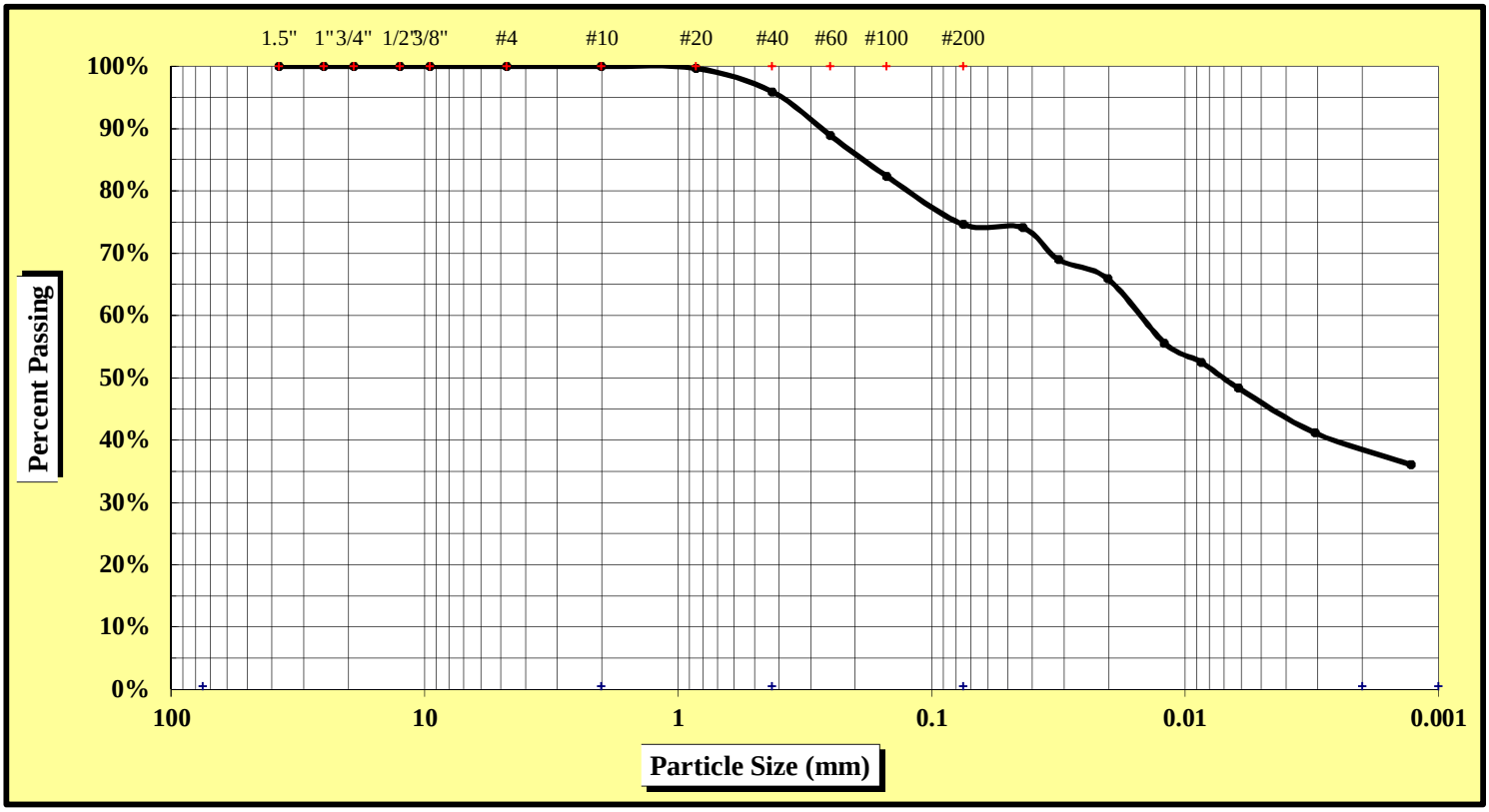
S&ME Project #: **1351-12-037 (01)** Report Date: 7/16/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-1	Sample #: SS-2	Sample Date: 2014/2015
Route-Station:	Forest Dr. 10+73	Offset: 6' LT	Depth: 2.4-4.0'
Sample Description:	Orange Brown Clay w/Coarse to Fine Sand (CH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	4.1%	Silt	36%
Maximum Particle Size	#20	Fine Sand	21.3%	Clay	39%
Apparent Relative Density(Assumed)	2.650	Moisture Content	28.0%	Silt & Clay (% Passing #200)	74.6%
Liquid Limit	60	Plastic Limit	30	Plastic Index	30

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

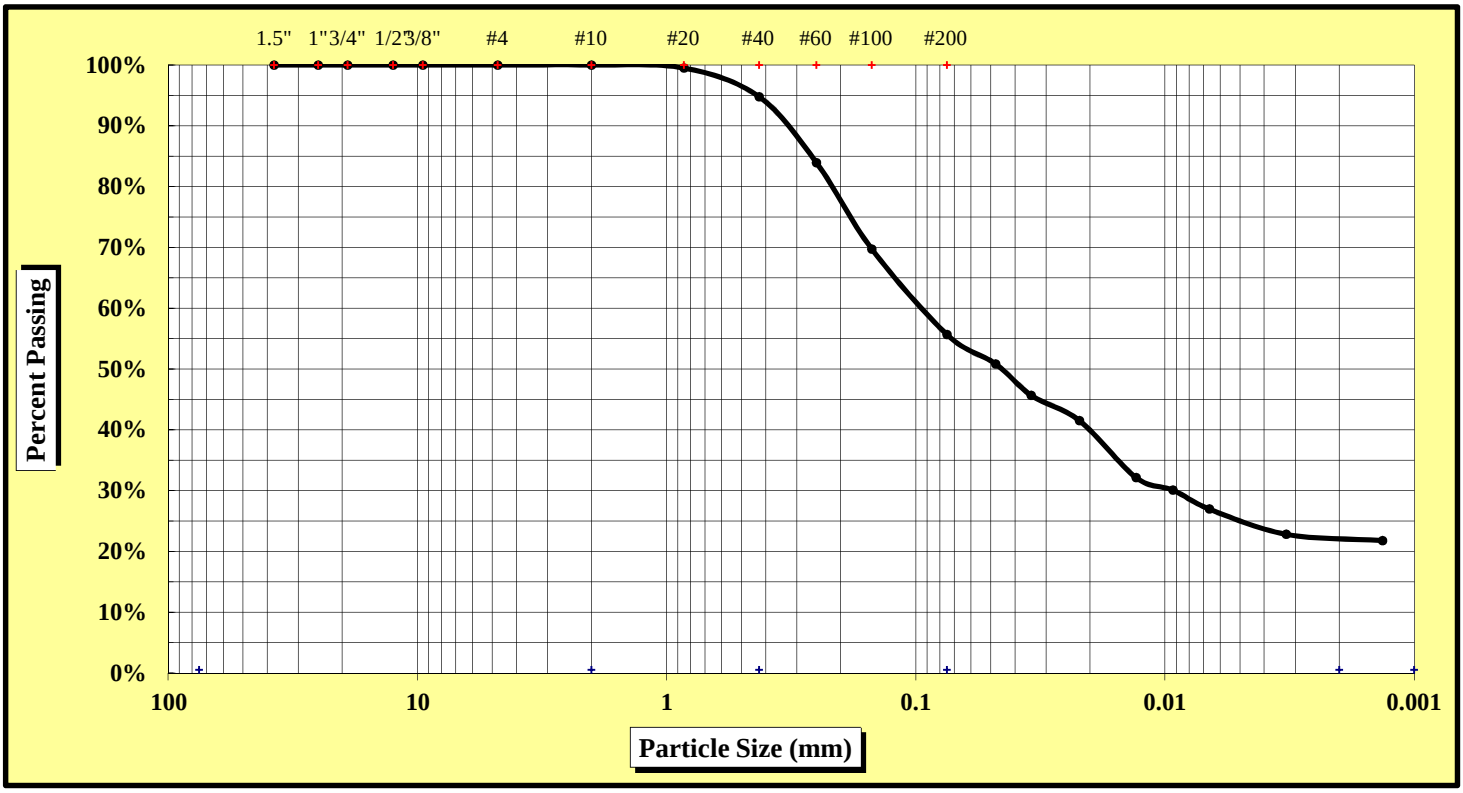
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	B-1	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station	Forest Dr. 10+73	Offset:	6' LT	Depth:	6.5-8'
Sample Description:	Orange Brown Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	5.2%	Silt	33%
Maximum Particle Size	#20	Fine Sand	39.1%	Clay	23%
Specific Gravity (Assumed)	2.650	Moisture Content	28.0%	Silt & Clay (% Passing #200)	55.7%
Liquid Limit	38	Plastic Limit	22	Plastic Index	16

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

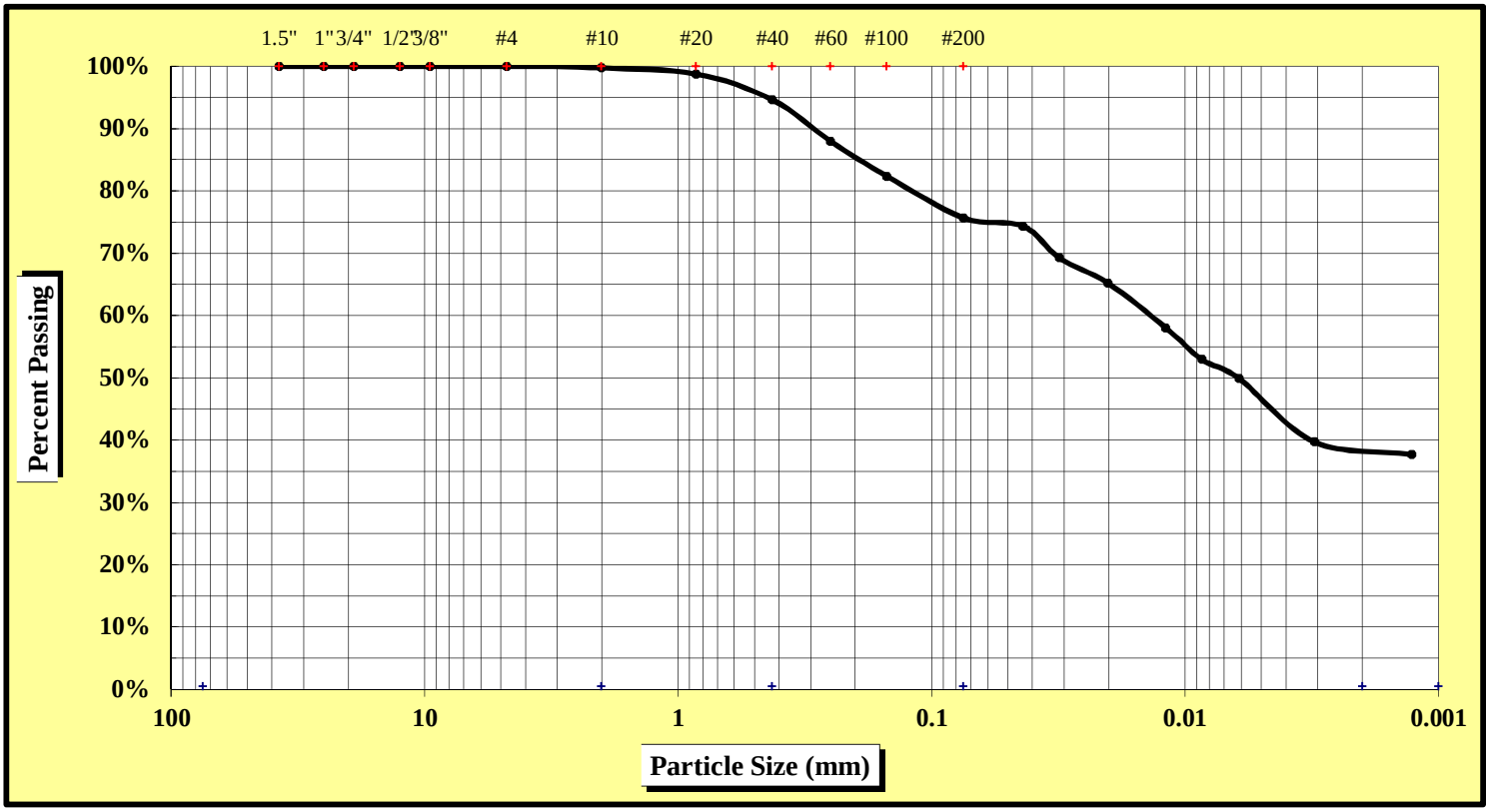
S&ME Project #: **1351-12-037 (01)** Report Date: 7/16/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-2	Sample #: Bulk	Sample Date: 2014/2015
Route-Station:	Gold Hill Rd. - 13+68	Offset: 2' RT	Depth: 1-10'
Sample Description:	Orange Brown Clayey Silt w/Coarse to Fine Sand (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.3%	Coarse Sand	5.1%	Silt	38%
Maximum Particle Size	#10	Fine Sand	19.0%	Clay	38%
Apparent Relative Density(Assumed)	2.650	Moisture Content	31.8%	Silt & Clay (% Passing #200)	75.7%
Liquid Limit	66	Plastic Limit	34	Plastic Index	32

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

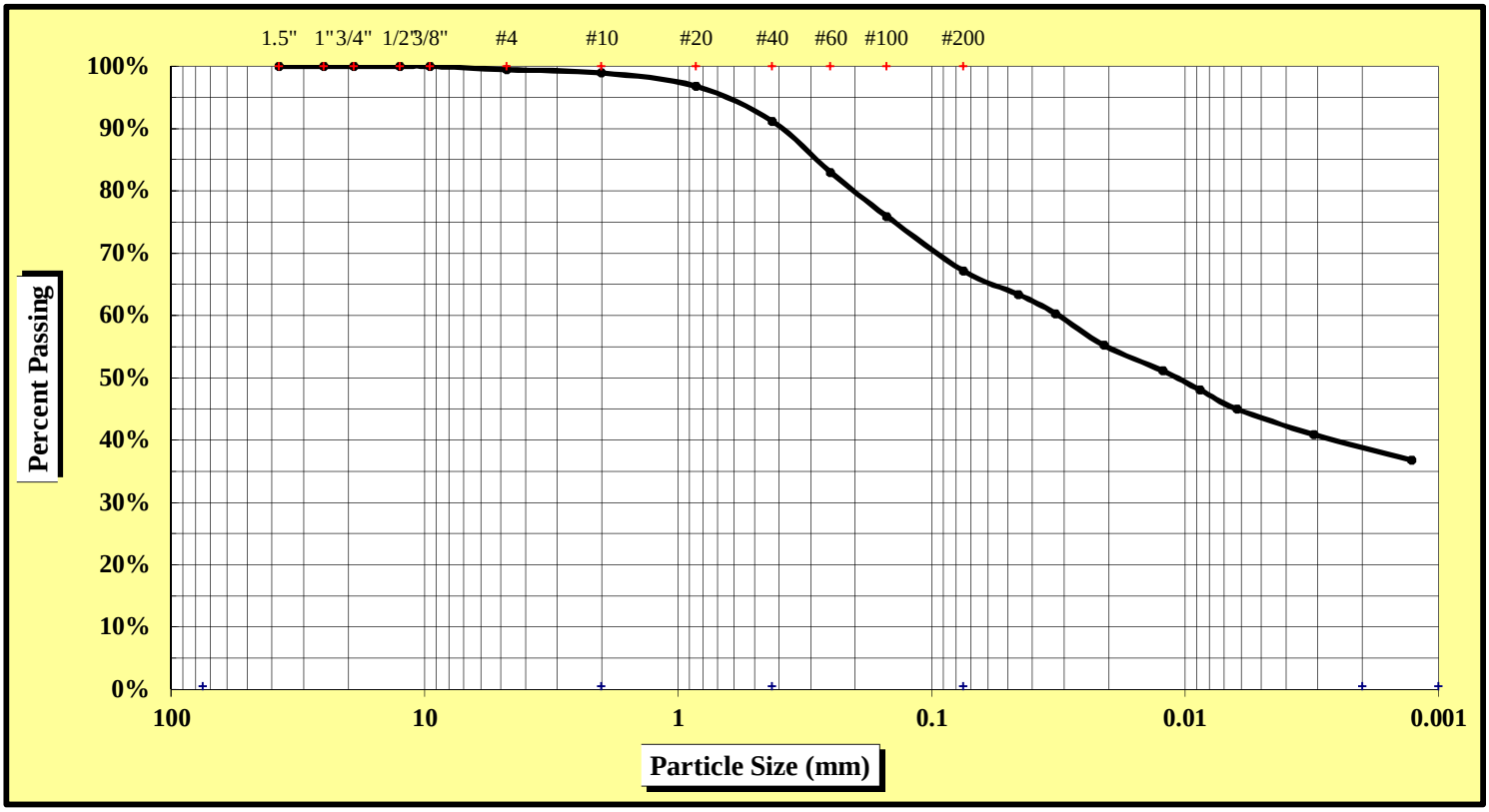
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #: **1351-12-037 (01)** Report Date: 7/16/15
Project Name: **SCDOT US 21 to SC 51**
Client Name: STV
Client Address: NA

Boring #:	B-4	Sample #: Bulk	Sample Date: 2014/2015
Route-Station:	Proposed Road 16+87	Offset: 2' LT	Depth: 1-10'
Sample Description:	Orange Brown Coarse to Fine Sandy Clay (CH)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.1%	Coarse Sand	7.7%	Silt	28%
Maximum Particle Size	#4	Fine Sand	24.0%	Clay	39%
Apparent Relative Density(Assumed)	2.650	Moisture Content	35.8%	Silt & Clay (% Passing #200)	67.2%
Liquid Limit	59	Plastic Limit	21	Plastic Index	38

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

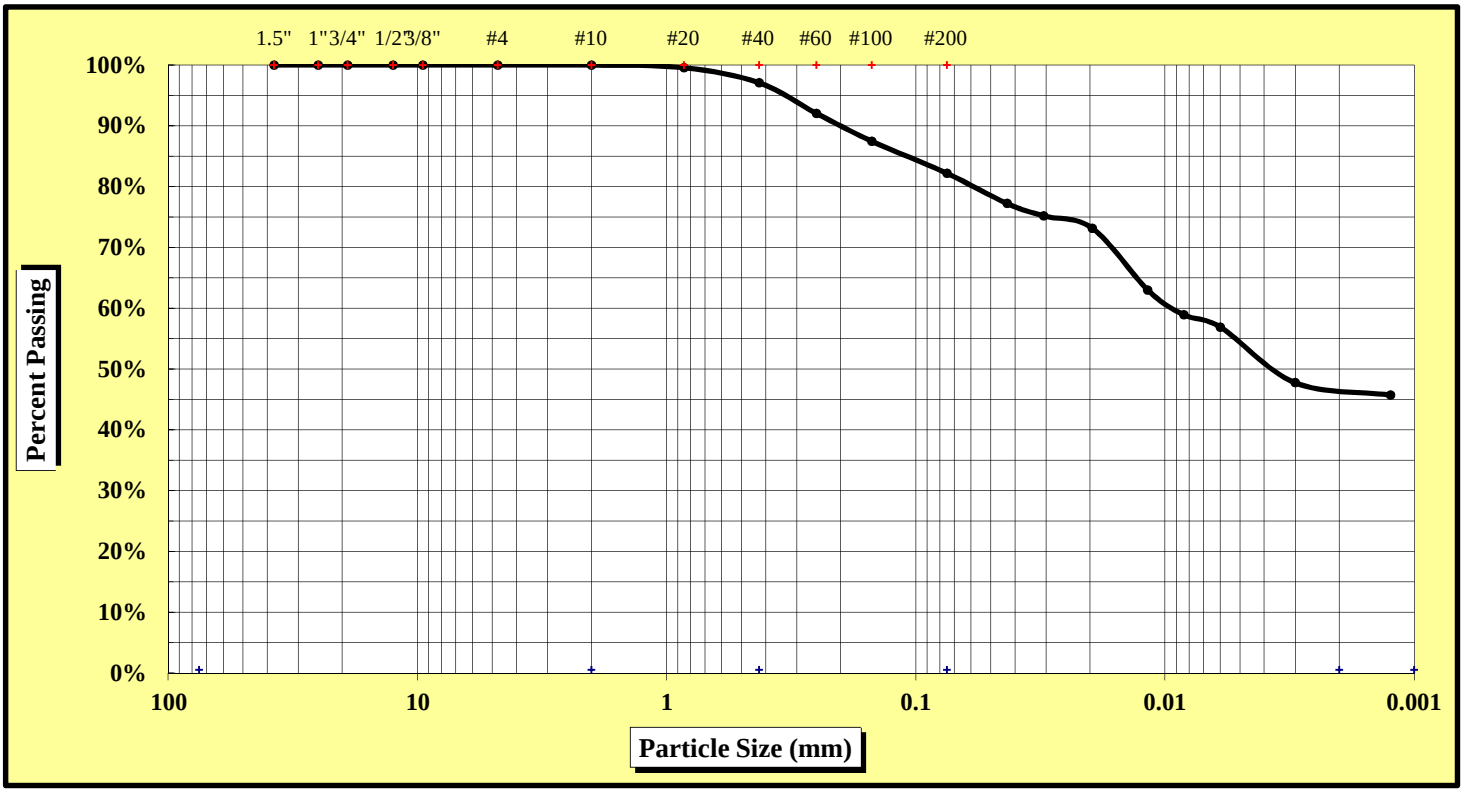
S&ME Project #: **1351-12-037 (01)** Report Date: 7/16/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-5	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Old Nation Rd. 11+85	Offset: 1" LT	Depth: .5-2'
Sample Description:	Orange Brown Clayey Silt w/Coarse to Fine Sand (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	2.9%	Silt	35%
Maximum Particle Size	#20	Fine Sand	14.9%	Clay	47%
Apparent Relative Density(Assumed)	2.650	Moisture Content	30.6%	Silt & Clay (% Passing #200)	82.2%
Liquid Limit	72	Plastic Limit	36	Plastic Index	36

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

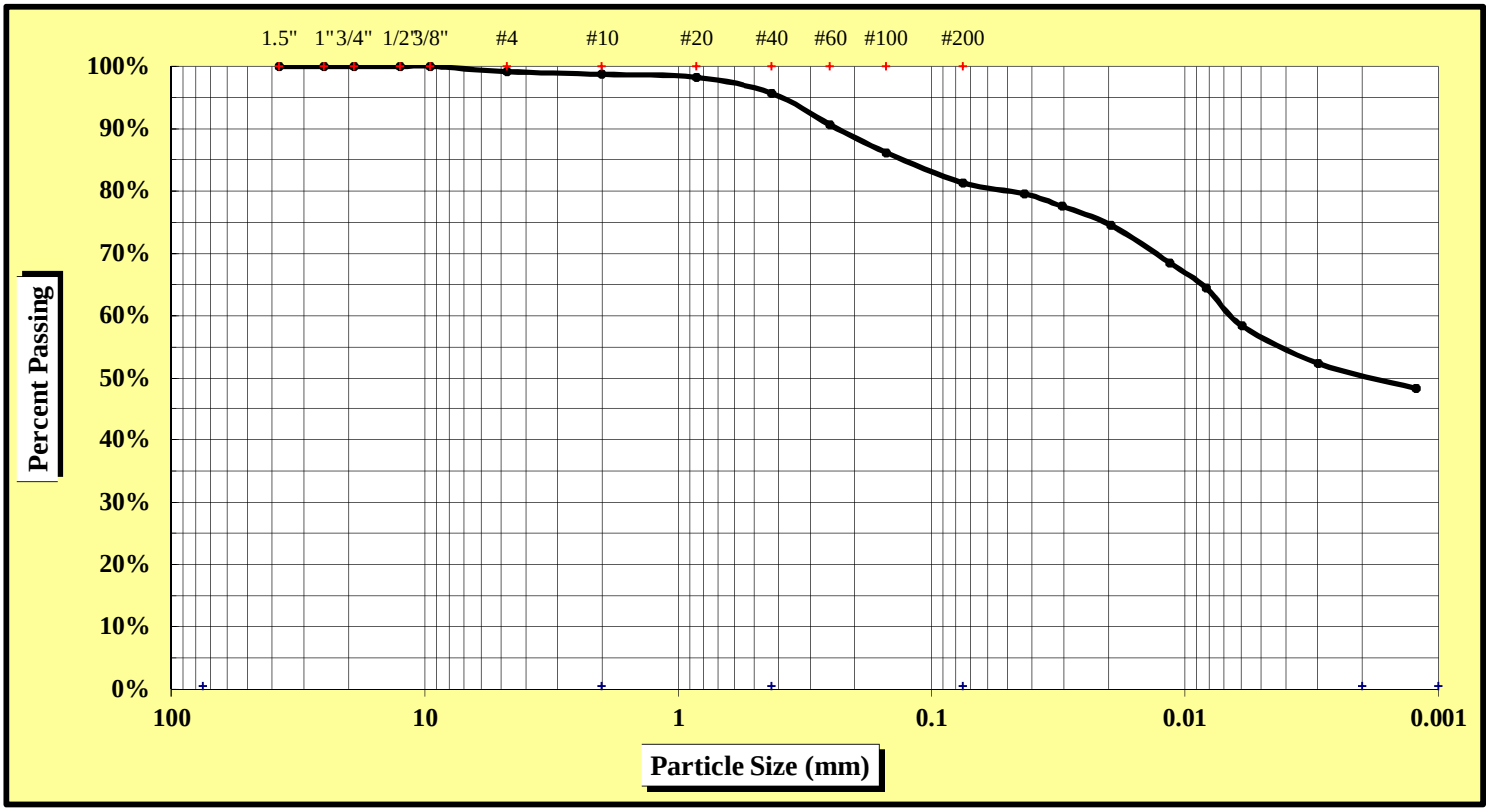
S&ME Project #: **1351-12-037 (01)** Report Date: 7/16/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-5	Sample #: SS-3	Sample Date: 2014/2015
Route-Station:	Old Nation Rd 11+85	Offset: 1' LT	Depth: 4.5-6'
Sample Description:	Orange Brown Clay w/Coarse to Fine Sand (CH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.3%	Coarse Sand	3.0%	Silt	31%
Maximum Particle Size	#4	Fine Sand	14.4%	Clay	50%
Apparent Relative Density(Assumed)	2.650	Moisture Content	30.7%	Silt & Clay (% Passing #200)	81.3%
Liquid Limit	75	Plastic Limit	35	Plastic Index	40

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

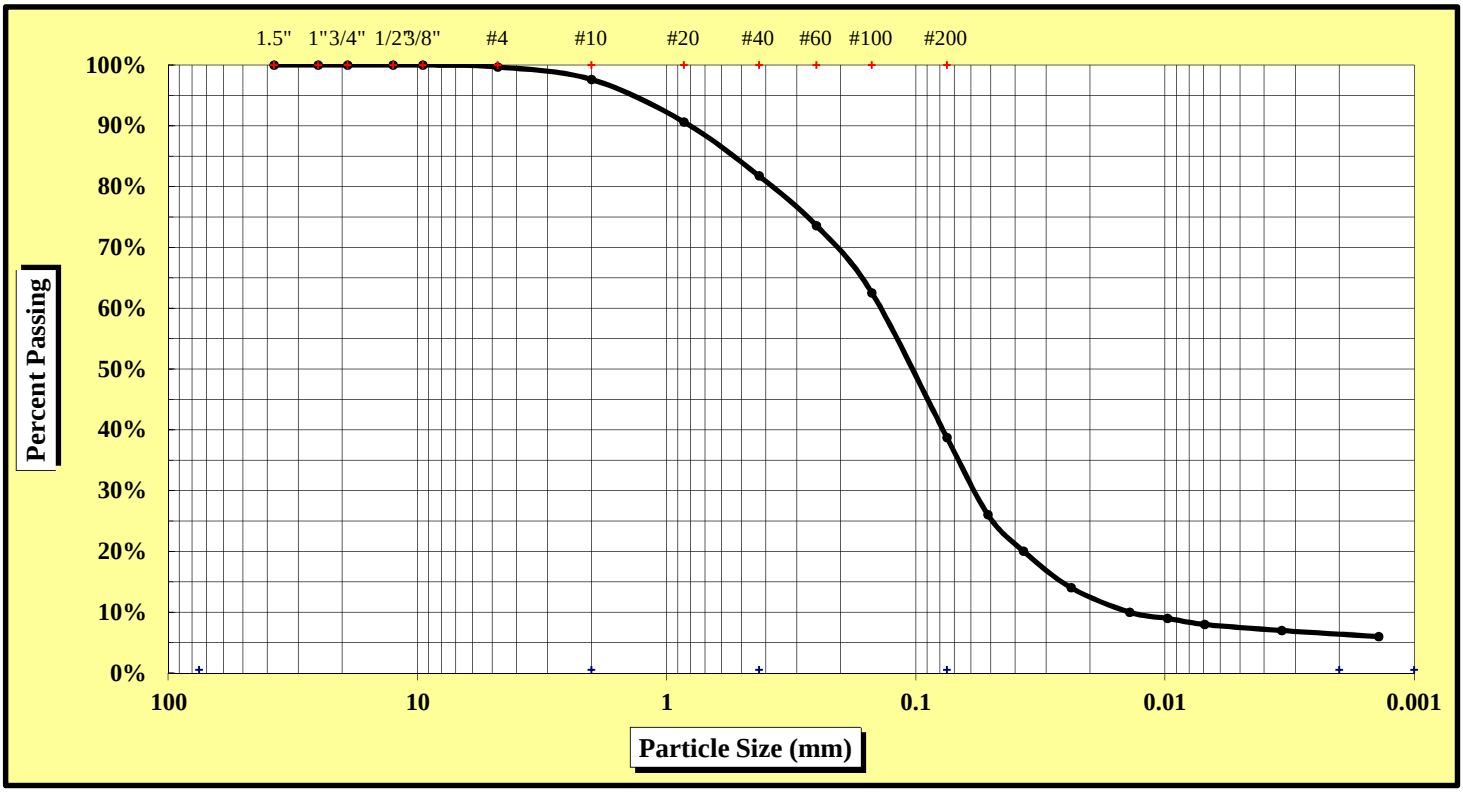
S&ME Project #: **1351-12-037 (01)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-6	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Springhill Farm Rd	Offset: 1' RT	Depth: 0.5-2.0'
Sample Description:	Gray Brown Silty Coarse to Fine Sand (SM)		A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.4%	Coarse Sand	15.9%	Silt	32%
Maximum Particle Size	#4	Fine Sand	43.0%	Clay	7%
Apparent Relative Density(Assumed)	2.650	Moisture Content	6.7%	Silt & Clay (% Passing #200)	38.7%
Liquid Limit	0	Plastic Limit	0	Plastic Index	0

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

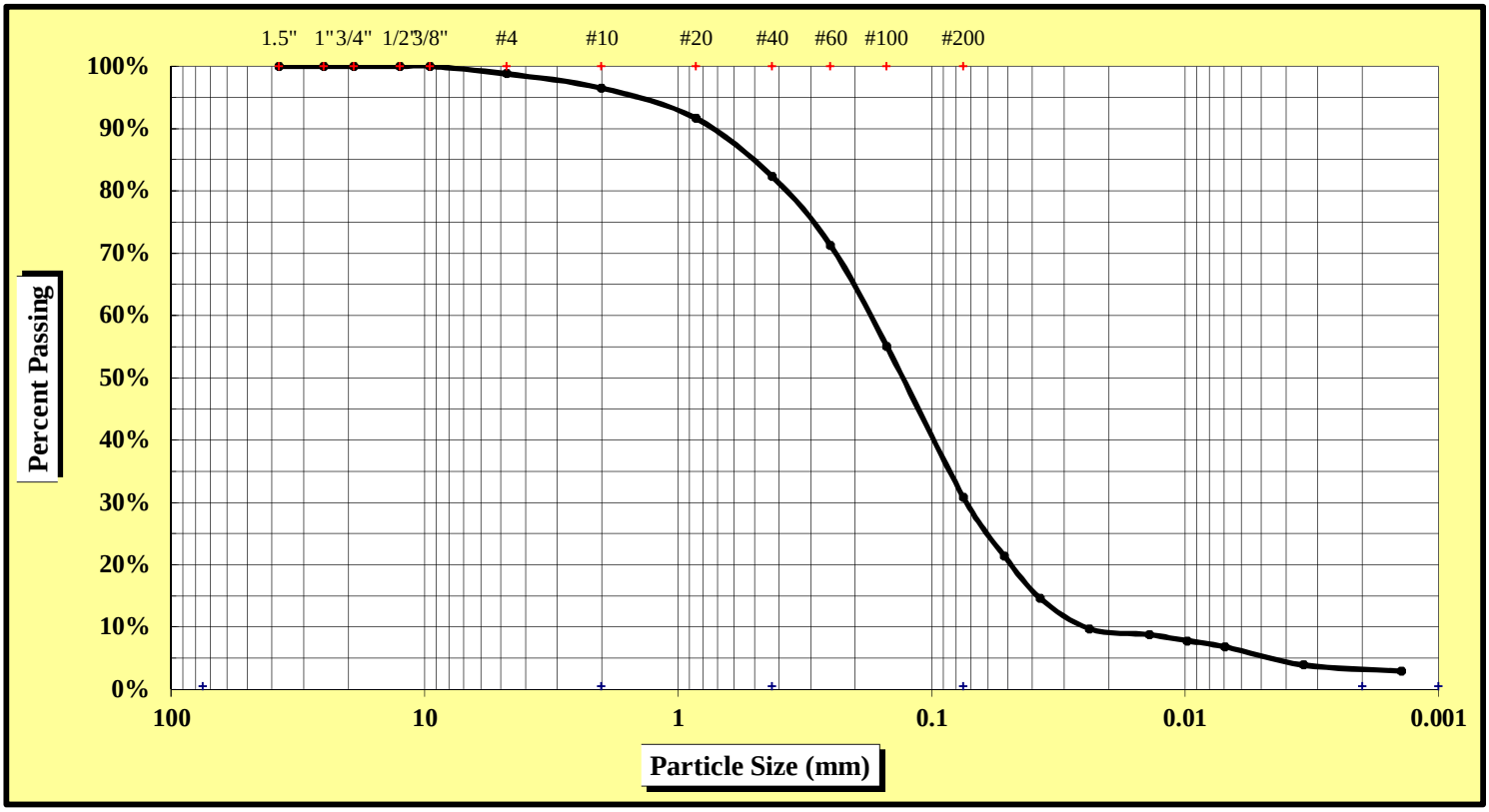
S&ME Project #: **1351-12-037 (01)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-7	Sample #: SS-2	Sample Date: 2014/2015
Route-Station:	Springhill Farm Rd.	Offset: 1' RT	Depth: 2.5-4.0'
Sample Description:	Gray Brown Silty Coarse to Fine Sand (SM)		A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	3.5%	Coarse Sand	14.2%	Silt	27%
Maximum Particle Size	#4	Fine Sand	51.4%	Clay	4%
Apparent Relative Density(Assumed)	2.650	Moisture Content	4.3%	Silt & Clay (% Passing #200)	30.9%
Liquid Limit	0	Plastic Limit	0	Plastic Index	0

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

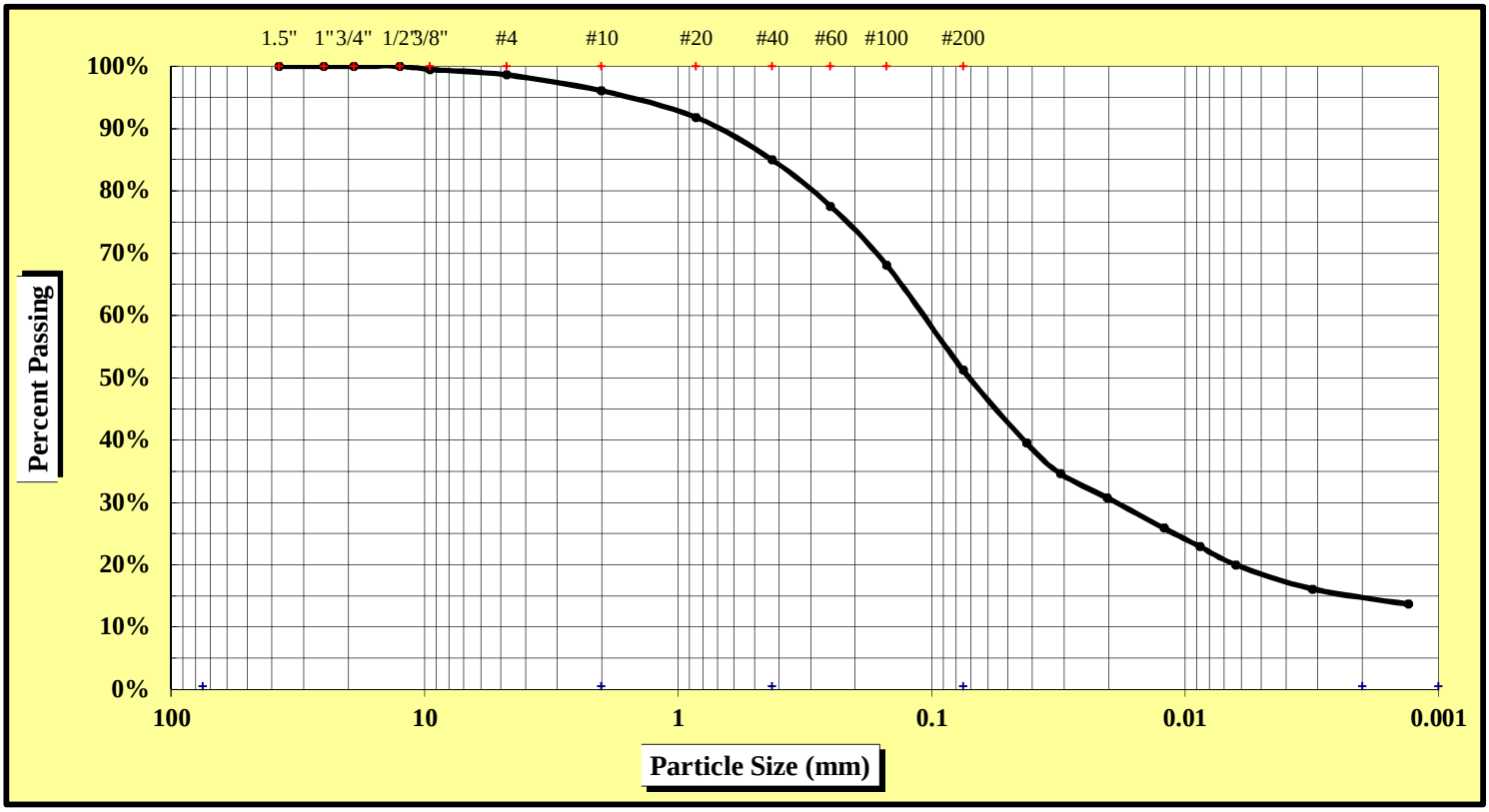
S&ME Project #: **1351-12-037 (01)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-8	Sample #: Bulk	Sample Date: 2014/2015
Route-Station:	Springhill Farm Road	Offset: 1' RT	Depth: 1-10'
Sample Description:	Brown Gray Coarse to Fine Sandy Silty Clay (CL)		A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	4.0%	Coarse Sand	11.1%	Silt	37%
Maximum Particle Size	3/8"	Fine Sand	33.7%	Clay	15%
Apparent Relative Density(Assumed)	2.650	Moisture Content	8.6%	Silt & Clay (% Passing #200)	51.2%
Liquid Limit	23	Plastic Limit	12	Plastic Index	11

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

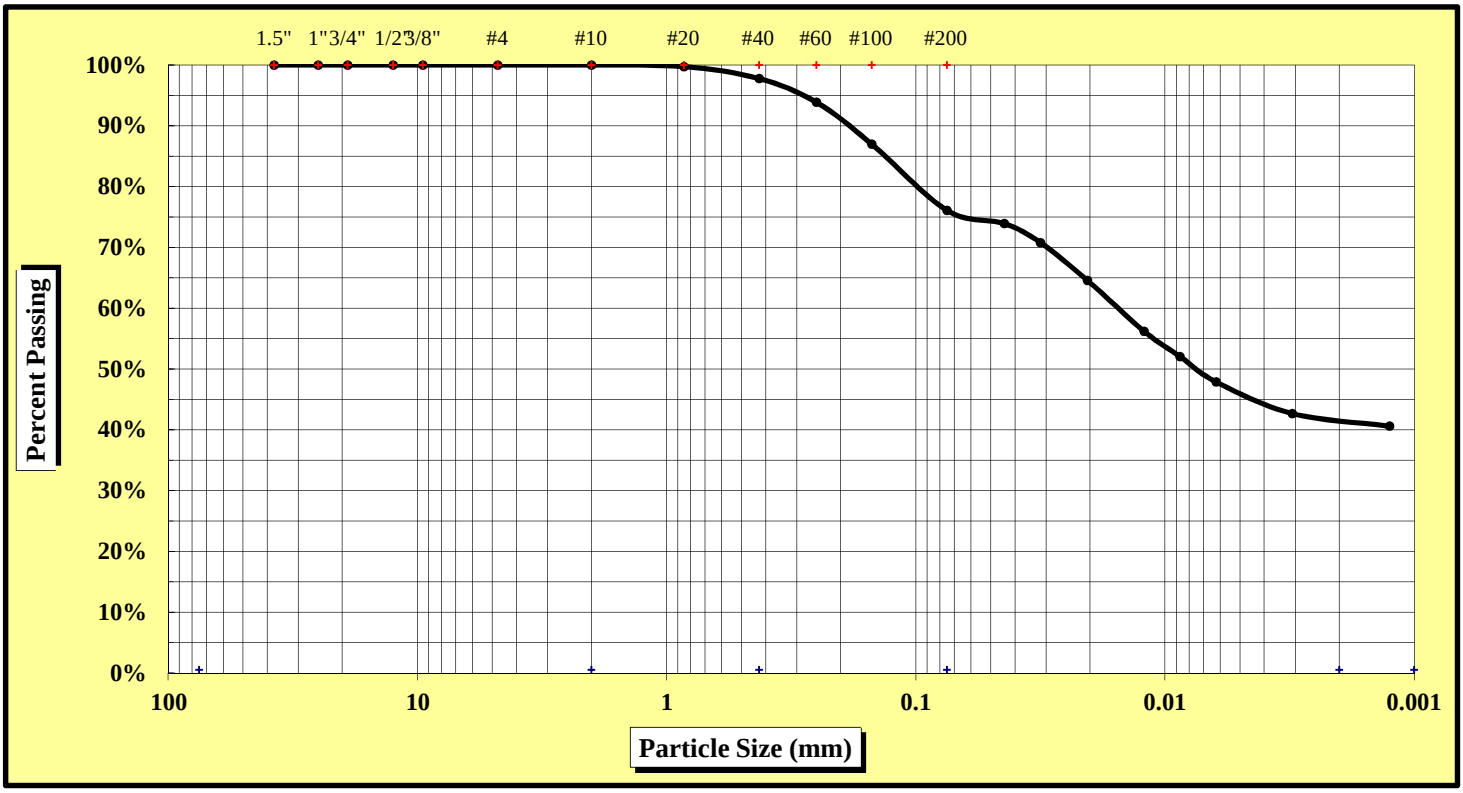
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/2/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	B-9	Sample #:	SS-2	Sample Date:	2014/2015
Route-Station	Springhill Farm Rd.	Offset:	1' RT	Depth:	4.5-6'
Sample Description:	Gray Orange Tan Clayey Silt w/Coarse to Fine Sand (MH)				A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	2.2%	Silt	35%
Maximum Particle Size	#20	Fine Sand	21.7%	Clay	41%
Specific Gravity (Assumed)	2.650	Moisture Content	10.9%	Silt & Clay (% Passing #200)	76.1%
Liquid Limit	62	Plastic Limit	33	Plastic Index	29

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

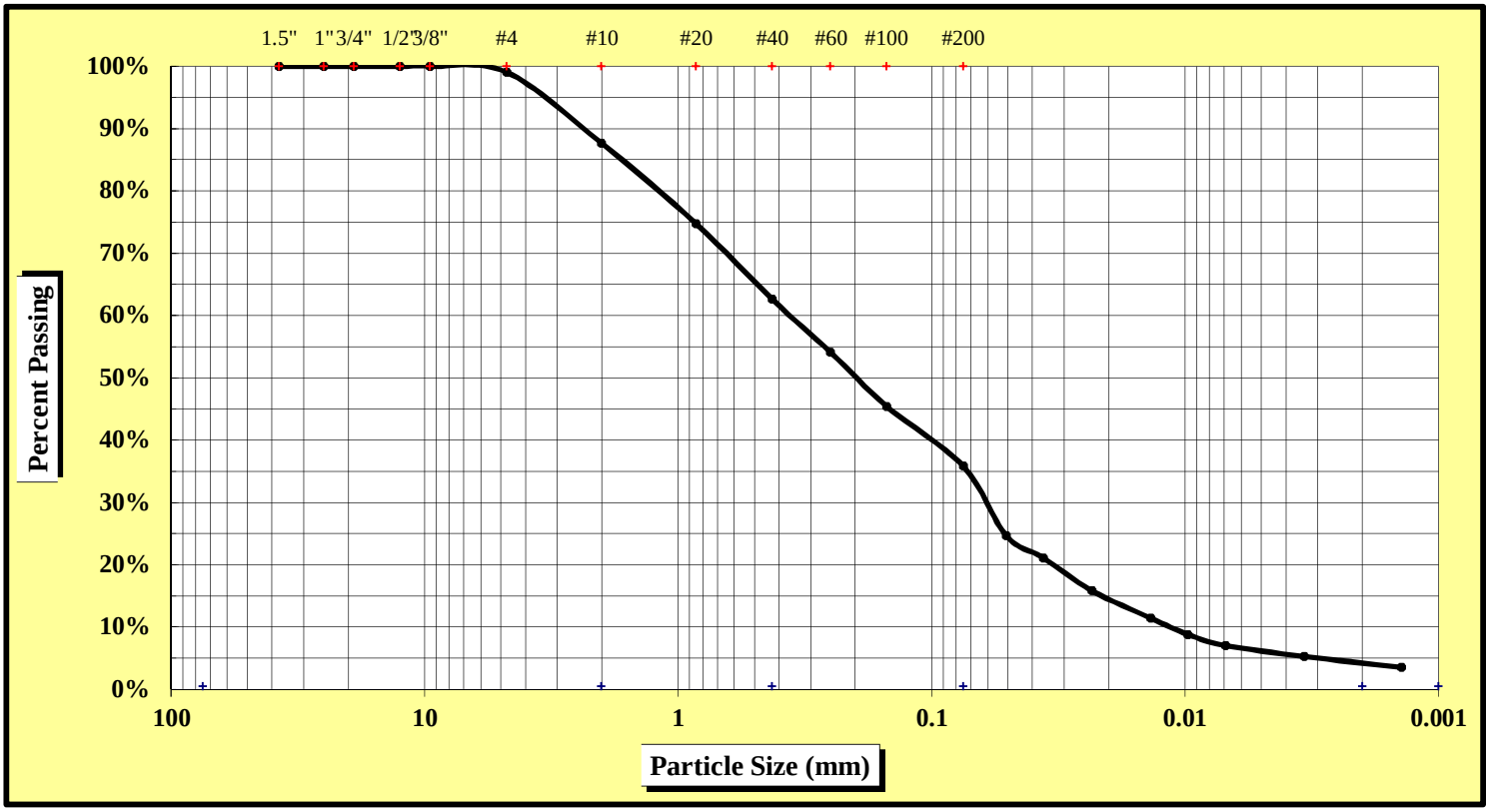
S&ME Project #: **1351-12-037 (01)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	B-9	Sample #: SS-5	Sample Date: 2014/2015
Route-Station:	Springhill Farm Road	Offset: 1' RT	Depth: 8.5-10'
Sample Description:	Gray Orange Tan Silty Coarse to Fine Sand (SM)		A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	12.4%	Coarse Sand	25.0%	Silt	31%
Maximum Particle Size	#4	Fine Sand	26.8%	Clay	5%
Apparent Relative Density(Assumed)	2.650	Moisture Content	10.9%	Silt & Clay (% Passing #200)	35.8%
Liquid Limit	0	Plastic Limit	0	Plastic Index	0

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

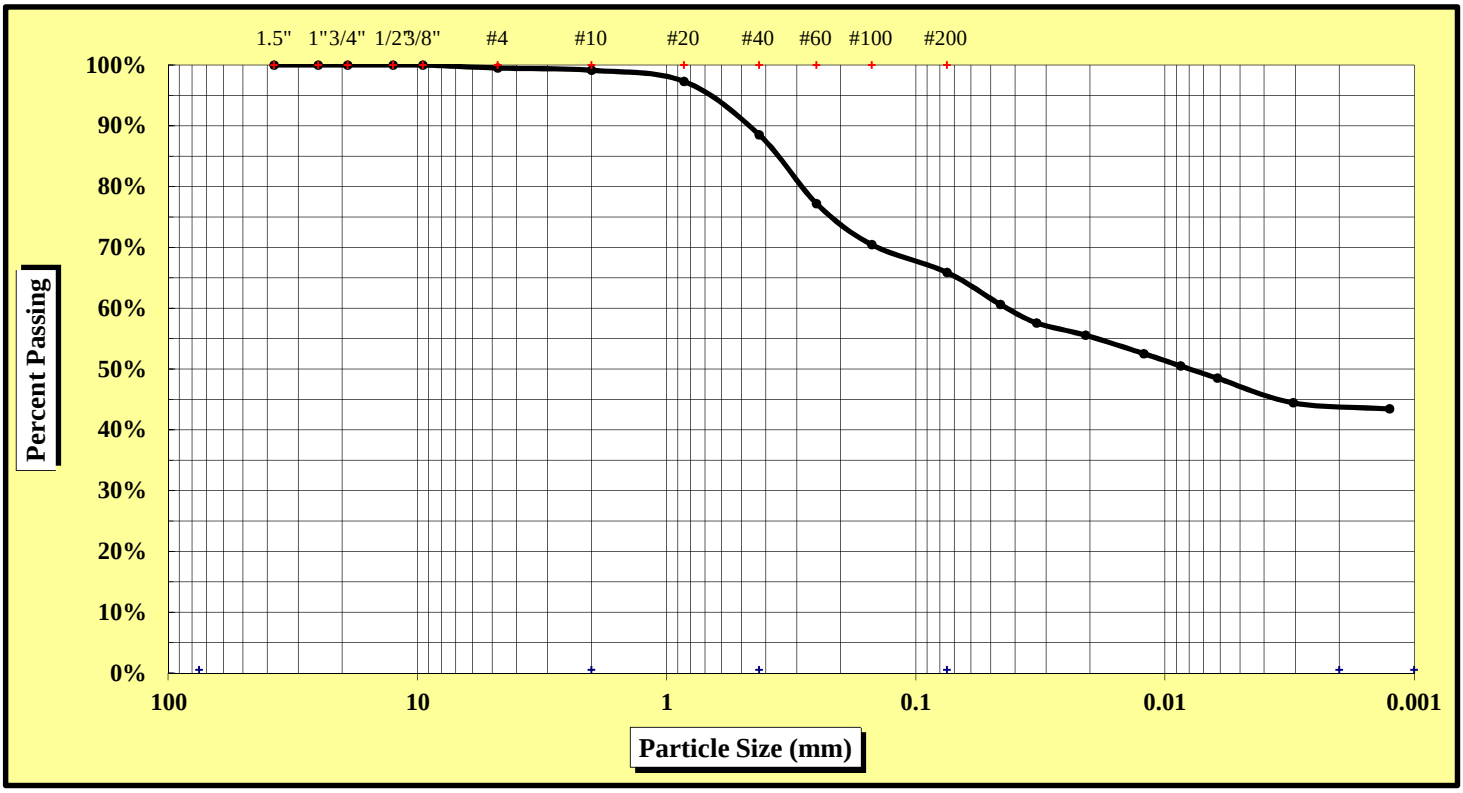
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: B-10	Sample #: SS-1	Sample Date: 2014/2015	
Route-Station: SC 51 296+16	Offset: 24' RT	Depth: .5-10.0'	
Sample Description: Tan Orange Brown Coarse to Fine Sandy Clay (CH)		A-7-6	



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.9%	Coarse Sand	10.6%	Silt	22%
Maximum Particle Size	#4	Fine Sand	22.6%	Clay	44%
Apparent Relative Density(Assumed)	2.650	Moisture Content	21.4%	Silt & Clay (% Passing #200)	65.9%
Liquid Limit	64	Plastic Limit	22	Plastic Index	42

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

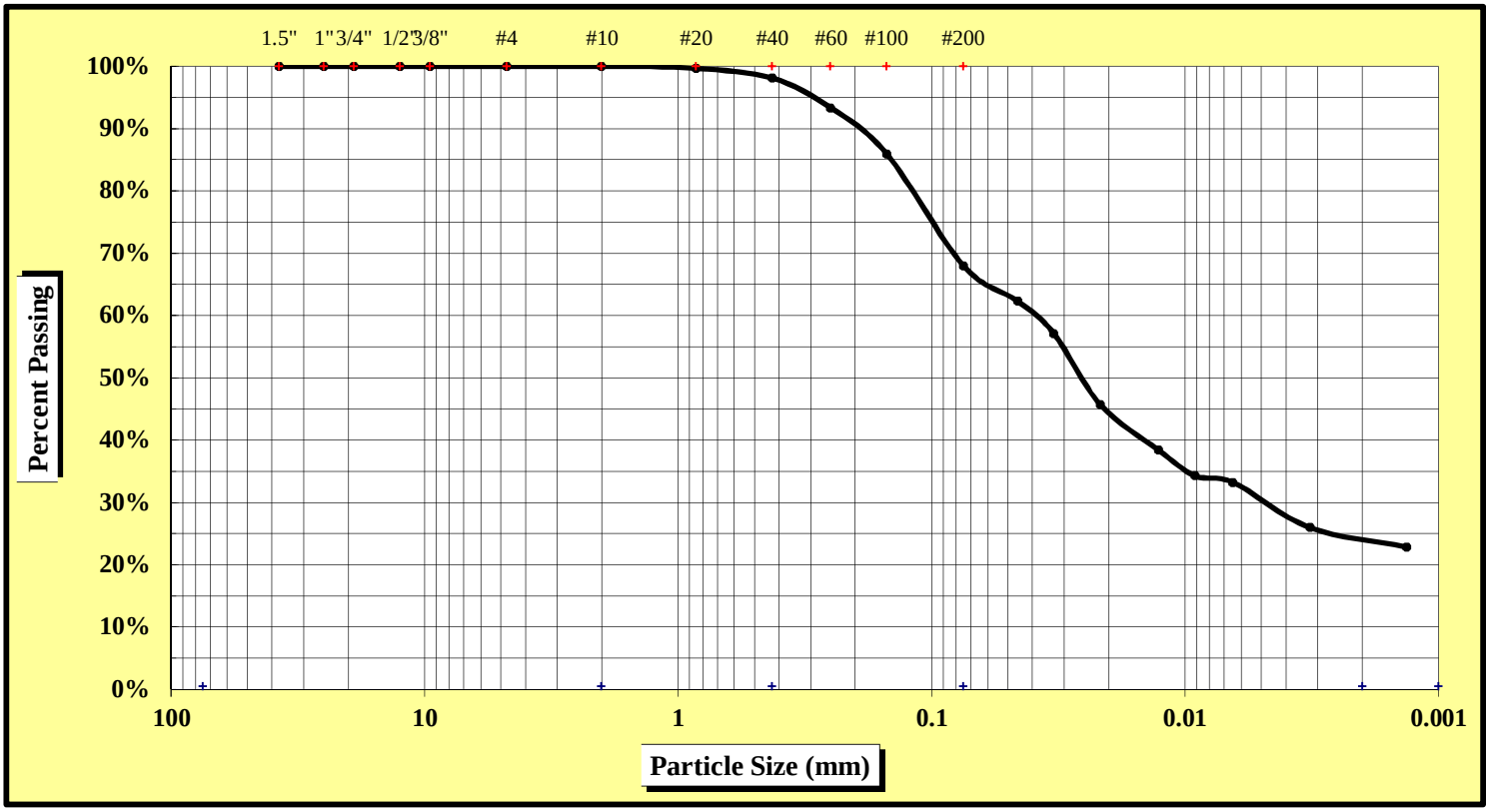
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: B-11	Sample #: Bulk	Sample Date: 2014/2015
Route-Station: SC 51 299+48	Offset: 26' RT	Depth: 1-10'
Sample Description: Brown Coarse to Fine Sandy Silty Clay (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	1.9%	Silt	44%
Maximum Particle Size	#20	Fine Sand	30.1%	Clay	24%
Apparent Relative Density(Assumed)	2.650	Moisture Content	21.4%	Silt & Clay (% Passing #200)	68.0%
Liquid Limit	47	Plastic Limit	24	Plastic Index	23

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

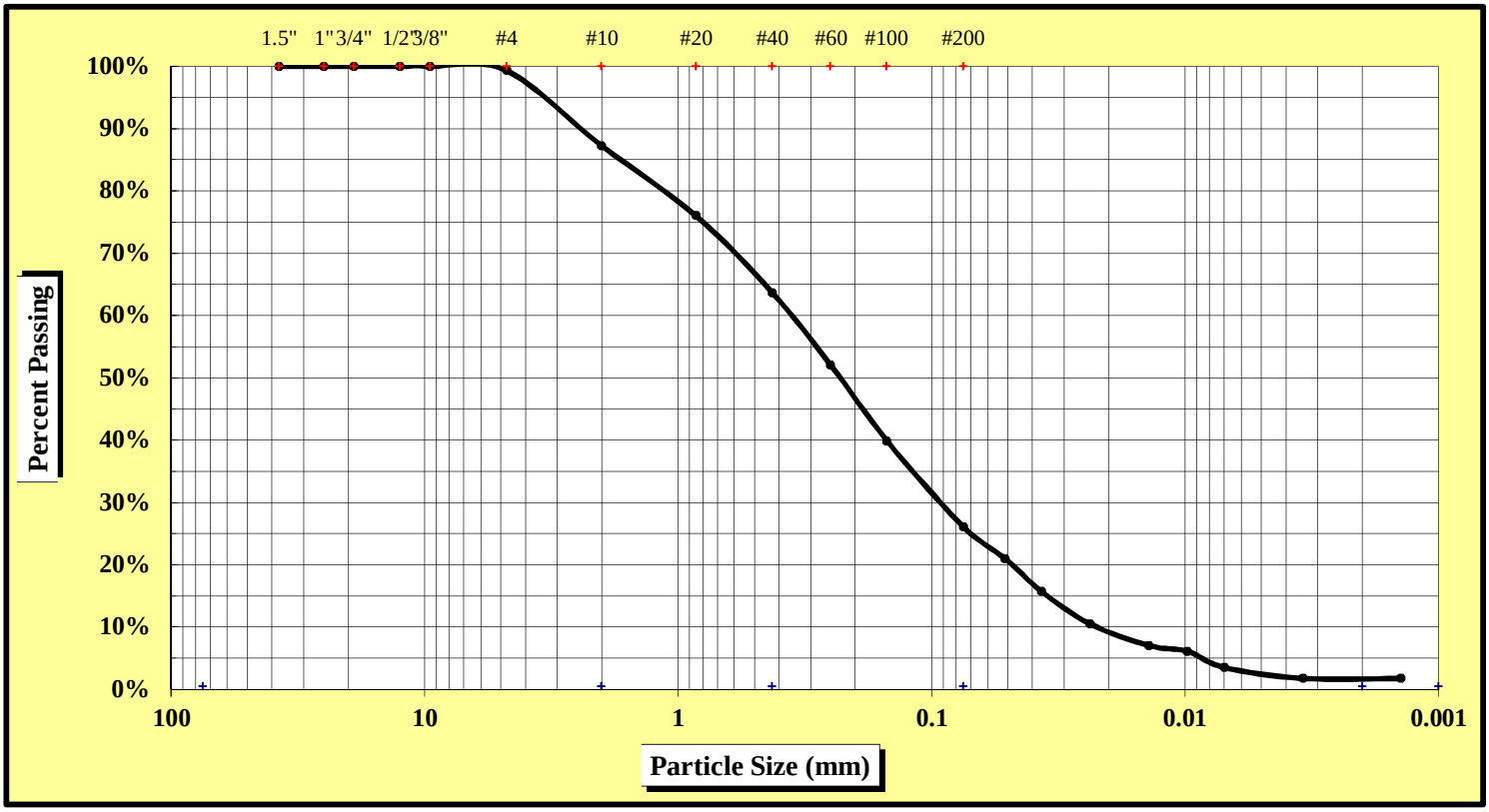
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-1	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Springfield Pkwy 12+98	Offset: 23' RT	Depth: 1.4-2.9'
Sample Description:	White Gray Silty Coarse to Fine Sand (SM)		A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	12.8%	Coarse Sand	23.6%	Silt	24%
Maximum Particle Size	#4	Fine Sand	37.5%	Clay	2%
Apparent Relative Density(Assumed)	2.650	Moisture Content	1.5%	Silt & Clay (% Passing #200)	26.1%
Liquid Limit	0	Plastic Limit	0	Plastic Index	0

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

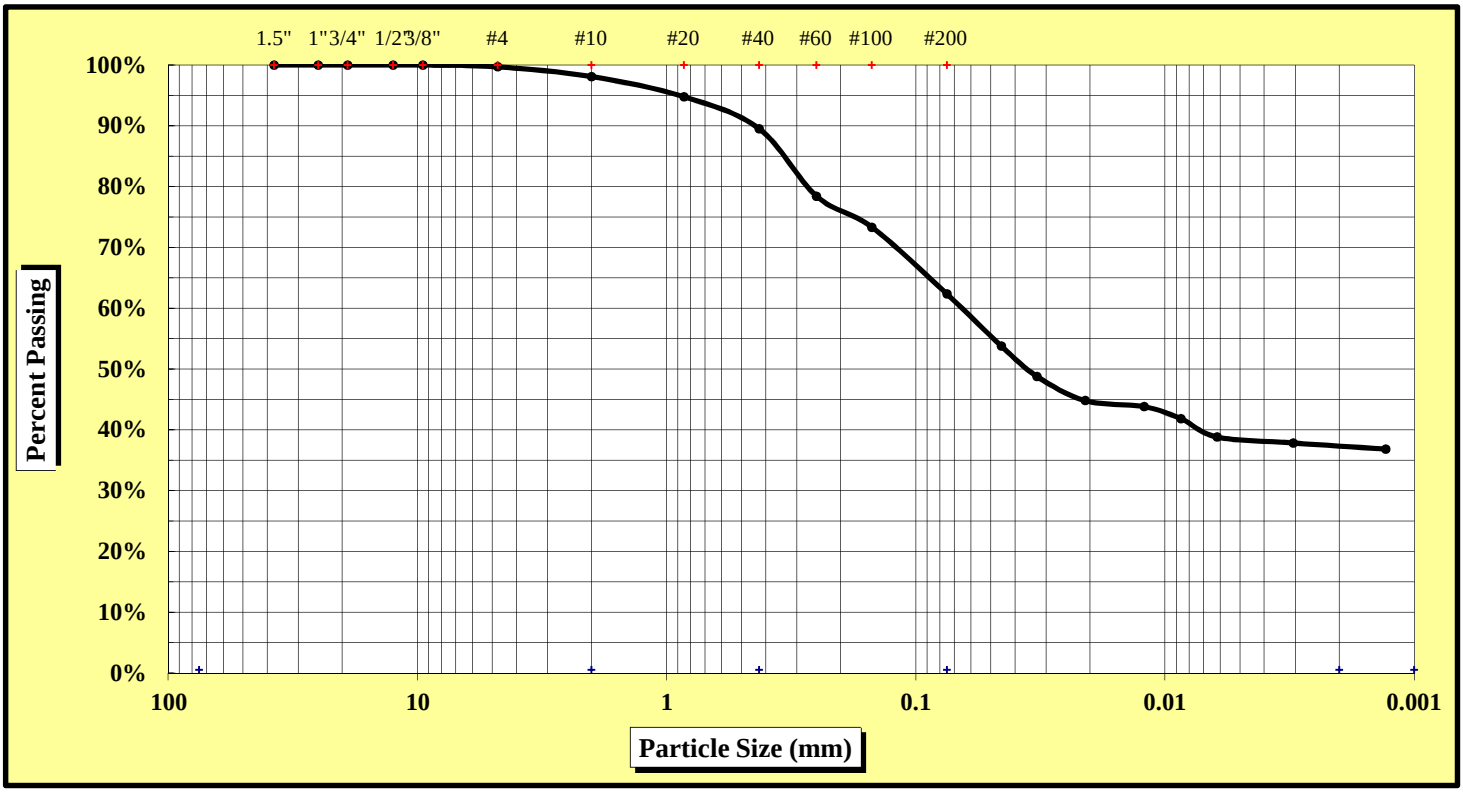
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-2	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Springfield Pkwy 18+10	Offset: 26' RT	Depth: 0.5-2.0'
Sample Description:	Brown Coarse to Fine Sandy Silty Clay (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.9%	Coarse Sand	8.6%	Silt	25%
Maximum Particle Size	#4	Fine Sand	27.2%	Clay	37%
Apparent Relative Density(Assumed)	2.650	Moisture Content	12.3%	Silt & Clay (% Passing #200)	62.3%
Liquid Limit	49	Plastic Limit	16	Plastic Index	33

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

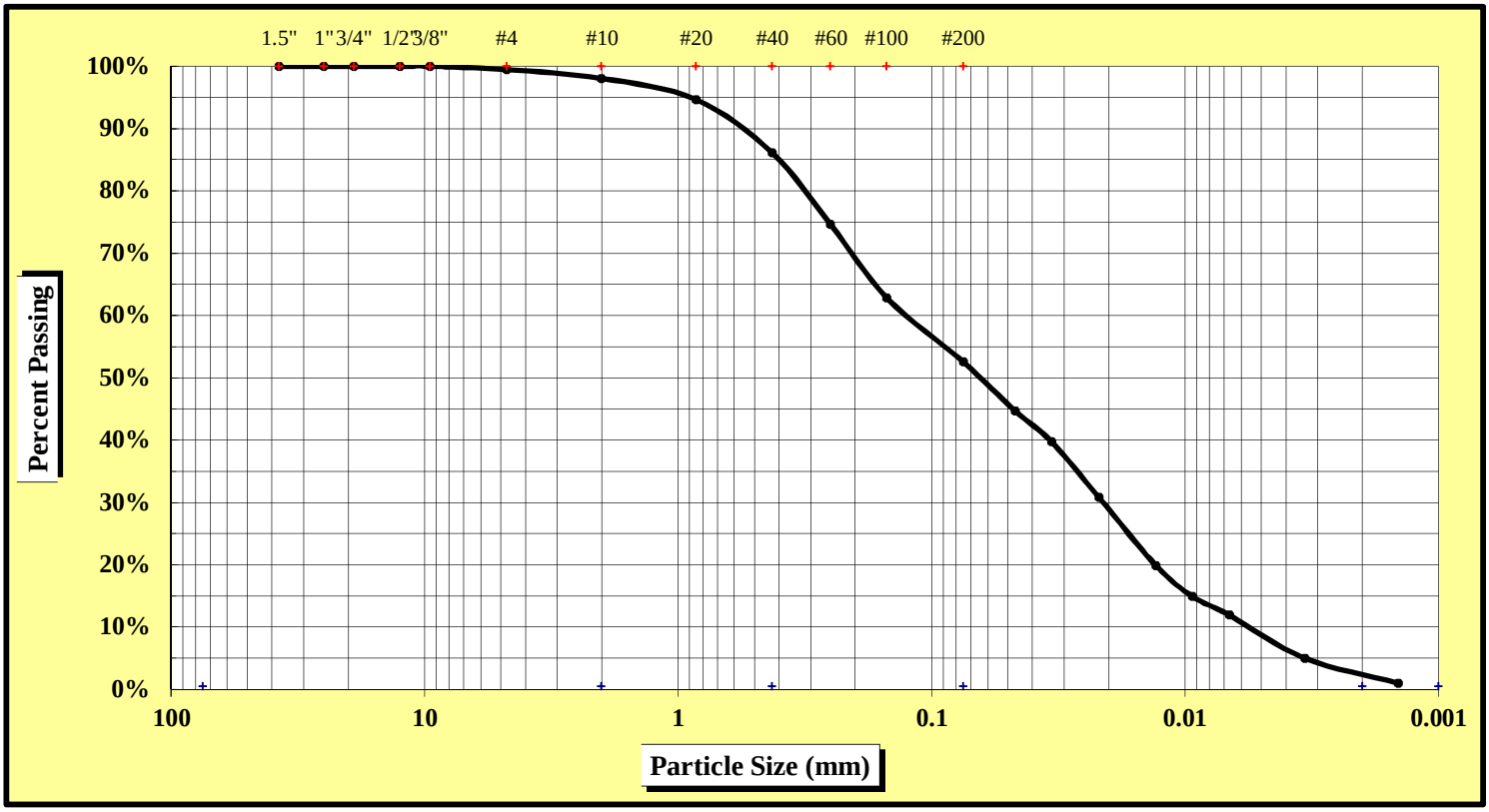
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: C-3	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: Mercantile 11+03	Offset: 14' LT	Depth: 1.2-2.5'
Sample Description: White Brown Tan Coarse to Fine Sandy Silt (ML)		A-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.0%	Coarse Sand	12.0%	Silt	50%
Maximum Particle Size	#4	Fine Sand	33.5%	Clay	3%
Apparent Relative Density(Assumed)	2.650	Moisture Content	17.9%	Silt & Clay (% Passing #200)	52.5%
Liquid Limit	41	Plastic Limit	34	Plastic Index	7

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

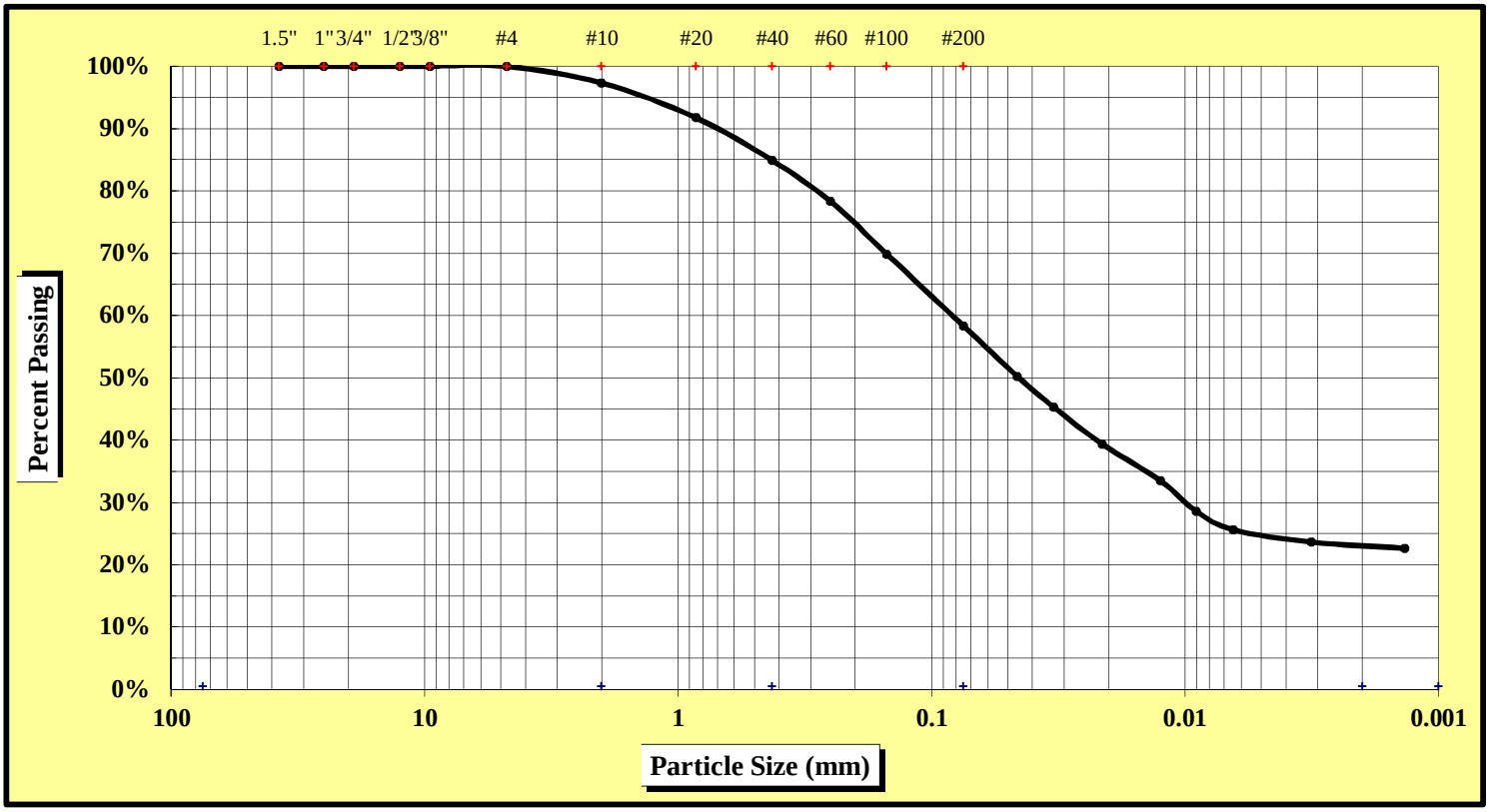
Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #: **1351-12-037 (010)**
Project Name: **SCDOT US 21 to SC 51**
Client Name: STV
Client Address: NA

Report Date: 0
7/17/15

Boring #:	C-4	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Lakeview Rd. 13 +40	Offset: 6' RT	Depth: 1-2.5'
Sample Description:	Orange Brown Coarse to Fine Sandy Silty Clay (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.7%	Coarse Sand	12.4%	Silt	34%
Maximum Particle Size	#10	Fine Sand	26.5%	Clay	24%
Apparent Relative Density(Assumed)	2.650	Moisture Content	20.3%	Silt & Clay (% Passing #200)	58.4%
Liquid Limit	45	Plastic Limit	23	Plastic Index	22

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☒

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

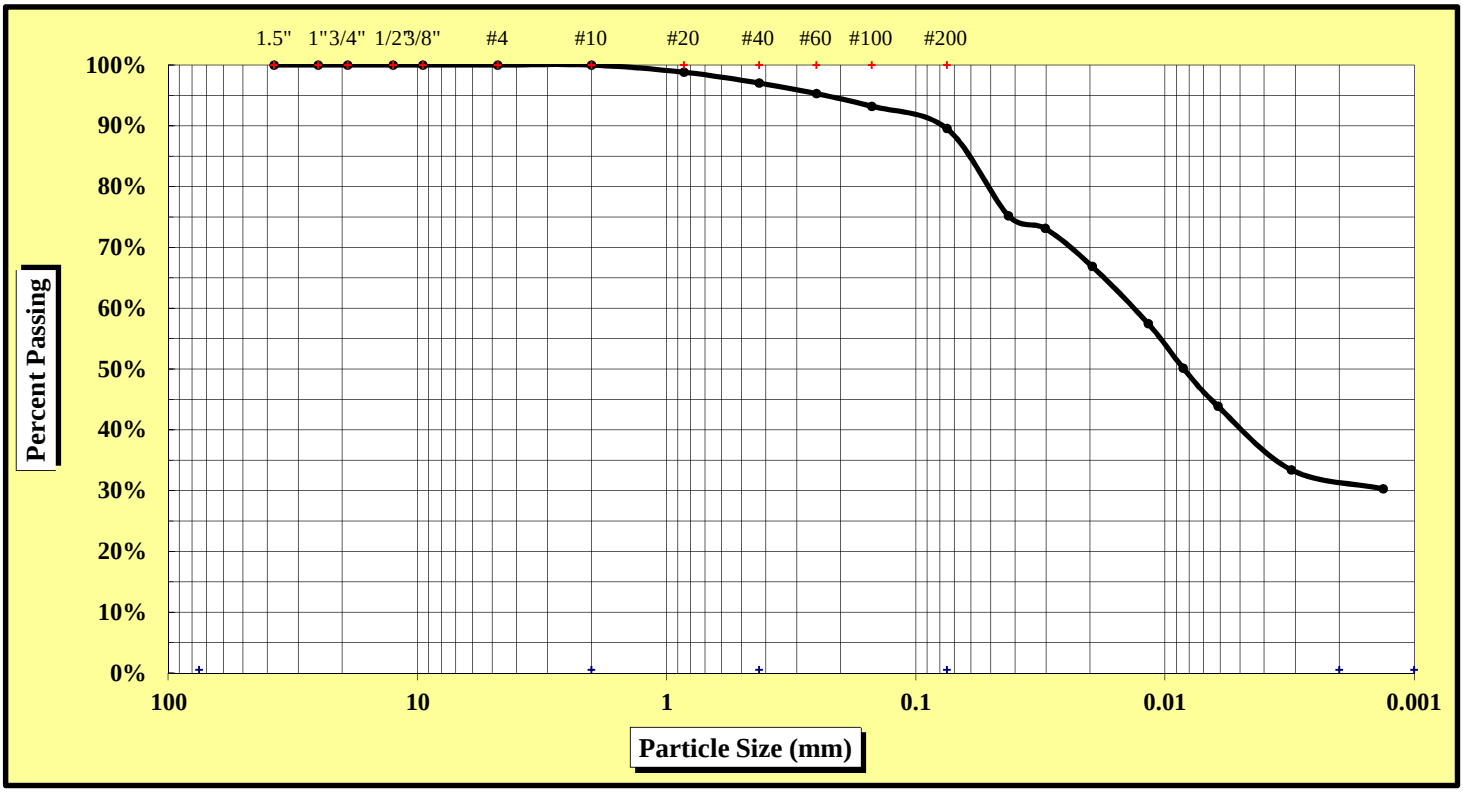
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: C-5	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: Amelea Dr. 11+07	Offset: 7' LT	Depth: 1-2.5'
Sample Description: Gray Brown Tan Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	3.0%	Silt	58%
Maximum Particle Size	#20	Fine Sand	7.5%	Clay	32%
Apparent Relative Density(Assumed)	2.650	Moisture Content	27.3%	Silt & Clay (% Passing #200)	89.5%
Liquid Limit	62	Plastic Limit	36	Plastic Index	26

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

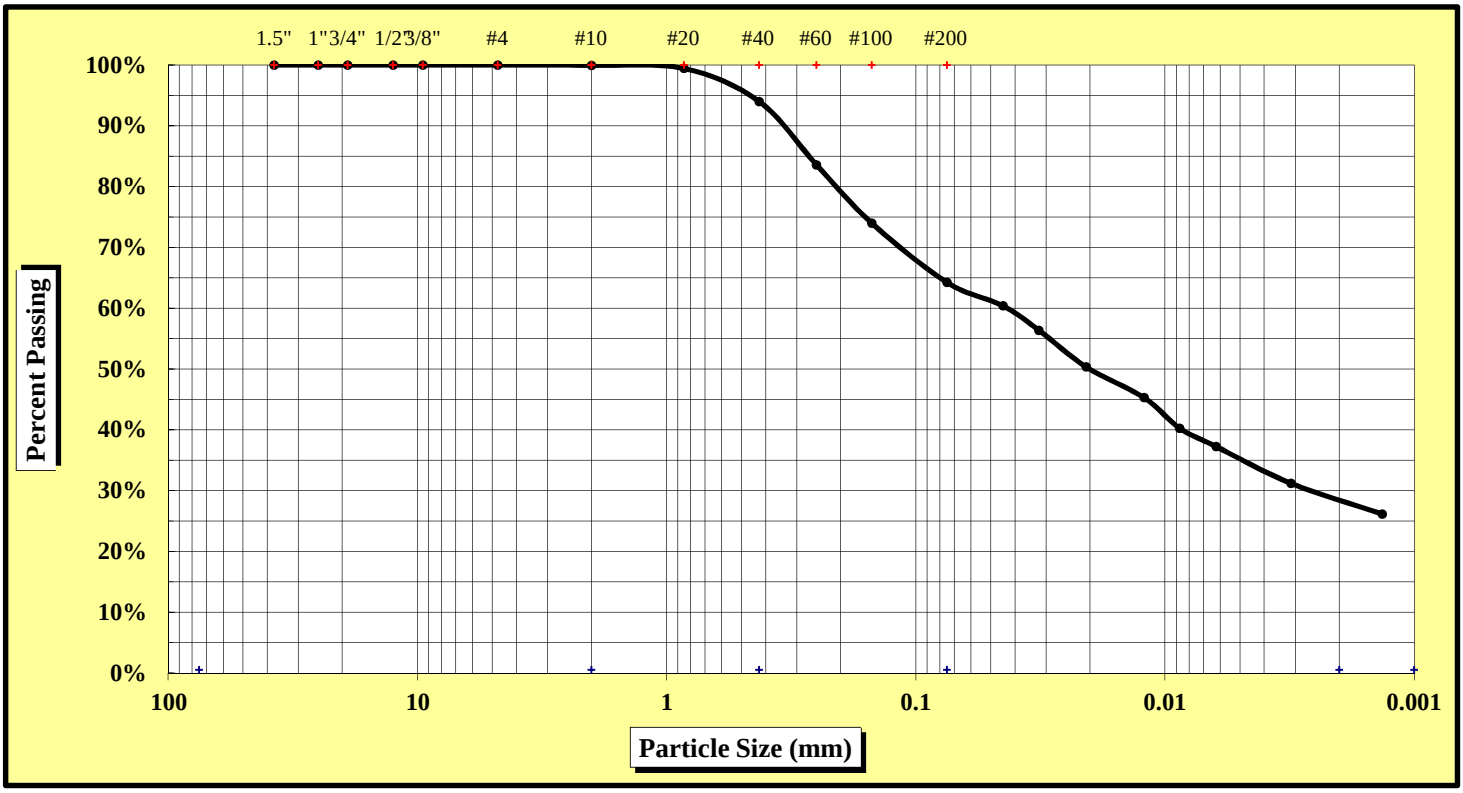
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-6	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Rain Forest Ct 11+52	Offset: 5' LT	Depth: 1-2.5'
Sample Description:	Orange Brown Coarse to Fine Sandy Sity Clay (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.1%	Coarse Sand	5.9%	Silt	35%
Maximum Particle Size	#10	Fine Sand	29.7%	Clay	29%
Apparent Relative Density(Assumed)	2.650	Moisture Content	14.7%	Silt & Clay (% Passing #200)	64.3%
Liquid Limit	41	Plastic Limit	21	Plastic Index	20

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

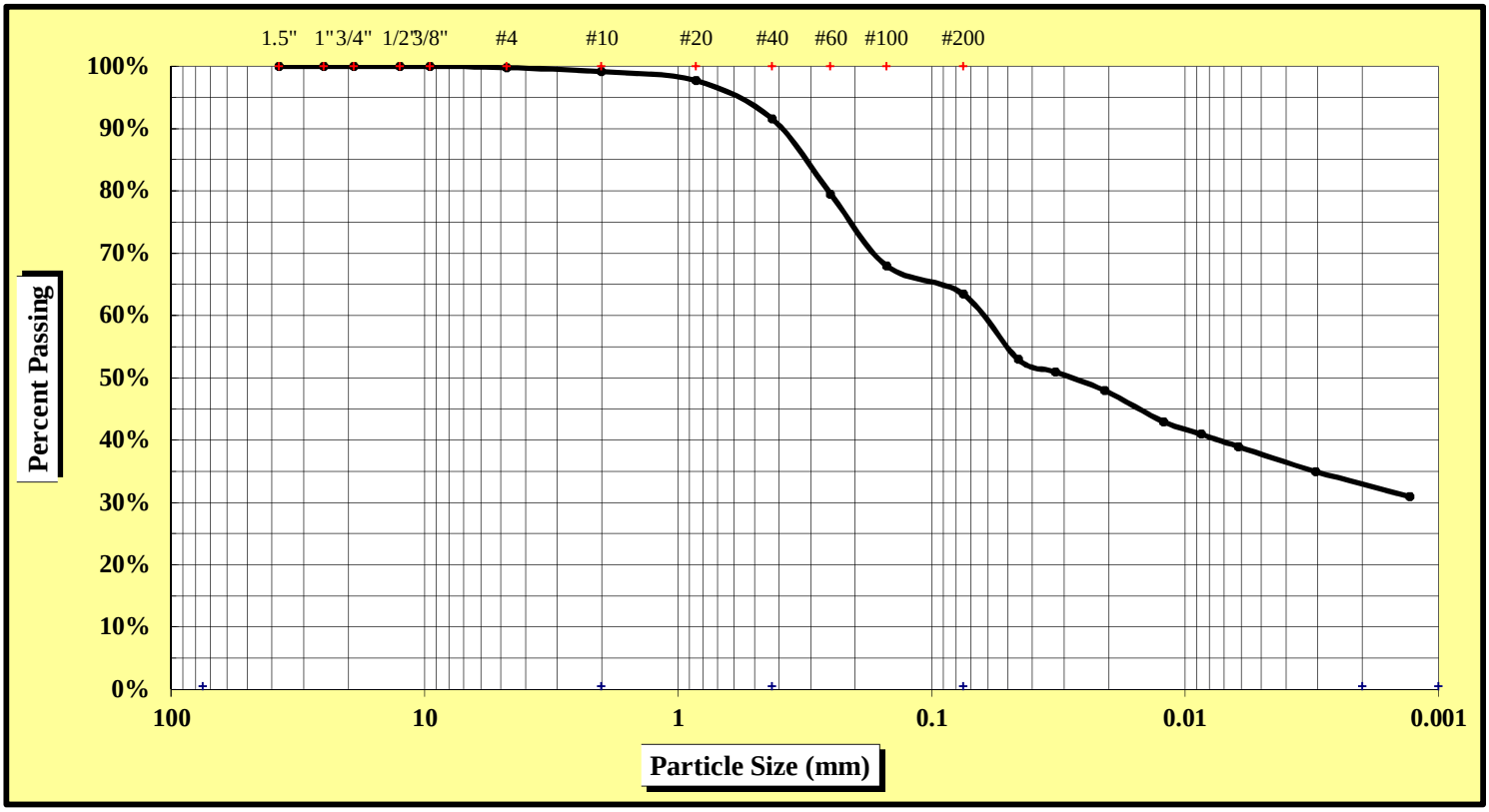
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-7	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Lakeshore Dr. 12+54	Offset: 5' RT	Depth: 1-2.5'
Sample Description:	Reddish Orange Brown Coarse to Fine Sandy Silty Clay (CL)		A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.9%	Coarse Sand	7.6%	Silt	30%
Maximum Particle Size	#4	Fine Sand	28.1%	Clay	34%
Apparent Relative Density(Assumed)	2.650	Moisture Content	5.7%	Silt & Clay (% Passing #200)	63.4%
Liquid Limit	36	Plastic Limit	17	Plastic Index	19

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

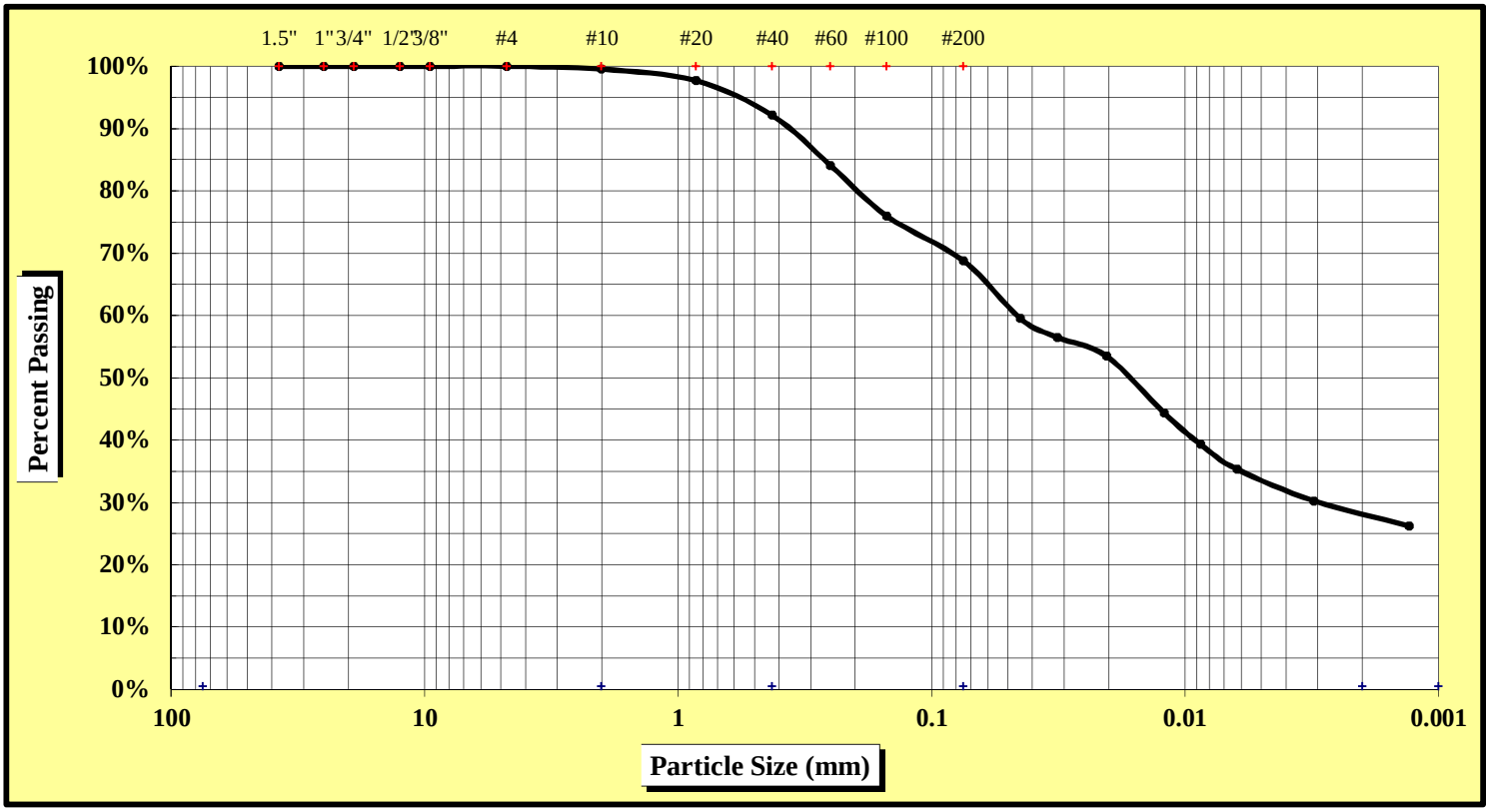
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-8	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Embassy Dr. 10+89	Offset: 3' LT	Depth: 1.5-3.0'
Sample Description:	Orange Brown Coarse to Fine Sndy Silty Clay (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.5%	Coarse Sand	7.4%	Silt	41%
Maximum Particle Size	#10	Fine Sand	23.3%	Clay	28%
Apparent Relative Density(Assumed)	2.650	Moisture Content	26.4%	Silt & Clay (% Passing #200)	68.8%
Liquid Limit	49	Plastic Limit	27	Plastic Index	22

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

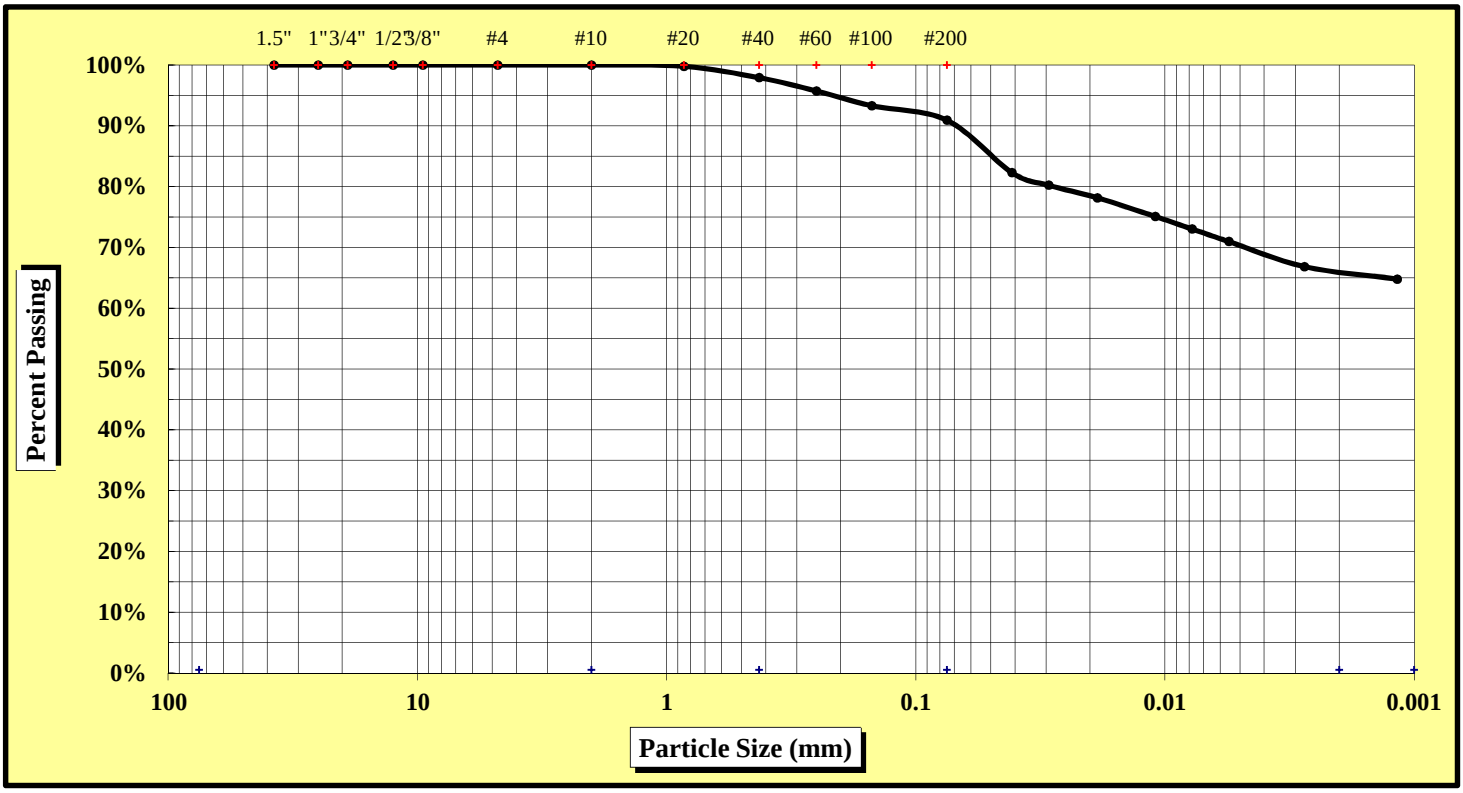
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-9	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Old Nation Rd. 15+10	Offset: 5' RT	Depth: 1.3-2.8'
Sample Description:	Orange Tan Clay (CH)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	2.1%	Silt	25%
Maximum Particle Size	#20	Fine Sand	7.0%	Clay	66%
Apparent Relative Density(Assumed)	2.650	Moisture Content	35.1%	Silt & Clay (% Passing #200)	90.9%
Liquid Limit	83	Plastic Limit	27	Plastic Index	56

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

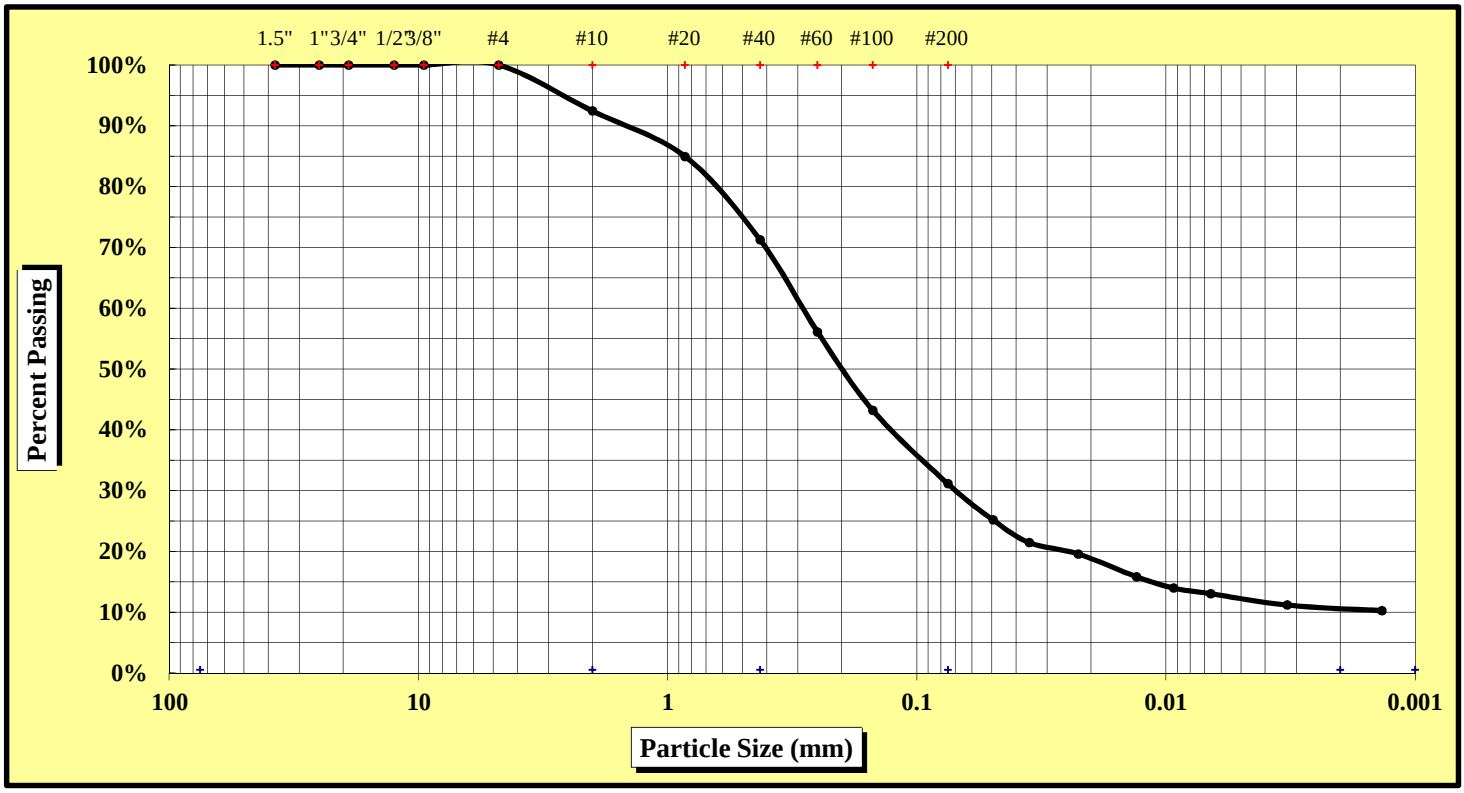
S&ME Project #: **1351-12-037 (010)** Report Date: 7/17/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-10	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Old Nation Rd. 17+26	Offset: 3' RT	Depth: 1-2.5'
Sample Description:	Blackish Brown Clayey Coarse to Fine Sand (SC)		A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	7.6%	Coarse Sand	21.2%	Silt	21%
Maximum Particle Size	#10	Fine Sand	40.1%	Clay	11%
Apparent Relative Density(Assumed)	2.650	Moisture Content	15.0%	Silt & Clay (% Passing #200)	31.1%
Liquid Limit	28	Plastic Limit	18	Plastic Index	10

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

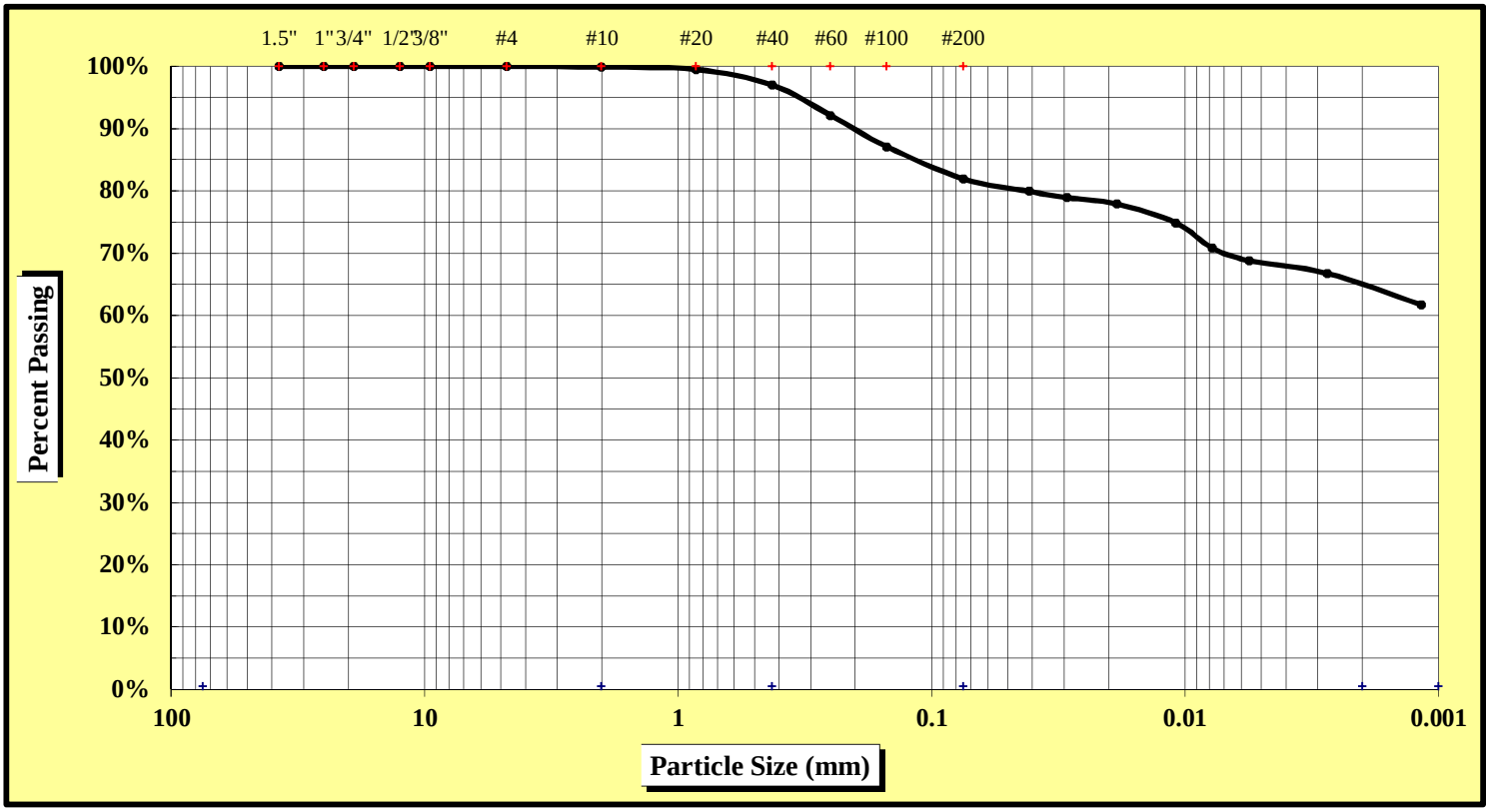
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: C-12	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: Baxter Ln 12+02	Offset: 1' LT	Depth: .5-2.0'
Sample Description: Red Brown Clay w/Coarse to Fine Sand (CH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.1%	Coarse Sand	2.9%	Silt	17%
Maximum Particle Size	#10	Fine Sand	15.1%	Clay	65%
Apparent Relative Density(Assumed)	2.650	Moisture Content	18.1%	Silt & Clay (% Passing #200)	81.9%
Liquid Limit	75	Plastic Limit	31	Plastic Index	44

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

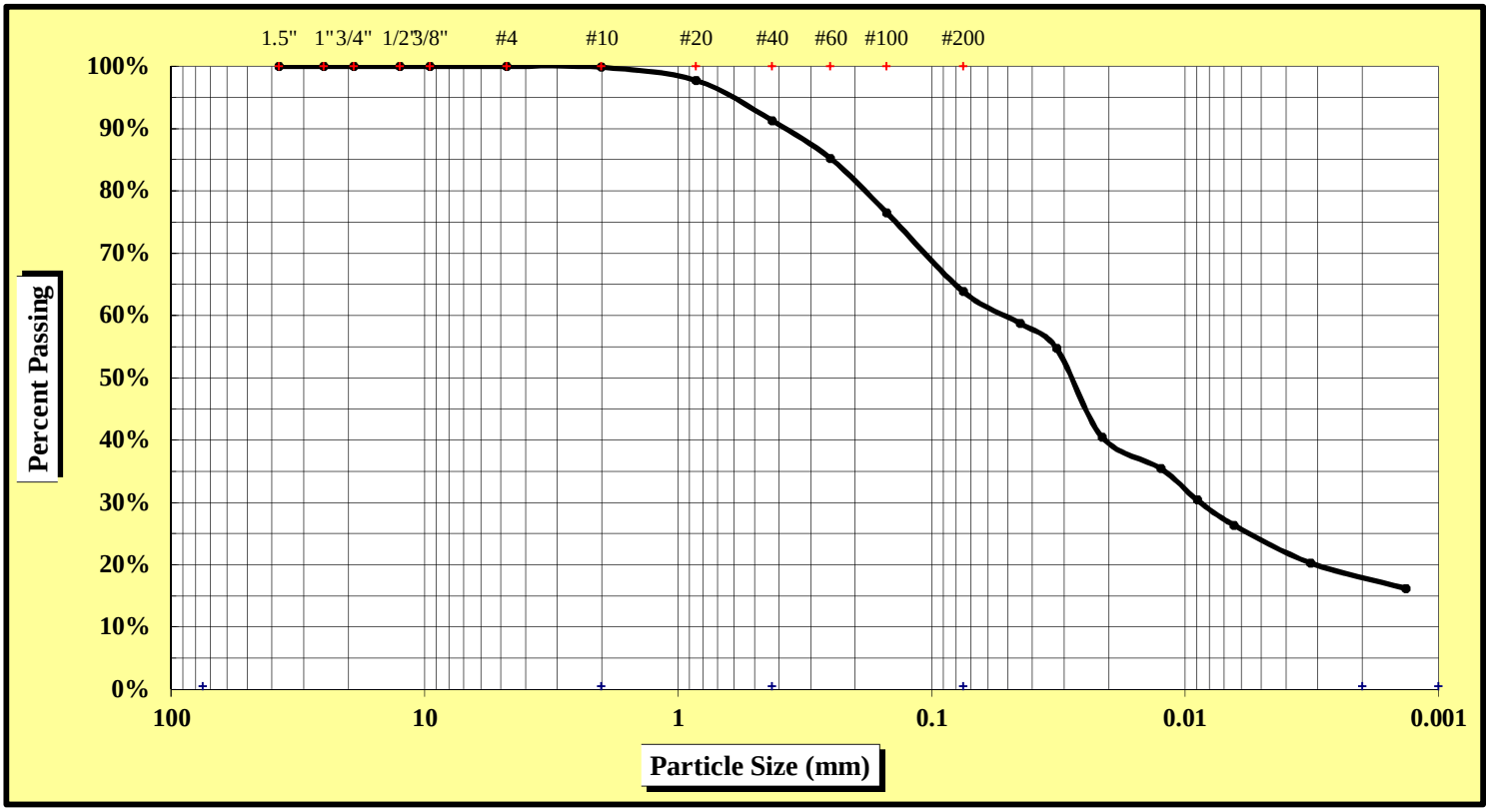
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-13	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Central Carolinas Pkwy	Offset: 8' RT	Depth: 1-2.5'
Sample Description:	Orange Brown Coarse to Fine Sandy Silt (ML) w/Mica		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.2%	Coarse Sand	8.6%	Silt	46%
Maximum Particle Size	#10	Fine Sand	27.4%	Clay	18%
Apparent Relative Density(Assumed)	2.650	Moisture Content	22.7%	Silt & Clay (% Passing #200)	63.8%
Liquid Limit	49	Plastic Limit	37	Plastic Index	12

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

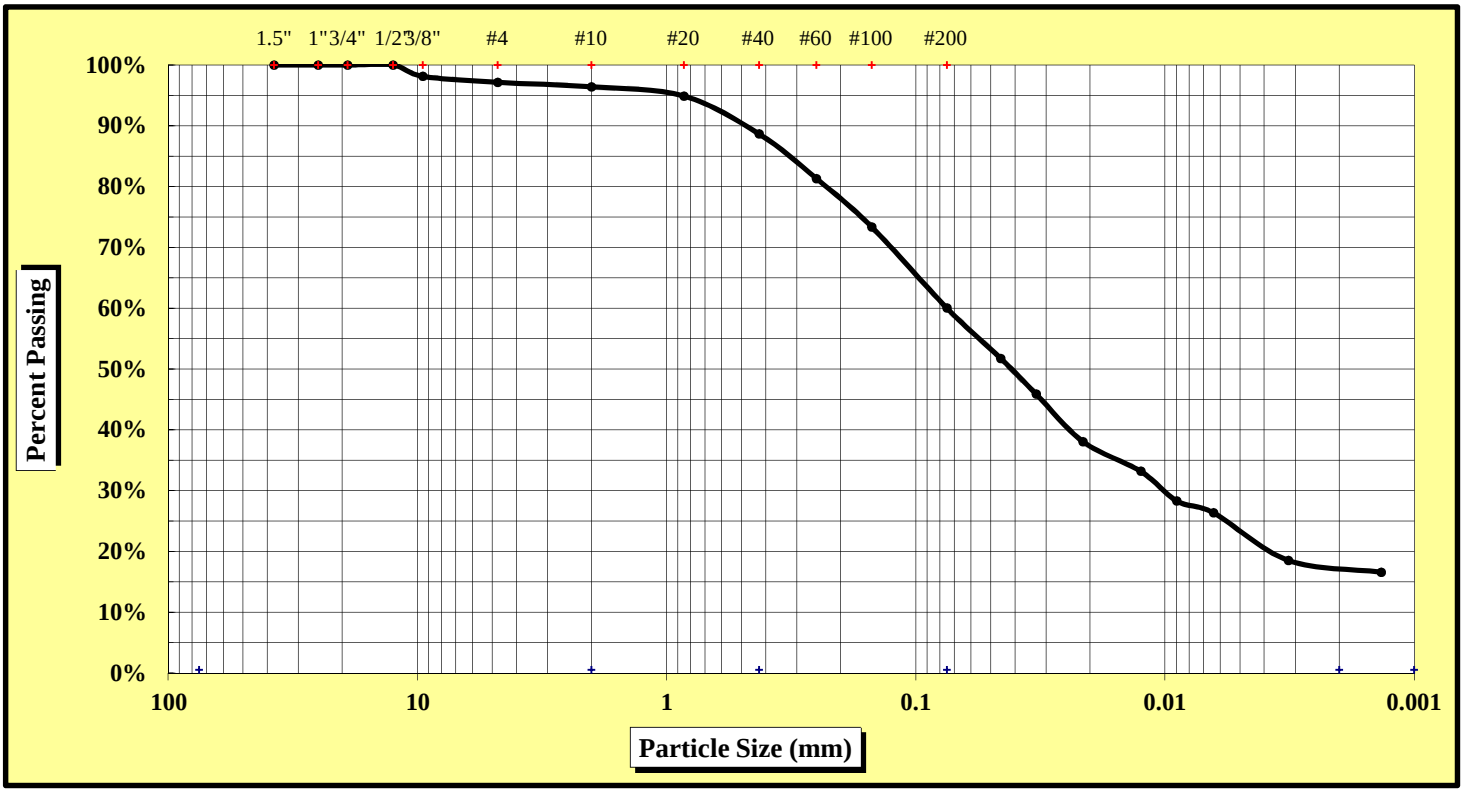
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	C-14	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	Regent Dr. 11+62	Offset:	13' LT	Depth:	1-2.5'
Sample Description:	Orange Brown Coarse to Fine Sandy Silt (ML)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	3.6%	Coarse Sand	7.8%	Silt	43%
Maximum Particle Size	3/8"	Fine Sand	28.6%	Clay	17%
Specific Gravity (Assumed)	2.650	Moisture Content	16.2%	Silt & Clay (% Passing #200)	60.0%
Liquid Limit	37	Plastic Limit	25	Plastic Index	12

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

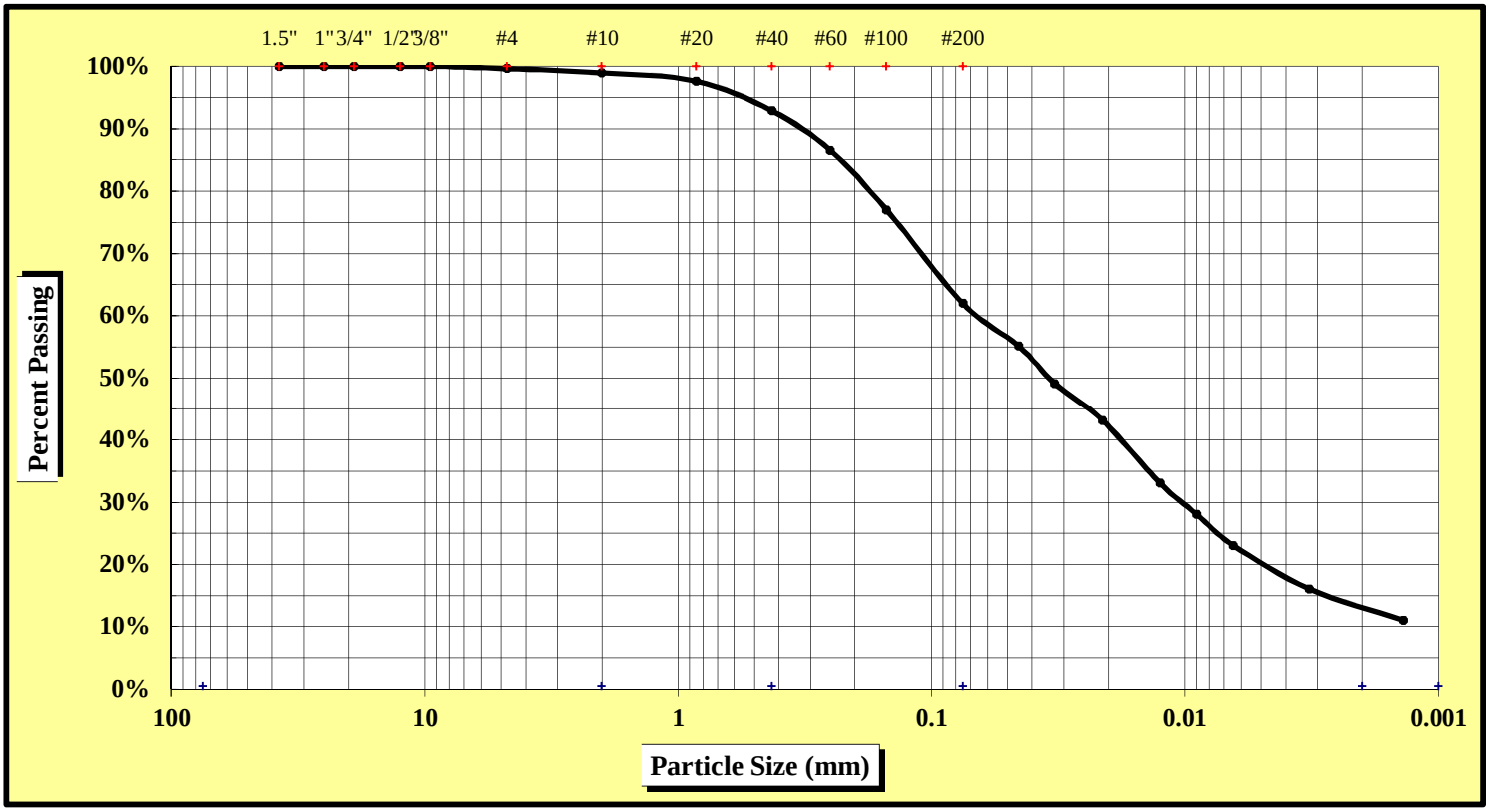
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: C-14	Sample #: SS-4	Sample Date: 2014/2015
Route-Station: Regent Dr 11+62	Offset: 13' LT	Depth: 6.5-8.0'
Sample Description: Gray Tan Coarse to Fine Sandy Silt (ML)		A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.0%	Coarse Sand	6.1%	Silt	49%
Maximum Particle Size	#4	Fine Sand	30.9%	Clay	13%
Apparent Relative Density(Assumed)	2.650	Moisture Content	11.4%	Silt & Clay (% Passing #200)	62.0%
Liquid Limit	37	Plastic Limit	28	Plastic Index	9

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

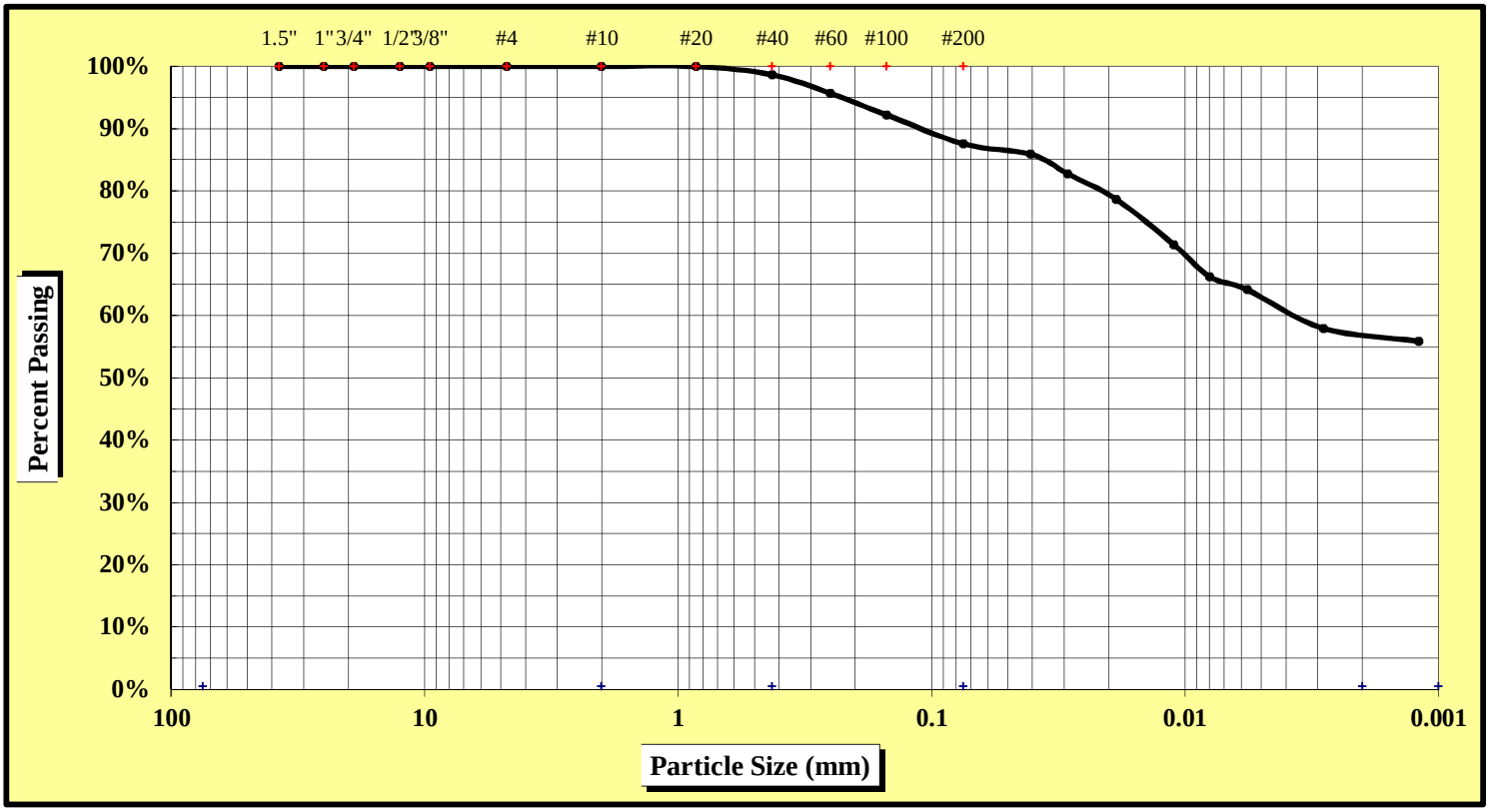
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: C-15	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: Regent Pkwy 12+20	Offset: 15' RT	Depth: 1-2.5'
Sample Description: Orange Brown Clay (CH) w/Mica		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	1.4%	Silt	31%
Maximum Particle Size	#40	Fine Sand	11.1%	Clay	57%
Apparent Relative Density(Assumed)	2.650	Moisture Content	32.1%	Silt & Clay (% Passing #200)	87.5%
Liquid Limit	85	Plastic Limit	37	Plastic Index	48

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☐ Soft ☒ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

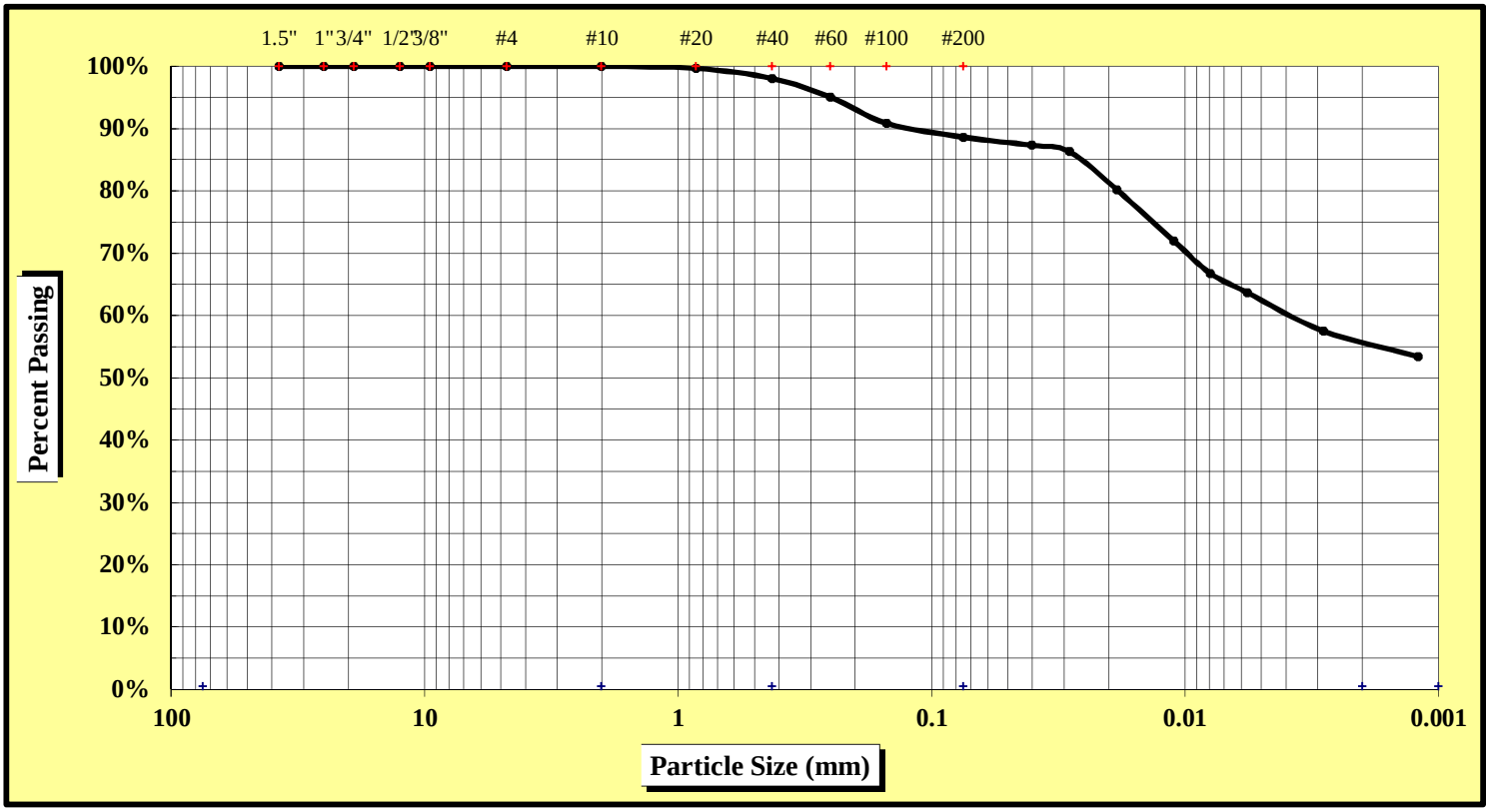
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #: C-16	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: Lakes Blvd 11+64	Offset: 13' LT	Depth: 1-2.5'
Sample Description: Orange Brown Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	2.0%	Silt	33%
Maximum Particle Size	#20	Fine Sand	9.4%	Clay	56%
Apparent Relative Density(Assumed)	2.650	Moisture Content	24.6%	Silt & Clay (% Passing #200)	88.6%
Liquid Limit	71	Plastic Limit	43	Plastic Index	28

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

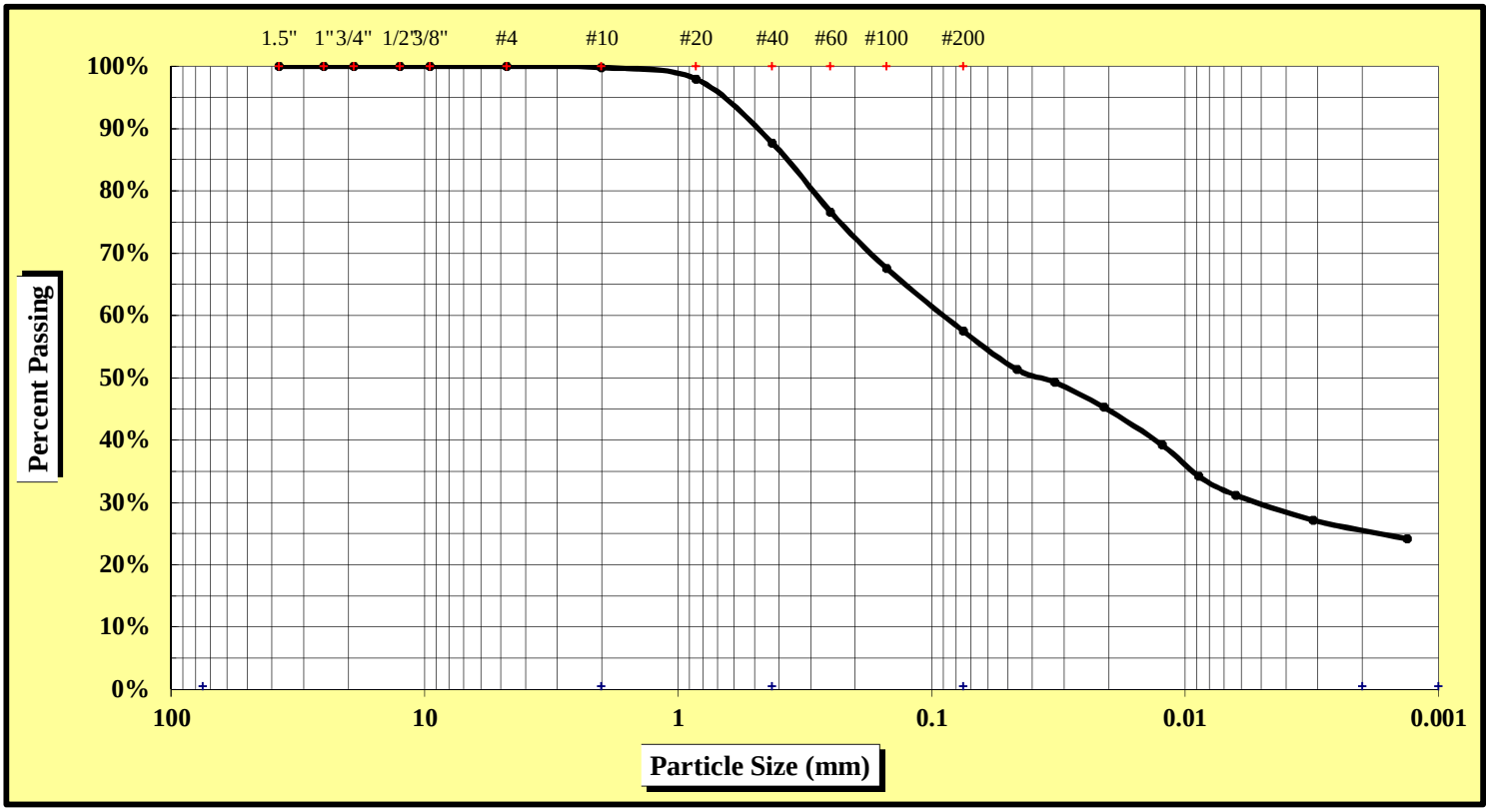
S&ME Project #: **1351-12-037 (010)** Report Date: 7/20/15

Project Name: **SCDOT US 21 to SC 51**

Client Name: STV

Client Address: NA

Boring #:	C-17	Sample #: SS-1	Sample Date: 2014/2015
Route-Station:	Flint Hill Rd 12+01	Offset: 7' LT	Depth: 1.5-3.0'
Sample Description:	Orangish Brown Coarse to Fine Sandy Silty Clay (CL)		A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.2%	Coarse Sand	12.1%	Silt	32%
Maximum Particle Size	#4	Fine Sand	30.2%	Clay	26%
Apparent Relative Density(Assumed)	2.650	Moisture Content	11.4%	Silt & Clay (% Passing #200)	57.5%
Liquid Limit	31	Plastic Limit	15	Plastic Index	16

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils

Technical Responsibility: Stewart Laney _____ Project Manager

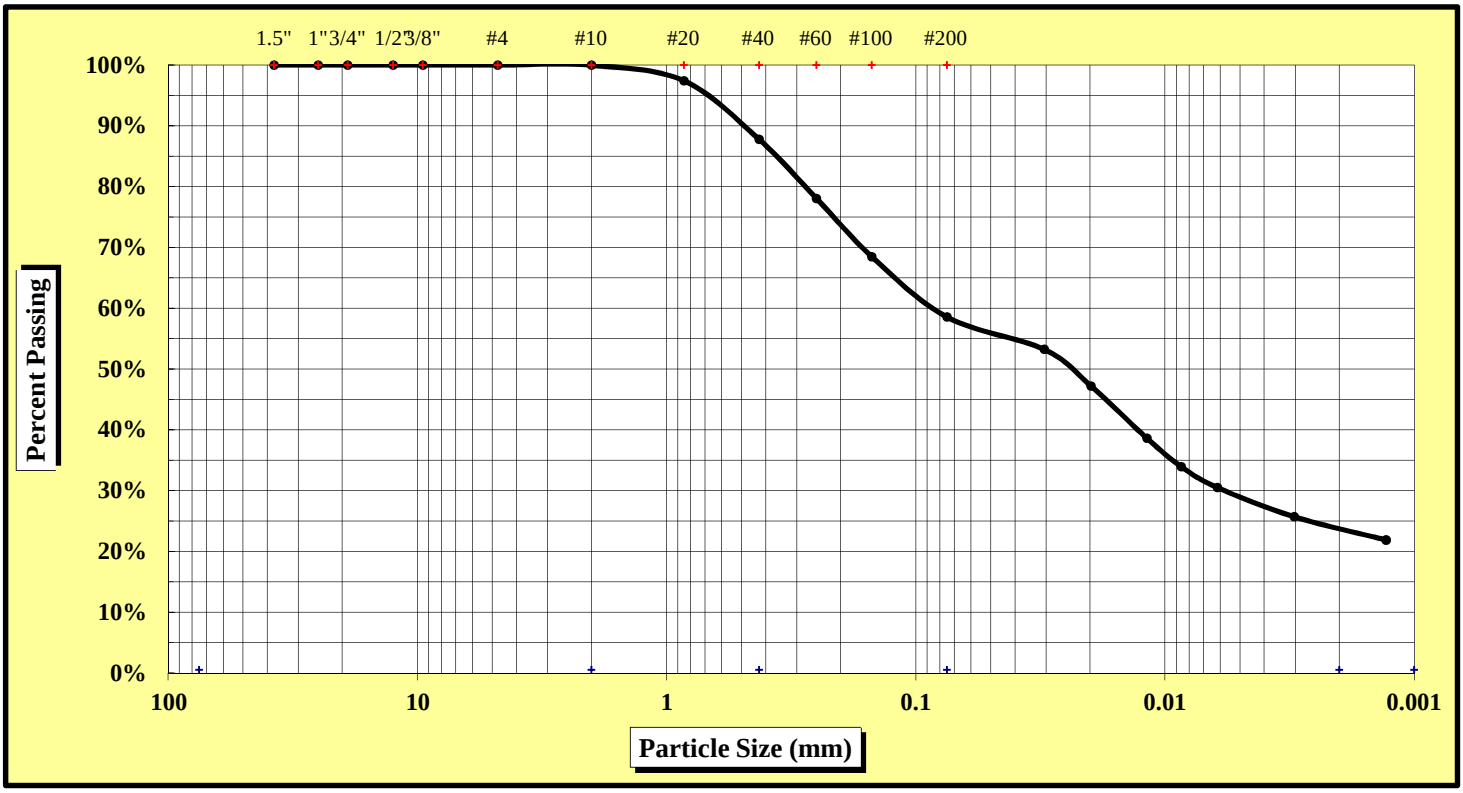
Signature *Signature*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/17/15 - 7/20/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-1	Sample #:	SS-1	Sample Date:	2014/2015
Station-Route	US 21 17+49	Offset:	30' RT	Depth:	0.5 - 2.0 ft
Sample Description:	Red Yellow Coarse to Fine Sandy Clay (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	12.2%	Silt	36%
Maximum Particle Size	No. 10	Fine Sand	29.2%	Clay	23%
Specific Gravity (Assumed)	2.680	Moisture Content	23.1%	Silt & Clay (% Passing #200)	58.6%
Liquid Limit	53	Plastic Limit	28	Plastic Index	25

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

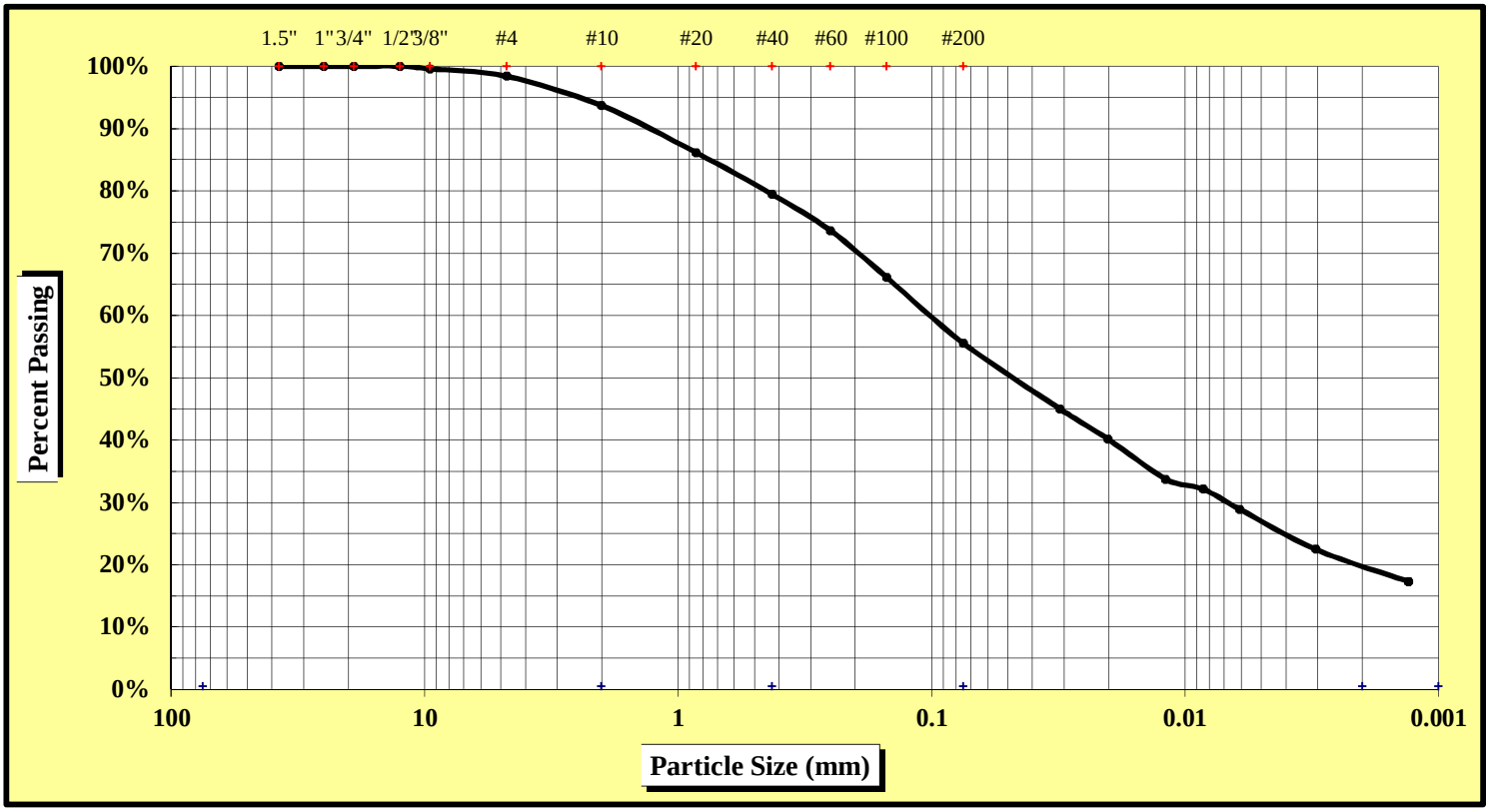
Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #: **1351-12-037 (010)**
Project Name: **SCDOT US 21 to SC 51**
Client Name: STV
Client Address: NA

Report Date: 7/25/15
Test Date(s): 7/17/15 - 7/20/15

Boring #: R-2	Sample #: Bulk	Sample Date: 2014/2015
Station-Route: US 21 23+68	Offset: 29' LT	Depth: 1' - 10'
Sample Description: Brown Coarse to Fine Sandy Silty Clay (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	6.3%	Coarse Sand	14.2%	Silt	36%
Maximum Particle Size	3/8"	Fine Sand	23.9%	Clay	20%
Specific Gravity (Assumed)	2.680	Moisture Content	20.7%	Silt & Clay (% Passing #200)	55.6%
Liquid Limit	49	Plastic Limit	21	Plastic Index	28

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

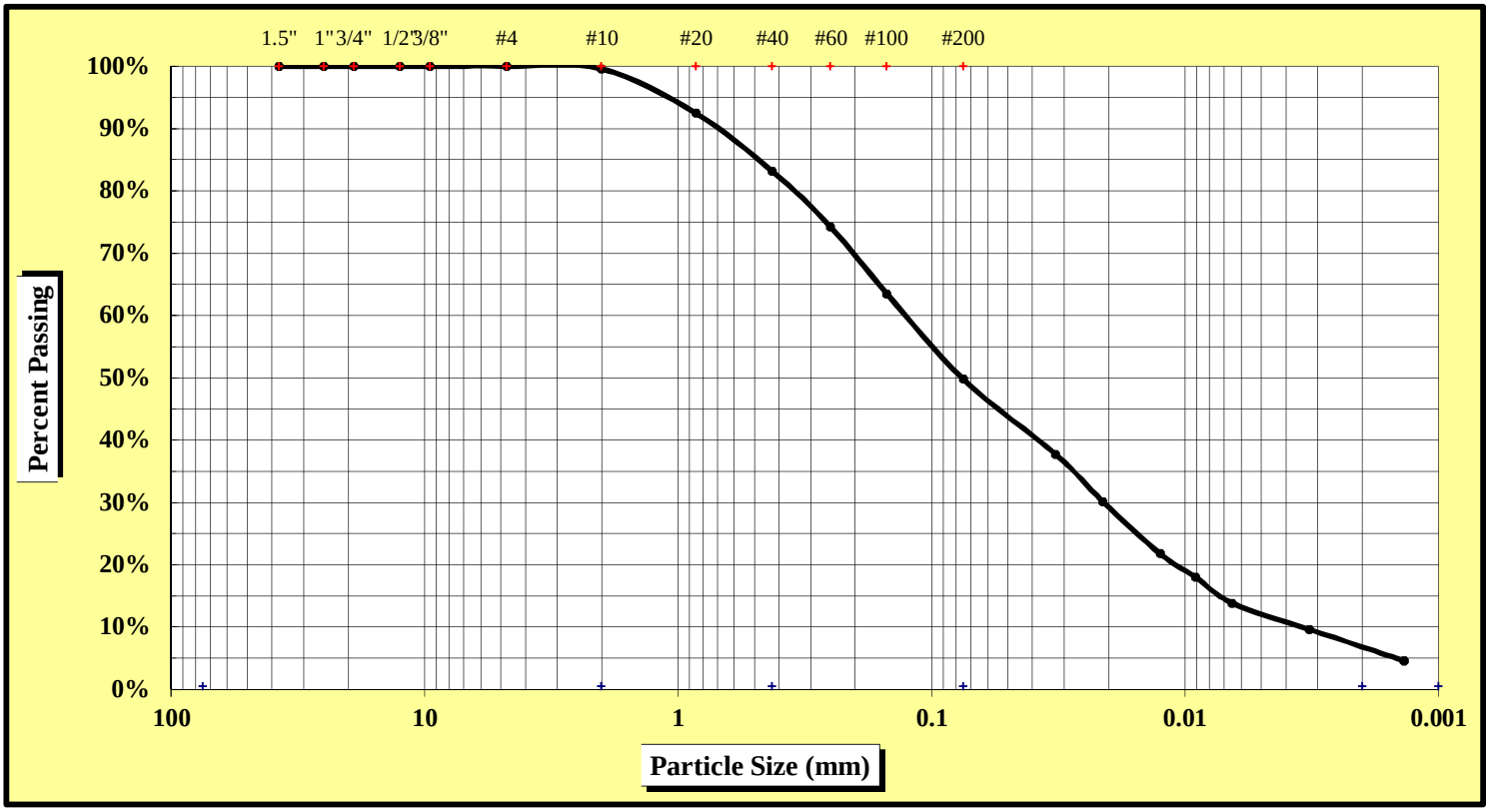
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/17/15 - 7/20/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-3	Sample #: SS-2	Sample Date: 2014/2015
Station-Route:	US 21 23+68	Offset: 29' LT	Depth: 2.5 - 4.0 ft
Sample Description:	Tan White Black Silty Coarse to Fine Sand (SM)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.5%	Coarse Sand	16.4%	Silt	43%
Maximum Particle Size	No. 10	Fine Sand	33.4%	Clay	7%
Specific Gravity (Assumed)	2.680	Moisture Content	20.8%	Silt & Clay (% Passing #200)	49.8%
Liquid Limit	42	Plastic Limit	27	Plastic Index	15

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

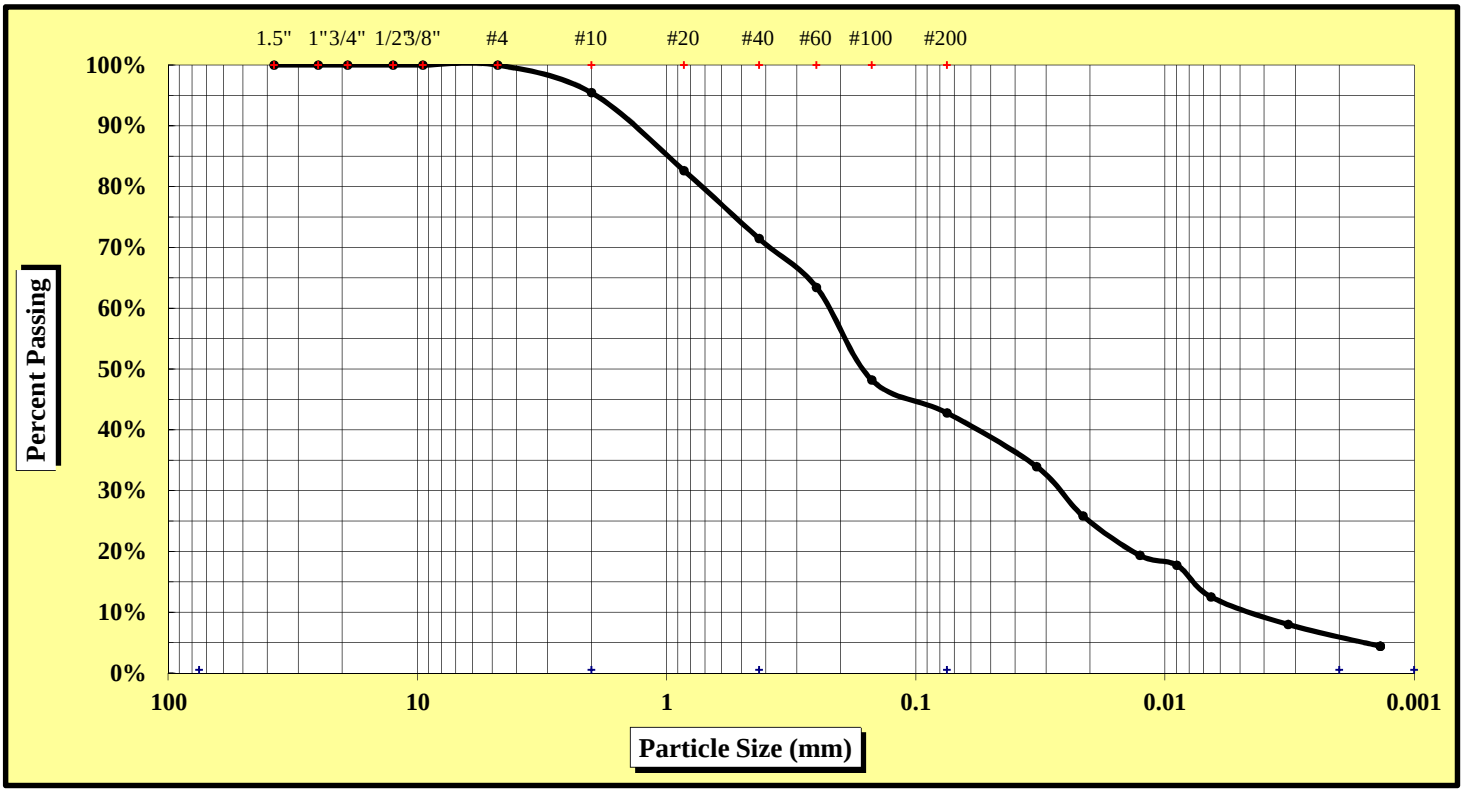
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/17/15 - 7/20/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-3	Sample #:	SS-5	Sample Date:	2014/2015
Station-Route	US 21 28+68	Offset:	29' RT	Depth:	8.5 - 10.0 ft
Sample Description:	Tan White Black Clayey Coarse to Fine Sand (SC)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	4.6%	Coarse Sand	24.0%	Silt	37%
Maximum Particle Size	No. 4	Fine Sand	28.6%	Clay	6%
Specific Gravity (Assumed)	2.680	Moisture Content	19.2%	Silt & Clay (% Passing #200)	42.8%
Liquid Limit	39	Plastic Limit	24	Plastic Index	15

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

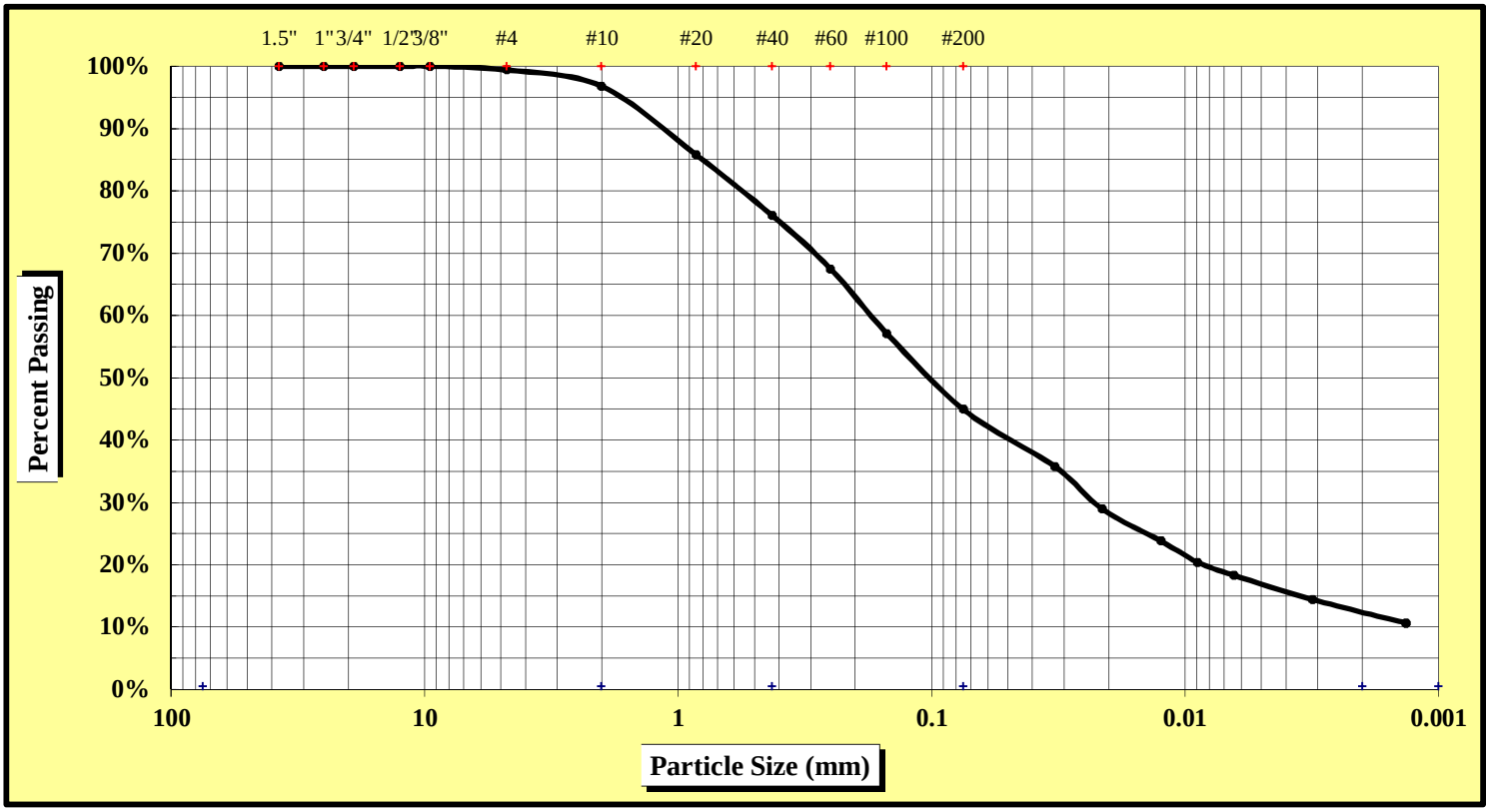
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/17/15 - 7/20/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-5	Sample #: SS-4	Sample Date: 2014/2015
Station-Route	US 21 38+68	Offset: 28' RT	Depth: 6.5 - 8.0 ft
Sample Description:	Red Light Brown Silty Coarse to Fine Sand (SM)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	3.2%	Coarse Sand	20.7%	Silt	32%
Maximum Particle Size	No. 4	Fine Sand	31.1%	Clay	13%
Specific Gravity (Assumed)	2.680	Moisture Content	25.0%	Silt & Clay (% Passing #200)	44.9%
Liquid Limit	44	Plastic Limit	28	Plastic Index	16

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

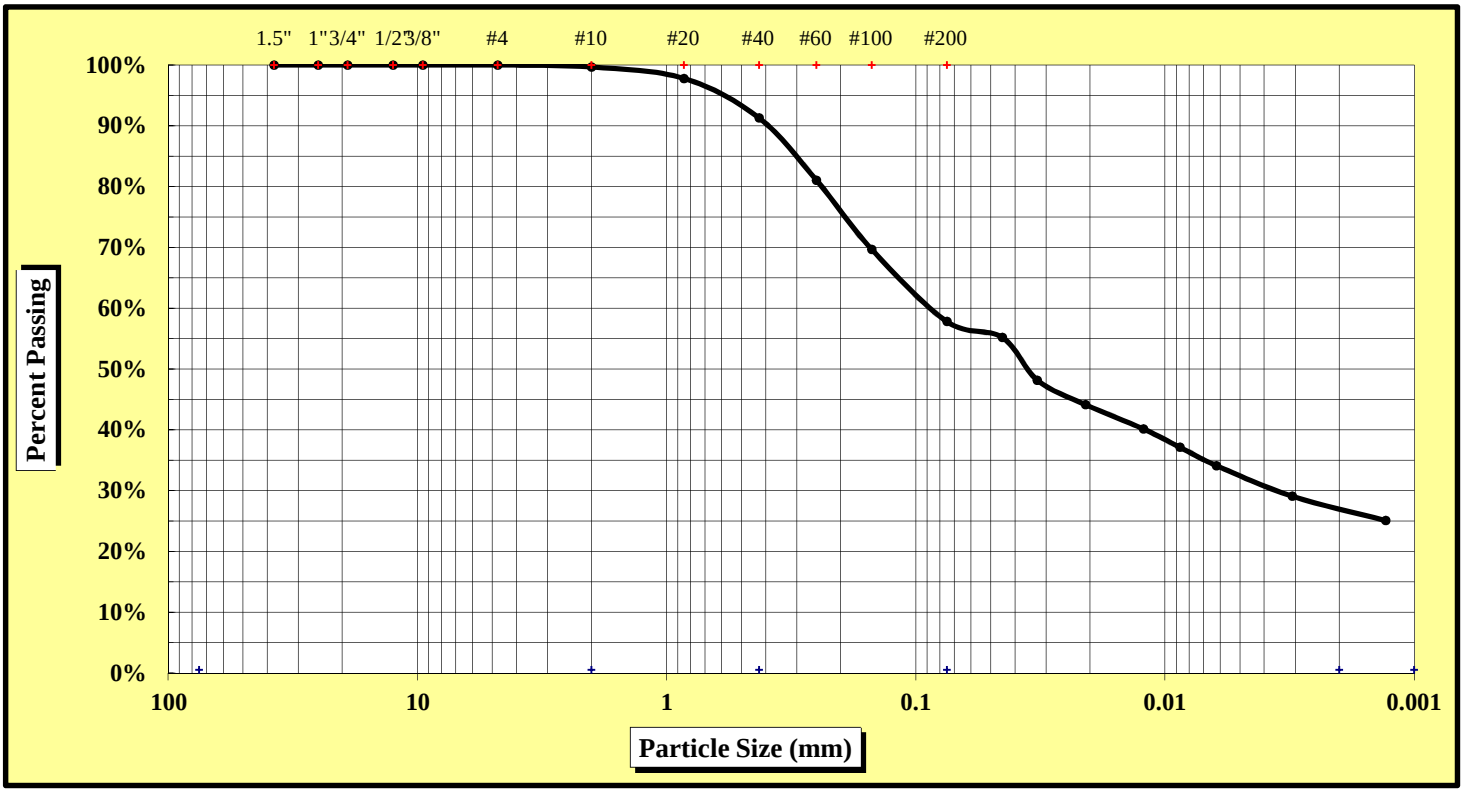
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-5	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	US 21 38+68	Offset:	28' RT	Depth:	8.5-10'
Sample Description:	Reddish Brown Coarse to Fine Sandy Silty Clay (CL)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.3%	Coarse Sand	8.4%	Silt	31%
Maximum Particle Size	#10	Fine Sand	33.5%	Clay	27%
Specific Gravity (Assumed)	2.650	Moisture Content	19.5%	Silt & Clay (% Passing #200)	57.8%
Liquid Limit	41	Plastic Limit	21	Plastic Index	20

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

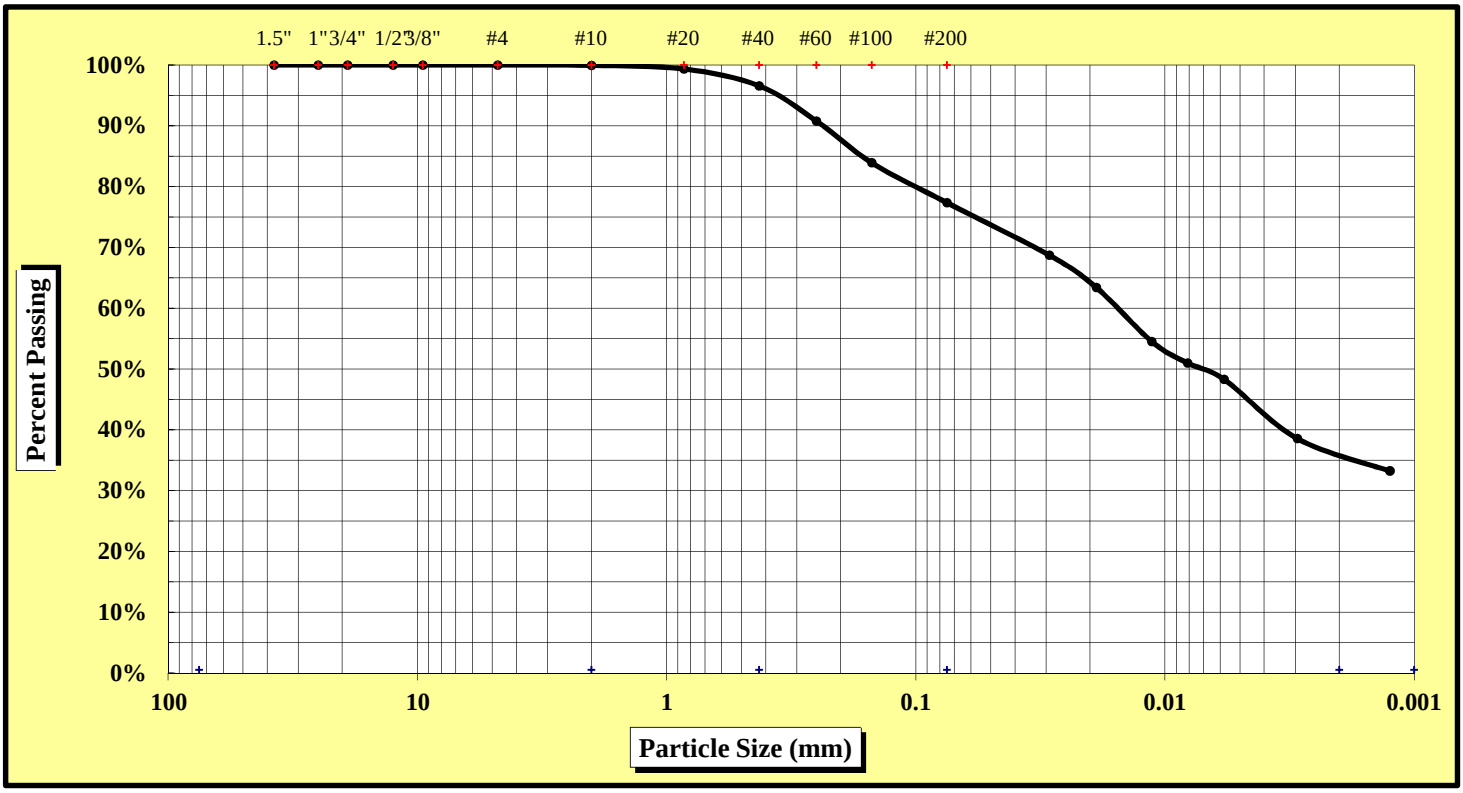
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/22/15 - 7/23/15
Client Name:	STV		
Client Address:	NA		

Boring #: R-6	Sample #: SS-4	Sample Date: 2014/2015
Station-Route: US 21 43+66	Offset: 30' RT	Depth: 6.5 - 8.0 ft
Sample Description: Red Tan Clay w/Coarse to Fine Sand (CH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.1%	Coarse Sand	3.4%	Silt	41%
Maximum Particle Size	No. 20	Fine Sand	19.2%	Clay	36%
Specific Gravity (Assumed)	2.680	Moisture Content	24.2%	Silt & Clay (% Passing #200)	77.4%
Liquid Limit	60	Plastic Limit	30	Plastic Index	30

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

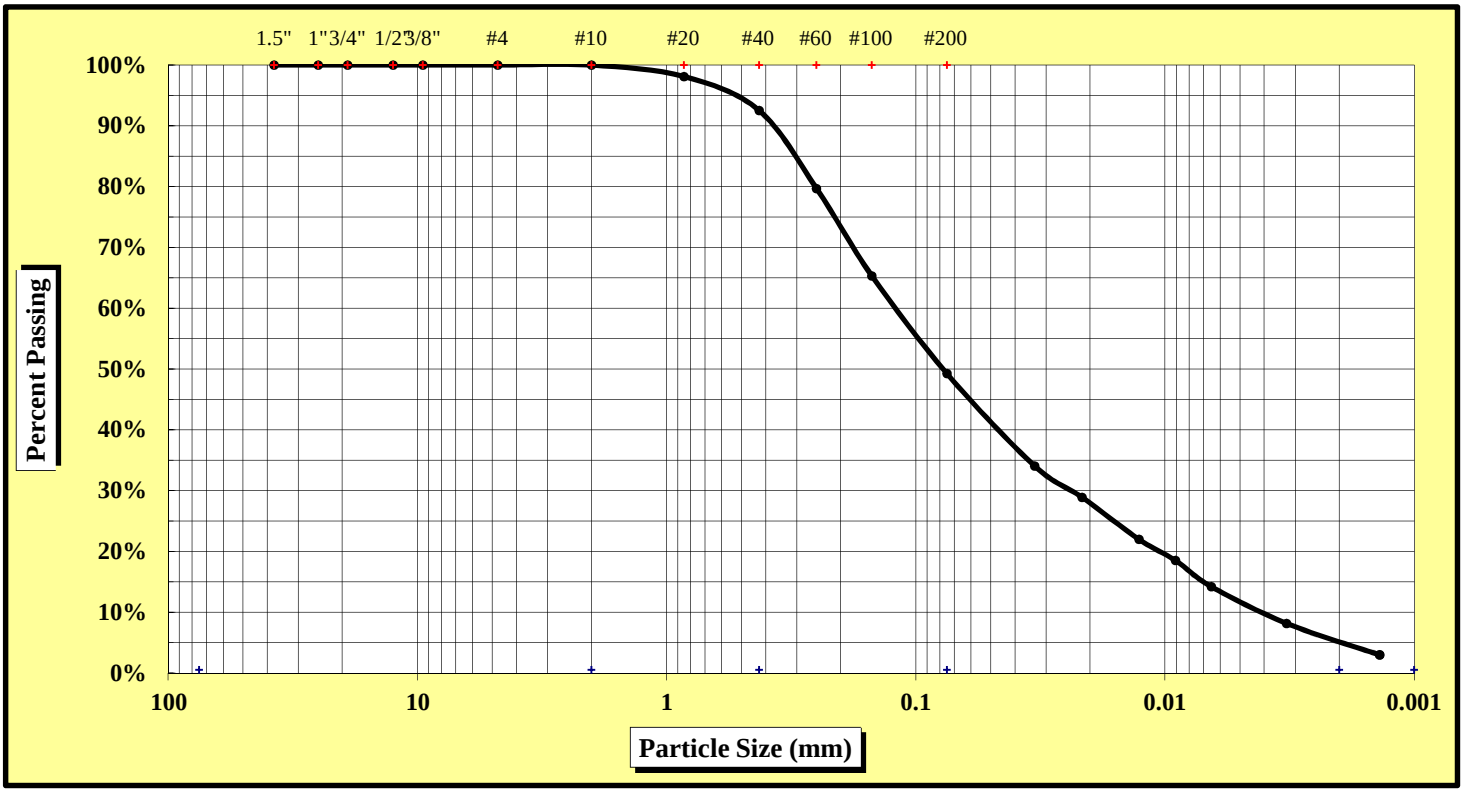
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/22/15 - 7/23/15
Client Name:	STV		
Client Address:			

Boring #: R-7	Sample #: SS-2	Sample Date: 2014/2015
Station-Route: US 21 48+68	Offset: 25' LT	Depth: 2.5 - 4.0 ft
Sample Description: Gray Orangish Brown Silty Coarse to Fine Sand (SM)		A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	7.5%	Silt	44%
Maximum Particle Size	No. 10	Fine Sand	43.3%	Clay	5%
Specific Gravity (Assumed)	2.680	Moisture Content	14.3%	Silt & Clay (% Passing #200)	49.3%
Liquid Limit	32	Plastic Limit	25	Plastic Index	7

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

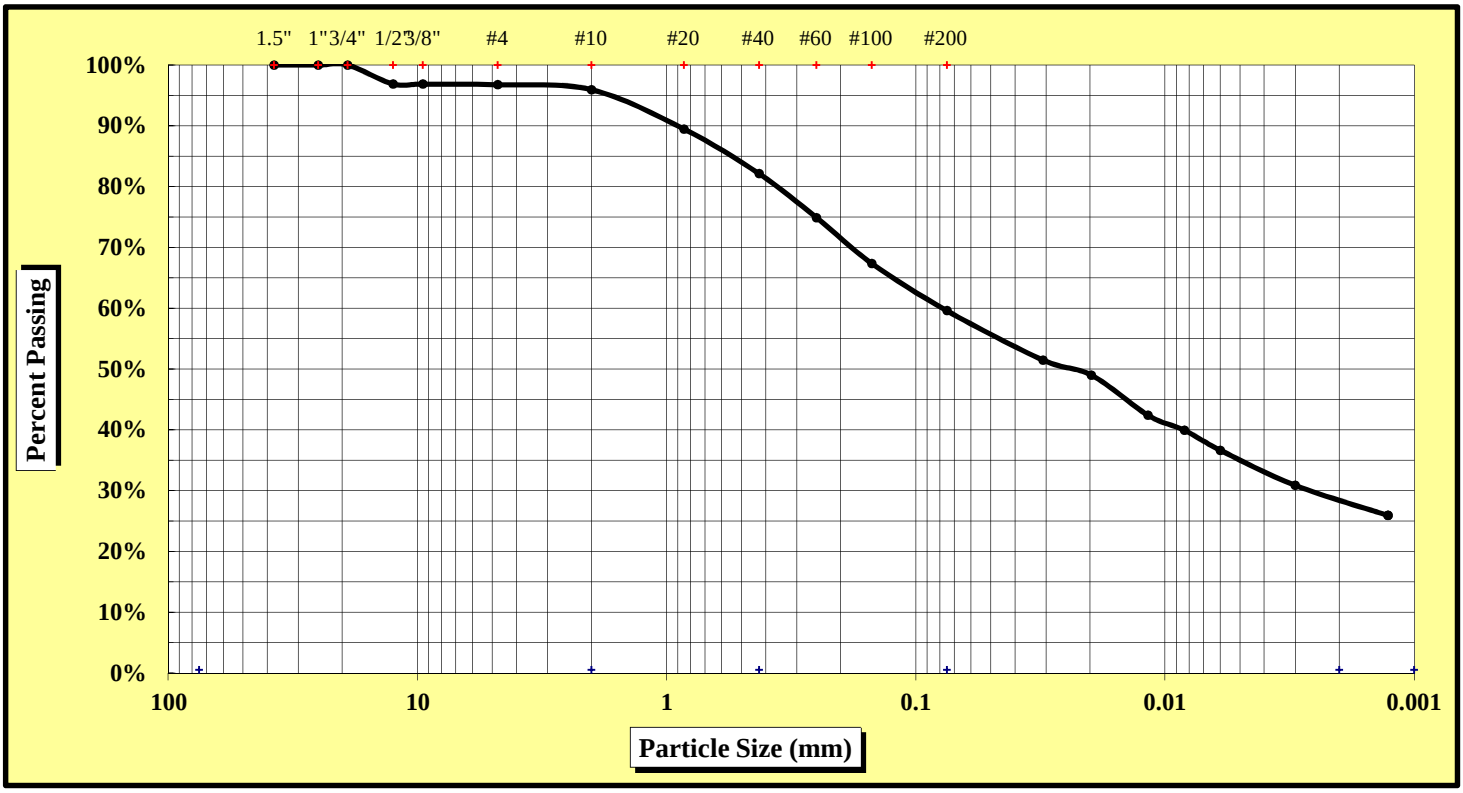
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/22/15 - 7/23/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-8	Sample #:	SS-3	Sample Date:	2014/2015
Station-Route	US 21 53+57	Offset:	31' RT	Depth:	4.5 - 6.0 ft
Sample Description:	Red Brown Tan Coarse to Fine Sandy Clay (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	4.1%	Coarse Sand	13.8%	Silt	31%
Maximum Particle Size	3/4"	Fine Sand	22.5%	Clay	29%
Specific Gravity (Assumed)	2.680	Moisture Content	24.1%	Silt & Clay (% Passing #200)	59.6%
Liquid Limit	50	Plastic Limit	24	Plastic Index	26

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

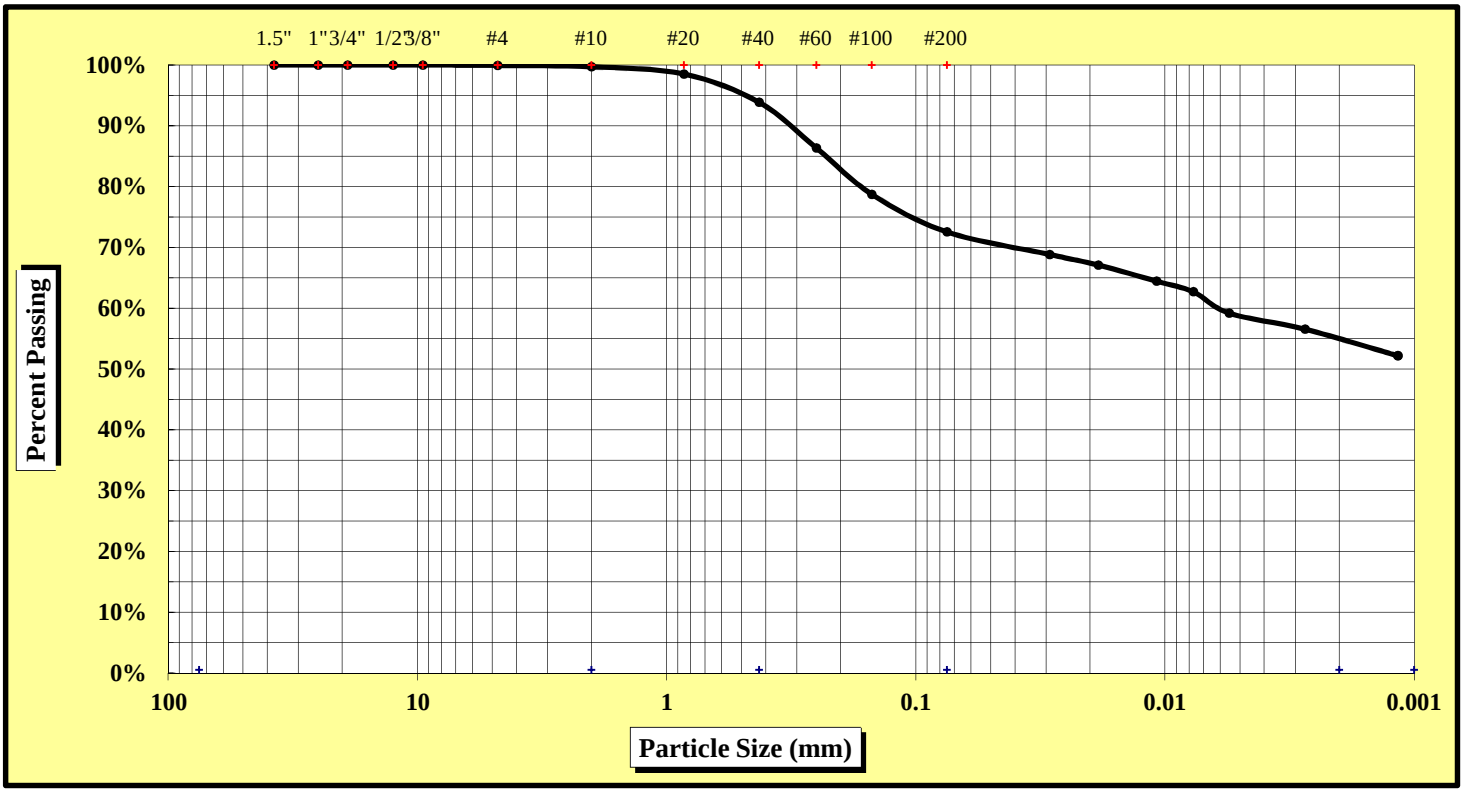
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/22/15 - 7/23/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-9	Sample #:	Bulk	Sample Date:	2014/2015
Station-Route	US 21 58+68	Offset:	26' LT	Depth:	1' - 10'
Sample Description:	Red Clay w/Coarse to Fine Sand (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.3%	Coarse Sand	5.8%	Silt	18%
Maximum Particle Size	#4	Fine Sand	21.3%	Clay	55%
Specific Gravity (Assumed)	2.680	Moisture Content	26.3%	Silt & Clay (% Passing #200)	72.5%
Liquid Limit	59	Plastic Limit	25	Plastic Index	34

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

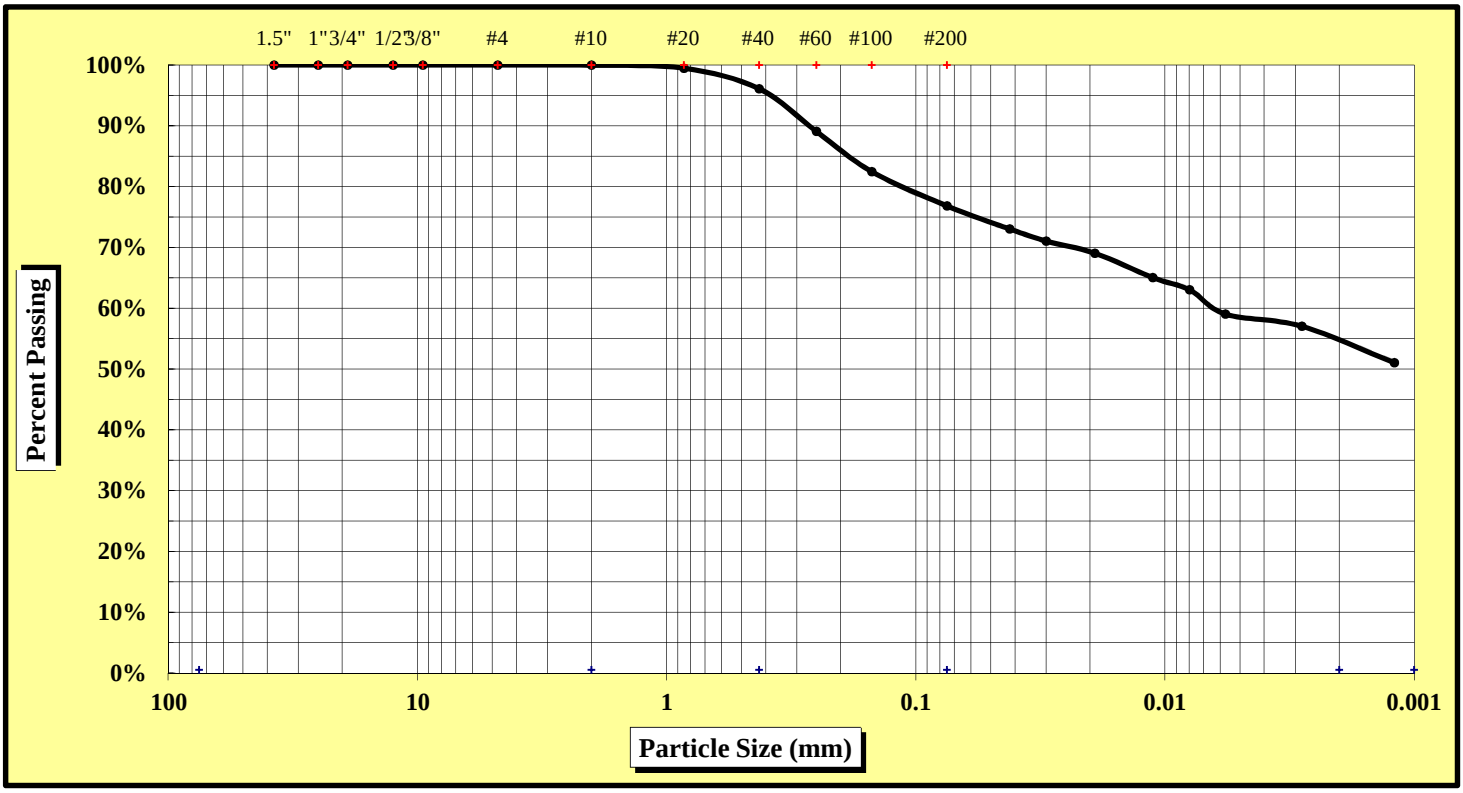
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-9	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station	US 21 58+68	Offset:	26' LT	Depth:	6.5-8'
Sample Description:	Tan Red Brown Clay w/Coarse to Fine Sand (CH)				A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	3.9%	Silt	22%
Maximum Particle Size	#10	Fine Sand	19.3%	Clay	55%
Specific Gravity (Assumed)	2.650	Moisture Content	27.7%	Silt & Clay (% Passing #200)	76.8%
Liquid Limit	63	Plastic Limit	31	Plastic Index	32

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

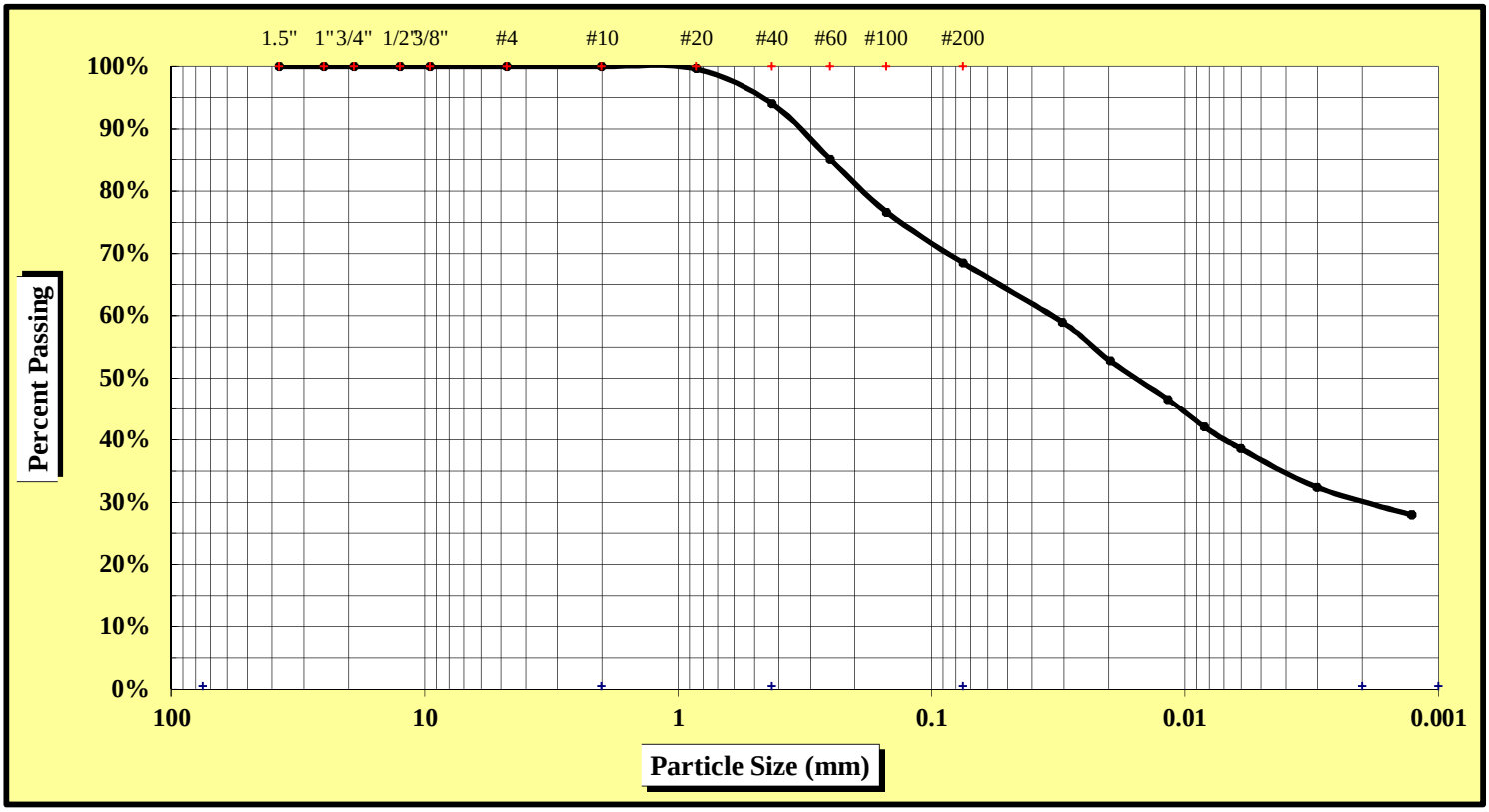
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/25/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/22/15 - 7/23/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-10	Sample #: SS-2	Sample Date: 2014/2015
Station-Route	US 21 63+68	Offset: 28' LT	Depth: 2.5 - 4.0 ft
Sample Description:	Red Tan Coarse to Fine Sandy Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	6.0%	Silt	38%
Maximum Particle Size	No. 20	Fine Sand	25.5%	Clay	30%
Specific Gravity (Assumed)	2.680	Moisture Content	33.4%	Silt & Clay (% Passing #200)	68.5%
Liquid Limit	54	Plastic Limit	30	Plastic Index	24

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

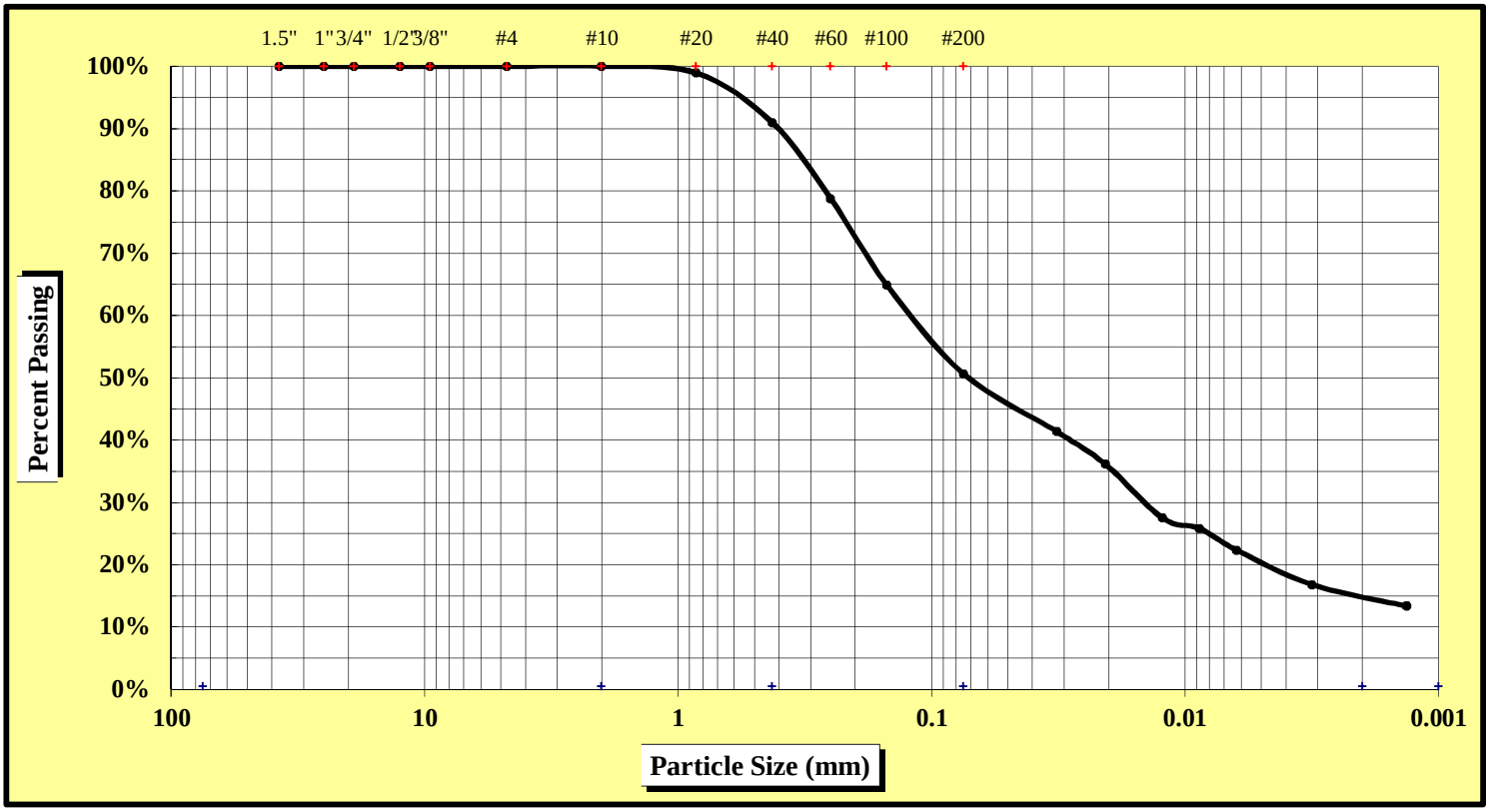
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/24/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-11	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station:	US 21 68+68	Offset:	30' RT	Depth:	6.5 - 8.0 ft
Sample Description:	Red Light Brown and Tan Coarse to Fine Sandy Silty Clay (CL)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	9.0%	Silt	36%
Maximum Particle Size	No. 10	Fine Sand	40.3%	Clay	15%
Specific Gravity (Assumed)	2.680	Moisture Content	18.2%	Silt & Clay (% Passing #200)	50.7%
Liquid Limit	46	Plastic Limit	27	Plastic Index	19

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

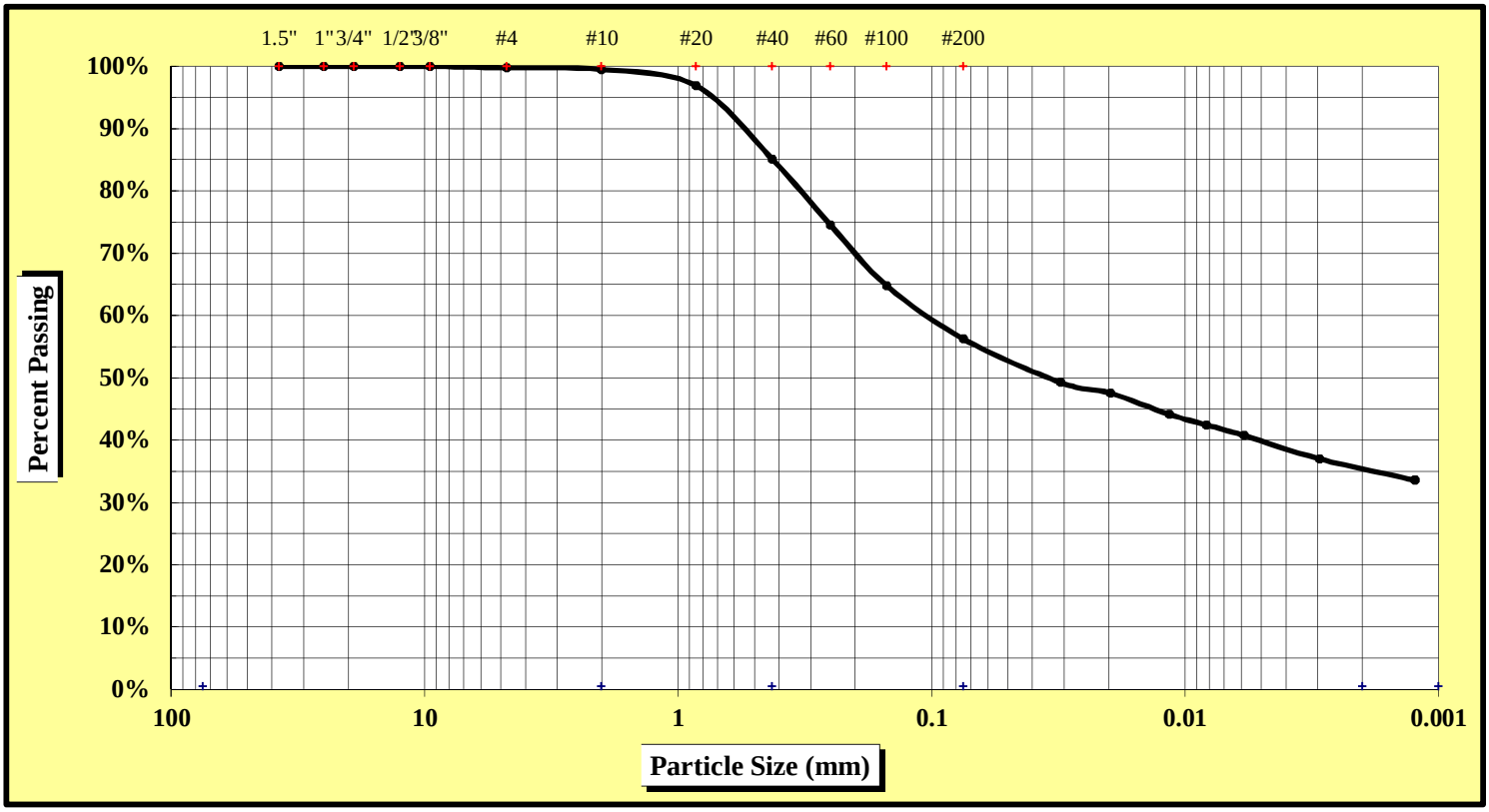
Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #: **1351-12-037 (010)**
Project Name: **SCDOT US 21 to SC 51**
Client Name: STV
Client Address:

Report Date: 7/28/2015
Test Date(s): 7/24/15 - 7/28/15

Boring #: R-12	Sample #: SS-2	Sample Date: 2014/2015
Route-Station" US 21 73+68	Offset: 27' LT	Depth: 2.5 - 4.0 ft
Sample Description: Brown and Red Coarse to Fine Sandy Clay (CH)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.5%	Coarse Sand	14.4%	Silt	21%
Maximum Particle Size	No. 10	Fine Sand	28.9%	Clay	35%
Specific Gravity (Assumed)	2.680	Moisture Content	4.4%	Silt & Clay (% Passing #200)	56.2%
Liquid Limit	51	Plastic Limit	20	Plastic Index	31

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

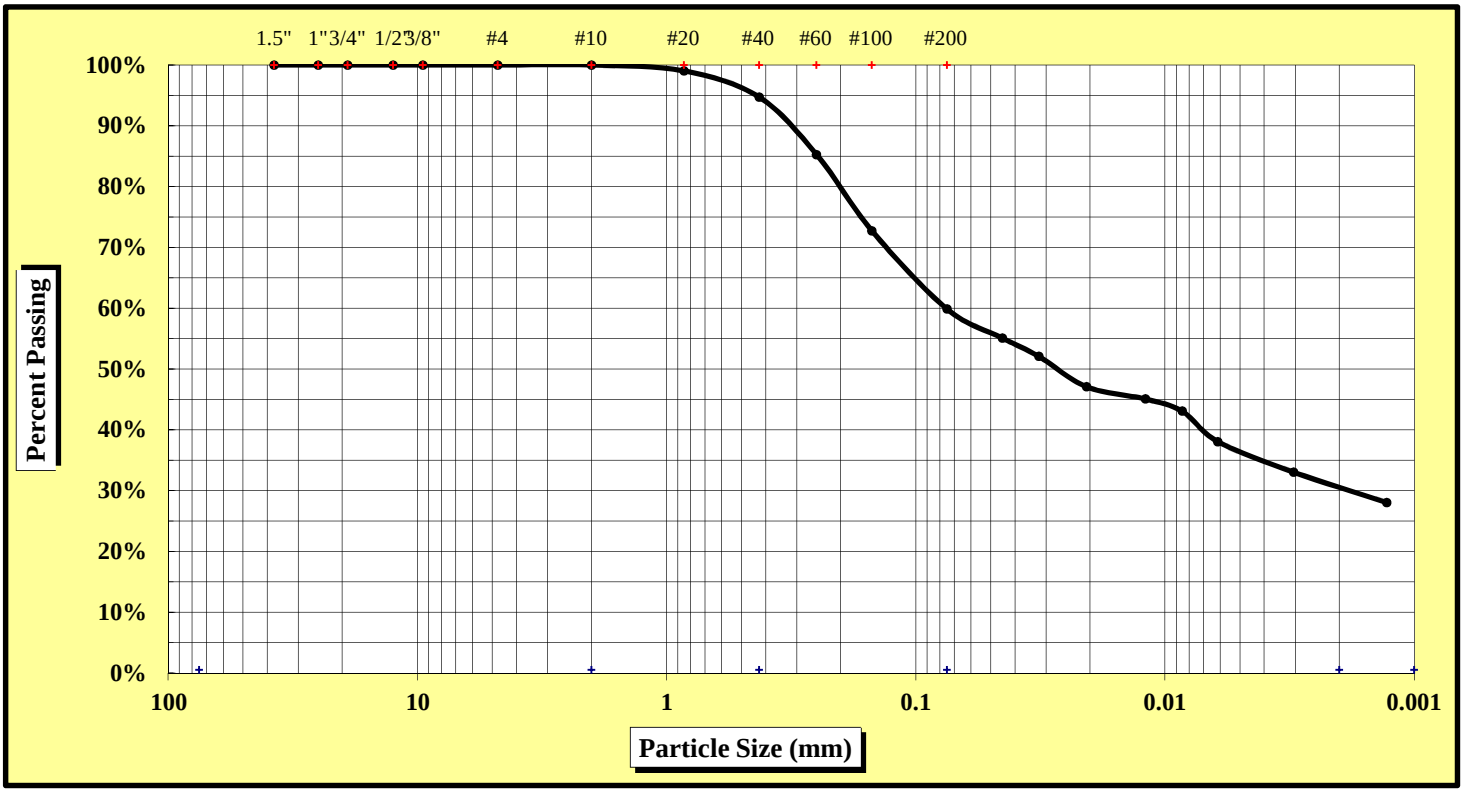
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-12	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	US 21 73+68	Offset:	27' LT	Depth:	8.5-10'
Sample Description:	Orange Brown Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	5.3%	Silt	29%
Maximum Particle Size	#10	Fine Sand	34.8%	Clay	31%
Specific Gravity (Assumed)	2.650	Moisture Content	11.9%	Silt & Clay (% Passing #200)	59.9%
Liquid Limit	36	Plastic Limit	18	Plastic Index	18

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

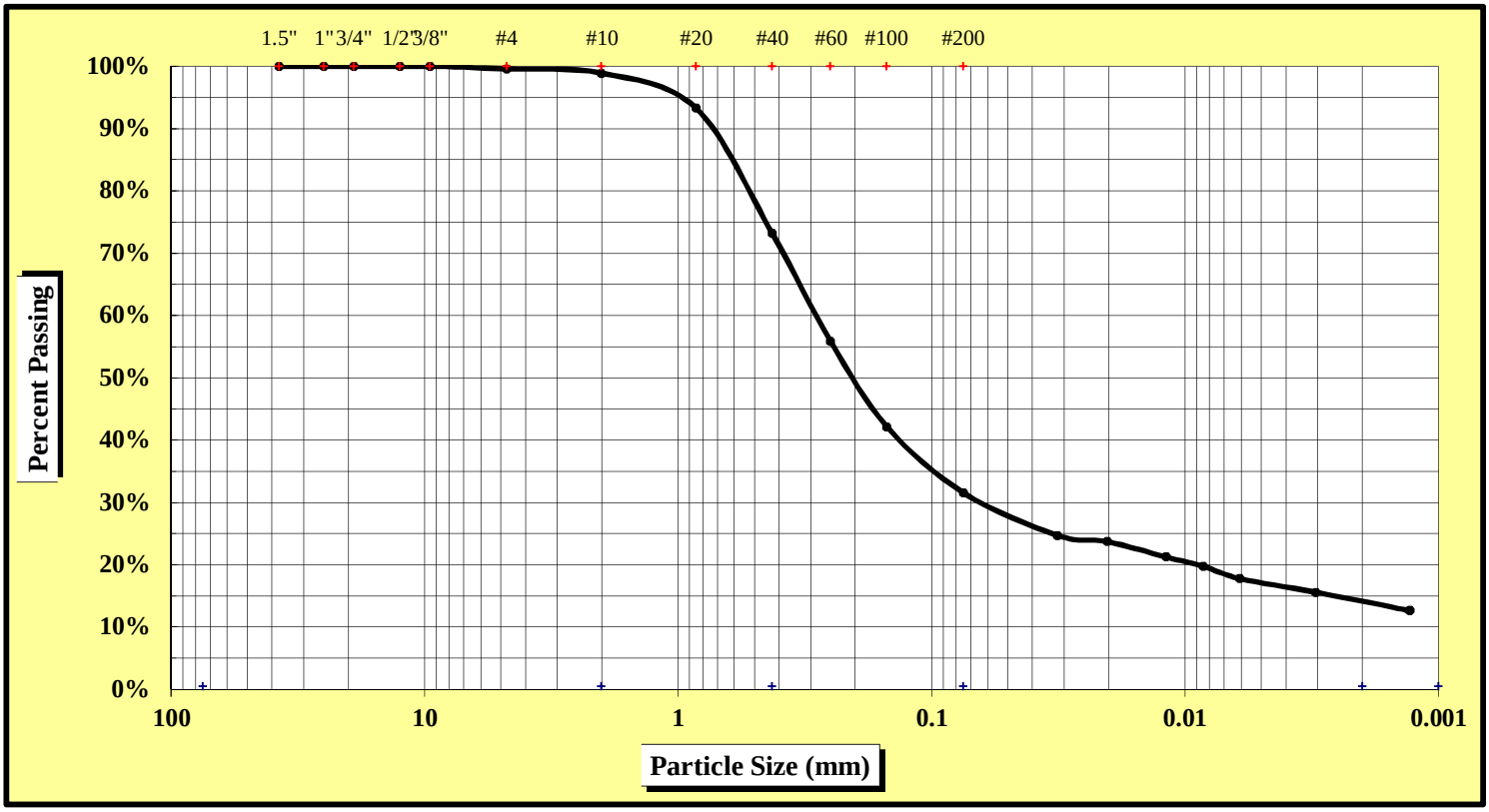
Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #: **1351-12-037 (010)**
Project Name: **SCDOT US 21 to SC 51**
Client Name: STV
Client Address:

Report Date: 7/28/2015
Test Date(s): 7/24/15 - 7/28/15

Boring #: R-14	Sample #: SS-3	Sample Date: 2014/2015	
Route-Station: US 21 88+44	Offset: 31' LT	Depth: 4.5 - 6.0 ft	
Sample Description: Brown and Light Brown Clayey Coarse to Fine Sand (SC)			A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.1%	Coarse Sand	25.7%	Silt	17%
Maximum Particle Size	No. 4	Fine Sand	41.6%	Clay	14%
Specific Gravity (Assumed)	2.680	Moisture Content	10.2%	Silt & Clay (% Passing #200)	31.6%
Liquid Limit	22	Plastic Limit	12	Plastic Index	10

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

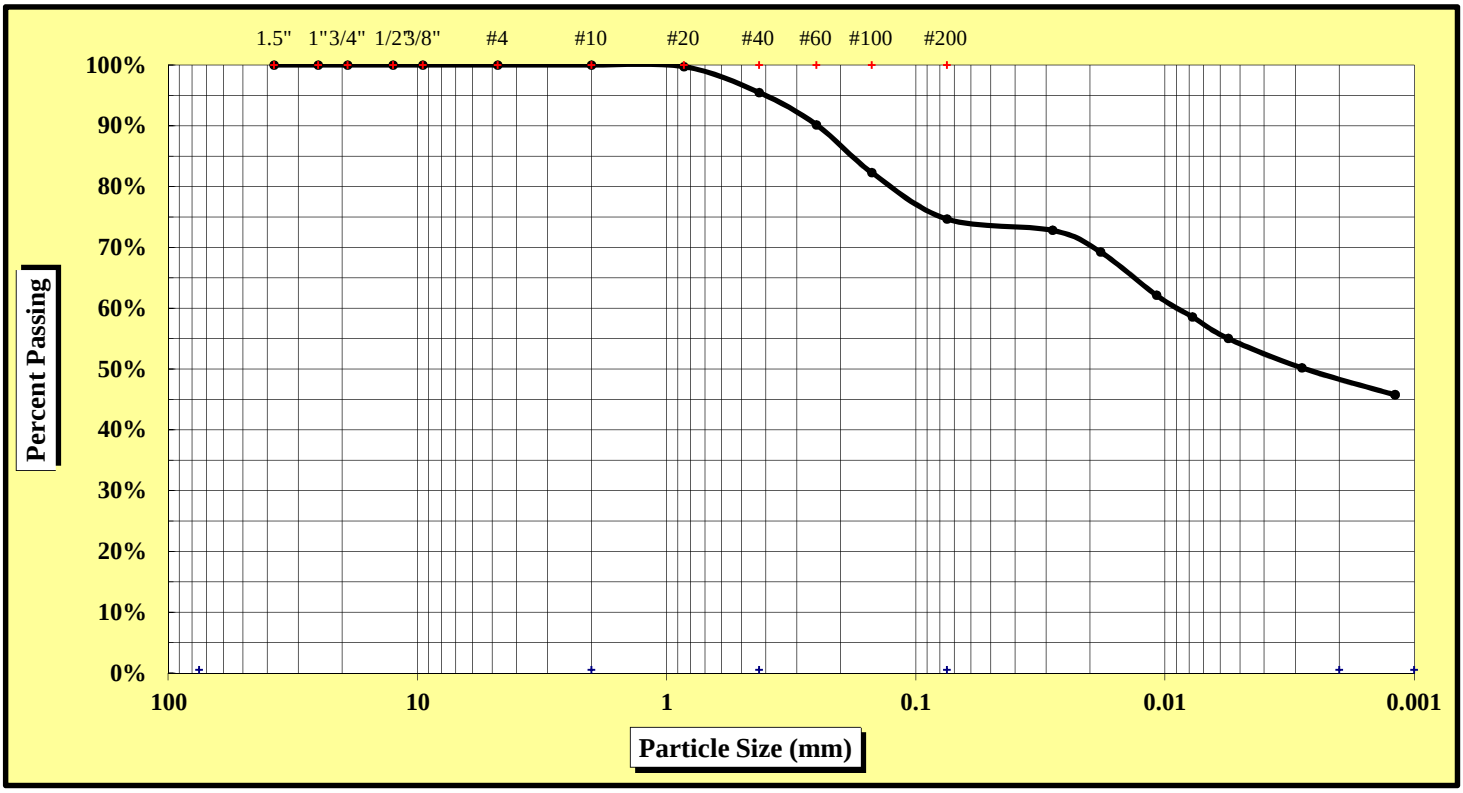
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/24/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #: R-15	Sample #: SS-3	Sample Date: 2014/2015
Route-Station: US 21 93+ 60	Offset: 32' LT	Depth: 4.5 - 6.0 ft
Sample Description: Red and Tan Clayey Silt w/Coarse to Fine Sandy (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	4.5%	Silt	26%
Maximum Particle Size	No. 20	Fine Sand	20.8%	Clay	48%
Specific Gravity (Assumed)	2.680	Moisture Content	25.1%	Silt & Clay (% Passing #200)	74.7%
Liquid Limit	71	Plastic Limit	39	Plastic Index	32

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

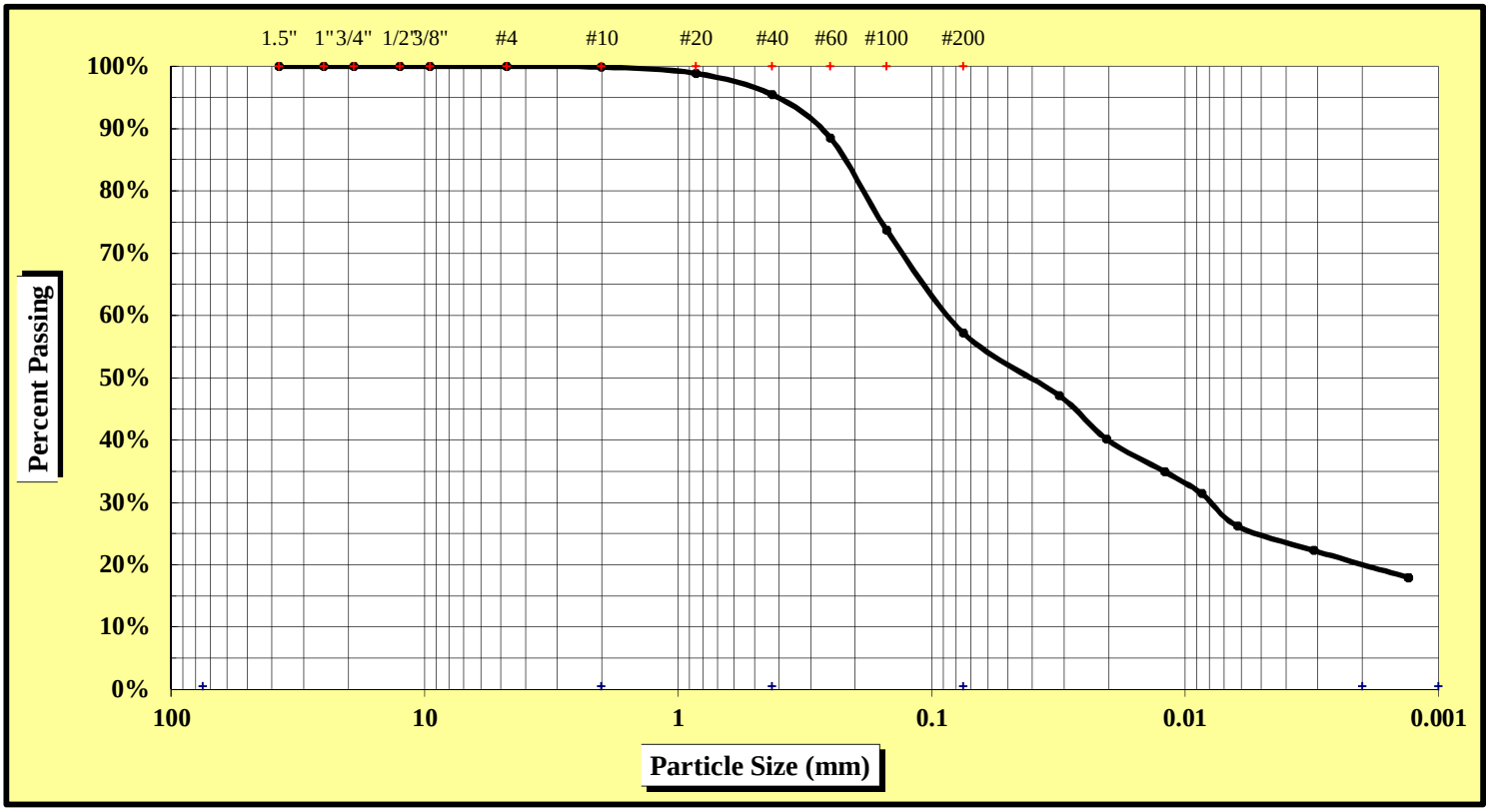
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/24/15 - 7/28/15
Client Name:	STV		
Client Address:			

Boring #: R-15	Sample #: SS-5	Sample Date: 2014/2015
Route-Station: US 21 93+60	Offset: 32' LT	Depth: 8.5 - 10.0 ft
Sample Description: Light Brown and Tan Coarse to Fine Sandy Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.1%	Coarse Sand	4.4%	Silt	37%
Maximum Particle Size	No. 10	Fine Sand	38.2%	Clay	20%
Specific Gravity (Assumed)	2.680	Moisture Content	12.3%	Silt & Clay (% Passing #200)	57.2%
Liquid Limit	50	Plastic Limit	30	Plastic Index	20

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

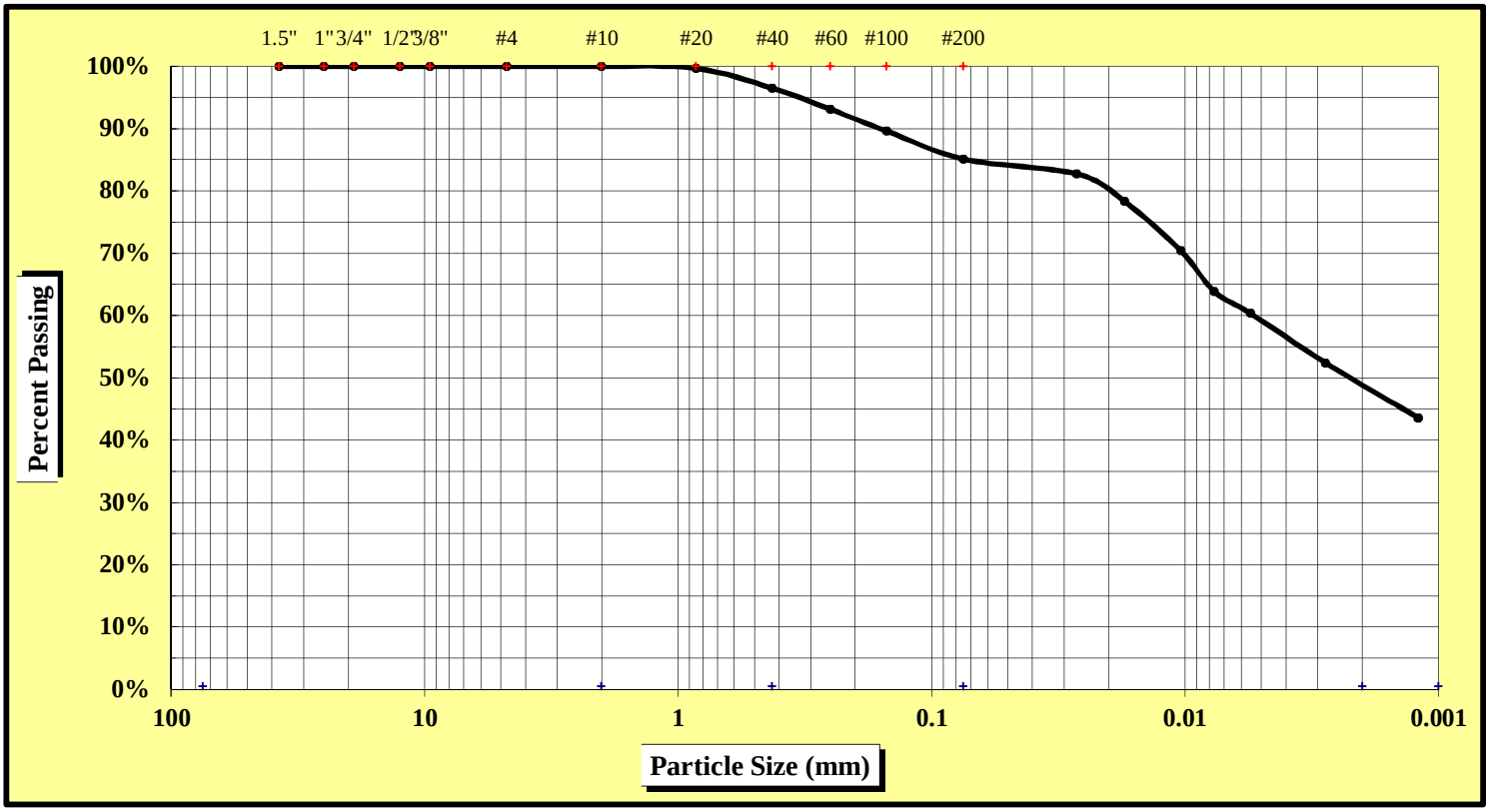
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/27/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-16	Sample #: SS-2	Sample Date: 2014/2015
Route-Station:	US 21 98+40	Offset: 32' RT	Depth: 2.5 - 4.0 ft
Sample Description:	Red Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	3.5%	Silt	36%
Maximum Particle Size	No. 20	Fine Sand	11.4%	Clay	49%
Specific Gravity (Assumed)	2.680	Moisture Content	25.5%	Silt & Clay (% Passing #200)	85.1%
Liquid Limit	77	Plastic Limit	42	Plastic Index	35

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

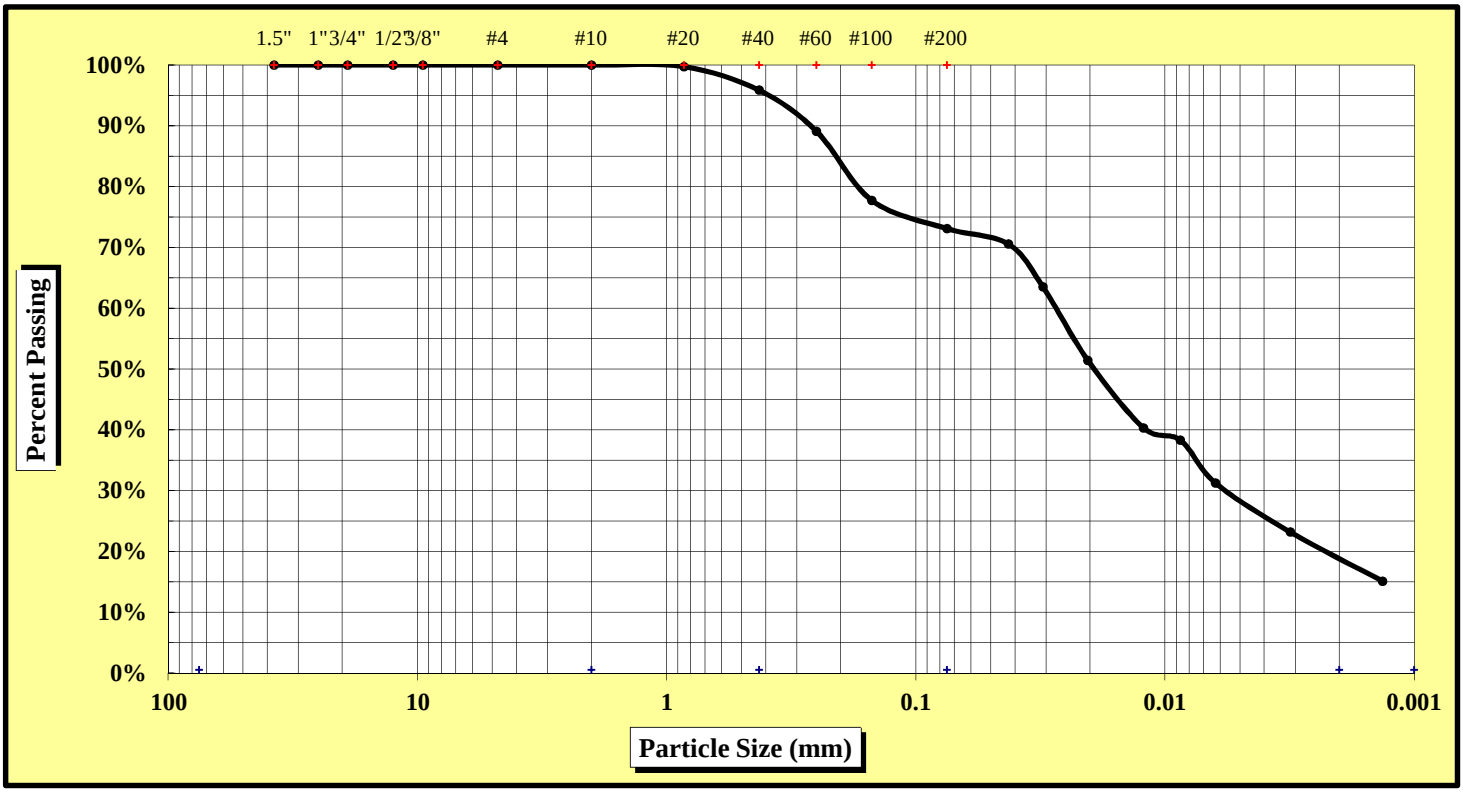
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-16	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	US 21 98+40	Offset:	32' RT	Depth:	8.5-10'
Sample Description:	Brown Orange Clayey Silt w/Coarse to Fine Sand (MH)				A-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	4.2%	Silt	54%
Maximum Particle Size	#20	Fine Sand	22.7%	Clay	19%
Specific Gravity (Assumed)	2.650	Moisture Content	15.5%	Silt & Clay (% Passing #200)	73.1%
Liquid Limit	53	Plastic Limit	44	Plastic Index	9

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

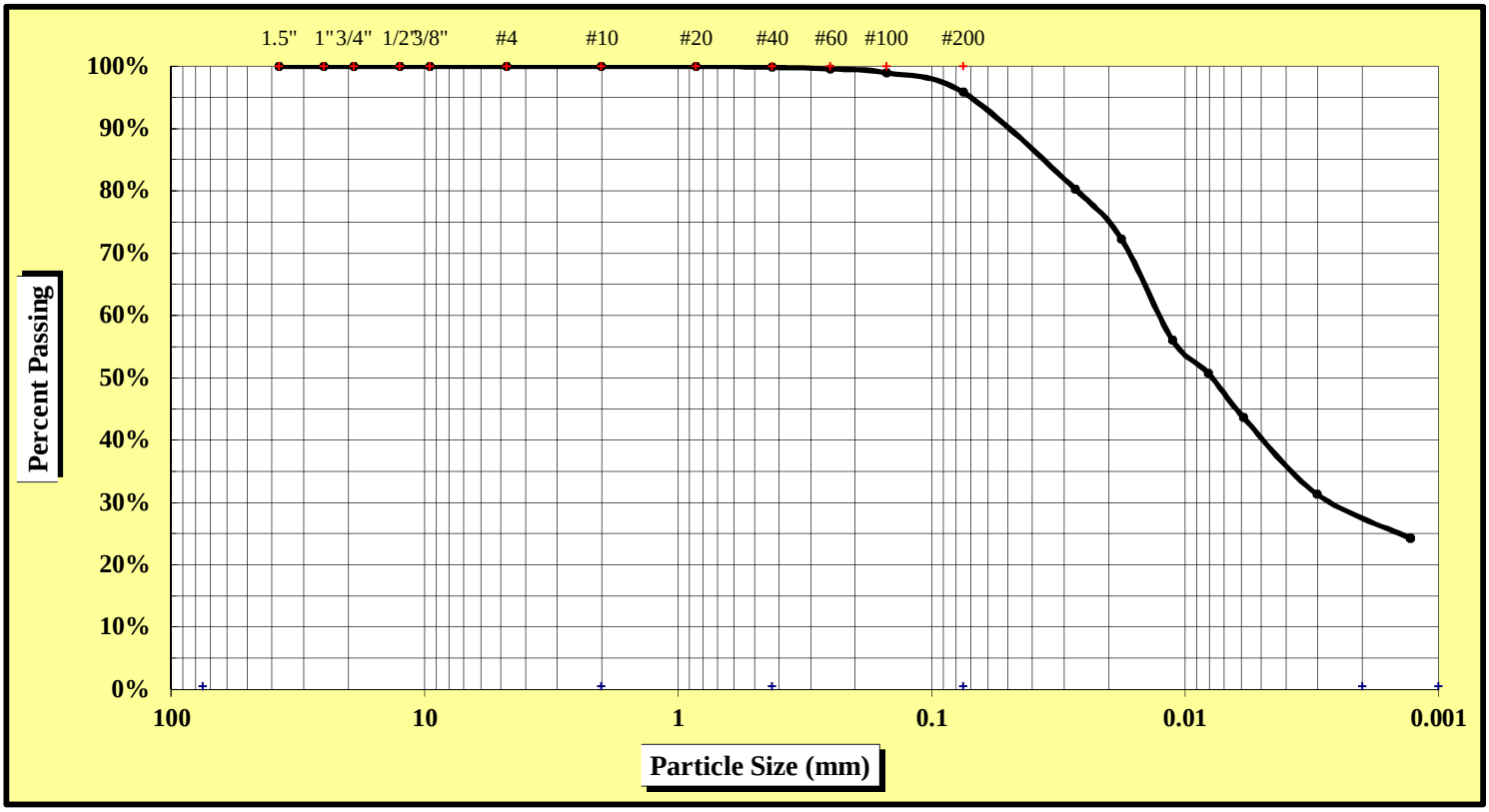
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/27/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-17	Sample #: SS-4	Sample Date: 2014/2015
Route-Station:	US 21 103+66	Offset: 52' LT	Depth: 6.5 - 8.0 ft
Sample Description:	Red and Tan Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	0.2%	Silt	68%
Maximum Particle Size	No. 60	Fine Sand	4.0%	Clay	28%
Specific Gravity (Assumed)	2.680	Moisture Content	41.1%	Silt & Clay (% Passing #200)	95.8%
Liquid Limit	71	Plastic Limit	45	Plastic Index	26

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

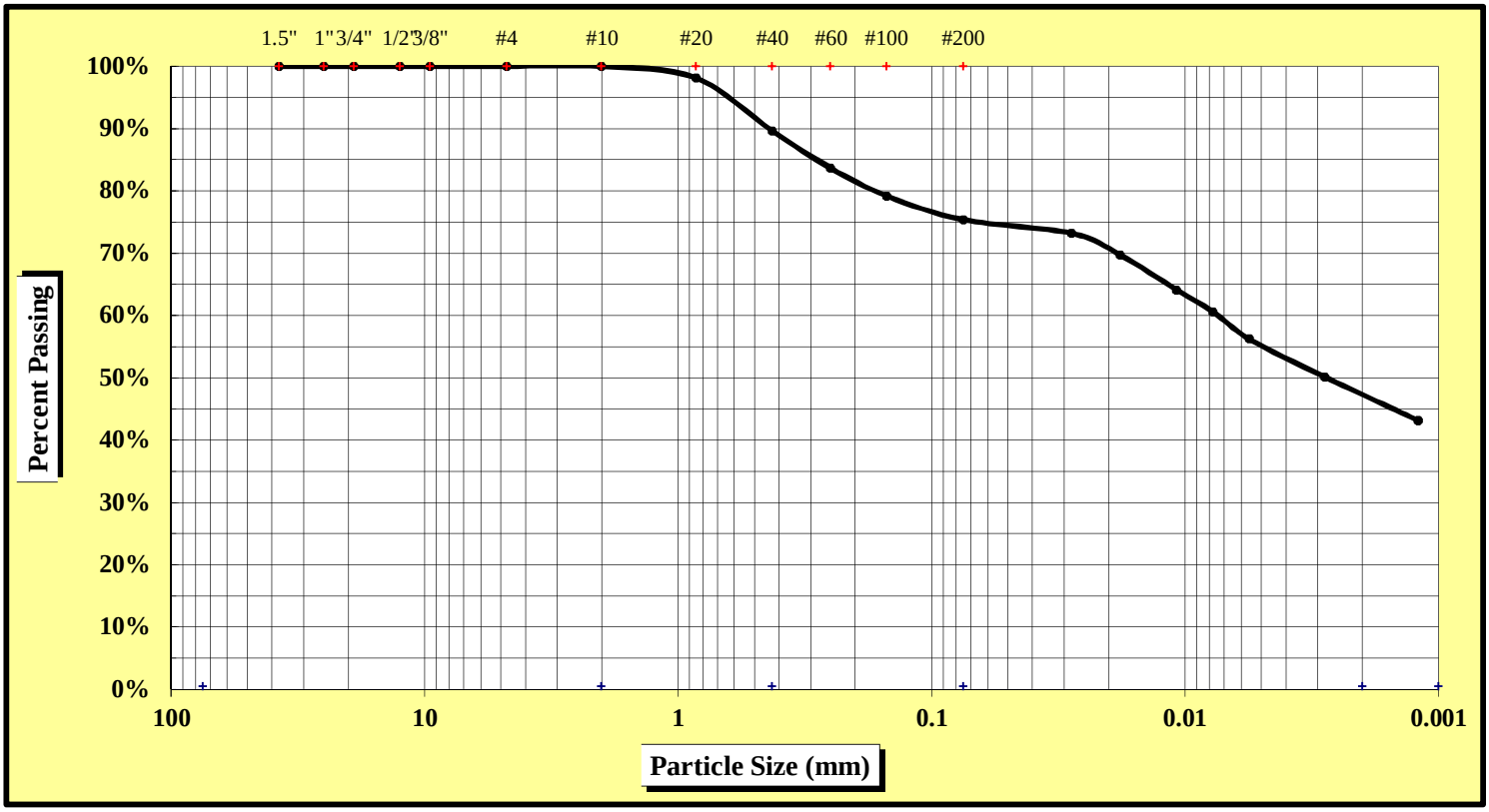
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/27/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-18	Sample #: SS-3	Sample Date: 2014/2015
Route-Station:	US 21 109+85	Offset: 28' RT	Depth: 4.5 - 6.0 ft
Sample Description:	Red and Tan Clay w/Coarse to Fine Sand (CH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	10.4%	Silt	28%
Maximum Particle Size	No. 10	Fine Sand	14.2%	Clay	47%
Specific Gravity (Assumed)	2.680	Moisture Content	22.4%	Silt & Clay (% Passing #200)	75.4%
Liquid Limit	73	Plastic Limit	33	Plastic Index	40

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

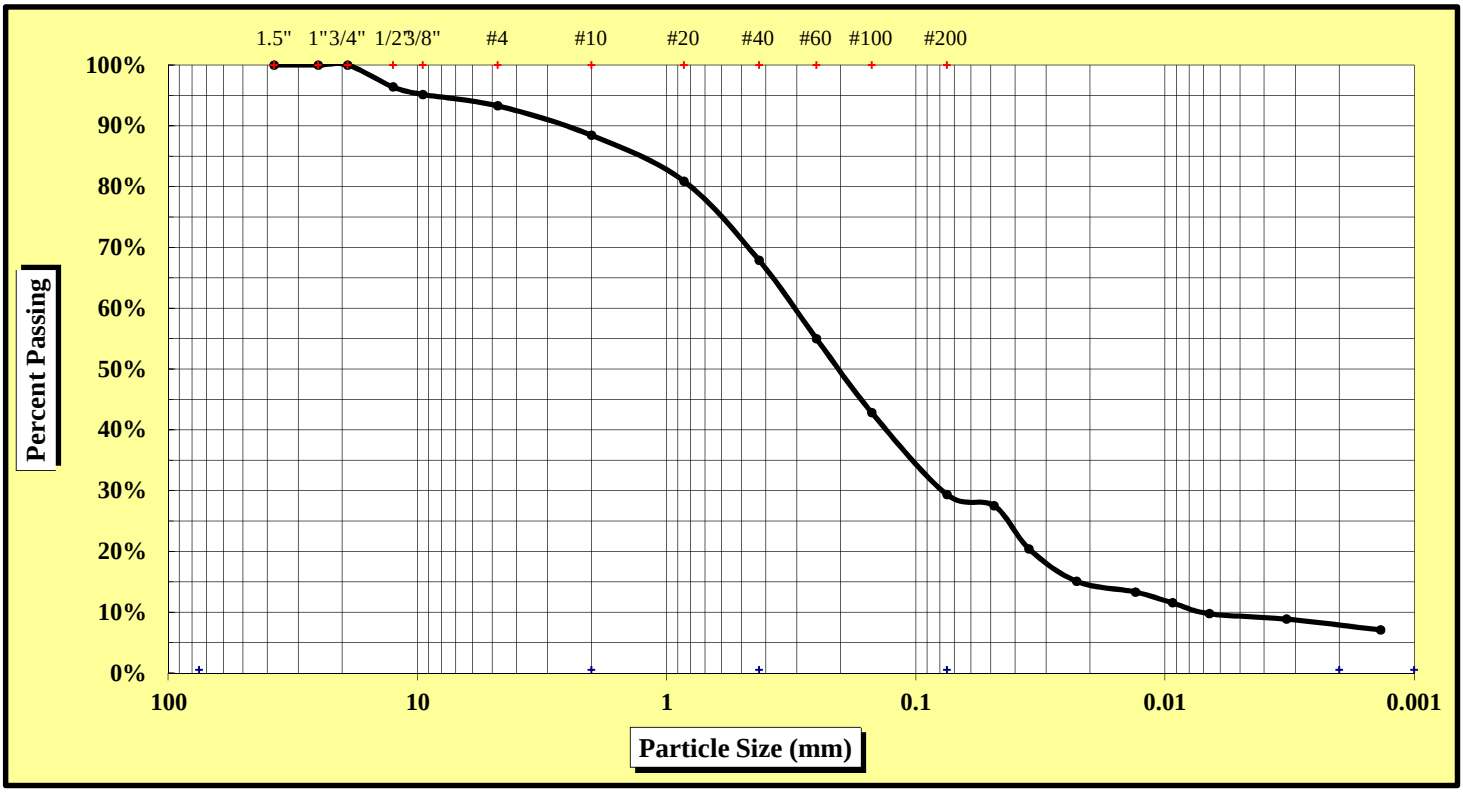
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-19	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	US 21 113+68	Offset:	50' LT	Depth:	2.5-4'
Sample Description:	White Gray Silty Clayey Coarse to Fine Sand (SC-SM)				A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	11.5%	Coarse Sand	20.6%	Silt	21%
Maximum Particle Size	1/2"	Fine Sand	38.5%	Clay	8%
Specific Gravity (Assumed)	2.650	Moisture Content	3.6%	Silt & Clay (% Passing #200)	29.4%
Liquid Limit	22	Plastic Limit	18	Plastic Index	4

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

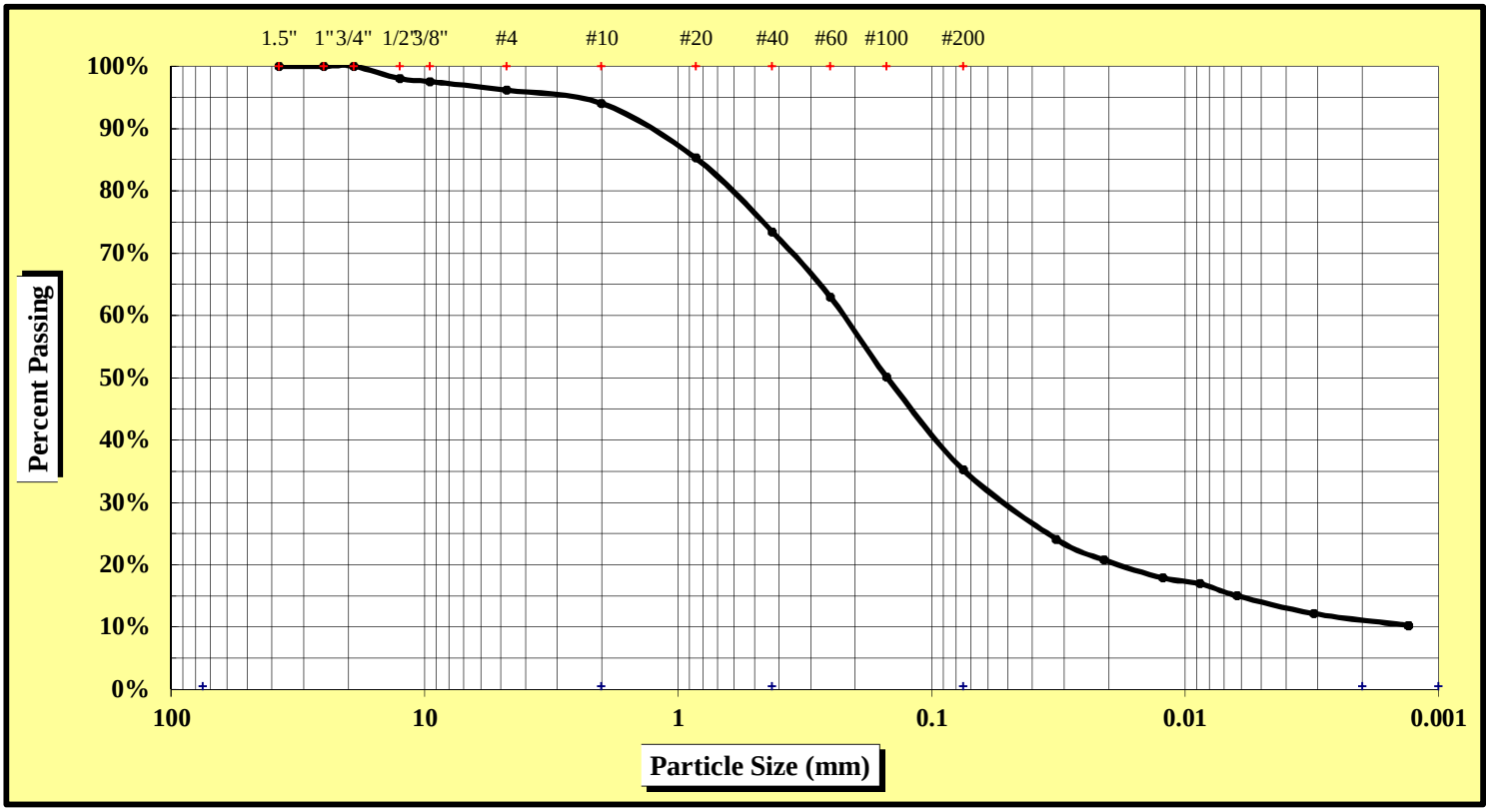
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/27/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-19	Sample #: SS-4	Sample Date: 2014/2015
Route-Station:	US 21 113+68	Offset: 50' LT	Depth: 8.5 - 10.0 ft
Sample Description:	Gray and Tan Clayey Coarse to Fine Sand (SC)		A-2-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	6.0%	Coarse Sand	20.6%	Silt	24%
Maximum Particle Size	3/4"	Fine Sand	38.2%	Clay	11%
Specific Gravity (Assumed)	2.680	Moisture Content	13.7%	Silt & Clay (% Passing #200)	35.3%
Liquid Limit	28	Plastic Limit	17	Plastic Index	11

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

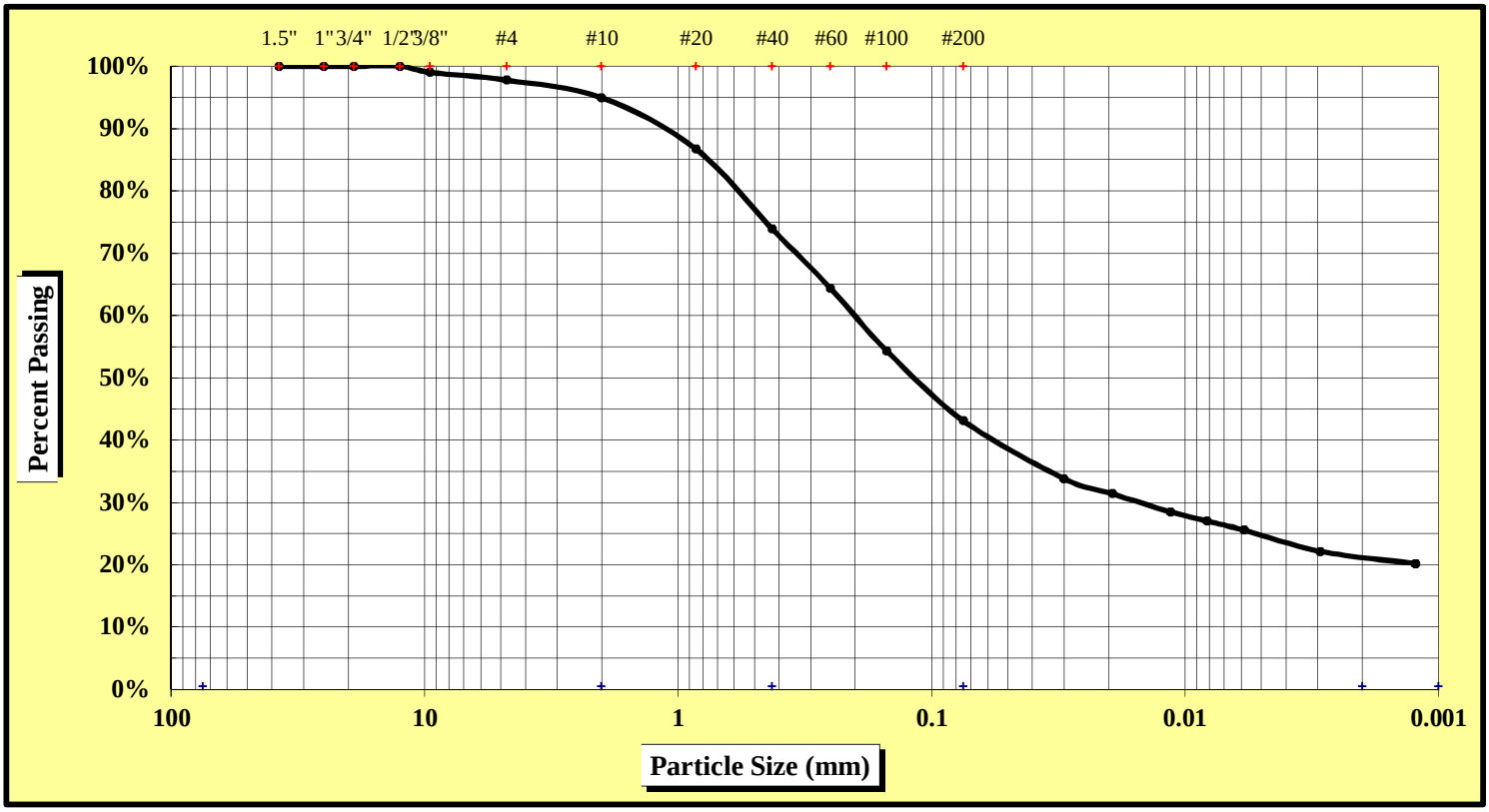
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/28/2015
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	7/27/15 - 7/28/15
Client Name:	STV		
Client Address:	NA		

Boring #: R-20	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: US 21 118+68	Offset: 56' RT	Depth: 0.5 - 2.0 ft
Sample Description: Brown Clayey Coarse to Fine Sand (SC)		A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	5.0%	Coarse Sand	21.1%	Silt	22%
Maximum Particle Size	1/2"	Fine Sand	30.8%	Clay	21%
Specific Gravity (Assumed)	2.680	Moisture Content	6.6%	Silt & Clay (% Passing #200)	43.1%
Liquid Limit	37	Plastic Limit	15	Plastic Index	22

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

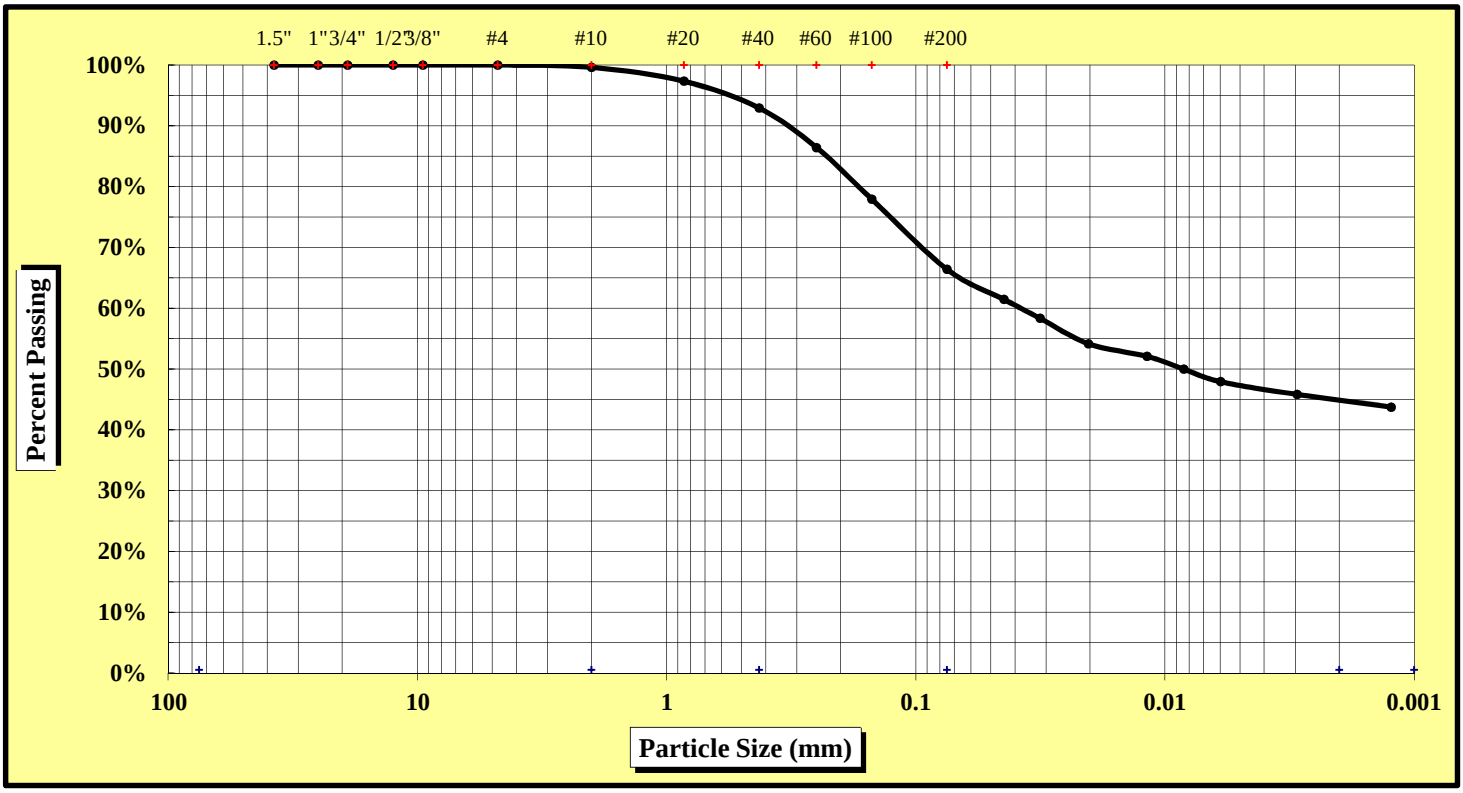
Technical Responsibility: N. Randy Rainwater *Signature* Project Engineer *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-21	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station	US 21 123+68	Offset:	61' RT	Depth:	8.5-10'
Sample Description:	Brown Gray Coarse to Fine Sandy Clay (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.4%	Coarse Sand	6.7%	Silt	21%
Maximum Particle Size	#10	Fine Sand	26.5%	Clay	45%
Specific Gravity (Assumed)	2.650	Moisture Content	7.8%	Silt & Clay (% Passing #200)	66.4%
Liquid Limit	55	Plastic Limit	15	Plastic Index	40

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

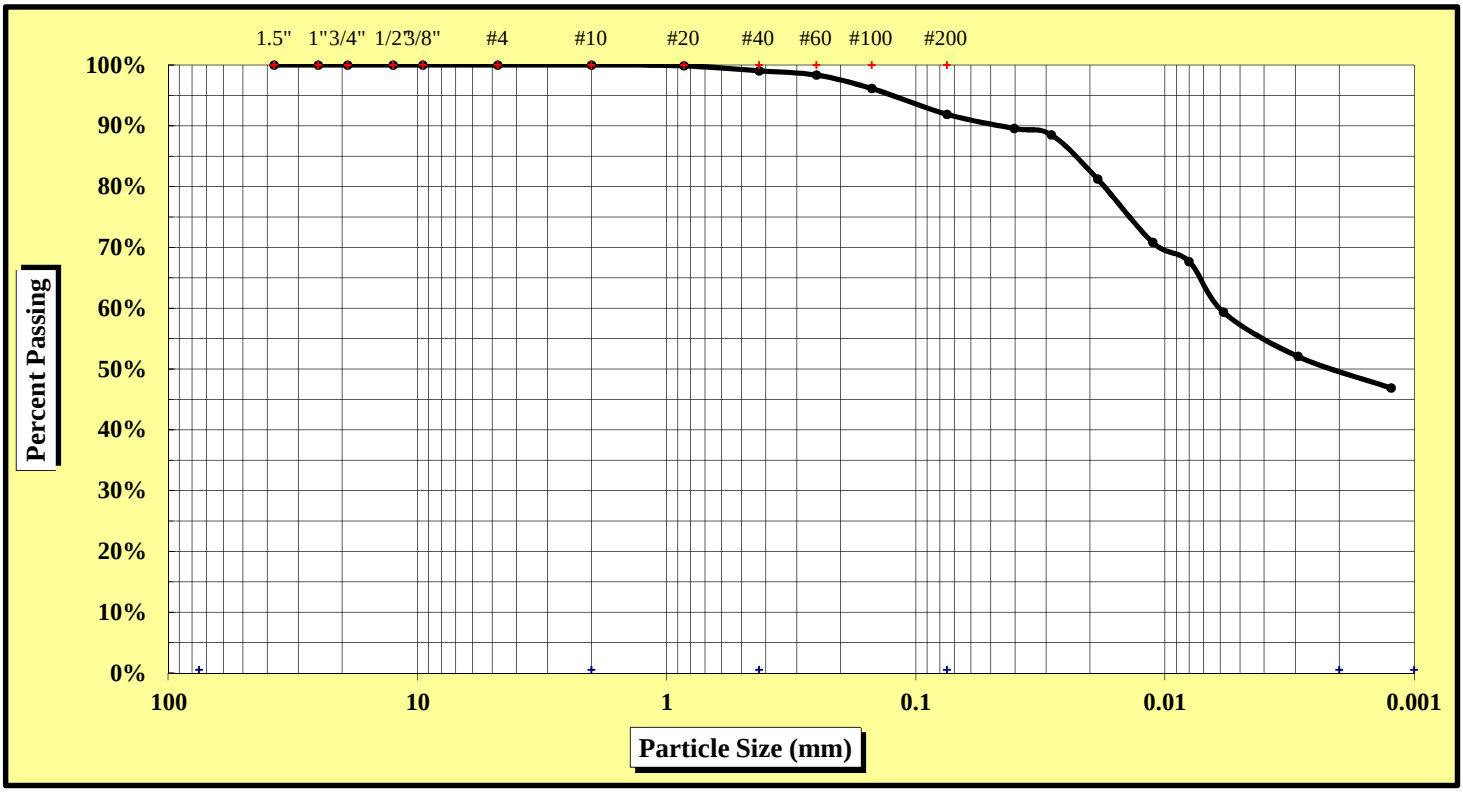
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #: R-22	Sample #: SS-3	Sample Date: 2014/2015
Route-Station: SC 51 315+15	Offset: 38' RT	Depth: 4.5-6'
Sample Description: Orange Brown Clayey Silt (MH)		A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	1.0%	Silt	42%
Maximum Particle Size	#20	Fine Sand	7.1%	Clay	50%
Specific Gravity (Assumed)	2.650	Moisture Content	21.9%	Silt & Clay (% Passing #200)	91.9%
Liquid Limit	74	Plastic Limit	43	Plastic Index	31

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

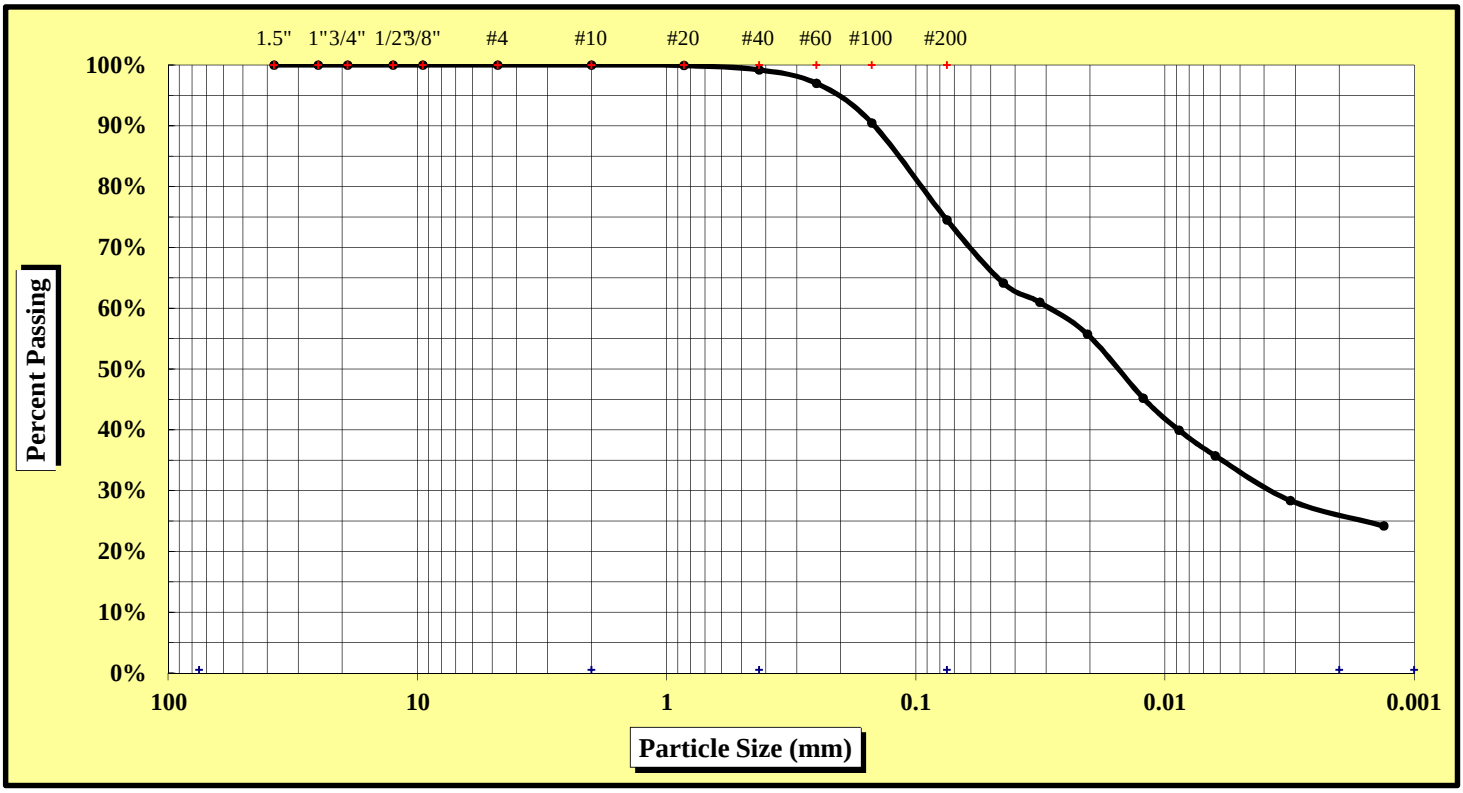
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #: R-23	Sample #: SS-1	Sample Date: 2014/2015
Route-Station: SC 51 310+66	Offset: 8' LT	Depth: 2.5-4.0'
Sample Description: Gray Orange Brown Silty Clay w/Fine Sand (CL)		A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	0.8%	Silt	49%
Maximum Particle Size	#20	Fine Sand	24.7%	Clay	26%
Specific Gravity (Assumed)	2.650	Moisture Content	26.4%	Silt & Clay (% Passing #200)	74.5%
Liquid Limit	45	Plastic Limit	25	Plastic Index	20

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

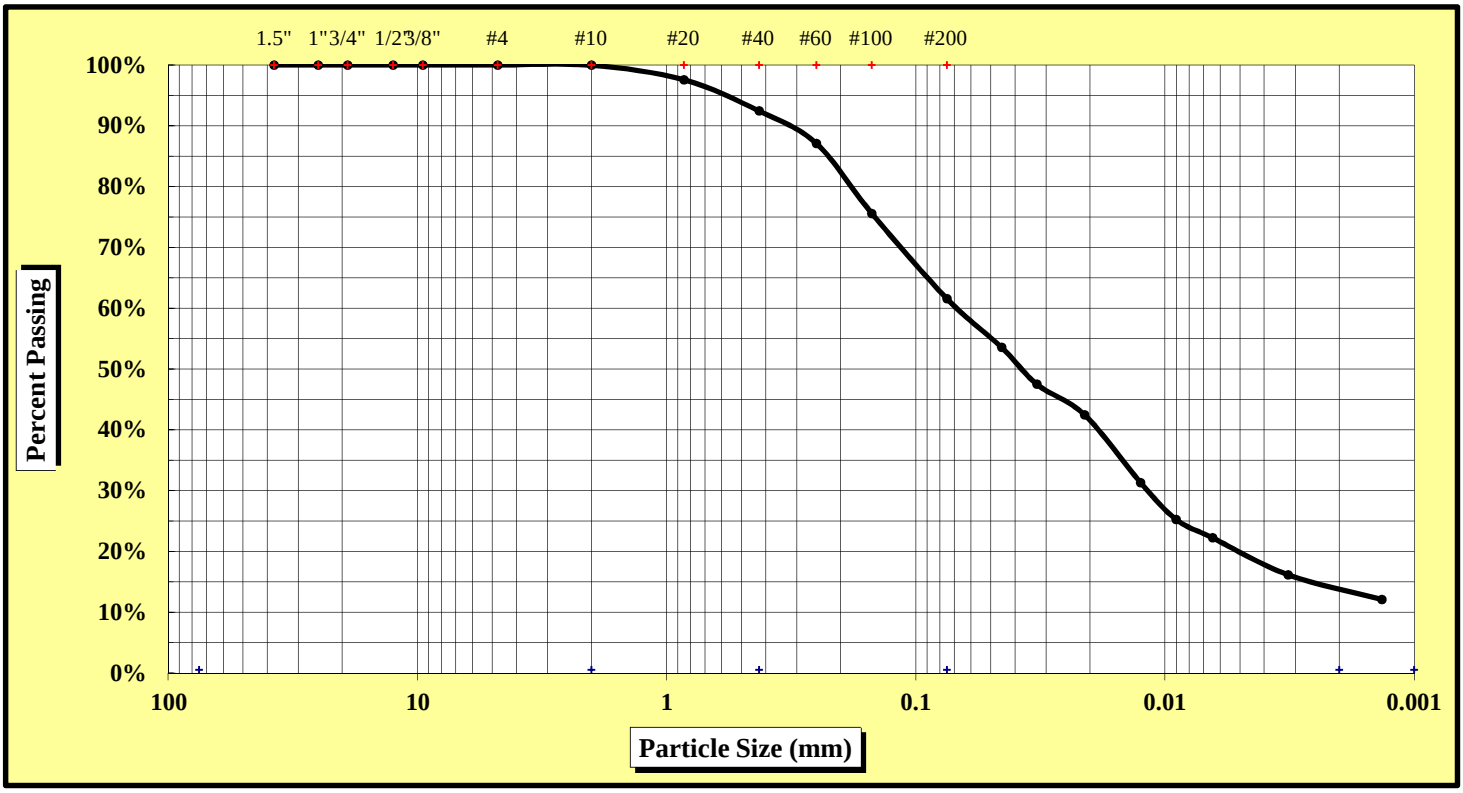
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/3/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-23	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station	SC 51 310+66	Offset:	8' LT	Depth:	8.5-10'
Sample Description:	Brown Orange Gray Coarse to Fine Sandy Silty Clay (CL)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	7.5%	Silt	48%
Maximum Particle Size	#10	Fine Sand	30.9%	Clay	14%
Specific Gravity (Assumed)	2.650	Moisture Content	26.4%	Silt & Clay (% Passing #200)	61.6%
Liquid Limit	42	Plastic Limit	26	Plastic Index	16

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

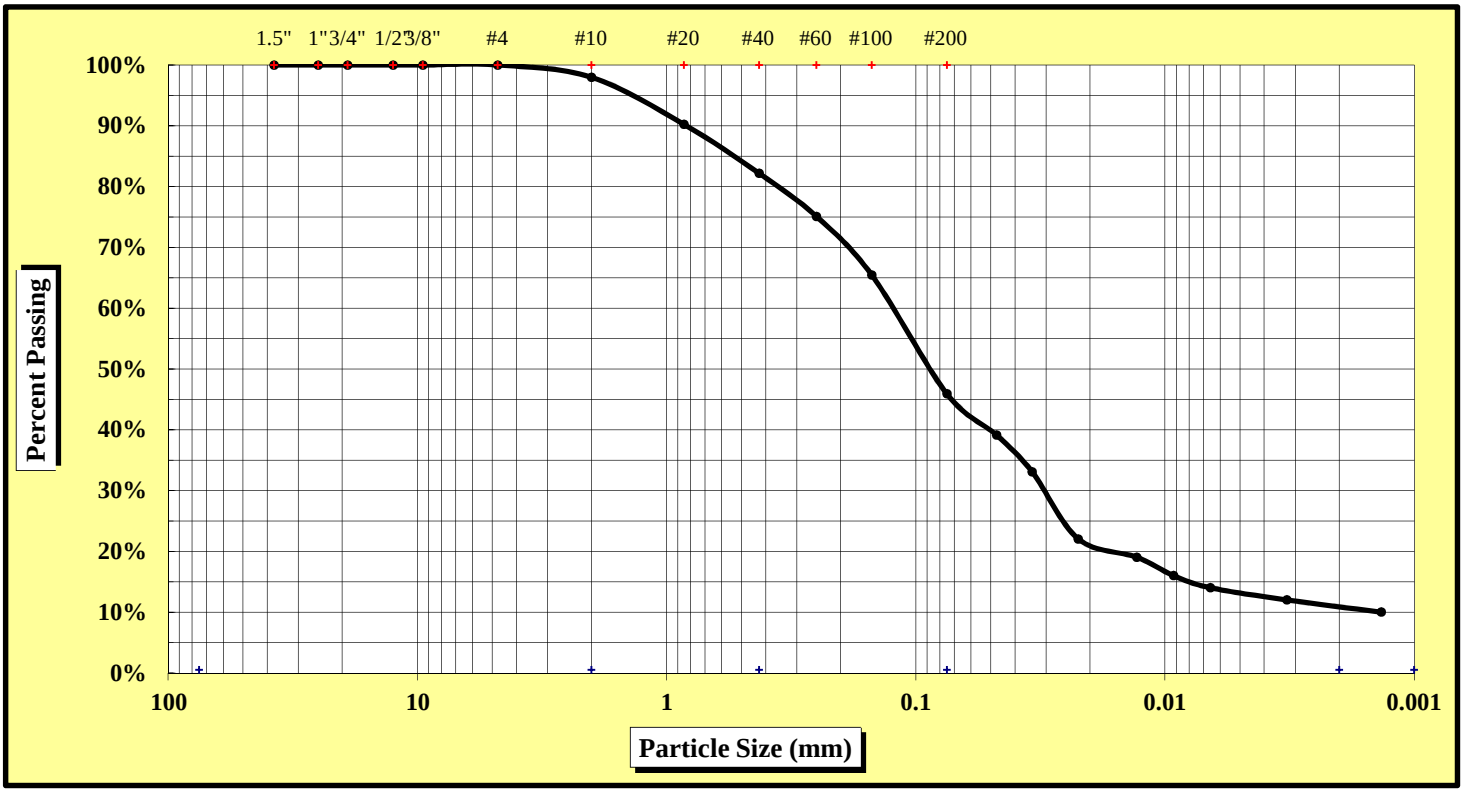
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-24	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	SC 51 306+47	Offset:	11' RT	Depth:	8.5-10'
Sample Description:	White Brown Silty Coarse to Fine Sand (SM)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.0%	Coarse Sand	15.8%	Silt	35%
Maximum Particle Size	#10	Fine Sand	36.3%	Clay	11%
Specific Gravity (Assumed)	2.650	Moisture Content	14.2%	Silt & Clay (% Passing #200)	45.9%
Liquid Limit	33	Plastic Limit	25	Plastic Index	8

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

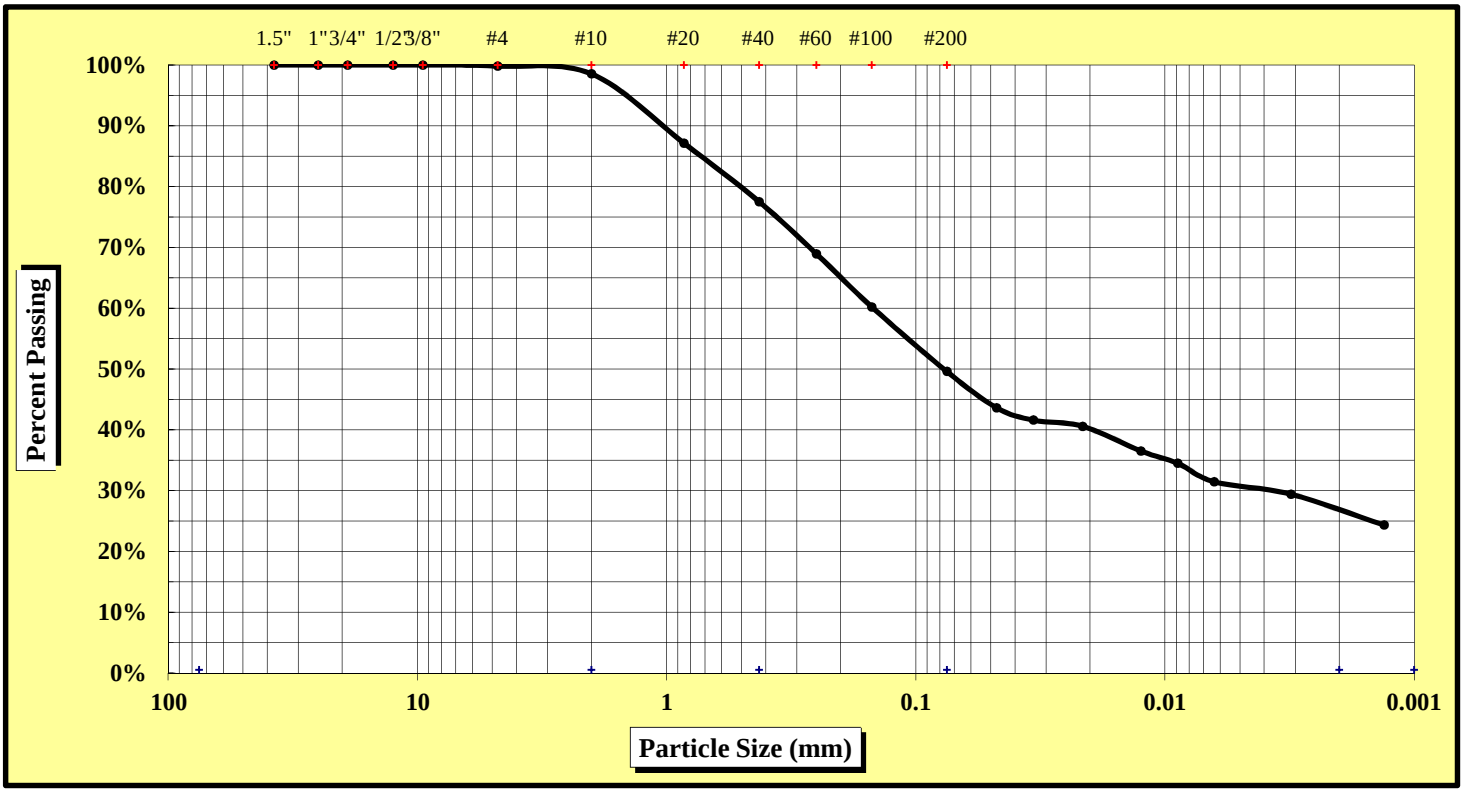
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-25	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	SC 51 304+00	Offset:	30' RT	Depth:	4.5-6'
Sample Description:	Brown Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.5%	Coarse Sand	21.0%	Silt	23%
Maximum Particle Size	#4	Fine Sand	27.9%	Clay	27%
Specific Gravity (Assumed)	2.650	Moisture Content	21.7%	Silt & Clay (% Passing #200)	49.6%
Liquid Limit	38	Plastic Limit	18	Plastic Index	20

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

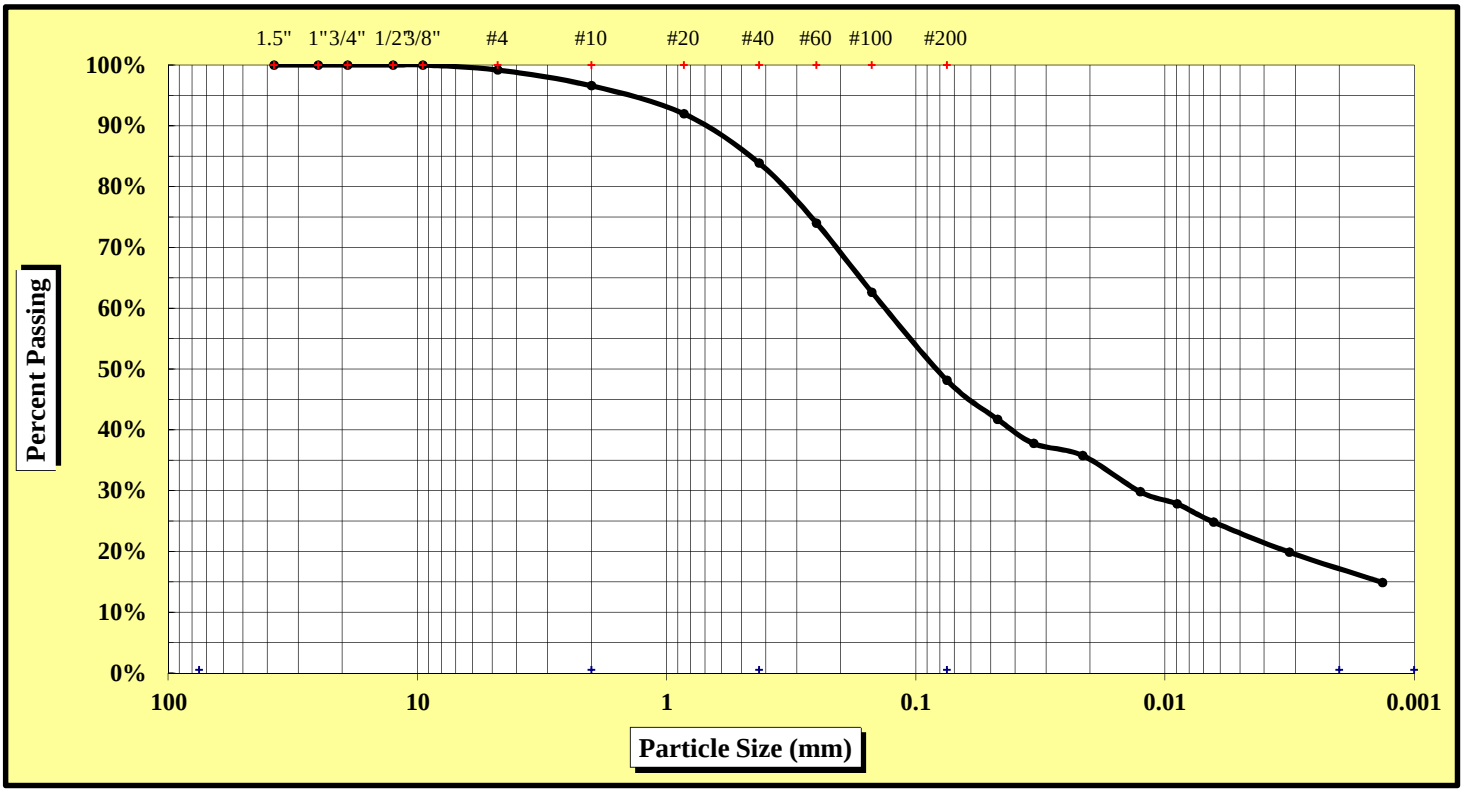
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-26	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station	SC 51 308+54	Offset:	28' LT	Depth:	1-10'
Sample Description:	Grayish Brown Clayey Coarse to Fine Sand (SC)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	3.4%	Coarse Sand	12.7%	Silt	31%
Maximum Particle Size	#4	Fine Sand	35.7%	Clay	17%
Specific Gravity (Assumed)	2.650	Moisture Content	17.2%	Silt & Clay (% Passing #200)	48.2%
Liquid Limit	34	Plastic Limit	16	Plastic Index	18

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

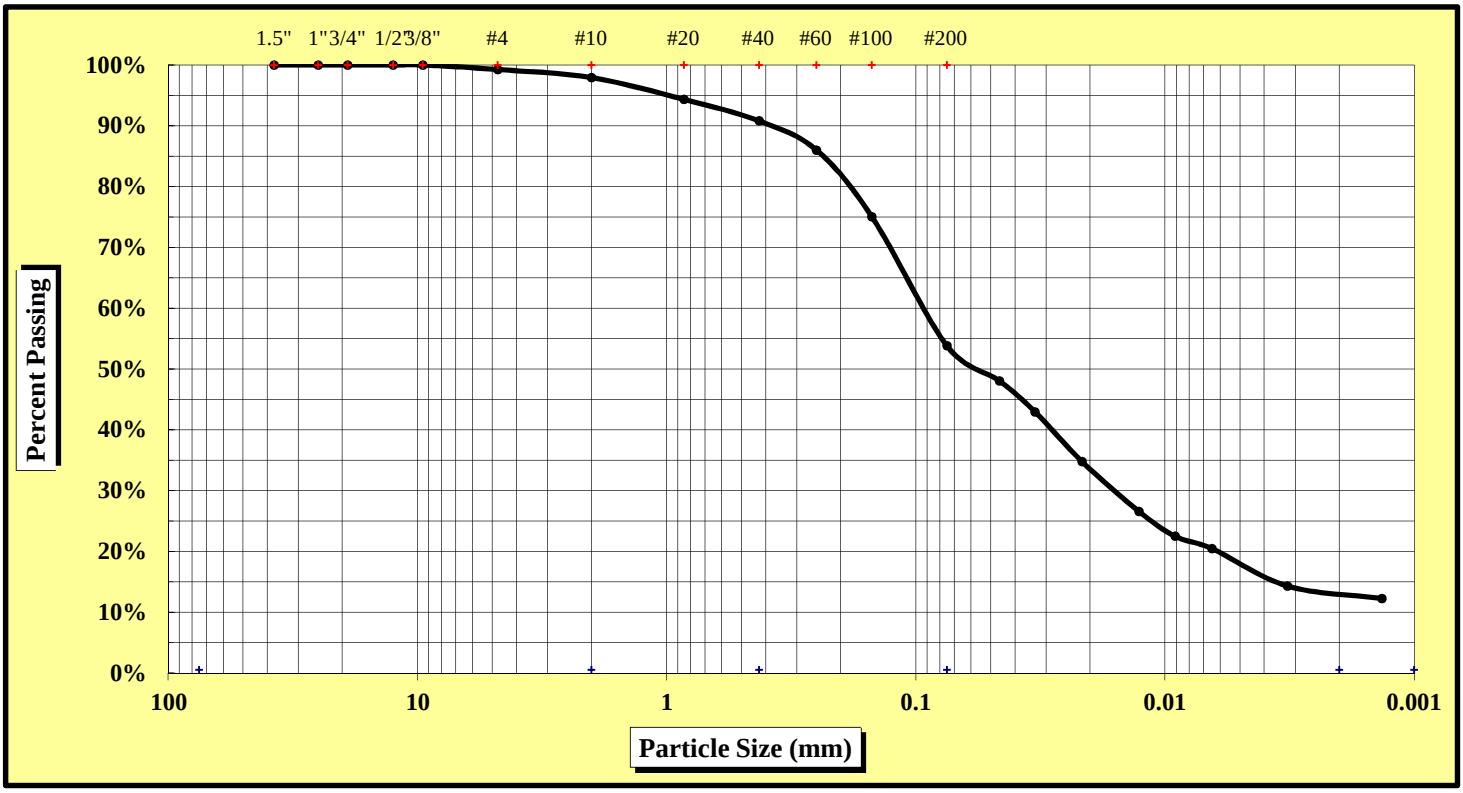
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-27	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	SC 51 313+58	Offset:	29' LT	Depth:	4.5-6'
Sample Description:	White Brown Gray Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.1%	Coarse Sand	7.1%	Silt	40%
Maximum Particle Size	#4	Fine Sand	37.0%	Clay	14%
Specific Gravity (Assumed)	2.650	Moisture Content	25.6%	Silt & Clay (% Passing #200)	53.8%
Liquid Limit	39	Plastic Limit	20	Plastic Index	19

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

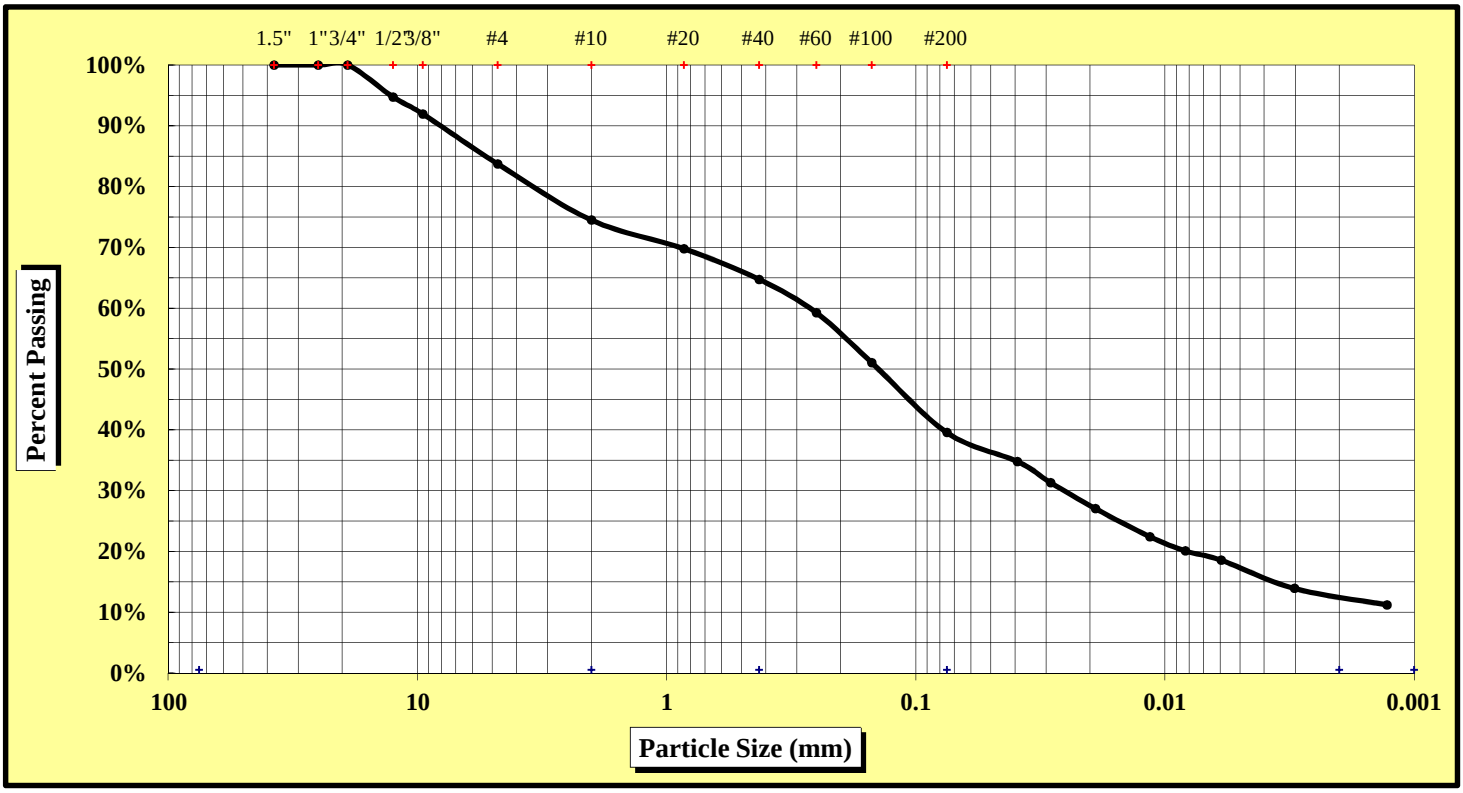
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-28	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station	SC 51 318+60	Offset:	26' LT	Depth:	1-10'
Sample Description:	Gray Clayey Coarse to Fine Sand w/Gravel (SC)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	25.5%	Coarse Sand	9.8%	Silt	27%
Maximum Particle Size	1/2"	Fine Sand	25.2%	Clay	13%
Specific Gravity (Assumed)	2.650	Moisture Content	21.9%	Silt & Clay (% Passing #200)	39.5%
Liquid Limit	37	Plastic Limit	19	Plastic Index	18

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

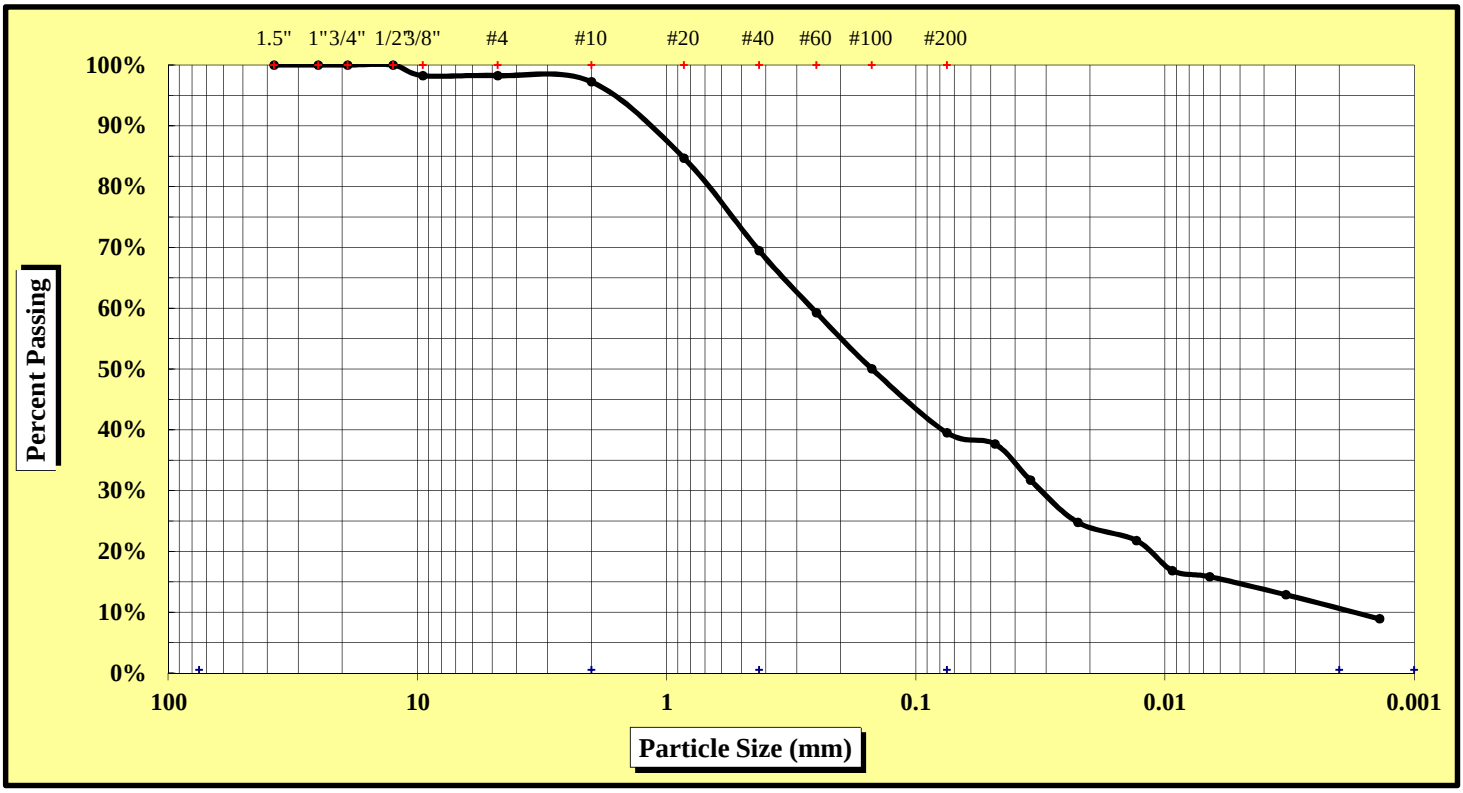
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-29	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	SC 51 323+61	Offset:	28' LT	Depth:	.5-2.0'
Sample Description:	White Brown Gray Silty Clayey Coarse to Fine Sand (SC-SM)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.8%	Coarse Sand	27.8%	Silt	29%
Maximum Particle Size	3/8"	Fine Sand	29.9%	Clay	11%
Specific Gravity (Assumed)	2.650	Moisture Content	11.3%	Silt & Clay (% Passing #200)	39.5%
Liquid Limit	23	Plastic Limit	16	Plastic Index	7

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

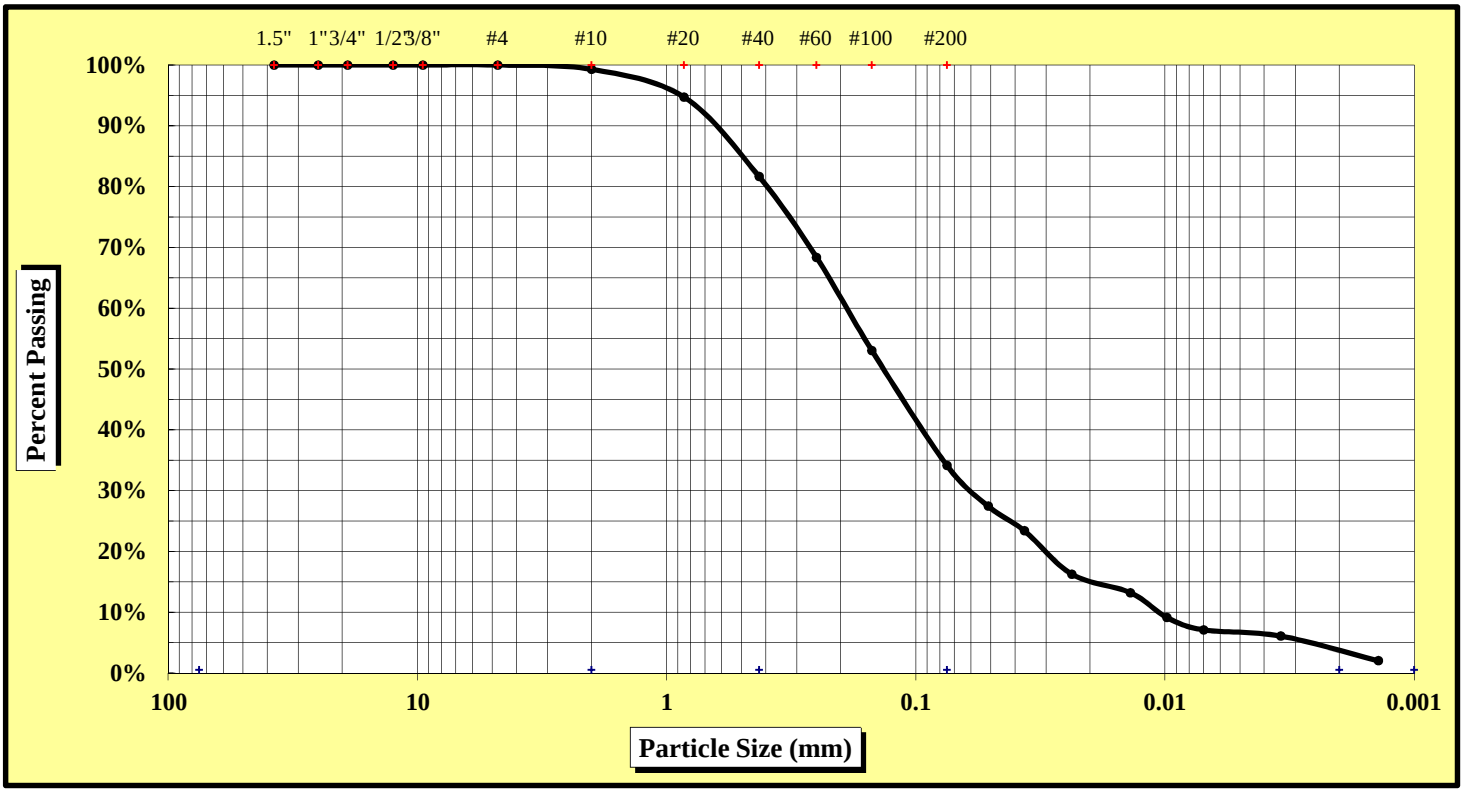
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-29	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	SC 51 323+61	Offset:	28' LT	Depth:	4.5-6'
Sample Description:	Black Gray Silty Coarse to Fine Sand (SM)				A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.7%	Coarse Sand	17.7%	Silt	30%
Maximum Particle Size	#10	Fine Sand	47.5%	Clay	4%
Specific Gravity (Assumed)	2.650	Moisture Content	14.2%	Silt & Clay (% Passing #200)	34.1%
Liquid Limit	26	Plastic Limit	24	Plastic Index	2

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

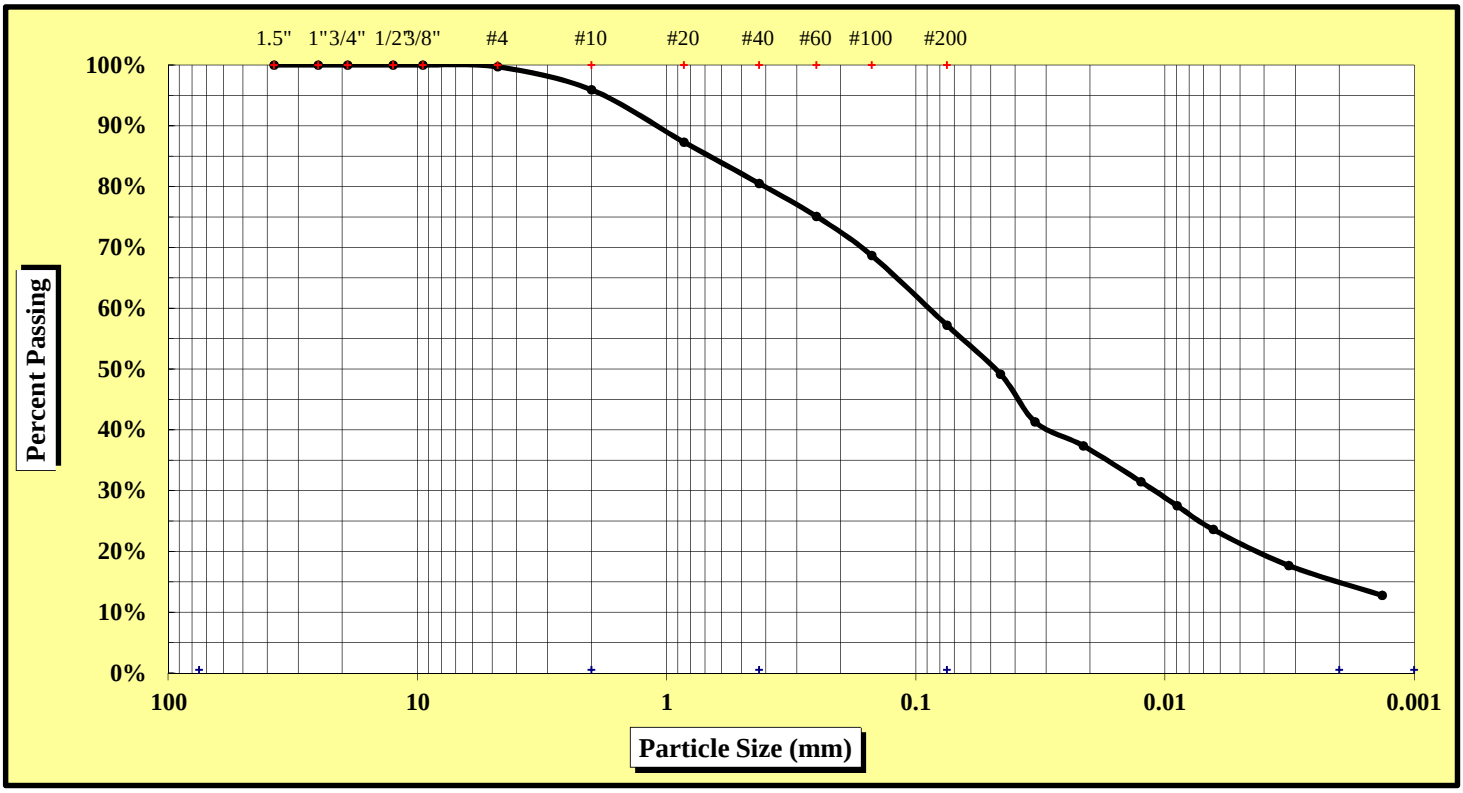
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-30	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station	SC 51 328+65	Offset:	28' LT	Depth:	1-10'
Sample Description:	Gray Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	4.1%	Coarse Sand	15.4%	Silt	42%
Maximum Particle Size	#4	Fine Sand	23.3%	Clay	15%
Specific Gravity (Assumed)	2.650	Moisture Content	14.6%	Silt & Clay (% Passing #200)	57.2%
Liquid Limit	34	Plastic Limit	16	Plastic Index	18

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

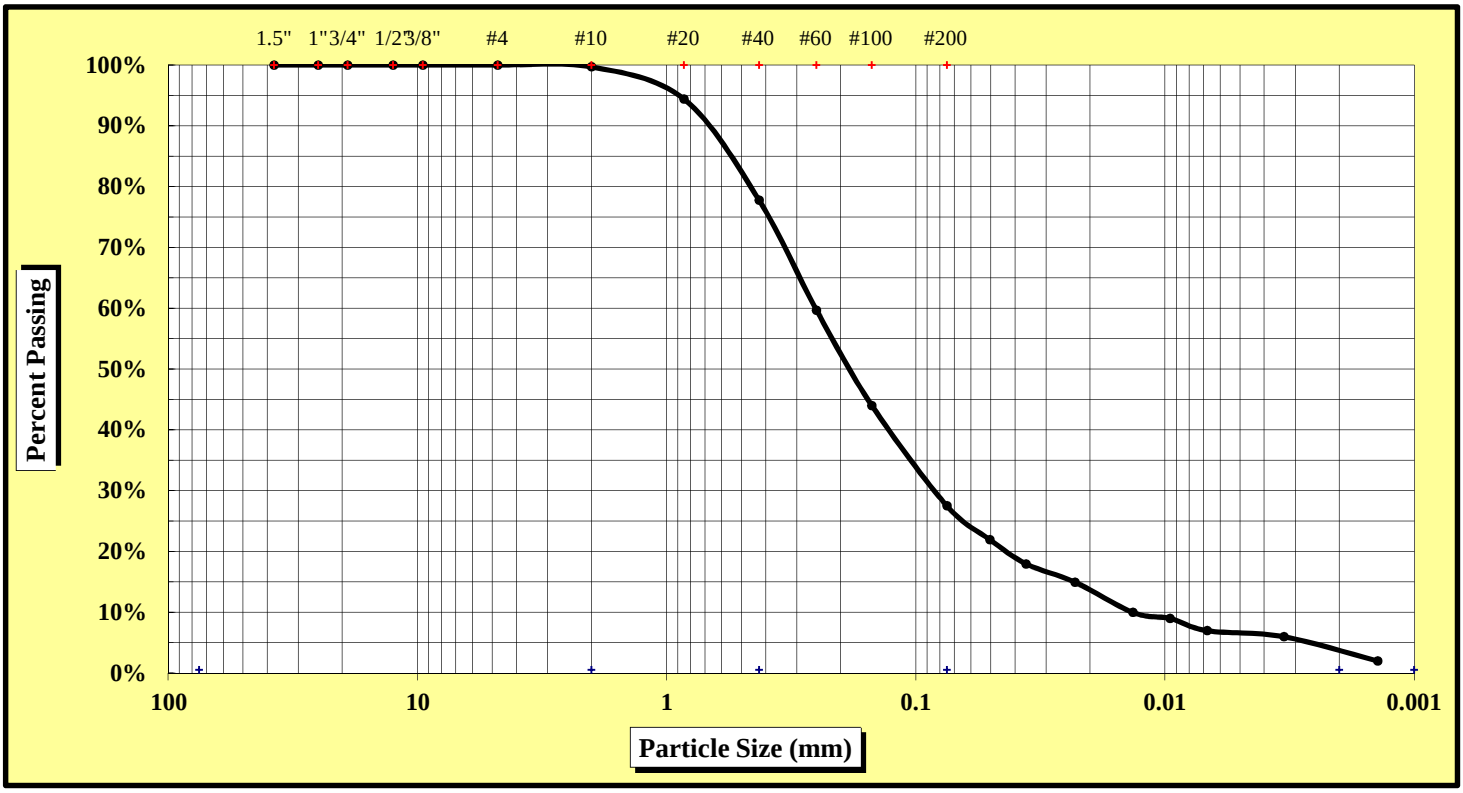
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-31	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	SC 51 333+61	Offset:	26' LT	Depth:	8.5-10'
Sample Description:	Gray Brown Silty Coarse to Fine Sand (SM)				A-2-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.3%	Coarse Sand	21.9%	Silt	24%
Maximum Particle Size	#10	Fine Sand	50.3%	Clay	4%
Specific Gravity (Assumed)	2.650	Moisture Content	7.4%	Silt & Clay (% Passing #200)	27.5%
Liquid Limit	0	Plastic Limit	0	Plastic Index	0

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

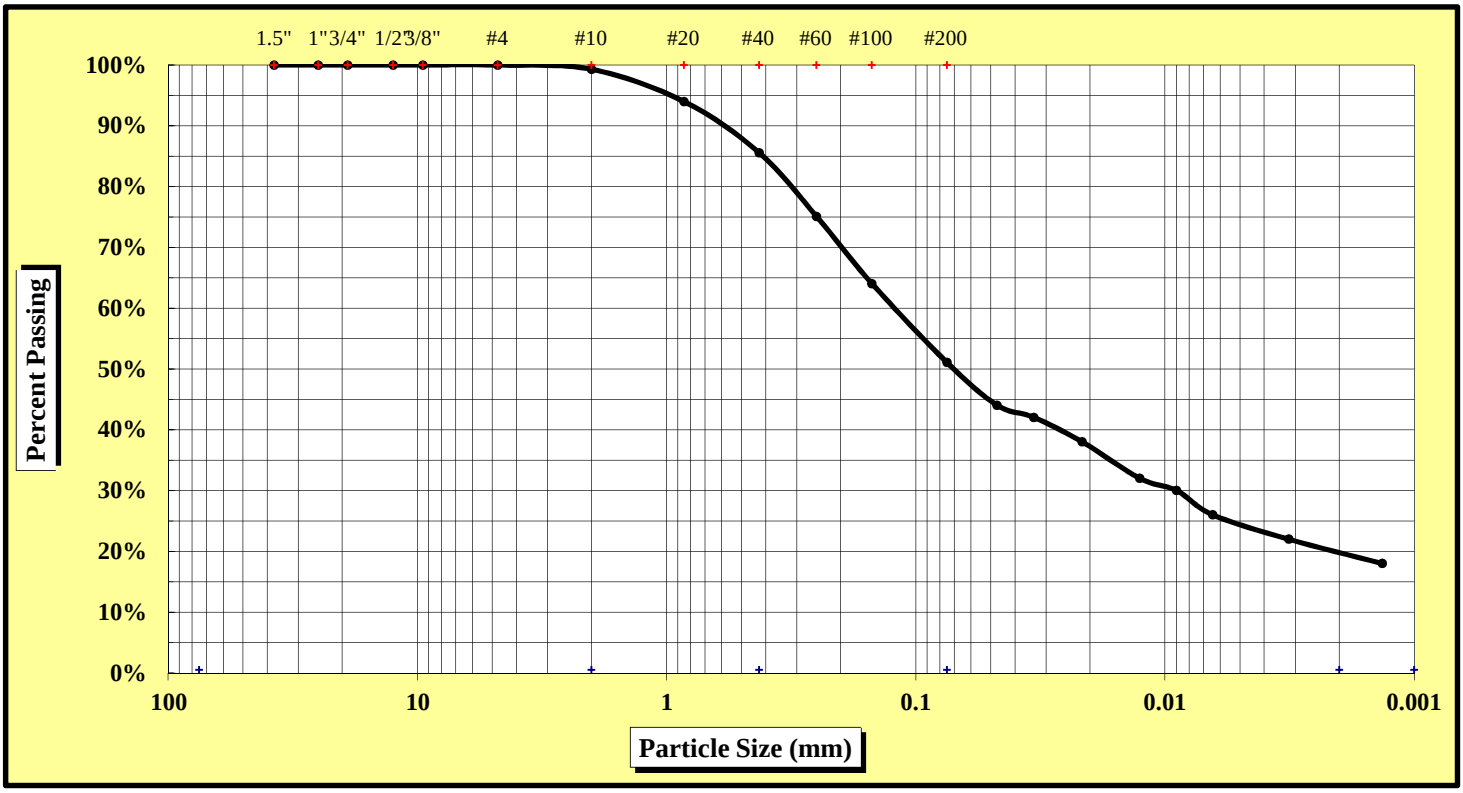
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	7/27/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	R-32	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station	SC 51 338+56	Offset:	30' LT	Depth:	1-10'
Sample Description:	Tan Brown Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.7%	Coarse Sand	13.7%	Silt	31%
Maximum Particle Size	#10	Fine Sand	34.5%	Clay	20%
Specific Gravity (Assumed)	2.650	Moisture Content	13.0%	Silt & Clay (% Passing #200)	51.1%
Liquid Limit	30	Plastic Limit	14	Plastic Index	16

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Position*

Sieve Analysis of Soils

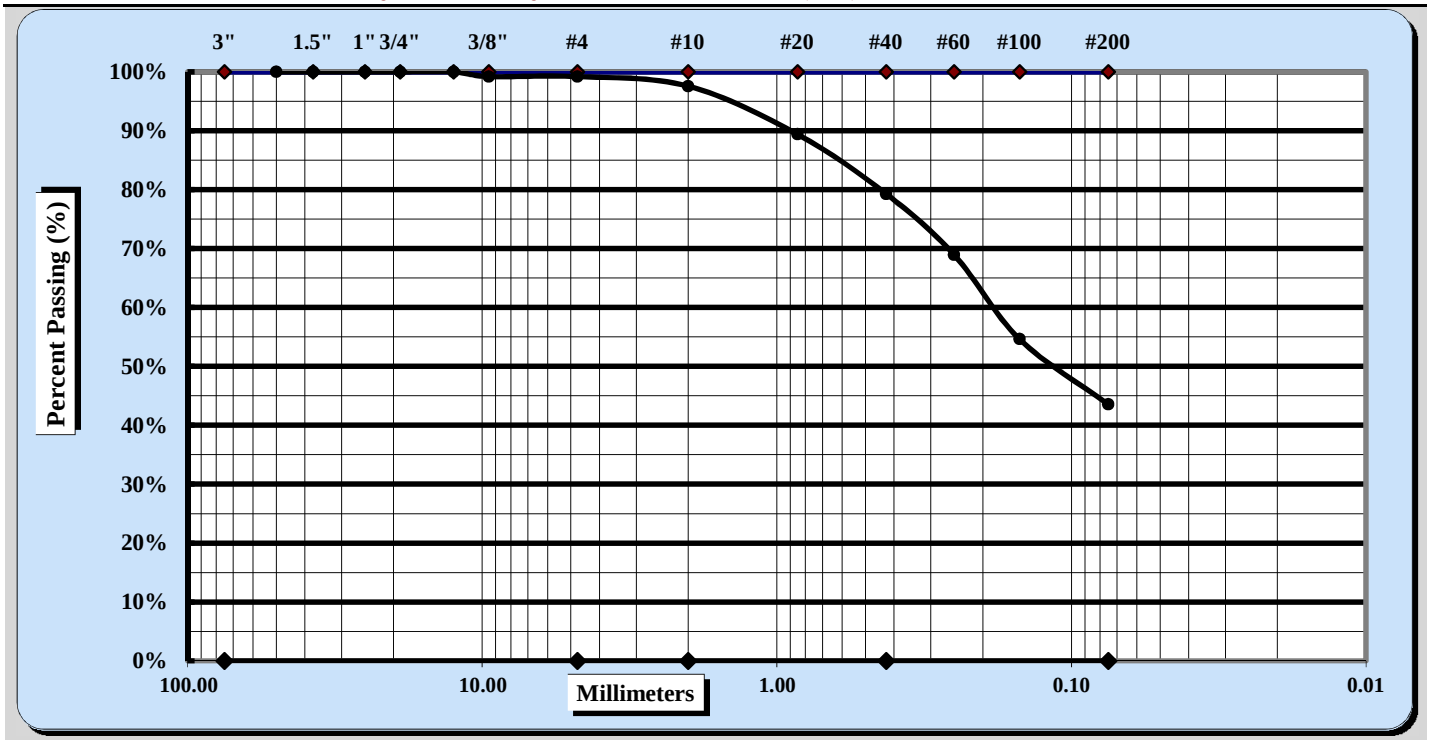
ASTM D 422

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard~Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	2/1/16
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	1/19-2/1/16
Client Name:	STV		
Client Address:	NA		
Sample ID:	R-33	Type: Undisturbed	Sample Date: 2014/2015
Location:	NA	Sample: UD-1	Elevation: 23.5-25.8'

Sample Description: Gray Brown Silty Coarse to Fine Sand (SM) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	1.6%	Fine Sand	35.7%
Gravel	0.8%	Medium Sand	18.3%	Silt & Clay	43.6%
Liquid Limit	20	Plastic Limit	18	Plastic Index	2
Specific Gravity	ND			Moisture Content	19.2%
Coarse Sand	1.6%	Medium Sand	18.3%	Fine Sand	35.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Technician Name: **Date:**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
Date

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Sieve Analysis of Soils

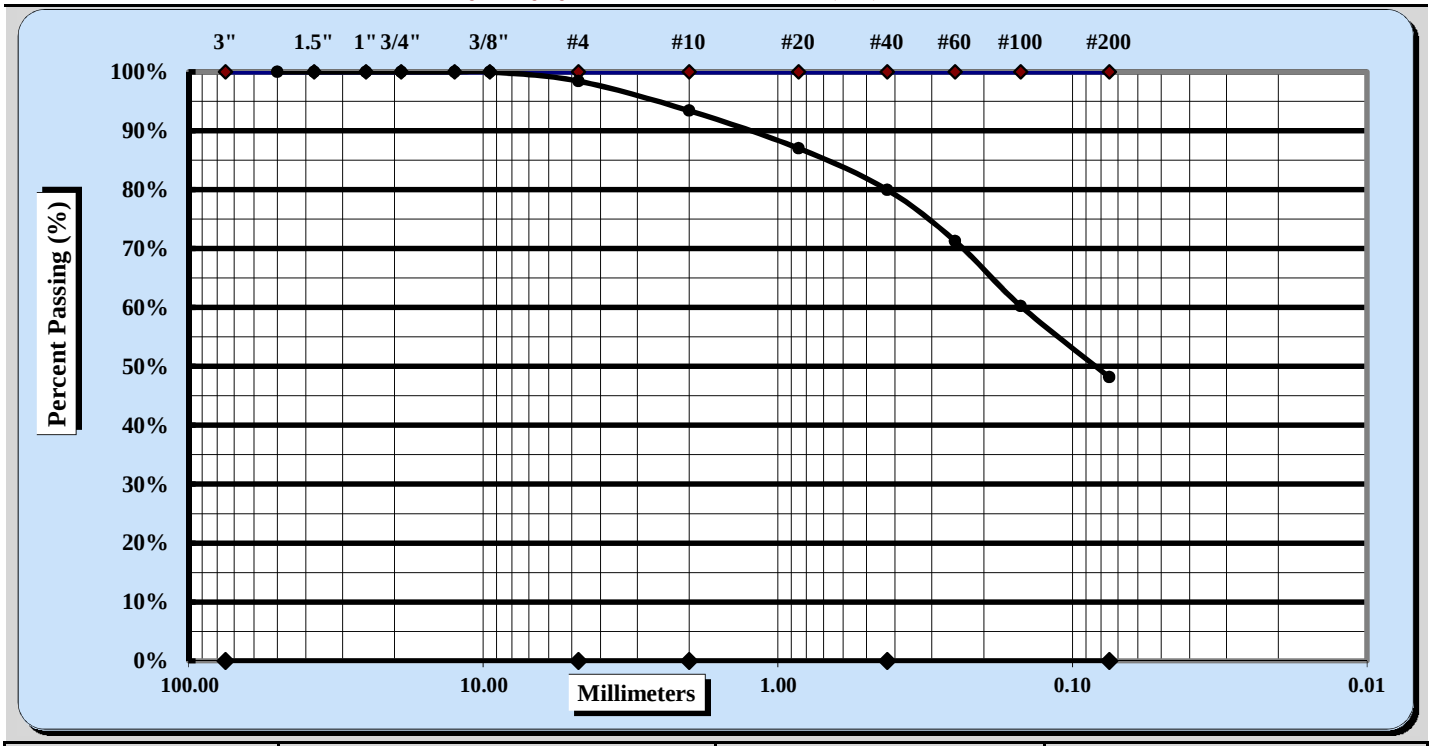
ASTM D 422

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard~Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	1/19/16
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	1/7-19/16
Client Name:	STV		
Client Address:	NA		
Sample ID:	R-34	Type: Split Spoon	Sample Date: 12/21/15
Location:	NA	Sample: SS-8	Elevation: 23.5-25'

Sample Description: Brown Gray Clayey Coarse to Fine Sand (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	5.0%	Fine Sand	31.8%
Gravel	1.6%	Medium Sand	13.4%	Silt & Clay	48.2%
Liquid Limit	31	Plastic Limit	17	Plastic Index	14
Specific Gravity	ND			Moisture Content	18.3%
Coarse Sand	5.0%	Medium Sand	13.4%	Fine Sand	31.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Technician Name: **Date:**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
Date

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Sieve Analysis of Soils

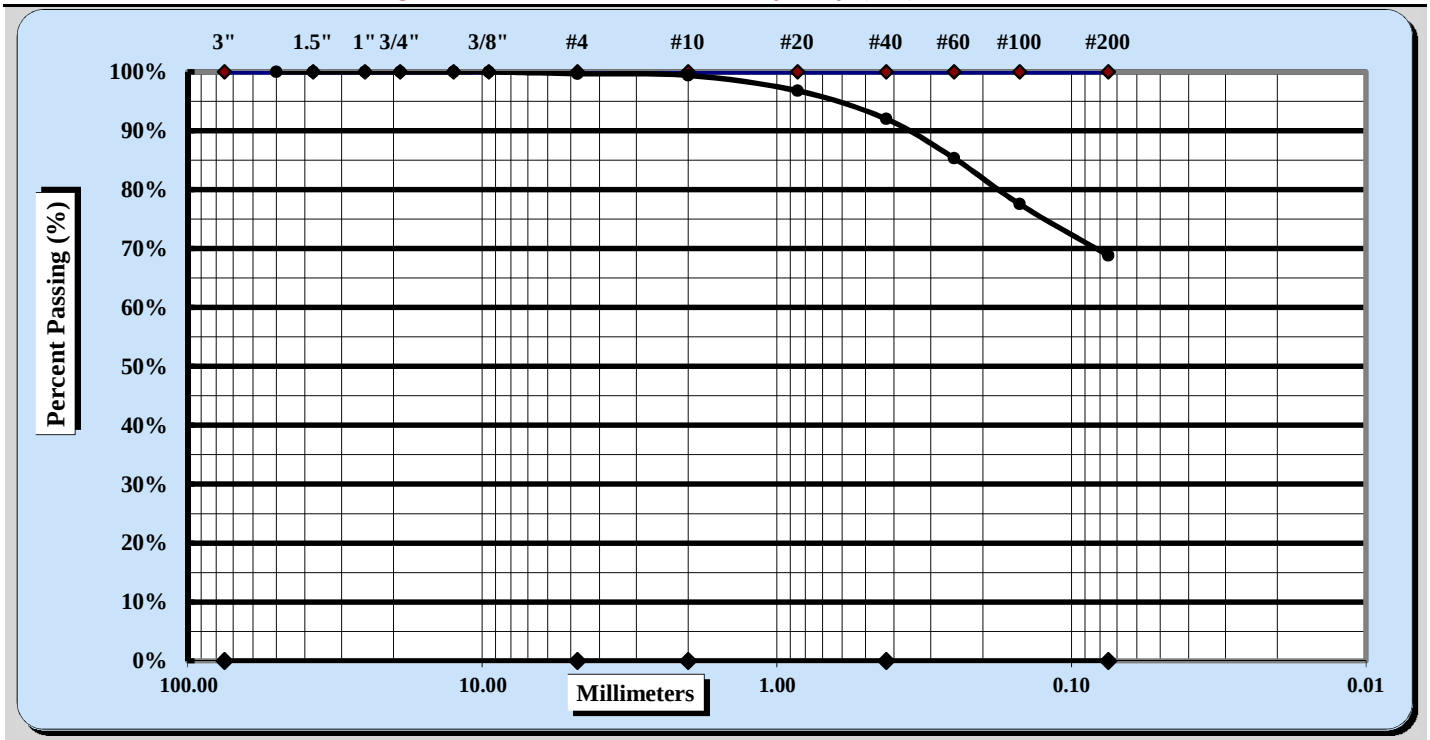
ASTM D 422

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard~Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	1/19/16
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	1/7-19/16
Client Name:	STV		
Client Address:	NA		
Sample ID:	R-35	Type: Split Spoon	Sample Date: 12/21/15
Location:	NA	Sample: SS-7	Elevation: 18.5-20'

Sample Description: Orange Brown Medium to Fine Sandy Clay (CH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.3%	Fine Sand	23.2%
Gravel	0.3%	Medium Sand	7.4%	Silt & Clay	68.8%
Liquid Limit	62	Plastic Limit	30	Plastic Index	32
Specific Gravity	ND			Moisture Content	29.3%
Coarse Sand	0.3%	Medium Sand	7.4%	Fine Sand	23.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Technician Name: **Date:**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
Date

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Sieve Analysis of Soils

ASTM D 422

Quality Assurance

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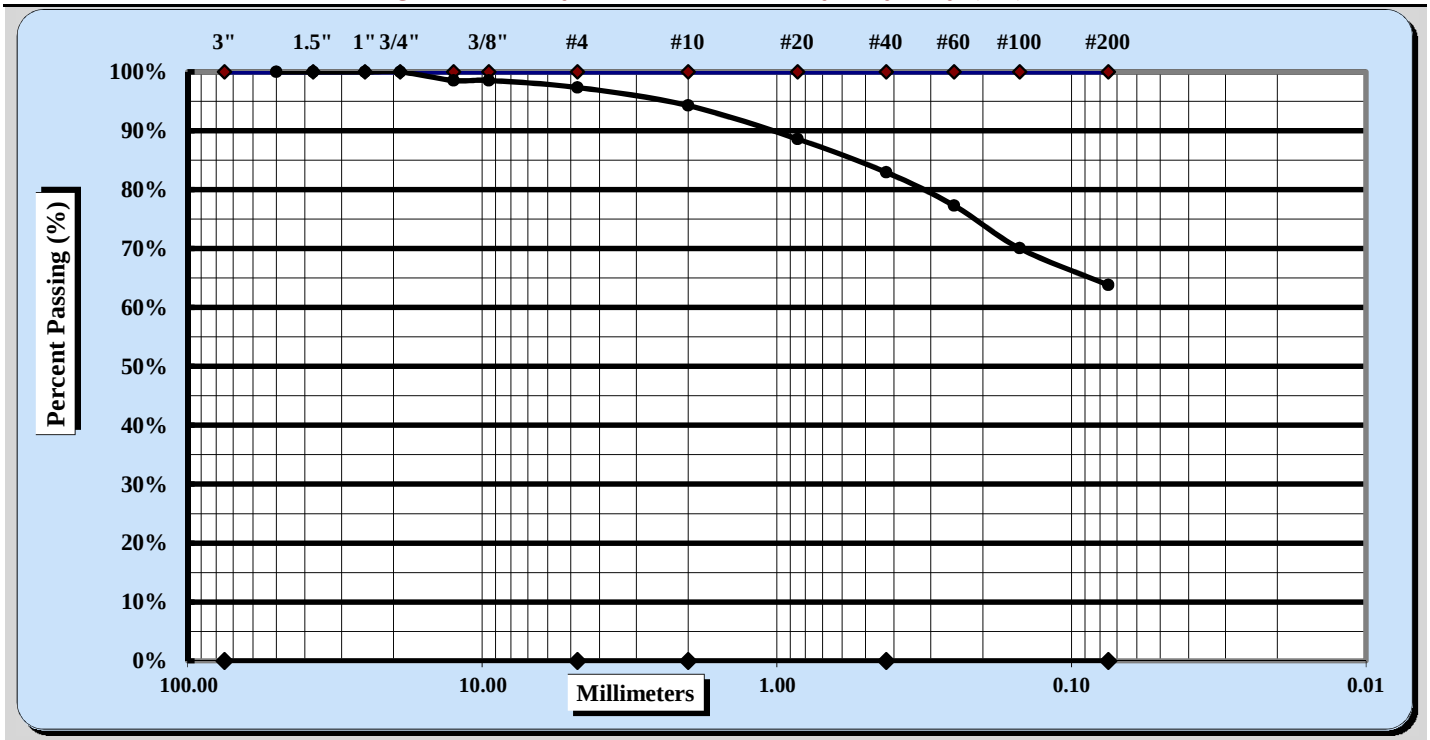
Project #:	**1351-12-037 (01)**	Report Date:	2/1/16
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	1/19-2/1/16
Client Name:	STV		
Client Address:	NA		
Sample ID:	R-37	Type: Undisturbed	Sample Date: 2014/2015
Location:	NA	Sample: UD-1	Elevation: 13.5-15'

Sample Description: Orange Brown Gray Coarse to Fine Sandy Silty Clay (CL) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1/2"	Coarse Sand	3.1%	Fine Sand	19.1%
Gravel	2.7%	Medium Sand	11.3%	Silt & Clay	63.8%
Liquid Limit	45	Plastic Limit	23	Plastic Index	22
Specific Gravity	ND			Moisture Content	18.1%
Coarse Sand	3.1%	Medium Sand	11.3%	Fine Sand	19.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☒

Notes / Deviations / References:

Technician Name: **Date:**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
Date

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Sieve Analysis of Soils

ASTM D 422

Quality Assurance

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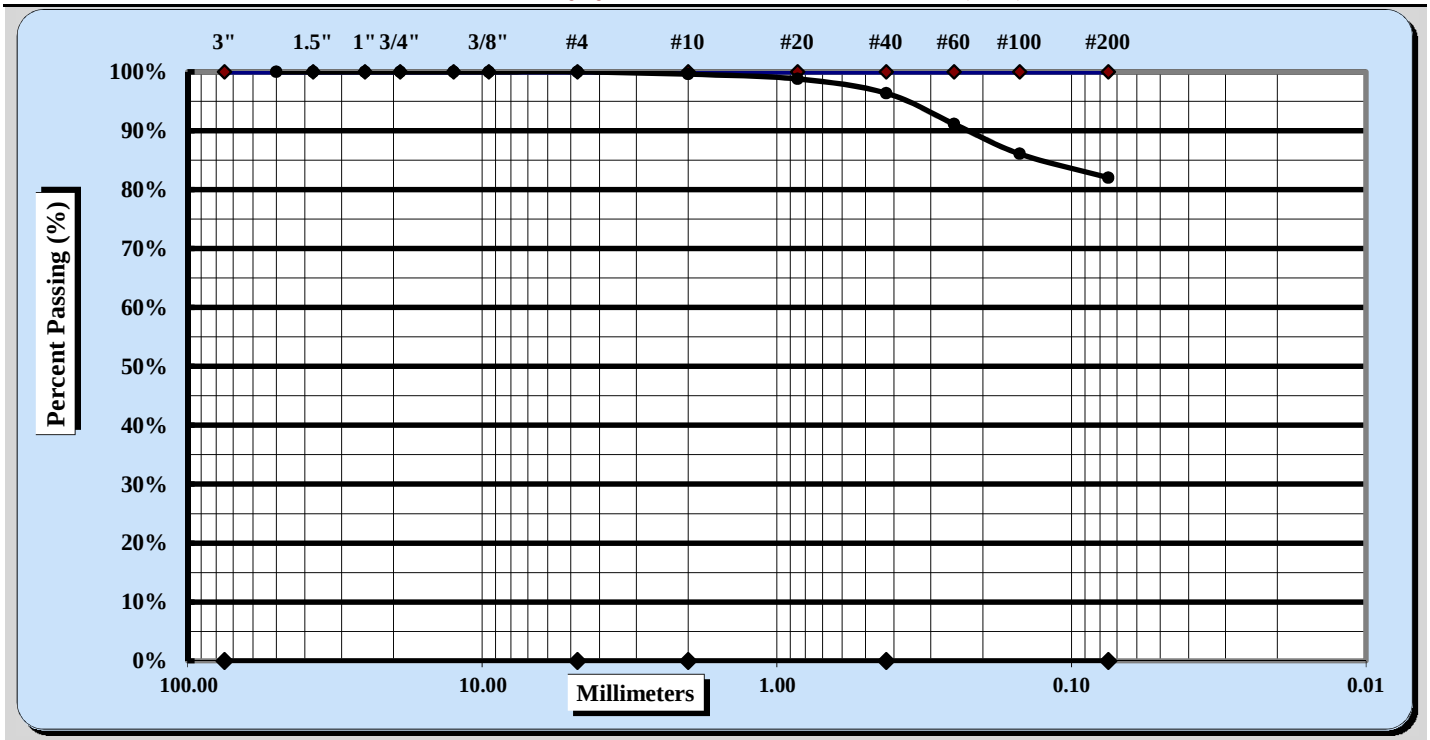
Project #:	**1351-12-037 (01)**	Report Date:	1/19/16
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	1/7-19/16
Client Name:	STV		
Client Address:	NA		
Sample ID:	R-38	Type: Split Spoon	Sample Date: 12/21/15
Location:	NA	Sample: SS-6	Elevation: 13.5-15'

Sample Description: Reddish Brown Clayey Silt w/Medium to Fine Sand (MH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.4%	Fine Sand	14.3%
Gravel	0.0%	Medium Sand	3.2%	Silt & Clay	82.0%
Liquid Limit	70	Plastic Limit	36	Plastic Index	34
Specific Gravity	ND			Moisture Content	39.4%
Coarse Sand	0.4%	Medium Sand	3.2%	Fine Sand	14.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Technician Name: **Date:**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
Date

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Sieve Analysis of Soils

ASTM D 422

Quality Assurance

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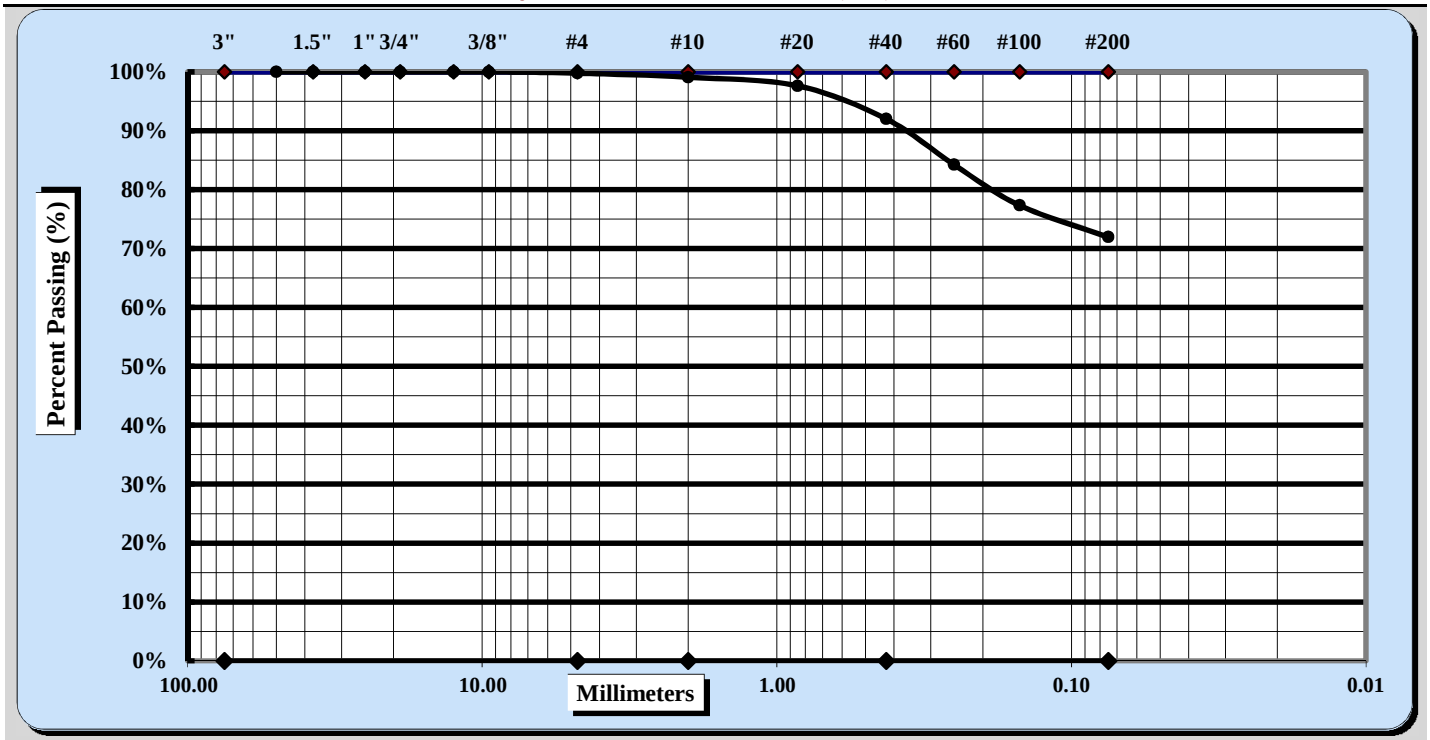
Project #:	**1351-12-037 (01)**	Report Date:	2/1/16
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	1/19-2/1/16
Client Name:	STV		
Client Address:	NA		
Sample ID:	R-41	Type: Undisturbed	Sample Date: 2014/2015
Location:	NA	Sample: UD-1	Elevation: 13.5-15'

Sample Description: Red Brown Clay w/Medium to Fine Sand (CH) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.7%	Fine Sand	20.1%
Gravel	0.2%	Medium Sand	7.1%	Silt & Clay	71.9%
Liquid Limit	67	Plastic Limit	25	Plastic Index	42
Specific Gravity	ND			Moisture Content	23.4%
Coarse Sand	0.7%	Medium Sand	7.1%	Fine Sand	20.1%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Technician Name: **Date:**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
Date

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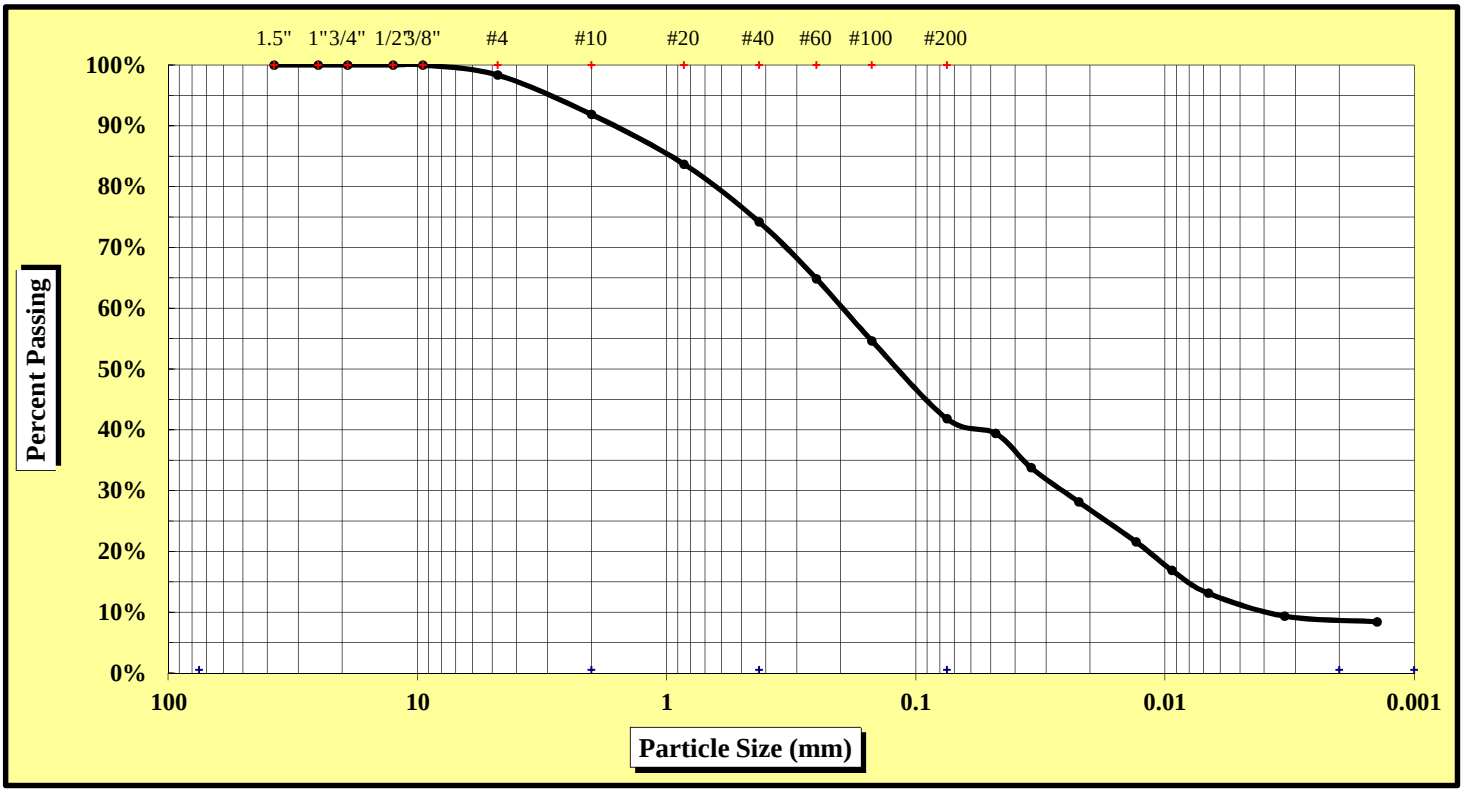
Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-1	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	US 21 23+00	Offset:	30' LT	Depth:	4.5-6'
Sample Description:	Orange Tan Brown Silty Coarse to Fine Sand (SM)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	8.1%	Coarse Sand	17.7%	Silt	33%
Maximum Particle Size	#4	Fine Sand	32.4%	Clay	9%
Specific Gravity (Assumed)	2.650	Moisture Content	20.4%	Silt & Clay (% Passing #200)	41.8%
Liquid Limit	36	Plastic Limit	29	Plastic Index	7

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

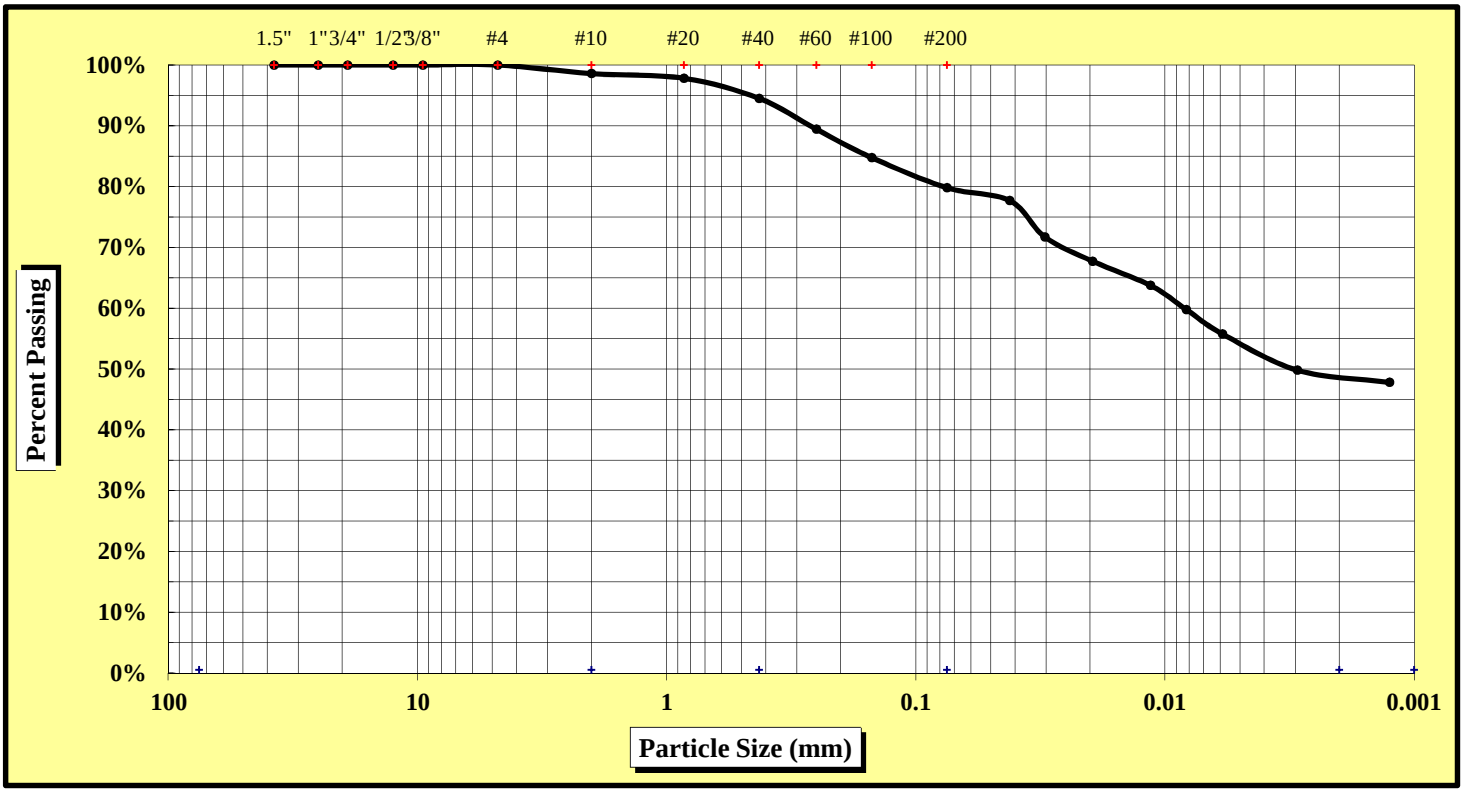
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-2	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	US 21 34+00	Offset:	27' RT	Depth:	1-2.5'
Sample Description:	Red Brown Clay w/Coarse to Fine Sand (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.4%	Coarse Sand	4.1%	Silt	31%
Maximum Particle Size	#10	Fine Sand	14.7%	Clay	49%
Specific Gravity (Assumed)	2.650	Moisture Content	32.0%	Silt & Clay (% Passing #200)	79.8%
Liquid Limit	67	Plastic Limit	28	Plastic Index	39

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

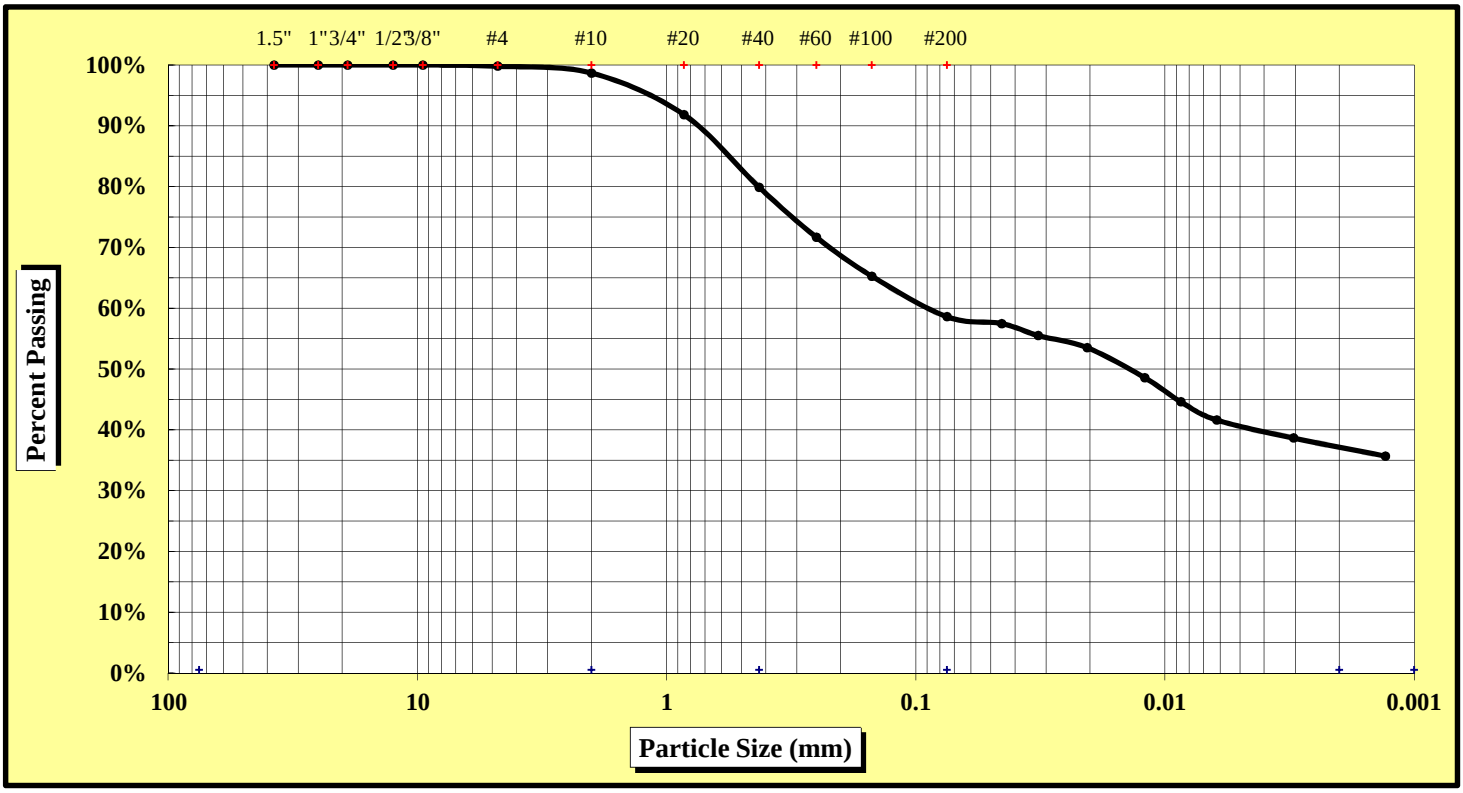
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-4	Sample #:	SS-2	Sample Date:	2014/2015
Route-Station	US 21 40+37	Offset:	30' LT	Depth:	2.5-4'
Sample Description:	Orange Brown Coarse to Fine Sandy Clay (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.3%	Coarse Sand	18.8%	Silt	22%
Maximum Particle Size	#4	Fine Sand	21.3%	Clay	37%
Specific Gravity (Assumed)	2.650	Moisture Content	21.1%	Silt & Clay (% Passing #200)	58.6%
Liquid Limit	53	Plastic Limit	25	Plastic Index	28

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

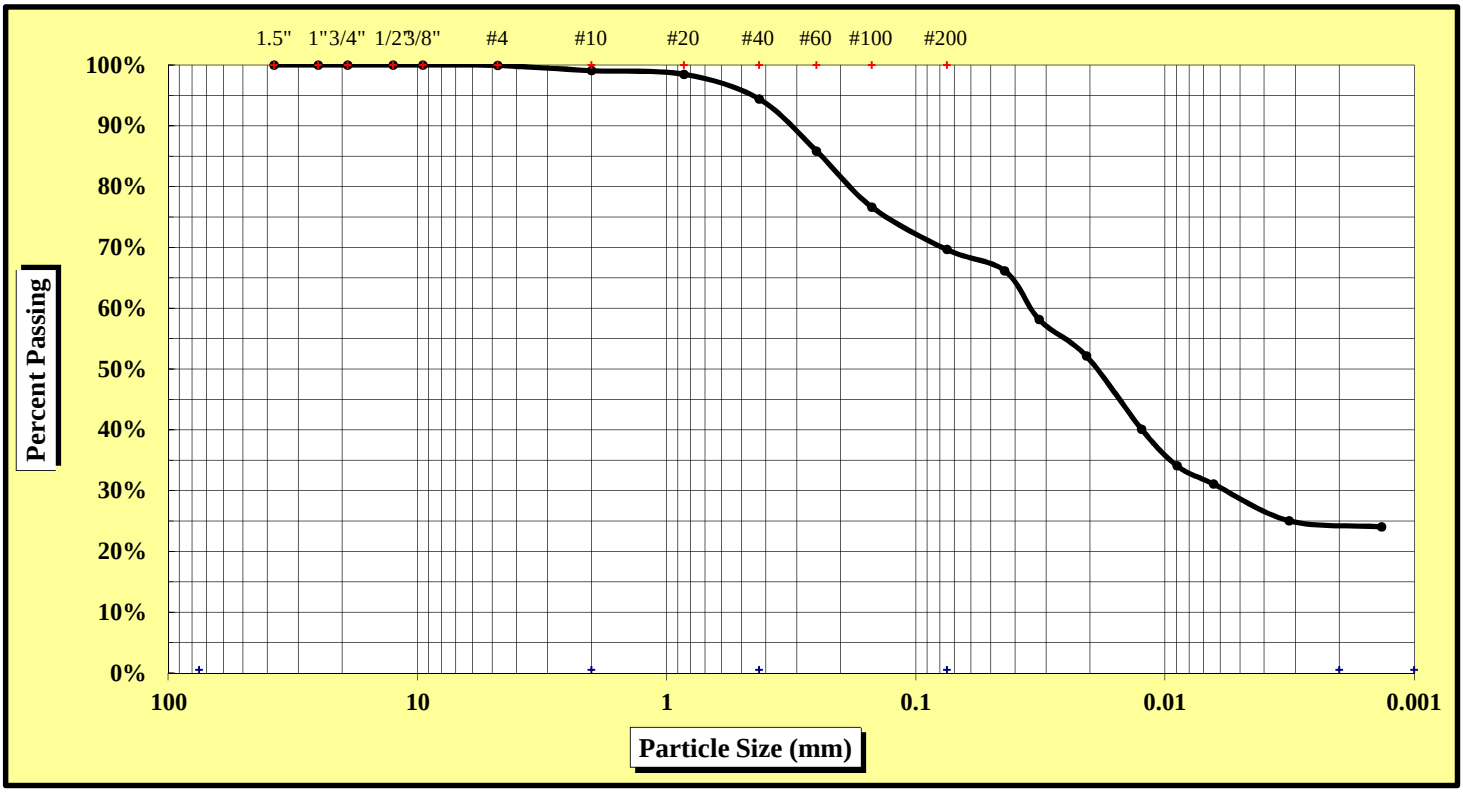
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-5	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	US 21 42+06	Offset:	29' RT	Depth:	7.5-10'
Sample Description:	Orange Brown Clayey Silt w/Coarse to Fine Sand (MH)				A-7-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.9%	Coarse Sand	4.7%	Silt	45%
Maximum Particle Size	0	Fine Sand	24.8%	Clay	25%
Specific Gravity (Assumed)	2.650	Moisture Content	38.7%	Silt & Clay (% Passing #200)	69.6%
Liquid Limit	50	Plastic Limit	32	Plastic Index	18

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

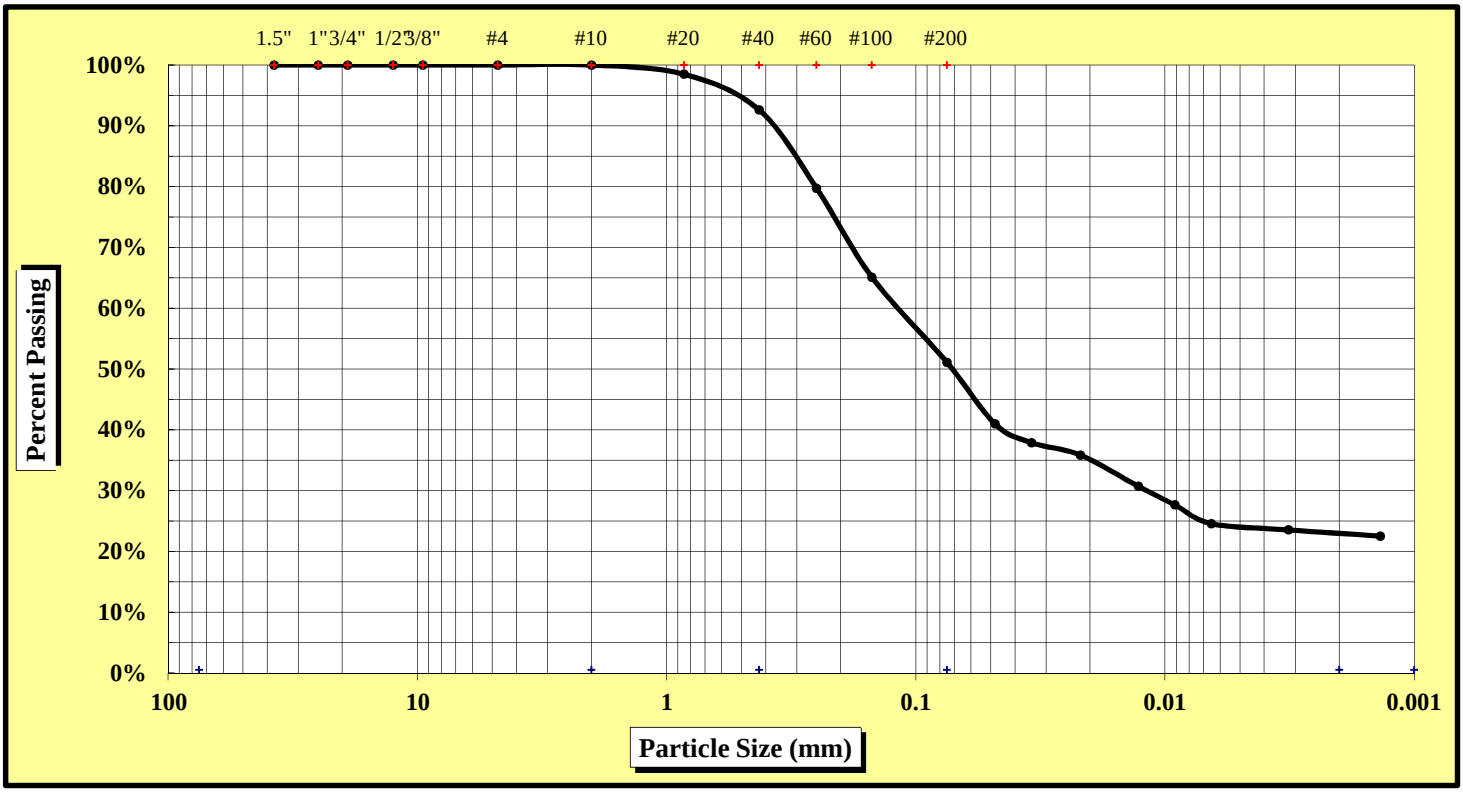
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-6	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	US 21 45+10	Offset:	31' LT	Depth:	4.5-6'
Sample Description:	Orange Tan Brown Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	7.4%	Silt	28%
Maximum Particle Size	#20	Fine Sand	41.5%	Clay	24%
Specific Gravity (Assumed)	2.650	Moisture Content	19.9%	Silt & Clay (% Passing #200)	51.1%
Liquid Limit	34	Plastic Limit	22	Plastic Index	12

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

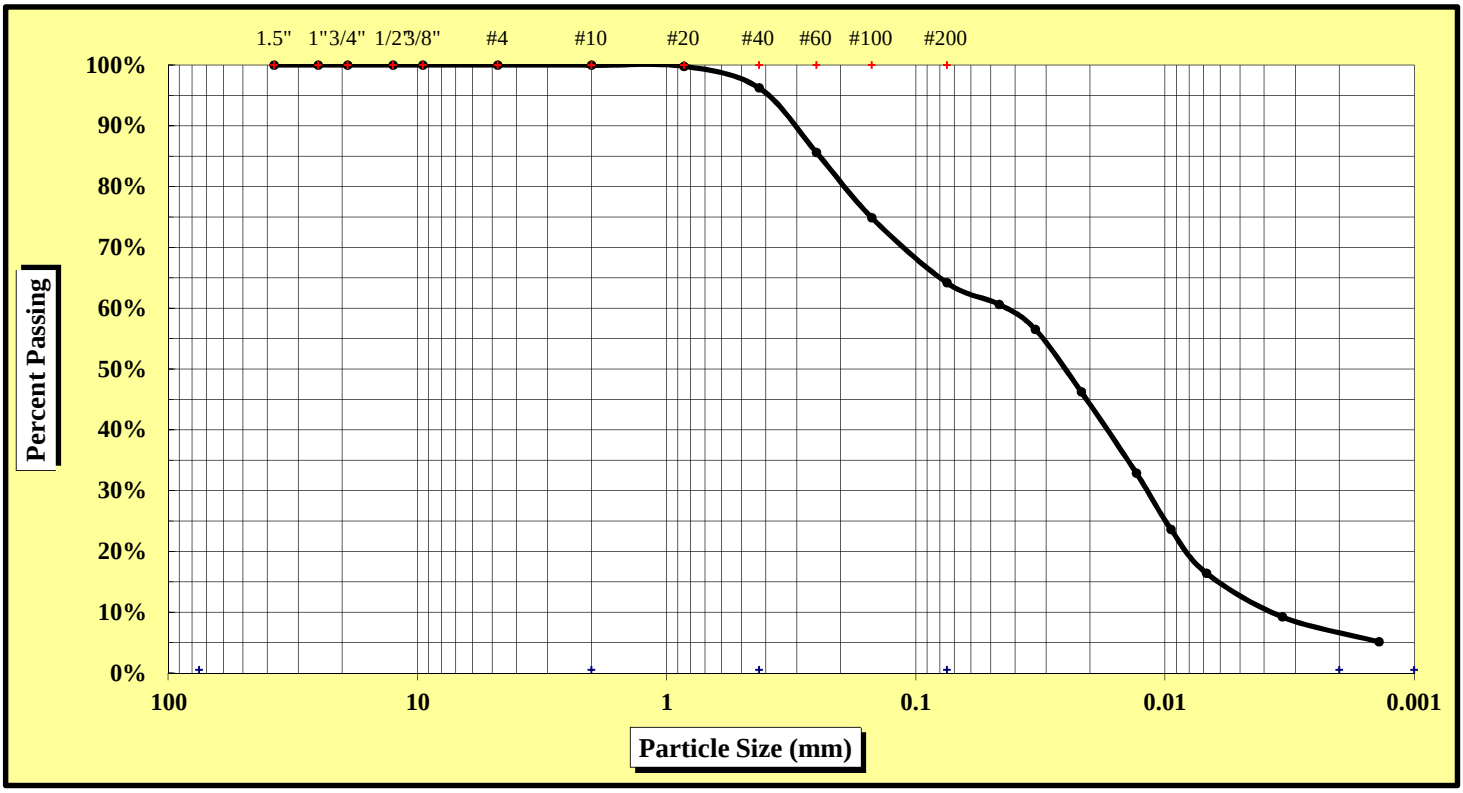
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-7	Sample #:	SS-2	Sample Date:	2014/2015
Route-Station	US 21 46+87	Offset:	32' LT	Depth:	2.5-4'
Sample Description:	Tan Brown Coarse to Fine Sandy Silt (ML)				A-5



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	3.7%	Silt	58%
Maximum Particle Size	#10	Fine Sand	32.1%	Clay	7%
Specific Gravity (Assumed)	2.650	Moisture Content	28.7%	Silt & Clay (% Passing #200)	64.2%
Liquid Limit	46	Plastic Limit	38	Plastic Index	8

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

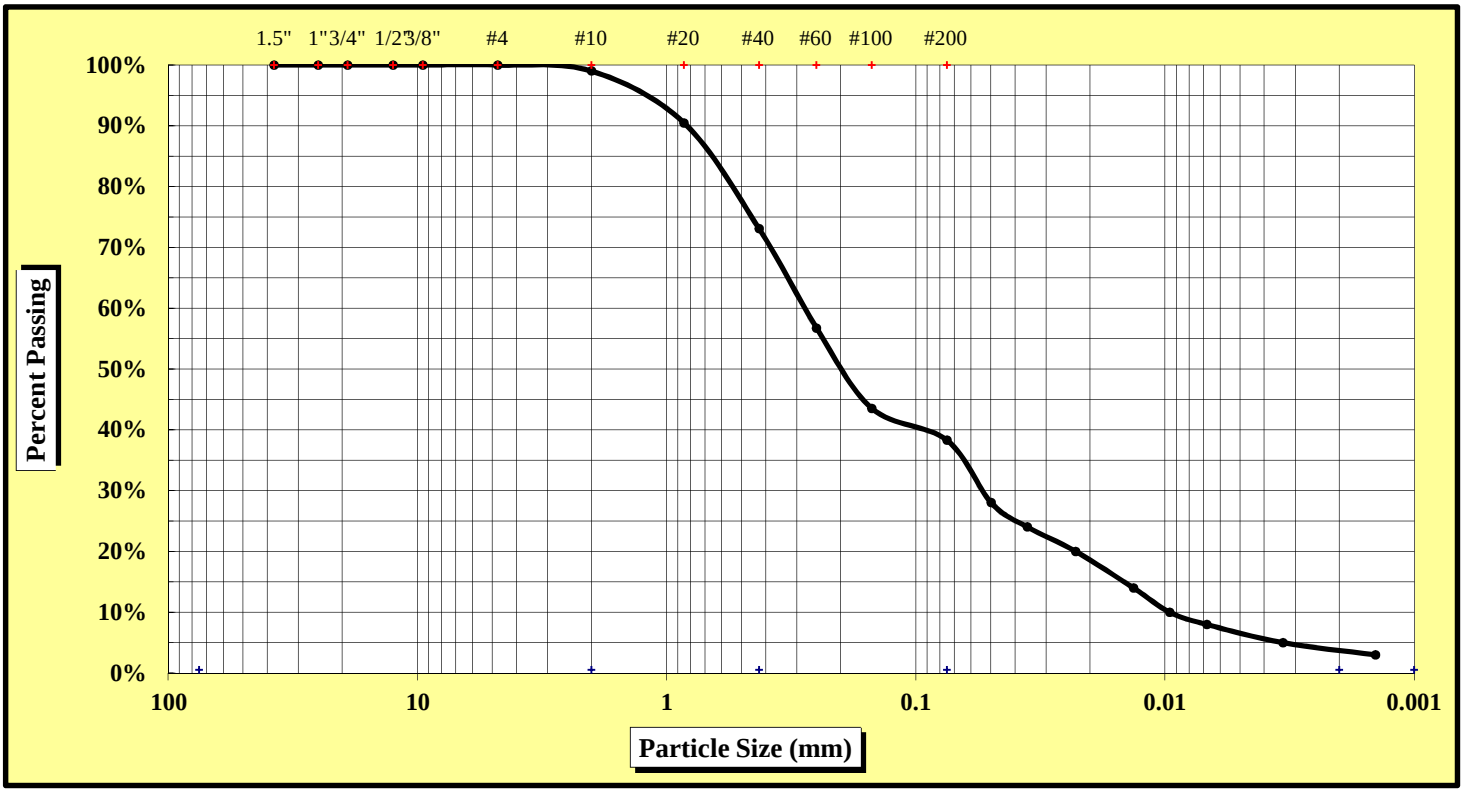
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-8	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station	US 21 49+12	Offset:	29' LT	Depth:	6.5-8'
Sample Description:	Black Gray Silty Coarse to Fine Sand (SM)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.0%	Coarse Sand	25.9%	Silt	34%
Maximum Particle Size	#10	Fine Sand	34.8%	Clay	4%
Specific Gravity (Assumed)	2.650	Moisture Content	11.5%	Silt & Clay (% Passing #200)	38.3%
Liquid Limit	28	Plastic Limit	26	Plastic Index	2

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

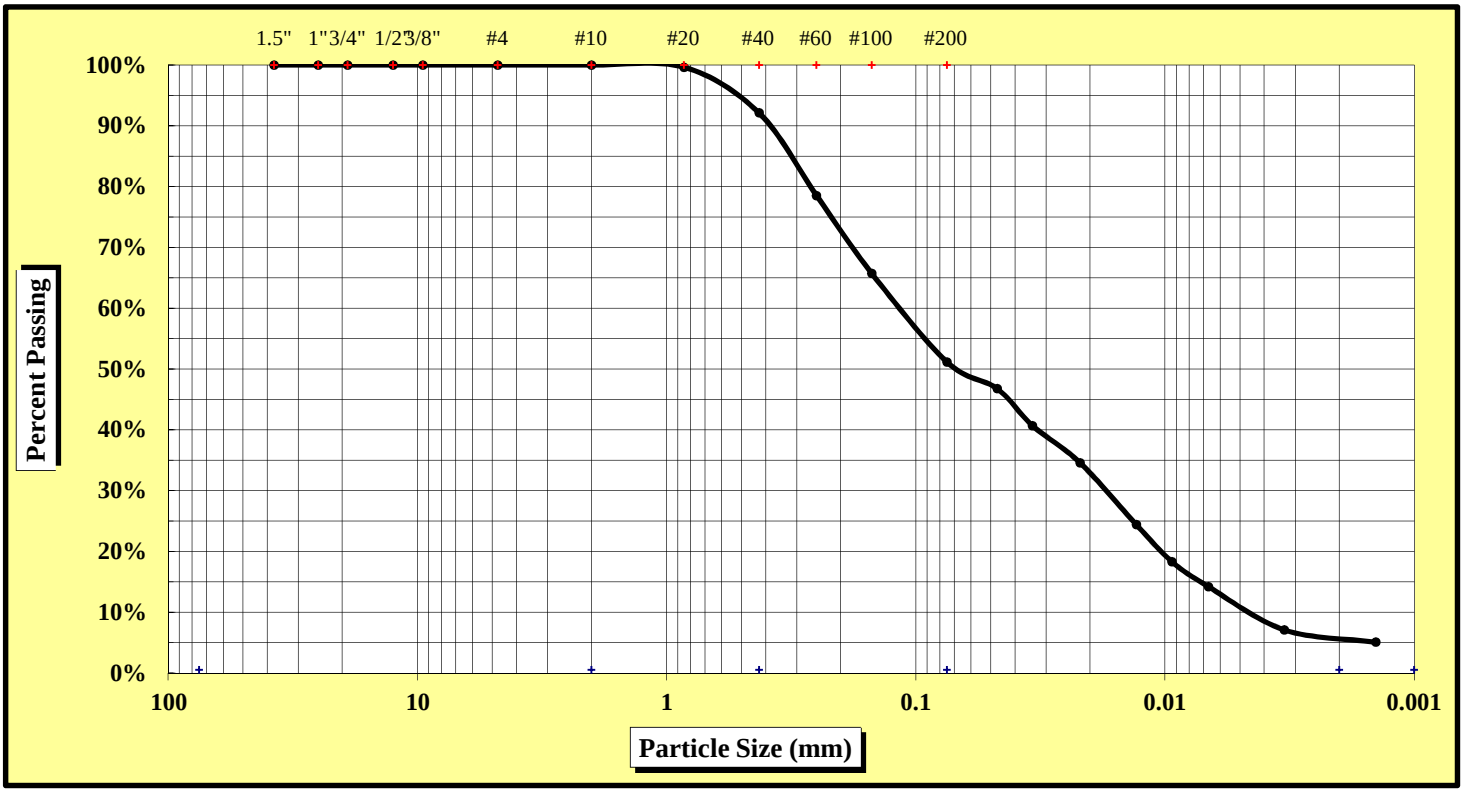
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-9	Sample #:	SS-5	Sample Date:	2014/2015
Route-Station	US 21 51+12	Offset:	31' LT	Depth:	8.5-10'
Sample Description:	White Gray Coarse to Fine Sandy Silt (ML)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.0%	Coarse Sand	7.9%	Silt	46%
Maximum Particle Size	#20	Fine Sand	40.9%	Clay	6%
Specific Gravity (Assumed)	2.650	Moisture Content	18.1%	Silt & Clay (% Passing #200)	51.2%
Liquid Limit	35	Plastic Limit	31	Plastic Index	4

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

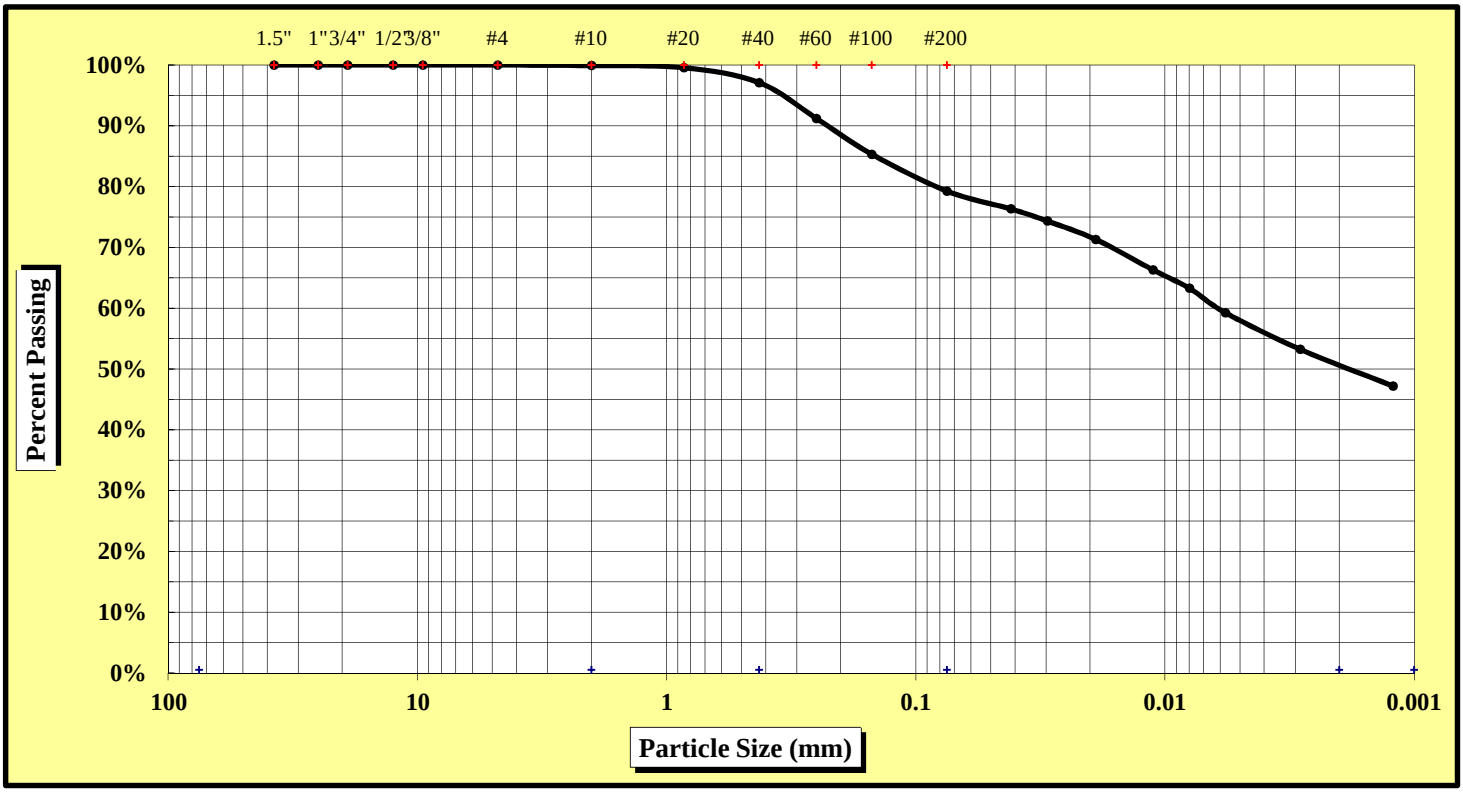
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-10	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	US 21 53+11	Offset:	30' LT	Depth:	1-2.5'
Sample Description:	Orange Red Brown Clay w/Coarse to Fine Sand (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.1%	Coarse Sand	2.8%	Silt	28%
Maximum Particle Size	#10	Fine Sand	17.8%	Clay	51%
Specific Gravity (Assumed)	2.650	Moisture Content	25.1%	Silt & Clay (% Passing #200)	79.3%
Liquid Limit	62	Plastic Limit	27	Plastic Index	35

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

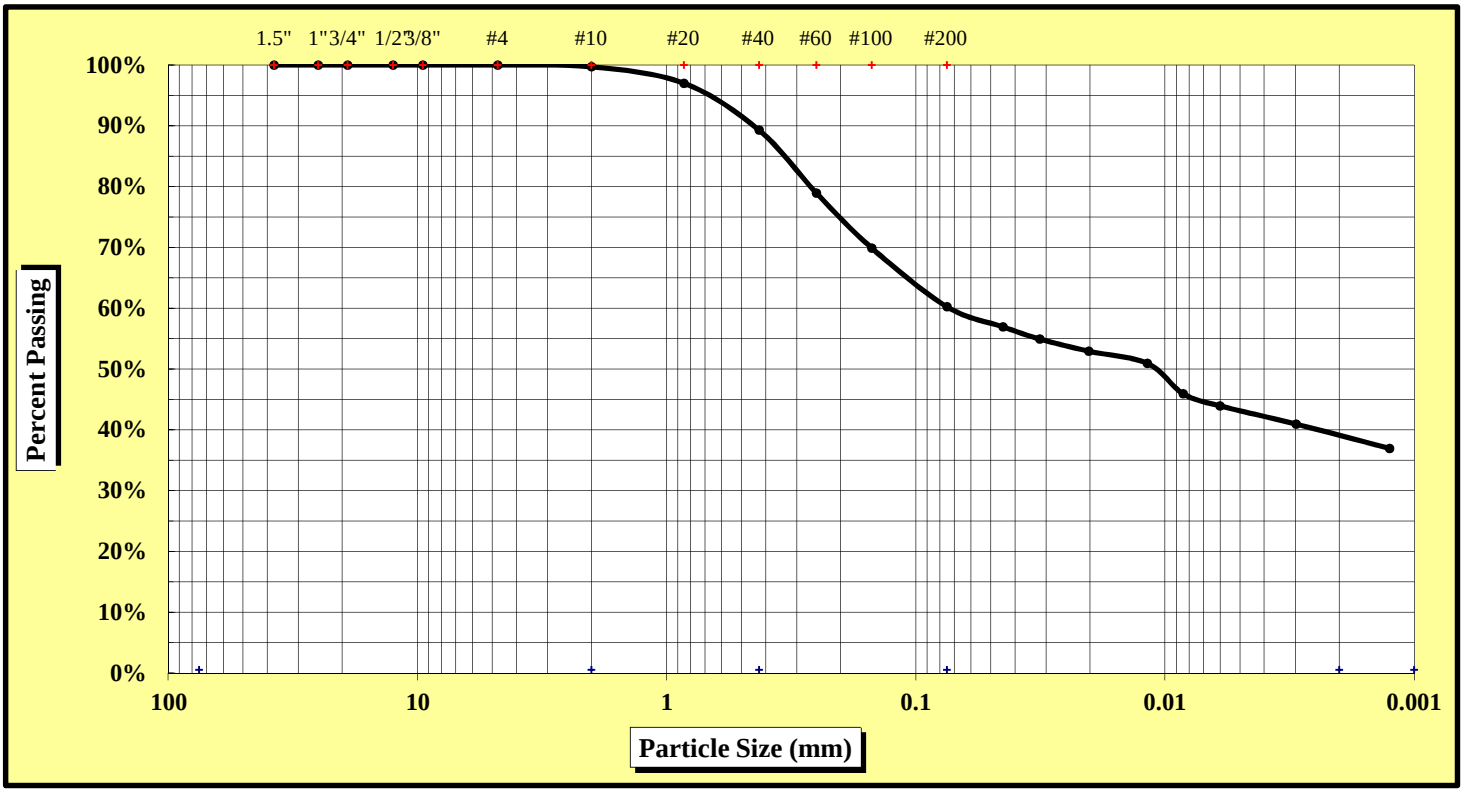
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	S-11	Sample #:	SS-4	Sample Date:	2014/2015
Route-Station	US 21 66+75	Offset:	32' LT	Depth:	6.5-8'
Sample Description:	Red Brown Coarse to Fine Sandy Clay (CH)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.3%	Coarse Sand	10.4%	Silt	21%
Maximum Particle Size	#10	Fine Sand	29.0%	Clay	40%
Specific Gravity (Assumed)	2.650	Moisture Content	16.1%	Silt & Clay (% Passing #200)	60.3%
Liquid Limit	51	Plastic Limit	19	Plastic Index	32

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test
AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils
AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

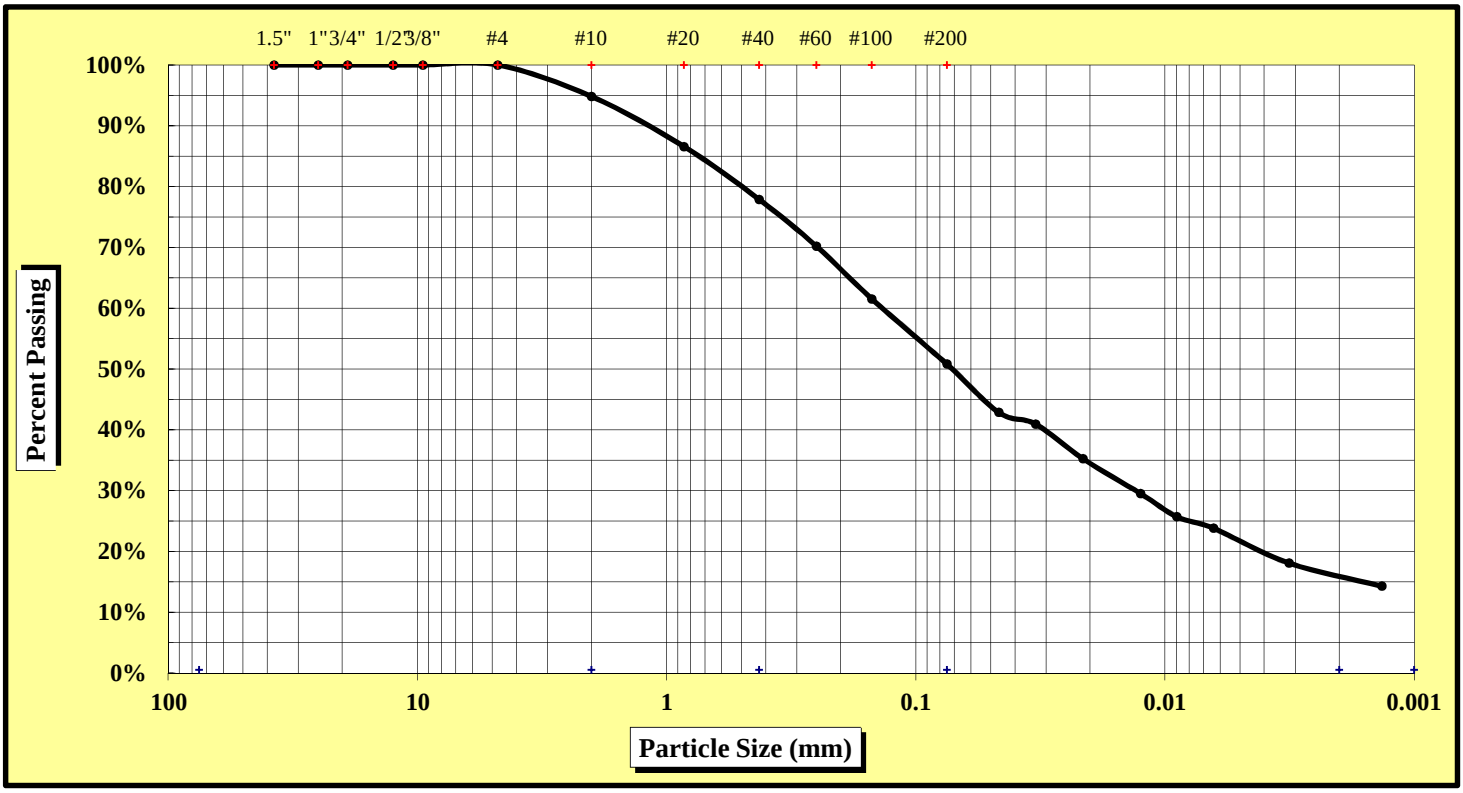
Technical Responsibility: Stewart Laney _____ Project Manager
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	HA-1	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	NA	Offset:	NA	Depth:	6'
Sample Description:	Grayish Brown Coarse to Fine Sandy Silty Clay (CL)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	5.2%	Coarse Sand	16.9%	Silt	35%
Maximum Particle Size	#10	Fine Sand	27.1%	Clay	16%
Specific Gravity (Assumed)	2.650	Moisture Content	23.5%	Silt & Clay (% Passing #200)	50.8%
Liquid Limit	26	Plastic Limit	16	Plastic Index	10

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

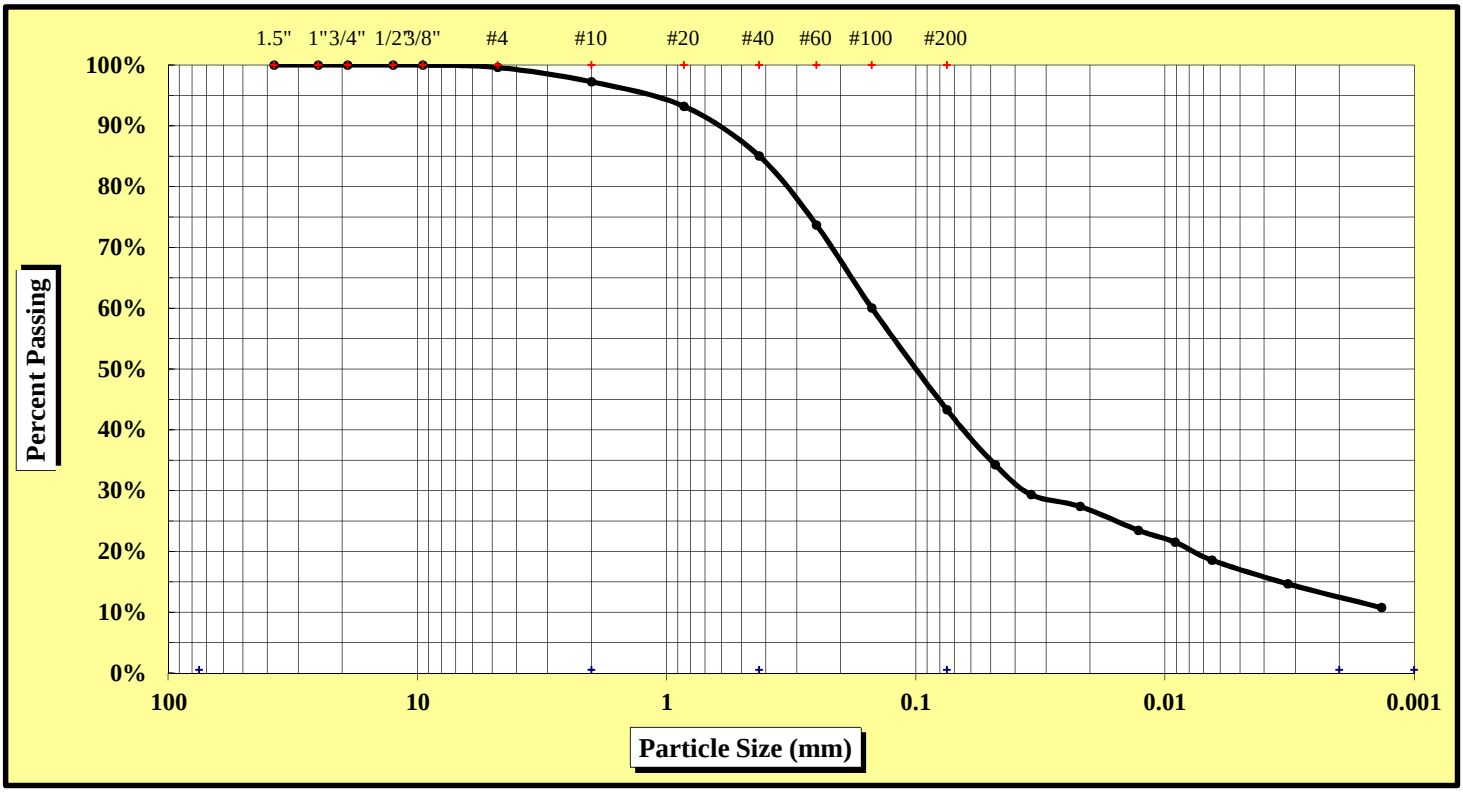
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	HA-2	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	NA	Offset:	NA	Depth:	4'
Sample Description:	Black Brown Silty Coarse to Fine Sand (SM)				A-4



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	2.8%	Coarse Sand	12.2%	Silt	31%
Maximum Particle Size	#4	Fine Sand	41.7%	Clay	13%
Specific Gravity (Assumed)	2.650	Moisture Content	62.1%	Silt & Clay (% Passing #200)	43.3%
Liquid Limit	36	Plastic Limit	30	Plastic Index	6

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

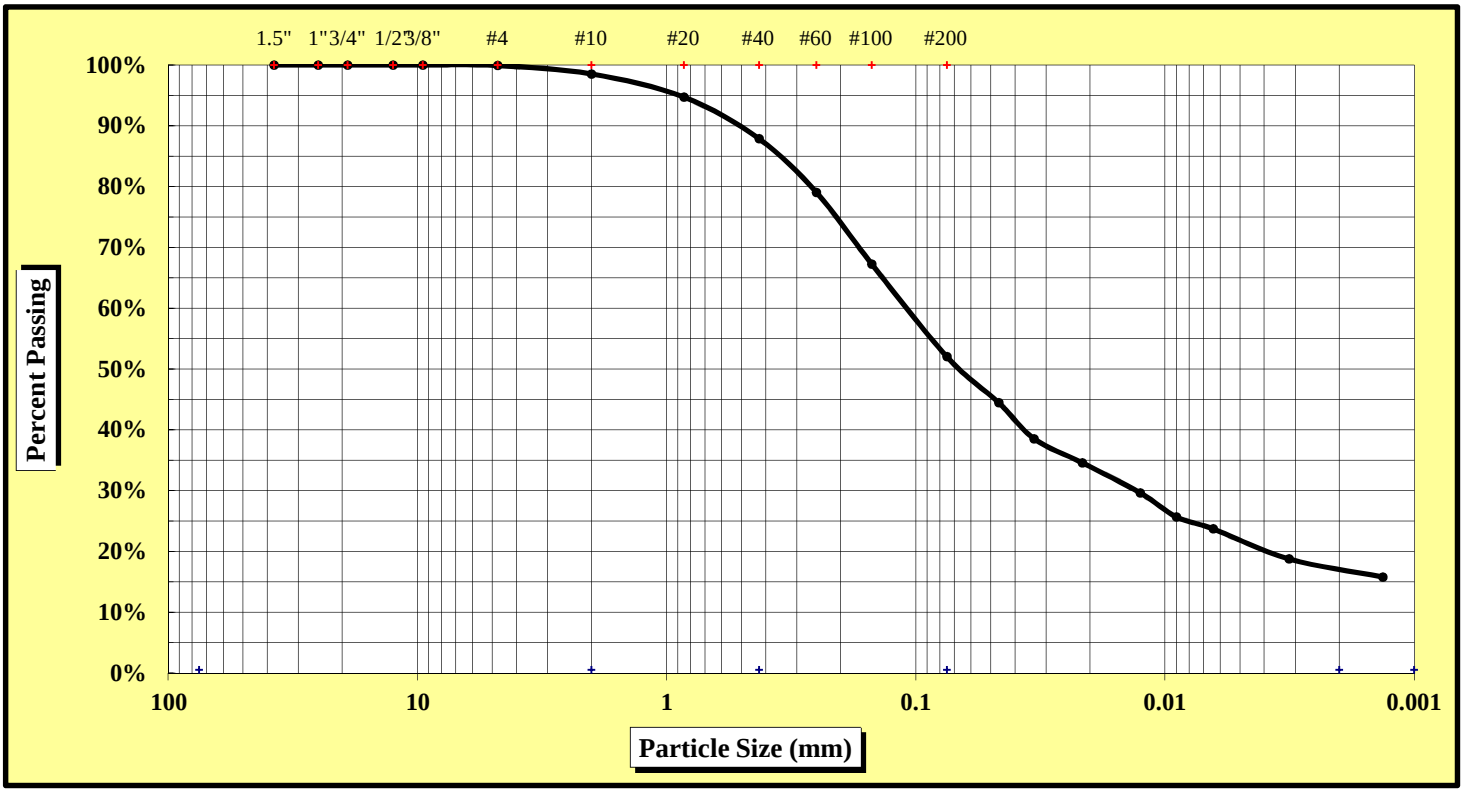
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	HA-3	Sample #:	SS-2	Sample Date:	2014/2015
Route-Station	NA	Offset:	NA	Depth:	6'
Sample Description:	Gray Coarse to Fine Sandy Silty Clay (CL)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.5%	Coarse Sand	10.7%	Silt	36%
Maximum Particle Size	#4	Fine Sand	35.8%	Clay	17%
Specific Gravity (Assumed)	2.650	Moisture Content	30.6%	Silt & Clay (% Passing #200)	52.0%
Liquid Limit	29	Plastic Limit	18	Plastic Index	11

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

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AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

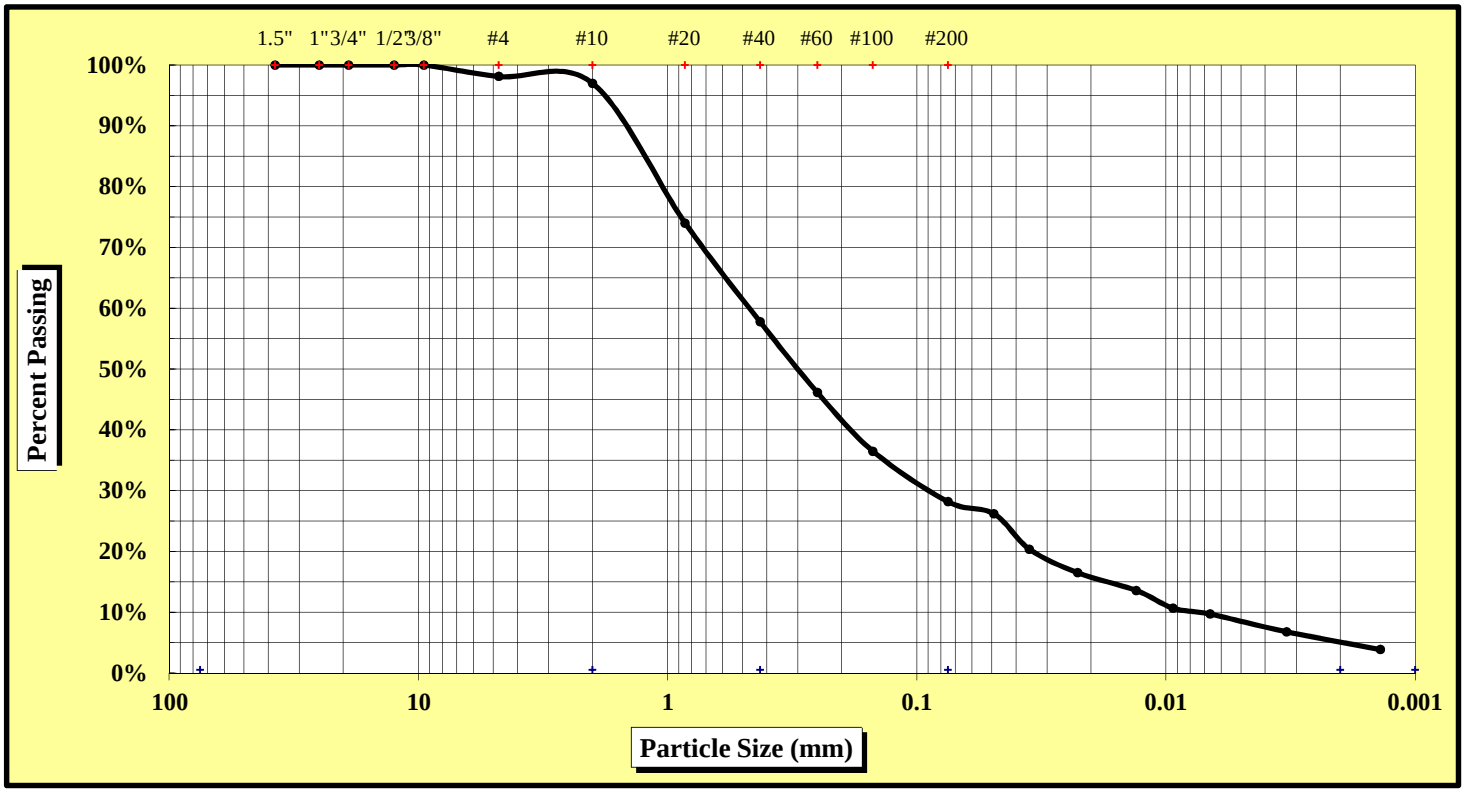
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	HA-4	Sample #:	SS-2	Sample Date:	2014/2015
Route-Station	NA	Offset:	NA	Depth:	6'
Sample Description:	Orange Brown Silty Fine to Coarse Sand (SM)				A-2-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	3.0%	Coarse Sand	39.2%	Silt	23%
Maximum Particle Size	#4	Fine Sand	29.6%	Clay	5%
Specific Gravity (Assumed)	2.650	Moisture Content	25.4%	Silt & Clay (% Passing #200)	28.2%
Liquid Limit	38	Plastic Limit	26	Plastic Index	12

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

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AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

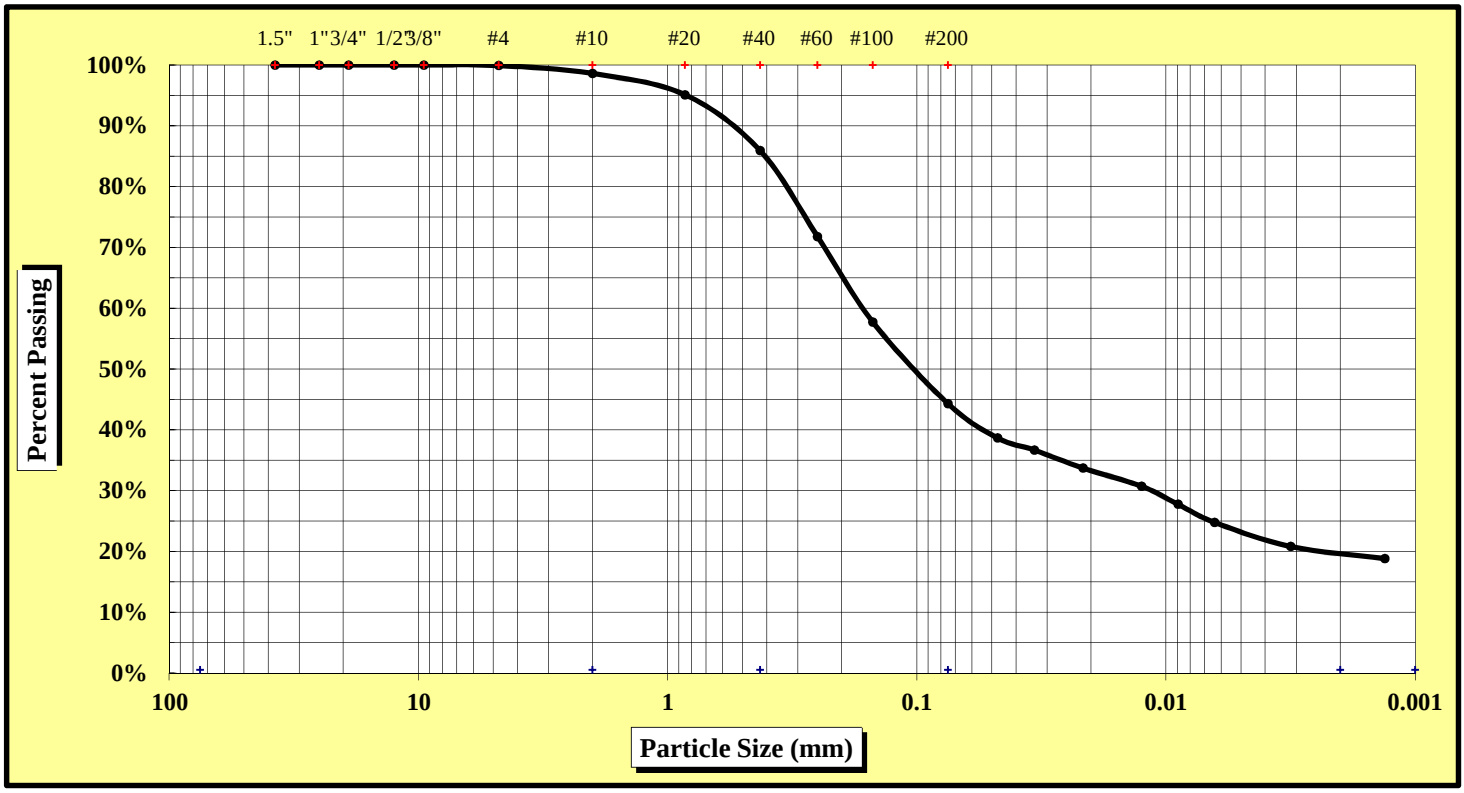
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	HA-5	Sample #:	SS-1	Sample Date:	2014/2015
Route-Station	NA	Offset:	NA	Depth:	2'
Sample Description:	Black Gray Clayey Coarse to Fine Sand (SC)				A-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	1.4%	Coarse Sand	12.7%	Silt	24%
Maximum Particle Size	#4	Fine Sand	41.6%	Clay	20%
Specific Gravity (Assumed)	2.650	Moisture Content	33.4%	Silt & Clay (% Passing #200)	44.3%
Liquid Limit	36	Plastic Limit	22	Plastic Index	14

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

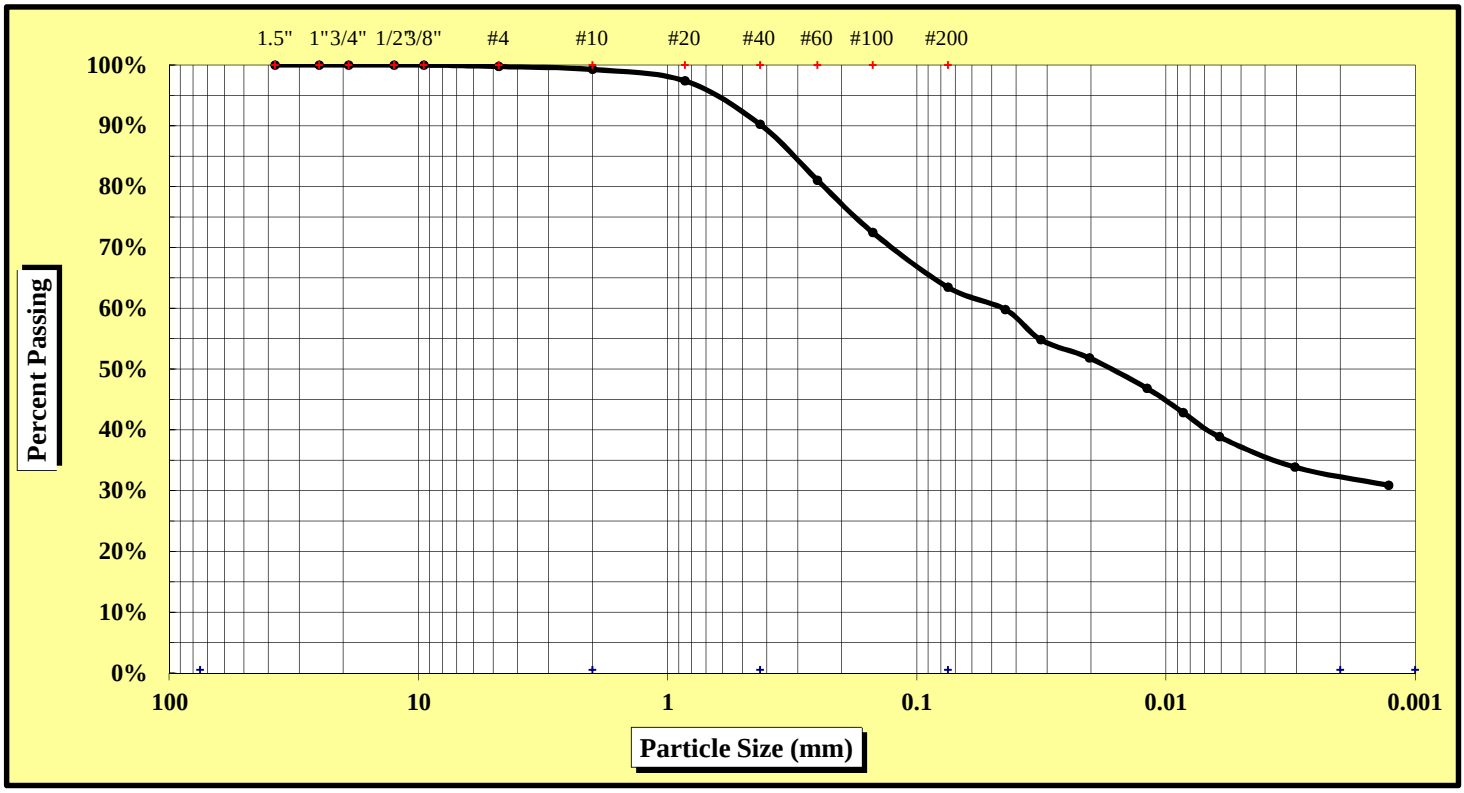
Signature *Position*

Particle Size Analysis of Soils

AASHTO T 88

S&ME Project #:	**1351-12-037 (010)**	Report Date:	8/4/15
Project Name:	**SCDOT US 21 to SC 51**	Test Date(s):	6/8-7/25/15
Client Name:	STV		
Client Address:	NA		

Boring #:	HA-6	Sample #:	SS-3	Sample Date:	2014/2015
Route-Station	NA	Offset:	NA	Depth:	5'
Sample Description:	Gray Coarse to Fine Sandy Silty Clay (CL)				A-7-6



As Defined by AASHTO		Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.075 and > 0.002 mm
Coarse Sand	< 2.00 mm and > 0.425 mm	Clay	< 0.002 mm

Gravel	0.7%	Coarse Sand	9.0%	Silt	30%
Maximum Particle Size	#4	Fine Sand	26.8%	Clay	33%
Specific Gravity (Assumed)	2.650	Moisture Content	26.5%	Silt & Clay (% Passing #200)	63.5%
Liquid Limit	41	Plastic Limit	19	Plastic Index	22

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes

AASHTO T265: Laboratory Determination of Moisture Content of Soils; ASTM D2487 Classification of Soils for Engineering Purposes (USCS)

Technical Responsibility: Stewart Laney _____ Project Manager

Signature *Position*

Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

ASTM D-2974

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Raod, Raleigh, North Carolina 27616

Project #:	3405-15-022	Report Date:	6/15/15
Project Name:	SCDOT US 21/51	Test Date(s):	6/12 - 6/15/15
Client Name:	SCDOT US		
Client Address:			

Boring #:	R-18	Sample #:	SS-1	Sample Date:	Unknown
Location:	Site-Borehole	Offset:	N/A	Depth (ft):	0.5 - 2.0 ft.

Sample Description: Brown Sandy CLAY with Organics

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capaccity*

Balance: *S&ME ID #:* ***1024*** *Cal. Date:* ***11/4/14*** *Due:* ***11/4/15***

Method A: Moisture Content Determination

Required Oven Temperature:105 ± 5 °C

	Oven Temperature: **105 °C**	*Tare #*	116
t	Tare Weight *(Dish plus Aluminum Foil Cover)*	*grams*	117.87
a	Mass of ***As-Received*** Specimen + Tare Wt.	*grams*	254.20
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	234.63
w	Water Weight	*(a-b)*	19.57
A	Mass of As-Received Specimen	*(a-t)*	136.33
B	Mass of Oven Dry Specimen	*(b-t)*	116.76
	% Moisture Content as a % of As Received or Total Mass	*(w/A)*100*	**14.4%**
	% Moisture Content as a % of Oven-dried Mass	*(w/B)*100*	**16.8%**

Oven *S&ME ID #:* ***1454*** *Cal. Date:* ***10/1/14*** *Due:* ***10/1/15***

Method C (440 °C) or D (750 °C): Ash Content and Organic Matter Determination

	Muffle Furnace: **440 °C**	*Tare #*	6
t	Tare Weight *(Dish plus Aluminum Foil Cover)*	*grams*	21.04
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	102.73
c	Ash Weight + Tare Wt.	*grams*	100.83
C	Ash Weight	*c-t*	79.79
B	Mass of Oven Dry Specimen	*(b-t)*	81.69
D	***% Ash Content***	*(C/B)*100*	**97.7%**
	% Organic Matter	*100-D*	**2.3%**

Muffle Furnace: *S&ME ID #:* ***00261***

Notes / Deviations / References: ASTM D2974: Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

Mal Krajan, ET		Laboratory Manager	6/17/2015
Technical Responsibility	*Signature*	*Position*	*Date*

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Moisture, Ash, and Organic Matter

ASTM D-2974

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Raod, Raleigh, North Carolina 27616

Project #:	3405-15-022	Report Date:	6/15/15
Project Name:	SCDOT US 21/51	Test Date(s):	6/12 - 6/15/15
Client Name:	SCDOT US		
Client Address:			

Boring #:	S-2	Sample #:	SS-9	Sample Date:	Unknown
Location:	Site-Borehole	Offset:	N/A	Depth (ft):	28.5 - 30.0 ft.

Sample Description: Gray Sandy CLAY

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capaccity*

Balance: *S&ME ID #:* ***1024*** *Cal. Date:* ***11/4/14*** *Due:* ***11/4/15***

Method A: Moisture Content Determination

Required Oven Temperature:105 ± 5 °C

	Oven Temperature: **105 °C**	*Tare #*	126
t	Tare Weight *(Dish plus Aluminum Foil Cover)*	*grams*	147.44
a	Mass of ***As-Received*** Specimen + Tare Wt.	*grams*	313.74
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	287.43
w	Water Weight	*(a-b)*	26.31
A	Mass of As-Received Specimen	*(a-t)*	166.30
B	Mass of Oven Dry Specimen	*(b-t)*	139.99
	% Moisture Content as a % of As Received or Total Mass	*(w/A)*100*	**15.8%**
	% Moisture Content as a % of Oven-dried Mass	*(w/B)*100*	**18.8%**

Oven *S&ME ID #:* ***1454*** *Cal. Date:* ***10/1/14*** *Due:* ***10/1/15***

Method C (440 °C) or D (750 °C): Ash Content and Organic Matter Determination

	Muffle Furnace: **440 °C**	*Tare #*	1
t	Tare Weight *(Dish plus Aluminum Foil Cover)*	*grams*	21.14
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	110.32
c	Ash Weight + Tare Wt.	*grams*	109.07
C	Ash Weight	*c-t*	87.93
B	Mass of Oven Dry Specimen	*(b-t)*	89.18
D	***% Ash Content***	*(C/B)*100*	**98.6%**
	% Organic Matter	*100-D*	**1.4%**

Muffle Furnace: *S&ME ID #:* ***00261***

Notes / Deviations / References: ASTM D2974: Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

Mal Krajan, ET		Laboratory Manager	6/17/2015
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

ASTM D-2974

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Raod, Raleigh, North Carolina 27616

Project #:	3405-15-022	Report Date:	6/15/15
Project Name:	SCDOT US 21/51	Test Date(s):	6/12 - 6/15/15
Client Name:	SCDOT US		
Client Address:			

Boring #:	S-5	Sample #:	SS-7	Sample Date:	Unknown
Location:	Site-Borehole	Offset:	N/A	Depth (ft):	18.5 - 20 ft.

Sample Description: Brown Sandy CLAY with Organics

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capaccity*

Balance: *S&ME ID #:* ***1024*** *Cal. Date:* ***11/4/14*** *Due:* ***11/4/15***

Method A: Moisture Content Determination

Required Oven Temperature:105 ± 5 °C

	Oven Temperature: **105 °C**	*Tare #*	117
t	Tare Weight *(Dish plus Aluminum Foil Cover)*	*grams*	118.23
a	Mass of ***As-Received*** Specimen + Tare Wt.	*grams*	300.35
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	264.63
w	Water Weight	*(a-b)*	35.72
A	Mass of As-Received Specimen	*(a-t)*	182.12
B	Mass of Oven Dry Specimen	*(b-t)*	146.40
	% Moisture Content as a % of As Received or Total Mass	*(w/A)*100*	**19.6%**
	% Moisture Content as a % of Oven-dried Mass	*(w/B)*100*	**24.4%**

Oven *S&ME ID #:* ***1454*** *Cal. Date:* ***10/1/14*** *Due:* ***10/1/15***

Method C (440 °C) or D (750 °C): Ash Content and Organic Matter Determination

	Muffle Furnace: **440 °C**	*Tare #*	4
t	Tare Weight *(Dish plus Aluminum Foil Cover)*	*grams*	21.03
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	112.83
c	Ash Weight + Tare Wt.	*grams*	110.87
C	Ash Weight	*c-t*	89.84
B	Mass of Oven Dry Specimen	*(b-t)*	91.80
D	***% Ash Content***	*(C/B)*100*	**97.9%**
	% Organic Matter	*100-D*	**2.1%**

Muffle Furnace: *S&ME ID #:* ***00261***

Notes / Deviations / References: ASTM D2974: Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

Mal Krajan, ET		Laboratory Manager	6/17/2015
Technical Responsibility	*Signature*	*Position*	*Date*

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Moisture - Density Report

Quality Assurance

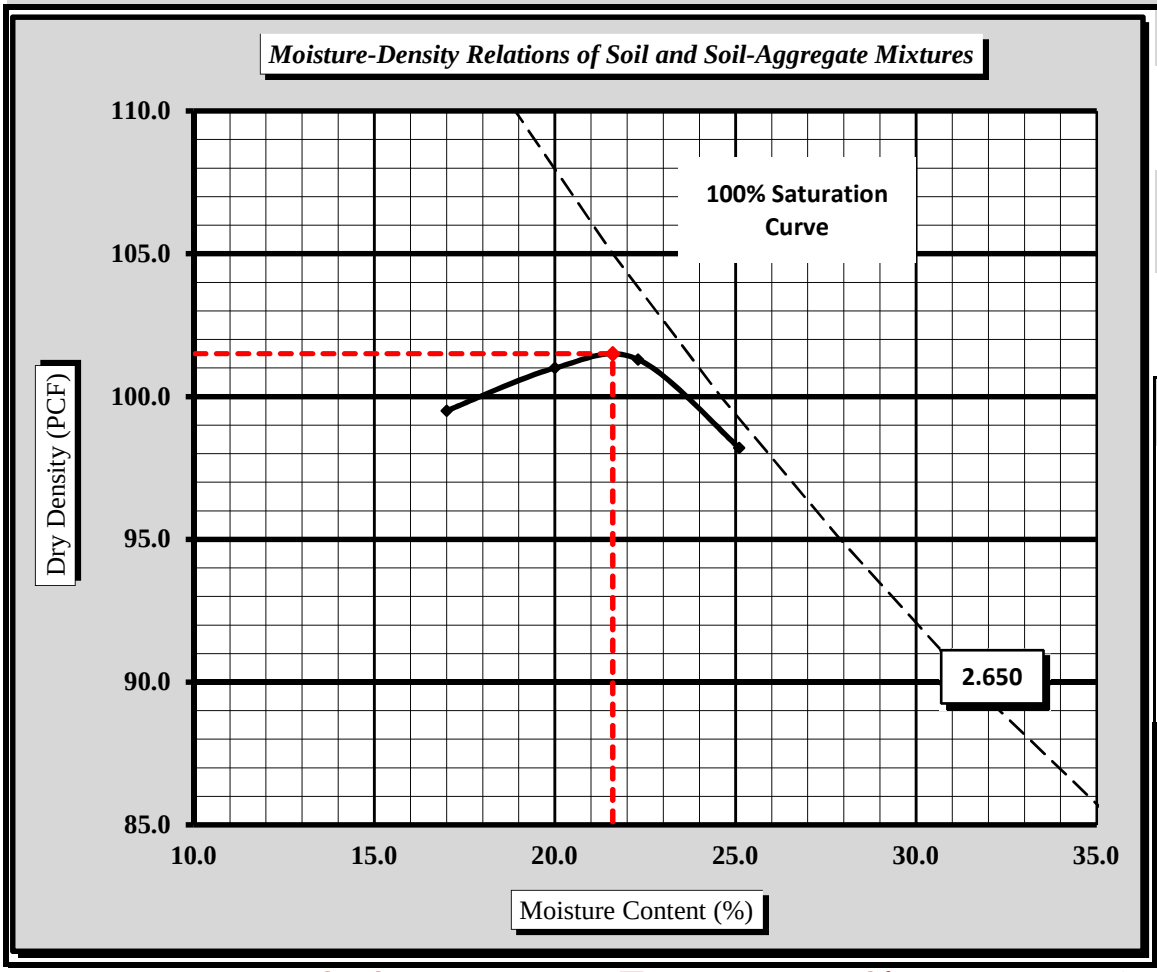
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	7/16/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/4-16/15
Client Name:	STV		
Client Address:	NI		

Boring #:	B-2	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	Gold Hill Rd. - 13+68	Offset:	2' RT	Depth:	1-10'
Sample Description:	Orange Brown Clayey Silt w/Coarse to Fine Sand (MH)				A-7-5

Maximum Dry Density **101.5** **PCF.** **Optimum Moisture Content** **21.6%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**31.8%**
Specific Gravity of Soil	**ND**
Liquid Limit	**66**
Plastic Limit	**34**
Plastic Index	**32**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	100.0%
#10	99.7%
#20	98.8%
#40	94.6%
#200	75.7%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date:

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Moisture - Density Report

Quality Assurance

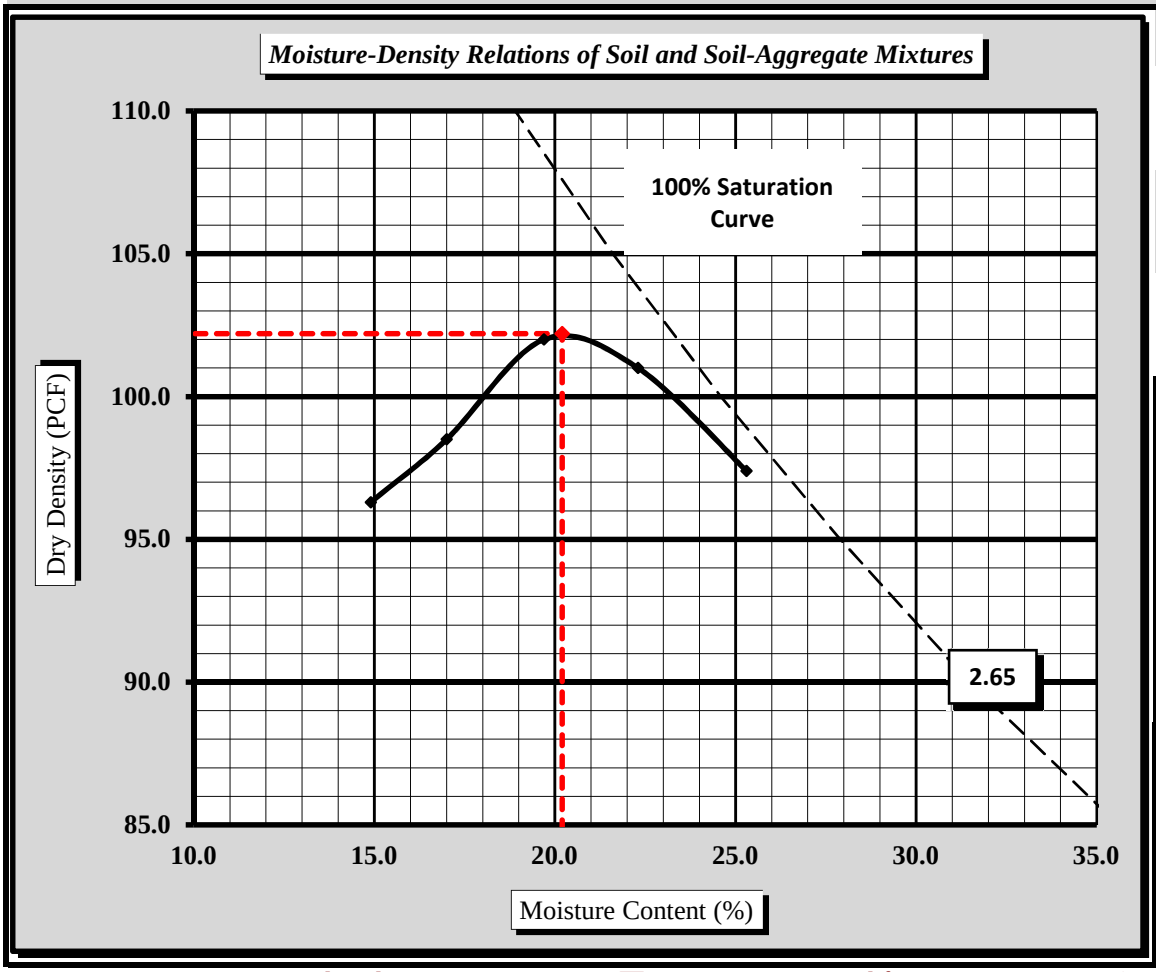
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	7/16/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/4-16/15
Client Name:	STV		
Client Address:	NI		

Boring #:	B-4	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	Proposed Road 16+87	Offset:	2' LT	Depth:	1-10'
Sample Description:	Orange Brown Coarse to Fine Sandy Clay (CH)				A-7-6

Maximum Dry Density **102.2** **PCF.** **Optimum Moisture Content** **20.2%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**30.6%**
Specific Gravity of Soil	**ND**
Liquid Limit	**59**
Plastic Limit	**21**
Plastic Index	**38**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	99.5%
#10	98.9%
#20	96.8%
#40	91.2%
#200	67.2%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date:

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Moisture - Density Report

Quality Assurance

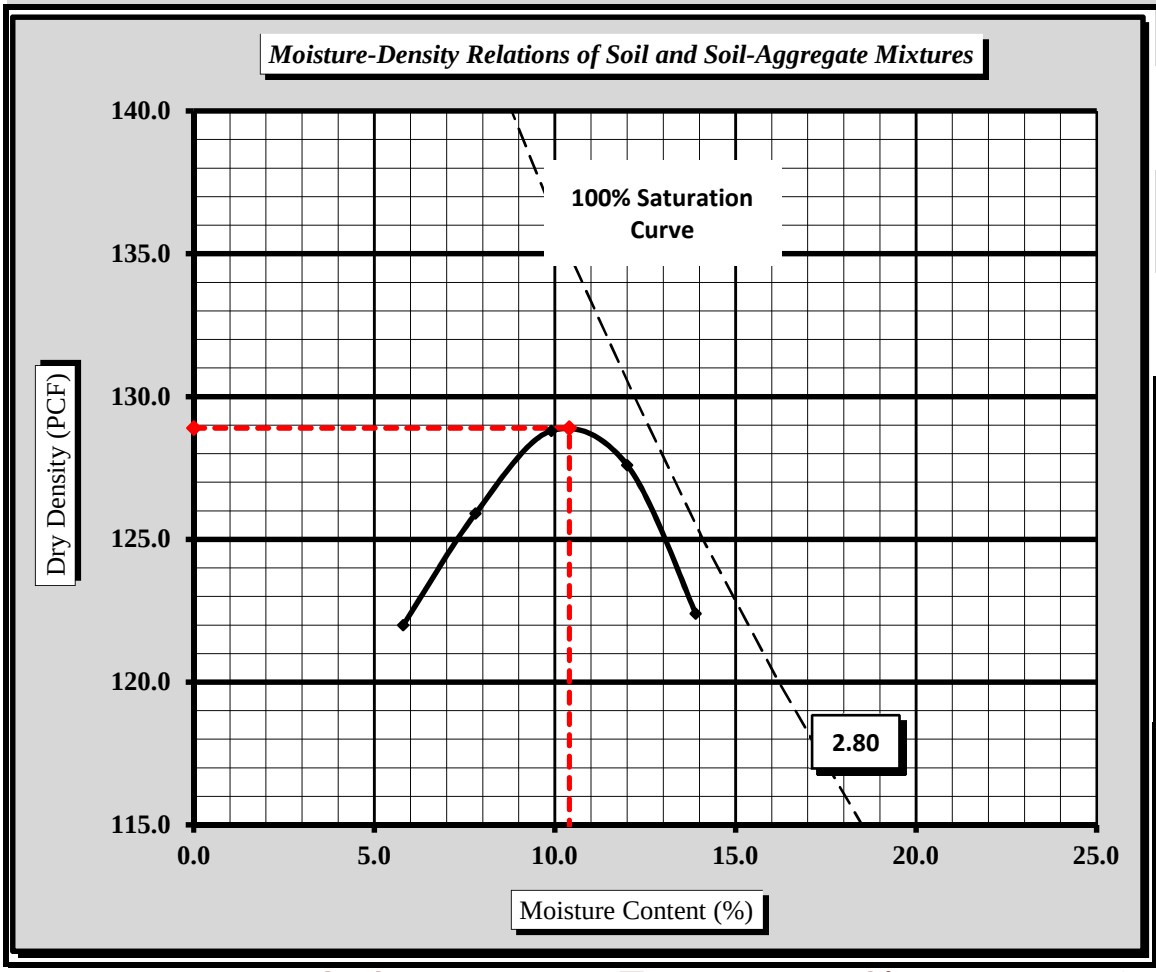
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	7/17/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-10/15
Client Name:	STV		
Client Address:	NI		

Boring #:	B-8	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	Springhill Farm Rd.	Offset:	1' RT	Depth:	1-10'
Sample Description:	Brown Gray Coarse to Fine Sandy Silty Clay (CL)				A-6

Maximum Dry Density **128.9** **PCF.** **Optimum Moisture Content** **10.4%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**8.6%**
Specific Gravity of Soil	**ND**
Liquid Limit	**23**
Plastic Limit	**12**
Plastic Index	**11**

% Passing	
3/4"	100.0%
3/8"	99.5%
#4	98.6%
#10	96.0%
#20	91.8%
#40	84.9%
#200	51.2%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date:

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

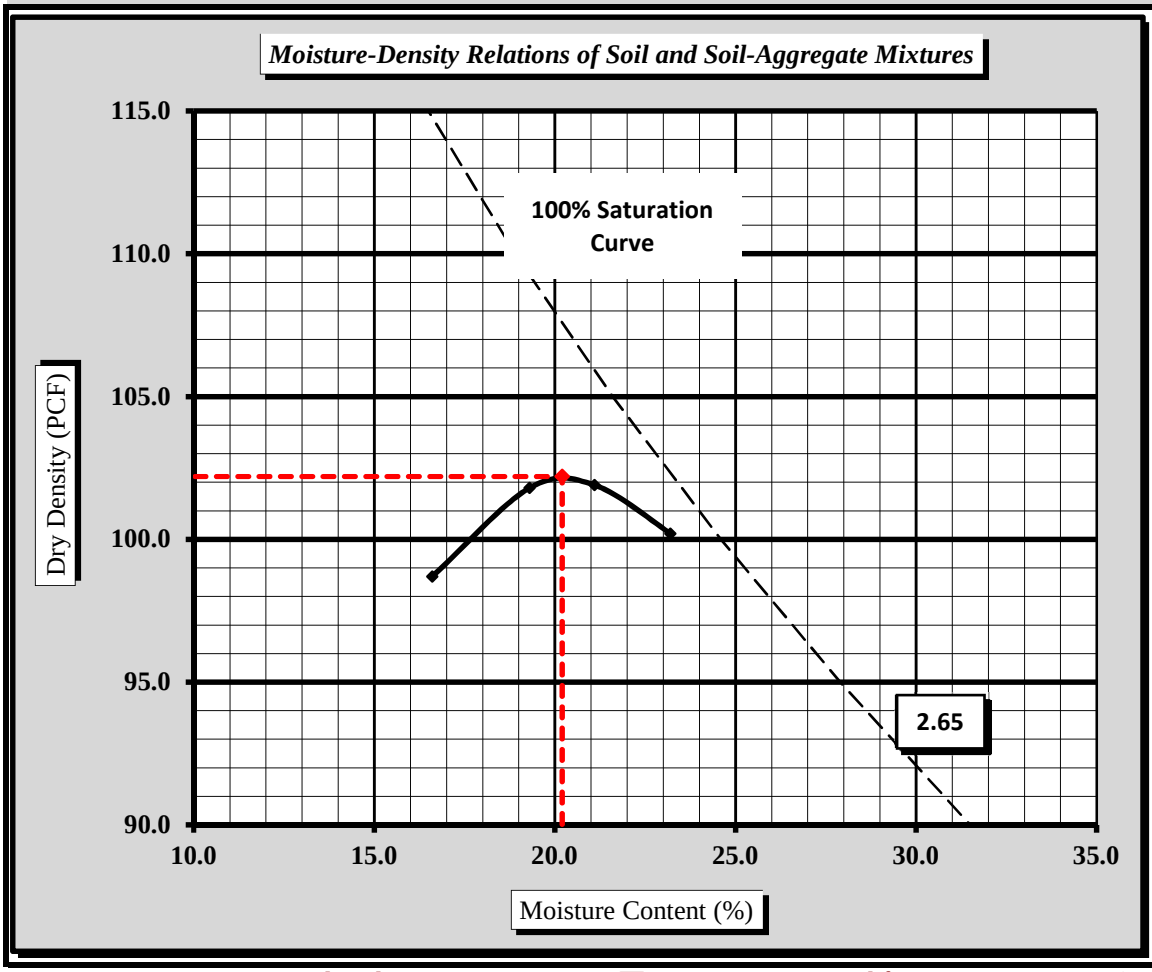
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	7/17/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-16/15
Client Name:	STV		
Client Address:	NI		

Boring #:	B-11	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	SC 51 299+48	Offset:	26' RT	Depth:	1-10'
Sample Description:	Brown Coarse to Fine Sandy Silty Clay (CL)				A-7-6

Maximum Dry Density **102.2** **PCF.** **Optimum Moisture Content** **20.2%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**21.4%**
Specific Gravity of Soil	**ND**
Liquid Limit	**47**
Plastic Limit	**24**
Plastic Index	**23**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	100.0%
#10	100.0%
#20	99.7%
#40	98.1%
#200	68.0%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date:

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Moisture - Density Report

Quality Assurance

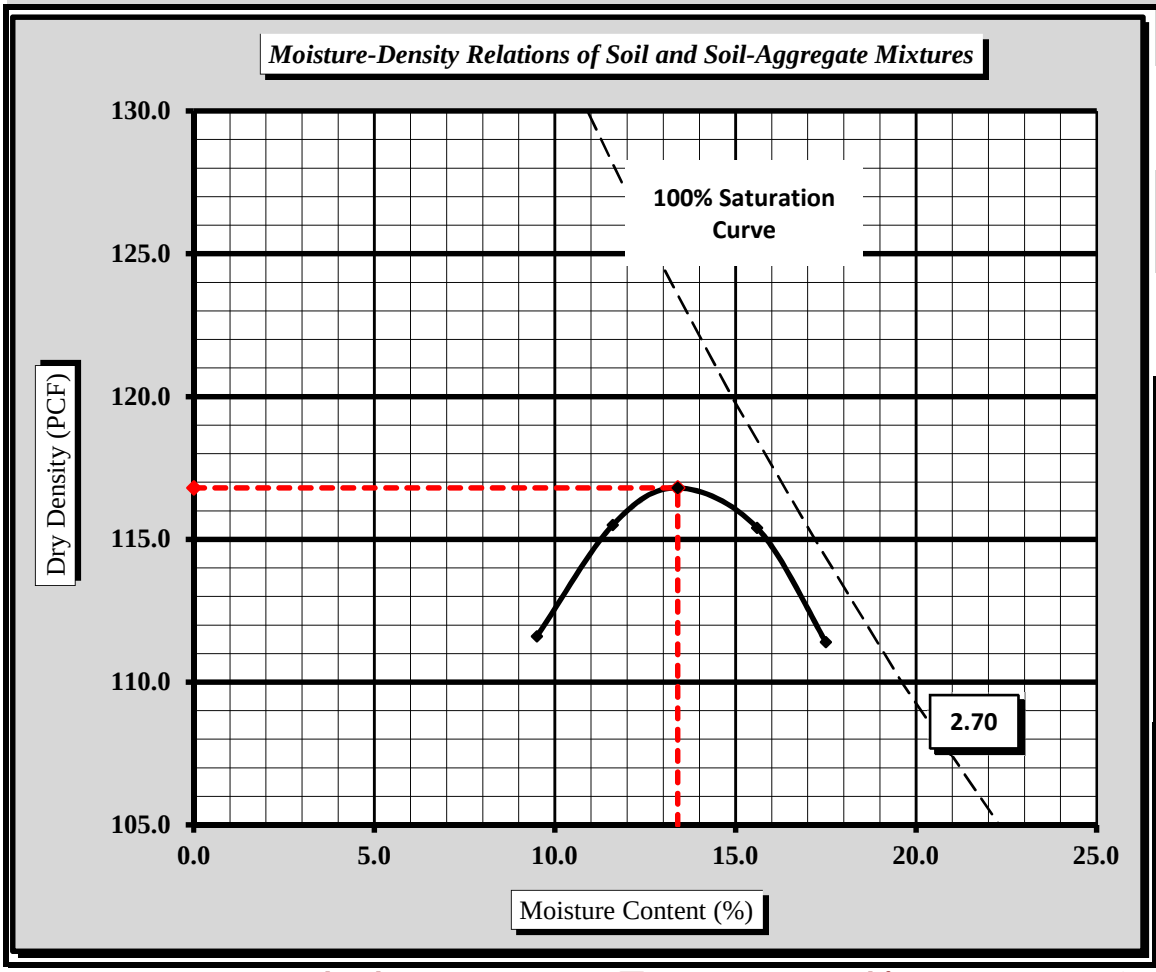
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/4-16/15
Client Name:	STV		
Client Address:	NI		

Boring #:	R-2	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	US 21 23+68	Offset:	29' LT	Depth:	1-10'
Sample Description:	Brown Coarse to Fine Sandy Silty Clay (CL)				A-7-6

Maximum Dry Density **116.8** **PCF.** **Optimum Moisture Content** **13.4%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**20.7%**
Specific Gravity of Soil	**ND**
Liquid Limit	**49**
Plastic Limit	**21**
Plastic Index	**28**

% Passing	
3/4"	100.0%
3/8"	99.6%
#4	98.4%
#10	93.7%
#20	86.2%
#40	79.4%
#200	55.6%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date:

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Moisture - Density Report

Quality Assurance

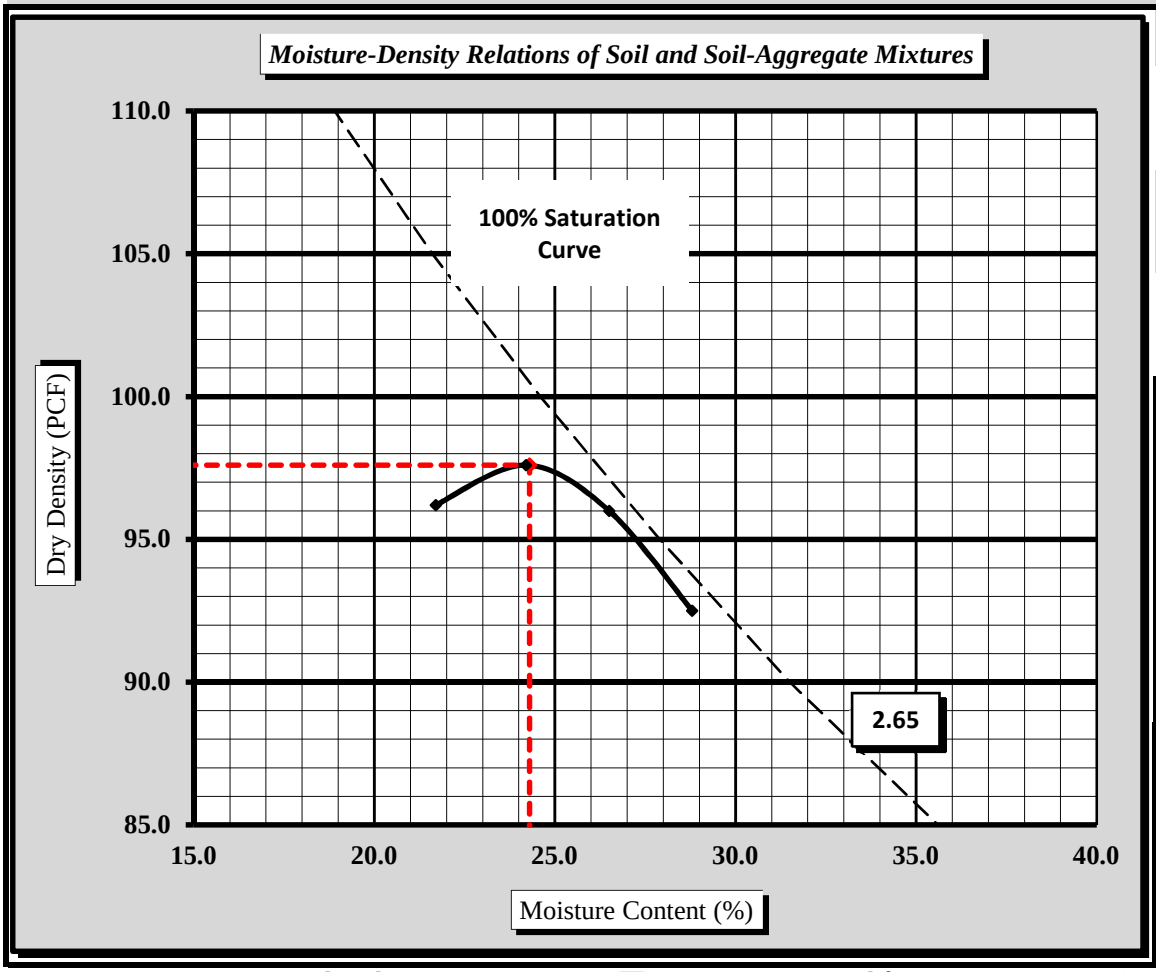
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-11/15
Client Name:	STV		
Client Address:	NI		

Boring #:	R-9	Sample #:	Bulk	Sample Date:	2014/2015
Station-Route:	US 21 58+68	Offset:	26' LT	Depth:	1-10'
Sample Description:	Red Clay w/Coarse to Fine Sand (CH)				A-7-6

Maximum Dry Density **97.6** **PCF.** **Optimum Moisture Content** **24.3%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**26.3%**
Specific Gravity of Soil	**ND**
Liquid Limit	**59**
Plastic Limit	**25**
Plastic Index	**34**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	99.9%
#10	99.7%
#20	98.5%
#40	93.9%
#200	72.5%

Oversize Fraction
Bulk Gravity
% Moisture
% Oversize
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date: 8/5/15

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

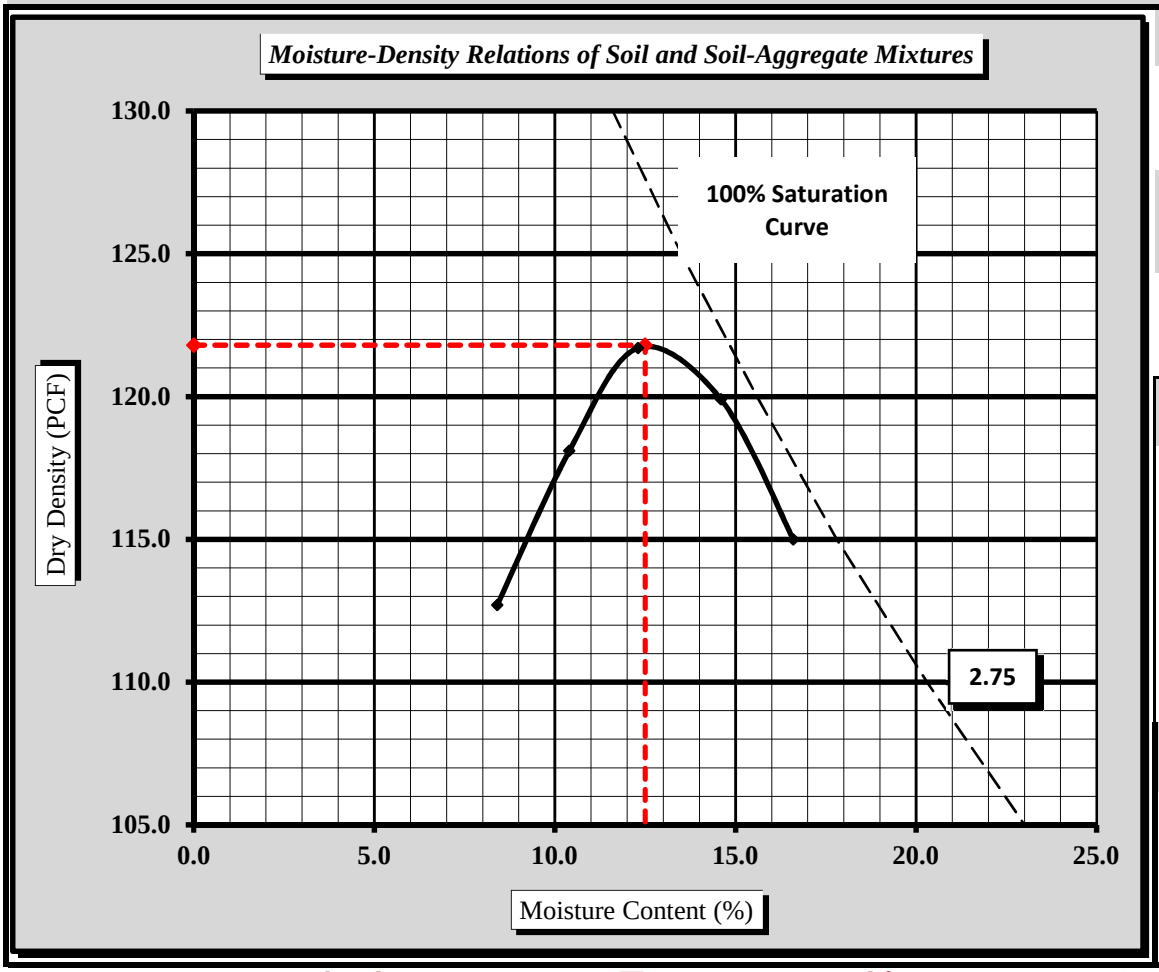
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-17/15
Client Name:	STV		
Client Address:	NI		

Boring #:	R-26	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	SC 51 308+54	Offset:	28' LT	Depth:	1-10'
Sample Description:	Grayish Brown Clayey Coarse to Fine Sand (SC)				A-6

Maximum Dry Density **121.8** **PCF.** **Optimum Moisture Content** **12.5%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**17.2%**
Specific Gravity of Soil	**ND**
Liquid Limit	**34**
Plastic Limit	**16**
Plastic Index	**18**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	99.2%
#10	96.6%
#20	92.0%
#40	83.9%
#200	48.2%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date: 8/5/15

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

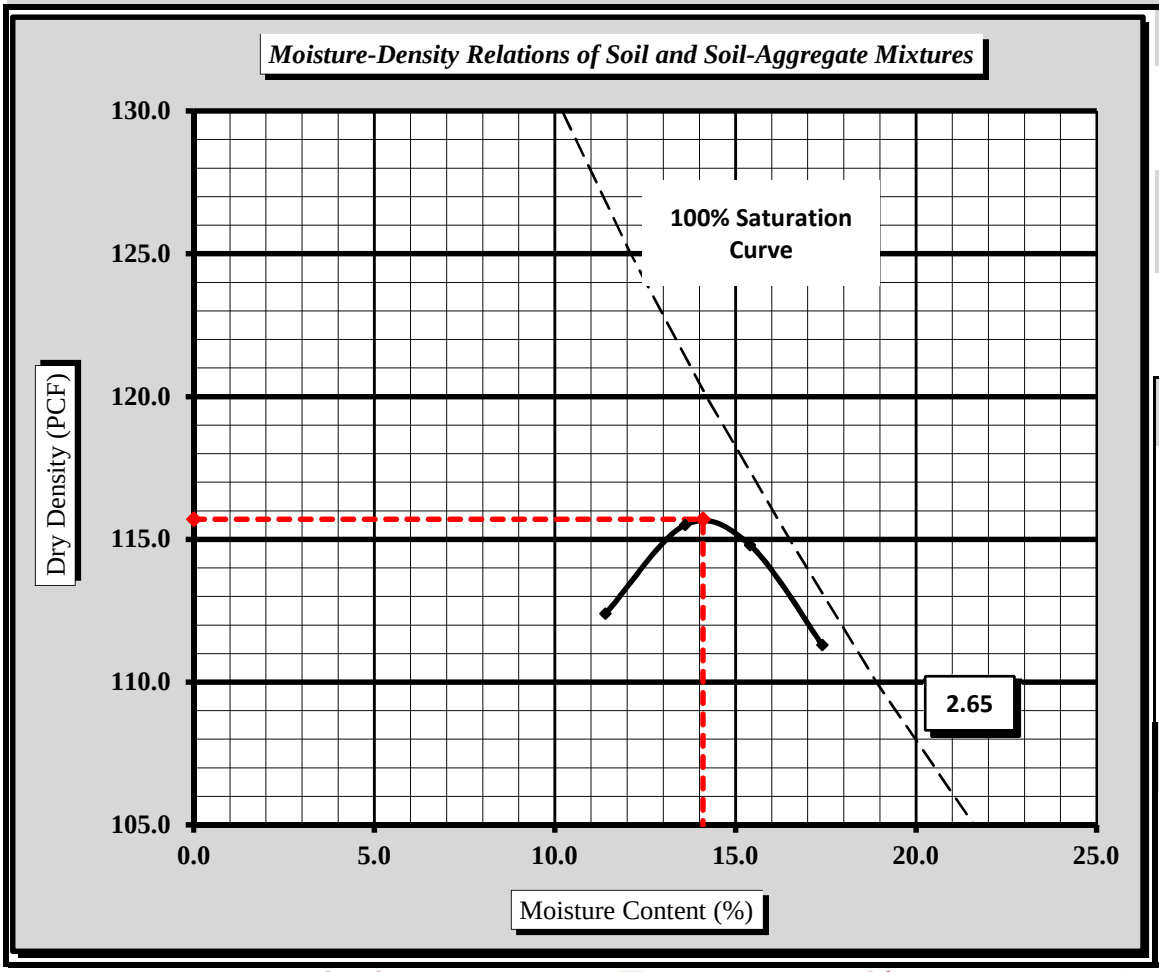
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-17/15
Client Name:	STV		
Client Address:	NI		

Boring #:	R-28	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	SC 51 318+60	Offset:	26' LT	Depth:	1-10'
Sample Description:	Gray Clayey Coarse to Fine Sand (SC)				A-6

Maximum Dry Density **115.7** **PCF.** **Optimum Moisture Content** **14.1%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**21.9%**
Specific Gravity of Soil	**ND**
Liquid Limit	**37**
Plastic Limit	**19**
Plastic Index	**18**

% Passing	
3/4"	100.0%
3/8"	91.9%
#4	83.7%
#10	74.5%
#20	69.8%
#40	64.7%
#200	39.5%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date: 8/5/15

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Engineer	
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

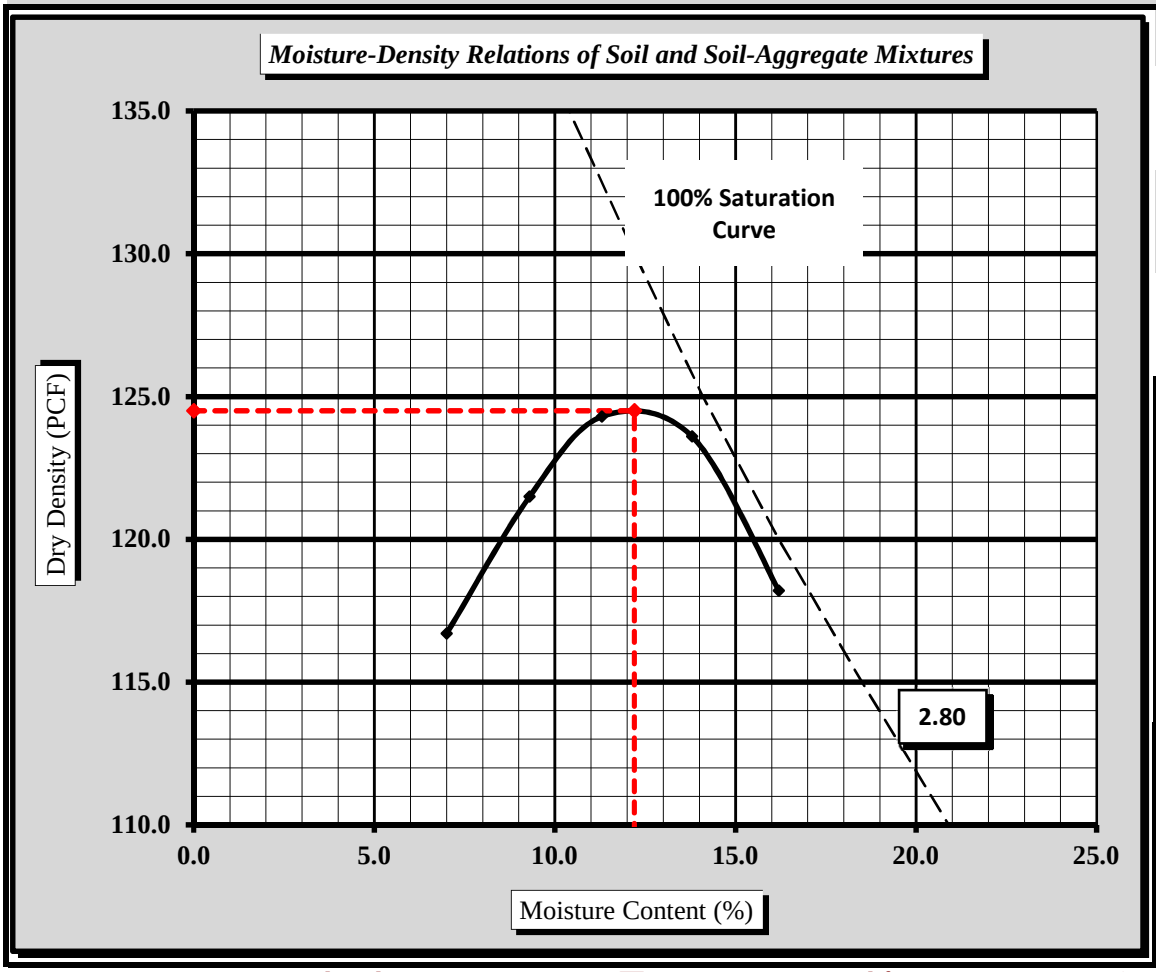
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-10/15
Client Name:	STV		
Client Address:	NI		

Boring #:	R-30	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	SC 51 328+65	Offset:	28' LT	Depth:	1-10'
Sample Description:	Gray Coarse to Fine Sandy Silty Clay (CL)				A-6

Maximum Dry Density **124.5** **PCF.** **Optimum Moisture Content** **12.2%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**14.6%**
Specific Gravity of Soil	**ND**
Liquid Limit	**34**
Plastic Limit	**16**
Plastic Index	**18**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	99.7%
#10	95.9%
#20	87.3%
#40	80.5%
#200	57.2%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date: 8/5/15

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Engineer	
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

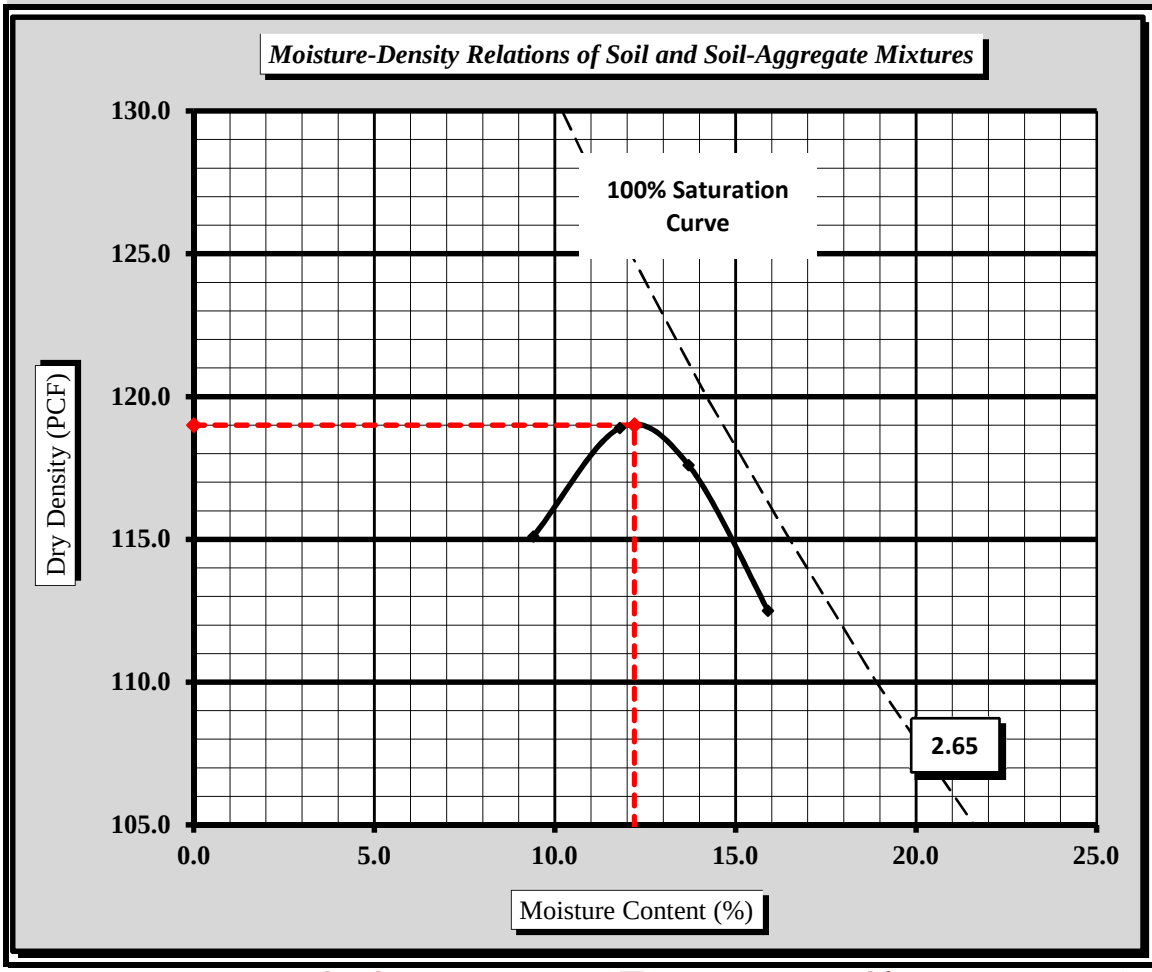
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

S&ME Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s):	6/5-11/15
Client Name:	STV		
Client Address:	NI		

Boring #:	R-32	Sample #:	Bulk	Sample Date:	2014/2015
Route-Station:	SC 51 338+56	Offset:	30' LT	Depth:	1-10'
Sample Description:	Tan Brown Coarse to Fine Sandy Silty Clay (CL)				A-6

Maximum Dry Density **119.0** **PCF.** **Optimum Moisture Content** **12.2%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	**13.0%**
Specific Gravity of Soil	**ND**
Liquid Limit	**30**
Plastic Limit	**14**
Plastic Index	**16**

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	100.0%
#10	99.3%
#20	94.0%
#40	85.6%
#200	51.1%

Oversize Fraction
Bulk Gravity
% Moisture
% Oversize
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND = Not determined NI = Information was not provided

Technician: Jennifer Olsen Date: 8/5/15

AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Stewart Laney		Project Engineer	
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	7/16/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/15-23/15
Client Name:	STV		
Client Address:	NI		

Boring #: B-2 Sample #: Bulk Sample Date: 2014/2015

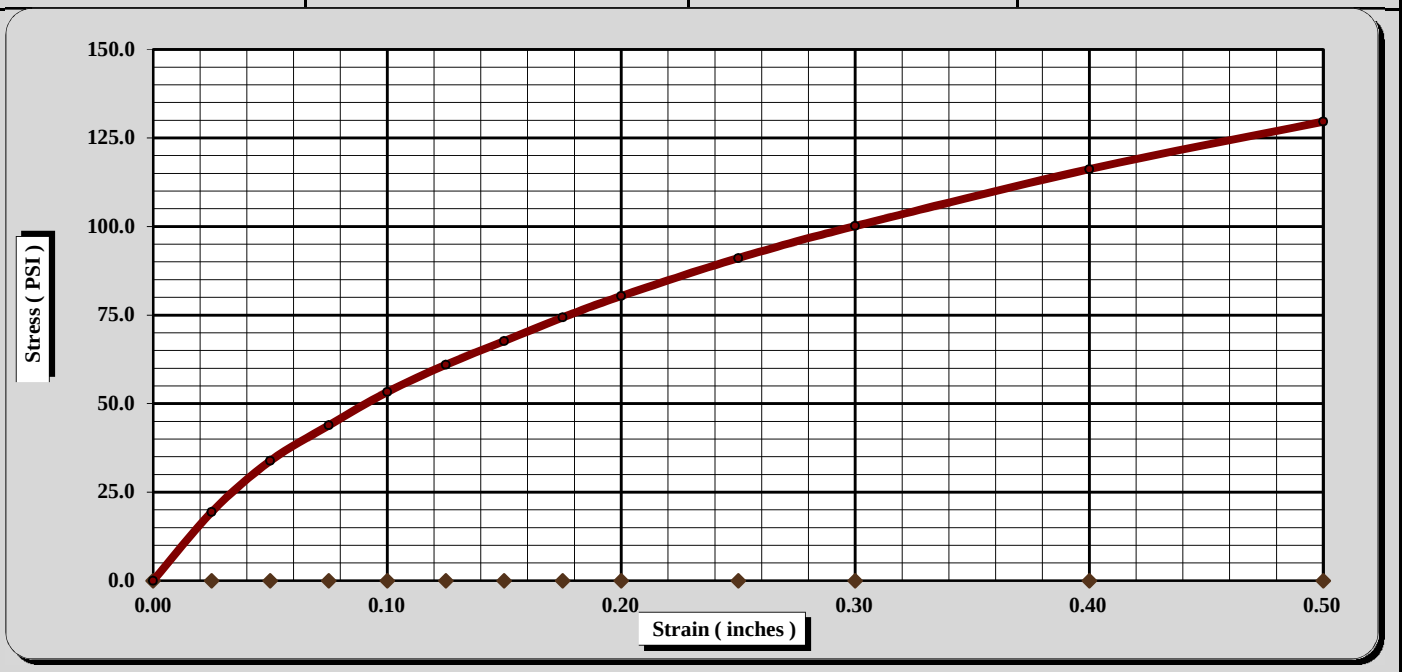
Route-Station: Gold Hill Rd. - 13+68 Offset: 2' RT Elevation: 1-10'

Sample Description: Orange Brown Clayey Silt w/Coarse to Fine Sand (MH) A-7-5

AASHTO T99 *Method A* Maximum Dry Density: **101.5 PCF** Optimum Moisture Content: **21.6%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 5.3	**CBR at 0.2 in. 5.4**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	34	Final Dry Density (PCF)	91.3
Initial Dry Density (PCF)	95.9	Average Final Moisture Content	26.4%
Moisture Content of the Compacted Specimen	22.0%	Moisture Content (top 1" after soaking)	28.0%
Percent Compaction	94.5%	Percent Swell	1.5%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 66 Plastic Index 32 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 6/23/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	7/16/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/15-23/15
Client Name:	STV		
Client Address:	NI		

Boring #: B-4 Sample #: Bulk Sample Date: 2014/2015

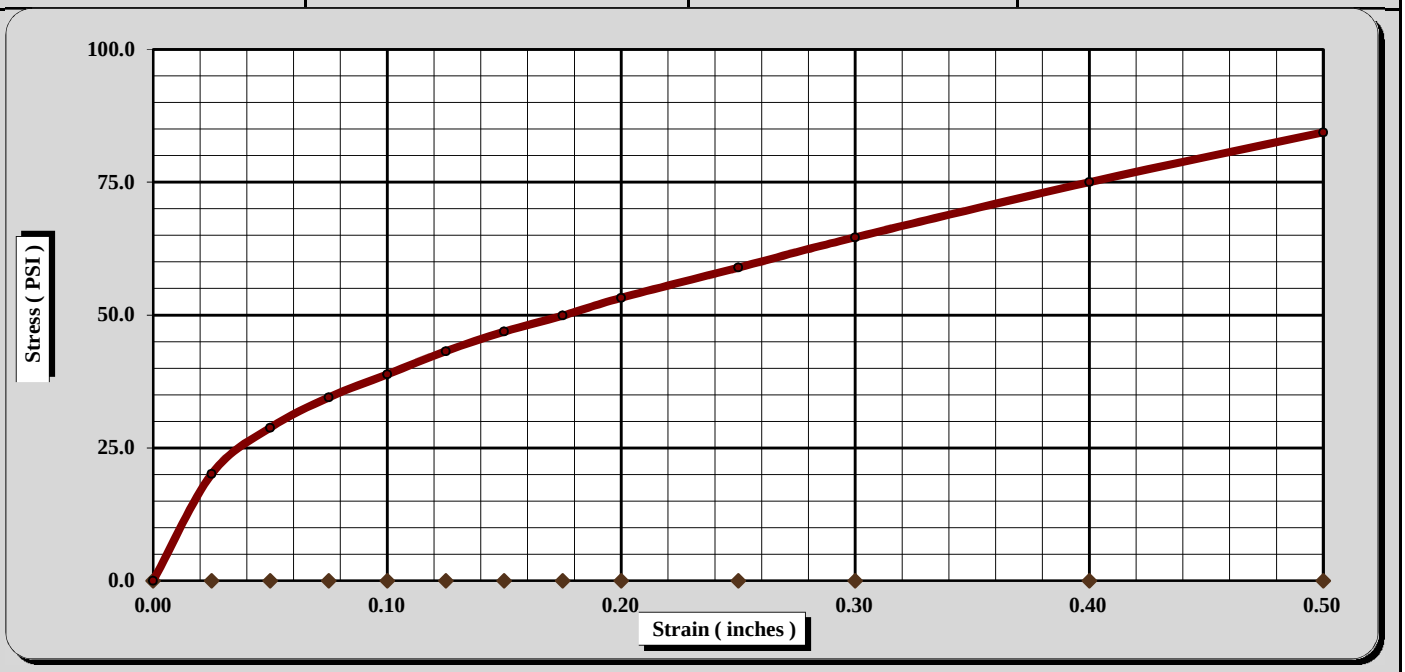
Route-Station: Proposed Road 16+87 Offset: 2' RT Elevation: 1-10'

Sample Description: Orange Brown Coarse to Fine Sandy Clay (CH) A-7-6

AASHTO T99 *Method A* Maximum Dry Density: **102.2** **PCF** Optimum Moisture Content: **20.2%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 3.9	**CBR at 0.2 in. 3.5**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	39	Final Dry Density (PCF)	92.2
Initial Dry Density (PCF)	97.8	Average Final Moisture Content	22.7%
Moisture Content of the Compacted Specimen	20.8%	Moisture Content (top 1" after soaking)	27.9%
Percent Compaction	95.7%	Percent Swell	4.3%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 59 Plastic Index 38 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 7/16/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	7/17/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/5-17/15
Client Name:	STV		
Client Address:	NI		

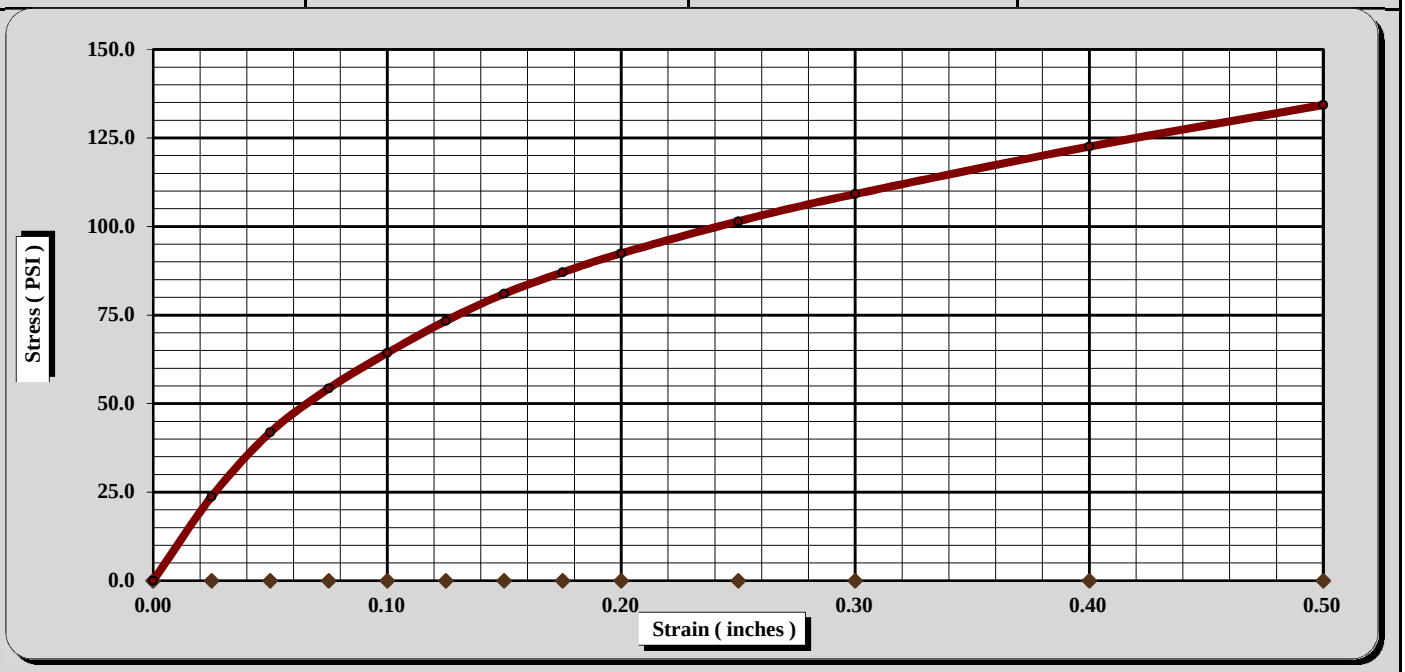
Boring #: B-8	Sample #: Bulk	Sample Date: 2014/2015
Route-Station: Springhill Farm Rd.	Offset: 1' RT	Elevation: 1-10'

Sample Description: Brown Gray Coarse to Fine Sandy Silty Clay (CL) A-6

AASHTO T99 *Method A* Maximum Dry Density: **128.9** **PCF** Optimum Moisture Content: **10.4%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 6.4	**CBR at 0.2 in. 6.2**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	27	Final Dry Density (PCF)	117.6
Initial Dry Density (PCF)	121.2	Average Final Moisture Content	13.1%
Moisture Content of the Compacted Specimen	10.4%	Moisture Content (top 1" after soaking)	13.9%
Percent Compaction	94.1%	Percent Swell	0.5%

Soak Time:	96 Hours	Surcharge Weight	30.5	Surcharge Wt. per sq. Ft.	155.0
Liquid Limit	23	Plastic Index	11	Apparent Relative Density	ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: **Jennifer Olsen** **Date: 7/17/15**

Stewart Laney		Project Manager	
Technical Responsibility	*Signature*	*Position*	*Date*

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Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	7/17/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/15-23/15
Client Name:	STV		
Client Address:	NI		

Boring #: B-11 Sample #: Bulk Sample Date: 2014/2015

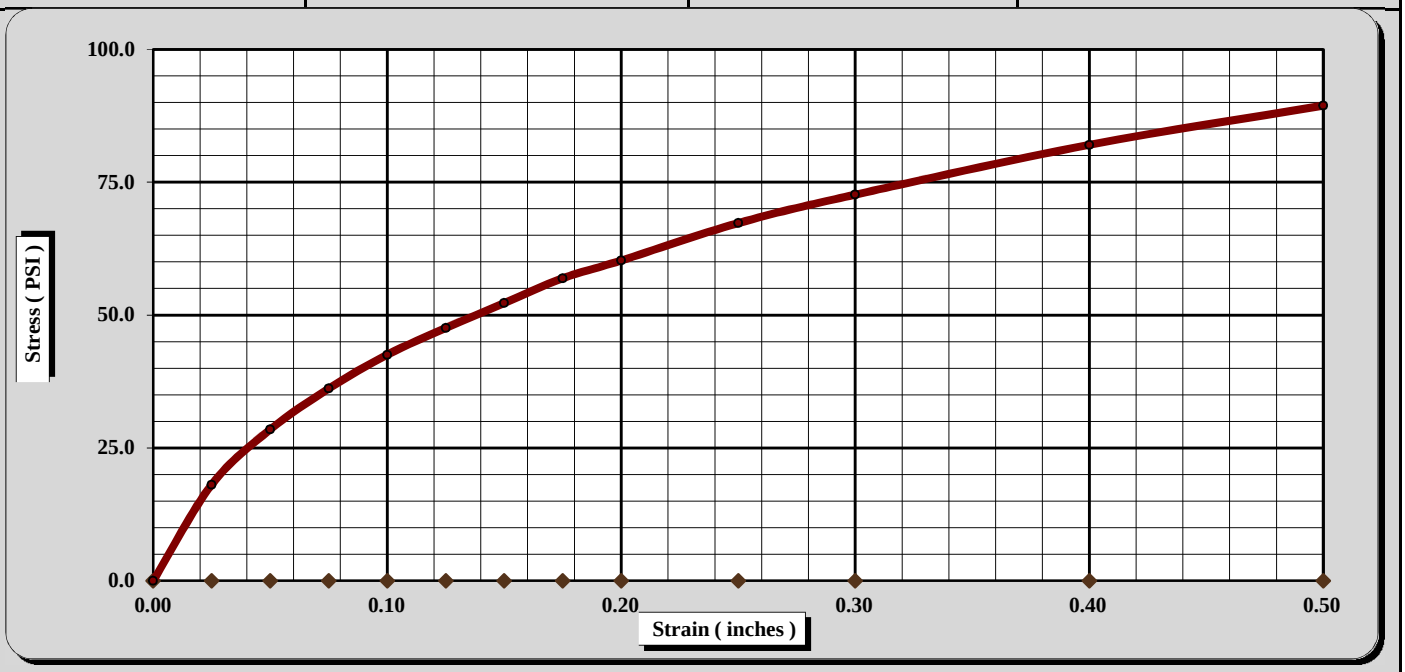
Route-Station: SC 51 299+48 Offset: 26' RT Elevation: 1-10'

Sample Description: Brown Coarse to Fine Sandy Silty Clay (CL) A-7-6

AASHTO T99 *Method A* Maximum Dry Density: **102.2** **PCF** Optimum Moisture Content: **20.2%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 4.3	**CBR at 0.2 in. 4.0**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	34	Final Dry Density (PCF)	90.7
Initial Dry Density (PCF)	95.5	Average Final Moisture Content	24.9%
Moisture Content of the Compacted Specimen	20.5%	Moisture Content (top 1" after soaking)	25.4%
Percent Compaction	93.4%	Percent Swell	1.4%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 47 Plastic Index 23 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 7/17/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/15-23/15
Client Name:	STV		
Client Address:	NI		

Boring #: R-2 Sample #: Bulk Sample Date: 2014/2015

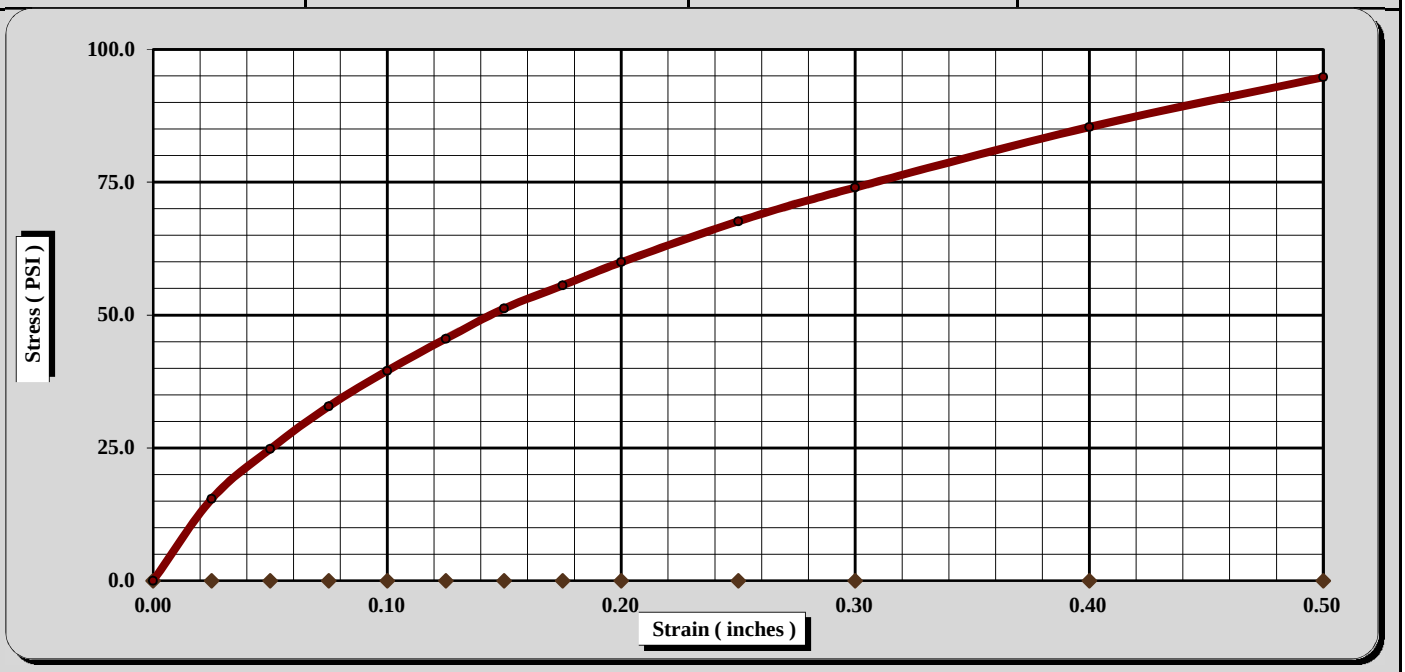
Route-Station: US 21 23+68 Offset: 29' LT Elevation: 1-10'

Sample Description: Brown Coarse to Fine Sandy Silty Clay (CL) A-7-6

AASHTO T99 *Method A* Maximum Dry Density: **116.8** **PCF** Optimum Moisture Content: **13.4%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 4.0	**CBR at 0.2 in. 4.0**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	32	Final Dry Density (PCF)	105.9
Initial Dry Density (PCF)	112.0	Average Final Moisture Content	17.6%
Moisture Content of the Compacted Specimen	13.3%	Moisture Content (top 1" after soaking)	19.6%
Percent Compaction	95.8%	Percent Swell	1.6%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 49 Plastic Index 21 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 6/23/15**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/5-17/15
Client Name:	STV		
Client Address:	NI		

Boring #: R-9 Sample #: Bulk Sample Date: 2014/2015

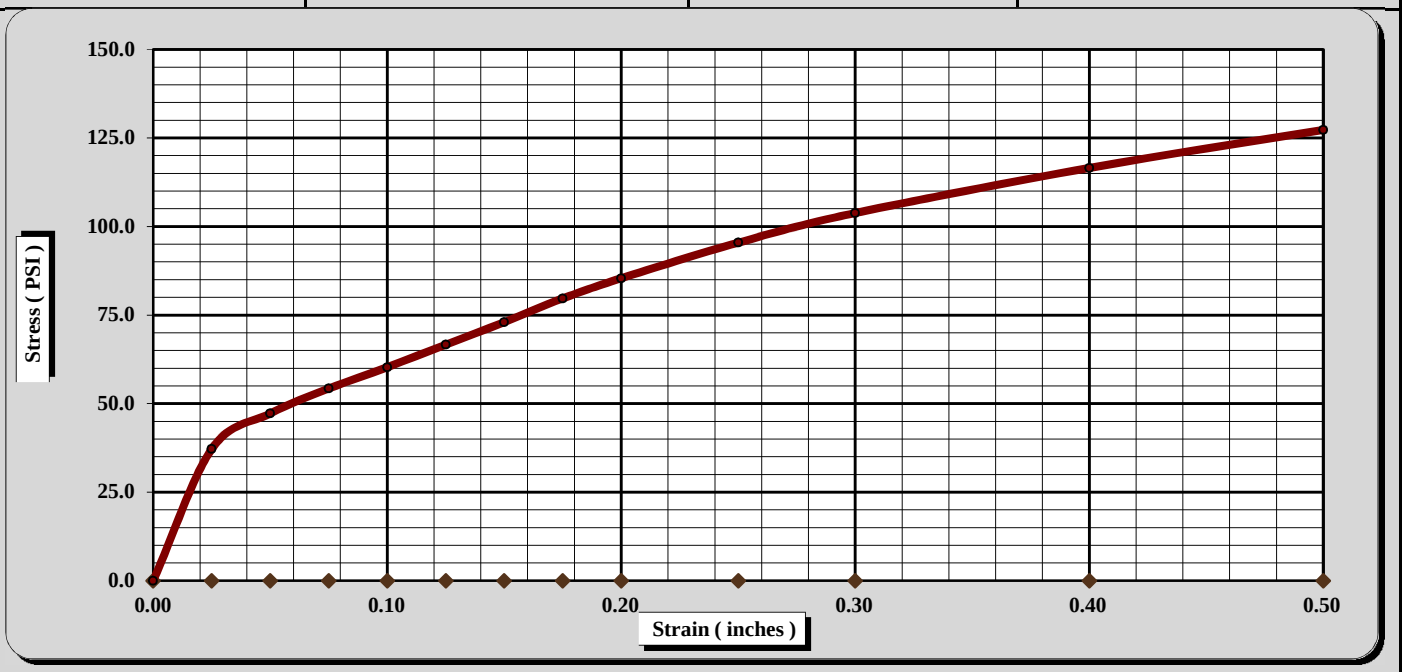
Station-Route US 21 58+68 Offset: 26' LT Elevation: 1-10'

Sample Description: Red Clay w/Coarse to Fine Sand (CH) A-7-6

AASHTO T99 *Method A* Maximum Dry Density: **97.6** **PCF** Optimum Moisture Content: **24.3%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 6.0	**CBR at 0.2 in. 5.7**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	34	Final Dry Density (PCF)	89.3
Initial Dry Density (PCF)	92.1	Average Final Moisture Content	27.2%
Moisture Content of the Compacted Specimen	24.4%	Moisture Content (top 1" after soaking)	26.6%
Percent Compaction	94.4%	Percent Swell	0.6%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 59 Plastic Index 34 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 6/17/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/15-23/15
Client Name:	STV		
Client Address:	NI		

Boring #: R-26 Sample #: Bulk Sample Date: 2014/2015

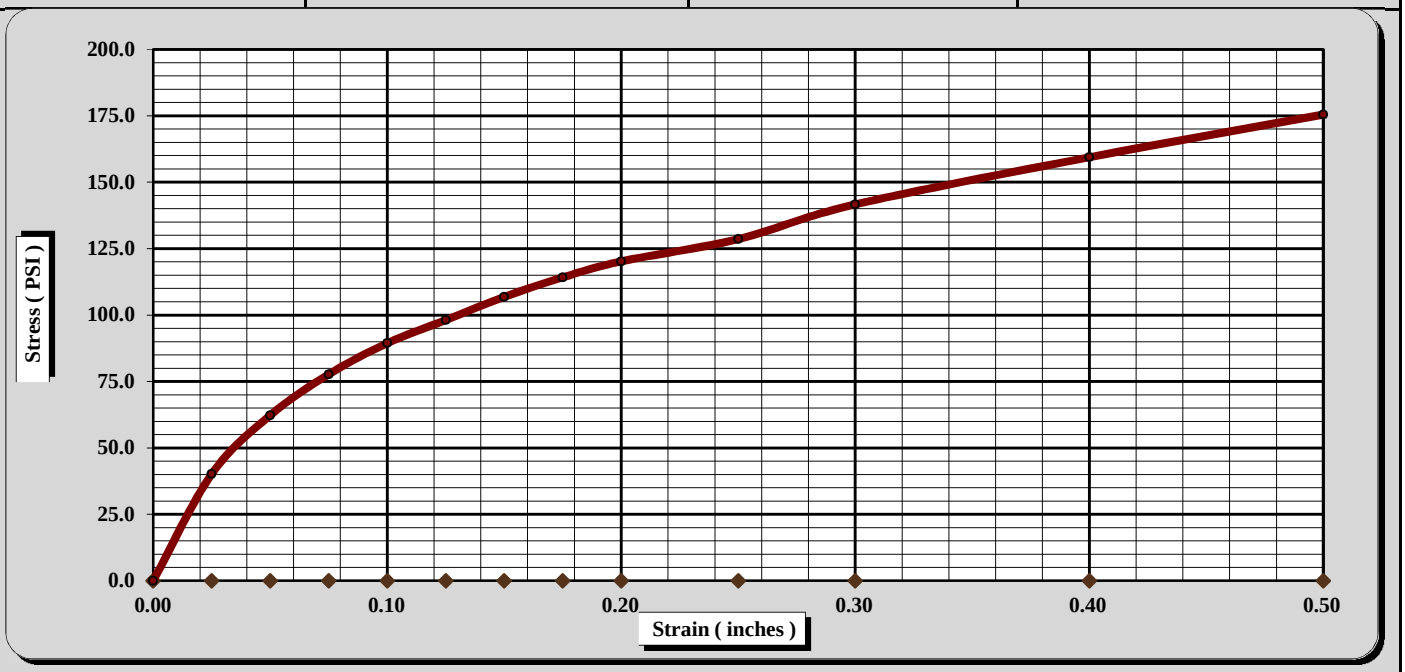
Route-Station: SC 51 308+54 Offset: 28' LT Elevation: 1-10'

Sample Description: Grayish Brown Clayey Coarse to Fine Sand (SC) A-6

AASHTO T99 *Method A* Maximum Dry Density: **121.8** **PCF** Optimum Moisture Content: **12.5%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 8.9	**CBR at 0.2 in. 8.0**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	33	Final Dry Density (PCF)	112.3
Initial Dry Density (PCF)	114.8	Average Final Moisture Content	15.1%
Moisture Content of the Compacted Specimen	13.0%	Moisture Content (top 1" after soaking)	15.0%
Percent Compaction	94.3%	Percent Swell	0.3%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 34 Plastic Index 18 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 6/23/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/15-23/15
Client Name:	STV		
Client Address:	NI		

Boring #: R-28 Sample #: Bulk Sample Date: 2014/2015

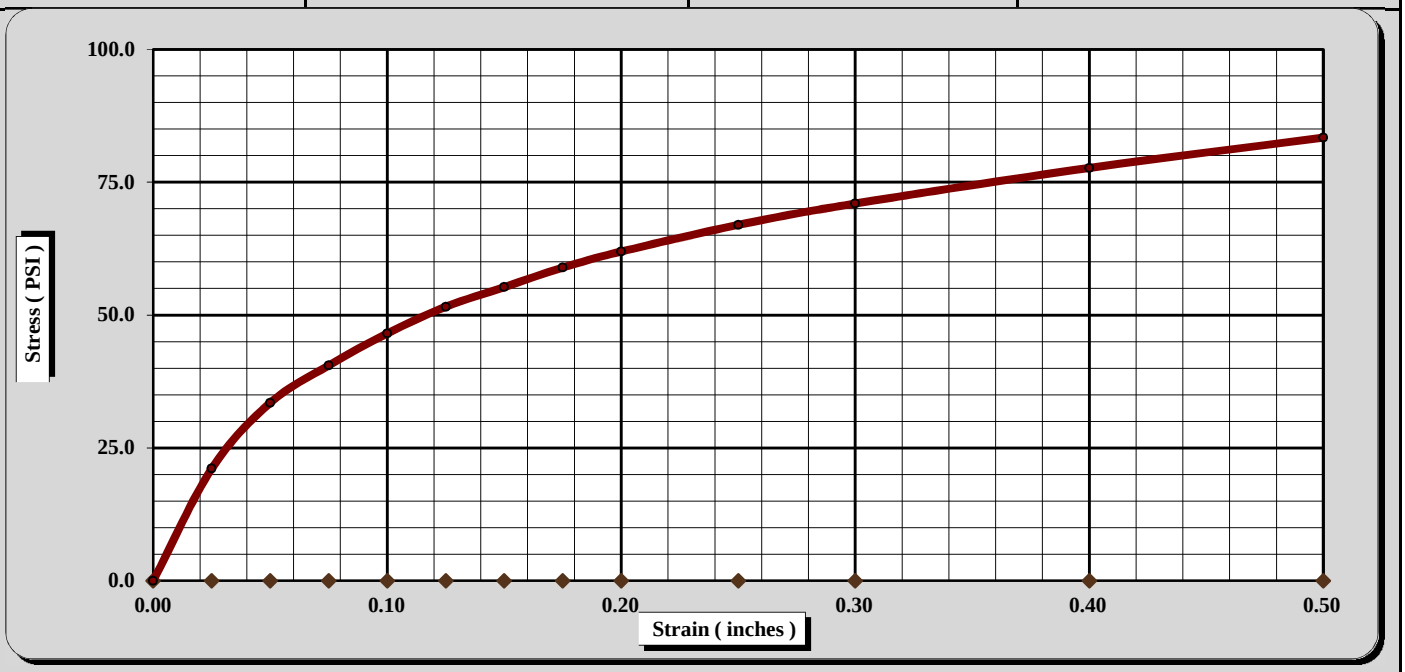
Route-Station: SC 51 318+60 Offset: 26' LT Elevation: 1-10'

Sample Description: Gray Clayey Coarse to Fine Sand (SC) w/Gravel A-6

AASHTO T99 *Method A* Maximum Dry Density: **115.7** **PCF** Optimum Moisture Content: **14.1%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 4.7	**CBR at 0.2 in. 4.1**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	22	Final Dry Density (PCF)	105.5
Initial Dry Density (PCF)	109.1	Average Final Moisture Content	17.3%
Moisture Content of the Compacted Specimen	14.1%	Moisture Content (top 1" after soaking)	17.3%
Percent Compaction	94.3%	Percent Swell	0.5%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 37 Plastic Index 18 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 6/23/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

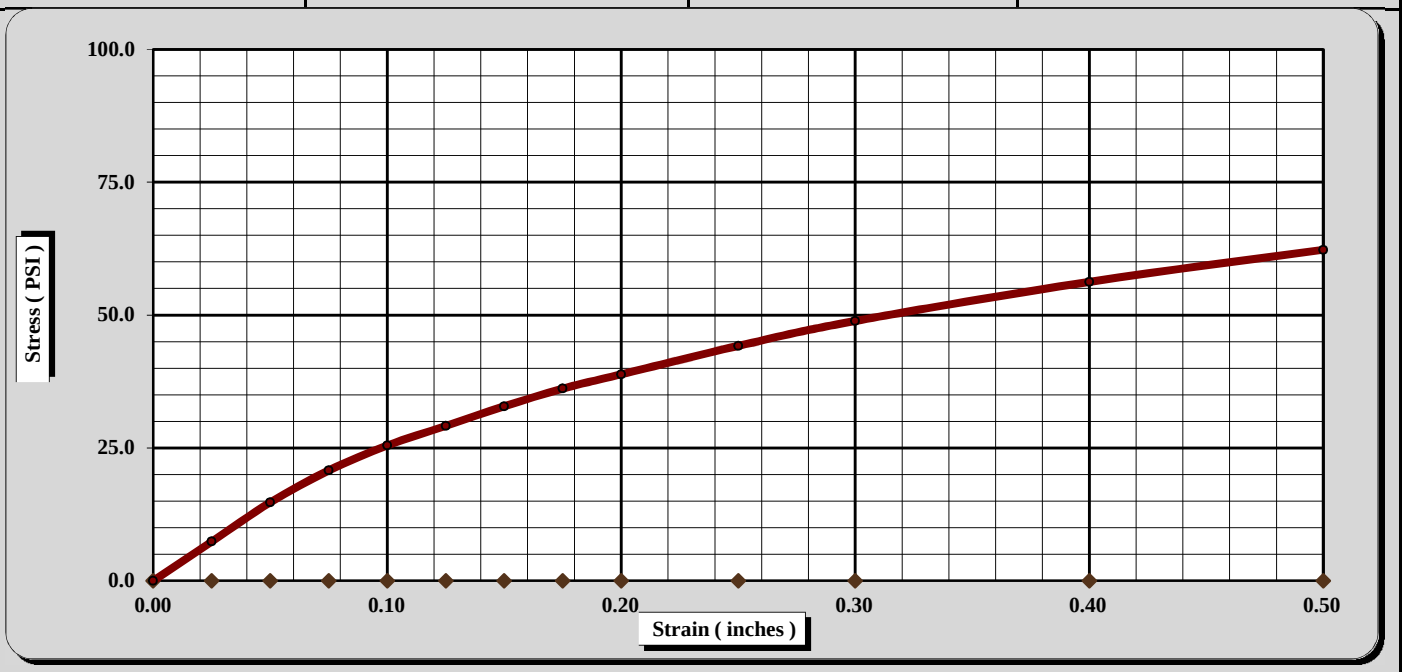
S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/5-17/15
Client Name:	STV		
Client Address:	NI		
Boring #:	R-30	Sample #: Bulk	Sample Date: 2014/2015
Route-Station:	SC 51 328-65	Offset: 28' LT	Elevation: 1-10'
Sample Description:	Gray Coare to Fine Sandy Silty Clay (CL)		A-6

AASHTO T99 *Method A* Maximum Dry Density: **124.5** **PCF** Optimum Moisture Content: **12.2%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 2.5	**CBR at 0.2 in. 2.6**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	30	Final Dry Density (PCF)	110.2
Initial Dry Density (PCF)	117.3	Average Final Moisture Content	16.9%
Moisture Content of the Compacted Specimen	12.4%	Moisture Content (top 1" after soaking)	18.6%
Percent Compaction	94.2%	Percent Swell	2.4%

Soak Time:	96 Hours	Surcharge Weight	30.5	Surcharge Wt. per sq. Ft.	155.0
Liquid Limit	34	Plastic Index	18	Apparent Relative Density	ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: **Jennifer Olsen** **Date: 6/17/15**

Stewart Laney — *Technical Responsibility*
_____ — *Signature*
Project Manager — *Position*
_____ — *Date*

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Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc. ~ 9751 Southern Pine Boulevard ~ Charlotte, NC 28273

Project #:	**1351-12-037 (01)**	Report Date:	8/5/15
Project Name:	SCDOT US 21 to SC 51	Test Date(s)	6/5-17/15
Client Name:	STV		
Client Address:	NI		

Boring #: R-32 Sample #: Bulk Sample Date: 2014/2015

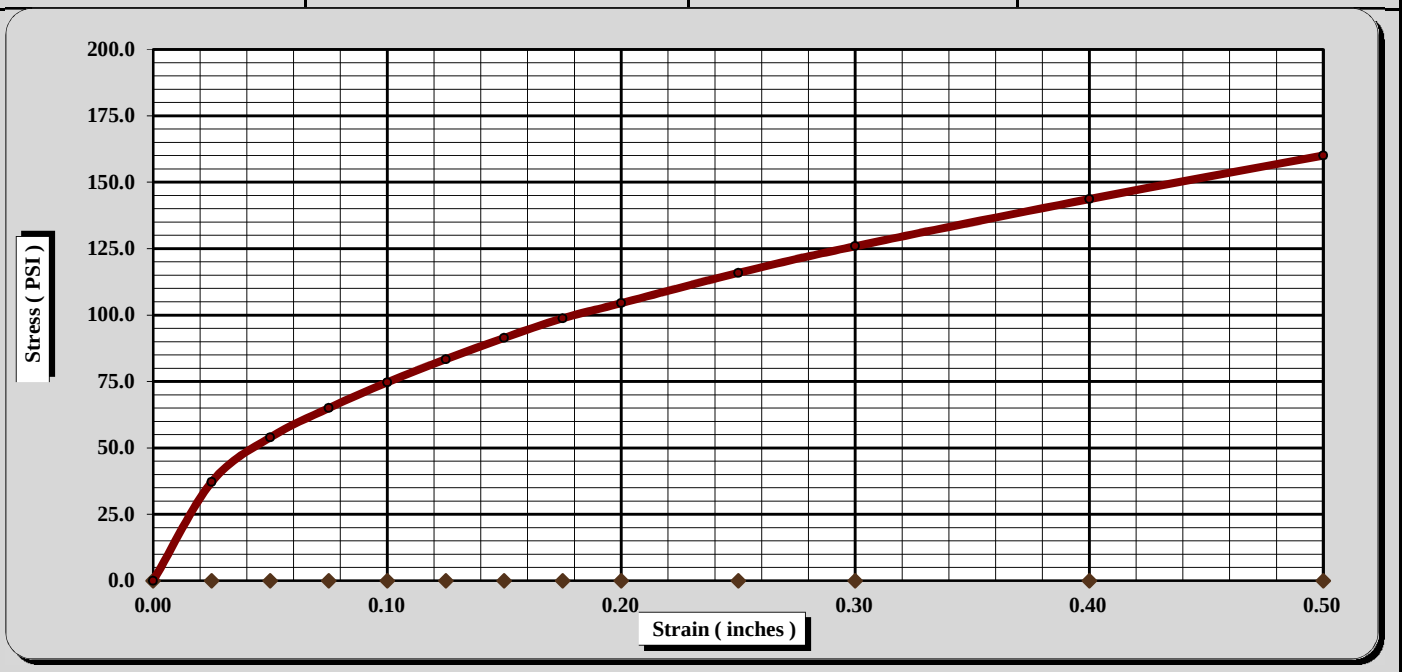
Route-Station: SC 51 338+56 Offset: 30' LT Elevation: 1-10'

Sample Description: Tan Brown Coarse to Fine Sandy Silty Clay (CL) A-6

AASHTO T99 *Method A* Maximum Dry Density: **119.0** **PCF** Optimum Moisture Content: **12.2%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 7.5	**CBR at 0.2 in. 7.0**	**CBR at 0.1 in. 0.0**	**CBR at 0.2 in. 0.0**



CBR Sample Preparation: *Performed on the fine fraction*

The replacement method was used and compacted in a 6" CBR mold in accordance with AASHTO T 193, Section 5.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	29	Final Dry Density (PCF)	110.9
Initial Dry Density (PCF)	113.1	Average Final Moisture Content	14.1%
Moisture Content of the Compacted Specimen	12.3%	Moisture Content (top 1" after soaking)	14.4%
Percent Compaction	95.0%	Percent Swell	0.2%

Soak Time: 96 Hours Surcharge Weight 30.5 Surcharge Wt. per sq. Ft. 155.0

Liquid Limit 30 Plastic Index 16 Apparent Relative Density ND

Notes/Deviations/References: NI = No information provided. ND = Not determined.

Technician: Jennifer Olsen **Date: 6/17/15**

Stewart Laney — *Technical Responsibility*

_____ — *Signature*

Project Manager — *Position*

_____ — *Date*

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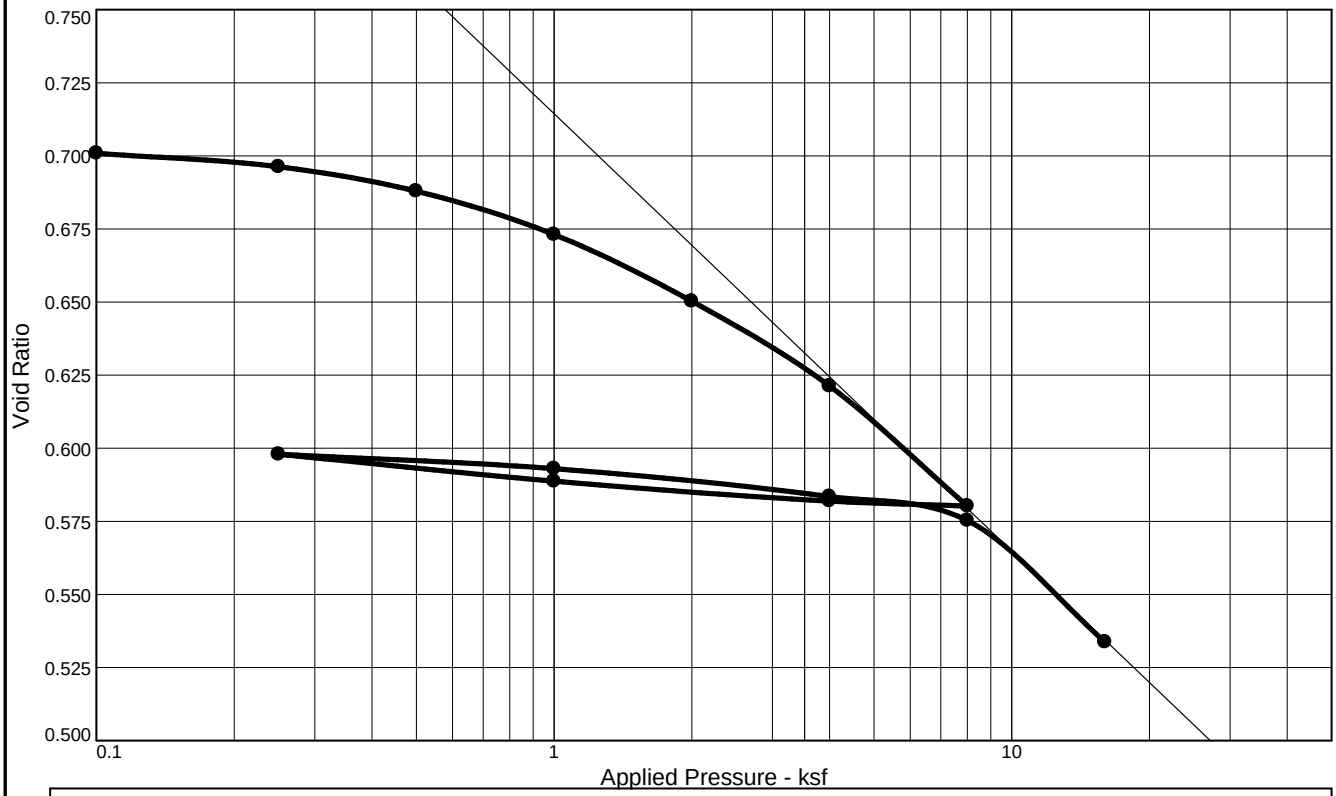
CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.10	48.060		8	4.00	28.014					
2	0.25	11.123		9	1.00	30.850					
3	0.50	0.386		10	0.25	17.632					
4	1.00	5.994		11	1.00	2.702					
5	2.00	15.537		12	4.00	19.100					
6	4.00	8.165		13	8.00	31.820					
7	8.00	8.320		14	16.00	3.851					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
71.9 %	19.0 %	97.7	20	2	2.65		4.0	0.15	0.05	0.702

MATERIAL DESCRIPTION	USCS	AASHTO
Gray Brown Silty Coarse to Fine Sand (SM)	SM	A-4

Project No. 1351-12-037 **Client:** STV

Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft **Sample Number:** R-33

S & ME, INC.

Charlotte, North Carolina

Remarks:
Inundated in the seat load. ASTM 2435

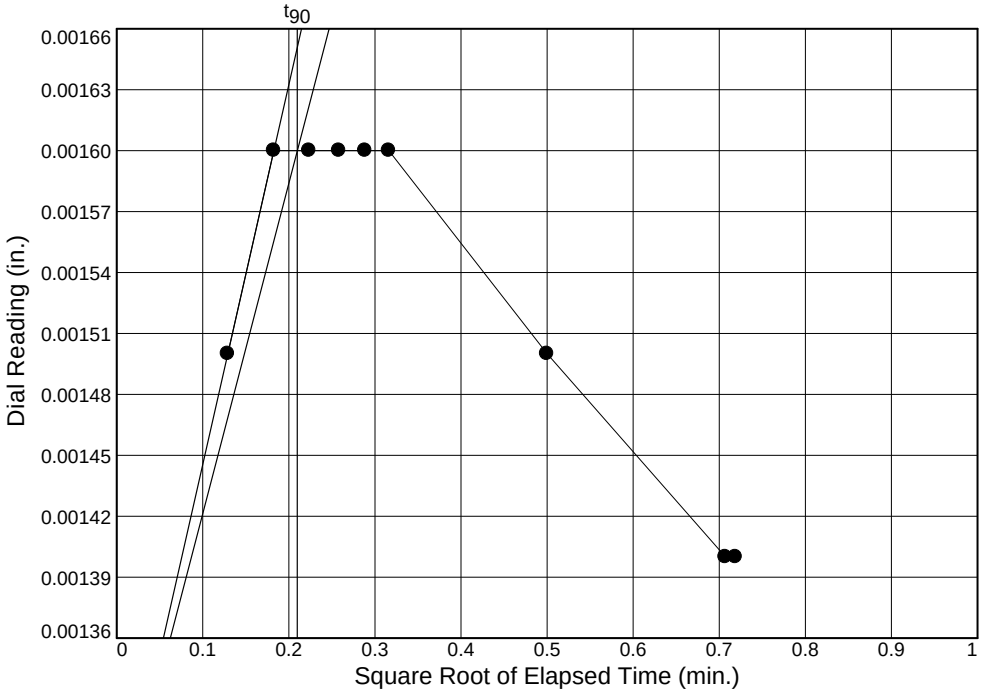
Figure R-33 UD-1

Tested By: Karen Warner **Checked By:** Randy Rainwater

Dial Reading vs. Time

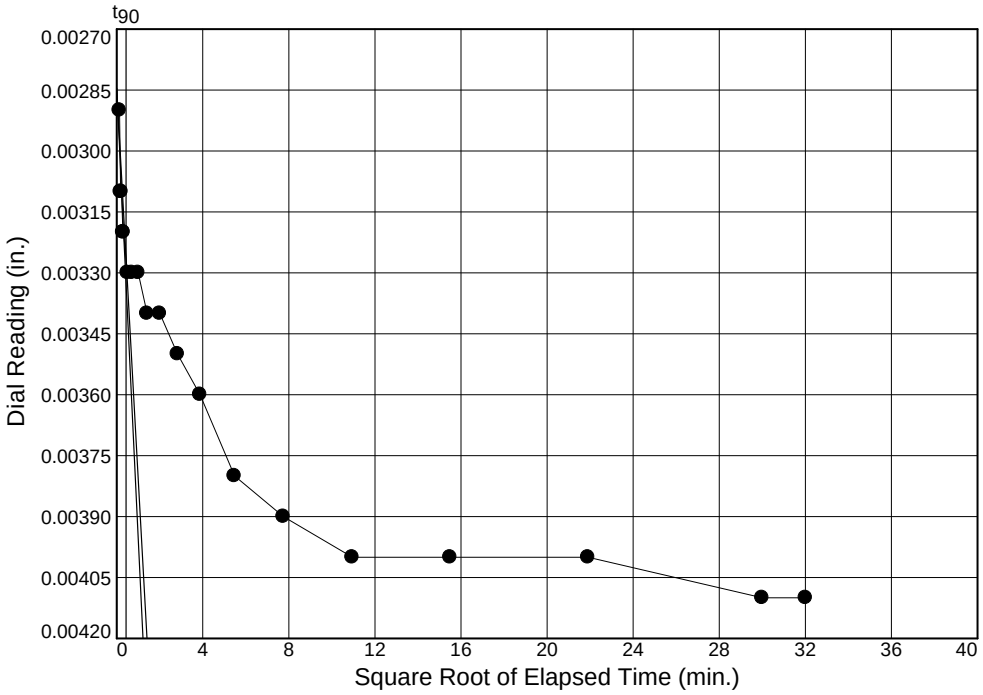
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 1
Load= 0.10 ksf
D_0 = 0.0013
D_{90} = 0.0016
D_{100} = 0.0016
T_{90} = 0.04 min.

C_v @ T_{90}
48.060 ft.^{2}/day



Load No.= 2
Load= 0.25 ksf
D_0 = 0.0028
D_{90} = 0.0033
D_{100} = 0.0033
T_{90} = 0.19 min.

C_v @ T_{90}
11.123 ft.^{2}/day

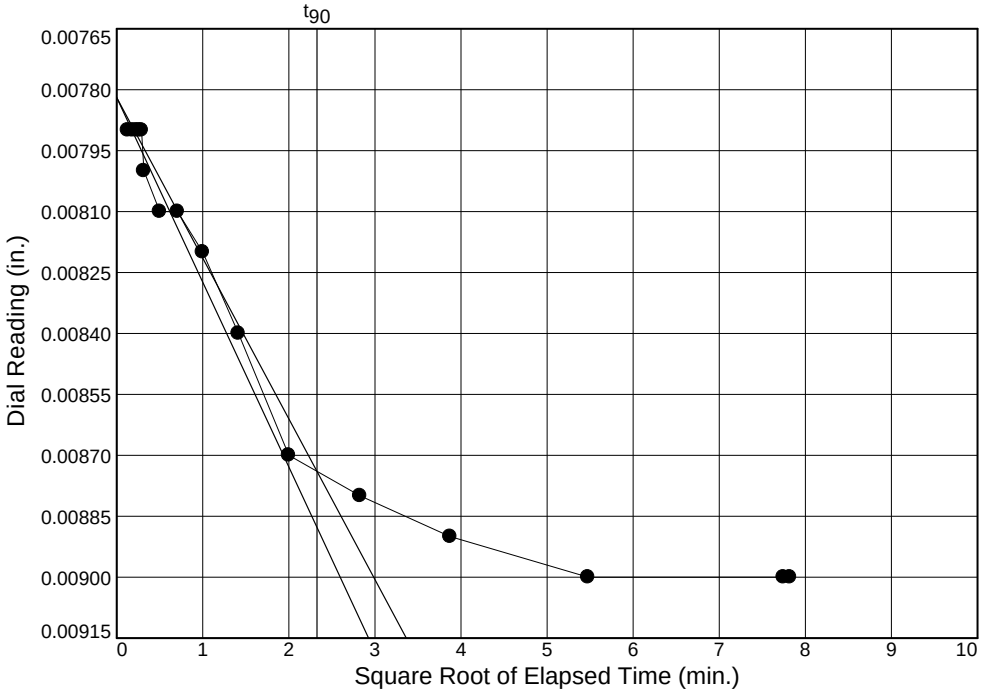
Figure R-33 UD-2

S & ME, INC.

Dial Reading vs. Time

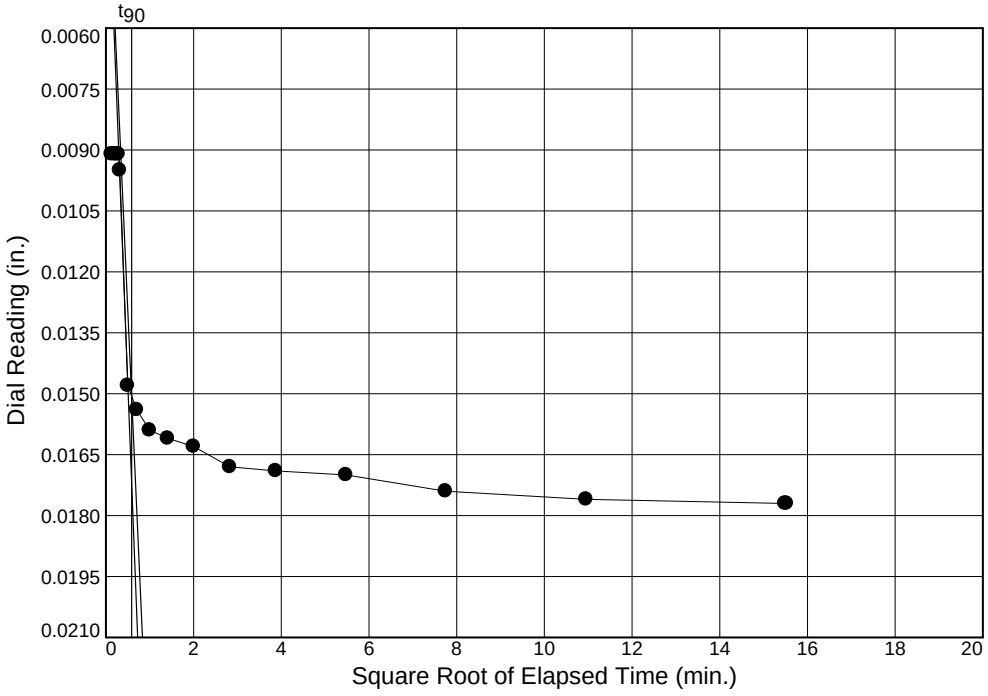
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 3
Load= 0.50 ksf
D_0 = 0.0078
D_{90} = 0.0087
D_{100} = 0.0088
T_{90} = 5.41 min.

C_v @ T_{90}
0.386 ft.^{2}/day



Load No.= 4
Load= 1.00 ksf
D_0 = 0.0009
D_{90} = 0.0151
D_{100} = 0.0166
T_{90} = 0.34 min.

C_v @ T_{90}
5.994 ft.^{2}/day

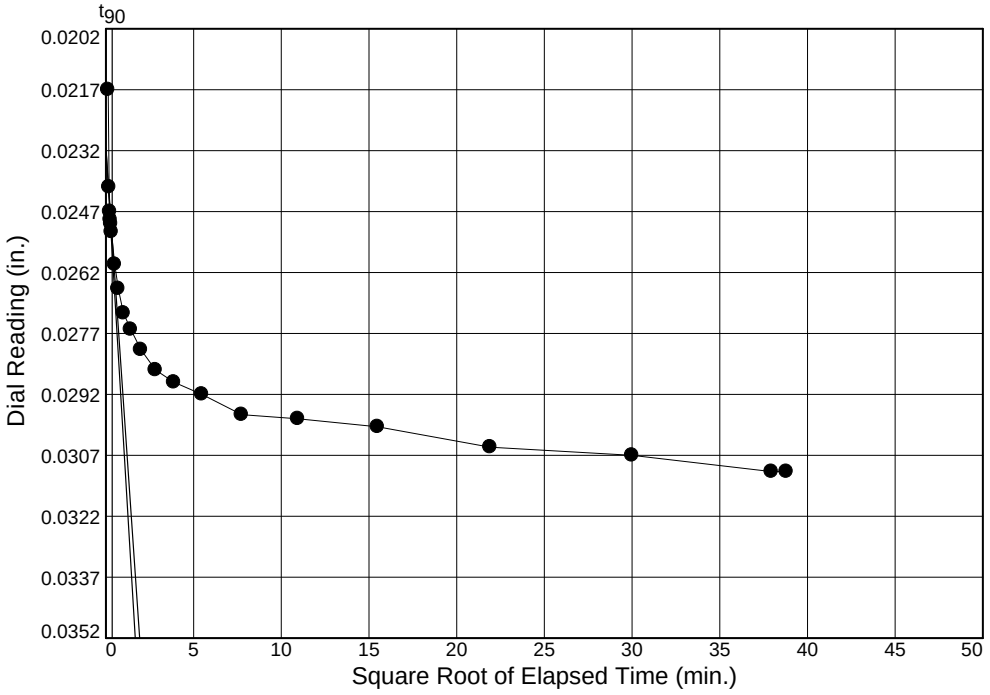
Figure R-33 UD-3

S & ME, INC.

Dial Reading vs. Time

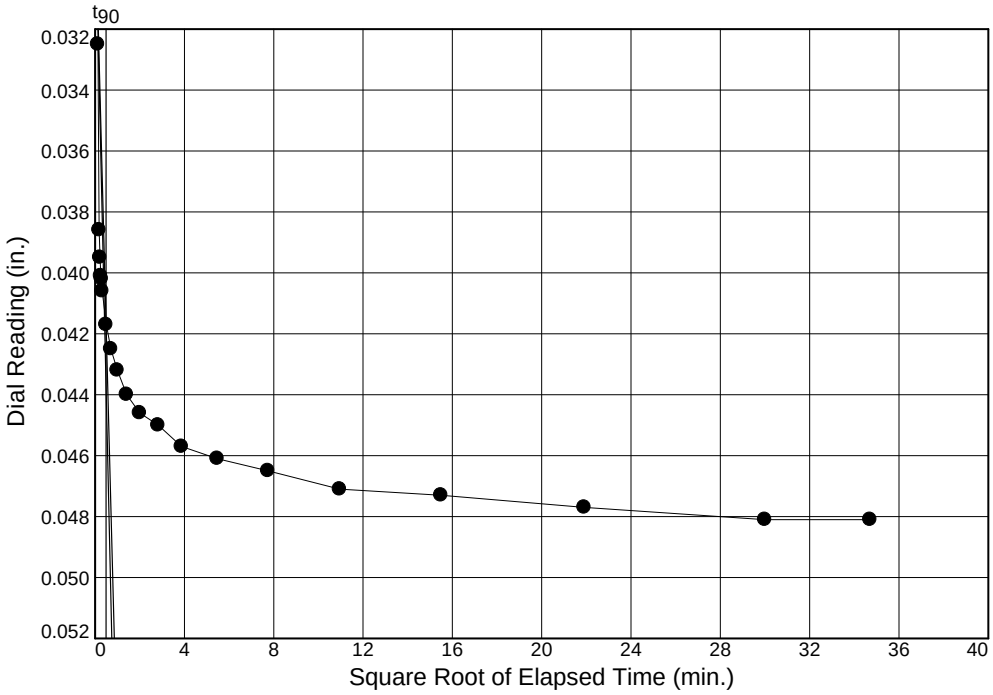
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 5
Load= 2.00 ksf
D_0 = 0.0231
D_{90} = 0.0254
D_{100} = 0.0256
T_{90} = 0.13 min.

C_v @ T_{90}
15.537 ft.^{2}/day



Load No.= 6
Load= 4.00 ksf
D_0 = 0.0280
D_{90} = 0.0416
D_{100} = 0.0431
T_{90} = 0.24 min.

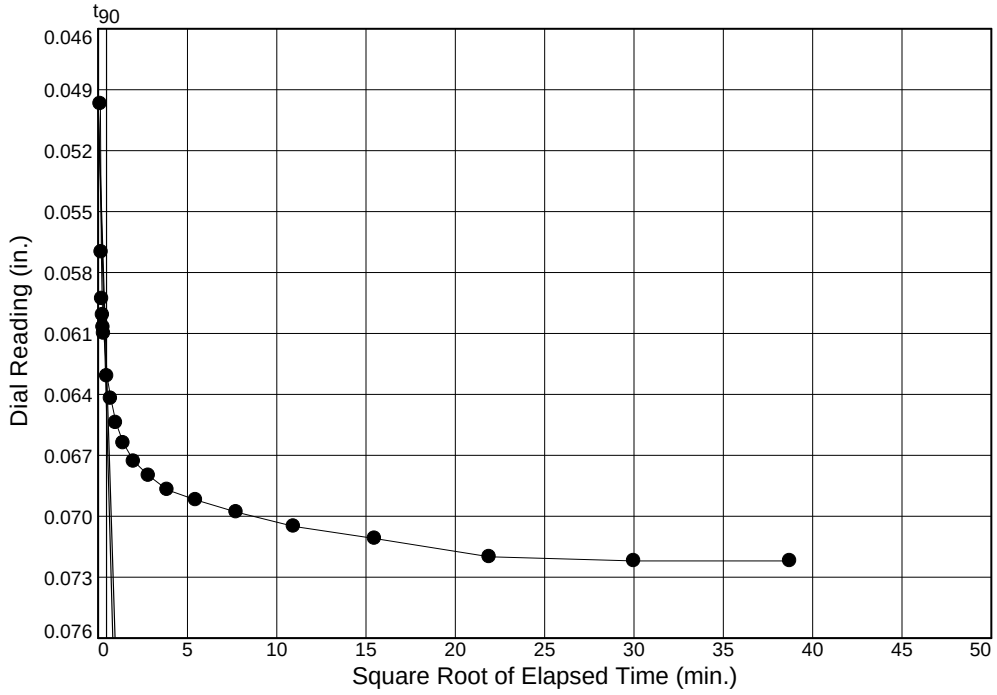
C_v @ T_{90}
8.165 ft.^{2}/day

Figure R-33 UD-4

Dial Reading vs. Time

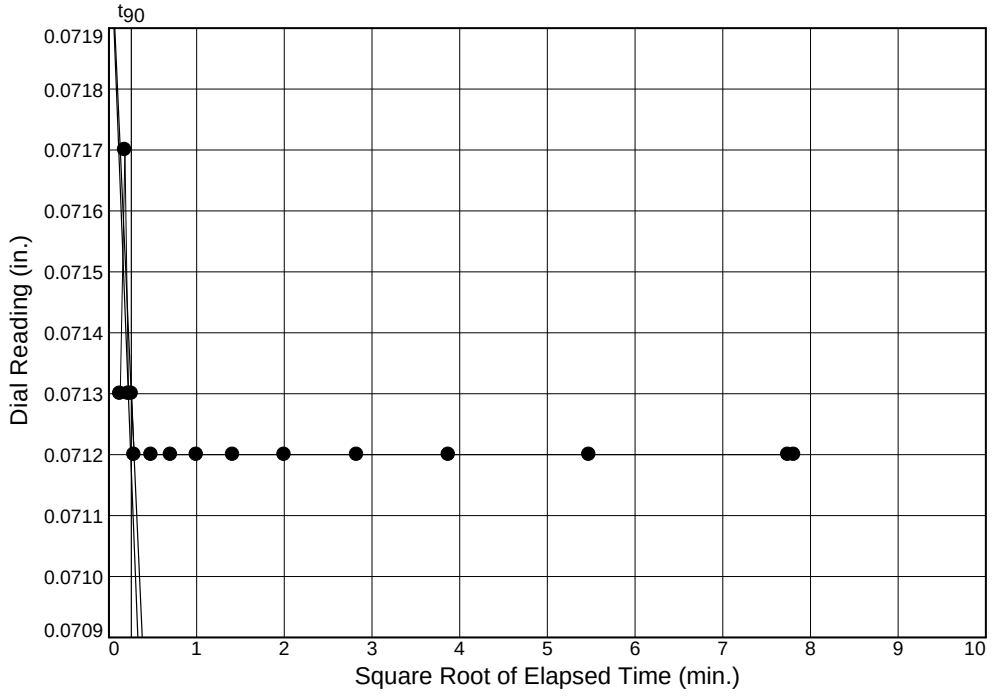
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 7
Load= 8.00 ksf
D_0 = 0.0497
D_{90} = 0.0628
D_{100} = 0.0643
T_{90} = 0.22 min.

C_v @ T_{90}
8.320 ft.^{2}/day



Load No.= 8
Load= 4.00 ksf
D_0 = 0.0721
D_{90} = 0.0713
D_{100} = 0.0712
T_{90} = 0.07 min.

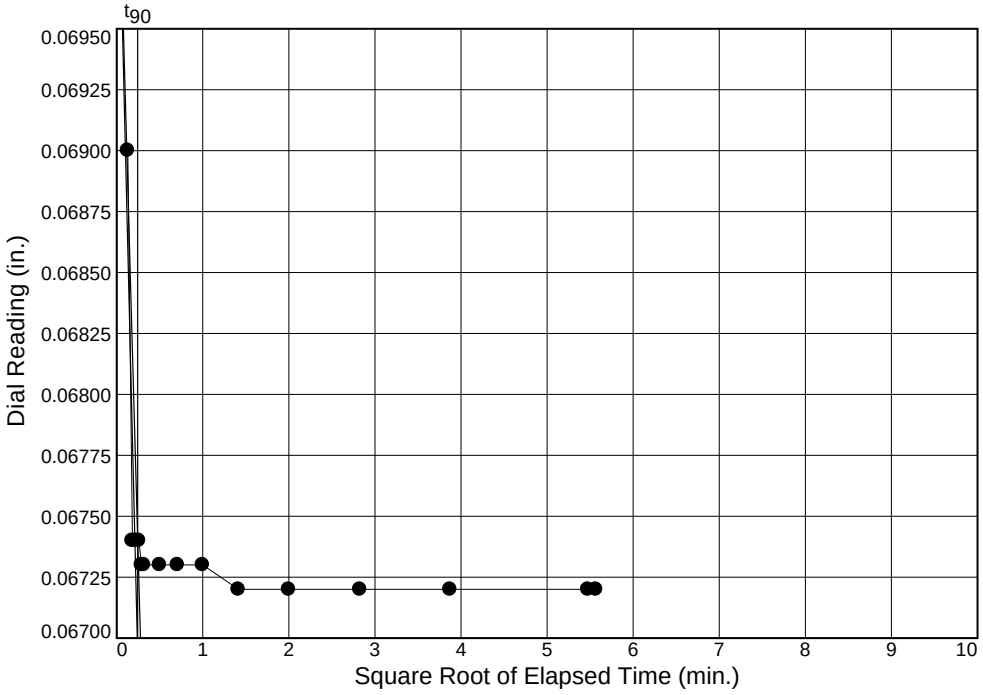
C_v @ T_{90}
28.014 ft.^{2}/day

Figure R-33 UD-5

Dial Reading vs. Time

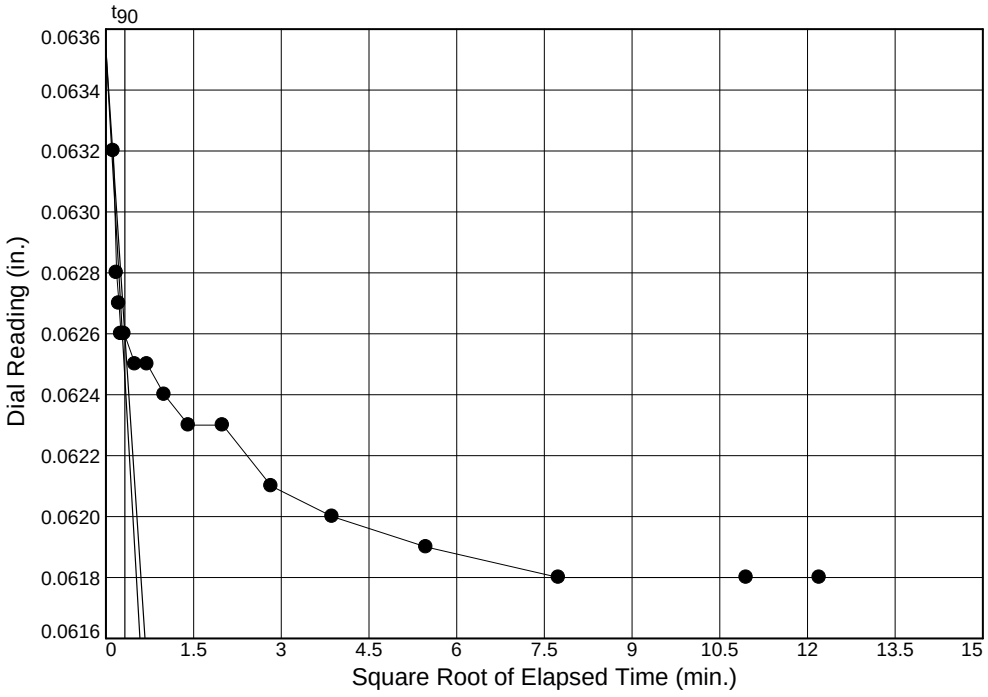
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 9
Load= 1.00 ksf
D_0 = 0.0705
D_{90} = 0.0674
D_{100} = 0.0671
T_{90} = 0.06 min.

C_v @ T_{90}
30.850 ft.^{2}/day



Load No.= 10
Load= 0.25 ksf
D_0 = 0.0635
D_{90} = 0.0626
D_{100} = 0.0625
T_{90} = 0.11 min.

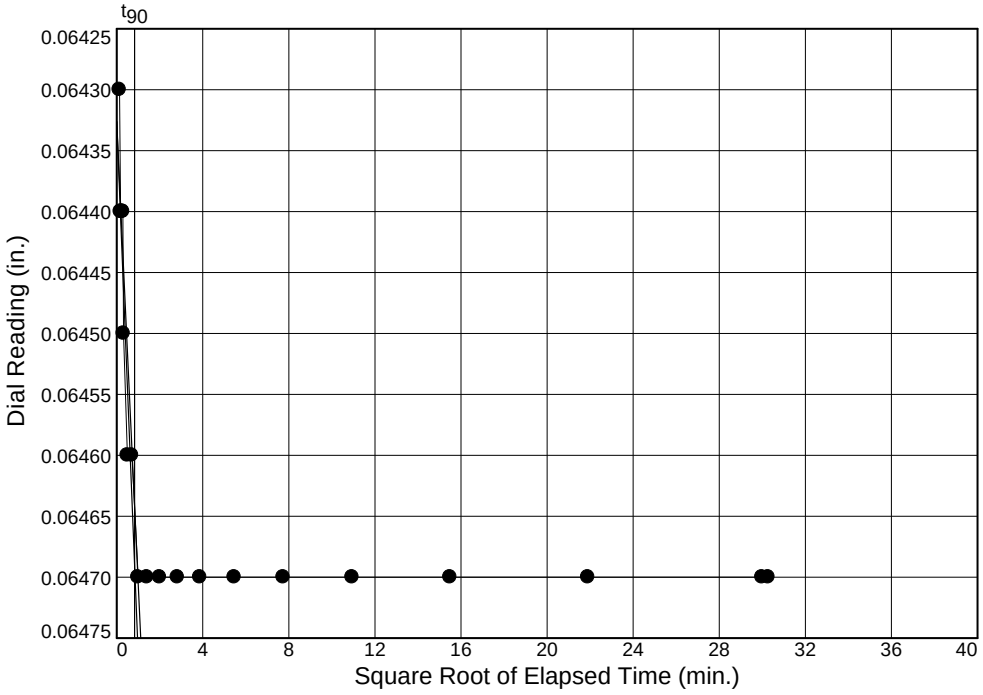
C_v @ T_{90}
17.632 ft.^{2}/day

Figure R-33 UD-6

Dial Reading vs. Time

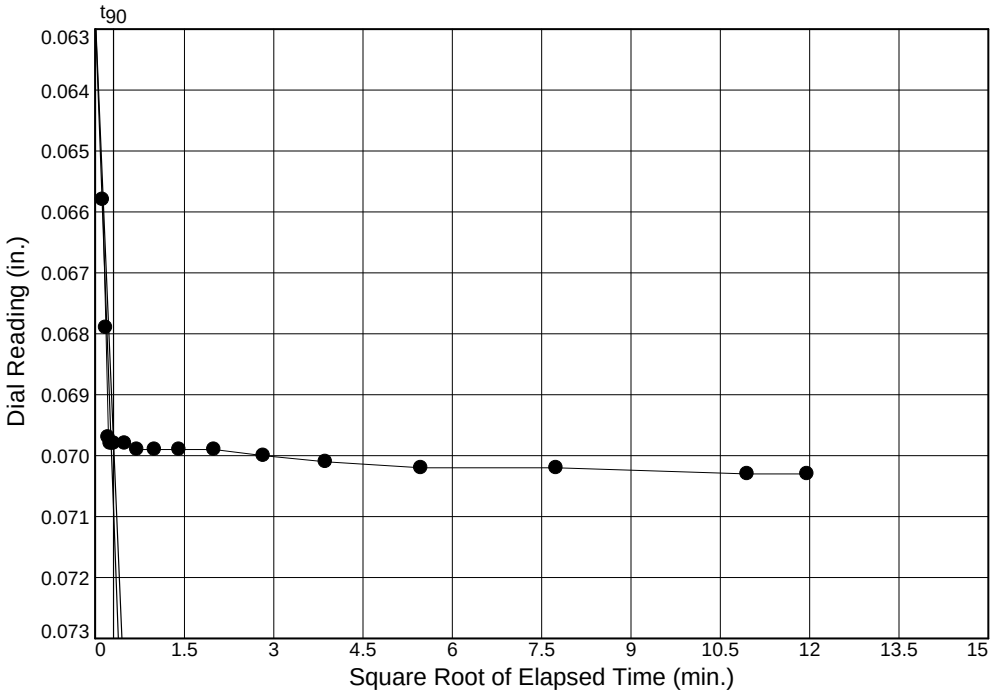
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 11
Load= 1.00 ksf
D_0 = 0.0643
D_{90} = 0.0646
D_{100} = 0.0647
T_{90} = 0.69 min.

C_v @ T_{90}
2.702 ft.^{2}/day



Load No.= 12
Load= 4.00 ksf
D_0 = 0.0627
D_{90} = 0.0698
D_{100} = 0.0706
T_{90} = 0.10 min.

C_v @ T_{90}
19.100 ft.^{2}/day

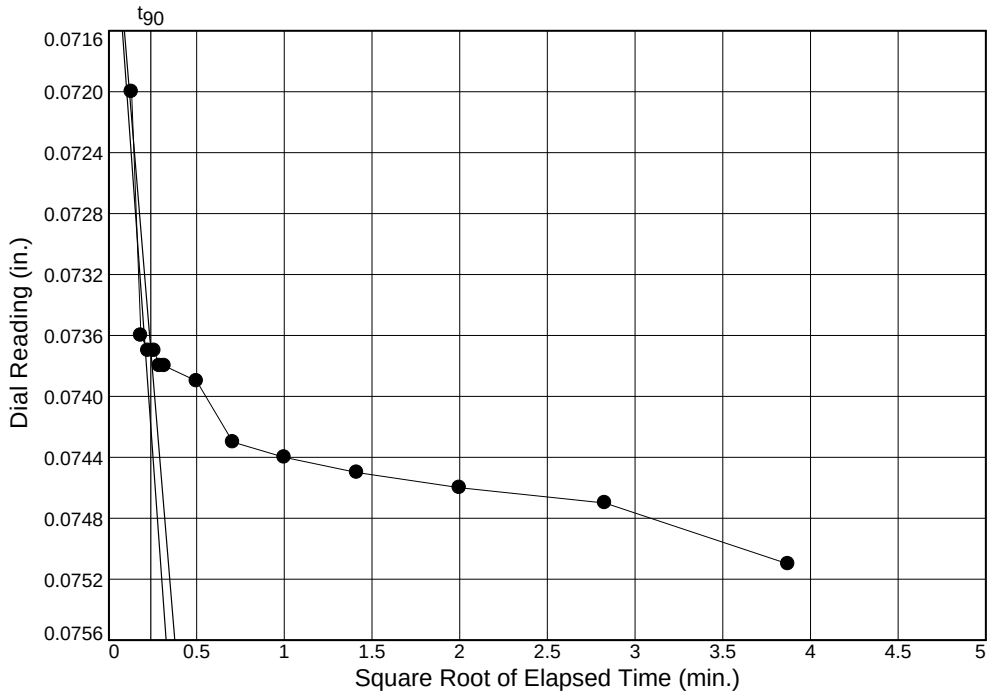
Figure R-33 UD-7

S & ME, INC.

Dial Reading vs. Time

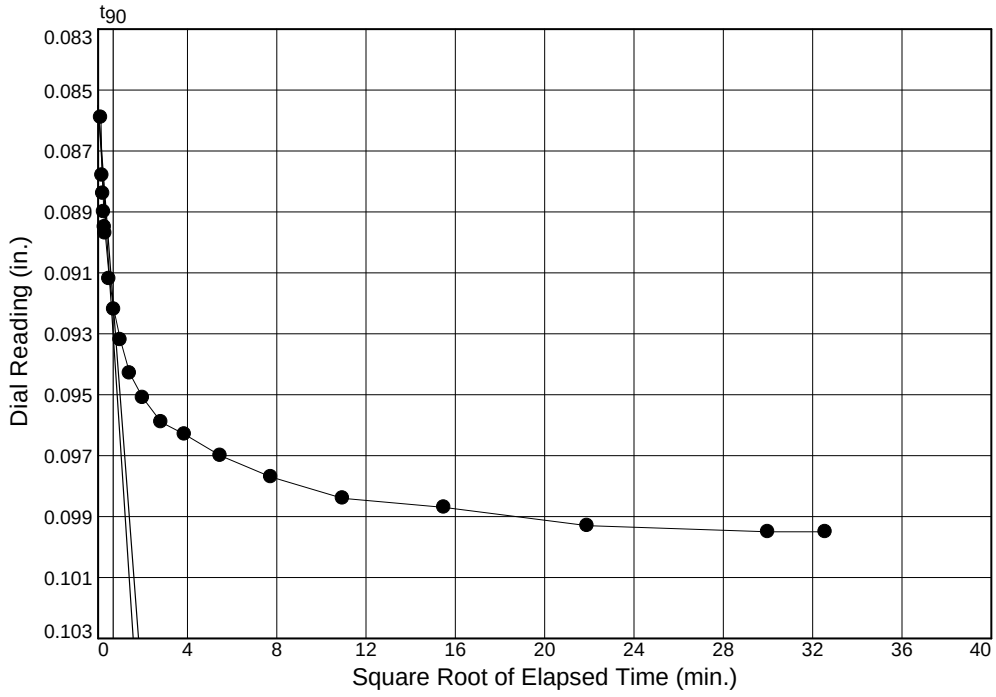
Project No.: 1351-12-037 (01)
Project: SCDOT US 21 to SC 51

Depth: 23.5-25.8 ft Sample Number: R-33



Load No.= 13
Load= 8.00 ksf
D_0 = 0.0704
D_{90} = 0.0737
D_{100} = 0.0741
T_{90} = 0.06 min.

C_v @ T_{90}
31.820 ft.^{2}/day

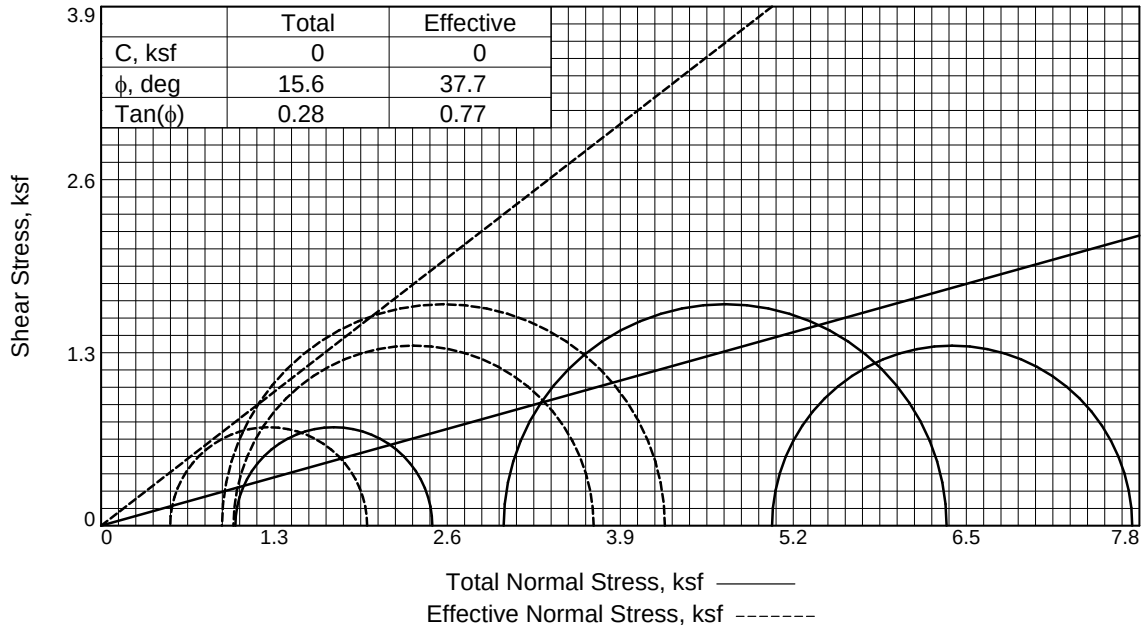


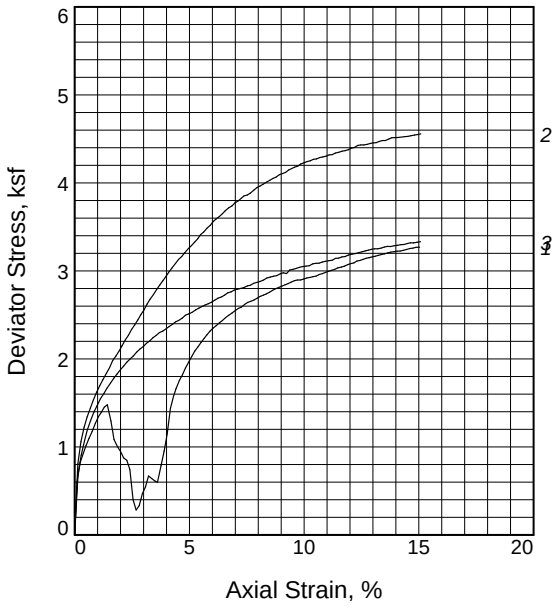
Load No.= 14
Load= 16.00 ksf
D_0 = 0.0855
D_{90} = 0.0921
D_{100} = 0.0928
T_{90} = 0.46 min.

C_v @ T_{90}
3.851 ft.^{2}/day

Figure R-33 UD-8

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1	2	3
Initial	Water Content, %	18.1	18.1	18.3
	Dry Density, pcf	107.7	102.8	99.0
	Saturation, %	89.5	78.7	72.1
	Void Ratio	0.5358	0.6092	0.6714
	Diameter, in.	2.862	2.868	2.862
	Height, in.	5.980	6.011	5.770
At Test	Water Content, %	17.9	18.3	20.9
	Dry Density, pcf	112.1	111.4	106.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4754	0.4853	0.5534
	Diameter, in.	2.824	2.792	2.793
	Height, in.	5.901	5.854	5.632
Strain rate, in./min.		0.004	0.004	0.004
Eff. Cell Pressure, ksf		1.01	3.02	5.04
Fail. Stress, ksf		1.48	3.33	2.71
Total Pore Pr., ksf		10.57	12.20	14.13
Strain, %		1.4	5.2	6.4
Ult. Stress, ksf		3.27	4.56	3.33
Total Pore Pr., ksf		9.69	11.43	13.77
Strain, %		15.0	15.1	15.1
$\bar{\sigma}_1$ Failure, ksf		2.00	4.24	3.70
$\bar{\sigma}_3$ Failure, ksf		0.52	0.91	0.99

Type of Test:
CU with Pore Pressures

Sample Type: Undistrubed

Description: Orange Brown Gray Coarse to Fine Sandy Silty Clay (CL) A-7-6

LL= 45 **PL=** 23 **PI=** 22

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. ASTM D4767

Figure R-37

Client: STV

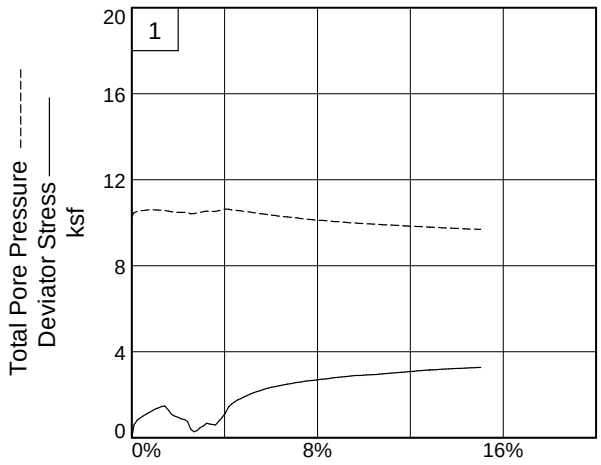
Project: SCDOT US 21 to SC 51

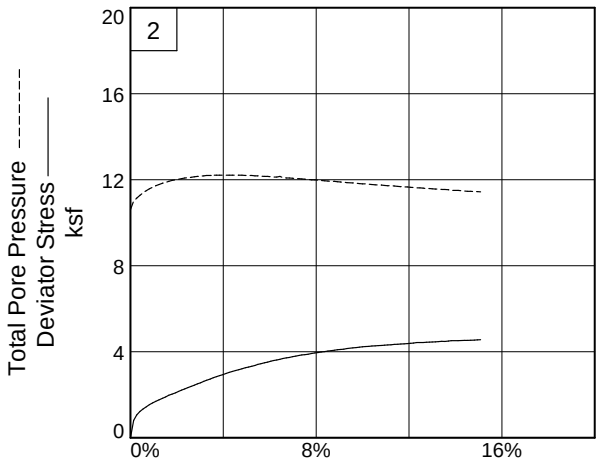
Sample Number: R-37 UD-1 **Depth:** 13.5-15.5 ft

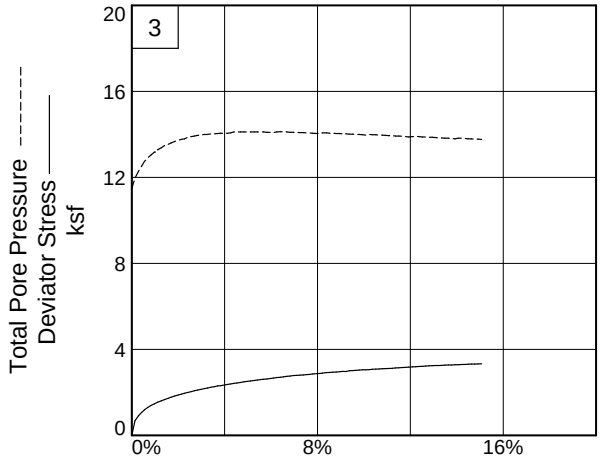
Proj. No.: 1351-12-037 (01) **Date Sampled:** 2014/2015

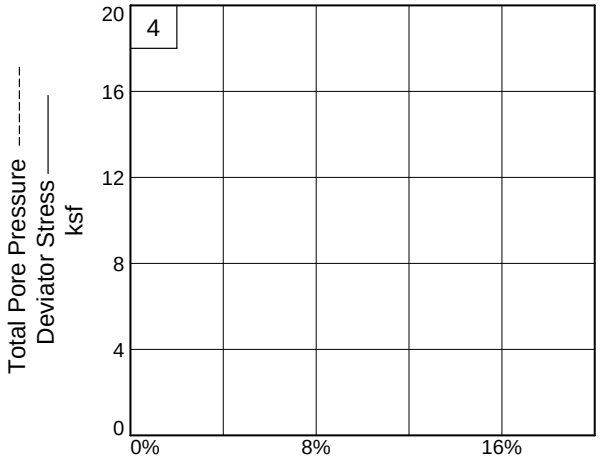
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Charlotte, North Carolina

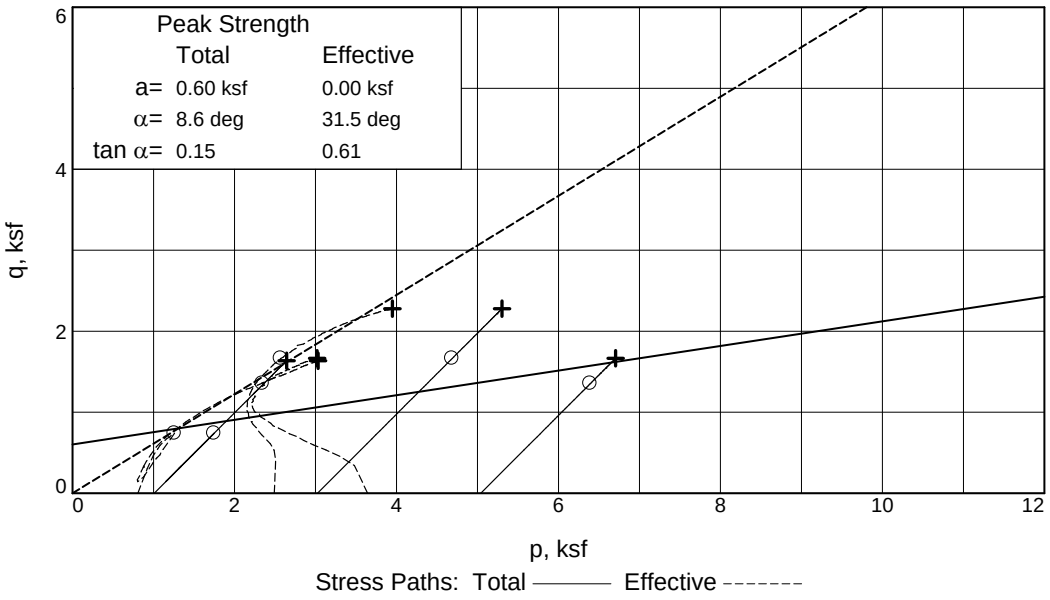
Tested By: Karen Warner **Checked By:** N. Randy Rainwater 2/2/16











Client: STV
Project: SCDOT US 21 to SC 51
Depth: 13.5-15.5 ft **Sample Number:** R-37 UD-1
Project No.: 1351-12-037 (01) **Figure** R-37

S & ME, INC.

Tested By: Karen Warner **Checked By:** N. Randy Rainwater 2/2/16

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 2/2/2016

CU with Pore Pressures 3:27 PM

Date: 2014/2015
Client: STV
Project: SCDOT US 21 to SC 51
Project No.: 1351-12-037 (01)
Depth: 13.5-15.5 ft **Sample Number:** R-37 UD-1
Description: Orange Brown Gray Coarse to Fine Sandy Silty Clay (CL) A-7-6
Remarks: The specimens failed in bulging. ASTM D4767
Type of Sample: Undistrubed
Assumed Specific Gravity=2.65 **LL=**45 **PL=**23 **PI=**22
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	243.180			1038.410
Moisture content: Dry soil+tare, gms.	223.140			854.310
Moisture content: Tare, gms.	112.380			83.380
Moisture, %	18.1	19.9	17.9	23.9
Moist specimen weight, gms.	1284.64			
Diameter, in.	2.862	2.857	2.824	
Area, in.²	6.433	6.410	6.263	
Height, in.	5.980	5.969	5.901	
Net decrease in height, in.		0.011	0.068	
Wet density, pcf	127.2	129.9	132.2	
Dry density, pcf	107.7	108.3	112.1	
Void ratio	0.5358	0.5273	0.4754	
Saturation, %	89.5	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 77.00 psi (11.09 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, in./min. = 0.004
Fail. Stress = 1.48 ksf **at reading no.** 11
Ult. Stress = 3.27 ksf **at reading no.** 112

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0010	19.900	0.0	0.0	0.00	0.81	0.81	1.00	71.40	0.81	0.00
1	0.0070	46.200	26.3	0.1	0.60	0.62	1.22	1.98	72.70	0.92	0.30
2	0.0150	55.700	35.8	0.2	0.82	0.56	1.38	2.46	73.10	0.97	0.41
3	0.0230	60.500	40.6	0.4	0.93	0.53	1.46	2.75	73.30	1.00	0.46
4	0.0300	64.200	44.3	0.5	1.01	0.52	1.53	2.96	73.40	1.03	0.51
5	0.0380	68.000	48.1	0.6	1.10	0.50	1.60	3.18	73.50	1.05	0.55
6	0.0460	71.600	51.7	0.8	1.18	0.49	1.67	3.41	73.60	1.08	0.59
7	0.0540	75.500	55.6	0.9	1.27	0.49	1.76	3.59	73.60	1.12	0.63
8	0.0620	79.000	59.1	1.0	1.34	0.49	1.83	3.75	73.60	1.16	0.67
9	0.0690	81.100	61.2	1.2	1.39	0.50	1.89	3.76	73.50	1.20	0.70
10	0.0770	83.900	64.0	1.3	1.45	0.50	1.96	3.88	73.50	1.23	0.73
11	0.0850	85.200	65.3	1.4	1.48	0.52	2.00	3.85	73.40	1.26	0.74
12	0.0940	77.100	57.2	1.6	1.29	0.55	1.84	3.37	73.20	1.19	0.65
13	0.1020	67.900	48.0	1.7	1.08	0.58	1.66	2.88	73.00	1.12	0.54
14	0.1110	64.370	44.5	1.9	1.00	0.59	1.59	2.70	72.90	1.09	0.50
15	0.1190	62.000	42.1	2.0	0.95	0.60	1.55	2.57	72.80	1.08	0.47
16	0.1270	58.800	38.9	2.1	0.88	0.60	1.48	2.45	72.80	1.04	0.44
17	0.1350	57.700	37.8	2.3	0.85	0.60	1.45	2.40	72.80	1.03	0.42
18	0.1430	53.100	33.2	2.4	0.74	0.62	1.36	2.20	72.70	0.99	0.37
19	0.1510	37.800	17.9	2.5	0.40	0.68	1.08	1.59	72.30	0.88	0.20
20	0.1590	32.600	12.7	2.7	0.28	0.66	0.95	1.43	72.40	0.80	0.14
21	0.1670	34.800	14.9	2.8	0.33	0.63	0.97	1.53	72.60	0.80	0.17
22	0.1750	41.000	21.1	2.9	0.47	0.60	1.08	1.78	72.80	0.84	0.24
23	0.1830	44.400	24.5	3.1	0.55	0.58	1.12	1.95	73.00	0.85	0.27
24	0.1910	50.000	30.1	3.2	0.67	0.55	1.22	2.22	73.20	0.88	0.33
25	0.1990	48.800	28.9	3.4	0.64	0.56	1.20	2.14	73.10	0.88	0.32
26	0.2070	47.600	27.7	3.5	0.61	0.56	1.18	2.09	73.10	0.87	0.31
27	0.2140	46.900	27.0	3.6	0.60	0.56	1.16	2.07	73.10	0.86	0.30
28	0.2230	55.500	35.6	3.8	0.79	0.52	1.31	2.52	73.40	0.91	0.39
29	0.2310	63.000	43.1	3.9	0.95	0.49	1.44	2.95	73.60	0.97	0.48
30	0.2390	72.000	52.1	4.0	1.15	0.46	1.61	3.49	73.80	1.04	0.57
31	0.2470	85.100	65.2	4.2	1.44	0.46	1.90	4.12	73.80	1.18	0.72
32	0.2550	91.400	71.5	4.3	1.57	0.49	2.06	4.21	73.60	1.28	0.79
33	0.2620	95.700	75.8	4.4	1.67	0.50	2.17	4.30	73.50	1.34	0.83
34	0.2700	99.900	80.0	4.6	1.76	0.52	2.27	4.39	73.40	1.40	0.88
35	0.2780	102.900	83.0	4.7	1.82	0.53	2.35	4.41	73.30	1.44	0.91
36	0.2860	106.600	86.7	4.8	1.90	0.56	2.46	4.38	73.10	1.51	0.95
37	0.2940	109.800	89.9	5.0	1.96	0.58	2.54	4.41	73.00	1.56	0.98
38	0.3020	112.800	92.9	5.1	2.03	0.59	2.62	4.43	72.90	1.60	1.01
39	0.3100	115.800	95.9	5.2	2.09	0.62	2.71	4.37	72.70	1.66	1.04
40	0.3180	118.200	98.3	5.4	2.14	0.63	2.77	4.38	72.60	1.70	1.07
41	0.3260	120.600	100.7	5.5	2.19	0.66	2.85	4.30	72.40	1.76	1.09
42	0.3340	122.900	103.0	5.6	2.23	0.68	2.91	4.30	72.30	1.79	1.12
43	0.3410	124.900	105.0	5.8	2.27	0.69	2.97	4.29	72.20	1.83	1.14
44	0.3490	126.900	107.0	5.9	2.31	0.72	3.03	4.22	72.00	1.88	1.16
45	0.3570	128.700	108.8	6.0	2.35	0.73	3.08	4.20	71.90	1.91	1.18
46	0.3650	130.200	110.3	6.2	2.38	0.75	3.13	4.18	71.80	1.94	1.19

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.3740	132.000	112.1	6.3	2.41	0.78	3.19	4.10	71.60	1.98	1.21
48	0.3810	133.200	113.3	6.4	2.44	0.79	3.23	4.08	71.50	2.01	1.22
49	0.3890	134.900	115.0	6.6	2.47	0.81	3.28	4.06	71.40	2.04	1.24
50	0.3970	136.300	116.4	6.7	2.50	0.82	3.32	4.04	71.30	2.07	1.25
51	0.4060	137.700	117.8	6.9	2.52	0.84	3.36	4.02	71.20	2.10	1.26
52	0.4140	139.200	119.3	7.0	2.55	0.86	3.41	3.95	71.00	2.14	1.28
53	0.4220	140.500	120.6	7.1	2.57	0.86	3.44	3.98	71.00	2.15	1.29
54	0.4300	141.400	121.5	7.3	2.59	0.89	3.48	3.90	70.80	2.19	1.30
55	0.4380	143.000	123.1	7.4	2.62	0.91	3.53	3.89	70.70	2.22	1.31
56	0.4460	144.200	124.3	7.5	2.64	0.92	3.56	3.87	70.60	2.24	1.32
57	0.4540	145.000	125.1	7.7	2.66	0.94	3.59	3.84	70.50	2.26	1.33
58	0.4620	145.900	126.0	7.8	2.67	0.95	3.62	3.81	70.40	2.29	1.34
59	0.4700	147.000	127.1	7.9	2.69	0.96	3.65	3.79	70.30	2.31	1.34
60	0.4780	148.200	128.3	8.1	2.71	0.98	3.69	3.77	70.20	2.33	1.36
61	0.4860	149.000	129.1	8.2	2.72	0.98	3.70	3.78	70.20	2.34	1.36
62	0.4940	149.900	130.0	8.4	2.74	0.99	3.73	3.76	70.10	2.36	1.37
63	0.5020	151.000	131.1	8.5	2.76	1.01	3.77	3.74	70.00	2.39	1.38
64	0.5100	152.200	132.3	8.6	2.78	1.02	3.80	3.72	69.90	2.41	1.39
65	0.5170	153.200	133.3	8.7	2.80	1.04	3.83	3.70	69.80	2.44	1.40
66	0.5260	154.200	134.3	8.9	2.81	1.04	3.85	3.71	69.80	2.44	1.41
67	0.5340	155.100	135.2	9.0	2.83	1.05	3.88	3.69	69.70	2.47	1.41
68	0.5420	156.000	136.1	9.2	2.84	1.07	3.91	3.67	69.60	2.49	1.42
69	0.5500	156.900	137.0	9.3	2.86	1.08	3.94	3.65	69.50	2.51	1.43
70	0.5580	157.900	138.0	9.4	2.87	1.09	3.97	3.63	69.40	2.53	1.44
71	0.5660	158.900	139.0	9.6	2.89	1.09	3.98	3.64	69.40	2.54	1.44
72	0.5740	159.500	139.6	9.7	2.90	1.11	4.01	3.61	69.30	2.56	1.45
73	0.5820	159.700	139.8	9.8	2.90	1.12	4.02	3.58	69.20	2.57	1.45
74	0.5900	160.400	140.5	10.0	2.91	1.12	4.03	3.59	69.20	2.58	1.45
75	0.5980	161.200	141.3	10.1	2.92	1.14	4.06	3.57	69.10	2.60	1.46
76	0.6060	161.700	141.8	10.3	2.93	1.14	4.06	3.57	69.10	2.60	1.46
77	0.6140	162.400	142.5	10.4	2.94	1.15	4.09	3.55	69.00	2.62	1.47
78	0.6220	162.900	143.0	10.5	2.94	1.15	4.09	3.55	69.00	2.62	1.47
79	0.6300	164.000	144.1	10.7	2.96	1.17	4.13	3.54	68.90	2.65	1.48
80	0.6380	164.700	144.8	10.8	2.97	1.18	4.15	3.52	68.80	2.67	1.48
81	0.6460	165.600	145.7	10.9	2.98	1.18	4.16	3.53	68.80	2.67	1.49
82	0.6540	166.400	146.5	11.1	3.00	1.20	4.19	3.51	68.70	2.69	1.50
83	0.6620	167.200	147.3	11.2	3.01	1.20	4.20	3.52	68.70	2.70	1.50
84	0.6700	168.000	148.1	11.3	3.02	1.21	4.23	3.50	68.60	2.72	1.51
85	0.6780	169.000	149.1	11.5	3.03	1.21	4.24	3.51	68.60	2.73	1.52
86	0.6870	169.700	149.8	11.6	3.04	1.22	4.27	3.49	68.50	2.75	1.52
87	0.6950	170.500	150.6	11.8	3.06	1.24	4.29	3.47	68.40	2.77	1.53
88	0.7030	171.500	151.6	11.9	3.07	1.24	4.31	3.48	68.40	2.77	1.54
89	0.7110	172.400	152.5	12.0	3.08	1.25	4.34	3.46	68.30	2.79	1.54
90	0.7190	173.000	153.1	12.2	3.09	1.25	4.34	3.47	68.30	2.80	1.55
91	0.7270	174.300	154.4	12.3	3.11	1.27	4.38	3.46	68.20	2.82	1.56
92	0.7350	174.900	155.0	12.4	3.12	1.27	4.39	3.46	68.20	2.83	1.56
93	0.7430	175.700	155.8	12.6	3.13	1.28	4.41	3.44	68.10	2.85	1.57

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
94	0.7510	176.600	156.7	12.7	3.14	1.28	4.43	3.45	68.10	2.85	1.57
95	0.7580	177.200	157.3	12.8	3.15	1.30	4.45	3.43	68.00	2.87	1.58
96	0.7580	177.200	157.3	12.8	3.15	1.30	4.45	3.43	68.00	2.87	1.58
97	0.7660	177.800	157.9	13.0	3.16	1.30	4.46	3.44	68.00	2.88	1.58
98	0.7740	178.400	158.5	13.1	3.17	1.31	4.48	3.42	67.90	2.89	1.58
99	0.7820	179.200	159.3	13.2	3.18	1.31	4.49	3.43	67.90	2.90	1.59
100	0.7900	179.900	160.0	13.4	3.19	1.32	4.51	3.41	67.80	2.92	1.59
101	0.7980	180.500	160.6	13.5	3.19	1.32	4.52	3.41	67.80	2.92	1.60
102	0.8060	181.300	161.4	13.6	3.20	1.34	4.54	3.39	67.70	2.94	1.60
103	0.8140	182.000	162.1	13.8	3.21	1.34	4.55	3.40	67.70	2.95	1.61
104	0.8220	182.500	162.6	13.9	3.22	1.35	4.57	3.38	67.60	2.96	1.61
105	0.8300	183.100	163.2	14.0	3.23	1.35	4.58	3.38	67.60	2.97	1.61
106	0.8380	183.400	163.5	14.2	3.23	1.37	4.59	3.36	67.50	2.98	1.61
107	0.8470	184.200	164.3	14.3	3.24	1.37	4.60	3.37	67.50	2.99	1.62
108	0.8550	184.900	165.0	14.5	3.24	1.38	4.63	3.35	67.40	3.00	1.62
109	0.8630	185.700	165.8	14.6	3.26	1.38	4.64	3.35	67.40	3.01	1.63
110	0.8710	186.200	166.3	14.7	3.26	1.38	4.64	3.36	67.40	3.01	1.63
111	0.8790	186.900	167.0	14.9	3.27	1.40	4.67	3.34	67.30	3.03	1.63
112	0.8880	187.300	167.4	15.0	3.27	1.40	4.67	3.34	67.30	3.03	1.64

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	243.180			653.910
Moisture content: Dry soil+tare, gms.	223.140			519.640
Moisture content: Tare, gms.	112.380			74.530
Moisture, %	18.1	22.4	18.3	30.2
Moist specimen weight, gms.	1237.51			
Diameter, in.	2.868	2.858	2.792	
Area, in.²	6.460	6.417	6.123	
Height, in.	6.011	5.991	5.854	
Net decrease in height, in.		0.020	0.137	
Wet density, pcf	121.4	127.1	131.8	
Dry density, pcf	102.8	103.8	111.4	
Void ratio	0.6092	0.5932	0.4853	
Saturation, %	78.7	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 91.00 psi (13.10 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 3.02 ksf
Strain rate, in./min. = 0.004
Fail. Stress = 3.33 ksf **at reading no.** 38
Ult. Stress = 4.56 ksf **at reading no.** 107

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0050	18.600	0.0	0.0	0.00	2.49	2.49	1.00	73.70	2.49	0.00
1	0.0130	53.100	34.5	0.1	0.81	2.10	2.91	1.39	76.40	2.51	0.41
2	0.0210	63.800	45.2	0.3	1.06	1.96	3.02	1.54	77.40	2.49	0.53
3	0.0290	70.900	52.3	0.4	1.22	1.83	3.05	1.67	78.30	2.44	0.61
4	0.0370	76.000	57.4	0.5	1.34	1.71	3.06	1.78	79.10	2.38	0.67
5	0.0450	80.400	61.8	0.7	1.44	1.61	3.06	1.90	79.80	2.33	0.72
6	0.0530	84.500	65.9	0.8	1.54	1.53	3.06	2.01	80.40	2.29	0.77
7	0.0610	88.300	69.7	1.0	1.62	1.45	3.08	2.12	80.90	2.27	0.81
8	0.0690	91.500	72.9	1.1	1.70	1.38	3.08	2.23	81.40	2.23	0.85
9	0.0770	94.600	76.0	1.2	1.77	1.32	3.09	2.33	81.80	2.21	0.88
10	0.0860	97.800	79.2	1.4	1.84	1.27	3.10	2.45	82.20	2.19	0.92
11	0.0940	100.700	82.1	1.5	1.90	1.22	3.13	2.55	82.50	2.17	0.95
12	0.1020	104.300	85.7	1.7	1.98	1.18	3.16	2.68	82.80	2.17	0.99
13	0.1100	106.600	88.0	1.8	2.03	1.14	3.17	2.79	83.10	2.15	1.02
14	0.1190	109.400	90.8	1.9	2.09	1.11	3.20	2.89	83.30	2.16	1.05
15	0.1260	112.000	93.4	2.1	2.15	1.08	3.23	2.99	83.50	2.16	1.08
16	0.1340	115.000	96.4	2.2	2.22	1.05	3.27	3.11	83.70	2.16	1.11
17	0.1420	117.400	98.8	2.3	2.27	1.02	3.29	3.22	83.90	2.16	1.13
18	0.1500	120.400	101.8	2.5	2.33	1.01	3.34	3.32	84.00	2.18	1.17
19	0.1580	122.800	104.2	2.6	2.39	0.99	3.38	3.40	84.10	2.19	1.19
20	0.1660	125.500	106.9	2.8	2.45	0.96	3.41	3.53	84.30	2.19	1.22
21	0.1740	128.300	109.7	2.9	2.51	0.95	3.46	3.64	84.40	2.20	1.25
22	0.1820	130.800	112.2	3.0	2.56	0.94	3.50	3.73	84.50	2.22	1.28
23	0.1900	133.900	115.3	3.2	2.63	0.92	3.55	3.85	84.60	2.23	1.31
24	0.1970	136.300	117.7	3.3	2.68	0.91	3.58	3.95	84.70	2.25	1.34
25	0.2060	138.900	120.3	3.4	2.73	0.91	3.64	4.01	84.70	2.27	1.37

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
26	0.2140	141.600	123.0	3.6	2.79	0.89	3.68	4.12	84.80	2.29	1.39
27	0.2220	144.000	125.4	3.7	2.84	0.89	3.73	4.18	84.80	2.31	1.42
28	0.2300	146.400	127.8	3.8	2.89	0.89	3.78	4.24	84.80	2.34	1.45
29	0.2380	148.700	130.1	4.0	2.94	0.89	3.83	4.29	84.80	2.36	1.47
30	0.2460	151.300	132.7	4.1	2.99	0.89	3.89	4.35	84.80	2.39	1.50
31	0.2540	153.500	134.9	4.3	3.04	0.89	3.93	4.40	84.80	2.41	1.52
32	0.2620	155.800	137.2	4.4	3.09	0.89	3.98	4.46	84.80	2.44	1.54
33	0.2700	158.000	139.4	4.5	3.13	0.89	4.02	4.51	84.80	2.46	1.57
34	0.2780	159.700	141.1	4.7	3.16	0.89	4.06	4.54	84.80	2.47	1.58
35	0.2860	161.900	143.3	4.8	3.21	0.89	4.10	4.59	84.80	2.50	1.60
36	0.2950	164.200	145.6	5.0	3.25	0.91	4.16	4.59	84.70	2.53	1.63
37	0.3030	165.900	147.3	5.1	3.29	0.91	4.20	4.62	84.70	2.55	1.64
38	0.3110	167.900	149.3	5.2	3.33	0.91	4.24	4.67	84.70	2.57	1.66
39	0.3190	169.800	151.2	5.4	3.37	0.92	4.29	4.65	84.60	2.60	1.68
40	0.3260	172.100	153.5	5.5	3.41	0.92	4.33	4.70	84.60	2.63	1.71
41	0.3340	173.600	155.0	5.6	3.44	0.94	4.38	4.68	84.50	2.66	1.72
42	0.3430	176.000	157.4	5.8	3.49	0.95	4.44	4.67	84.40	2.69	1.74
43	0.3510	177.600	159.0	5.9	3.52	0.95	4.47	4.70	84.40	2.71	1.76
44	0.3590	179.900	161.3	6.0	3.56	0.96	4.53	4.69	84.30	2.75	1.78
45	0.3660	181.300	162.7	6.2	3.59	0.98	4.57	4.67	84.20	2.77	1.80
46	0.3740	182.800	164.2	6.3	3.62	0.98	4.60	4.70	84.20	2.79	1.81
47	0.3820	184.500	165.9	6.4	3.65	0.95	4.60	4.84	84.40	2.78	1.83
48	0.3890	186.200	167.6	6.6	3.68	1.01	4.69	4.65	84.00	2.85	1.84
49	0.3980	188.000	169.4	6.7	3.72	1.02	4.74	4.64	83.90	2.88	1.86
50	0.4060	189.200	170.6	6.9	3.74	1.02	4.76	4.66	83.90	2.89	1.87
51	0.4140	191.100	172.5	7.0	3.77	1.04	4.81	4.64	83.80	2.92	1.89
52	0.4220	192.400	173.8	7.1	3.80	1.05	4.85	4.61	83.70	2.95	1.90
53	0.4300	194.000	175.4	7.3	3.83	1.05	4.88	4.64	83.70	2.96	1.91
54	0.4370	195.500	176.9	7.4	3.85	1.07	4.92	4.62	83.60	2.99	1.93
55	0.4450	196.200	177.6	7.5	3.86	1.08	4.94	4.58	83.50	3.01	1.93
56	0.4530	197.400	178.8	7.7	3.88	1.09	4.98	4.55	83.40	3.04	1.94
57	0.4620	199.300	180.7	7.8	3.92	1.11	5.03	4.53	83.30	3.07	1.96
58	0.4700	200.900	182.3	7.9	3.95	1.11	5.06	4.56	83.30	3.08	1.97
59	0.4780	202.000	183.4	8.1	3.96	1.12	5.09	4.53	83.20	3.11	1.98
60	0.4860	203.300	184.7	8.2	3.99	1.14	5.12	4.50	83.10	3.13	1.99
61	0.4950	204.700	186.1	8.4	4.01	1.15	5.16	4.48	83.00	3.16	2.01
62	0.5030	205.900	187.3	8.5	4.03	1.17	5.20	4.46	82.90	3.18	2.02
63	0.5110	207.200	188.6	8.6	4.05	1.18	5.23	4.43	82.80	3.21	2.03
64	0.5190	208.200	189.6	8.8	4.07	1.18	5.25	4.44	82.80	3.21	2.03
65	0.5270	209.700	191.1	8.9	4.09	1.20	5.29	4.43	82.70	3.24	2.05
66	0.5350	210.600	192.0	9.1	4.11	1.21	5.32	4.40	82.60	3.26	2.05
67	0.5430	211.500	192.9	9.2	4.12	1.22	5.34	4.37	82.50	3.28	2.06
68	0.5510	213.100	194.5	9.3	4.15	1.24	5.39	4.35	82.40	3.31	2.07
69	0.5660	215.100	196.5	9.6	4.18	1.25	5.43	4.34	82.30	3.34	2.09
70	0.5740	216.000	197.4	9.7	4.19	1.27	5.46	4.31	82.20	3.36	2.10
71	0.5820	217.400	198.8	9.9	4.21	1.28	5.50	4.29	82.10	3.39	2.11
72	0.5900	218.400	199.8	10.0	4.23	1.30	5.53	4.26	82.00	3.41	2.11

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
73	0.5980	219.300	200.7	10.1	4.24	1.30	5.54	4.27	82.00	3.42	2.12
74	0.6060	220.100	201.5	10.3	4.25	1.31	5.56	4.25	81.90	3.44	2.13
75	0.6140	221.200	202.6	10.4	4.27	1.32	5.59	4.22	81.80	3.46	2.13
76	0.6220	221.700	203.1	10.5	4.27	1.34	5.61	4.19	81.70	3.48	2.14
77	0.6300	222.700	204.1	10.7	4.29	1.35	5.64	4.17	81.60	3.50	2.14
78	0.6380	223.400	204.8	10.8	4.30	1.35	5.65	4.17	81.60	3.50	2.15
79	0.6460	224.100	205.5	10.9	4.30	1.37	5.67	4.15	81.50	3.52	2.15
80	0.6540	225.100	206.5	11.1	4.32	1.38	5.70	4.12	81.40	3.54	2.16
81	0.6620	225.600	207.0	11.2	4.32	1.38	5.70	4.13	81.40	3.54	2.16
82	0.6700	226.800	208.2	11.4	4.34	1.40	5.74	4.11	81.30	3.57	2.17
83	0.6790	227.600	209.0	11.5	4.35	1.41	5.76	4.08	81.20	3.59	2.17
84	0.6870	228.500	209.9	11.7	4.36	1.43	5.79	4.06	81.10	3.61	2.18
85	0.6950	229.100	210.5	11.8	4.37	1.44	5.81	4.03	81.00	3.62	2.18
86	0.7030	229.900	211.3	11.9	4.38	1.44	5.82	4.04	81.00	3.63	2.19
87	0.7110	231.100	212.5	12.1	4.40	1.45	5.85	4.02	80.90	3.65	2.20
88	0.7190	231.800	213.2	12.2	4.40	1.47	5.87	4.00	80.80	3.67	2.20
89	0.7270	233.300	214.7	12.3	4.43	1.48	5.91	3.98	80.70	3.70	2.21
90	0.7350	233.900	215.3	12.5	4.43	1.48	5.92	3.99	80.70	3.70	2.22
91	0.7430	234.200	215.6	12.6	4.43	1.50	5.93	3.96	80.60	3.71	2.22
92	0.7510	234.900	216.3	12.7	4.44	1.51	5.95	3.94	80.50	3.73	2.22
93	0.7590	235.700	217.1	12.9	4.45	1.51	5.96	3.94	80.50	3.74	2.22
94	0.7660	236.300	217.7	13.0	4.45	1.53	5.98	3.92	80.40	3.75	2.23
95	0.7740	236.800	218.2	13.1	4.46	1.54	6.00	3.89	80.30	3.77	2.23
96	0.7820	237.800	219.2	13.3	4.47	1.54	6.01	3.90	80.30	3.78	2.24
97	0.7900	238.700	220.1	13.4	4.48	1.56	6.04	3.88	80.20	3.80	2.24
98	0.7980	239.000	220.4	13.5	4.48	1.56	6.04	3.88	80.20	3.80	2.24
99	0.8070	240.300	221.7	13.7	4.50	1.57	6.07	3.87	80.10	3.82	2.25
100	0.8140	241.300	222.7	13.8	4.51	1.60	6.11	3.82	79.90	3.86	2.26
101	0.8310	242.200	223.6	14.1	4.52	1.60	6.12	3.83	79.90	3.86	2.26
102	0.8470	243.400	224.8	14.4	4.53	1.63	6.15	3.78	79.70	3.89	2.26
103	0.8550	243.900	225.3	14.5	4.53	1.64	6.17	3.76	79.60	3.91	2.26
104	0.8630	244.600	226.0	14.7	4.54	1.64	6.18	3.76	79.60	3.91	2.27
105	0.8720	245.400	226.8	14.8	4.54	1.66	6.20	3.74	79.50	3.93	2.27
106	0.8800	246.100	227.5	14.9	4.55	1.66	6.21	3.75	79.50	3.93	2.28
107	0.8880	246.800	228.2	15.1	4.56	1.67	6.23	3.73	79.40	3.95	2.28

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	243.380			926.830
Moisture content: Dry soil+tare, gms.	223.140			738.030
Moisture content: Tare, gms.	112.380			74.360
Moisture, %	18.3	24.7	20.9	28.4
Moist specimen weight, gms.	1140.68			
Diameter, in.	2.862	2.852	2.793	
Area, in.²	6.433	6.389	6.126	
Height, in.	5.770	5.750	5.632	
Net decrease in height, in.		0.020	0.118	
Wet density, pcf	117.1	124.7	128.7	
Dry density, pcf	99.0	100.0	106.5	
Void ratio	0.6714	0.6540	0.5534	
Saturation, %	72.1	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 105.00 psi (15.12 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 5.04 ksf
Strain rate, in./min. = 0.004
Fail. Stress = 2.71 ksf **at reading no.** 44
Ult. Stress = 3.33 ksf **at reading no.** 104

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0010	29.000	0.0	0.0	0.00	3.64	3.64	1.00	79.70	3.64	0.00
1	0.0090	58.100	29.1	0.1	0.68	3.14	3.82	1.22	83.20	3.48	0.34
2	0.0170	67.700	38.7	0.3	0.91	2.85	3.76	1.32	85.20	3.30	0.45
3	0.0250	74.700	45.7	0.4	1.07	2.59	3.66	1.41	87.00	3.13	0.53
4	0.0320	80.100	51.1	0.6	1.19	2.38	3.57	1.50	88.50	2.97	0.60
5	0.0400	84.800	55.8	0.7	1.30	2.20	3.51	1.59	89.70	2.85	0.65
6	0.0480	88.900	59.9	0.8	1.40	2.07	3.47	1.67	90.60	2.77	0.70
7	0.0560	92.100	63.1	1.0	1.47	1.94	3.41	1.76	91.50	2.68	0.73
8	0.0640	95.600	66.6	1.1	1.55	1.83	3.38	1.85	92.30	2.60	0.77
9	0.0725	98.200	69.2	1.3	1.61	1.74	3.35	1.92	92.90	2.55	0.80
10	0.0800	100.900	71.9	1.4	1.67	1.64	3.31	2.02	93.60	2.47	0.83
11	0.0890	103.600	74.6	1.6	1.73	1.58	3.31	2.09	94.00	2.45	0.86
12	0.0970	106.140	77.1	1.7	1.78	1.51	3.29	2.18	94.50	2.40	0.89
13	0.1050	108.300	79.3	1.8	1.83	1.45	3.28	2.26	94.90	2.37	0.91
14	0.1136	110.600	81.6	2.0	1.88	1.39	3.27	2.35	95.36	2.33	0.94
15	0.1210	112.400	83.4	2.1	1.92	1.35	3.27	2.42	95.60	2.31	0.96
16	0.1290	114.400	85.4	2.3	1.96	1.32	3.29	2.48	95.80	2.31	0.98
17	0.1370	116.200	87.2	2.4	2.00	1.25	3.25	2.60	96.30	2.25	1.00
18	0.1450	117.800	88.8	2.6	2.03	1.22	3.26	2.66	96.50	2.24	1.02
19	0.1530	119.800	90.8	2.7	2.08	1.20	3.27	2.74	96.70	2.23	1.04
20	0.1610	121.500	92.5	2.8	2.11	1.17	3.28	2.81	96.90	2.22	1.06
21	0.1690	122.800	93.8	3.0	2.14	1.15	3.29	2.86	97.00	2.22	1.07
22	0.1770	124.600	95.6	3.1	2.18	1.12	3.30	2.94	97.20	2.21	1.09
23	0.1850	125.900	96.9	3.3	2.20	1.12	3.33	2.96	97.20	2.22	1.10
24	0.1930	127.700	98.7	3.4	2.24	1.09	3.34	3.05	97.40	2.21	1.12
25	0.2010	129.000	100.0	3.6	2.27	1.09	3.36	3.07	97.40	2.23	1.13

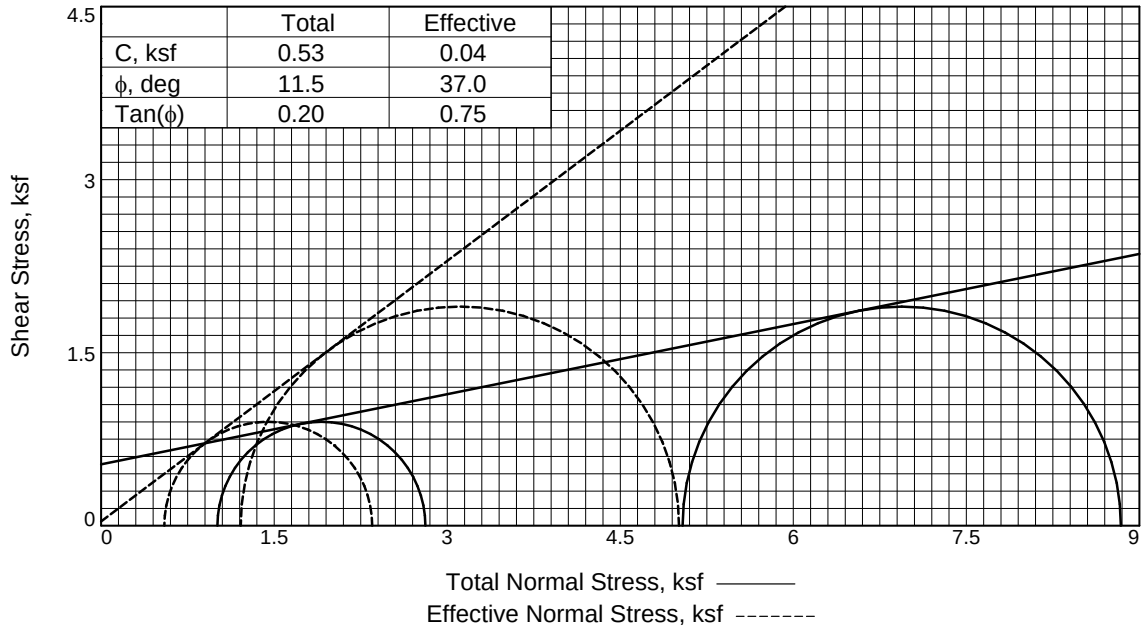
Test Readings for Specimen No. 3

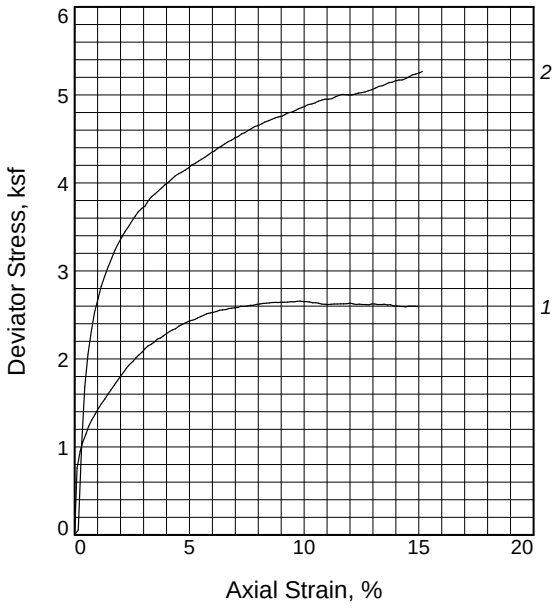
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
26	0.2090	130.600	101.6	3.7	2.30	1.08	3.38	3.13	97.50	2.23	1.15
27	0.2170	131.400	102.4	3.8	2.31	1.07	3.38	3.17	97.60	2.22	1.16
28	0.2330	134.100	105.1	4.1	2.37	1.07	3.43	3.22	97.60	2.25	1.18
29	0.2410	135.400	106.4	4.3	2.39	1.05	3.45	3.28	97.70	2.25	1.20
30	0.2490	136.800	107.8	4.4	2.42	1.01	3.43	3.40	98.00	2.22	1.21
31	0.2560	137.600	108.6	4.5	2.44	1.01	3.45	3.42	98.00	2.23	1.22
32	0.2650	139.000	110.0	4.7	2.46	1.01	3.47	3.45	98.00	2.24	1.23
33	0.2730	140.600	111.6	4.8	2.50	1.01	3.50	3.48	98.00	2.26	1.25
34	0.2810	141.500	112.5	5.0	2.51	1.01	3.52	3.49	98.00	2.26	1.26
35	0.2890	142.400	113.4	5.1	2.53	1.01	3.54	3.51	98.00	2.27	1.26
36	0.2980	143.900	114.9	5.3	2.56	1.01	3.57	3.54	98.00	2.29	1.28
37	0.3060	144.900	115.9	5.4	2.58	1.01	3.59	3.56	98.00	2.30	1.29
38	0.3140	146.000	117.0	5.6	2.60	1.01	3.61	3.58	98.00	2.31	1.30
39	0.3210	146.800	117.8	5.7	2.61	1.01	3.62	3.59	98.00	2.31	1.31
40	0.3290	147.700	118.7	5.8	2.63	1.02	3.65	3.57	97.90	2.34	1.31
41	0.3380	148.800	119.8	6.0	2.65	1.02	3.67	3.59	97.90	2.35	1.32
42	0.3450	149.900	120.9	6.1	2.67	1.04	3.71	3.57	97.80	2.37	1.33
43	0.3530	151.100	122.1	6.3	2.69	1.01	3.70	3.67	98.00	2.35	1.35
44	0.3620	152.000	123.0	6.4	2.71	0.99	3.70	3.72	98.10	2.35	1.35
45	0.3690	153.100	124.1	6.5	2.73	1.01	3.73	3.71	98.00	2.37	1.36
46	0.3770	154.400	125.4	6.7	2.75	1.01	3.76	3.73	98.00	2.38	1.38
47	0.3850	155.100	126.1	6.8	2.76	1.02	3.78	3.70	97.90	2.40	1.38
48	0.3930	156.300	127.3	7.0	2.78	1.02	3.81	3.72	97.90	2.41	1.39
49	0.4010	156.900	127.9	7.1	2.79	1.02	3.82	3.73	97.90	2.42	1.40
50	0.4090	157.500	128.5	7.2	2.80	1.04	3.84	3.70	97.80	2.44	1.40
51	0.4170	158.200	129.2	7.4	2.81	1.04	3.85	3.71	97.80	2.44	1.41
52	0.4250	159.200	130.2	7.5	2.83	1.05	3.88	3.69	97.70	2.47	1.42
53	0.4320	159.700	130.7	7.7	2.84	1.05	3.89	3.70	97.70	2.47	1.42
54	0.4400	160.900	131.9	7.8	2.86	1.07	3.92	3.68	97.60	2.50	1.43
55	0.4560	162.300	133.3	8.1	2.88	1.08	3.96	3.67	97.50	2.52	1.44
56	0.4640	163.200	134.2	8.2	2.90	1.05	3.95	3.75	97.70	2.50	1.45
57	0.4730	164.600	135.6	8.4	2.92	1.05	3.97	3.78	97.70	2.51	1.46
58	0.4810	165.300	136.3	8.5	2.93	1.07	4.00	3.75	97.60	2.53	1.47
59	0.4890	165.900	136.9	8.7	2.94	1.07	4.01	3.76	97.60	2.54	1.47
60	0.4970	166.500	137.5	8.8	2.95	1.08	4.03	3.73	97.50	2.55	1.47
61	0.5060	167.700	138.7	9.0	2.97	1.08	4.05	3.75	97.50	2.56	1.48
62	0.5130	168.400	139.4	9.1	2.98	1.09	4.07	3.72	97.40	2.58	1.49
63	0.5210	168.200	139.2	9.2	2.97	1.09	4.06	3.71	97.40	2.58	1.49
64	0.5290	170.300	141.3	9.4	3.01	1.11	4.12	3.71	97.30	2.61	1.51
65	0.5370	170.900	141.9	9.5	3.02	1.11	4.13	3.72	97.30	2.62	1.51
66	0.5450	171.600	142.6	9.7	3.03	1.12	4.15	3.70	97.20	2.64	1.51
67	0.5530	172.400	143.4	9.8	3.04	1.12	4.16	3.71	97.20	2.64	1.52
68	0.5610	173.100	144.1	9.9	3.05	1.14	4.19	3.68	97.10	2.66	1.53
69	0.5690	173.500	144.5	10.1	3.05	1.15	4.21	3.65	97.00	2.68	1.53
70	0.5770	174.000	145.0	10.2	3.06	1.12	4.18	3.72	97.20	2.65	1.53
71	0.5850	175.200	146.2	10.4	3.08	1.14	4.22	3.71	97.10	2.68	1.54
72	0.5930	175.700	146.7	10.5	3.09	1.14	4.22	3.71	97.10	2.68	1.54

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
73	0.6010	176.000	147.0	10.7	3.09	1.15	4.24	3.68	97.00	2.70	1.54
74	0.6090	176.900	147.9	10.8	3.10	1.15	4.25	3.69	97.00	2.70	1.55
75	0.6170	177.500	148.5	10.9	3.11	1.17	4.28	3.67	96.90	2.72	1.55
76	0.6250	178.100	149.1	11.1	3.12	1.18	4.30	3.64	96.80	2.74	1.56
77	0.6330	178.600	149.6	11.2	3.12	1.18	4.30	3.64	96.80	2.74	1.56
78	0.6410	179.800	150.8	11.4	3.14	1.20	4.34	3.63	96.70	2.77	1.57
79	0.6490	180.200	151.2	11.5	3.15	1.20	4.34	3.63	96.70	2.77	1.57
80	0.6570	181.100	152.1	11.6	3.16	1.21	4.37	3.61	96.60	2.79	1.58
81	0.6650	181.600	152.6	11.8	3.16	1.22	4.39	3.59	96.50	2.81	1.58
82	0.6730	182.600	153.6	11.9	3.18	1.24	4.42	3.57	96.40	2.83	1.59
83	0.6820	183.400	154.4	12.1	3.19	1.22	4.41	3.61	96.50	2.82	1.60
84	0.6900	184.000	155.0	12.2	3.20	1.21	4.41	3.64	96.60	2.81	1.60
85	0.6980	184.700	155.7	12.4	3.21	1.22	4.43	3.62	96.50	2.83	1.60
86	0.7060	185.400	156.4	12.5	3.22	1.24	4.45	3.60	96.40	2.85	1.61
87	0.7140	186.200	157.2	12.7	3.23	1.24	4.47	3.61	96.40	2.85	1.61
88	0.7220	186.900	157.9	12.8	3.24	1.25	4.49	3.58	96.30	2.87	1.62
89	0.7300	187.600	158.6	12.9	3.25	1.25	4.50	3.59	96.30	2.88	1.62
90	0.7370	188.100	159.1	13.1	3.25	1.27	4.52	3.57	96.20	2.89	1.63
91	0.7450	188.400	159.4	13.2	3.25	1.28	4.53	3.54	96.10	2.91	1.63
92	0.7530	189.000	160.0	13.4	3.26	1.28	4.54	3.54	96.10	2.91	1.63
93	0.7610	189.900	160.9	13.5	3.27	1.30	4.57	3.52	96.00	2.93	1.64
94	0.7690	190.500	161.5	13.6	3.28	1.30	4.57	3.53	96.00	2.94	1.64
95	0.7770	190.700	161.7	13.8	3.28	1.31	4.59	3.50	95.90	2.95	1.64
96	0.7850	191.400	162.4	13.9	3.29	1.32	4.61	3.48	95.80	2.97	1.64
97	0.7930	191.900	162.9	14.1	3.29	1.30	4.59	3.54	96.00	2.94	1.65
98	0.8020	192.600	163.6	14.2	3.30	1.30	4.59	3.55	96.00	2.95	1.65
99	0.8090	192.900	163.9	14.3	3.30	1.31	4.61	3.52	95.90	2.96	1.65
100	0.8170	193.700	164.7	14.5	3.31	1.32	4.64	3.50	95.80	2.98	1.66
101	0.8250	194.400	165.4	14.6	3.32	1.32	4.64	3.51	95.80	2.98	1.66
102	0.8330	194.600	165.6	14.8	3.32	1.34	4.66	3.48	95.70	3.00	1.66
103	0.8410	195.300	166.3	14.9	3.33	1.34	4.67	3.48	95.70	3.00	1.66
104	0.8500	195.900	166.9	15.1	3.33	1.35	4.69	3.46	95.60	3.02	1.67

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1	2
Initial	Water Content, %	16.7	30.1
	Dry Density, pcf	113.8	96.8
	Saturation, %	97.4	109.4
	Void Ratio	0.4539	0.7420
	Diameter, in.	2.875	2.856
	Height, in.	6.042	6.015
At Test	Water Content, %	13.9	23.4
	Dry Density, pcf	120.9	103.4
	Saturation, %	100.0	100.0
	Void Ratio	0.3684	0.6307
	Diameter, in.	2.817	2.794
	Height, in.	5.922	5.885
Strain rate, in./min.		0.004	0.004
Eff. Cell Pressure, ksf		1.01	5.04
Fail. Stress, ksf		1.80	3.80
Total Pore Pr., ksf		10.54	13.91
Strain, %		2.0	3.2
Ult. Stress, ksf		2.60	5.27
Total Pore Pr., ksf		10.17	13.33
Strain, %		15.0	15.2
$\bar{\sigma}_1$ Failure, ksf		2.35	5.01
$\bar{\sigma}_3$ Failure, ksf		0.55	1.21

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Red Brown Clay w/Medium to Fine Sand (CH) A-7-6

LL= 67 **PL=** 25 **PI=** 42

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. Only 2 specimens could be obtained from tube. ASTM D4767

Figure R-41 UD-1

Client: STV

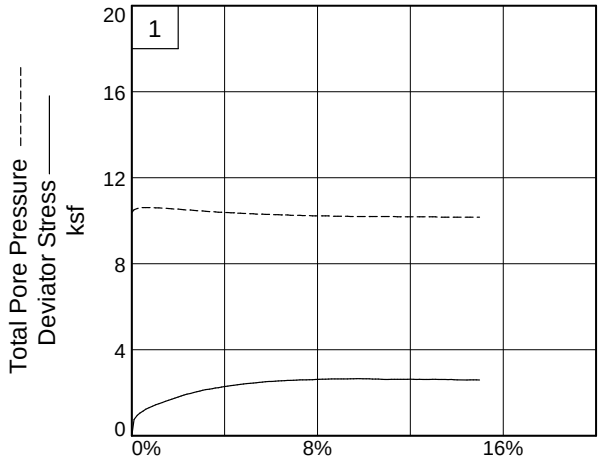
Project: SCDOT US 21 to SC 51

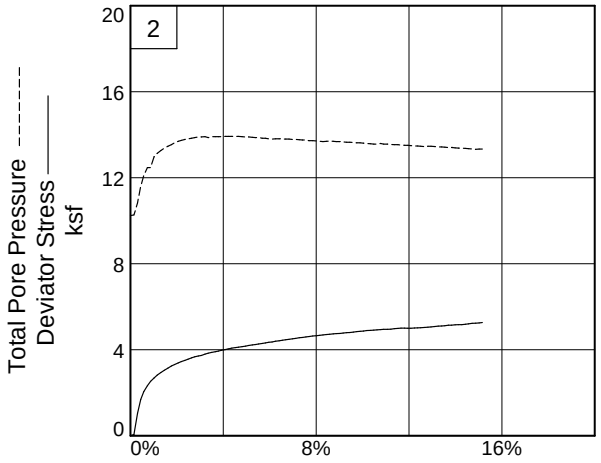
Sample Number: R-41 UD-1 **Depth:** 13.5-15 ft

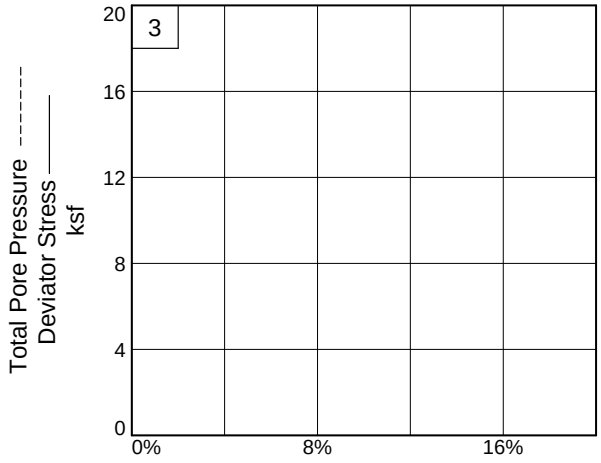
Proj. No.: 1351-12-037 (01) **Date Sampled:** 2014-2015

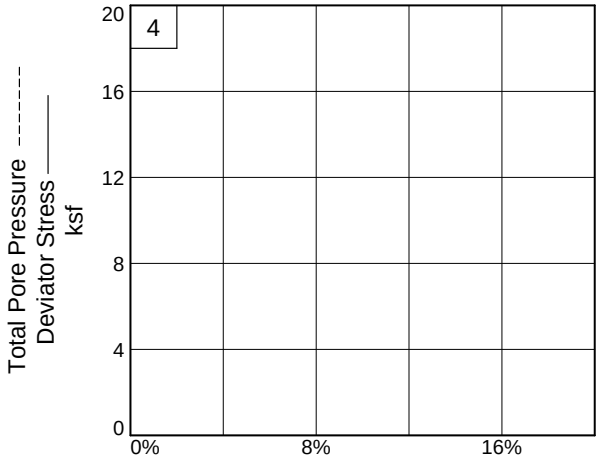
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Charlotte, North Carolina

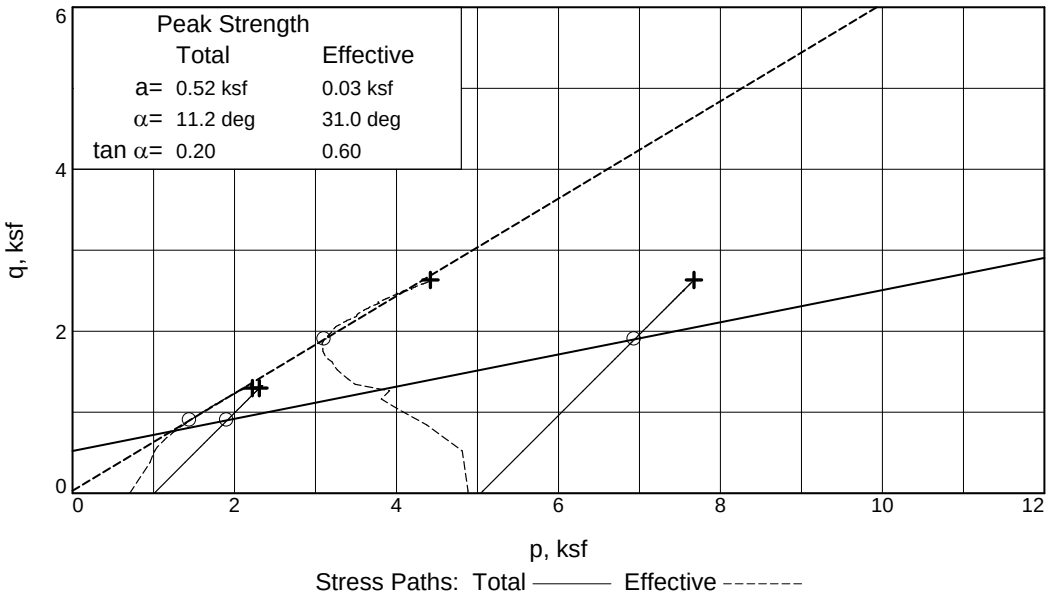
Tested By: Karen Warner **Checked By:** N. Randy Rainwater 2/2/16











C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: STV
Project: SCDOT US 21 to SC 51
Depth: 13.5-15 ft **Sample Number:** R-41 UD-1
Project No.: 1351-12-037 (01) **Figure** R-41 UD-1

S & ME, INC.

Tested By: Karen Warner **Checked By:** N. Randy Rainwater 2/2/16

TRIAXIAL COMPRESSION TEST

2/2/2016

CU with Pore Pressures

3:29 PM

Date: 2014-2015
Client: STV
Project: SCDOT US 21 to SC 51
Project No.: 1351-12-037 (01)
Depth: 13.5-15 ft **Sample Number:** R-41 UD-1
Description: Red Brown Clay w/Medium to Fine Sand (CH) A-7-6
Remarks: The specimens failed in bulging. Only 2 specimens could be obtained from tube. ASTM D4767
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=**67 **PL=**25 **PI=**42
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	145.520			1493.350
Moisture content: Dry soil+tare, gms.	136.260			1291.650
Moisture content: Tare, gms.	80.760			111.520
Moisture, %	16.7	16.6	13.9	17.1
Moist specimen weight, gms.	1367.05			
Diameter, in.	2.875	2.865	2.817	
Area, in.²	6.492	6.449	6.234	
Height, in.	6.042	6.022	5.922	
Net decrease in height, in.		0.020	0.100	
Wet density, pcf	132.8	134.0	137.7	
Dry density, pcf	113.8	114.9	120.9	
Void ratio	0.4539	0.4395	0.3684	
Saturation, %	97.4	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 77.00 psi (11.09 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, in./min. = 0.004
Fail. Stress = 1.80 ksf **at reading no.** 15
Ult. Stress = 2.60 ksf **at reading no.** 109

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0020	16.200	0.0	0.0	0.00	0.71	0.71	1.00	72.10	0.71	0.00
1	0.0080	49.100	32.9	0.1	0.76	0.58	1.34	2.32	73.00	0.96	0.38
2	0.0160	57.400	41.2	0.2	0.95	0.52	1.47	2.83	73.40	0.99	0.47
3	0.0230	62.200	46.0	0.4	1.06	0.49	1.55	3.16	73.60	1.02	0.53
4	0.0310	66.100	49.9	0.5	1.15	0.48	1.62	3.41	73.70	1.05	0.57
5	0.0380	70.000	53.8	0.6	1.24	0.48	1.71	3.60	73.70	1.09	0.62
6	0.0460	73.200	57.0	0.7	1.31	0.48	1.78	3.75	73.70	1.13	0.65
7	0.0550	76.200	60.0	0.9	1.37	0.48	1.85	3.89	73.70	1.16	0.69
8	0.0630	79.100	62.9	1.0	1.44	0.49	1.93	3.94	73.60	1.21	0.72
9	0.0710	81.600	65.4	1.2	1.49	0.49	1.98	4.05	73.60	1.24	0.75
10	0.0800	84.000	67.8	1.3	1.55	0.50	2.05	4.07	73.50	1.28	0.77
11	0.0880	86.500	70.3	1.5	1.60	0.50	2.10	4.18	73.50	1.30	0.80
12	0.0960	88.800	72.6	1.6	1.65	0.52	2.17	4.18	73.40	1.34	0.83
13	0.1040	91.200	75.0	1.7	1.70	0.53	2.24	4.20	73.30	1.38	0.85
14	0.1120	93.500	77.3	1.9	1.75	0.55	2.30	4.20	73.20	1.42	0.88
15	0.1200	95.800	79.6	2.0	1.80	0.55	2.35	4.29	73.20	1.45	0.90
16	0.1280	97.900	81.7	2.1	1.85	0.56	2.41	4.29	73.10	1.49	0.92
17	0.1350	100.000	83.8	2.2	1.89	0.58	2.47	4.29	73.00	1.52	0.95
18	0.1430	102.000	85.8	2.4	1.93	0.59	2.53	4.28	72.90	1.56	0.97
19	0.1520	103.700	87.5	2.5	1.97	0.59	2.56	4.34	72.90	1.58	0.98
20	0.1600	105.700	89.5	2.7	2.01	0.60	2.62	4.33	72.80	1.61	1.01
21	0.1680	107.400	91.2	2.8	2.05	0.62	2.67	4.31	72.70	1.64	1.02
22	0.1760	108.900	92.7	2.9	2.08	0.63	2.71	4.28	72.60	1.67	1.04
23	0.1830	110.600	94.4	3.1	2.11	0.63	2.75	4.34	72.60	1.69	1.06
24	0.1910	112.200	96.0	3.2	2.15	0.65	2.79	4.31	72.50	1.72	1.07
25	0.2000	113.300	97.1	3.3	2.17	0.66	2.83	4.27	72.40	1.75	1.08
26	0.2080	114.600	98.4	3.5	2.19	0.66	2.86	4.31	72.40	1.76	1.10
27	0.2150	116.100	99.9	3.6	2.22	0.68	2.90	4.29	72.30	1.79	1.11
28	0.2230	116.800	100.6	3.7	2.24	0.69	2.93	4.24	72.20	1.81	1.12
29	0.2310	118.100	101.9	3.9	2.26	0.69	2.95	4.27	72.20	1.82	1.13
30	0.2390	119.400	103.2	4.0	2.29	0.71	2.99	4.24	72.10	1.85	1.14
31	0.2470	120.600	104.4	4.1	2.31	0.71	3.02	4.28	72.10	1.86	1.16
32	0.2550	121.600	105.4	4.3	2.33	0.72	3.05	4.24	72.00	1.89	1.17
33	0.2620	122.300	106.1	4.4	2.34	0.72	3.06	4.25	72.00	1.89	1.17
34	0.2710	123.800	107.6	4.5	2.37	0.73	3.11	4.23	71.90	1.92	1.19
35	0.2790	124.800	108.6	4.7	2.39	0.73	3.13	4.26	71.90	1.93	1.20
36	0.2870	125.700	109.5	4.8	2.41	0.75	3.16	4.22	71.80	1.95	1.20
37	0.2950	126.700	110.5	4.9	2.43	0.75	3.17	4.24	71.80	1.96	1.21
38	0.3040	127.400	111.2	5.1	2.44	0.76	3.20	4.19	71.70	1.98	1.22
39	0.3120	128.100	111.9	5.2	2.45	0.76	3.21	4.21	71.70	1.99	1.22
40	0.3190	129.000	112.8	5.4	2.47	0.78	3.24	4.17	71.60	2.01	1.23
41	0.3270	129.900	113.7	5.5	2.48	0.78	3.26	4.19	71.60	2.02	1.24
42	0.3350	130.700	114.5	5.6	2.50	0.78	3.27	4.21	71.60	2.03	1.25
43	0.3430	131.700	115.5	5.8	2.51	0.79	3.31	4.17	71.50	2.05	1.26
44	0.3520	132.300	116.1	5.9	2.52	0.79	3.32	4.19	71.50	2.05	1.26
45	0.3590	132.700	116.5	6.0	2.53	0.81	3.34	4.14	71.40	2.07	1.26
46	0.3680	133.400	117.2	6.2	2.54	0.81	3.35	4.15	71.40	2.08	1.27

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.3760	134.200	118.0	6.3	2.55	0.81	3.36	4.17	71.40	2.08	1.28
48	0.3840	134.600	118.4	6.5	2.56	0.82	3.38	4.12	71.30	2.10	1.28
49	0.3920	134.900	118.7	6.6	2.56	0.82	3.38	4.12	71.30	2.10	1.28
50	0.4000	135.600	119.4	6.7	2.57	0.82	3.39	4.13	71.30	2.11	1.29
51	0.4070	135.900	119.7	6.8	2.58	0.84	3.41	4.08	71.20	2.12	1.29
52	0.4150	136.400	120.2	7.0	2.58	0.84	3.42	4.09	71.20	2.13	1.29
53	0.4230	136.700	120.5	7.1	2.59	0.84	3.42	4.10	71.20	2.13	1.29
54	0.4310	137.500	121.3	7.2	2.60	0.84	3.43	4.11	71.20	2.13	1.30
55	0.4380	137.600	121.4	7.4	2.60	0.85	3.45	4.06	71.10	2.15	1.30
56	0.4470	137.900	121.7	7.5	2.60	0.85	3.45	4.06	71.10	2.15	1.30
57	0.4550	138.500	122.3	7.6	2.61	0.85	3.46	4.07	71.10	2.15	1.30
58	0.4630	138.700	122.5	7.8	2.61	0.86	3.47	4.02	71.00	2.17	1.30
59	0.4710	139.400	123.2	7.9	2.62	0.86	3.48	4.03	71.00	2.17	1.31
60	0.4800	139.800	123.6	8.1	2.62	0.86	3.49	4.04	71.00	2.18	1.31
61	0.4880	140.300	124.1	8.2	2.63	0.86	3.50	4.05	71.00	2.18	1.32
62	0.4960	140.600	124.4	8.3	2.63	0.86	3.50	4.05	71.00	2.18	1.32
63	0.5040	140.900	124.7	8.5	2.64	0.86	3.50	4.05	71.00	2.18	1.32
64	0.5120	141.300	125.1	8.6	2.64	0.88	3.52	4.01	70.90	2.20	1.32
65	0.5200	141.600	125.4	8.7	2.64	0.88	3.52	4.01	70.90	2.20	1.32
66	0.5280	141.700	125.5	8.9	2.64	0.88	3.52	4.01	70.90	2.20	1.32
67	0.5360	142.100	125.9	9.0	2.65	0.88	3.52	4.01	70.90	2.20	1.32
68	0.5430	142.200	126.0	9.1	2.64	0.88	3.52	4.01	70.90	2.20	1.32
69	0.5520	142.500	126.3	9.3	2.65	0.88	3.52	4.01	70.90	2.20	1.32
70	0.5600	142.900	126.7	9.4	2.65	0.89	3.54	3.97	70.80	2.22	1.33
71	0.5680	143.000	126.8	9.6	2.65	0.89	3.54	3.97	70.80	2.22	1.32
72	0.5760	143.500	127.3	9.7	2.66	0.89	3.55	3.97	70.80	2.22	1.33
73	0.5840	143.700	127.5	9.8	2.66	0.89	3.55	3.97	70.80	2.22	1.33
74	0.5920	143.700	127.5	10.0	2.65	0.89	3.54	3.97	70.80	2.22	1.33
75	0.6000	143.900	127.7	10.1	2.65	0.89	3.54	3.97	70.80	2.22	1.33
76	0.6080	143.900	127.7	10.2	2.65	0.89	3.54	3.97	70.80	2.22	1.32
77	0.6160	143.600	127.4	10.4	2.64	0.89	3.53	3.95	70.80	2.21	1.32
78	0.6240	143.900	127.7	10.5	2.64	0.89	3.53	3.96	70.80	2.21	1.32
79	0.6310	143.800	127.6	10.6	2.63	0.89	3.53	3.95	70.80	2.21	1.32
80	0.6400	143.500	127.3	10.8	2.62	0.89	3.52	3.94	70.80	2.20	1.31
81	0.6480	143.600	127.4	10.9	2.62	0.89	3.51	3.94	70.80	2.20	1.31
82	0.6560	143.600	127.4	11.0	2.62	0.89	3.51	3.93	70.80	2.20	1.31
83	0.6640	144.000	127.8	11.2	2.62	0.89	3.51	3.94	70.80	2.20	1.31
84	0.6720	144.300	128.1	11.3	2.62	0.89	3.52	3.94	70.80	2.20	1.31
85	0.6800	144.500	128.3	11.4	2.62	0.91	3.53	3.89	70.70	2.22	1.31
86	0.6880	144.800	128.6	11.6	2.63	0.91	3.53	3.90	70.70	2.22	1.31
87	0.6960	145.000	128.8	11.7	2.63	0.91	3.53	3.90	70.70	2.22	1.31
88	0.7050	145.300	129.1	11.9	2.63	0.91	3.54	3.90	70.70	2.22	1.31
89	0.7130	145.800	129.6	12.0	2.63	0.91	3.54	3.90	70.70	2.22	1.32
90	0.7210	145.600	129.4	12.1	2.63	0.91	3.53	3.89	70.70	2.22	1.31
91	0.7290	145.400	129.2	12.3	2.62	0.91	3.53	3.89	70.70	2.22	1.31
92	0.7360	145.800	129.6	12.4	2.62	0.91	3.53	3.89	70.70	2.22	1.31
93	0.7450	145.800	129.6	12.5	2.62	0.91	3.53	3.89	70.70	2.22	1.31

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
94	0.7530	146.000	129.8	12.7	2.62	0.91	3.53	3.89	70.70	2.22	1.31
95	0.7610	146.100	129.9	12.8	2.62	0.91	3.52	3.88	70.70	2.22	1.31
96	0.7699	146.800	130.6	13.0	2.63	0.91	3.53	3.89	70.70	2.22	1.31
97	0.7770	146.900	130.7	13.1	2.62	0.91	3.53	3.89	70.70	2.22	1.31
98	0.7840	146.800	130.6	13.2	2.62	0.92	3.54	3.84	70.60	2.23	1.31
99	0.7930	147.000	130.8	13.4	2.62	0.92	3.54	3.84	70.60	2.23	1.31
100	0.8010	147.400	131.2	13.5	2.62	0.92	3.54	3.84	70.60	2.23	1.31
101	0.8090	147.200	131.0	13.6	2.61	0.92	3.54	3.84	70.60	2.23	1.31
102	0.8170	147.600	131.4	13.8	2.62	0.92	3.54	3.84	70.60	2.23	1.31
103	0.8240	147.100	130.9	13.9	2.60	0.92	3.53	3.83	70.60	2.22	1.30
104	0.8320	147.200	131.0	14.0	2.60	0.92	3.52	3.82	70.60	2.22	1.30
105	0.8570	147.400	131.2	14.4	2.59	0.92	3.51	3.81	70.60	2.22	1.30
106	0.8650	148.000	131.8	14.6	2.60	0.92	3.52	3.82	70.60	2.22	1.30
107	0.8730	148.100	131.9	14.7	2.60	0.92	3.52	3.82	70.60	2.22	1.30
108	0.8810	148.300	132.1	14.8	2.60	0.92	3.52	3.82	70.60	2.22	1.30
109	0.8890	148.400	132.2	15.0	2.60	0.92	3.52	3.82	70.60	2.22	1.30

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	266.220			1365.020
Moisture content: Dry soil+tare, gms.	224.030			1131.070
Moisture content: Tare, gms.	83.740			86.530
Moisture, %	30.1	26.5	23.4	22.4
Moist specimen weight, gms.	1273.06			
Diameter, in.	2.856	2.842	2.794	
Area, in.²	6.406	6.342	6.129	
Height, in.	6.015	5.985	5.885	
Net decrease in height, in.		0.030	0.100	
Wet density, pcf	125.9	124.3	127.5	
Dry density, pcf	96.8	98.2	103.4	
Void ratio	0.7420	0.7160	0.6307	
Saturation, %	109.4	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 105.00 psi (15.12 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 5.04 ksf
Strain rate, in./min. = 0.004
Fail. Stress = 3.80 ksf **at reading no.** 22
Ult. Stress = 5.27 ksf **at reading no.** 104

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0050	22.100	0.0	0.0	0.00	4.88	4.88	1.00	71.10	4.88	0.00
1	0.0140	24.600	2.5	0.2	0.06	4.85	4.91	1.01	71.30	4.88	0.03
2	0.0230	66.600	44.5	0.3	1.04	4.29	5.33	1.24	75.20	4.81	0.52
3	0.0310	94.300	72.2	0.4	1.69	3.53	5.22	1.48	80.50	4.37	0.84
4	0.0390	110.100	88.0	0.6	2.06	3.01	5.07	1.68	84.10	4.04	1.03
5	0.0480	121.800	99.7	0.7	2.33	2.65	4.97	1.88	86.60	3.81	1.16
6	0.0560	130.700	108.6	0.9	2.53	2.65	5.18	1.95	86.60	3.91	1.26
7	0.0650	137.700	115.6	1.0	2.69	2.15	4.83	2.25	90.10	3.49	1.34
8	0.0730	143.700	121.6	1.2	2.82	1.99	4.81	2.42	91.20	3.40	1.41
9	0.0820	148.900	126.8	1.3	2.94	1.86	4.80	2.58	92.10	3.33	1.47
10	0.0910	153.800	131.7	1.5	3.05	1.74	4.79	2.75	92.90	3.27	1.52
11	0.1000	158.200	136.1	1.6	3.15	1.66	4.80	2.90	93.50	3.23	1.57
12	0.1090	162.600	140.5	1.8	3.24	1.58	4.83	3.05	94.00	3.21	1.62
13	0.1170	165.900	143.8	1.9	3.31	1.50	4.81	3.21	94.60	3.15	1.66
14	0.1260	169.300	147.2	2.1	3.39	1.43	4.81	3.38	95.10	3.12	1.69
15	0.1340	172.100	150.0	2.2	3.45	1.38	4.83	3.49	95.40	3.11	1.72
16	0.1430	174.900	152.8	2.3	3.51	1.34	4.84	3.62	95.70	3.09	1.75
17	0.1510	177.500	155.4	2.5	3.56	1.31	4.87	3.72	95.90	3.09	1.78
18	0.1600	180.500	158.4	2.6	3.62	1.28	4.90	3.83	96.10	3.09	1.81
19	0.1680	182.800	160.7	2.8	3.67	1.25	4.92	3.93	96.30	3.09	1.84
20	0.1770	184.800	162.7	2.9	3.71	1.22	4.93	4.03	96.50	3.08	1.86
21	0.1850	186.100	164.0	3.1	3.74	1.22	4.96	4.05	96.50	3.09	1.87
22	0.1940	189.200	167.1	3.2	3.80	1.21	5.01	4.14	96.60	3.11	1.90
23	0.2020	191.300	169.2	3.3	3.84	1.25	5.09	4.07	96.30	3.17	1.92
24	0.2110	193.100	171.0	3.5	3.88	1.21	5.09	4.20	96.60	3.15	1.94
25	0.2200	194.900	172.8	3.7	3.91	1.21	5.12	4.23	96.60	3.17	1.96

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
26	0.2280	196.500	174.4	3.8	3.94	1.21	5.15	4.26	96.60	3.18	1.97
27	0.2360	198.300	176.2	3.9	3.98	1.21	5.19	4.29	96.60	3.20	1.99
28	0.2450	199.900	177.8	4.1	4.01	1.20	5.20	4.35	96.70	3.20	2.00
29	0.2530	201.600	179.5	4.2	4.04	1.20	5.23	4.38	96.70	3.21	2.02
30	0.2620	203.600	181.5	4.4	4.08	1.20	5.27	4.41	96.70	3.23	2.04
31	0.2710	205.000	182.9	4.5	4.10	1.20	5.30	4.43	96.70	3.25	2.05
32	0.2790	206.000	183.9	4.7	4.12	1.20	5.31	4.45	96.70	3.25	2.06
33	0.2880	207.500	185.4	4.8	4.15	1.21	5.36	4.43	96.60	3.28	2.07
34	0.2970	208.900	186.8	5.0	4.17	1.22	5.39	4.41	96.50	3.31	2.09
35	0.3050	210.600	188.5	5.1	4.20	1.22	5.43	4.43	96.50	3.33	2.10
36	0.3140	211.800	189.7	5.3	4.22	1.24	5.46	4.41	96.40	3.35	2.11
37	0.3220	213.100	191.0	5.4	4.25	1.25	5.50	4.39	96.30	3.38	2.12
38	0.3300	214.400	192.3	5.5	4.27	1.25	5.52	4.41	96.30	3.39	2.13
39	0.3390	215.800	193.7	5.7	4.29	1.28	5.57	4.35	96.10	3.43	2.15
40	0.3470	217.200	195.1	5.8	4.32	1.28	5.60	4.37	96.10	3.44	2.16
41	0.3560	218.900	196.8	6.0	4.35	1.31	5.66	4.32	95.90	3.48	2.17
42	0.3640	219.900	197.8	6.1	4.36	1.32	5.69	4.29	95.80	3.51	2.18
43	0.3730	221.800	199.7	6.3	4.40	1.31	5.71	4.36	95.90	3.51	2.20
44	0.3820	223.100	201.0	6.4	4.42	1.31	5.73	4.37	95.90	3.52	2.21
45	0.3900	224.500	202.4	6.5	4.44	1.31	5.75	4.39	95.90	3.53	2.22
46	0.3990	226.000	203.9	6.7	4.47	1.32	5.79	4.37	95.80	3.56	2.23
47	0.4070	227.000	204.9	6.8	4.48	1.32	5.81	4.39	95.80	3.57	2.24
48	0.4160	228.600	206.5	7.0	4.51	1.34	5.85	4.37	95.70	3.60	2.26
49	0.4240	229.500	207.4	7.1	4.53	1.34	5.86	4.38	95.70	3.60	2.26
50	0.4330	231.300	209.2	7.3	4.56	1.35	5.91	4.37	95.60	3.63	2.28
51	0.4410	232.200	210.1	7.4	4.57	1.37	5.94	4.34	95.50	3.65	2.29
52	0.4500	233.700	211.6	7.6	4.60	1.37	5.96	4.36	95.50	3.67	2.30
53	0.4580	235.000	212.9	7.7	4.62	1.40	6.01	4.31	95.30	3.71	2.31
54	0.4670	236.500	214.4	7.9	4.64	1.40	6.04	4.32	95.30	3.72	2.32
55	0.4760	237.300	215.2	8.0	4.65	1.41	6.06	4.30	95.20	3.74	2.33
56	0.4850	238.700	216.6	8.2	4.67	1.43	6.10	4.28	95.10	3.76	2.34
57	0.4930	239.900	217.8	8.3	4.69	1.44	6.13	4.26	95.00	3.79	2.35
58	0.5020	240.900	218.8	8.4	4.71	1.43	6.13	4.30	95.10	3.78	2.35
59	0.5100	241.900	219.8	8.6	4.72	1.41	6.13	4.35	95.20	3.77	2.36
60	0.5190	243.100	221.0	8.7	4.74	1.43	6.16	4.32	95.10	3.79	2.37
61	0.5270	244.000	221.9	8.9	4.75	1.44	6.19	4.30	95.00	3.82	2.38
62	0.5360	244.700	222.6	9.0	4.76	1.44	6.20	4.30	95.00	3.82	2.38
63	0.5440	245.900	223.8	9.2	4.78	1.45	6.23	4.28	94.90	3.84	2.39
64	0.5530	247.300	225.2	9.3	4.80	1.47	6.27	4.27	94.80	3.87	2.40
65	0.5610	247.900	225.8	9.4	4.80	1.47	6.27	4.27	94.80	3.87	2.40
66	0.5700	249.100	227.0	9.6	4.82	1.48	6.30	4.25	94.70	3.89	2.41
67	0.5790	250.500	228.4	9.8	4.84	1.50	6.34	4.23	94.60	3.92	2.42
68	0.5870	251.500	229.4	9.9	4.86	1.50	6.35	4.24	94.60	3.93	2.43
69	0.5960	252.600	230.5	10.0	4.87	1.51	6.38	4.22	94.50	3.95	2.44
70	0.6040	253.900	231.8	10.2	4.89	1.53	6.42	4.20	94.40	3.97	2.45
71	0.6130	254.600	232.5	10.3	4.90	1.54	6.44	4.18	94.30	3.99	2.45
72	0.6220	255.600	233.5	10.5	4.91	1.56	6.47	4.16	94.20	4.01	2.46

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
73	0.6300	256.800	234.7	10.6	4.93	1.56	6.48	4.17	94.20	4.02	2.46
74	0.6390	257.800	235.7	10.8	4.94	1.53	6.47	4.24	94.40	4.00	2.47
75	0.6470	258.700	236.6	10.9	4.95	1.56	6.51	4.18	94.20	4.03	2.48
76	0.6560	259.100	237.0	11.1	4.95	1.56	6.51	4.18	94.20	4.03	2.48
77	0.6650	259.800	237.7	11.2	4.96	1.57	6.53	4.16	94.10	4.05	2.48
78	0.6740	261.200	239.1	11.4	4.98	1.58	6.56	4.14	94.00	4.07	2.49
79	0.6830	262.400	240.3	11.5	5.00	1.58	6.58	4.15	94.00	4.08	2.50
80	0.6910	263.300	241.2	11.7	5.01	1.60	6.60	4.13	93.90	4.10	2.50
81	0.7000	263.600	241.5	11.8	5.00	1.61	6.62	4.10	93.80	4.11	2.50
82	0.7080	263.800	241.7	11.9	5.00	1.61	6.61	4.10	93.80	4.11	2.50
83	0.7160	264.200	242.1	12.1	5.00	1.63	6.63	4.07	93.70	4.13	2.50
84	0.7250	265.100	243.0	12.2	5.01	1.64	6.65	4.05	93.60	4.15	2.51
85	0.7330	266.000	243.9	12.4	5.02	1.64	6.66	4.06	93.60	4.15	2.51
86	0.7410	266.600	244.5	12.5	5.03	1.66	6.68	4.03	93.50	4.17	2.51
87	0.7500	267.500	245.4	12.7	5.04	1.67	6.71	4.01	93.40	4.19	2.52
88	0.7590	268.600	246.5	12.8	5.05	1.66	6.71	4.05	93.50	4.18	2.52
89	0.7670	269.500	247.4	12.9	5.06	1.66	6.72	4.06	93.50	4.19	2.53
90	0.7760	270.800	248.7	13.1	5.08	1.67	6.75	4.04	93.40	4.21	2.54
91	0.7850	272.200	250.1	13.3	5.10	1.68	6.78	4.03	93.30	4.23	2.55
92	0.7940	273.000	250.9	13.4	5.10	1.68	6.79	4.03	93.30	4.24	2.55
93	0.8020	274.200	252.1	13.5	5.12	1.70	6.82	4.01	93.20	4.26	2.56
94	0.8110	275.600	253.5	13.7	5.14	1.71	6.85	4.00	93.10	4.28	2.57
95	0.8190	276.200	254.1	13.8	5.14	1.71	6.86	4.00	93.10	4.29	2.57
96	0.8280	277.500	255.4	14.0	5.16	1.73	6.89	3.99	93.00	4.31	2.58
97	0.8370	278.400	256.3	14.1	5.17	1.74	6.91	3.97	92.90	4.33	2.59
98	0.8450	278.800	256.7	14.3	5.17	1.74	6.91	3.97	92.90	4.33	2.58
99	0.8540	280.100	258.0	14.4	5.19	1.76	6.94	3.95	92.80	4.35	2.59
100	0.8620	281.300	259.2	14.6	5.20	1.77	6.97	3.94	92.70	4.37	2.60
101	0.8710	283.000	260.9	14.7	5.23	1.79	7.01	3.93	92.60	4.40	2.61
102	0.8800	284.000	261.9	14.9	5.24	1.80	7.04	3.91	92.50	4.42	2.62
103	0.8890	285.100	263.0	15.0	5.25	1.79	7.04	3.94	92.60	4.41	2.63
104	0.8970	286.300	264.2	15.2	5.27	1.79	7.05	3.95	92.60	4.42	2.63

Appendix VI – Culvert Memorandas

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August 17, 2021

STV Incorporated
2430 Mall Drive, Suite 315 Building B
North Charleston, South Carolina 29406

Attention: Mr. Thomas Mastillone, P.E.

Reference: **Culvert Extensions at Station 33+80 and 41+06 – REV1**
US 21 and SC 51 Widening
York County, South Carolina
S&ME Project No. 1351-12-037

Dear Mr. Mastillone:

The purpose of this geotechnical memo is to provide design recommendations for the two above-referenced box culvert extensions. Authorization to proceed with this study was provided in general accordance with the Subcontract for Professional Services between STV Incorporated (STV) and S&ME dated November 27, 2012 and the First Amendment to Subcontract for Professional Services dated April 2014.

♦ Background

This project is a Pennies for Progress project that includes widening and realignment of approximately 2.9 miles of US 21 from SC Highway 460 (Springfield Parkway) to SC Highway 51 and SC Highway 51 from US 21 to the North Carolina and South Carolina border. The project site is located within York County, South Carolina. Culvert extension plan and section drawings (prepared by KCI Technologies (KCI) dated May 14, 2020) were provided by Ron Patton with STV on June 9, 2020. These plan and section drawings were subsequently provided to S&ME in Microstation format by Phil Leazer of KCI on June 10, 2020. In subsequent email correspondence, Thomas Mastillone provided PDF roadway plans dated March 18, 2021 that included culvert detail drawings prepared by KCI Technologies dated September 17, 2020.

The project includes adding a travel lane in each direction, adding a center turn lane, improvements to existing intersections and other impacted roadways. Two culverts will require extensions as a part of this project.

The existing 5-foot by 5-foot reinforced concrete box culvert located at approximate Station 33+80 will be extended in each direction. The cast-in-place culvert extension will have an upstream invert elevation of 565.64 feet and will have a downstream invert elevation of 561.77 feet. We have assumed that a minimum of 18 inches of #57 Stone for bedding will be placed under the culvert extension.

The existing 5-foot by 5-foot reinforced concrete box culvert located at approximate Station 41+06 will be extended in each direction. The cast-in-place culvert extension will have an upstream invert elevation of 568.48 feet and will have a downstream invert elevation of 565.32 feet. We have assumed that a minimum of 18 inches of #57 Stone for bedding will be placed under the culvert extension.

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♦ Culvert Extension Exploration

The proposed culvert extension areas were previously explored during development of S&ME's *Preliminary Roadway Geotechnical Engineering Report (PRGER)* dated February 3, 2016. Several soil test borings, hand auger borings, and rod soundings were performed in the vicinity of the proposed culvert extension areas. In the vicinity of the Station 33+80 culvert extension, previous test locations include: HA-2/RS-2, HA-3/RS-3, R-4, R-34, R-35, R-36, S-2, and S-3. In the vicinity of the Station 41+06 culvert extension, previous test locations include: HA-4/RS-4, HA-5/RS-5, R-38, S-4, and S-5.

To supplement the previous exploration of the subgrade conditions at the culvert extensions, additional hand auger borings and rod soundings were conducted at each end of each of the two culvert extensions. Locations were determined in the field by S&ME personnel based on information provided by STV and KCI. Hand augers HA-102, HA-102A, and HA-103/RS-103 were performed at the Station 33+80 culvert extension. Hand augers HA-104/RS-104, HA-105, and HA-105A/RS-105A were performed at the 41+06 culvert extension.

The hand auger borings were advanced manually using a bucket-type hand auger. The soils encountered were classified by a staff professional from cuttings brought to the surface by the augering process and a field log of the encountered conditions was created. Following the water level measurements, the test locations were backfilled with auger cuttings.

Dynamic cone penetrometer (DCP) testing was conducted in the hand auger boreholes in general accordance with the procedure outlined in ASTM Special Technical Publication No. 399, Vane Shear and Cone Penetration Resistance Testing of In-Situ Soils. The dynamic cone penetrometer test was performed by driving an enlarged cone point into the soil using a 15-pound weight falling 20-inches sliding on a steel driving rod. The penetration testing was performed at various test depths in manually augered boreholes, each approximately 3-½ inches in diameter. After augering to each test depth, the cone point (45-degree apex angle, 1.5-inch diameter) was seated 2-inches into the undisturbed bottom of the borehole in order to embed the cone. The cone point was further driven 1-3/4 inches using the 15-pound weight falling 20-inches, and the number of hammer blows required to advance the point was recorded. The cone was typically advanced a total of three, 1-3/4 inch increments at each test depth, obtaining three dynamic penetration resistances. The blow count for each 1-3/4 inch increment provides a relative index to the soil strength and density/consistency. The resulting DCP blow count has been generally correlated for varying soil types and standard penetration resistance values in the above-noted reference.

Rod soundings are commonly used for supplementing traditional borings where access is limited or when hand auger boreholes cave in due to water inflow. The rod sounding consists of manually driving a 0.5-inch diameter steel rod into the ground with a standardized drop hammer while recording the number of blows required to penetrate two 6-inch increments. The total number of blows over the 1-foot penetration interval is referred to as a "blow count" in this report and provides a general indication of material consistency or relative density. The "blow count" is not the same as an SPT N-value and samples are not recovered for classification; therefore, strata and material types are inferred based on engineering judgement.

♦ Surface Conditions

Based on our site reconnaissance, the culvert extension areas are currently moderately to heavily wooded. At the time of our current exploration on June 19, 2020, the downstream culvert opening of the Station 33+80 culvert was completely submerged, and the upstream culvert opening was partially submerged. The depth of water flowing through the Station 41+06 culvert was relatively shallow.

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♦ Subsurface Conditions

Culvert at 33+80

Soils along the Station 33+80 culvert extension were explored at test locations HA-2/RS-2, HA-3/RS-3, HA-102, HA-102A, and HA-103/RS-103. Borings R-4, R-34, R-35, R-36, S-2, and S-3 were performed in proximity to the existing culvert.

Subsurface conditions as indicated by the hand auger borings generally consist of topsoil underlain by alluvial soils and residual soils. The generalized subsurface conditions are described below. For more detailed soil descriptions and stratifications at a particular location, the respective hand auger log should be reviewed.

Topsoil: Hand auger borings HA-2 and HA-3 encountered 5 inches of topsoil at the ground surface.

Alluvial Soils: Alluvial soils were encountered underlying the surficial topsoil or at the existing ground surface in the hand auger borings and extended to depths of approximately 3.5 to 8.1 feet. The alluvial soils generally consisted of very soft silty clay and clay (USCS Classification CH), very soft to soft clayey silt (MH), very soft to stiff sandy clay and clay (CL), very loose clayey sand (SC), and very loose to loose silty sand (SM). The alluvial soils were noted as being wet to saturated. The soils encountered in HA-103 were noted as containing trace to few organics. HA-3 was terminated in alluvial soils at a depth of 8.1 feet. HA-102 and HA-103 were terminated in alluvial soils due to borehole cave-in at depths of 3.5 feet and 4 feet, respectively.

Residual Soils: Underlying the alluvial soils, residual soils were encountered in hand auger borings HA-2 and HA-102A. The residual soils generally consisted of stiff sandy silt (ML) and medium dense silty sand (SM). The residual soils were noted as being wet. HA-2 and HA-102A were terminated in residual soils. Hand auger refusal was encountered in HA-2 at a depth of 7.1 feet in the residual soils. HA-102A was terminated at a depth of 6.2 feet.

Water Levels: Groundwater level measurements were attempted at termination in each hand auger boring. Groundwater was encountered in each hand auger boring at depths ranging from approximately 1.2 to 2.8 feet (approximate elevations of 572.9 to 566.2 feet) below the existing ground surface.

Water levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, groundwater may be encountered during construction at depths not indicated by the borings.

Culvert at 41+06

Soils along the Station 41+06 culvert extension were explored at test locations HA-4/RS-4, HA-5/RS-5, HA-104/RS-104, HA-105, and HA-105A/RS-105A. Borings R-38, S-4, and S-5 were performed in proximity to the existing culvert.

Subsurface conditions as indicated by the hand auger borings generally consist of topsoil underlain by fill soils, alluvial soils and residual soils. The generalized subsurface conditions are described below. For more detailed soil descriptions and stratifications at a particular location, the respective hand auger log should be reviewed.

Topsoil: Hand auger boring HA-5 encountered 2 inches of topsoil at the existing ground surface.

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Fill Soils: Fill soils were encountered underlying the surficial topsoil in HA-5 and extended to a depth of 1.7 feet below the existing ground surface. The fill soils generally consisted of sandy clay (CL). The fill soils were noted as being dry.

Alluvial Soils: Alluvial soils were encountered underlying the surficial topsoil or at the existing ground surface in the hand auger borings and extended to depths of approximately 3.6 to 6.5 feet. The alluvial soils generally consisted of very soft to firm silty clay (CH), firm sandy clay (CL), very loose to medium dense clayey sand (SC), and medium dense silty sand (SM). The alluvial soils were noted as being moist to saturated. The soils encountered in HA-4 were noted as containing trace of trash consisting of a plastic bag. HA-4 and HA-5 were terminated in alluvial soils at depths of 6.1 and 3.8 feet, respectively, upon encountering hand auger refusal. HA-104 and HA-105A were terminated in alluvial soils due to borehole cave-in at depths of 6.5 and 0.5 feet, respectively.

Residual Soils: Residual soils were encountered in hand auger boring HA-105 at the existing ground surface. The residual soils generally consisted of very soft to firm sandy clay (CL). The residual soils were noted as being moist. HA-105 was terminated in residual soils at a depth of 4 feet.

Water Levels: Groundwater level measurements were attempted at termination in each hand auger boring. Groundwater was encountered in most of the hand auger borings at depths ranging from approximately 0.25 to 2.9 feet (approximate elevations of 571.1 to 567.2 feet) below the existing ground surface.

Water levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, groundwater may be encountered during construction at depths not indicated by the borings.

♦ Recommendations

Bearing Resistance

Based on the stratigraphy encountered in the borings performed at the culvert extensions, recommended maximum values of nominal (q_n) and factored (q_R) bearing resistance at the service and strength limit states for the culvert are presented in the table below. The culvert located at Station 33+80 will bear about 7 to 9 feet below the existing ground surface on medium dense and hard residual soils. The culvert located at Station 41+06 will bear about 6 to 8 feet below the existing ground surface on loose residual soils and firm alluvial soils.

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Table 1 – Bearing Resistance for Culvert

Structure	Offset (ft)	Approximate Bearing Elevation (ft)	Bearing Material	Limit State	Nominal Bearing Resistance, q_n (ksf)	Factored Bearing Resistance, q_R (ksf)
33+80 5x5′ Culvert Extension	102.6 LT	560.0	Sandy Silt (ML)	Service	11.2	5.0
				Extreme	2.9	2.9
	98.8 RT	563.5	Silty Sand (SM)	Service	6.4	2.9
				Extreme	1.3	1.3
41+06 5x5′ Culvert Extension	92.1 LT	563.5	Silty Clay (CH)	Service	5.5	2.5
				Extreme	2.8	2.8
	102.0 RT	566.5	Silty Sand (SM)	Service	6.5	2.9
				Extreme	1.4	1.4

Note: Resistance Factor (φ_b) used for Service and Extreme Limit States are 0.45 and 1.00, respectively. (Table 9-1, Chapter 9 of the SCDOT GDM)

Settlement Potential

As previously mentioned, the existing 5-foot by 5-foot reinforced concrete box culvert located at approximate Station 33+80 will be extended in each direction. Additional fill heights on the order of 27 feet are planned to widen the existing roadway. Total settlements anticipated for the culvert extensions range from about ¼ inch near the ends of the extensions at the proposed embankment toes, to about ½ inch at the point where the extensions connect to the existing culvert. Differential settlement inferred from these values would be approximately ¼ inch over a distance of approximately 50 feet for the western extension and approximately 43 feet for the eastern extension, resulting in angular distortions of the culvert of approximately 1/2400 for the western extension, and 1/2000 for the eastern extension. Settlements are anticipated to occur during construction of the extensions and embankment widening.

The existing 5-foot by 5-foot reinforced concrete box culvert located at approximate Station 41+06 will be extended in each direction. Additional fill heights on the order of 16 feet are planned to widen the existing roadway. Total settlements anticipated for the western culvert extension range from about ¼ inch near the end of the western extension at the proposed embankment toe, to about 1/10 of an inch at the point where the extension connects to the existing culvert. Differential settlement inferred from these values would be approximately 0.15 inches over a distance of approximately 73 feet, resulting in an angular distortion of the culvert of approximately 1/5800 for the western extension. Total settlements anticipated for the eastern culvert extension range from about 0.15 inches near the end of the eastern extension at the proposed embankment toe, to less than 1/10 of an inch at the point where the extension connects to the existing culvert. Differential settlement inferred from these values would be approximately 1/10 of an inch over a distance of approximately 111 feet, resulting in an angular distortion of the culvert of approximately 1/13000 for the eastern extension. Settlements are anticipated to occur during construction of the extensions and embankment widening.

Soft, saturated alluvial soils should be mucked out where they occur below the culvert extensions. No. 57 Stone should be used to backfill muck excavation. The depth of undercut shall be extended to a suitable bearing material.

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Based on Section 10.1 of the SCDOT Geotechnical Design Manual, "no performance objectives or limits have been established for hydraulic structures (i.e., culverts and pipes). The acceptable performance of a hydraulic structure is based on the integrity of the structure and the ability of the structure to continue to function as designed (i.e., convey water from one side of the embankment to the other). Therefore, the GEOR shall report anticipated deformations (i.e., total and differential settlement, etc.) to both the SEOR as well as the HEOR. It is the responsibility of these designers (i.e., SEOR and HEOR) to determine if the hydraulic structure will perform as designed given the anticipated deformations."

Sliding Resistance

The factored resistance against failure by sliding (R_R) should be determined using Eq. 10.6.3.4-1 of the current AASHTO LRFD Bridge Design Specifications.

For headwall foundations bearing 2 feet or more below final grades, the nominal sliding resistance (R_τ) between the soil and the shallow spread culvert headwall foundation should be taken as the total vertical force (V) acting on the foundation multiplied by the recommended coefficient of friction (tan δ). For the Station 33+80 culvert inlet and outlet headwall foundations, tan δ is recommended to be 0.53. For the Station 41+06 culvert inlet headwall foundations, tan δ is recommended to be 0.53. For the Station 41+06 culvert outlet headwall foundations, the recommended unit sliding resistance is 1 kip per square foot (ksf). If the headwall foundations are precast concrete units, the factored sliding resistance may then be determined by applying a resistance factor of 0.8 to the nominal value for shearing between the footing and granular soil.

Excavations

Partially weathered rock and auger refusal material were encountered in the soil test borings performed in the vicinity of the proposed culvert extension areas. These borings were presented in S&ME's *Preliminary Roadway Geotechnical Engineering Report (PRGER)* dated February 3, 2016. Based on the borings and the culvert extension invert elevations, excavation into PWR and/or rock may be required during construction of the culvert extensions.

Excavatable PWR is defined as material that can excavated using traditional equipment by first loosening with a single tooth ripper attached to a suitable sized dozer, such as a Caterpillar D-8 or D-9, or suitable sized trackhoe such as a Caterpillar C320 equipped with a rock bucket with a curling force of 18,300 pounds or greater.

Jack hammering or blasting may be required for PWR in trench excavations, below the upper 2-4 feet of PWR in open excavations, and for rock in both open site (greater than 10 feet wide and 30 feet long) and trench excavations. We anticipate blasting will not be allowed to due to the close proximity of the roadways.

Jack hammering or blasting of rock may result in an uneven rock surface in the bottom of trench excavations and a subsequent point load condition on the culvert. If dissimilar bearing conditions exist in excavations, we recommend that those conditions be evaluated on a case-by-case basis. To provide a uniform bearing surface and reduce the potential for point loading, over-excavation below the bearing elevation and replacement with properly compacted low-plasticity granular soil, crushed stone, or lean concrete may be required.

The depth to, and thickness of, PWR, rock lenses or seams and bedrock, can vary dramatically in short distances and between boring locations; therefore, PWR, boulders or bedrock may be encountered during any excavation on this project.

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Controlled Fill

Fill material proposed for the project should be in general accordance with SCDOT Standard Specifications for borrow in Section 203.2.1.8. York County lies in Group A as defined in that section, and would require AASHTO soils A-1, A-2, A-3, A-4, A-5, or A-6 be used for borrow material within the top 5 feet of the embankment. Below the top 5 feet other soils (besides muck) can be used as long as they are stable when compacted to the required density.

Fill placement and compaction should be in general accordance with the SCDOT Standard Specifications for Highway Construction 2007 edition, Division 205 Embankment Construction and any applicable project specifications or provisions. In-place density testing should be performed by an experienced engineering technician to confirm that the contractor's compaction method can achieve the specified compaction and that the fill material meets the specified requirements. Fill subgrade evaluations and proofrolling and subgrade repair and/or undercutting operations should be observed by a representative of the geotechnical engineer or an experienced engineering technician.

♦ Recommended Notes on Plans

S&ME recommends the following notes be included on the plans specific to the culvert extensions:

- A minimum of 18 inches of #57 Stone for bedding shall be placed under the culvert extensions, and a non-woven geotextile shall be placed so that the 57 Stone is separated on all sides from the surrounding and underlying soils.
- If conditions are encountered that require mucking or undercutting use No. 57 stone as borrow material. The depth to which mucking or undercutting is required is dependent upon encountering a suitable bearing material within the excavation as determined by the Geotechnical Engineer of Record. When using No. 57 Stone to backfill undercut areas, use a non-woven geotextile to separate the No. 57 Stone from the surrounding soils. If muck excavation is required, refer to the Supplemental Specification for Muck Excavation.
- Based on the borings and the culvert extension invert elevations, excavation into PWR and/or rock may be required during construction of the culvert extensions. Excavation into PWR and/or rock should be anticipated for the Station 33+80 culvert upstream and downstream extensions. Excavation into PWR and/or rock should be anticipated for the Station 41+06 culvert upstream extension.

♦ Limitations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations in this report are based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The nature and extent of variations between the borings will not become evident until construction. If variations appear evident, then we will need to re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by the submitting engineers.

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Closure

S&ME, Inc. appreciates the opportunity to assist you during this phase of the project. If you should have questions concerning this report, or if we may be of further assistance, please contact us.

Sincerely,

S&ME, Inc.

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
STACIE E. MITCHELL
No. 28292
8/17/2021

DocuSigned by:
Stacie Mitchell
BBC611B64F19468...

Stacie E. Mitchell, P.E.
Project Engineer
SC Registration No. 28292

SOUTH CAROLINA
S & ME, INC.
No. C00473
CERTIFICATE OF AUTHORIZATION

Nate R. Bradley, P.E.
Project Engineer

Senior Review by: Kristen H. Hill, P.E., P.G.

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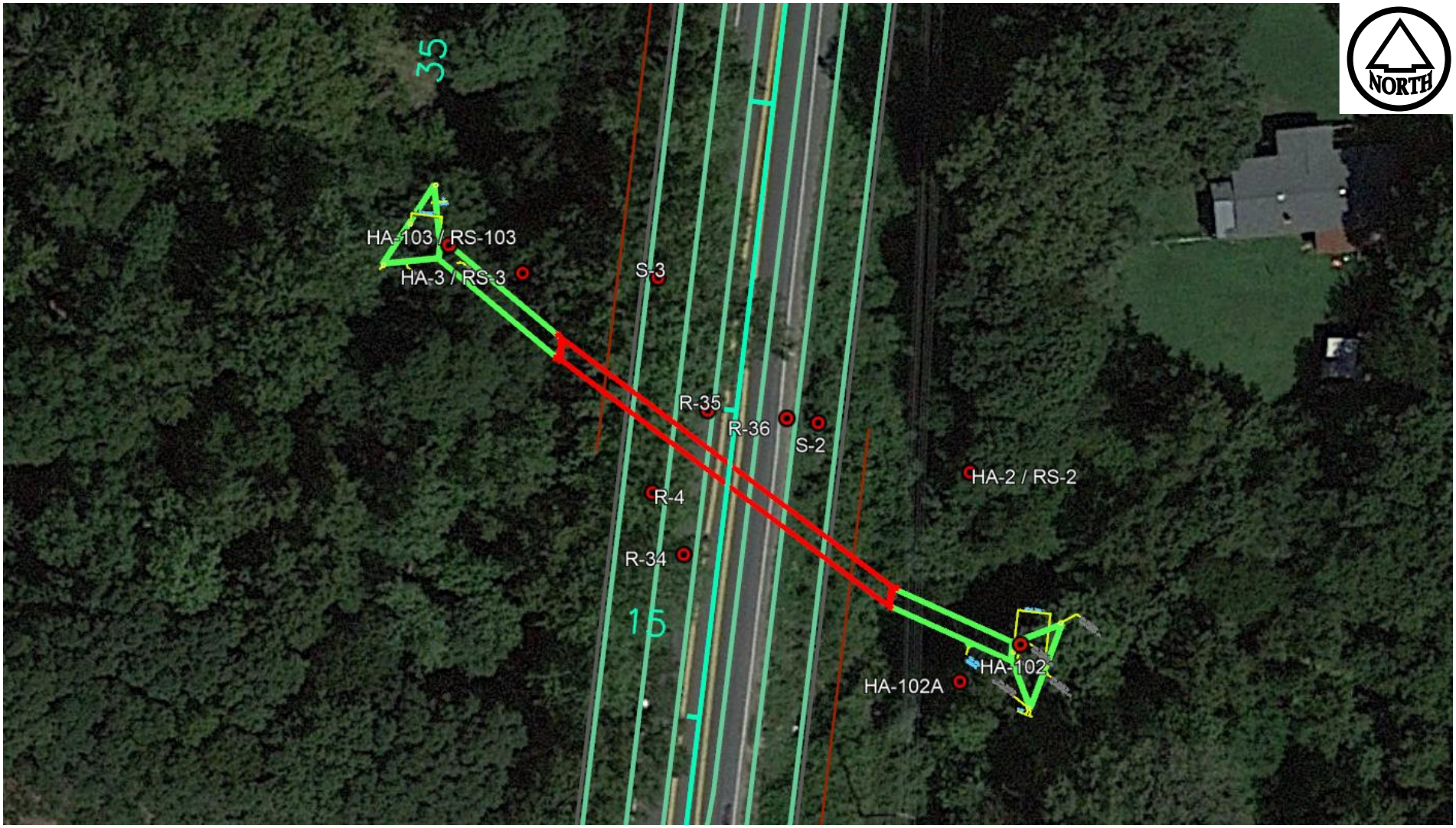


NOTE: AERIAL IMAGE OBTAINED FROM GOOGLE EARTH PRO™ AND MODIFIED BY S&ME TO SHOW APPROXIMATE TEST LOCATIONS. DO NOT USE DRAWING TO DETERMINE DISTANCES OR QUANTITIES.

LEGEND

APPROXIMATE TEST LOCATION

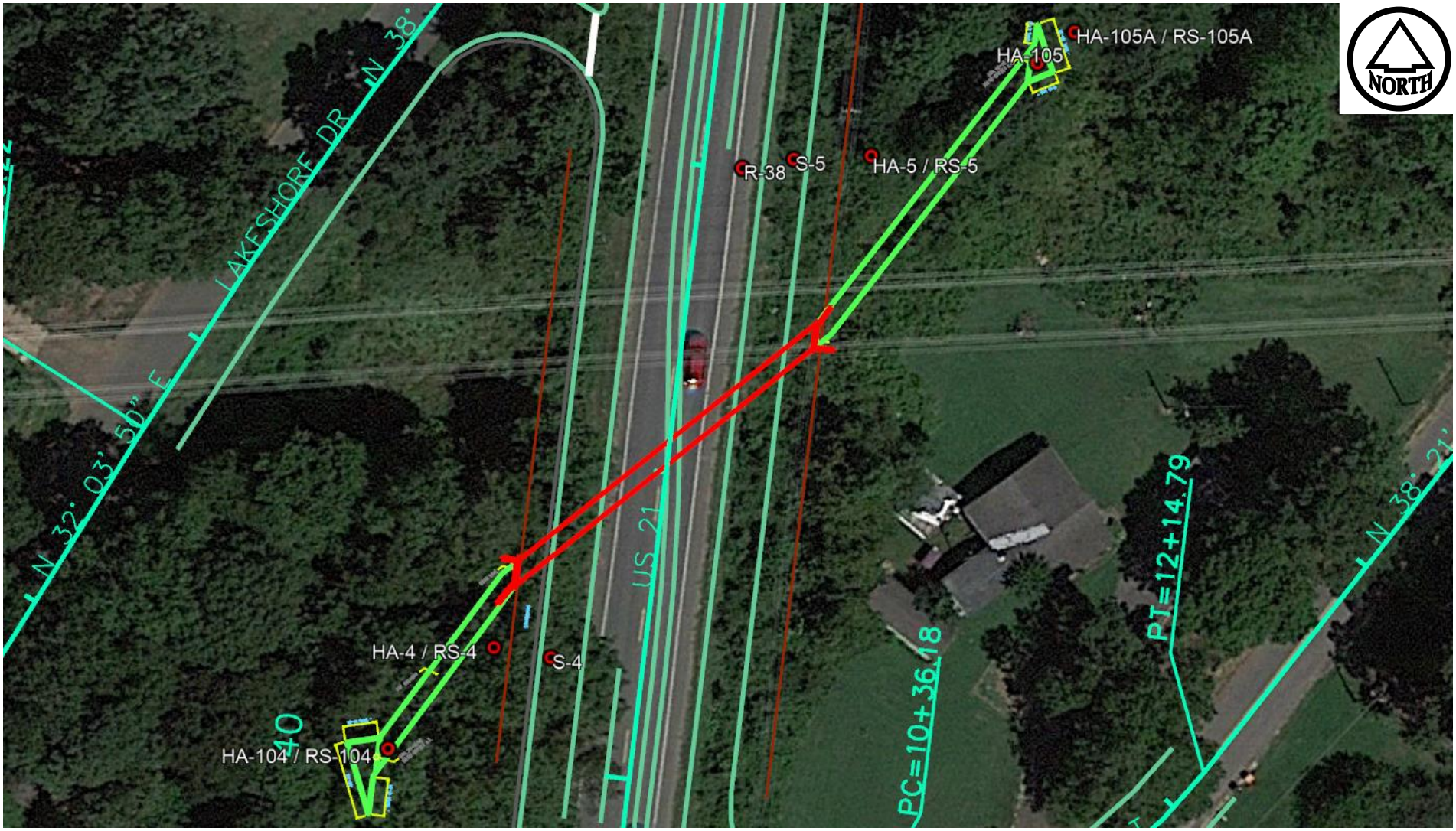
TEST LOCATION PLAN

US 21 AND SC 51 WIDENING

YORK COUNTY, SOUTH CAROLINA

SCALE: Not to Scale	DRAWN BY: NRB	FIGURE NO. 1
DATE: 8/17/2021	CHECKED BY: SEM	
PROJECT NO: 1351-12-037		

DocuSign Envelope ID: B78C5337-9AC5-4FD1-9516-EB260A554DE1



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LEGEND

APPROXIMATE TEST LOCATION

TEST LOCATION PLAN

US 21 AND SC 51 WIDENING

YORK COUNTY, SOUTH CAROLINA

SCALE: Not to Scale	DRAWN BY: NRB	FIGURE NO. 2
DATE: 8/17/2021	CHECKED BY: SEM	
PROJECT NO: 1351-12-037		

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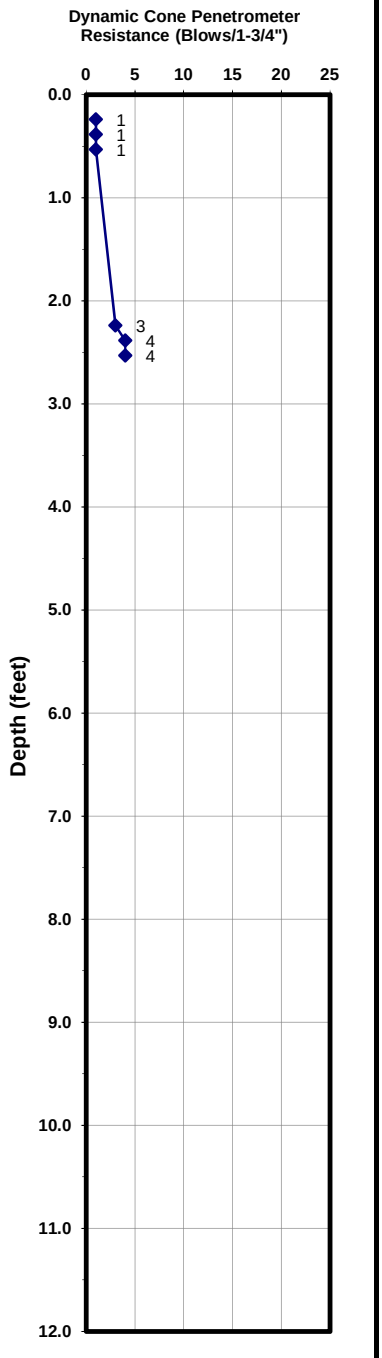
PROJECT:	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG: HA-102
DATE PERFORMED: **6/19/2020** PERFORMED BY: **C. Phillips/J. Friar** NORTHING: **1,174,607** EASTIING: **2,018,916**	ELEVATION: **570.5 feet** BORING DEPTH: **3.5 feet** WATER LEVEL: **2 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP 399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 2	**Alluvial:** Gray Sandy **CLAY (CL)** with trace fine to coarse Sand, saturated
2 - 3.5	**Alluvial**: Gray Silty fine to coarse **SAND (SM)**, saturated

Terminated at 3.5 feet due to cave in.

Groundwater encountered at 2 feet at termination of boring.



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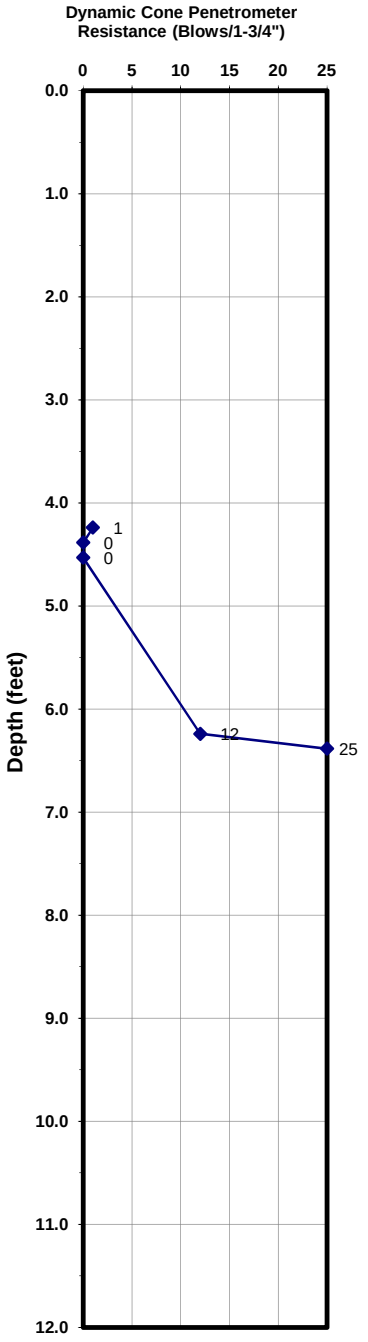
PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-102A**
DATE PERFORMED: **6/19/2020** PERFORMED BY: **C. Phillips/J. Friar** NORTHING: **1,174,595** EASTIING: **2,018,896**	ELEVATION: **570.2 feet** BORING DEPTH: **6.2 feet** WATER LEVEL: **1.2 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP 399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 1	**Alluvial:** Gray Silty **CLAY (CH)**, saturated
1 - 6	**Alluvial**: Gray Clayey fine to coarse **SAND (SC)**, saturated
6 - 6.2	**Residual:** Red Tan, Silty **SAND (SM)**, wet

Terminated at 6.2 feet.

Groundwater encountered at 1.2 feet at termination of boring.



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PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-103**
DATE PERFORMED: **6/19/2020** PERFORMED BY: **C. Phillips/J. Friar** NORTHING: **1,174,736** EASTIING: **2,018,730**	ELEVATION: **568.7 feet** BORING DEPTH: **4 feet** WATER LEVEL: **1.5 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP 399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

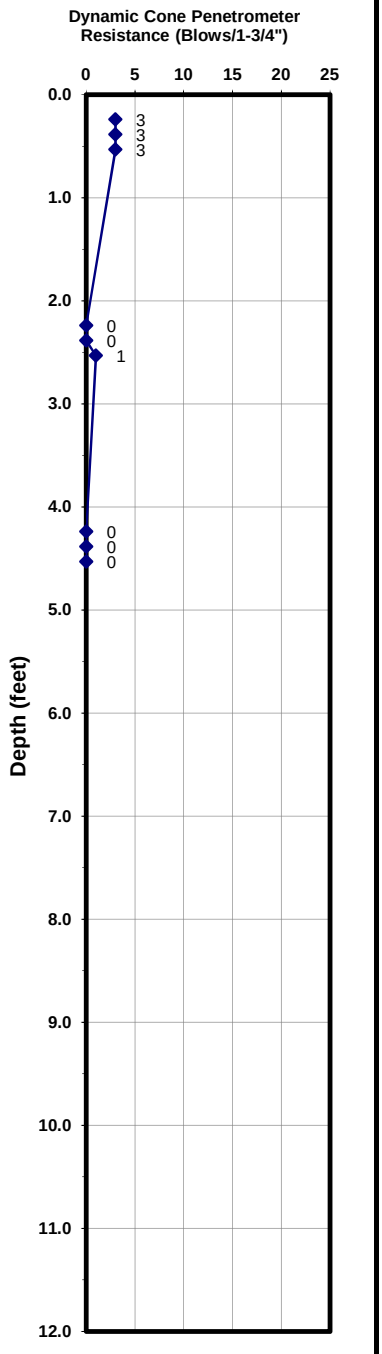
HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 3	**Alluvial:** Gray Clayey **SILT (MH)** with trace coarse Sand, wet, trace organics
3 - 4	**Alluvial:** Gray Silty **CLAY (CH)**, saturated, few organics

Terminated at 4 feet due to cave in.

Groundwater encountered at 1.5 feet at termination of boring.

Borehole cave-in encountered at 4 feet in one offset.



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ROD SOUNDING LOG

PROJECT	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037			**TEST NUMBER**	**RS-103**
ELEVATION	568.7 feet	**NORTH** 1174736	**EAST** 2018730	**DATE**	6/19/2020
DEPTH	9 feet	**DRILL METHOD**	Rod Sounding	**FIELD TECHS.**	CP/JF

DEPTH (ft)	BLOW COUNT 0.5 ft	0.5 ft	TOTAL	BLOWS PER FOOT 0 25 50 75 100	NOTES
	2	2	4		
	2	1	3		Terminated at depth of 9 feet.
	2	2	4		
	6	2	8		
	10	3	13		
5	2	2	4		
	4	4	8		
	13	9	22		
	15	25	40		
10					
15					

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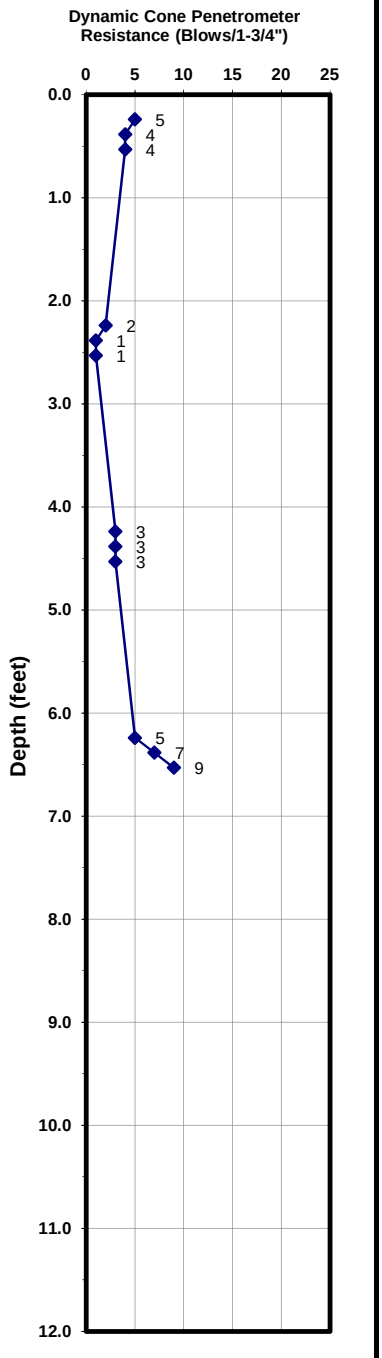
PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-104**
DATE PERFORMED: **6/19/2020** PERFORMED BY: **C. Phillips/J. Friar** NORTHING: **1,175,288** EASTIING: **2,018,817**	ELEVATION: **569.4 feet** BORING DEPTH: **6.5 feet** WATER LEVEL: **2.2 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP 399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 2	**Alluvial:** Brown Gray Sandy **CLAY (CL)**, moist
2 - 3.5	**Alluvial**: Gray Brown Silty **CLAY (CH)**, wet
3.5 - 6.5	**Alluvial:** Gray Silty **CLAY (CH)**, saturated

Terminated at 6.5 feet due to cave in.

Groundwater encountered at 2.2 feet at termination of boring.



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ROD SOUNDING LOG

PROJECT	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037			**TEST NUMBER**	**RS-104**
ELEVATION	569.4 feet	**NORTH** 1175288	**EAST** 2018817	**DATE**	6/19/2020
DEPTH	10 feet	**DRILL METHOD**	Rod Sounding	**FIELD TECHS.**	CP/JF

DEPTH (ft)	BLOW COUNT 0.5 ft	0.5 ft	TOTAL	BLOWS PER FOOT 0 25 50 75 100	NOTES
	1	1	2		
	1	0	1		Terminated at depth of 10 feet.
	0	0	0		
	4	2	6		
	3	3	6		
5	2	2	4		
	3	2	5		
	3	4	7		
	8	10	18		
	50	50	100		
10					
15					

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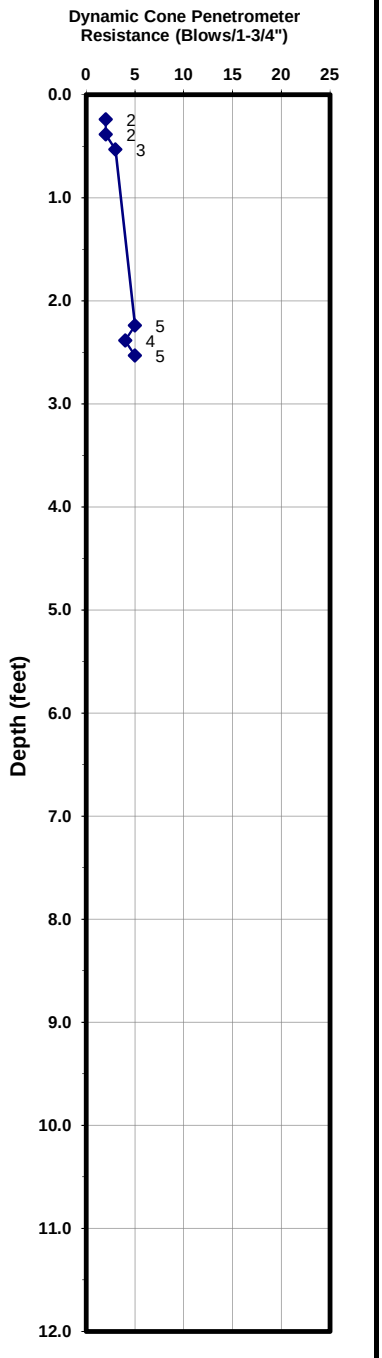
PROJECT:	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG: HA-105
DATE PERFORMED: **6/19/2020** PERFORMED BY: **C. Phillips/J. Friar** NORTHING: **1,175,510** EASTIING: **2,019,028**	ELEVATION: **573.9 feet** BORING DEPTH: **4 feet** WATER LEVEL: **Not Encountered**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP 399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 4	**Residual:** Orange Tan Sandy **CLAY (CL)**, moist

Terminated at 4 feet.

Groundwater not encountered at termination of boring.



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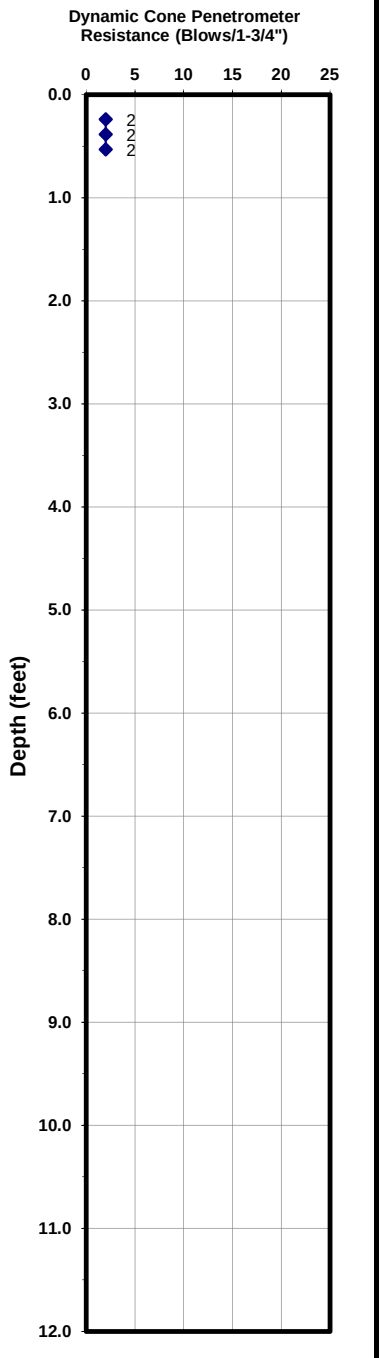
PROJECT:	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG: HA-105A
DATE PERFORMED: **6/19/2020** PERFORMED BY: **C. Phillips/J. Friar** NORTHING: **1,175,520** EASTIING: **2,019,040**	ELEVATION: **569.1 feet** BORING DEPTH: **0.5 feet** WATER LEVEL: **0.25 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP 399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.5	**Alluvial:** Gray Clayey fine to coarse **SAND (SC)**, saturated

Terminated at 0.5 feet due to cave in.

Groundwater encountered at 0.25 feet at termination of boring.



9751 Southern Pine Boulevard
Charlotte, North Carolina 28723
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ROD SOUNDING LOG

PROJECT	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037			**TEST NUMBER**	**RS-105A**
ELEVATION	569.1 feet	**NORTH** 1175520	**EAST** 2019040	**DATE**	6/19/2020
DEPTH	5 feet	**DRILL METHOD**	Rod Sounding	**FIELD TECHS.**	CP/JF

DEPTH (ft)	BLOW COUNT 0.5 ft	0.5 ft	TOTAL	BLOWS PER FOOT 0 25 50 75 100	NOTES
	0	1	1		
	1	1	2		Terminated at depth of 5 feet.
	0	1	1		
	5	10	15		
	20	42	62		
5					
10					
15					

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

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Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B
32	
	d_q = 0.0000
37	

ϕ	d_q for D_f/B
37	
	d_q = 0.0000
42	

VALUES: (enter values)

N_{cm} = 27.67353

N_c = 25.80 *Table 1*

s_c = 1.07

i_c = 1.00

N_{qm} = 14.17273

N_q = 14.70 *Table 1*

s_q = 0.96

d_q = 1.00 *Table 4*

i_q = 1.00

$N_{\gamma m}$ = 15.84862745

N_γ = 16.70 *Table 1*

s_γ = 0.95

i_γ = 1.00

c = 0.00

ϕ = 28

γ = 0.14 *data*

D_f = 2.00 *plans*

B = 6.50 *plans*

L = 51 *plans*

N_{cm} = 27.67

N_{qm} = 14.17

$N_{\gamma m}$ = 15.85

C_{wq} = 1.00 *Table 2*

$C_{w\gamma}$ = 1.00 *Table 2*

i_c = 1

i_γ = 1

i_q = 1

s_c = 1.07

s_γ = 0.95

s_q = 0.96

d_q = 1.00

NOMINAL RESISTANCE: q_n = **11.18**

RESISTANCE FACTOR: 0.45 *from Ch 9 of SCDOT GDM - Strength Event*

FACTORED RESISTANCE: q_f = **5.03**

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

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GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

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N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
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	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 10.85882
N_c = 10.40 *Table 1*
s_c = 1.04
i_c = 1.00

N_{qm} = 6.923996
N_q = 3.60 *Table 1*
s_q = 1.92
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 2.182745098
N_γ = 2.30 *Table 1*
s_γ = 0.95
i_γ = 1.00

c = 0.00
ϕ = 14
γ = 0.14 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 51 *plans*

N_{cm} = 10.86
N_{qm} = 6.92
$N_{\gamma m}$ = 2.18
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 1.00 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.04
s_γ = 0.95
s_q = 1.92
d_q = 1.00

NOMINAL RESISTANCE: q_n = **2.93**

RESISTANCE FACTOR: 1 *from Ch 9 of SCDOT GDM - Extreme Event*

FACTORED RESISTANCE: q_f = **2.93**

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
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- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

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Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 28.075
N_c = 25.80 *Table 1*
s_c = 1.09
i_c = 1.00

N_{qm} = 14.05975
N_q = 14.70 *Table 1*
s_q = 0.96
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 15.66619048
N_γ = 16.70 *Table 1*
s_γ = 0.94
i_γ = 1.00

c = 0.00
ϕ = 28
γ = 0.12 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 42 *plans*

N_{cm} = 28.08
N_{qm} = 14.06
$N_{\gamma m}$ = 15.67
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.09
s_γ = 0.94
s_q = 0.96
d_q = 1.00

NOMINAL RESISTANCE: q_n = **6.43**

RESISTANCE FACTOR: 0.45 *from Ch 9 of SCDOT GDM - Strength Event*

FACTORED RESISTANCE: q_f = **2.89**

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AASHTO LRFD Method

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i.e. S&ME will assume all inclination factors = 1

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3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 11.60357
N_c = 11.00 *Table 1*
s_c = 1.05
i_c = 1.00

N_{qm} = 3.383347
N_q = 3.90 *Table 1*
s_q = 0.87
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 2.532857143
N_γ = 2.70 *Table 1*
s_γ = 0.94
i_γ = 1.00

c = 0.00
ϕ = 15
γ = 0.12 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 42 *plans*

N_{cm} = 11.60
N_{qm} = 3.38
$N_{\gamma m}$ = 2.53
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.05
s_γ = 0.94
s_q = 0.87
d_q = 1.00

NOMINAL RESISTANCE: q_n = **1.31**

RESISTANCE FACTOR: 1 *from Ch 9 of SCDOT GDM - Extreme Event*

FACTORED RESISTANCE: q_f = **1.31**

Station 33+80 Culvert
Offset RT
Extreme Limit State

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 5.244444
N_c = 5.10 *Table 1*
s_c = 1.03
i_c = 1.00

N_{qm} = 1
N_q = 1.00 *Table 1*
s_q = 1.00
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 0
N_γ = 0.00 *Table 1*
s_γ = 0.94
i_γ = 1.00

c = 1.00
ϕ = 0
γ = 0.11 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 45 *plans*

N_{cm} = 5.24
N_{qm} = 1.00
$N_{\gamma m}$ = 0.00
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.03
s_γ = 0.94
s_q = 1.00
d_q = 1.00

NOMINAL RESISTANCE: q_n = **5.46**

RESISTANCE FACTOR: 0.45 *from Ch 9 of SCDOT GDM - Strength Event*

FACTORED RESISTANCE: q_f = **2.46**

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 5.244444
N_c = 5.10 *Table 1*
s_c = 1.03
i_c = 1.00

N_{qm} = 1
N_q = 1.00 *Table 1*
s_q = 1.00
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 0
N_γ = 0.00 *Table 1*
s_γ = 0.94
i_γ = 1.00

c = 0.50
ϕ = 0
γ = 0.11 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 45 *plans*

N_{cm} = 5.24
N_{qm} = 1.00
$N_{\gamma m}$ = 0.00
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.03
s_γ = 0.94
s_q = 1.00
d_q = 1.00

NOMINAL RESISTANCE: q_n = **2.84**

RESISTANCE FACTOR: 1 *from Ch 9 of SCDOT GDM - Extreme Event*

FACTORED RESISTANCE: q_f = **2.84**

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Extreme Limit State

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 27.47632
N_c = 25.80 *Table 1*
s_c = 1.06
i_c = 1.00

N_{qm} = 14.22824
N_q = 14.70 *Table 1*
s_q = 0.97
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 15.93824561
N_γ = 16.70 *Table 1*
s_γ = 0.95
i_γ = 1.00

c = 0.00
ϕ = 28
γ = 0.12 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 57 *plans*

N_{cm} = 27.48
N_{qm} = 14.23
$N_{\gamma m}$ = 15.94
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.06
s_γ = 0.95
s_q = 0.97
d_q = 1.00

NOMINAL RESISTANCE: q_n = **6.52**

RESISTANCE FACTOR: 0.45 *from Ch 9 of SCDOT GDM - Strength Event*

FACTORED RESISTANCE: q_f = **2.94**

Station 41+06 Culvert
Offset RT
Service Limit State

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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above ofr below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 11.44474
N_c = 11.00 *Table 1*
s_c = 1.04
i_c = 1.00

N_{qm} = 3.519308
N_q = 3.90 *Table 1*
s_q = 0.90
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 2.576842105
N_γ = 2.70 *Table 1*
s_γ = 0.95
i_γ = 1.00

c = 0.00
ϕ = 15
γ = 0.12 *data*
D_f = 2.00 *plans*
B = 6.50 *plans*
L = 57 *plans*

N_{cm} = 11.44
N_{qm} = 3.52
$N_{\gamma m}$ = 2.58
C_{wq} = 1.00 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.04
s_γ = 0.95
s_q = 0.90
d_q = 1.00

NOMINAL RESISTANCE: q_n = **1.35**

RESISTANCE FACTOR: 1 *from Ch 9 of SCDOT GDM - Extreme Event*

FACTORED RESISTANCE: q_f = **1.35**

Station 41+06 Culvert
Offset RT
Extreme Limit State

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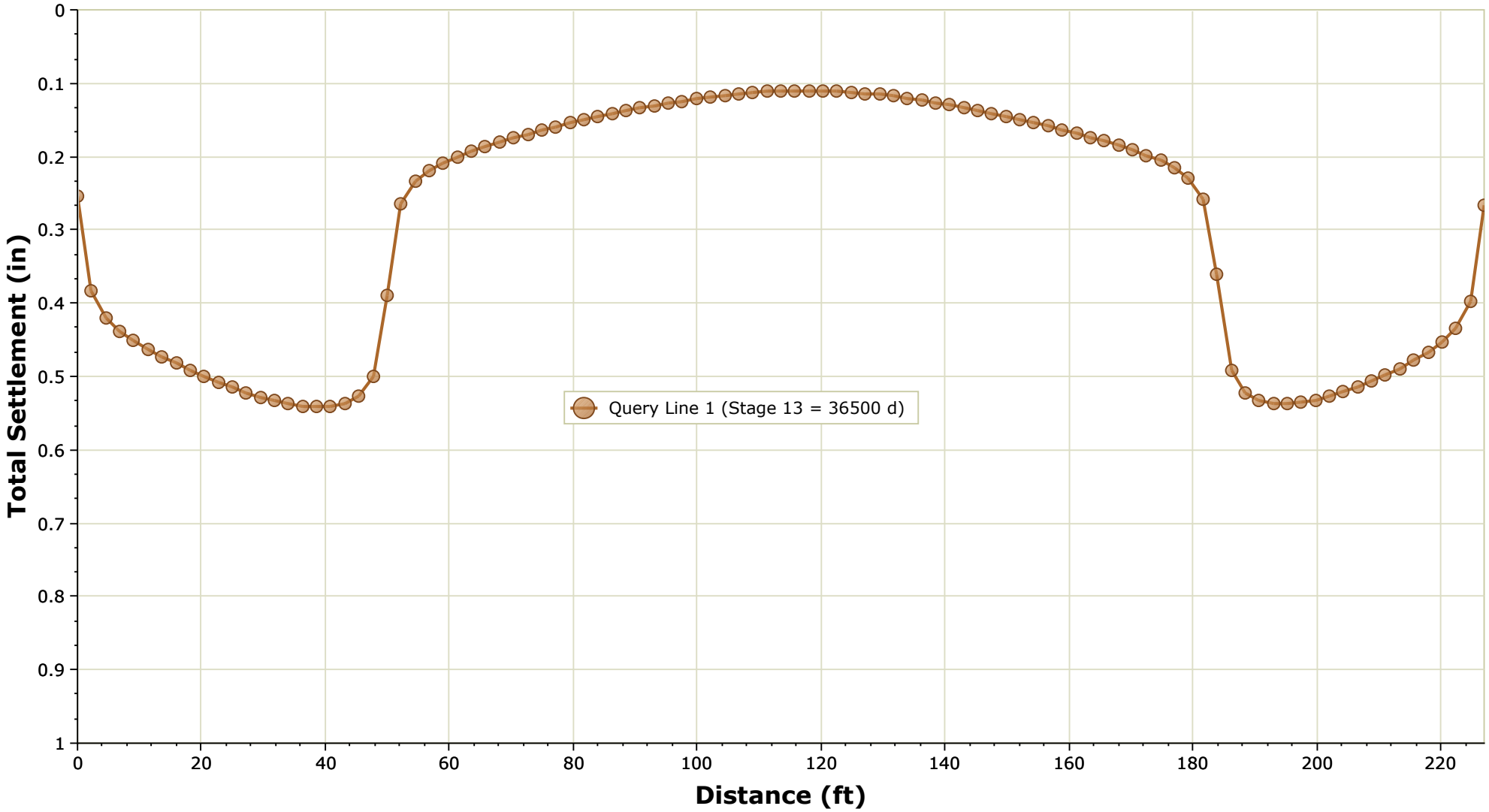
33+80 Culvert: Distance vs. Total Settlement



Reference Stage: Stage 1 = 0 d
Total Settlement at Depth = 7 ft

Project	US 21 and SC 51 Widening			
Analysis	33+80 Culvert		Description	
Drawn By	NRB	Project Number 1351-12-037	Company S&ME	Figure X
Location		File Name 3380 Culvert.s3z	Date 6/24/2020	

SETTLE3 5.003

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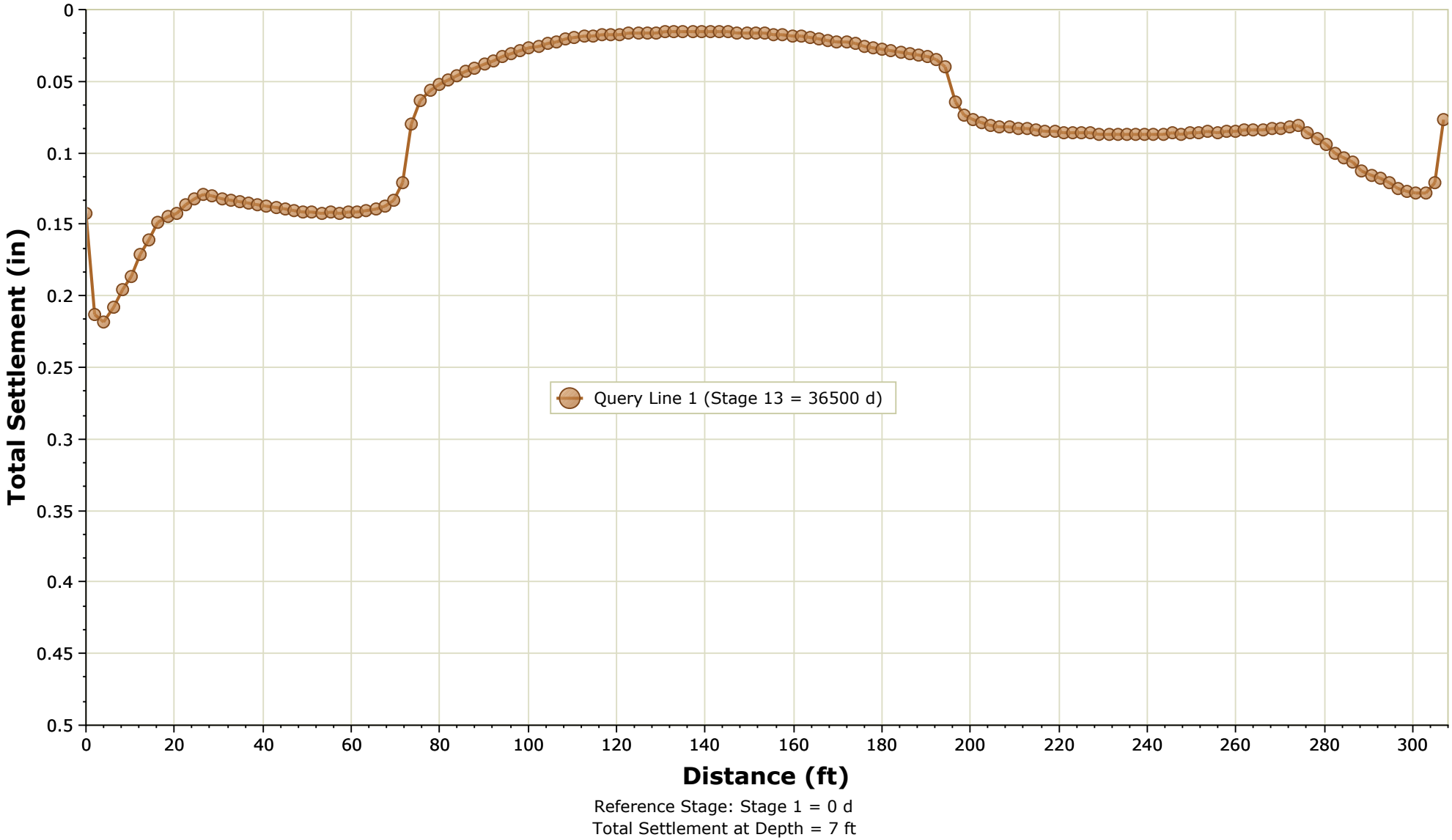
41+06 Culvert: Distance vs. Total Settlement



Reference Stage: Stage 1 = 0 d
Total Settlement at Depth = 7 ft

Project	US 21 and SC 51 Widening			
Analysis	41+06 Culvert		Description	
Drawn By: NRB		Project Number: 1351-12-037	Company: S&ME	Figure: X
Location		File Name: 4106 Culvert.s3z	Date: 6/24/2020	

SETTLE3 5.003

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Version 2.0 (7/7/2015)

Project No	1351-12-037		Sheet	1	of 1
Client	STV	**Calc. By**	NRB	**Date**	6/24/20
Project	US 21 and SC 51 Widening	**Check By**		**Date**	
Desc.	Culvert Headwall				
	33+80 Culvert				

LRFD SLIDING PARAMETERS

Inlet Headwall:

Reference Boring: HA-102A

D_f = 2 ft below existing grade, bearing in: Gravel with Sand and Silt (A-2-4)

For Cohesionless Soils (i.e. $\phi_f > 0$):

N = 11 bpf

ϕ_f = 28 degrees

Coefficient of Friction = tan δ

= tan(ϕ_f) for concrete cast against soil

= 0.8 tan(ϕ_f) for precast concrete footing

FootingType: Cast-in-Place

tan δ = tan (28)

tan δ = **0.53**

For Cohesive Soils (i.e. $\phi_f = 0$):

q_u = N/A tsf

S_u = N/A ksf

For Gravel with Sand and Silt (A-2-4) soil, the unit sliding resistance equals the undrained shear strength (Su)

Therefore, sliding resistance = **N/A** ksf

Outlet Headwall:

Reference Boring: S-3

D_f = 2 ft below existing grade, bearing in: Sandy Silt (A-4a)

For Cohesionless Soils (i.e. $\phi_f > 0$):

N = 47 bpf

ϕ_f = 28 degrees

Coefficient of Friction = tan δ

tan(ϕ_f) for concrete cast against soil

0.8 tan(ϕ_f) for precast concrete footing

Footing Type: Cast-in-Place

tan δ = tan (28)

tan δ = **0.53**

For Cohesive Soils (i.e. $\phi_f = 0$):

q_u = N/A tsf

S_u = 0 ksf

For Sandy Silt (A-4a) soil, the unit sliding resistance equals the undrained shear strength (Su)

Therefore, sliding resistance = **N/A** ksf

REFERENCES AASHTO LRFD Bridge Design Specifications, 6th Edition, Section 10: Foundations. 10.6.3.4 Failure by Sliding

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S&ME ENGINEERING INTEGRITY

Version 2.0 (7/7/2015)

Project No	1351-12-037		Sheet	1	of 1
Client	STV	**Calc. By**	NRB	**Date**	6/24/20
Project	US 21 and SC 51 Widening	**Check By**		**Date**	
Desc.	Culvert Headwall				
	41+06 Culvert				

LRFD SLIDING PARAMETERS

Inlet Headwall:

Reference Boring: HA-105A

D_f = 2 ft below existing grade, bearing in: Gravel with Sand and Silt (A-2-4)

For Cohesionless Soils (i.e. $\phi_f > 0$):

N = 10 bpf

ϕ_f = 28 degrees

Coefficient of Friction = tan δ

= tan(ϕ_f) for concrete cast against soil

= 0.8 tan(ϕ_f) for precast concrete footing

FootingType: Cast-in-Place

tan δ = tan (28)

tan δ = **0.53**

For Cohesive Soils (i.e. $\phi_f = 0$):

q_u = N/A tsf

S_u = N/A ksf

For Gravel with Sand and Silt (A-2-4) soil, the unit sliding resistance equals the undrained shear strength (Su)

Therefore, sliding resistance = **N/A** ksf

Outlet Headwall:

Reference Boring: HA-104

D_f = 2 ft below existing grade, bearing in: Clay (A-7-6)

For Cohesionless Soils (i.e. $\phi_f > 0$):

N = 8 bpf

ϕ_f = 0 degrees

Coefficient of Friction = tan δ

tan(ϕ_f) for concrete cast against soil

0.8 tan(ϕ_f) for precast concrete footing

Footing Type: Cast-in-Place

tan δ = N/A

tan δ = **N/A**

For Cohesive Soils (i.e. $\phi_f = 0$):

q_u = 1 tsf

S_u = 1 ksf

For Clay (A-7-6) soil, the unit sliding resistance equals the undrained shear strength (Su)

Therefore, sliding resistance = **1** ksf

REFERENCES AASHTO LRFD Bridge Design Specifications, 6th Edition, Section 10: Foundations.
10.6.3.4 Failure by Sliding

SCDOT GDM

August 6, 2021

STV Incorporated
2430 Mall Drive, Suite 315 Building B
North Charleston, South Carolina 29406

Attention: Mr. Thomas Mastillone, P.E.

Reference: **Culvert Extension at SC 51 Station 316+23 – REV1**
US 21 and SC 51 Widening
York County, South Carolina
S&ME Project No. 1351-12-037

Dear Mr. Mastillone:

The purpose of this geotechnical memo is to provide design recommendations for the above-referenced box culvert extension. Authorization to proceed with this study was provided in general accordance with the Subcontract for Professional Services between STV Incorporated (STV) and S&ME dated November 27, 2012 and the First Amendment to Subcontract for Professional Services dated April 2014.

♦ Background

This project is a Pennies for Progress project that includes widening and realignment of approximately 2.9 miles of US 21 from SC Highway 460 (Springfield Parkway) to SC Highway 51 and SC Highway 51 from US 21 to the North Carolina and South Carolina border. The project site is located within York County, South Carolina. A culvert profile drawing in PDF format (prepared by STV dated October 26, 2020), along with a zip file containing various roadway design files in Microstation and PDF formats, were provided by Thomas Mastillone with STV on October 26, 2020. In subsequent email correspondence, Thomas Mastillone provided PDF roadway plans dated March 18, 2021 that included culvert detail drawings prepared by KCI Technologies dated May 2019.

The project includes adding a travel lane in each direction, adding a center turn lane, improvements to existing intersections and other impacted roadways. Three culverts will require extensions as a part of this project. Design recommendations for the two culvert extensions along the US 21 alignment were provided in a separate memo.

The existing 6-foot by 6-foot reinforced concrete box culvert located along SC 51 at approximate Station 316+23 will be extended in each direction. The cast-in-place culvert extension will have an upstream invert elevation of 591.47 feet and will have a downstream invert elevation of 589.08 feet. We have assumed that a minimum of 18 inches of #57 Stone for bedding will be placed under the culvert extension.

♦ Culvert Extension Exploration

The proposed culvert extension area was not explored during development of S&ME's *Preliminary Roadway Geotechnical Engineering Report (PRGER)* dated February 3, 2016, although two soil test borings (R-27 and R-28) were performed nearby.

In order to explore the subgrade conditions at the culvert extension, hand auger borings were conducted at each of the four corners of each side of the culvert extension. Locations were determined in the field by S&ME personnel based on information provided by STV. Hand augers HA-201 through HA-208 were performed at the SC 51 Station 316+23 culvert extension.

The hand auger borings were advanced manually using a bucket-type hand auger. The soils encountered were classified by a staff professional from cuttings brought to the surface by the augering process and a field log of the encountered conditions was created. Following the water level measurements, the test locations were backfilled with auger cuttings.

Dynamic cone penetrometer (DCP) testing was conducted in the hand auger boreholes in general accordance with the procedure outlined in ASTM Special Technical Publication No. 399, Vane Shear and Cone Penetration Resistance Testing of In-Situ Soils. The dynamic cone penetrometer test was performed by driving an enlarged cone point into the soil using a 15-pound weight falling 20-inches sliding on a steel driving rod. The penetration testing was performed at various test depths in manually augered boreholes, each approximately 3-½ inches in diameter. After augering to each test depth, the cone point (45-degree apex angle, 1.5-inch diameter) was seated 2-inches into the undisturbed bottom of the borehole in order to embed the cone. The cone point was further driven 1-3/4 inches using the 15-pound weight falling 20-inches, and the number of hammer blows required to advance the point was recorded. The cone was typically advanced a total of three, 1-3/4 inch increments at each test depth, obtaining three dynamic penetration resistances. The blow count for each 1-3/4 inch increment provides a relative index to the soil strength and density/consistency. The resulting DCP blow count has been generally correlated for varying soil types and standard penetration resistance values in the above-noted reference.

♦ Surface Conditions

Based on our site reconnaissance, the culvert extension areas are currently partially covered in low brush and partially wooded. At the time of our current exploration on November 11, 2020, the depth of water flowing through the culvert was relatively shallow.

♦ Subsurface Conditions

Soils along the SC 51 Station 316+23 culvert extension were explored at test locations HA-201 through HA-208.

Subsurface conditions as indicated by the hand auger borings generally consist of fill soils, alluvial soils and residual soils. The generalized subsurface conditions are described below. For more detailed soil descriptions and stratifications at a particular location, the respective hand auger log should be reviewed.

Fill Soils: Fill soils were encountered at the existing ground surface in each of the hand auger borings and extended to depths of 1 to 2 feet below the existing ground surface. The fill soils generally consisted of soft silty clay (USCS Classification CH), soft clayey silt (MH), soft to firm sandy clay (CL), soft sandy silt (ML), loose clayey sand (SC), and loose silty sand (SM). The fill soils were noted as being dry to wet. The fill soils encountered in HA-203 contained trace organic matter consisting of roots.

Alluvial Soils: Alluvial soils were encountered underlying the fill soils in hand auger borings HA-202 through HA-207 and extended to depths of approximately 3 to 5.5 feet. The alluvial soils generally consisted of very soft to stiff silty clay (CH), soft sandy clay (CL), loose clayey sand (SC), and loose silty sand (SM). The alluvial soils were

noted as being moist to saturated. Some of the alluvial soils encountered in HA-206 and HA-207 contained trace organic matter consisting of roots.

Residual Soils: Residual soils were encountered in each of the hand auger borings underlying the fill soils or the alluvial soils. The residual soils generally consisted of firm to stiff silty clay (CH), firm to stiff sandy clay (CL), firm to stiff sandy silt (ML), loose to medium dense clayey sand (SC), and very loose to medium dense silty sand (SM). The residual soils were noted as being moist to saturated. Each of the hand auger borings were terminated in residual soils at depths ranging from 5 to 9 feet.

Hand Auger Refusal: Hand auger refusal was encountered in HA-202, HA-205, HA-206, and HA-207 at depths ranging from 5 to 8 feet (approximate elevations of 584.6 feet to 588.8 feet). Hand auger refusal could be due to the presence of high consistency/relative density soils, partially weathered rock, or rock.

Water Levels: Groundwater level measurements were attempted at termination in each hand auger boring. Groundwater was encountered in HA-201, HA-202, HA-203, HA-206, and HA-207 at depths ranging from approximately 2.5 to 7 feet (approximate elevations of 588.1 to 589.7 feet) below the existing ground surface.

Water levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, groundwater may be encountered during construction at depths not indicated by the borings.

♦ Recommendations

Bearing Resistance

Based on the stratigraphy encountered in the borings performed at the culvert extension, recommended maximum values of nominal (q_n) and factored (q_R) bearing resistance at the strength and extreme limit states for the culvert are presented in the table below. The culvert located at Station 316+23 will bear about 5 to 7 feet below the existing ground surface on medium dense and firm residual soils.

Table 1 – Bearing Resistance for Culvert

Structure	Offset (ft)	Approximate Bearing Elevation (ft)	Bearing Material	Limit State	Nominal Bearing Resistance, q_n (ksf)	Factored Bearing Resistance, q_R (ksf)
316+23 6'x6' Box Culvert Extension	LT	588.7 to 586.9	Silty Sand (SM) and Sandy Silt (ML)	Strength	7.9	3.6
				Extreme	7.9	7.9
	RT	586.8 to 586.6	Clayey Sand (SC) and Silty Sand (SM)	Strength	8.0	3.6
				Extreme	8.0	8.0

Note: Resistance Factor (φ_b) used for Strength and Extreme Limit States are 0.45 and 1.00, respectively. (Table 9-1, Chapter 9 of the SCDOT GDM)

Settlement Potential

As previously mentioned, the existing 6-foot by 6-foot reinforced concrete box culvert located at approximate Station 316+23 will be extended in each direction. Additional fill heights on the order of 6 to 8 feet are planned to widen the existing roadway. Total settlements anticipated for the culvert extensions range from about 0.15 inches near the ends of the extensions (near the proposed embankment toes), up to about 0.3 inches along the lengths of the culvert extensions, and about 0.2 inches at the point where the extensions connect to the existing culvert. Differential settlement inferred from these values are approximately 1/10 of an inch over a distance of approximately 20 feet and approximately 0.15 inches over a distance of approximately 30 feet, resulting in angular distortions of the culvert extensions of approximately 1/2400. Settlements are anticipated to occur during construction of the extensions and embankment widening.

Soft, saturated soils, if encountered, should be mucked out where they occur below the culvert extensions. No. 57 Stone should be used to backfill muck excavation. The depth of undercut shall be extended to a suitable bearing material.

Based on Section 10.1 of the SCDOT Geotechnical Design Manual, "no performance objectives or limits have been established for hydraulic structures (i.e., culverts and pipes). The acceptable performance of a hydraulic structure is based on the integrity of the structure and the ability of the structure to continue to function as designed (i.e., convey water from one side of the embankment to the other). Therefore, the GEOR shall report anticipated deformations (i.e., total and differential settlement, etc.) to both the SEOR as well as the HEOR. It is the responsibility of these designers (i.e., SEOR and HEOR) to determine if the hydraulic structure will perform as designed given the anticipated deformations."

Sliding Resistance

The factored resistance against failure by sliding (R_R) should be determined using Eq. 10.6.3.4-1 of the current AASHTO LRFD Bridge Design Specifications.

For headwall foundations bearing 2.5 feet or more below final grades, the nominal sliding resistance (R_τ) between the soil and the shallow spread culvert headwall foundation should be taken as the total vertical force (V) acting on the foundation multiplied by the recommended coefficient of friction (tan δ). For the Station 316+23 culvert

inlet and outlet headwall foundations, tan δ is recommended to be 0.53. If the headwall foundations are precast concrete units, the factored sliding resistance may then be determined by applying a resistance factor of 0.8 to the nominal value for shearing between the footing and granular soil.

Excavations

As previously mentioned, hand auger refusal was encountered in HA-202, HA-205, HA-206, and HA-207 at depths ranging from 5 to 8 feet (approximate elevations of 584.6 feet to 588.8 feet). Hand auger refusal could be due to the presence of high consistency/relative density soils, partially weathered rock, or rock. As previously mentioned, two soil test borings (R-27 and R-28) were performed near the proposed culvert extension area. These borings were presented in S&ME's *Preliminary Roadway Geotechnical Engineering Report (PRGER)* dated February 3, 2016. Partially weathered rock was first encountered in R-28 at an approximate depth of 4.3 feet (approximate elevation of 595.7 feet). Auger refusal material was encountered in R-27 at an approximate depth of 10.9 feet (approximate elevation of 593.1 feet). Based on the borings and the culvert extension invert elevations, excavation into PWR and/or rock may be required during construction of the culvert extensions.

Excavatable PWR is defined as material that can be excavated using traditional equipment by first loosening with a single tooth ripper attached to a suitable sized dozer, such as a Caterpillar D-8 or D-9, or suitable sized trackhoe such as a Caterpillar C320 equipped with a rock bucket with a curling force of 18,300 pounds or greater.

Jack hammering or blasting may be required for PWR in trench excavations, below the upper 2-4 feet of PWR in open excavations, and for rock in both open site (greater than 10 feet wide and 30 feet long) and trench excavations. We anticipate blasting will not be allowed to due to the close proximity of the existing roadway.

Jack hammering or blasting of rock may result in an uneven rock surface in the bottom of trench excavations and a subsequent point load condition on the culvert. If dissimilar bearing conditions exist in excavations, we recommend that those conditions be evaluated on a case-by-case basis. To provide a uniform bearing surface and reduce the potential for point loading, over-excavation below the bearing elevation and replacement with properly compacted low-plasticity granular soil, crushed stone, or lean concrete may be required.

The depth to, and thickness of, PWR, rock lenses or seams and bedrock, can vary dramatically in short distances and between boring locations; therefore, PWR, boulders or bedrock may be encountered during any excavation on this project.

Controlled Fill

Fill material proposed for the project should be in general accordance with SCDOT Standard Specifications for borrow in Section 203.2.1.8. York County lies in Group A as defined in that section, and would require AASHTO soils A-1, A-2, A-3, A-4, A-5, or A-6 be used for borrow material within the top 5 feet of the embankment. Below the top 5 feet other soils (besides muck) can be used as long as they are stable when compacted to the required density.

Fill placement and compaction should be in general accordance with the SCDOT Standard Specifications for Highway Construction 2007 edition, Division 205 Embankment Construction and any applicable project specifications or provisions. In-place density testing should be performed by an experienced engineering technician to confirm that the contractor's compaction method can achieve the specified compaction and that the fill material meets the specified requirements. Fill subgrade evaluations and proofrolling and subgrade repair and/or undercutting operations should be observed by a representative of the geotechnical engineer or an experienced engineering technician.

Recommended Notes on Plans

S&ME recommends the following notes be included on the plans specific to the culvert extensions:

- A minimum of 18 inches of #57 Stone for bedding shall be placed under the culvert extension, and a non-woven geotextile shall be placed so that the 57 Stone is separated on all sides from the surrounding and underlying soils.
- If conditions are encountered that require mucking or undercutting use No. 57 stone as borrow material. The depth to which mucking or undercutting is required is dependent upon encountering a suitable bearing material within the excavation as determined by the Geotechnical Engineer of Record. When using No. 57 Stone to backfill undercut areas, use a non-woven geotextile to separate the No. 57 Stone from the surrounding soils. If muck excavation is required, refer to the Supplemental Specification for Muck Excavation.
- Based on the borings and the culvert extension invert elevations, excavation into PWR and/or rock may be required during construction of the culvert extensions.

Limitations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations in this report are based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The nature and extent of variations between the borings will not become evident until construction. If variations appear evident, then we will need to re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by the submitting engineers.

Closure

S&ME, Inc. appreciates the opportunity to assist you during this phase of the project. If you should have questions concerning this report, or if we may be of further assistance, please contact us.

Sincerely,

S&ME, Inc.

DocuSigned by:
Stacie Mitchell
BBC611B64F19458...

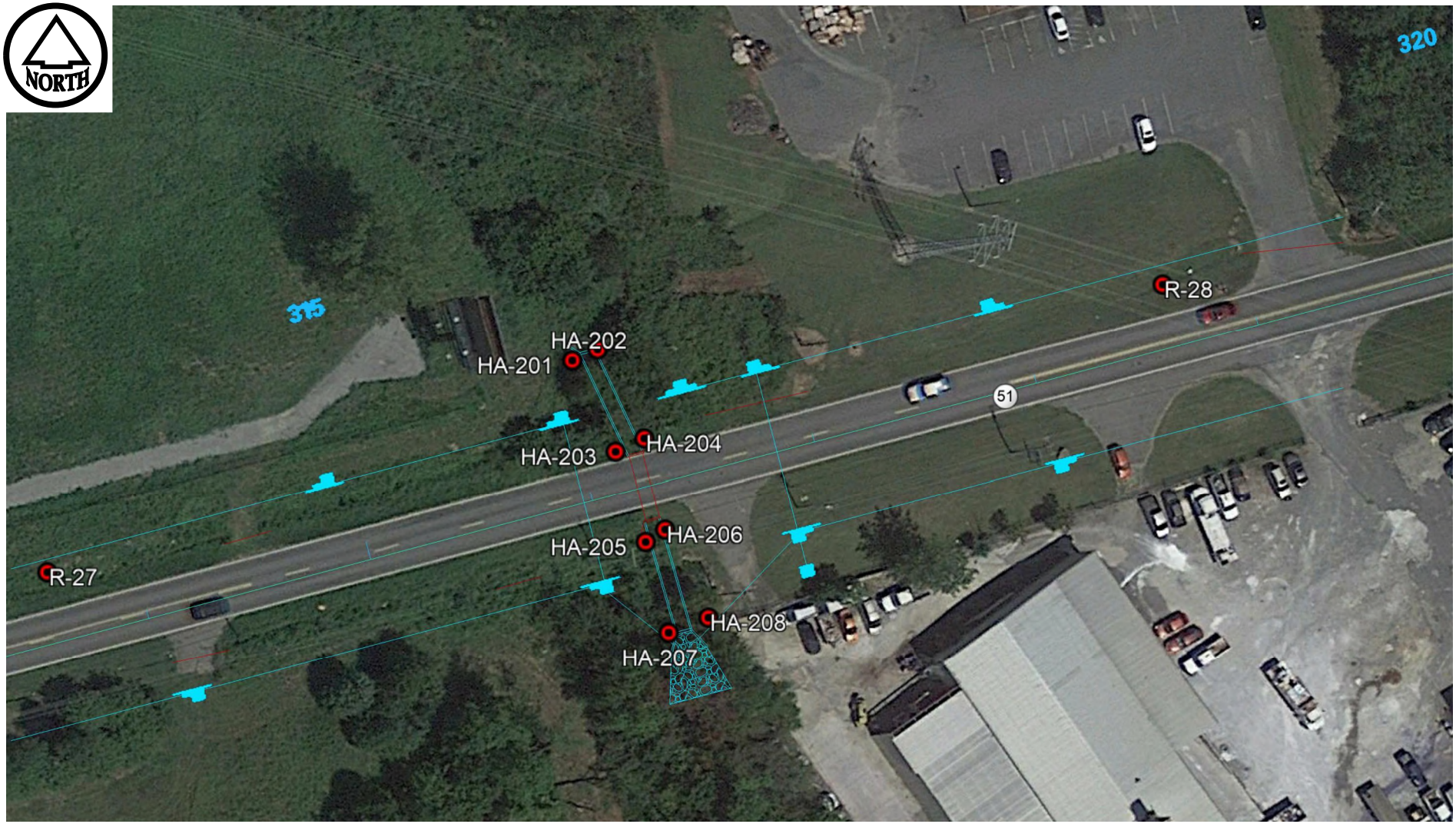
Stacie E. Mitchell, P.E.
Project Engineer
SC Registration No. 28292

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 28292
STACIE E. MITCHELL

Nate R. Bradley, P.E.
Project Engineer

SOUTH CAROLINA
S & ME, INC.
No. C00473
CERTIFICATE OF AUTHORIZATION

Senior Review by: Kristen H. Hill, P.E., P.G.



NOTE: AERIAL IMAGE OBTAINED FROM GOOGLE EARTH PRO™ AND MODIFIED BY S&ME TO SHOW APPROXIMATE TEST LOCATIONS. DO NOT USE DRAWING TO DETERMINE DISTANCES OR QUANTITIES.

LEGEND

APPROXIMATE TEST LOCATION

TEST LOCATION PLAN

US 21 AND SC 51 WIDENING

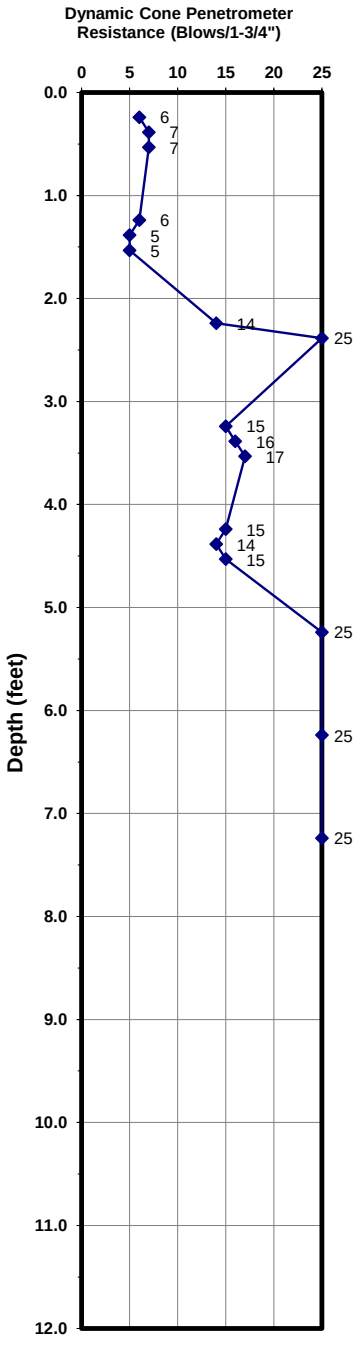
YORK COUNTY, SOUTH CAROLINA

SCALE: Not to Scale	DRAWN BY: NRB	FIGURE NO. 1
DATE: 8/6/2021	CHECKED BY: SEM	
PROJECT NO: 1351-12-037		

PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-201**
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,391** EASTING: **2,022,160**	ELEVATION: **595.7 feet** BORING DEPTH: **7.0 feet** WATER LEVEL: **6.0 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 2	**Fill:** Orange Brown Sandy **Clay (CL)**, moist
2 - 4	**Residual:** Orange Brown Sandy **Clay (CL)**, moist, trace rock fragments
4 - 6	Brown Orange Silty Fine to Coarse **Sand (SM)**, moist
6 - 7	Brown Orange Silty Fine to Coarse **Sand (SM)**, saturated
	Boring terminated at 7.0 feet. **Groundwater encountered at 6.0 feet at termination of boring.**



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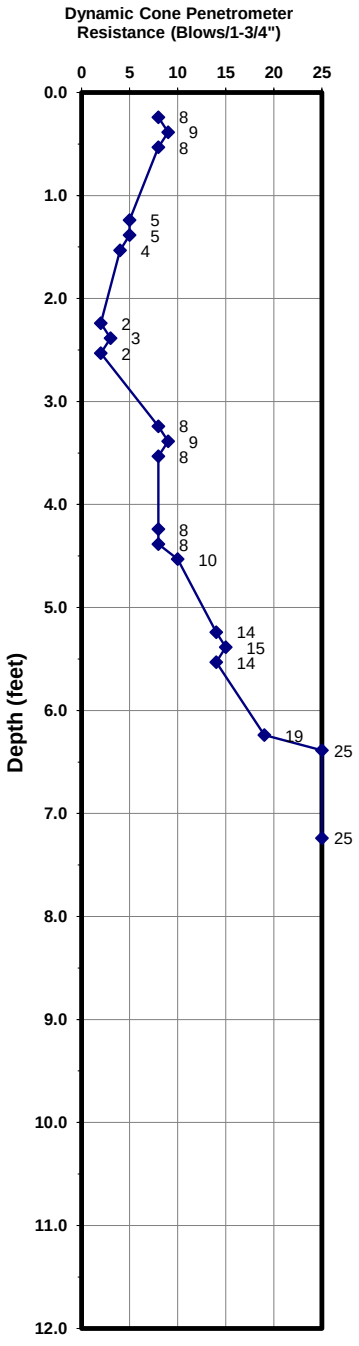
PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-202**
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,396** EASTING: **2,022,171**	ELEVATION: **595.8 feet** BORING DEPTH: **7.0 feet** WATER LEVEL: **7.0 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 1	**Fill:** Brown Silty Fine to Coarse **Sand (SM)**, dry
1 - 3.5	**Alluvial:** Gray Brown Silty **Clay (CH),** moist
3.5 - 4	**Alluvial:** Gray Brown Clayey Fine to Coarse **Sand (SC)**, moist, trace rock fragments
4 - 5.5	**Residual:** Gray Orange Silty **Clay (CH)**, moist
5.5 - 7	Brown Orange Silty Fine to Coarse **Sand (SM)**, moist
	Hand auger refusal encountered at 7.0 feet. **Groundwater encountered at 7.0 feet at termination of boring.**



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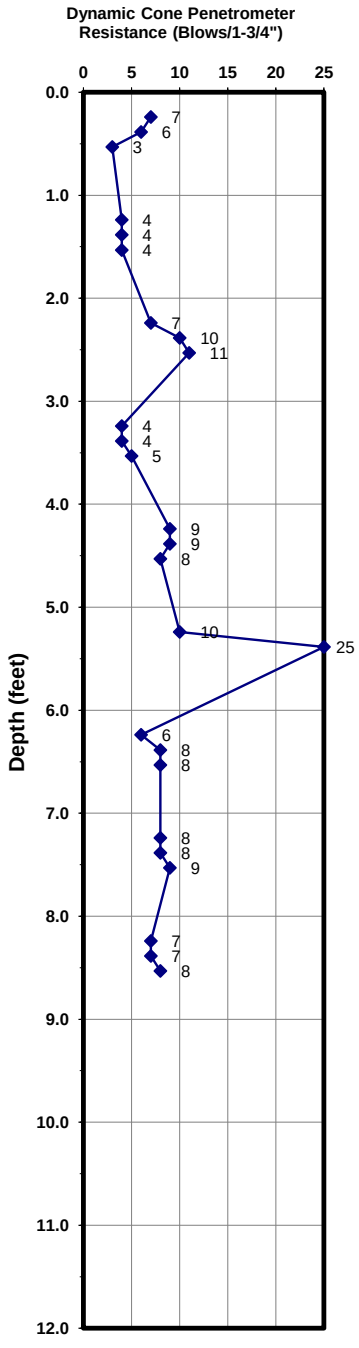
PROJECT:	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG:	HA-203
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,352** EASTING: **2,022,179**	ELEVATION: **591.8 feet** BORING DEPTH: **8.0 feet** WATER LEVEL: **2.5 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**	

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 1.5	**Fill:** Black Brown Silty **Clay (CH)**, moist, trace roots
1.5 - 2.5	**Alluvial:** Gray Silty **Clay (CH)**, wet, trace roots
2.5 - 5	**Alluvial:** Brown Gray Clayey Fine to Coarse **Sand (SC)**, saturated
5 - 8	**Residual:** Brown Orange Sandy **Silt (ML)**, moist
	Boring terminated at 8.0 feet. **Groundwater encountered at 2.5 feet at termination of boring.**



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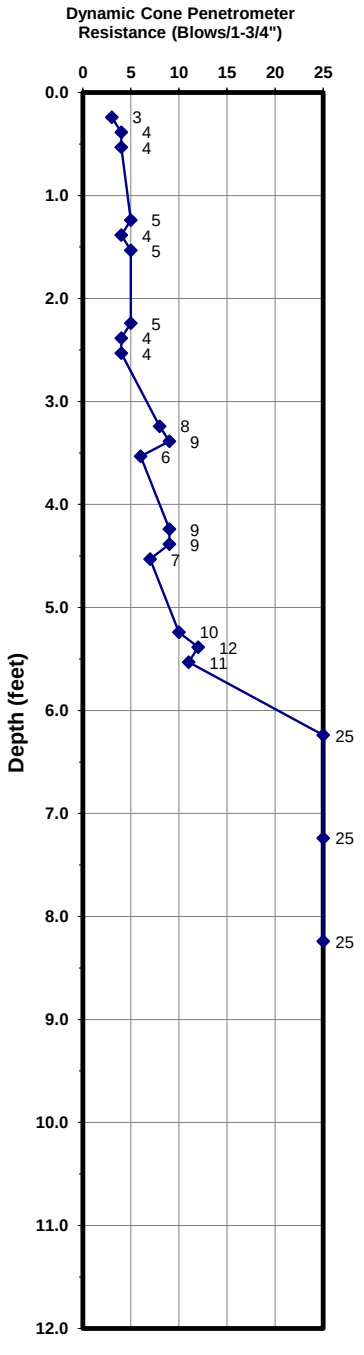
PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-204**
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,358** EASTING: **2,022,192**	ELEVATION: **594.4 feet** BORING DEPTH: **8.0 feet** WATER LEVEL: **Not Encountered**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 1	**Fill:** Brown Silty **Clay (CH)**, moist
1 - 3	**Alluvial:** Gray Silty **Clay (CH)**, moist
3 - 5	**Residual:** Orange Gray Silty **Clay (CH)**, moist
5 - 7	Orange Brown Sandy **Silt (ML)**, wet
7 - 8	Orange Brown Silty Fine to Coarse **Sand (SM)**, wet
	Boring terminated at 8.0 feet. **Groundwater was not encountered at termination of boring.**



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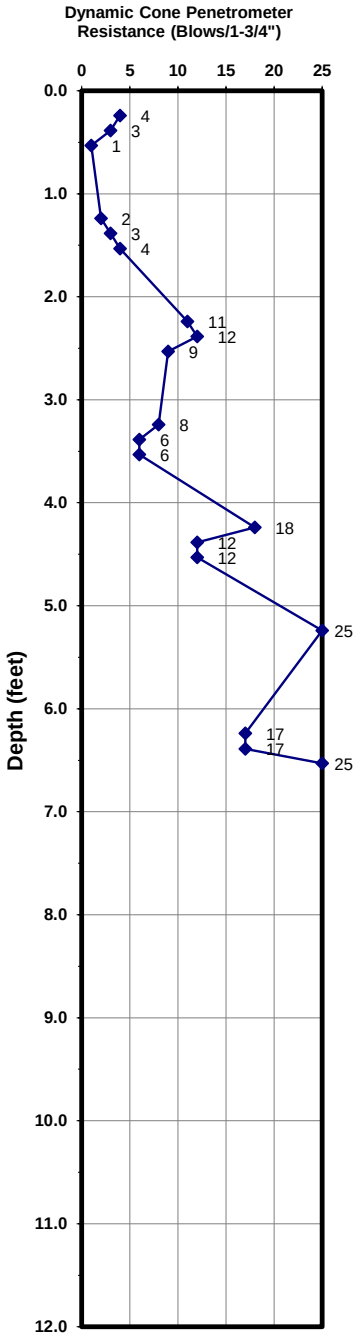
PROJECT:	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG:	HA-205
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,313** EASTING: **2,022,192**	ELEVATION: **592.5 feet** BORING DEPTH: **6.5 feet** WATER LEVEL: **Not Encountered**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**	

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 1	**Fill:** Brown Sandy Silt **(ML)**, moist
1 - 2	**Fill:** Brown Sandy **Clay (CL)**, moist
2 - 4.5	**Alluvial:** Gray Brown Silty **Clay (CH)**, moist
4.5 - 6.5	**Residual:** Black Brown Clayey Fine to Coarse **Sand (SC)**, trace rock fragments
	Hand auger refusal encountered at 6.5 feet. **Groundwater was not encountered at termination of boring.**



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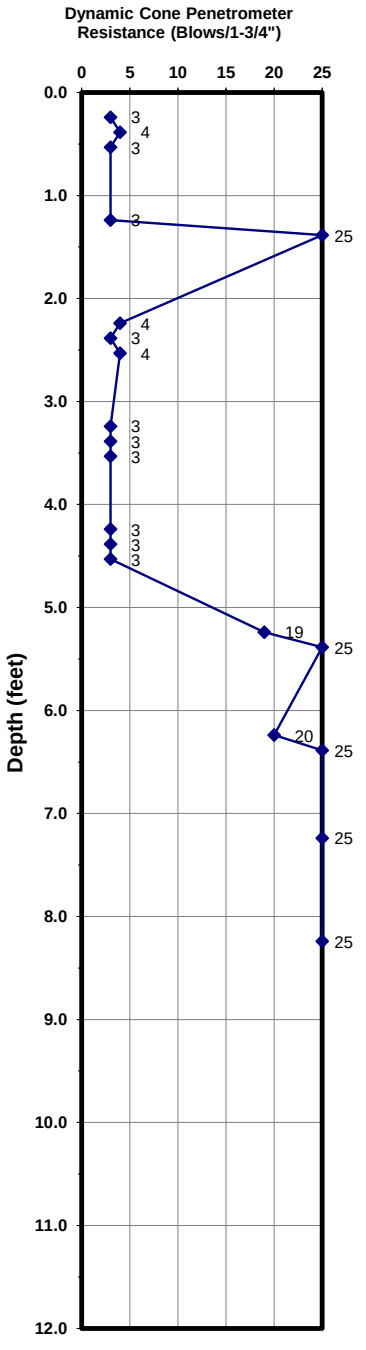
PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-206**
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,318** EASTING: **2,022,201**	ELEVATION: **592.6 feet** BORING DEPTH: **8.0 feet** WATER LEVEL: **4.0 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 2	**Fill:** Brown Clayey **Silt (MH)**, moist
2 - 4	**Alluvial:** Gray Silty **Clay (CH)**, wet
4 - 5.5	**Alluvial:** Gray Sandy **Clay (CL)**, wet, trace roots
5.5 - 8	**Residual:** Brown Orange Silty Fine to Coarse **Sand (SM)**, moist
	Hand auger refusal encountered at 8.0 feet. **Groundwater encountered at 4.0 feet at termination of boring.**



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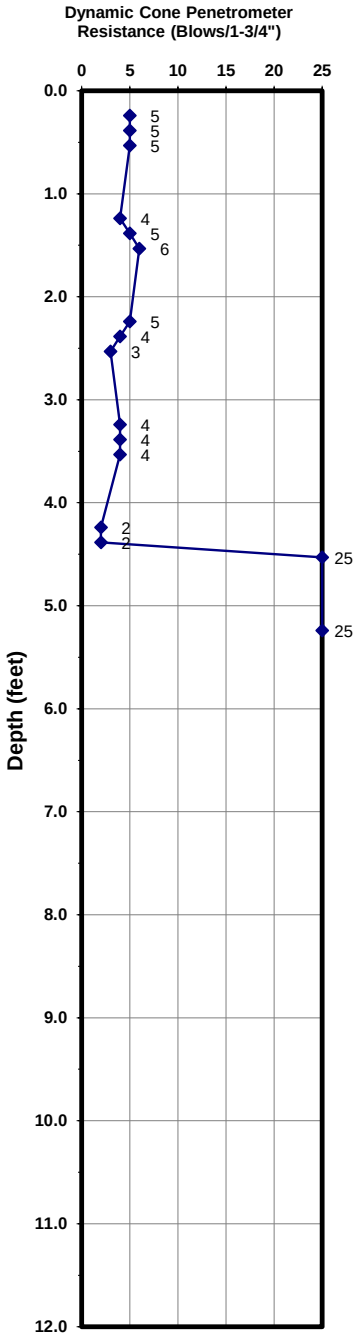
PROJECT:	US 21 and SC 51 Widening York County, South Carolina S&ME Project No. 1351-12-037	BORING LOG:	HA-207

DATE PERFORMED: **11/11/2020**	ELEVATION: **592.1 feet**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.**
PERFORMED BY: **A. Rodriguez/S. Jones**	BORING DEPTH: **5.0 feet**	**Hand auger boring elevation, northing and easting should be considered approximate.**
NORTHING: **1,184,274**	WATER LEVEL: **4.0 feet**	
EASTING: **2,022,202**		

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 1	**Fill:** Brown Clayey **Silt (MH)**, wet
1 - 2	**Alluvial:** Brown Black Silty Fine to Coarse **Sand (SM)**, moist, trace roots
2 - 4	**Alluvial:** Brown Gray Silty **Clay (CH)**, wet
4 - 5	**Residual:** Brown Orange Silty Fine to Coarse **Sand (SM)**, moist, trace rock fragments
	Hand auger refusal encountered at 5.0 feet. **Groundwater encountered at 4.0 feet at termination of boring.**



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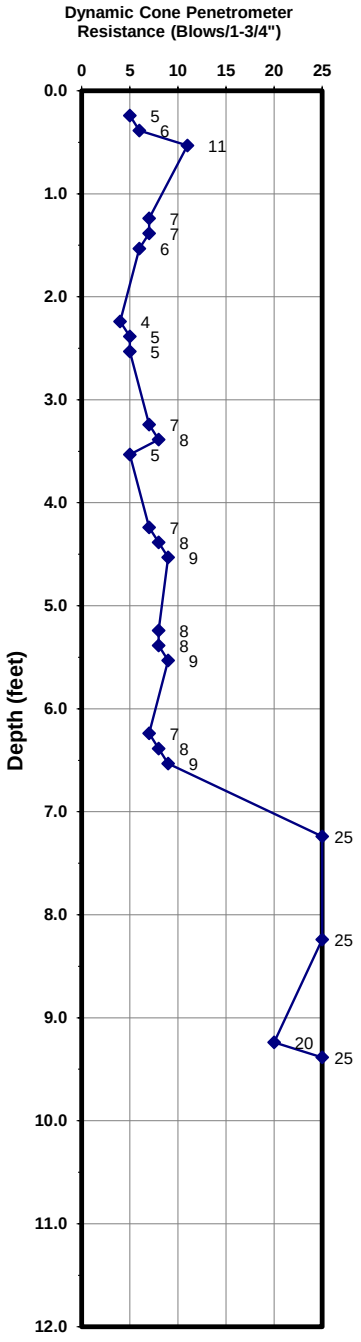
PROJECT:	**US 21 and SC 51 Widening** **York County, South Carolina** **S&ME Project No. 1351-12-037**	**BORING LOG:** **HA-208**
DATE PERFORMED: **11/11/2020** PERFORMED BY: **A. Rodriguez/S. Jones** NORTHING: **1,184,280** EASTING: **2,022,220**	ELEVATION: **593.5 feet** BORING DEPTH: **9.0 feet** WATER LEVEL: **Not Encountered**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Hand auger boring elevation, northing and easting should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 2	**Fill:** Brown Orange Clayey Fine to Coarse **Sand (SC)**, moist
2 - 3	**Residual:** Brown Orange Sandy **Clay (CL)**, moist
3 - 7	Black Brown Silty **Clay (CH)**, moist to wet, trace rock fragments
7 - 9	Orange Brown Clayey Fine to Coarse **Sand (SC)**, moist
	Boring terminated at 9.0 feet. **Groundwater not encountered at termination of boring.**



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Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above or below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 28.25
N_c = 25.80 *Table 1*
s_c = 1.09
i_c = 1.00

N_{qm} = 14.0105
N_q = 14.70 *Table 1*
s_q = 0.95
d_q = 1.00 *Table 4*
i_q = 1.00

$N_{\gamma m}$ = 15.58666667
N_γ = 16.70 *Table 1*
s_γ = 0.93
i_γ = 1.00

c = 0.00
ϕ = 28
γ = 0.12 *data*
D_f = 5.00 *plans*
B = 8.00 *plans*
L = 48 *plans*

N_{cm} = 28.25
N_{qm} = 14.01
$N_{\gamma m}$ = 15.59
C_{wq} = 0.50 *Table 2*
$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1
i_γ = 1
i_q = 1
s_c = 1.09
s_γ = 0.93
s_q = 0.95
d_q = 1.00

NOMINAL RESISTANCE: q_n = **7.94**

RESISTANCE FACTOR: 0.45 *from Ch 9 of SCDOT GDM - Strength*

FACTORED RESISTANCE: q_f = **3.57**

Station 316+23 Culvert
Offset LT
Strength Limit State

Ultimate Bearing Capacity Determination

AASHTO LRFD Method

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IN WHICH: $N_{cm} = N_c s_c i_c$

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N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

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D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

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3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 28.25

N_c = 25.80 *Table 1*

s_c = 1.09

i_c = 1.00

N_{qm} = 14.0105

N_q = 14.70 *Table 1*

s_q = 0.95

d_q = 1.00 *Table 4*

i_q = 1.00

$N_{\gamma m}$ = 15.58666667

N_γ = 16.70 *Table 1*

s_γ = 0.93

i_γ = 1.00

c = 0.00

ϕ = 28

γ = 0.12 *data*

D_f = 5.00 *plans*

B = 8.00 *plans*

L = 48 *plans*

N_{cm} = 28.25

N_{qm} = 14.01

$N_{\gamma m}$ = 15.59

C_{wq} = 0.50 *Table 2*

$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1

i_γ = 1

i_q = 1

s_c = 1.09

s_γ = 0.93

s_q = 0.95

d_q = 1.00

NOMINAL RESISTANCE: q_n = **7.94**

RESISTANCE FACTOR: 1 *from Ch 9 of SCDOT GDM - Extreme*

FACTORED RESISTANCE: q_f = **7.94**

Station 316+23 Culvert
Offset LT
Extreme Limit State

Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above or below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 28.152

N_c = 25.80 *Table 1*

s_c = 1.09

i_c = 1.00

N_{qm} = 14.03808

N_q = 14.70 *Table 1*

s_q = 0.95

d_q = 1.00 *Table 4*

i_q = 1.00

$N_{\gamma m}$ = 15.6312

N_γ = 16.70 *Table 1*

s_γ = 0.94

i_γ = 1.00

c = 0.00

ϕ = 28

γ = 0.12 *data*

D_f = 5.00 *plans*

B = 8.00 *plans*

L = 50 *plans*

N_{cm} = 28.15

N_{qm} = 14.04

$N_{\gamma m}$ = 15.63

C_{wq} = 0.50 *Table 2*

$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1

i_γ = 1

i_q = 1

s_c = 1.09

s_γ = 0.94

s_q = 0.95

d_q = 1.00

NOMINAL RESISTANCE: q_n = **7.96**

RESISTANCE FACTOR: 0.45 *from Ch 9 of SCDOT GDM - Strength*

FACTORED RESISTANCE: q_f = **3.58**

Station 316+23 Culvert
Offset RT
Strength Limit State

Ultimate Bearing Capacity Determination

AASHTO LRFD Method

NOTES:
- nominal bearing resistance (capacity) of spread footings on cohesionless soils shall be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- nominal bearing resistance (capacity) of spread footings on cohesive soils shall be evaulated for **total stress** analyses and **undrained** soil strength parameters.
- in cases where the cohesive soils may soften and lose strength with time, then these soils should be evaluated using **effective stress** analyses and **drained** soil strength parameters.
- for footings bearing on fill, the nominal bearing resistance (capacity) shall be evaluated using the **more critical of either total or effective strength** analyses.

GENERAL EQUATION: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$

IN WHICH: $N_{cm} = N_c s_c i_c$

$N_{qm} = N_q s_q d_q i_q$

$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$

WHERE: c = cohesion, taken as undrained shear strength (ksf)

N_c = cohesion term (undrained loading) bearing capacity factor as specified in Table 1 (dim.)

N_q = surcharge (embedment) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

N_γ = unit weight (footing width) term (drained loading) bearing capacity factor as specified in Table 1 (dim.)

γ = total (moist) unit weight of soil above or below the bearing depth of the footing (kcf)

D_f = footing embedment depth (ft.)

B = footing width (ft.)

$C_{wq}, C_{w\gamma}$ = correction factors to account for the location of the ground water table as specified in Table 2 (dim.)

s_c, s_γ, s_q = footing shape correction factors as specified in Table 3 (dim.)

d_q = correction factor to account for the shearing resistance along the failure surface passing through cohesionless material above the bearing elevation as specified in Table 4 (dim.)

i_c, i_γ, i_q = load inclination factors - for footings with modest embedment, consideration may be given to omission of the load inclination factors

i.e. S&ME will assume all inclination factors = 1

TABLE 1
Bearing Capacity Factors

ϕ	N_c	N_q	N_γ
0.0	5.1	1.0	0.0
1.0	5.4	1.1	0.1
2.0	5.6	1.2	0.2
3.0	5.9	1.3	0.2
4.0	6.2	1.4	0.3
5.0	6.5	1.6	0.5
6.0	6.8	1.7	0.6
7.0	7.2	1.9	0.7
8.0	7.5	2.1	0.9
9.0	7.9	2.3	1.0
10.0	8.4	2.5	1.2
11.0	8.8	2.7	1.4
12.0	9.3	3.0	1.7
13.0	9.8	3.3	2.0
14.0	10.4	3.6	2.3
15.0	11.0	3.9	2.7
16.0	11.6	4.3	3.1
17.0	12.3	4.8	3.5
18.0	13.1	5.3	4.1
19.0	13.9	5.8	4.7
20.0	14.8	6.4	5.4
21.0	15.8	7.1	6.2
22.0	16.9	7.8	7.1
23.0	18.1	8.7	8.2
24.0	19.3	9.6	9.4
25.0	20.7	10.7	10.9
26.0	22.3	11.9	12.5
27.0	23.9	13.2	14.5
28.0	25.8	14.7	16.7
29.0	27.9	16.4	19.3
30.0	30.1	18.4	22.4
31.0	32.7	20.6	26.0
32.0	35.5	23.2	30.2
33.0	38.6	26.1	35.2
34.0	42.2	29.4	41.1
35.0	46.1	33.3	48.0
36.0	50.6	37.8	56.3
37.0	55.6	42.9	66.2
38.0	61.4	48.9	78.0
39.0	67.9	56.0	92.3
40.0	75.3	64.2	109.4
41.0	83.9	73.9	130.2
42.0	93.7	85.4	155.6
43.0	105.1	99.0	186.5
44.0	118.4	115.3	224.6
45.0	133.9	134.9	271.8

Table 10.6.3.1.2a-1 from AASHTO LRFD Bridge Design Specifications

TABLE 2
Ground Water Correction Factors

D_w	C_{wq}	$C_{w\gamma}$
0.0	0.5	0.5
D_f	1.0	0.5
>1.5B+D_f	1.0	1.0

Table 10.6.3.1.2a-2 from AASHTO LRFD Bridge Design Specifications

TABLE 3
Shape Correction Factors

	s_c	s_γ	s_q
ϕ = 0	1 + (B/5L)	1	1
ϕ > 0	+ (B/L)(N_q/N	1 - 0.4(B/L)	1 +[(B/L)tanϕ]

Table 10.6.3.1.2a-3 from AASHTO LRFD Bridge Design Specifications

TABLE 4
Depth Correction Factor

ϕ	D_f/B	d_q
32.0	1	1.20
	2	1.30
	4	1.35
	8	1.40
37.0	1	1.20
	2	1.25
	4	1.30
	8	1.35
42.0	1	1.15
	2	1.20
	4	1.25
	8	1.30

Table 10.6.3.1.2a-4 from AASHTO LRFD Bridge Design Specifications

Linear Interpolation for friction angles in between those provided

ϕ	d_q for D_f/B		
32			
	d_q	=	0.0000
37			

ϕ	d_q for D_f/B		
37			
	d_q	=	0.0000
42			

VALUES: enter values

N_{cm} = 28.152

N_c = 25.80 *Table 1*

s_c = 1.09

i_c = 1.00

N_{qm} = 14.03808

N_q = 14.70 *Table 1*

s_q = 0.95

d_q = 1.00 *Table 4*

i_q = 1.00

$N_{\gamma m}$ = 15.6312

N_γ = 16.70 *Table 1*

s_γ = 0.94

i_γ = 1.00

c = 0.00

ϕ = 28

γ = 0.12 *data*

D_f = 5.00 *plans*

B = 8.00 *plans*

L = 50 *plans*

N_{cm} = 28.15

N_{qm} = 14.04

$N_{\gamma m}$ = 15.63

C_{wq} = 0.50 *Table 2*

$C_{w\gamma}$ = 0.50 *Table 2*

i_c = 1

i_γ = 1

i_q = 1

s_c = 1.09

s_γ = 0.94

s_q = 0.95

d_q = 1.00

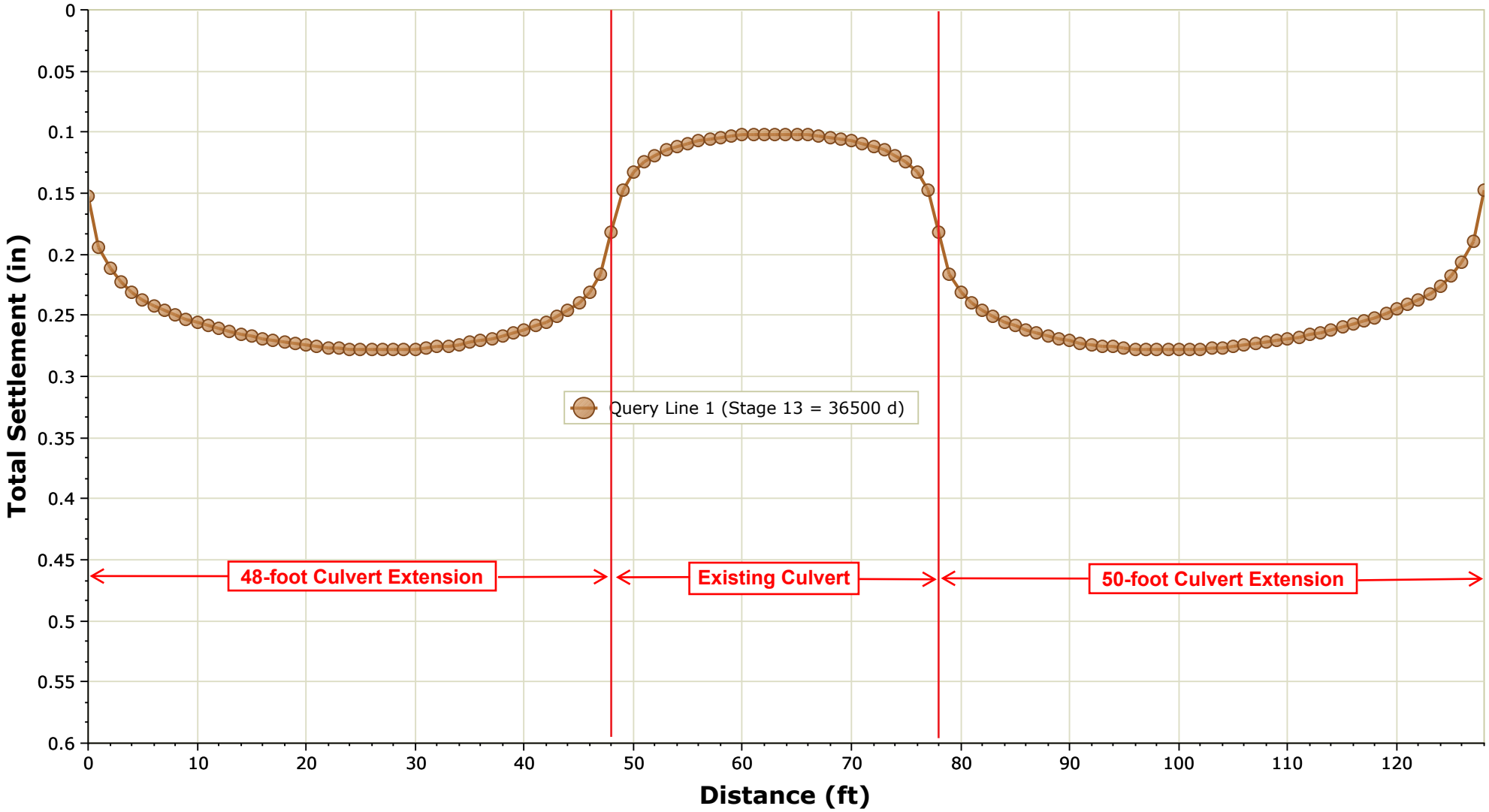
NOMINAL RESISTANCE: q_n = **7.96**

RESISTANCE FACTOR: 1 *from Ch 9 of SCDOT GDM - Extreme*

FACTORED RESISTANCE: q_f = **7.96**

Station 316+23 Culvert
Offset RT
Extreme Limit State

316+23 Culvert: Distance vs. Total Settlement



Reference Stage: Stage 1 = 0 d
Total Settlement at Depth = 5 ft

Project	US 21 and SC 51 Widening			
Analysis	316+23 Culvert		Description	_
Drawn By	NRB	Project Number	1351-12-037	Company S&ME	Figure X
Location	_	File Name	31623 Culvert.s3z	Date 11/23/2020	

SETTLE3 5.003

S&ME ENGINEERING INTEGRITY

Version 2.0 (7/7/2015)

Project No	1351-12-037		Sheet	1	of 1
Client	STV	**Calc. By**	NRB	**Date**	11/23/20
Project	US 21 and SC 51 Widening	**Check By**		**Date**	
Desc.	Culvert Headwall				
	316+23 Culvert				

LRFD SLIDING PARAMETERS

Inlet Headwall:

Reference Boring: HA-201

D_f = 2.5 ft below final grade, bearing in: Gravel with Sand and Silt (A-2-4)

For Cohesionless Soils (i.e. $\phi_f > 0$):

N = 14 bpf

ϕ_f = 28 degrees

Coefficient of Friction = tan δ
= tan(ϕ_f) for concrete cast against soil
= 0.8 tan(ϕ_f) for precast concrete footing

FootingType: Cast-in-Place

tan δ = tan (28)

tan δ = **0.53**

For Cohesive Soils (i.e. $\phi_f = 0$):

q_u = N/A tsf

S_u = N/A ksf

For Gravel with Sand and Silt (A-2-4) soil, the unit sliding resistance equals the undrained shear strength (Su)

Therefore, sliding resistance = **N/A** ksf

Outlet Headwall:

Reference Boring: HA-207

D_f = 2.5 ft below final grade, bearing in: Gravel with Sand and Silt (A-2-4)

For Cohesionless Soils (i.e. $\phi_f > 0$):

N = 14 bpf

ϕ_f = 28 degrees

Coefficient of Friction = tan δ
tan(ϕ_f) for concrete cast against soil
0.8 tan(ϕ_f) for precast concrete footing

Footing Type: Cast-in-Place

tan δ = tan (28)

tan δ = **0.53**

For Cohesive Soils (i.e. $\phi_f = 0$):

q_u = N/A tsf

S_u = N/A ksf

For Gravel with Sand and Silt (A-2-4) soil, the unit sliding resistance equals the undrained shear strength (Su)

Therefore, sliding resistance = **N/A** ksf

REFERENCES

AASHTO LRFD Bridge Design Specifications, 6th Edition, Section 10: Foundations.
10.6.3.4 Failure by Sliding

SCDOT GDM

Final Roadway Geotechnical Engineering Report (RGER)
Gold Hill Road Realignment
from Forest Way Drive to US 21 Bypass
York County, South Carolina
S&ME Project No. 1351-12-037

PREPARED FOR:

STV Incorporated
4969 Centre Pointe Dr, Suite 102
North Charleston, South Carolina 29418

PREPARED BY:

S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273

April 14, 2022

April 14, 2022

STV Incorporated
4969 Centre Pointe Dr, Suite 102
North Charleston, South Carolina 29418

Attention: Mr. Thomas Mastillone, P.E.

Reference: **Final Roadway Geotechnical Engineering Report (RGER)**
Gold Hill Road Realignment from Forest Way Drive to US 21 Bypass
York County, South Carolina
S&ME Project No. 1351-12-037

Dear Mr. Mastillone:

The purpose of this final roadway geotechnical engineering report (RGER) is to provide information that may be used in design of the roadway embankments associated with the Gold Hill Road realignment portion of the overall project consisting of widening US 21 Bypass and SC 51 from Springfield Parkway to the North Carolina Line in Fort Mill, York County, South Carolina. Our services were performed in general accordance with the subcontract between STV, Inc. (STV) and S&ME, Inc. dated November 27, 2012, and subsequent Amendment 2, dated December 2021. The attached report presents our understanding of the project requirements and provides our recommendations in general accordance with Chapter 21.4.2 the SCDOT Geotechnical Design Manual (GDM), Version 2.0, January 2019. The recommendations herein exclude other roadway alignments associated with this project, culverts, and pavements which were addressed under separate cover.

Sincerely,

S&ME, Inc.

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No.29638 4/14/2022 LUIS A. CAMPOS

Luis A. Campos, P.E.
Senior Engineer
SC Registration No. 29638

Nate R. Bradley, P.E.
Project Engineer

Senior Review by: Kristen H. Hill, P.E.

SOUTH CAROLINA S & ME, INC. No. C00473 CERTIFICATE OF AUTHORIZATION

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1.0 Introduction

This report summarizes the results of the geotechnical investigation conducted to date for the Gold Hill Road (S-1726) realignment between Forest Way Drive and US 21 Bypass, which is part of a larger project consisting of widening US 21 Bypass and SC 51 from Springfield Parkway to the North Carolina Line. The project is located in Fort Mill, York County, South Carolina, as shown on the Site Plan attached as Sheet 1 in Appendix I.

This RGER applies to the design and construction of the roadway embankments and roadway at grade. The pavement design recommendations are presented under separate cover. S&ME's scope of work relevant to the roadway embankment portion of the project included:

- Visits to the site by geotechnical personnel.
- Coordinating field exploration activities.
- Performing geotechnical subsurface investigations.
- Conducting laboratory testing.
- Reviewing available geologic and geotechnical-related data.
- Conducting geotechnical analyses to assess the encountered subsurface conditions as they relate to their support for the planned roadway embankment regarding slope stability and settlement.
- Preparing this report (RGER) which presents the results of our analyses and our geotechnical recommendations for the planned roadway embankments.

Project design parameters and computations generally follow those described in the relevant sections of the 2019 South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual v2.0 (GDM), except where specifically described otherwise in the report text.

2.0 Project Description

The Gold Hill Road portion of this Pennies for Progress project in York County, South Carolina includes removal of approximately 1,030 feet of the existing roadway between Forest Way Drive to the west and US 21 Bypass to the east. The roadway will be realigned to the north, resulting in approximately 1,845 feet of new roadway. The road will consist of one travel lane in each direction.

2.1 Existing Conditions

The southern approximate 1/3 of the new Gold Hill Road alignment mostly consists of an open grassy field. The northern approximate 2/3 of the alignment mostly consists of woods. Various underground utilities are present at the ends of the roadway, and an overhead power line crosses the southern end of the alignment.

Grades along the centerline of the alignment generally range from elevation 648 to 614 feet, MSL, with two low lying, dry drainage features around Station 24+50 and 27+50.

2.2 Planned Development

From our review of the plan, profile, and cross section sheets, the proposed roadway will generally consist of one 12-foot-wide travel lane in each direction, with two turn lanes added at the northbound/eastbound end at US 21 Bypass. Grades will generally follow existing grades between Station 14+00 to 22+00, and grades will be raised up to 28 feet between Station 22+00 and 28+50. The roadway will require up to 13 feet of cut between Station 28+50 and the tie-in at approximate Station 32+50 (US 21 Bypass). Drain ditches are planned for most of the roadway. Proposed slopes along the project will be 2H:1V or flatter.

3.0 Subsurface Exploration and Laboratory Testing

Representatives of S&ME were present for on-site field activities in March 2022 during the investigation to conduct the following testing:

- Six (6) Standard Penetration Test (SPT) borings (B-12 through B-17).
- Two (2) bulk samples at selected boring locations (B-14 and B-17).
- One (1) undisturbed (Shelby tube) sample at a select boring location (B-15).

The approximate test locations are shown on the Boring Location Plans (Sheet 2) in Appendix I. Boring numbers, station, offset, elevation, and depth are shown in Table 3-1. Termination depths for the SPT borings ranged from 15 feet to 39.4 feet below the existing ground surface. Borings were advanced by an ATV mounted CME 550X-drill rig using hollow-stem auger techniques. The boreholes were left open for at least 1 day to allow for a secondary groundwater level measurement. The borings were backfilled with auger cuttings after the secondary water level measurement attempt. Detailed graphical logs which describe the conditions and results at each test location are presented in Appendix II.

The elevation, station and offset, northing, and easting shown in Table 3-1 and/or on the logs should be considered approximate. This information was obtained from MicroStation files provided by STV. SPT hammer energy measurements were previously performed with a Pile Driving Analyzer (PDA) on the drill rig used to perform the borings. The N-values indicated on the logs are field values and were not corrected for overburden stress, rod length, borehole diameter, or hammer efficiency. Hammer energy ratios are provided on the individual soil test boring records.

Table 3-1: Summary of Test Locations

Test ID	Station	Offset (feet)	Surface Elevation (feet)	Depth (feet)
B-12	17+00	30 LT	630.7	15
B-13	19+00	35 RT	636.8	15
B-14	21+00	30 LT	639.2	20
B-15	24+00	50 LT	609.6	33.8
B-16	27+50	10 LT	629.3	25
B-17	31+00	50 RT	647.2	39.4

S&ME performed the following laboratory tests on recovered split-spoon, undisturbed, and bulk samples to help classify the soils and formulate our conclusions and recommendations.

Table 3-2: Summary of Laboratory Testing Quantities

Test Type	Quantity
Atterberg Limits	10
Grain Size Analysis	10
Natural Moisture Content	10
Standard Proctor	2
California Bearing Ratio	1
Consolidated-Undrained Triaxial Shear	2
Consolidation	1

A summary table of the laboratory test results as well as the individual laboratory test data sheets are included in Appendix III. The laboratory test methods used are indicated on the individual data sheets.

4.0 Subsurface Conditions

4.1 Area Geology

The project lies within the Piedmont Physiographic Province in York County, South Carolina. The Piedmont is bounded to the west by the mountains and east by the Coastal Plain physiographic provinces. The Piedmont region was once a mountain range but through millions of years of erosion its terrain has been reduced to gently rolling hills and relatively flat areas. At the surface the Piedmont the soils are composed of residual soils. These are soils are derived from weathered in place crystalline rock. Through uplift and erosion these soils are continuously weathered and exposed at the surface. The residuum is typically finer grained and has a higher clay content near the surface because of advanced weathering. Similarly, the soils typically become coarse grained with increasing depth because of decreased weathering. Piedmont residuum will often preserve the fabric (texture, appearance, foliations, etc.) of the parent crystalline rock that it is derived from and is called saprolite or described with the adjective, saprolitic. Beneath the residual soils lies a zone of partially weathered rock (PWR) that transitions to parent bedrock. The SPT test is used to determine where the zone of PWR begins and ends and where the bedrock boundary begins. The transition between hard/dense residual soils and PWR occurs at irregular depths due to variations in degree of weathering.

Geologically the project is located within the Charlotte Belt geologic province. The Charlotte Belt is mostly composed of plutonic bodies of rock with compositions ranging from granitic to gabbroic. These rocks were formed in the late Proterozoic to Cambrian periods during the Taconic orogeny when what is believed to be an exotic terrane in the form of a volcanic island arc was sutured to the North American craton. These rocks were later subjected to various degrees of metamorphism, folding and faulting during subsequent crustal reshaping and orogenic episodes. Rock types in this area are predominately composed of metavolcanics such as metagabbro and metadiorite and to a lesser extent biotite gneiss. The figure below shows a generalized geologic

map of the Charlotte Belt in northeastern York County, SC and adjacent Mecklenburg County, NC from 'The Geology of the Carolinas' by Horton and Zullo (1991).

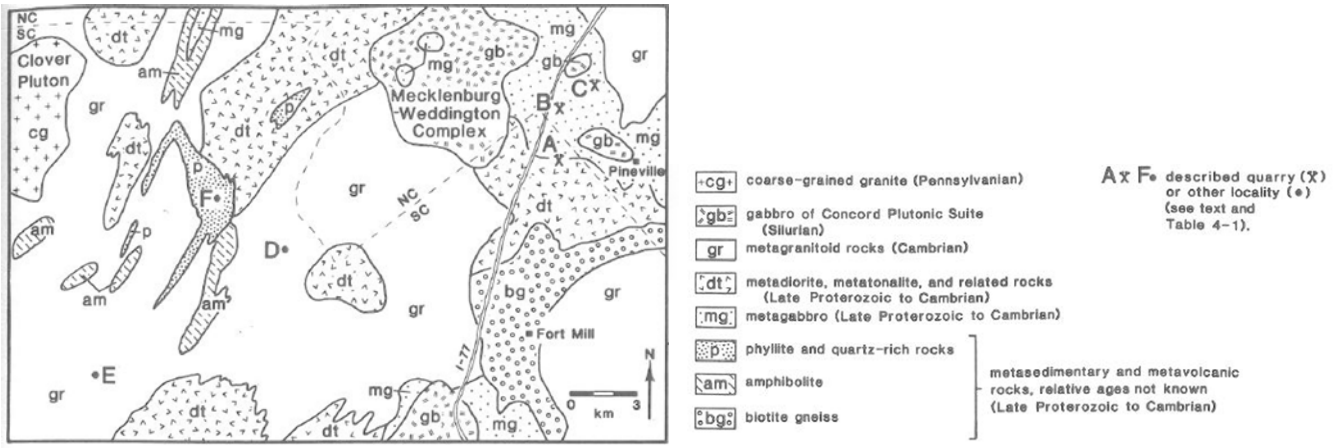


Fig. 4-3 from 'The Geology of the Carolinas' by Horton & Zullo (1991)

Water is typically present in the residual soils and within fractures in the PWR or underlying bedrock in the Piedmont. On upland ridges in the Piedmont, water may or may not be present in the residual soils above the PWR and bedrock. Alluvial soils, which have been transported and deposited by water, are typically found in floodplains and are generally saturated to within a few feet of the ground surface. Fluctuations in water levels are typical in residual soils and PWR in the Piedmont, depending on variations in precipitation, evaporation, and surface water runoff. Seasonal high-water levels are expected to occur during or just after the typically wetter months of the year (November through April).

4.2 Soil and Rock Stratification

The soils encountered by the borings generally consisted of surficial topsoil, residual soils, and Partially Weathered Rock (PWR). The thickness of and depth to the subsurface layers varied in the borings along the alignment. The boring logs should be referenced for details of subsurface conditions at specific locations.

4.2.1 Surface Materials

Surface materials penetrated by the borings consisted of topsoil. Topsoil thicknesses encountered by the borings were approximately 2 to 6 inches.

4.2.2 Residual Soils

Residual soils were encountered in each of the borings to depths of 15 to 37 feet. The residual soils encountered consisted of clay (CH / A-7-5), clayey silt (MH / A-7-5 and A-5), sandy clay (CL / A-6), sandy silt (ML / A-4), and silty sand (SM / A-2-4 and A-4). SPT N-values in the residual soils ranged from 5 to 34 blows per foot. Borings B-12, B-13, B-14, and B-16 were terminated in residual soils at their target depths.

4.2.3 Partially Weathered Rock (PWR)

PWR was first encountered at a depth of 17 feet (approximate elevation 592.6 feet) in Boring B-15 and at a depth of 37 feet (approximate elevation of 610.2 feet) in Boring B-17. The PWR consisted of silty sand (SM / A-2-4) when sampled. Boring B-15 was terminated in PWR at a depth of 33.8 feet and Boring B-17 was terminated in PWR at a depth of 39.4 feet.

4.2.4 Ground Water

Ground water was encountered in Boring B-15 at depths of 14.7 and 16 feet (approximate elevations of 594.9 and 593.6 feet) at drilling termination and after a 1-day waiting period, respectively. Ground water was not encountered in the other five borings at completion of drilling activities of after a 1-day waiting period.

5.0 Seismic Considerations

As described in the GDM, evaluation of performance under the EEI or EEII limit states is not required for roadway embankments. In addition, there are no proposed bridges or earth retaining structures (ERS) within the project limits. Therefore, evaluation of performance under the EEI or EEII limit states is not required for this project.

6.0 Roadway Embankments

The following paragraphs include recommendations for site preparation, fill placement and compaction, and design and construction of embankments. If the construction scope is altered, the proposed embankment locations are changed, or if conditions are encountered during construction that differ from those encountered by the soil test borings, S&ME should be retained to review these recommendations based upon the new information and make any necessary changes.

6.1 Slope Stability Analyses

Based on Section 17.1 of the GDM, embankments with heights of 10 feet or less and slopes 2H:1V, or embankments with heights of 15 feet or less and slopes 3H:1V or flatter do not require analysis. Most of the proposed embankment heights for this project are 10 feet or less. However, from approximately Station 23+50 to 25+50, new embankment is planned with grades raised up to approximately 28 feet with side slopes as steep as 2H:1V. Also, from approximately Station 30+50 to 31+50, the embankment will be cut resulting in up to 13-foot-tall slopes as steep as 2H:1V. Slope stability analyses were conducted on representative cross sections for these two areas. Analyses were performed in general accordance with Chapter 17 of the GDM.

Slope stability analyses were performed using the computer program SLIDE2 Version 9.020 and Spencer circular shear surfaces to find the critical shear surface. Slope stability analysis outputs for the roadway embankments are attached in Appendix IV.

6.1.1 Service Limit State

Soil test boring and laboratory testing results were incorporated into the soil parameters assumed for our service limit state analyses. Soil parameters assumed in global stability computations are included on the analysis outputs in Appendix IV. Our service limit state analyses considered the short-term (end-of-construction) condition as well as the long-term condition as defined in the GDM.

In selecting soil parameters for the proposed embankment fill, we considered the results of the triaxial shear strength testing from planned cut areas, as well as properties presented in the SCDOT *Borrow Materials Database Spreadsheet*, Version 2.0, dated December 6, 2018 for York County, assuming typical Upstate residual type soils and peak effective shear strengths. Based on the available material properties, we selected more conservative values as presented in Table 7-1. It was assumed that pore pressures induced by fill placement would have time to dissipate in the new fill soils. From our analyses, we provide the following results:

Table 6-1: Stability Analysis

Approximate Station	Slope (H:V)	Type	Approximate Height (feet)	Loading Condition	Resistance Factor	
					Computed	Required
24+00 LT	2:1	Fill Slope	28	Short-term	0.71	≤ 0.90
				Long-term	0.71	≤ 0.75
31+00 RT	2:1	Cut Slope	13	Short-term	0.45	≤ 0.90
				Long-term	0.45	≤ 0.75

From the above-summarized results, the computed resistance factors do not exceed the maximum resistance factor for roadway embankment in Table 9-5 of the GDM.

6.2 Settlement Analysis

Relatively little fill placement (10± feet or less) is expected over a majority of the new Gold Hill Road alignment. In these minor fill areas, elastic compression and most consolidation settlements are expected to occur during embankment construction. As a result, post-construction settlement of the embankments is anticipated to be minor and within GDM performance limits. The exception is the new embankment fill proposed from approximately Station 23+50 to 25+50.

Settlement analysis of the fill proposed from approximately Station 23+50 to 25+50 was performed using the computer program Settle3 version 5.013. Plans are to raise grades up to approximately 28 feet in this area. Soil test boring and laboratory testing results were incorporated into the soil parameters for our analysis.

Results of the analysis indicate maximum total settlement is computed to be on the order of 2.7 inches or less in the foundation soils due to placement of the new fill. Settlement within the new fill under its own weight is estimated to be approximately 3 inches. Therefore, maximum total settlement of the new fill is anticipated to be 6 inches or less. Most of the settlement is anticipated to occur progressively as the fill is being constructed. Based on the results of the analysis, post-construction settlements are anticipated to be on the order of 0.5 inches and

are anticipated to occur within approximately 1 month after the end of fill placement. Results of the settlement analyses are presented on the Settle3 output figures provided in Appendix V.

Settlement resulting from placement of the fill was compared to performance limits provided in Table 10-12 of the GDM. From our analyses, we provide the following results:

Table 6-2: Settlement versus Performance Limits

Location	EV-01A Settlement During Construction (inches)	EV-01B Total Post-Construction Settlement (inches)	EV-03 Longitudinal Differential Settlement (inches/50-ft)
Criteria	No Limit	3	1
Embankment Sta. 24+50	5.2	< 1	< 1

From the above-summarized results, the computed vertical settlements satisfy the performance limits outlined in Table 10-12 of the GDM.

Computations show that there need be no requirement for surcharging or wait periods following fill placement to meet the objectives of the GDM. This assumes construction of the fill in accordance with SCDOT standard specifications for earthwork. Geotechnical instrumentation such as settlement plates will not be required.

7.0 Earthwork Considerations

We assume the roadway embankments and cut slopes will be constructed in general conformance with the SCDOT Standard Specifications for Highway Construction, 2007 edition, Division 200. Soils excavated during planned grading activities are Unclassified Excavation unless considered muck or rock excavation as described in Section 203.

7.1 Excavations

PWR was first encountered at a depth of 17 feet (approximate elevation 592.6 feet) in Boring B-15 and at a depth of 37 feet (approximate elevation of 610.2 feet) in Boring B-17. The PWR, when sampled, consisted of silty sand (SM / A-2-4). Boring B-15 was terminated in PWR at a depth of 33.8 feet and Boring B-17 was terminated in PWR at a depth of 39.4 feet.

As previously mentioned, PWR was first encountered at a depth of 17 feet (approximate elevation 592.6 feet) in Boring B-15 and at a depth of 37 feet (approximate elevation of 610.2 feet) in Boring B-17. Auger refusal was not encountered in any of the six borings. Based on the borings and the planned grading, excavation into PWR and/or rock is not anticipated to be required.

The depth to, and thickness of, PWR, rock lenses or seams and bedrock, can vary dramatically in short distances and between boring locations; therefore, PWR, boulders or bedrock may be encountered during any excavation on this project.

7.2 Fill Soil Considerations

Borrow materials shall meet the requirements of subsection 203.2.1.8 of the Standard Specifications for York County. Based on the results of the triaxial shear strength testing from planned cut areas, the cut area soils appear to meet or exceed the shear strength properties used in our analyses.

The fill soil material properties used in slope stability analyses are provided in the following table:

Table 7-1: Fill Material Properties Table

Soil Property	Value Used in Analysis
Effective Friction Angle, φ′	30°
Effective Cohesion, c′	50
Total Unit Weight, γ	120 pcf

7.3 Surface Preparation of Embankments

Embankments planned along existing embankment fills widened to accommodate the planned roadway alignment sections will require preparation as described by the SCDOT standard specifications:

1. Clearing and Grubbing - Before starting embankment construction, clear and grub the embankment area according to Section 201 and install Drainage Structures according to the standard specifications.
2. Depressions and Undercut Areas - Fill depressions below the ground surface and undercut areas with suitable material. Remove unsuitable or unstable material and compact new fill according to Subsection 205.4.6 before beginning embankment construction.
3. Scarification and Other Preparation - Plow and scarify the entire area upon which the embankment is to be placed (except inundated areas) at least 6 in deep.
4. Benching and Compaction of the Subgrade - Before placing the embankment, re-compact loosened soil to the approximate density of the underlying soil. Cut benches as specified in Subsection 205.4.4.
5. Compaction Under Shallow Fills - When the depth of fill and surfacing is 3 feet (1 m) or less, compact the original subgrade at least 1 foot deep to at least 95 percent of the maximum laboratory dry density as determined from representative samples of the compacted material. The in-place density of the compacted fill will be determined according to nuclear gage at random intervals.
6. Embankment Construction - Construct embankments in general accordance with specifications for materials, equipment, measurement, and payment provided in Section 205.

7.4 Shoulders and Slopes

Materials placed at the surface of shoulders and slopes may consist of materials removed from stockpiled soils stripped from within the right-of-way or from areas of roadway and drainage excavation. This may include friable materials capable of growing grass that resist erosion when compacted.

Due to the planned grading, existing subsurface utilities present along the existing alignment at tie-in points may be encountered. Existing utility lines located within right-of way and proposed excavation depths should be removed or plugged and relocated.

7.5 Erosion

The slopes of the new embankments and cut locations will be susceptible to erosion during rainfall events. Construction operations should be performed in a manner consistent with good erosion control practices that minimize soil erosion as described in Subsections 205.4.1, 205.4.1.2, and 205.4.7 of SCDOT Standard Specifications for Highway Construction, 2007 edition. We recommend diverting surface water runoff of slopes by use of berms along the crest and temporary drainage piping. We recommend the slopes be seeded and grassed as soon as practical to minimize the effects of erosion.

7.6 Crossline Reinforced Concrete Pipes

One new crossline stormwater pipe is indicated on the plans. Installation of permanent pipe culverts is typically carried out in accordance with the plans and SCDOT supplemental technical specification SC-M-714 (01/21). Table 7-2 below provides a summary of planned crossline pipes and provides details of pipe location, size, and length as indicated by the cross sections. Table 7-2 also highlights pipe locations that either could require undercut and replacement of bearing soils, or where subsurface water or very dense soils were found near the pipe invert and may require ground water control or special excavation to install.

Table 7-2: Summary of Crossline Pipes

Pipe Details	Station	Approx. Length	Comments
24" SWP (CLP-11)	24+20	155 feet	Boring B-15 suggests stiff to very stiff clayey residual soils near pipe invert elevations

The planned crossline pipes will be installed in areas of the roadway embankment that require up to 28 feet of fill to reach planned grade. Most of the settlement of this new fill and existing subsurface soils are expected to occur during construction of the new embankment with less than 1 inch of settlement to occur post-construction. The contractor shall consider an appropriate construction sequence for the installation of this cross-lined pipe to minimize the impact of settlement of the new pipe.

8.0 Recommended Plan Notes

Refer to the previously submitted *Final RGER for the Widening of US 21 Bypass and SC 51 From Springfield Parkway to the NC Line* Report dated September 10, 2021 for recommended plan notes. No new plan notes are associated with the new Gold Hill Road alignment.

9.0 Closing

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

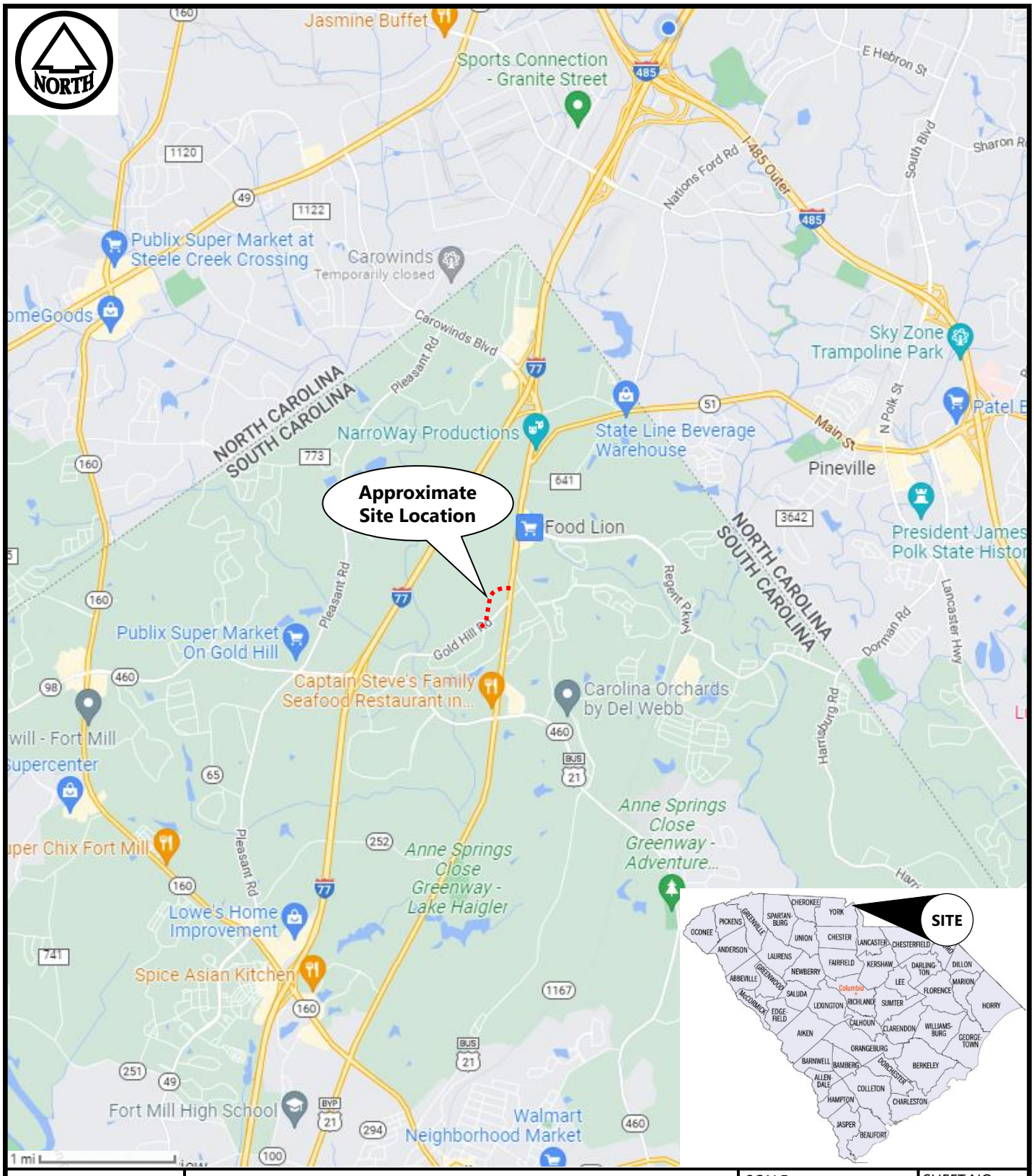
Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

Appendices

Appendix I – Figures



SITE VICINITY PLAN

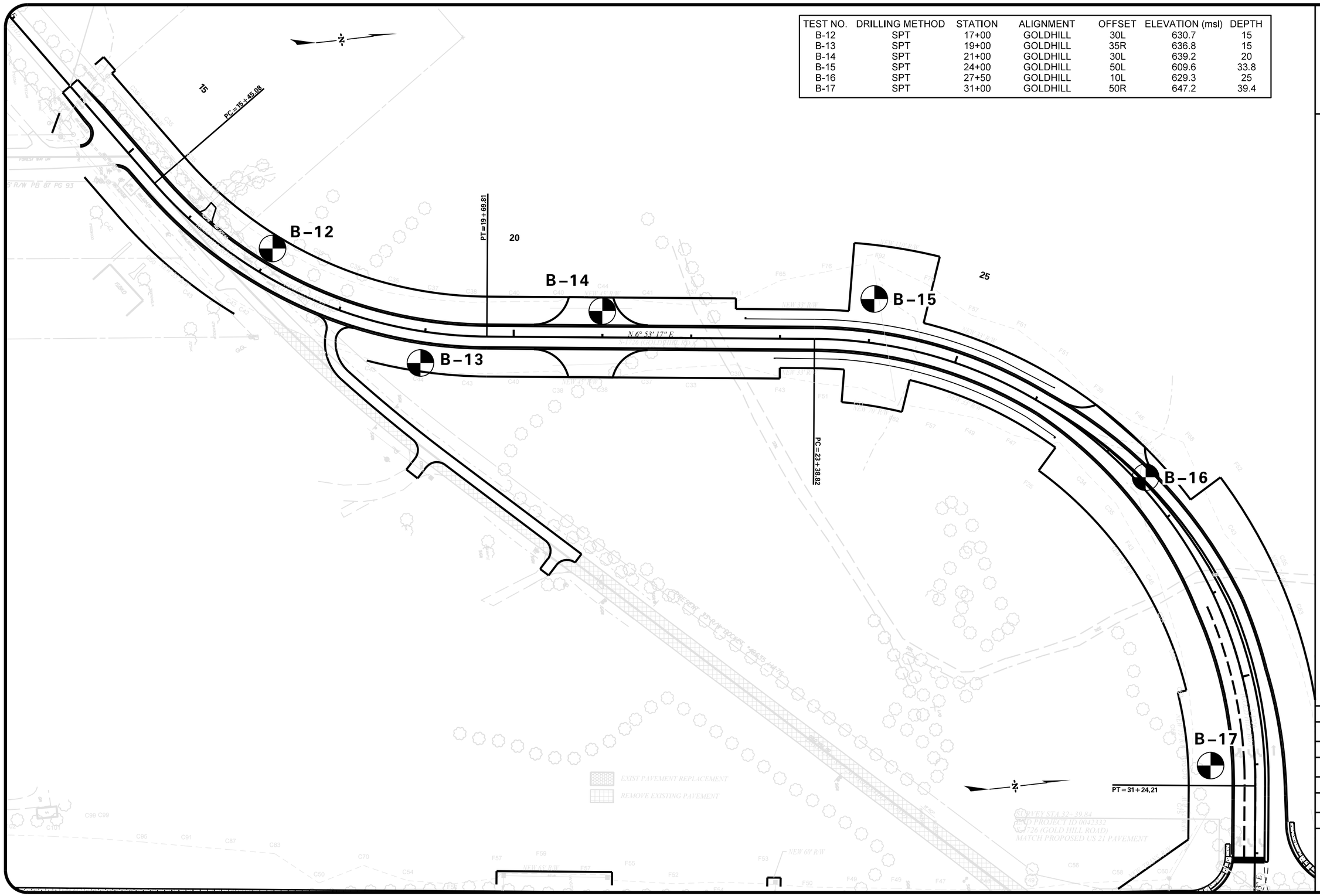
GOLD HILL ROAD REALIGNMENT

GOLD HILL ROAD AND HIGHWAY 21

YORK COUNTY, SOUTH CAROLINA

PROJECT NO.:	1351-12-037
SCALE:	AS SHOWN
DRAWN BY:	AMR
CHECKED BY:	LAC
DATE:	APRIL 2022
SHEET NO.	1

TEST NO.	DRILLING METHOD	STATION	ALIGNMENT	OFFSET	ELEVATION (msl)	DEPTH
B-12	SPT	17+00	GOLDHILL	30L	630.7	15
B-13	SPT	19+00	GOLDHILL	35R	636.8	15
B-14	SPT	21+00	GOLDHILL	30L	639.2	20
B-15	SPT	24+00	GOLDHILL	50L	609.6	33.8
B-16	SPT	27+50	GOLDHILL	10L	629.3	25
B-17	SPT	31+00	GOLDHILL	50R	647.2	39.4



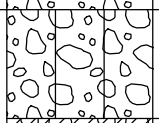
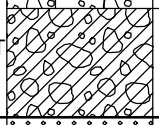
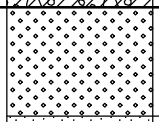
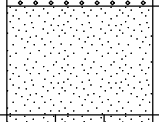
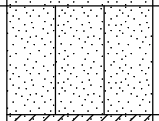
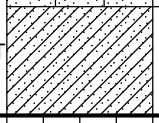
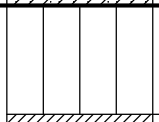
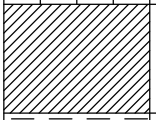
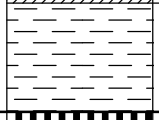
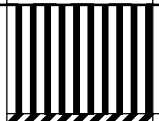
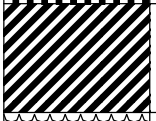
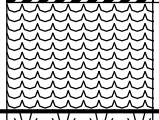
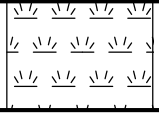
BORING LOCATION PLAN

US 21 TO SC 51
REALIGNMENT OF GOLD HILL ROAD
YORK COUNTY, SOUTH CAROLINA

SCALE:
1" = 100'
DATE:
APRIL 2022
PROJECT NUMBER
1351-12-037
SHEET NO.
2

Appendix II – Boring Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS: GRAPH	SYMBOLS: LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

USCS_LEGEND 1/30/21

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SCDOT Soil Test Log

Project ID:	0042332	**County:**	York	**Boring No.:**	B-12		
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)			**Route:**	Gold Hill Rd		
Eng./Geo.:	L. Campos	**Boring Location:**	17+00	**Offset:**	30 LT	**Alignment:**	GOLDHILL
Elev.:	630.7 ft	**Latitude:**	35.0668473	**Longitude:**	-80.9388977	**Date Started:**	3/3/2022
Total Depth:	15 ft	**Soil Depth:**	15 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/3/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0									
	0.5	Topsoil (6 inches)		0.0	SS-1	4	7	9	11	16
	2.0	**RESIDUUM** - Stiff, Moist, Red Brown, CLAY (CH / A-7-6), LL=76, PL=34, PI=42, NMC=29.0%, %200=80.7		2.0	SS-2	13	14	17	18	31
625.7		Very Stiff, Moist, Red Brown, Sandy CLAY (CL / A-6)		4.0	SS-3	10	15	19	16	34
				6.0	SS-4	4	10	14	14	24
	8.0			8.0						
		Very Stiff, Moist, Brown, Sandy SILT (ML / A-4)			SS-5	6	10	15	12	25
620.7										
				13.5						
					SS-6	4	8	9		17
615.7	15.0	Terminated at 15 feet.								
610.7										
605.7										
600.7										

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) ✿ RQD (%) ■ REC (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 GOLD HILL BORING LOGS.GPJ SCDOT_DATATEMPLATE.GDT 4/7/22

SCDOT Soil Test Log

Project ID:	0042332	**County:**	York	**Boring No.:**	B-13		
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)			**Route:**	Gold Hill Rd		
Eng./Geo.:	L. Campos	**Boring Location:**	19+00	**Offset:**	35 RT	**Alignment:**	GOLDHILL
Elev.:	636.8 ft	**Latitude:**	35.0672619	**Longitude:**	-80.9384062	**Date Started:**	3/4/2022
Total Depth:	15 ft	**Soil Depth:**	15 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/4/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0									
	0.3	Topsoil (3 inches)		0.0	SS-1	2	4	5	10	9
	2.0	**RESIDUUM** - Very Stiff, Moist, Red Brown, Clayey SILT (MH / A-7-5) LL=67, PL=39, PI=28, NMC=31.1%, %200=82.1		2.0	SS-2	10	14	15	19	29
631.8		Very Stiff to Firm, Moist, Red Brown, Sandy SILT (ML / A-4)		4.0	SS-3	9	11	12	13	23
				6.0	SS-4	3	4	6	7	10
				8.0	SS-5	3	5	7	7	12
626.8										
				13.5	SS-6	3	3	4		7
621.8	15.0	Terminated at 15 feet.								
616.8										
611.8										
606.8										

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) ✿ RQD (%) ■ REC (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 GOLD HILL BORING LOGS.GPJ SCDOT_DATATEMPLATE.GDT 4/7/22

SCDOT Soil Test Log

Project ID:	0042332	**County:**	York	**Boring No.:**	B-14		
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)			**Route:**	Gold Hill Rd		
Eng./Geo.:	L. Campos	**Boring Location:**	21+00	**Offset:**	30 LT	**Alignment:**	GOLDHILL
Elev.:	639.2 ft	**Latitude:**	35.0678388	**Longitude:**	-80.9385227	**Date Started:**	3/4/2022
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/4/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0									
	0.3	Topsoil (3 inches)		0.0	SS-1	3	4	6	7	10
		RESIDUUM - Stiff to Very Stiff, Moist, Red Brown, Clayey SILT (MH / A-7-5) LL=55, PL=38, PI=17, NMC=29.6%, %200=75.1		2.0	SS-2	10	14	16	16	30
634.2				4.0	SS-3	5	7	9	9	16
				6.0	SS-4	4	6	6	8	12
	8.0			8.0	SS-5	3	4	4	5	8
629.2		Firm, Moist, Brown, Trace Mica, Sandy SILT (ML / A-4)								
	12.0			13.5	SS-6	3	3	5		8
		Loose to Medium Dense, Moist, Gray Brown, Trace Mica, Fine Silty SAND (SM / A-2-4)								
624.2				18.5	SS-7	4	5	7		12
	20.0									
619.2		Terminated at 20 feet.								
614.2										
609.2										

● SPT N VALUE ●
PL MC LL
▲ FINES CONTENT (%)
✿ RQD (%) ■ REC (%)
0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 GOLD HILL BORING LOGS.GPJ SCDOT_DATATEMPLATE.GDT 4/7/22

SCDOT Soil Test Log

Project ID:	0042332			**County:**	York	**Boring No.:**	B-15
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)					**Route:**	Gold Hill Rd
Eng./Geo.:	L. Campos	**Boring Location:**	24+00	**Offset:**	50 LT	**Alignment:**	GOLDHILL
Elev.:	609.6 ft	**Latitude:**	35.0686794	**Longitude:**	-80.9384519	**Date Started:**	3/4/2022
Total Depth:	33.8 ft	**Soil Depth:**	33.8 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/4/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** 14.7 ft	**24HR**	16 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0									
	0.3	Topsoil (4 inches)		0.0	SS-1	3	4	5	6	9
		RESIDUUM - Stiff to Very Stiff, Moist, Brown, Trace Mica, Sandy CLAY (CL / A-6)		2.0	SS-2	6	8	9	11	17
		LL=37, PL=21, PI=16, NMC=19.4%, %200=61.4		4.0	SS-3	7	9	11	13	20
604.6				6.0	SS-4	5	10	11	11	21
		LL=36, PL=22, PI=14, NMC=21.4%, %200=51.6		8.0	SS-5	3	6	8	14	14
599.6										
	12.0	Dense, Dry, Gray, Trace Mica, Fine to Coarse Silty SAND (SM / A-2-4)		13.5	SS-6	10	14	18		32
594.6		▽								
		▼								
	17.0	**PARTIALLY WEATHERED ROCK (PWR)** - Very Dense, Dry, Gray, Fine to Coarse Silty SAND (SM / A-2-4)		18.5	SS-7	1750/5"				100
589.6				23.5	SS-8	1250/6"				100
584.6				28.5	SS-9	50/2"				100
579.6										
	33.8	Terminated at 33.8 feet.		33.5	SS-10	50/3"				100

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) ✿ RQD (%) ■ REC (%)
0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 GOLD HILL BORING LOGS.GPJ SCDOT_DATATEMPLATE.GDT 4/7/22

SCDOT Soil Test Log

Project ID:	0042332	**County:**	York	**Boring No.:**	B-16		
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)			**Route:**	Gold Hill Rd		
Eng./Geo.:	B. Kebea	**Boring Location:**	27+50	**Offset:**	10 LT	**Alignment:**	GOLDHILL
Elev.:	629.3 ft	**Latitude:**	35.069451	**Longitude:**	-80.9376695	**Date Started:**	3/5/2022
Total Depth:	25 ft	**Soil Depth:**	25 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/5/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** Dry	**24HR**	Dry

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0									
	0.2	Topsoil (2 inches)		0.0	SS-1	1	2	3	5	5
	2.0	**RESIDUUM** - Firm, Moist, Red to Brownish Red, Trace Mica, Clayey SILT (MH / A-7-5) LL=59, PL=33, PI=26, NMC=27.7%, %200=73.3		2.0	SS-2	6	6	7	8	13
624.3		Stiff to Very Stiff, Moist, Red to Brownish Red, Trace Mica, Sandy CLAY (CL / A-6)		4.0	SS-3	4	6	9	11	15
				6.0	SS-4	4	8	12	15	20
	8.0			8.0						
619.3		Medium Dense, Dry to Moist, Brown Gray, Fine to Coarse Silty SAND (SM / A-4) LL=NP, PL=NP, PI=NP, NMC=8.2%, %200=38.1			SS-5	4	5	6	7	11
				13.5	SS-6	4	5	7		12
614.3										
				18.5	SS-7	4	6	8		14
609.3										
				23.5	SS-8	6	8	10		18
604.3	25.0	Terminated at 25 feet.								
599.3										

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) ✿ RQD (%) ■ REC (%)
0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 GOLD HILL BORING LOGS.GPJ SCDOT_DATATEMPLATE.GDT 4/7/22

SCDOT Soil Test Log

Project ID:	0042332	**County:**	York	**Boring No.:**	B-17		
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)			**Route:**	Gold Hill Rd		
Eng./Geo.:	B. Kebea	**Boring Location:**	31+00	**Offset:**	50 RT	**Alignment:**	GOLDHILL
Elev.:	647.2 ft	**Latitude:**	35.0695493	**Longitude:**	-80.9365634	**Date Started:**	3/5/2022
Total Depth:	39.4 ft	**Soil Depth:**	39.4 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/5/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value
	0.0		0.0	SS-1	2	4	7	7	11
	0.3	Topsoil (3 inches)	2.0	SS-2	6	10	13	19	23
642.2		**RESIDUUM** - Stiff to Hard, Moist to Dry, Red Brown, Clayey SILT (MH / A-7-5)	4.0	SS-3	11	13	20	26	33
			6.0	SS-4	10	14	18	18	32
		LL=51, PL=44, PI=7, NMC=20.2%, %200=50.7	8.0	SS-5	4	8	9	11	17
637.2	11.0								
		Stiff, Dry, Brown Red, Trace Mica, Sandy SILT (ML / A-4)	13.5	SS-6	3	5	8		13
632.2									
	17.0		18.5	SS-7	4	5	7		12
		Medium Dense, Dry to Moist, Brown Gray, Trace Mica, Fine to Coarse Silty SAND (SM / A-2-4)							
627.2			23.5	SS-8	5	6	7		13
622.2			28.5	SS-9	3	6	8		14
617.2			33.5	SS-10	8	9	10		19

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) ✿ RQD (%) ■ REC (%)
0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Log

Project ID:	0042332			**County:**	York	**Boring No.:**	B-17
Site Description:	US 21 / SC 51 Widening - Gold Hill Road (S&ME Project 1351-12-037)					**Route:**	Gold Hill Rd
Eng./Geo.:	B. Kebea	**Boring Location:**	31+00	**Offset:**	50 RT	**Alignment:**	GOLDHILL
Elev.:	647.2 ft	**Latitude:**	35.0695493	**Longitude:**	-80.9365634	**Date Started:**	3/5/2022
Total Depth:	39.4 ft	**Soil Depth:**	39.4 ft	**Core Depth:**	N/A ft	**Date Completed:**	3/5/2022
Bore Hole Diameter (in):	8	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550X	**Drill Method:**	3 1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	J. Little	**Groundwater:**	**TOB** Dry	**24HR**	N/A

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6" / 4th 6"	N Value
	37.0	**PARTIALLY WEATHERED ROCK (PWR)** - Very Dense, Dry, Brown Gray, Trace Mica, Fine to Coarse Silty SAND (SM / A-2-4)		38.5	SS-11	7 50/5"	100
607.2	39.4	Terminated at 39.4 feet.					
602.2							
597.2							
592.2							
587.2							
582.2							

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) ✿ RQD (%) ■ REC (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 12-037 GOLD HILL BORING LOGS.GPJ SCDOT_DATATEMPLATE.GDT 4/7/22

Appendix III – Lab Summary and Lab Results

SUMMARY OF LABORATORY TEST RESULTS

Boring No.	Sample Depth (feet)	Sample Number *	Classification		Natural Moisture Content (%)	% Finer No. 200	Atterberg Limits			Triaxial Shear Strength				Consolidation		Standard Proctor		California Bearing Ratio	
			USCS	AASHTO			LL	PL	PI	Total		Effective		P_c (ksf)	C_c	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR at 0.1 in.	CBR at 0.2 in.
										c (psf)	φ (deg)	c' (psf)	φ' (deg)						
B-12	0 - 2.0	SS-1	CH	A-7-5	29.0	80.7	76	34	42	-	-	-	-	-	-	-	-	-	-
B-13	0 - 2.0	SS-1	MH	A-7-5	31.1	82.1	67	39	28	-	-	-	-	-	-	-	-	-	-
B-14	0.5 - 6.0	S-1	MH	A-7-5	31.7	81.1	61	35	26	344	12.2	134	31.6	-	-	94.4	25.4	-	-
B-14	2.0 - 4.0	SS-2	MH	A-7-5	29.6	75.1	55	38	17	-	-	-	-	-	-	-	-	-	-
B-15	2.0 - 4.0	ST-1	CL	A-6	19.4	61.4	37	21	16	-	-	-	-	2.2	0.10	-	-	-	-
B-15	8.0 - 10.0	SS-5	CL	A-6	21.4	51.6	36	22	14	-	-	-	-	-	-	-	-	-	-
B-16	0 - 2.0	SS-1	MH	A-7-5	27.7	73.3	59	33	26	-	-	-	-	-	-	-	-	-	-
B-16	8.0 - 10.0	SS-5	SM	A-4	8.2	38.1	NP*	NP	NP	-	-	-	-	-	-	-	-	-	-
B-17	0.5 - 10.0	S-1	MH	A-7-5	21.7	59.0	53	31	22	448	12.6	377	29.4	-	-	93.0	27.3	7.4	6.7
B-17	8.0 - 10.0	SS-5	MH	A-5	20.2	50.7	51	44	7	-	-	-	-	-	-	-	-	-	-

* SS = Split Spoon Sample (ASTM D1586)
ST = Undisturbed Sample (ASTM D1587)
S = Bulk/Bag Sample
NP = Non-Plastic

Graphic Presentations of Results of Grain Size Distribution, Triaxial Shear, and other tests follow this summary

Job Name: Gold Hill Road Realignment - US21/SC51 Widening
Job Location: York County, South Carolina
Job Number: 1351-12-037

Form No: TR-D2216-T265-1
Revision No. 1
Revision Date: 08/16/17

LABORATORY DETERMINATION OF WATER CONTENT

ASTM D 2216 ☐ *AASHTO T 265* ☑

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC51 - Gold Hill Road	Test Date(s):	3/8/22 - 4/6/22
Client Name:	STV, Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		
Sample by:	NI	Sample Date(s):	3/4/22
Sampling Method:	NI	Drill Rig :	NI

Method: **A (1%)** ☐ **B (0.1%)** ☑ Balance ID. 20233 Calibration Date: 9/27/21 Oven ID. 10844 Calibration Date: 2/19/22

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		ft. or m.		grams	grams	grams	grams	%	
B-12	SS-1	0-2	79	72.31	261.89	219.23	42.66	29.0%	
B-13	SS-1	0-2	583	86.68	289.96	241.69	48.27	31.1%	
B-14	S-1	0.5-6	5CC	124.88	352.58	297.79	54.79	31.7%	
B-14	SS-2	2-4	AL	86.50	299.10	250.56	48.54	29.6%	
B-15	ST-1	2.0-4.0	CAT	104.43	339.78	301.46	38.32	19.4%	
B-15	SS-5	8-10	101	74.65	304.42	263.89	40.53	21.4%	
B-16	SS-1	0-2	L-8	86.17	283.45	240.64	42.81	27.7%	
B-16	SS-5	8-10	JR	109.89	264.57	252.88	11.69	8.2%	
B-17	S-1	0.5-10	SGG	126.19	369.32	325.99	43.33	21.7%	
B-17	SS-5	8-10	180	110.52	298.29	266.73	31.56	20.2%	

Notes / Deviations / References

Karen Warner		NICET #117900	4/6/2022
Technician Name	*Signature*	*Certification Type / No.*	*Date*
Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

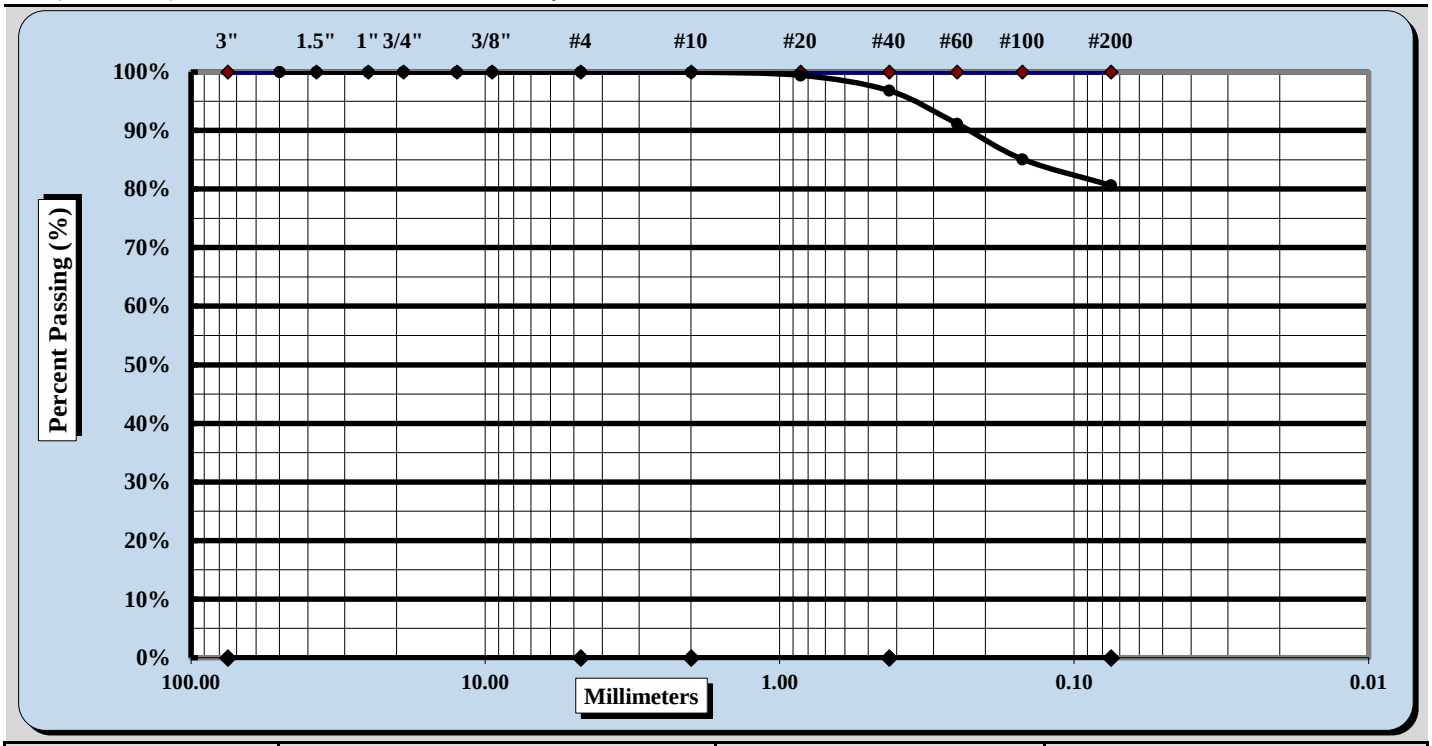
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-12	Type:	Split Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-1	Depth:	0-2'

Sample Description: Red Brown Fat Clay w/Medium to Fine Sand (CH) **A-7-5(38)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	16.2%
Gravel	0.0%	Medium Sand	3.1%	Silt & Clay	80.7%
Liquid Limit	76	Plastic Limit	34	Plastic Index	42
Specific Gravity	ND			Moisture Content	29.0%
Coarse Sand	0.0%	Medium Sand	3.1%	Fine Sand	16.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☒

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

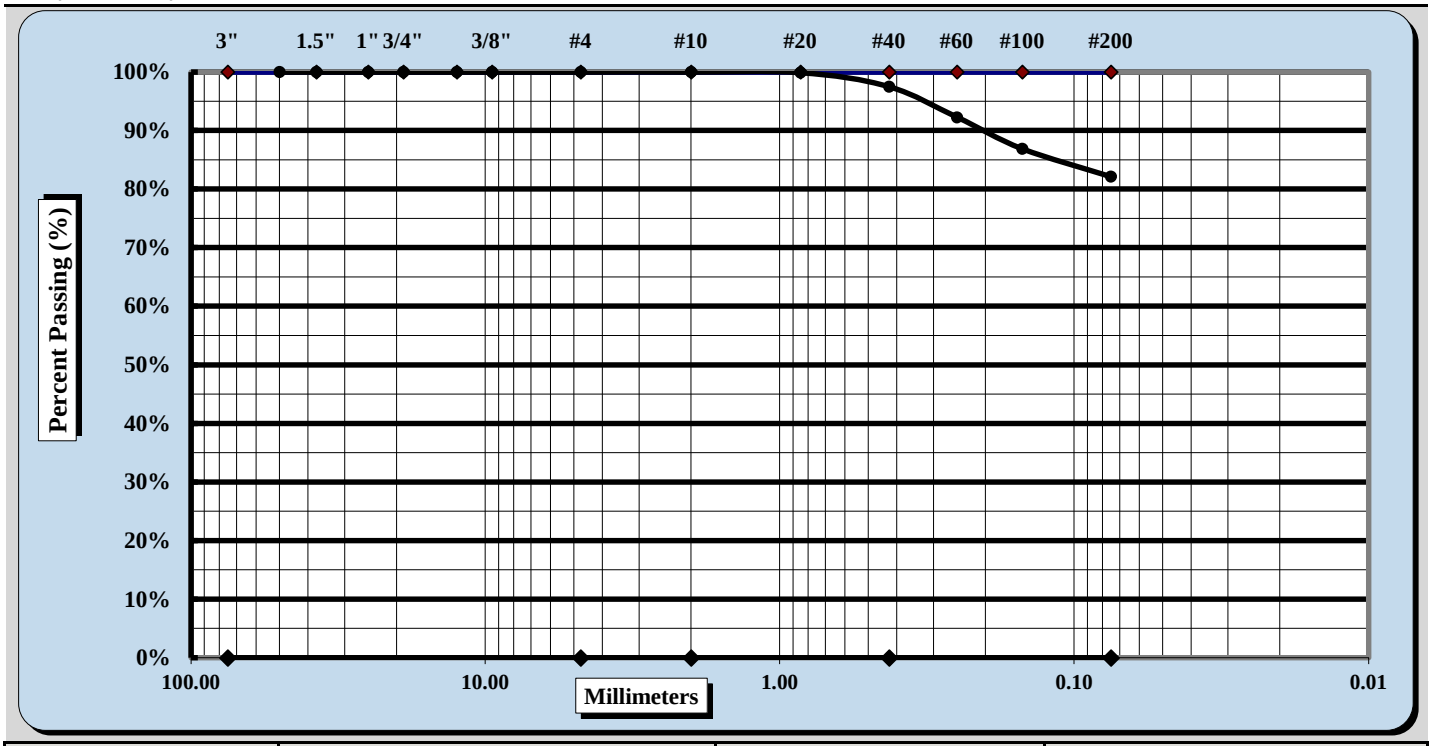
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-13	Type:	Split Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-1	Depth:	0-2'

Sample Description: Red Brown Elastic Silt w/Medium to Fine Sand (MH) **A-7-5(28)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	15.4%
Gravel	0.0%	Medium Sand	2.5%	Silt & Clay	82.1%
Liquid Limit	67	Plastic Limit	39	Plastic Index	28
Specific Gravity	ND			Moisture Content	31.1%
Coarse Sand	0.0%	Medium Sand	2.5%	Fine Sand	15.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☒

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

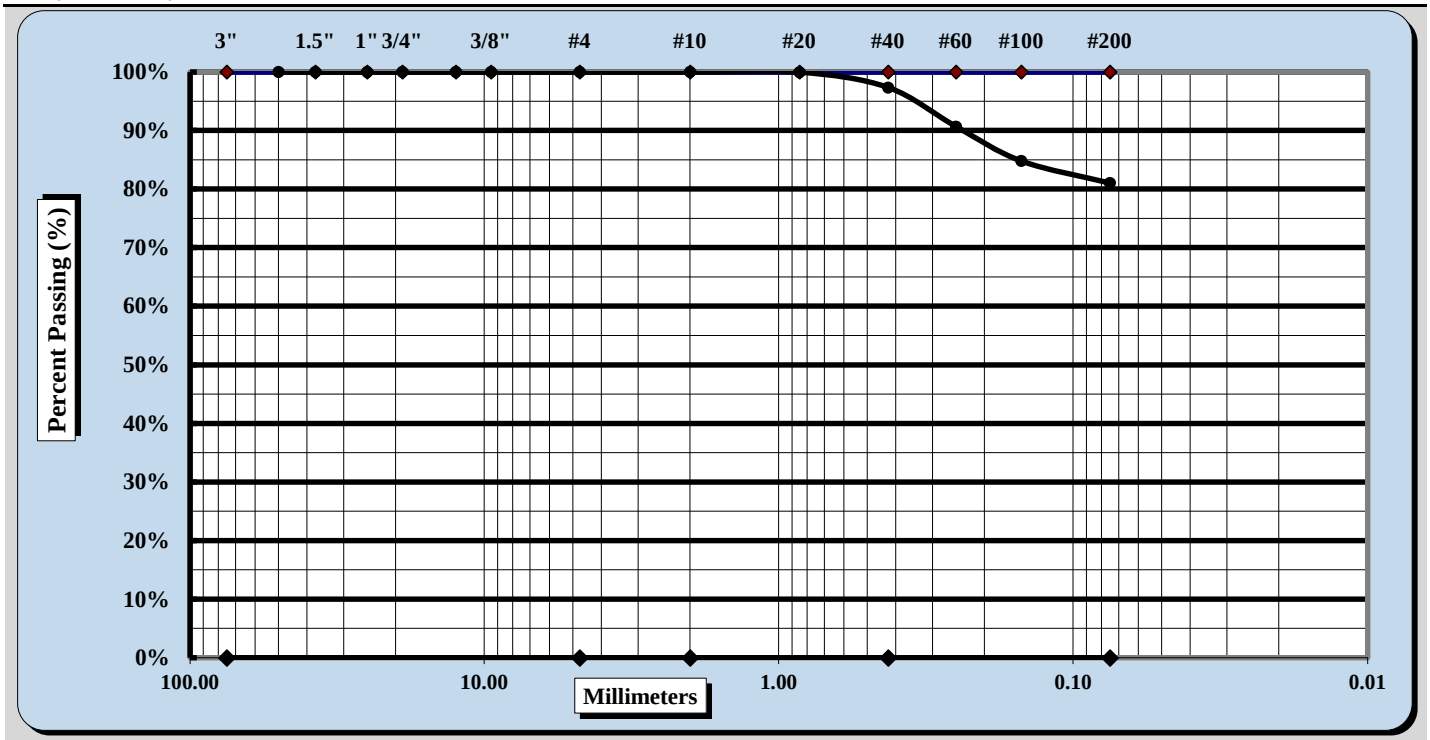
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	3/21-4/6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-14	Type:	Bulk	Sample Date:	3/4/22
Location:	Borings	Sample:	S-1	Depth:	0.5-6'

Sample Description: Brown Elastic Silt w/Medium to Fine Sand (MH) **A-7-5(25)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	16.3%
Gravel	0.0%	Medium Sand	2.7%	Silt & Clay	81.1%
Liquid Limit	61	Plastic Limit	35	Plastic Index	26
Specific Gravity	ND			Moisture Content	31.7%
Coarse Sand	0.0%	Medium Sand	2.7%	Fine Sand	16.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

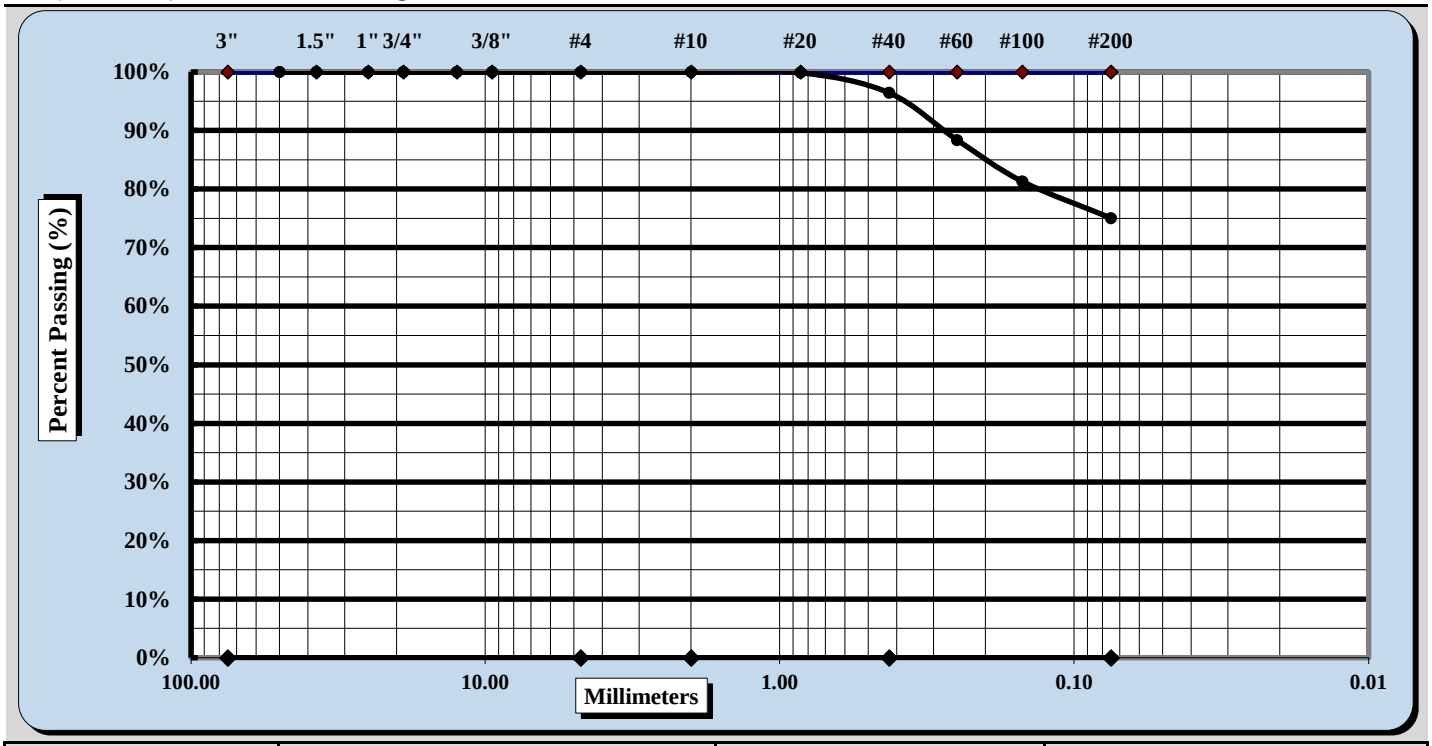
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-14	Type:	Split Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-2	Depth:	2-4'

Sample Description: Orange Brown Elastic Silt w/Medium to Fine Sand (MH) **A-7-5(15)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	21.4%
Gravel	0.0%	Medium Sand	3.6%	Silt & Clay	75.1%
Liquid Limit	55	Plastic Limit	38	Plastic Index	17
Specific Gravity	ND			Moisture Content	29.6%
Coarse Sand	0.0%	Medium Sand	3.6%	Fine Sand	21.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

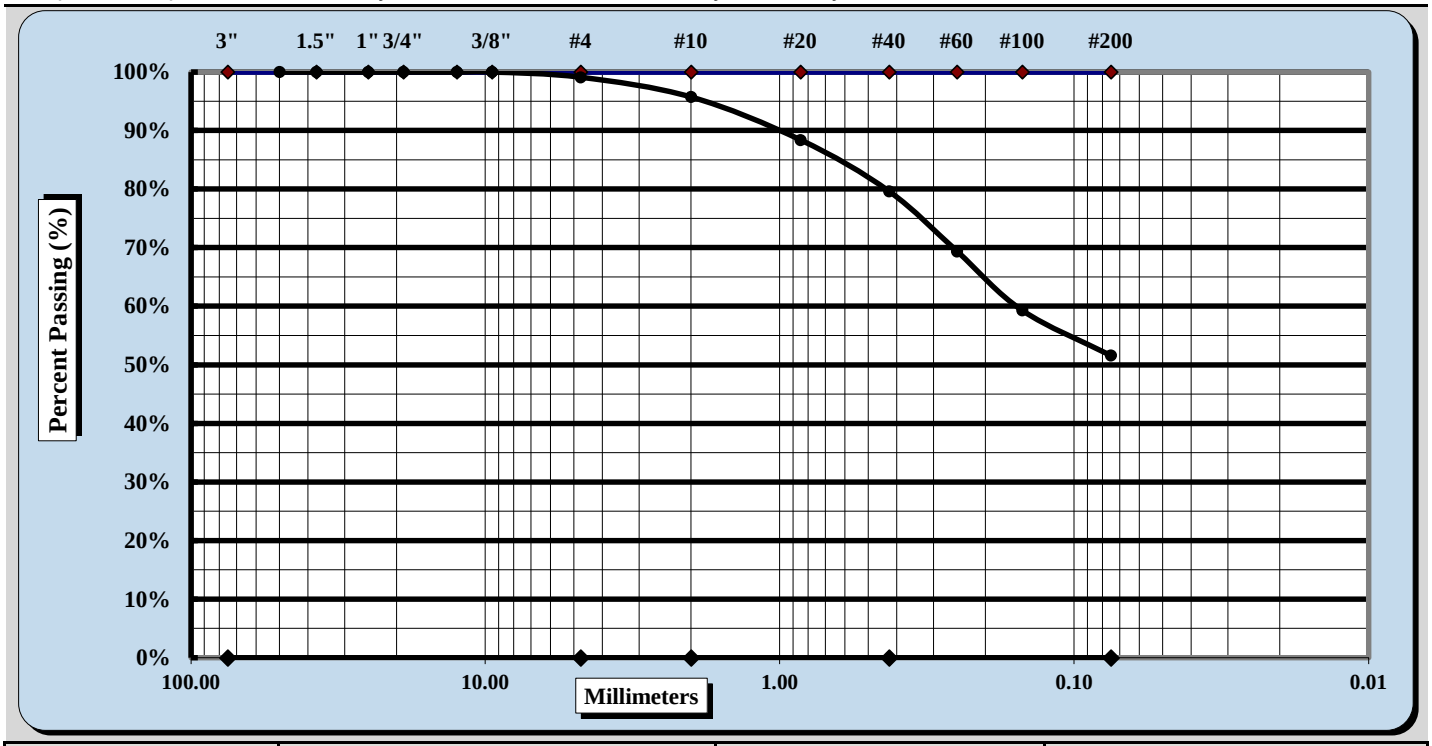
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-15	Type:	Split Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-5	Depth:	8-10'

Sample Description: Gray Brown Coarse to Fine Sandy Lean Clay (CL) **A-6(6)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	3.3%	Fine Sand	28.0%
Gravel	0.9%	Medium Sand	16.1%	Silt & Clay	51.6%
Liquid Limit	36	Plastic Limit	22	Plastic Index	14
Specific Gravity	ND			Moisture Content	21.4%
Coarse Sand	3.3%	Medium Sand	16.1%	Fine Sand	28.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

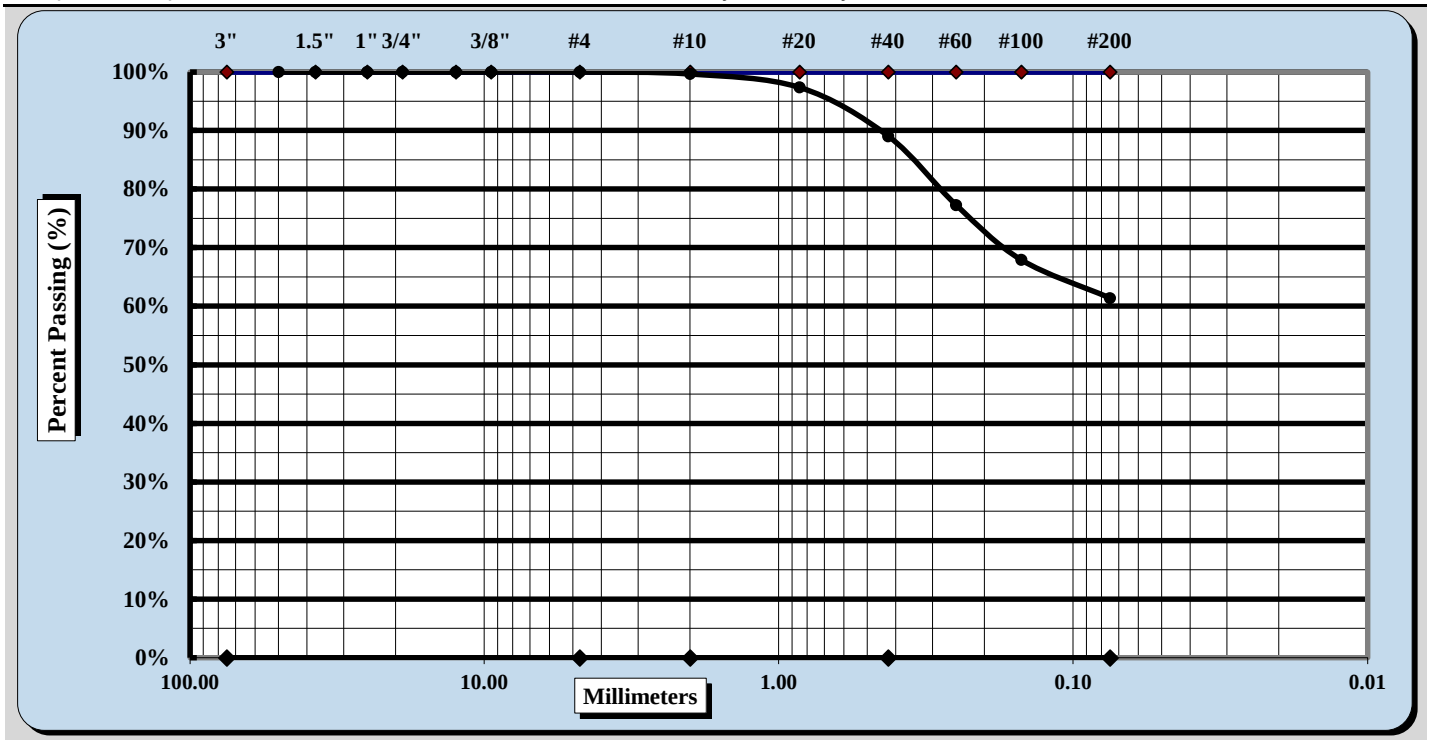
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-15 ST-1	Type:	Undisturbed	Sample Date:	3/4/22
Location:	Borings	Sample:	ST-1	Depth:	2-4'

Sample Description: Brown Red Medium to Fine Sandy Lean Clay (CL) **A-6(8)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.3%	Fine Sand	27.6%
Gravel	0.0%	Medium Sand	10.6%	Silt & Clay	61.4%
Liquid Limit	37	Plastic Limit	21	Plastic Index	16
Specific Gravity	ND			Moisture Content	19.4%
Coarse Sand	0.3%	Medium Sand	10.6%	Fine Sand	27.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

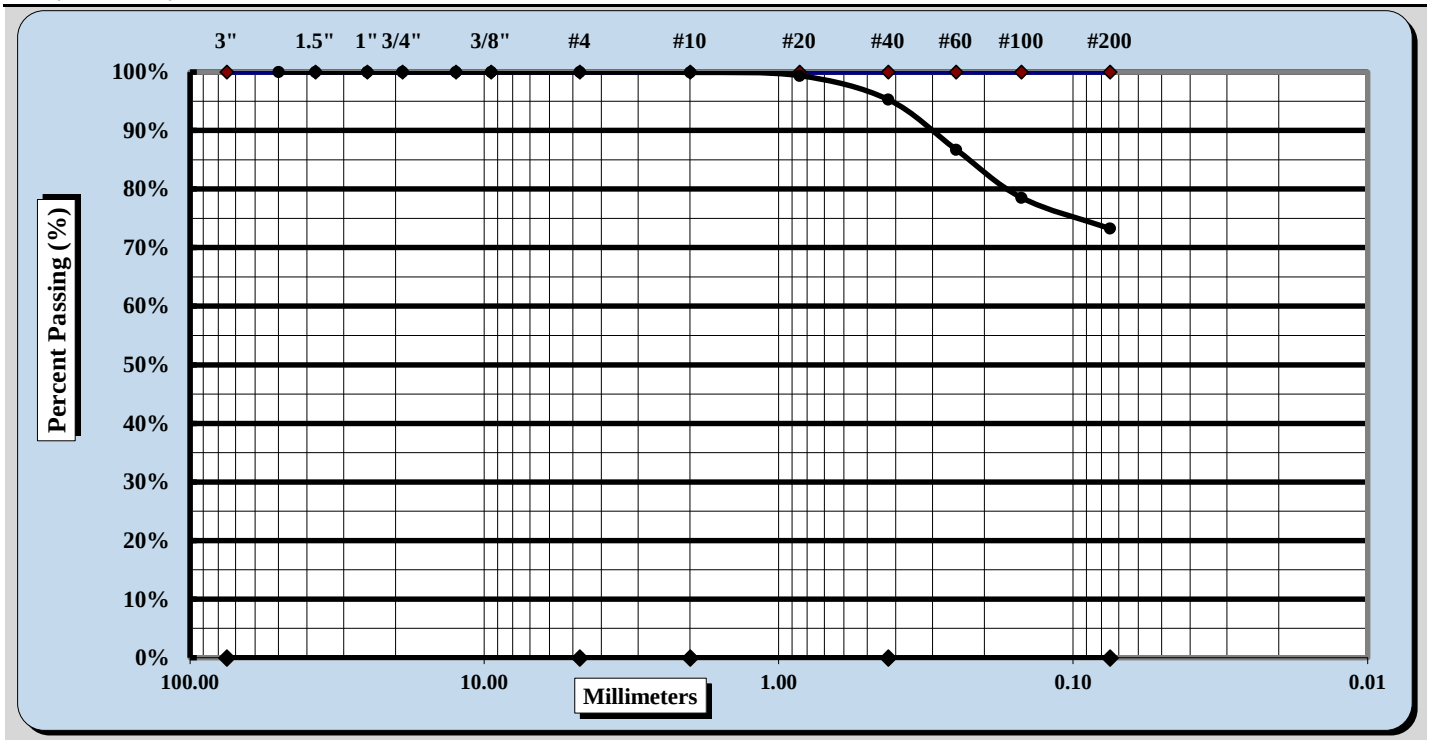
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102 ,North Charleston, SC 29418		

Sample Id.	B-16	Type:	Spilt Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-1	Depth:	0-2'

Sample Description: Red Brown Elastic Silt w/Medium to Fine Sand (MH) **A-7-5(21)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	22.0%
Gravel	0.0%	Medium Sand	4.7%	Silt & Clay	73.3%
Liquid Limit	59	Plastic Limit	33	Plastic Index	26
Specific Gravity	ND			Moisture Content	27.7%
Coarse Sand	0.0%	Medium Sand	4.7%	Fine Sand	22.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☒

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

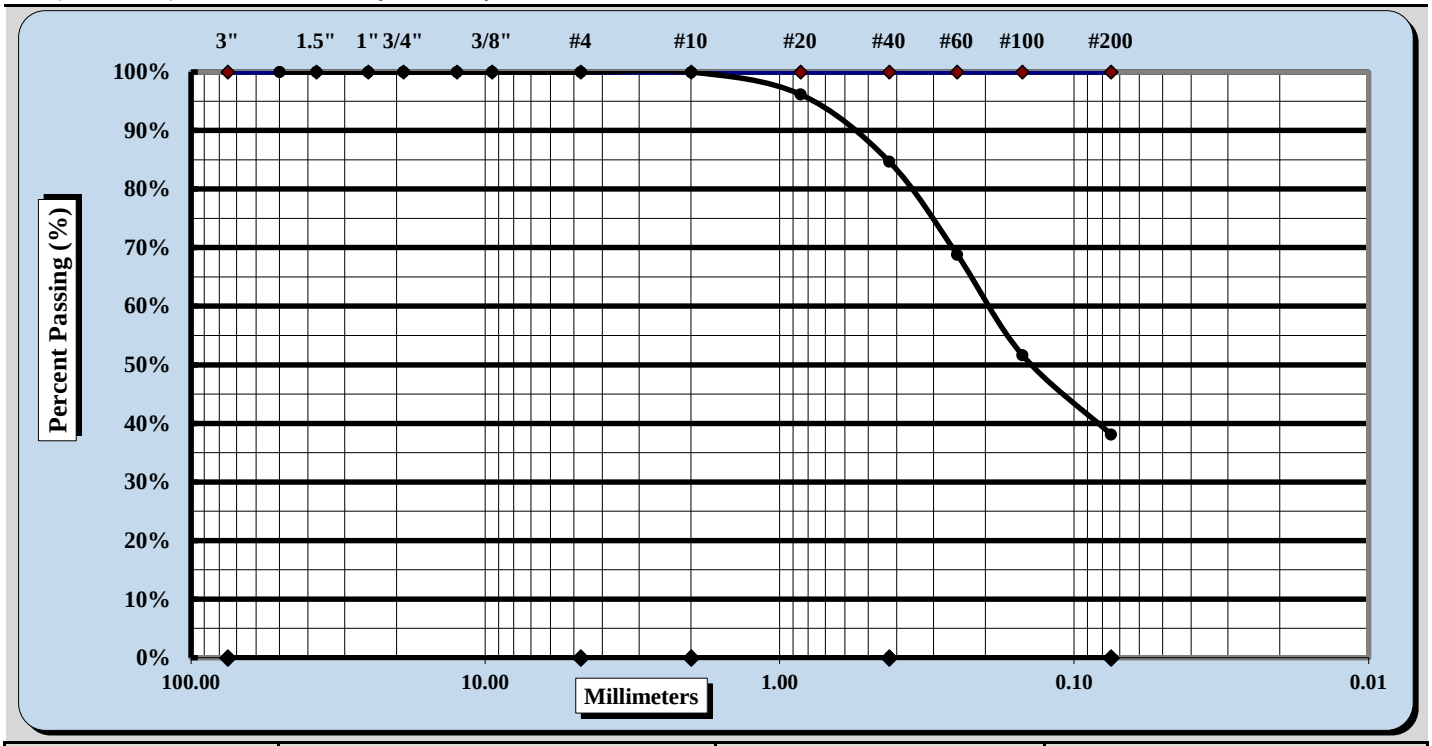
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102 ,North Charleston, SC 29418		

Sample Id.	B-16	Type:	Spilt Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-5	Depth:	8-10'

Sample Description: Gray Tan Silty Medium to Fine Sand (SM) **A-4(0)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.0%	Fine Sand	46.6%
Gravel	0.0%	Medium Sand	15.3%	Silt & Clay	38.1%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP
Specific Gravity	ND			Moisture Content	8.2%
Coarse Sand	0.0%	Medium Sand	15.3%	Fine Sand	46.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☒

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

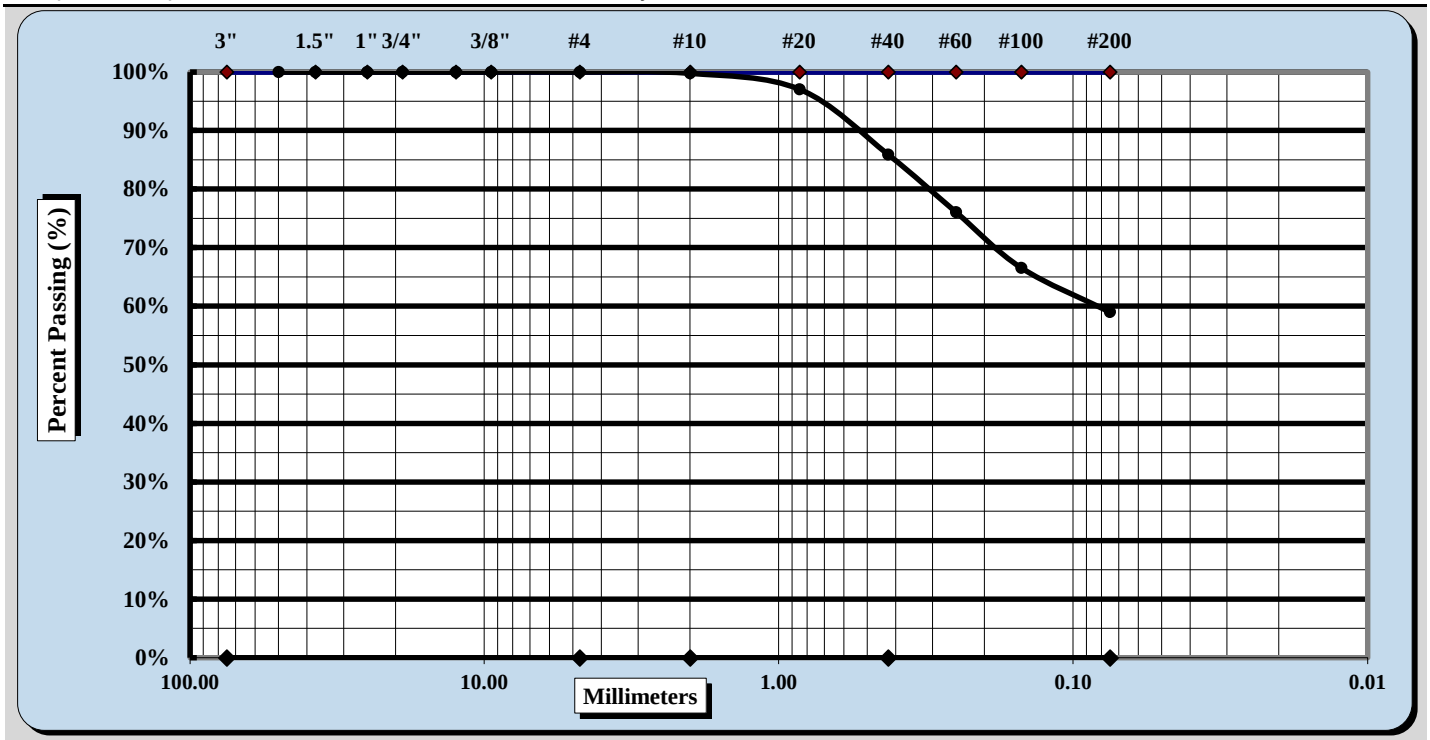
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	3/21-25/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-17	Type:	Bulk	Sample Date:	3/4/22
Location:	Borings	Sample:	S-1	Depth:	0.5-10'

Sample Description: Red Medium to Fine Sandy Elastic Silt (MH) **A-7-5(12)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.2%	Fine Sand	26.9%
Gravel	0.0%	Medium Sand	13.9%	Silt & Clay	59.0%
Liquid Limit	53	Plastic Limit	31	Plastic Index	22
Specific Gravity	ND			Moisture Content	21.7%
Coarse Sand	0.2%	Medium Sand	13.9%	Fine Sand	26.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Luis Campos, P.E. — *Technical Responsibility*
Signature
Project Engineer — *Position*
4/14/2022 — *Date*

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Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

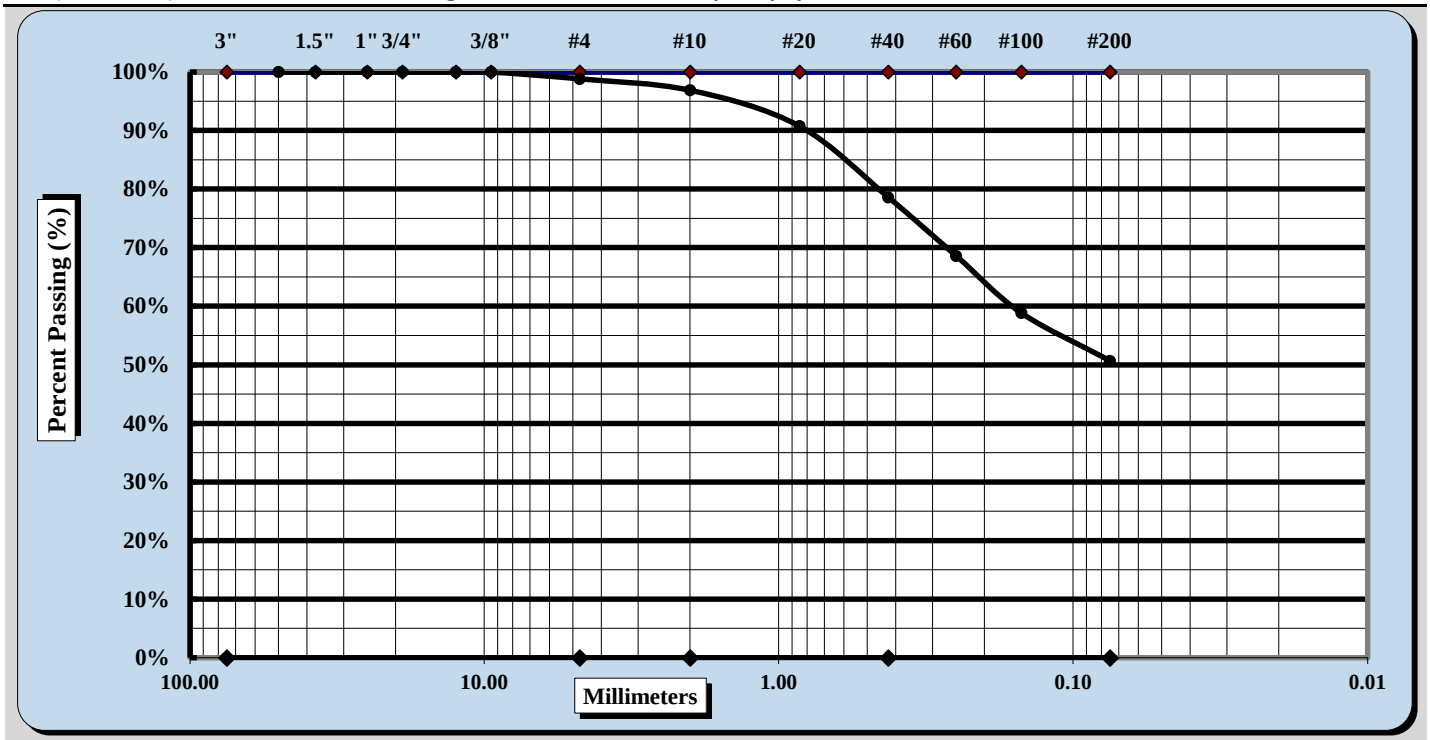
ASTM D 422

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	4/4-6/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Sample Id.	B-17	Type:	Split Spoon	Sample Date:	3/4/22
Location:	Borings	Sample:	SS-5	Depth:	8-10'

Sample Description: Tan Orange Coarse to Fine Sandy Clayey Silt (MH) **A-5(3)**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	1.9%	Fine Sand	27.9%
Gravel	1.2%	Medium Sand	18.3%	Silt & Clay	50.7%
Liquid Limit	51	Plastic Limit	44	Plastic Index	7
Specific Gravity	ND			Moisture Content	20.2%
Coarse Sand	1.9%	Medium Sand	18.3%	Fine Sand	27.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ND: Not Determined

Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

Quality Assurance

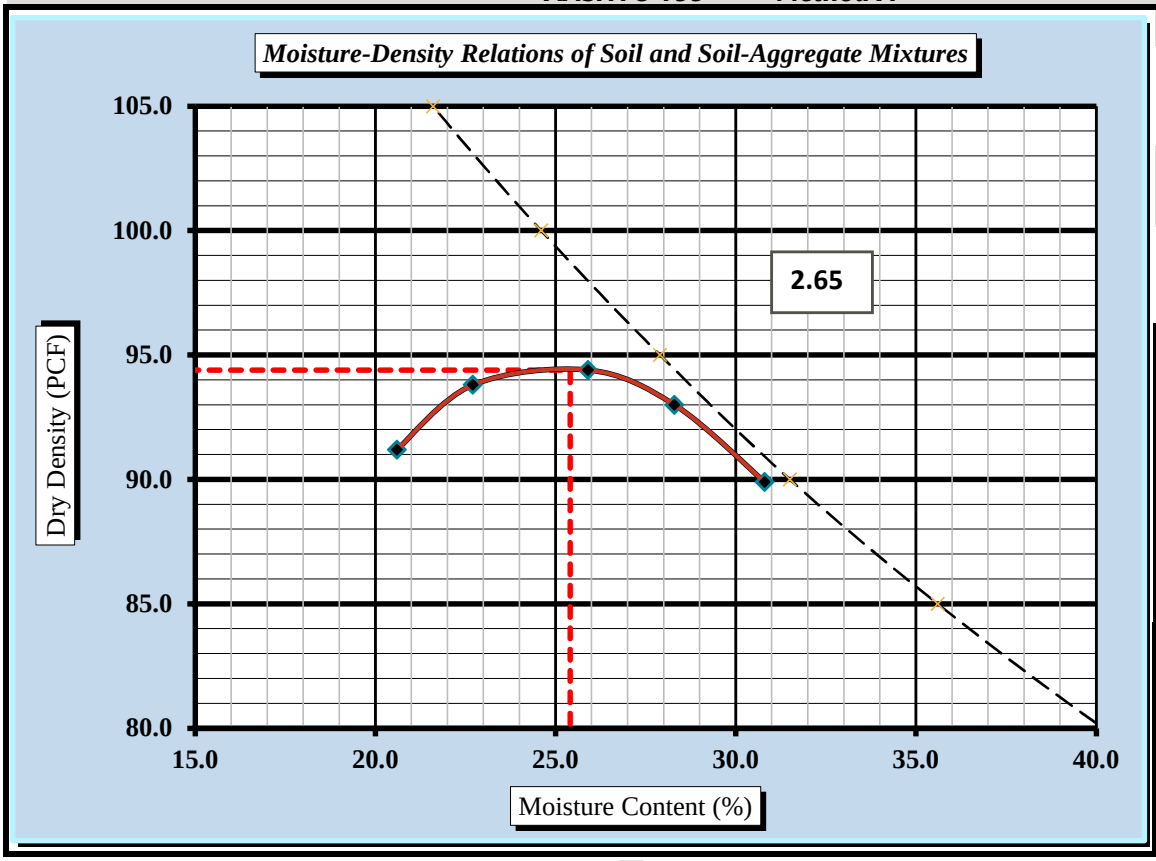
S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

S&ME Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	3/17-23/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Boring #:	B-14	Sample #:	S-1	Sample Date:	3/4/2022
Location:	Borings	Offset:	NI	Depth:	0.5-6'
Sample Description:	Brown Elastic Silt w/Medium to Fine Sand (MH)				A-7-5 (25)

Maximum Dry Density **94.4** **PCF.** **Optimum Moisture Content** **25.4%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	31.7%
Specific Gravity of Soil	ND
Liquid Limit	61
Plastic Limit	35
Plastic Index	26
% Passing	
3/4"	100.0%
#4	100.0%
#10	100.0%
#20	100.0%
#40	97.3%
#60	90.7%
#100	84.8%
#200	81.1%
Oversize Fraction	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND: Not Determined NI: No Information Provided

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

Quality Assurance

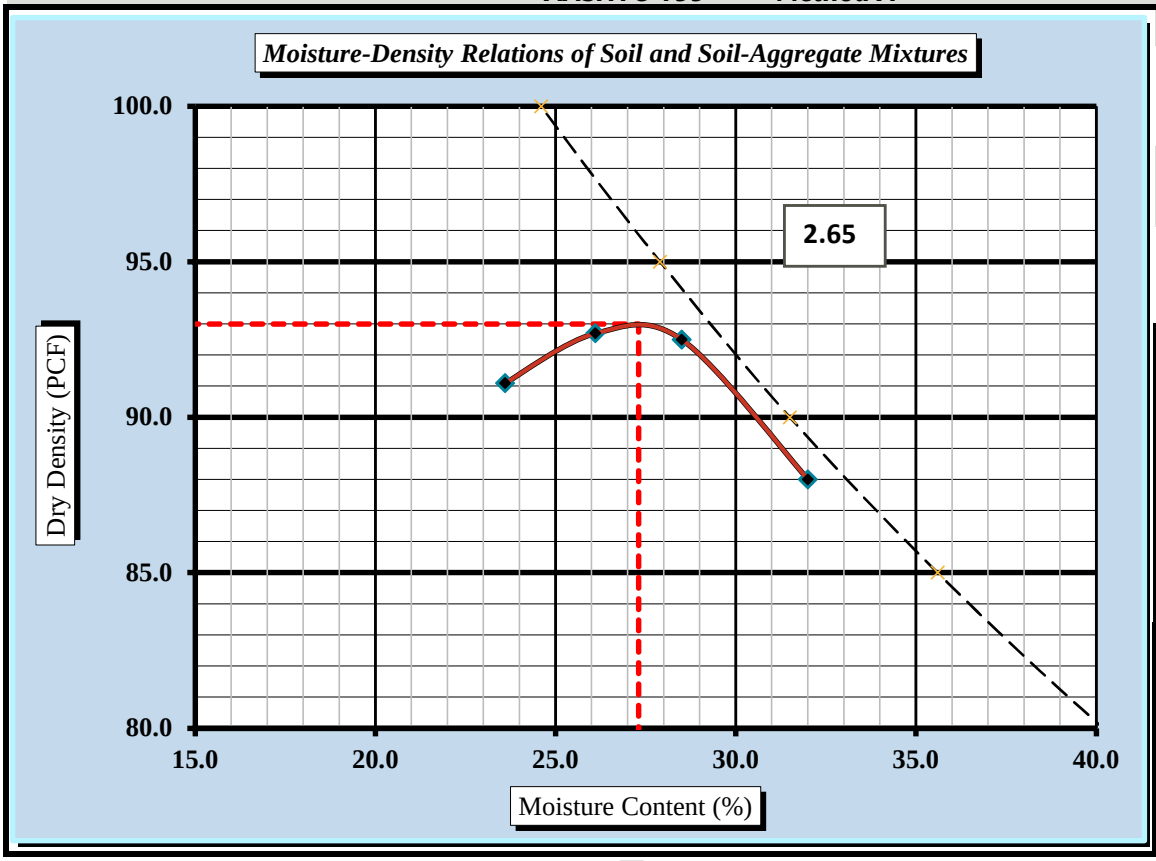
S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

S&ME Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s):	3/17-24/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102, North Charleston, SC 29418		

Boring #:	B-17	Sample #:	S-1	Sample Date:	3/4/2022
Location:	Borings	Offset:	NI	Depth:	0.5-10'
Sample Description:	Red Medium to Fine Sandy Elastic Silt (MH)				A-7-5 (12)

Maximum Dry Density **93.0** **PCF.** **Optimum Moisture Content** **27.3%**

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	21.7%
Specific Gravity of Soil	ND
Liquid Limit	53
Plastic Limit	31
Plastic Index	22
% Passing	
3/4"	100.0%
#4	100.0%
#10	99.8%
#20	97.1%
#40	85.9%
#60	76.1%
#100	66.6%
#200	59.0%
Oversize Fraction	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: ND: Not Determined NI: No Information Provided

AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

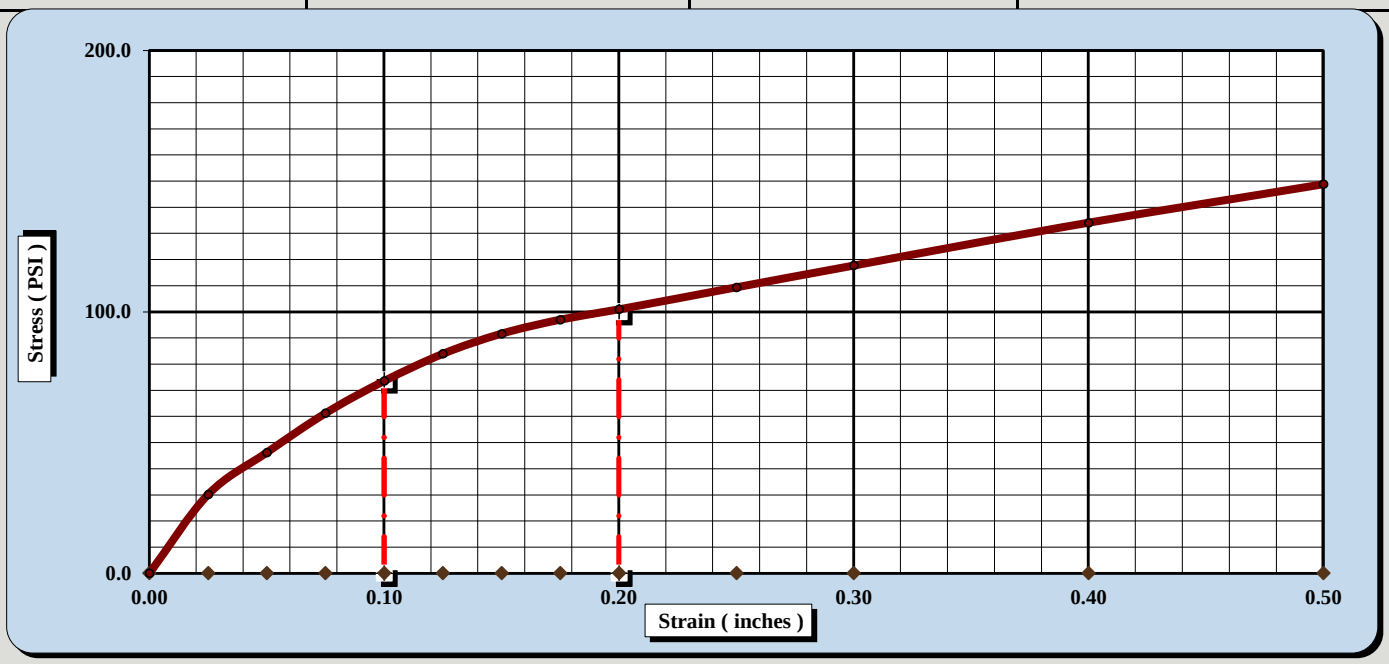
CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

AASHTO T 193

S&ME, Inc. Charlotte: 9751 Southern Pine Boulevard, Charlotte, NC 28273

Project #:	1351-12-037 (03)	Report Date:	4/6/22
Project Name:	SCDOT US 21 to SC 51 - Gold Hill Road	Test Date(s)	3/17-4/1/22
Client Name:	STV Inc.		
Client Address:	4969 Centre Pointe Dr., Suite 102,North Charleston, SC 29418		
Boring #:	B-17	Sample #: S-1	Sample Date: 3/4/22
Location:	Borings	Offset: NI	Depth: 0.5-10'
Sample Description:	Red Medium to Fine Sandy Elastic Silt (MH)		A-6-5(12)
AASHTO T99	*Method A*	Maximum Dry Density: 93.0 PCF	Optimum Moisture Content: 27.3%
			% Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 7.4	CBR at 0.2 in. 6.7	CBR at 0.1 in. 7.4	CBR at 0.2 in. 6.7



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	38		
Initial Dry Density (PCF)	89.1	Final Dry Density (PCF)	88.3
Moisture Content of the Compacted Specimen	27.4%	Moisture Content (top 1" after soaking)	33.7%
Percent Compaction	95.8%	Percent Swell	0.9%

Soak Time:	96 Hrs.	Surcharge Weight	30.4	Surcharge Wt. per sq. Ft.	155.0
Liquid Limit	53	Plastic Index	22	Assumed Apparent Relative Density	2.650

Notes/Deviations/References:

Luis Campos, P.E.		Project Engineer	4/14/2022
Technical Responsibility	*Signature*	*Position*	*Date*

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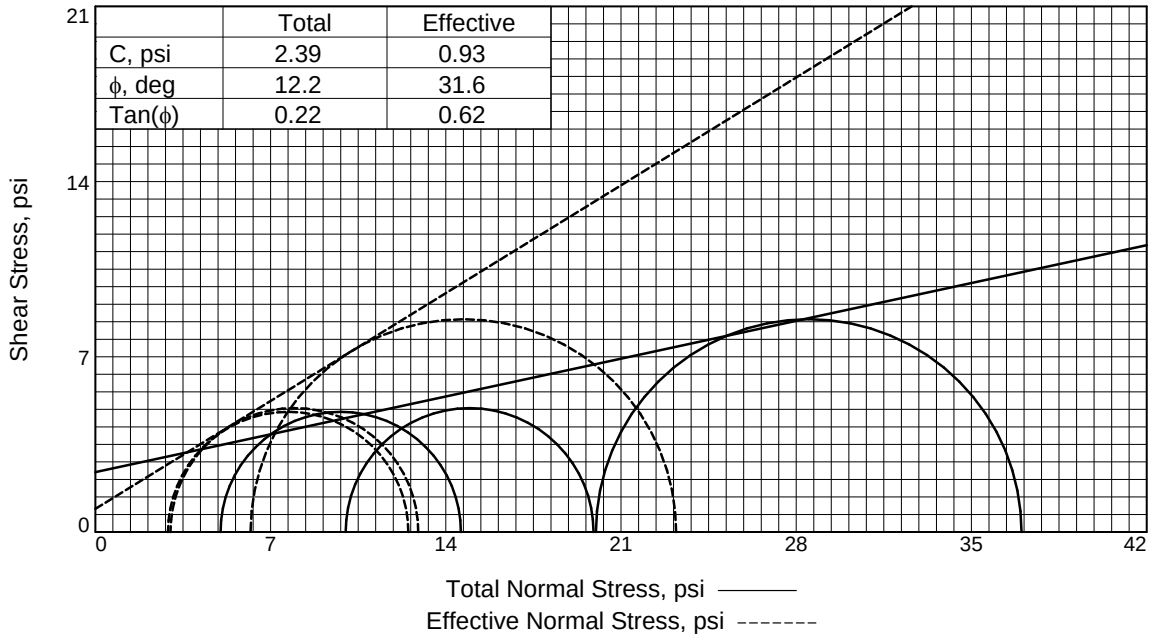
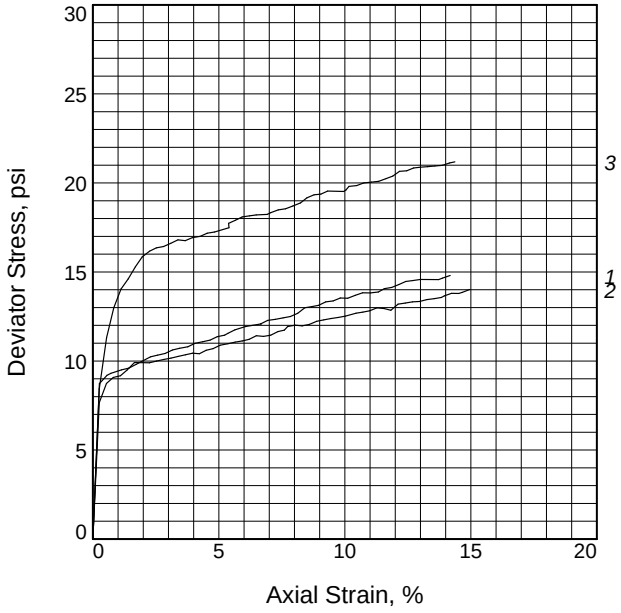
C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1	2	3
Initial	Water Content, %	25.7	25.5	25.5
	Dry Density, pcf	88.9	88.7	89.0
	Saturation, %	79.0	78.0	78.6
	Void Ratio	0.8618	0.8651	0.8589
	Diameter, in.	2.877	2.877	2.874
	Height, in.	5.997	6.012	6.004
At Test	Water Content, %	29.0	30.0	29.7
	Dry Density, pcf	93.5	92.1	92.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7688	0.7959	0.7862
	Diameter, in.	2.828	2.841	2.836
	Height, in.	5.896	5.937	5.925
Strain rate, in./min.		0.009	0.008	0.008
Eff. Cell Pressure, psi		5.0	10.0	20.0
Fail. Stress, psi		9.6	9.9	17.0
Total Pore Pr., psi		72.1	77.0	83.8
Strain, %		1.4	2.2	4.3
Ult. Stress, psi		14.8	14.0	21.2
Total Pore Pr., psi		69.4	74.9	82.0
Strain, %		14.2	15.0	14.4
$\bar{\sigma}_1$ Failure, psi		12.5	12.9	23.2
$\bar{\sigma}_3$ Failure, psi		2.9	3.0	6.2

Type of Test:
CU with Pore Pressures

Sample Type: Remolded

Description: Brown Elastic Silt w/Medium to Fine Sand (MH) A-7-5(25)

LL= 61 **PL=** 35 **PI=** 26

Assumed Specific Gravity= 2.65

Remarks: Remolded to 95% MDD at -1 to +2% over optimum moisture content (AASHTO T-99). All specimens failed in bulge (AASHTO T-296).

B-14

Client: STV Inc.

Project: SCDOT US 21 to SC 51

Location: Borings

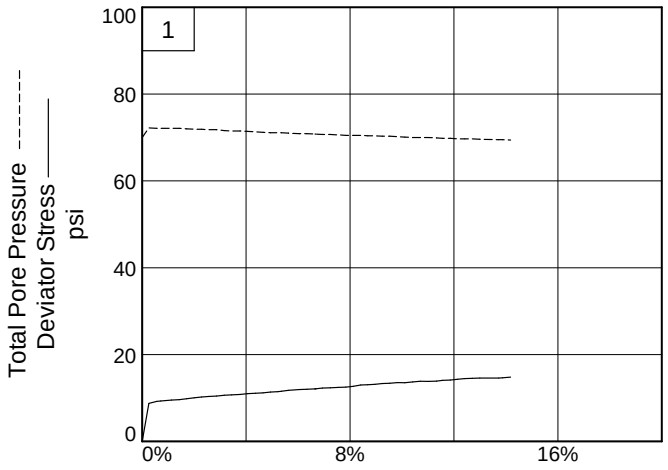
Sample Number: B-14 **Depth:** 0.5-6'

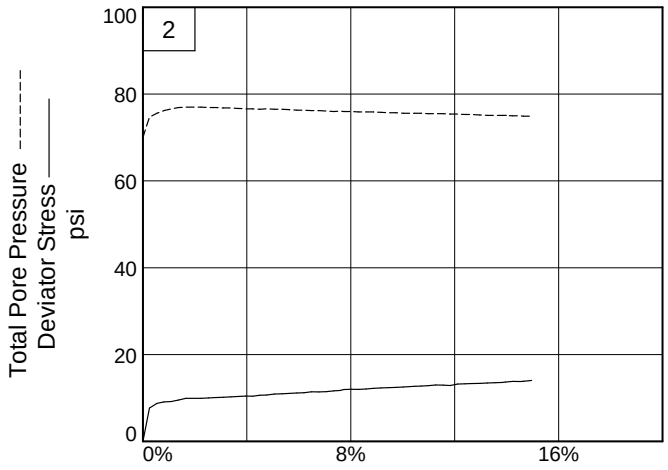
Proj. No.: 1351-12-037 **Date Sampled:** 3/4/22

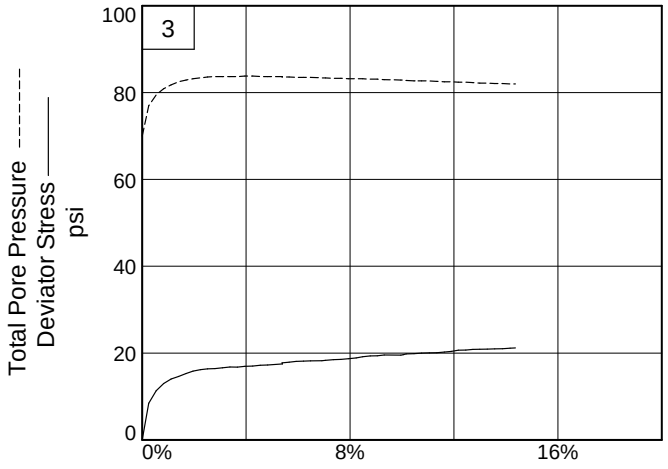
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Charlotte, North Carolina

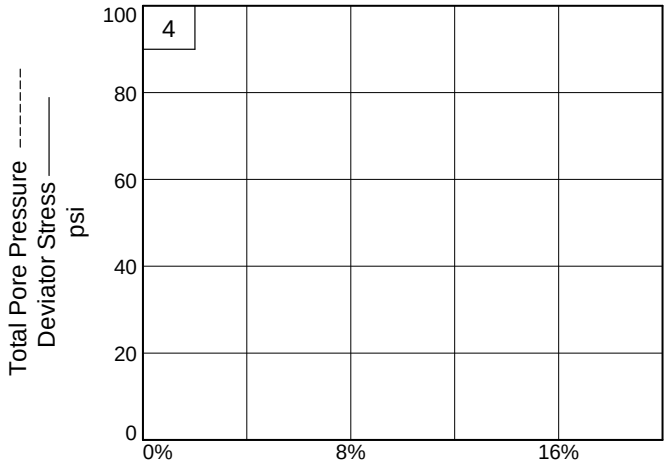
Tested By: Karen Warner **Checked By:** Kristen Hill, P.E. 4/13/22

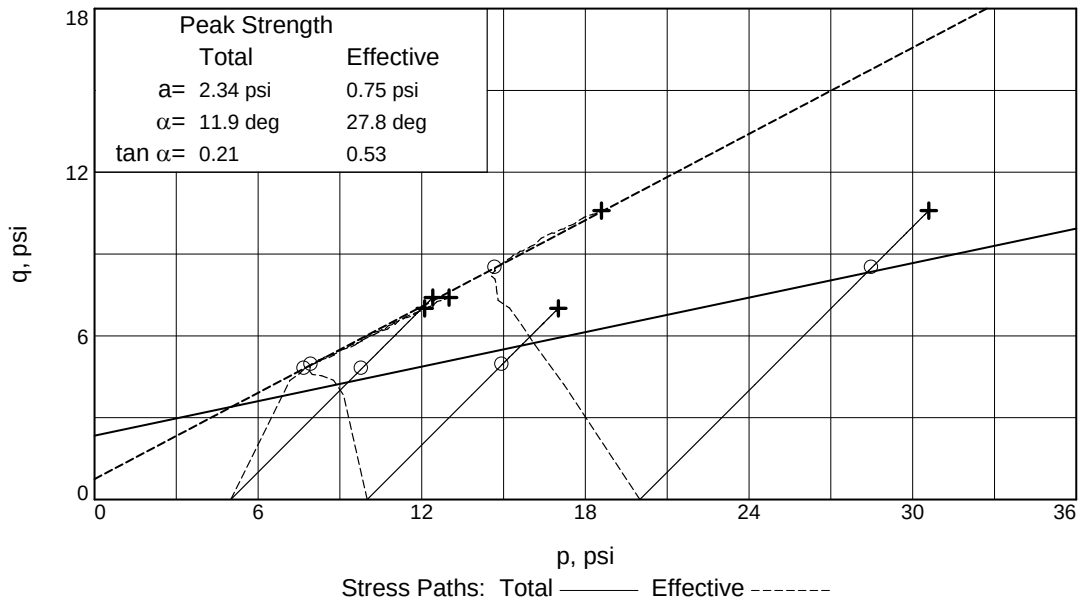
C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.











Client: STV Inc.
Project: SCDOT US 21 to SC 51
Location: Borings **Depth:** 0.5-6' **Sample Number:** B-14
B-14
Project No.: 1351-12-037

S & ME, INC.

Tested By: Karen Warner **Checked By:** Kristen Hill, P.E. 4/13/22

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

4/13/2022
11:52 AM

Date: 3/4/22
Client: STV Inc.
Project: SCDOT US 21 to SC 51
Project No.: 1351-12-037
Location: Borings
Depth: 0.5-6' **Sample Number:** B-14
Description: Brown Elastic Silt w/Medium to Fine Sand (MH) A-7-5(25)
Remarks: Remolded to 95% MDD at -1 to +2% over optimum moisture content (AASHTO T-99). All specimens failed in bulge (AASHTO T-296).
Type of Sample: Remolded
Assumed Specific Gravity=2.65 **LL=**61 **PL=**35 **PI=**26
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	315.650			n/a
Moisture content: Dry soil+tare, gms.	276.930			n/a
Moisture content: Tare, gms.	126.180			n/a
Moisture, %	25.7	29.1	29.0	
Moist specimen weight, gms.	1143.08			
Diameter, in.	2.877	2.830	2.828	
Area, in.²	6.502	6.291	6.283	
Height, in.	5.997	5.900	5.896	
Net decrease in height, in.		0.097	0.004	
Wet density, pcf	111.7	120.5	120.7	
Dry density, pcf	88.9	93.3	93.5	
Void ratio	0.8618	0.7724	0.7688	
Saturation, %	79.0	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 75.00 psi
Consolidation back pressure = 70.00 psi
Consolidation effective confining stress = 5.00 psi
Strain rate, in./min. = 0.009
Fail. Stress = 9.60 psi **at reading no.** 5
Ult. Stress = 14.81 psi **at reading no.** 49

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
0	0.0000	22.400	0.0	0.0	0.00	5.00	5.00	1.00	70.00	5.00	0.00
1	0.0150	77.400	55.0	0.3	8.73	2.80	11.53	4.12	72.20	7.17	4.37
2	0.0330	80.500	58.1	0.6	9.20	2.90	12.10	4.17	72.10	7.50	4.60
3	0.0420	81.300	58.9	0.7	9.31	2.90	12.21	4.21	72.10	7.55	4.65
4	0.0670	82.800	60.4	1.1	9.50	2.90	12.40	4.28	72.10	7.65	4.75
5	0.0840	83.600	61.2	1.4	9.60	2.90	12.50	4.31	72.10	7.70	4.80
6	0.1010	85.100	62.7	1.7	9.81	3.00	12.81	4.27	72.00	7.90	4.90
7	0.1180	86.700	64.3	2.0	10.03	3.10	13.13	4.24	71.90	8.11	5.01
8	0.1350	88.200	65.8	2.3	10.23	3.10	13.33	4.30	71.90	8.22	5.12
9	0.1510	89.000	66.6	2.6	10.33	3.20	13.53	4.23	71.80	8.36	5.16
10	0.1690	89.800	67.4	2.9	10.42	3.20	13.62	4.26	71.80	8.41	5.21
11	0.1860	91.300	68.9	3.2	10.62	3.40	14.02	4.12	71.60	8.71	5.31
12	0.2030	92.100	69.7	3.4	10.71	3.50	14.21	4.06	71.50	8.86	5.36
13	0.2220	92.900	70.5	3.8	10.80	3.50	14.30	4.09	71.50	8.90	5.40
14	0.2390	94.400	72.0	4.1	11.00	3.60	14.60	4.05	71.40	9.10	5.50
15	0.2570	95.200	72.8	4.4	11.08	3.70	14.78	4.00	71.30	9.24	5.54
16	0.2740	96.000	73.6	4.6	11.17	3.80	14.97	3.94	71.20	9.39	5.59
17	0.2910	97.500	75.1	4.9	11.36	3.90	15.26	3.91	71.10	9.58	5.68
18	0.3080	98.300	75.9	5.2	11.45	3.90	15.35	3.94	71.10	9.62	5.72
19	0.3160	99.100	76.7	5.4	11.55	3.90	15.45	3.96	71.10	9.68	5.78
20	0.3320	100.600	78.2	5.6	11.75	4.00	15.75	3.94	71.00	9.87	5.87
21	0.3570	102.200	79.8	6.1	11.93	4.10	16.03	3.91	70.90	10.07	5.97
22	0.3740	102.900	80.5	6.3	12.00	4.10	16.10	3.93	70.90	10.10	6.00
23	0.3920	103.700	81.3	6.6	12.08	4.20	16.28	3.88	70.80	10.24	6.04
24	0.3920	103.700	81.3	6.6	12.08	4.20	16.28	3.88	70.80	10.24	6.04
25	0.4090	105.300	82.9	6.9	12.28	4.30	16.58	3.86	70.70	10.44	6.14
26	0.4270	106.000	83.6	7.2	12.34	4.30	16.64	3.87	70.70	10.47	6.17
27	0.4450	106.800	84.4	7.5	12.42	4.40	16.82	3.82	70.60	10.61	6.21
28	0.4620	107.600	85.2	7.8	12.50	4.50	17.00	3.78	70.50	10.75	6.25
29	0.4790	109.100	86.7	8.1	12.68	4.50	17.18	3.82	70.50	10.84	6.34
30	0.4960	111.500	89.1	8.4	12.99	4.50	17.49	3.89	70.50	10.99	6.49
31	0.5120	112.200	89.8	8.7	13.05	4.60	17.65	3.84	70.40	11.13	6.53
32	0.5280	113.000	90.6	9.0	13.13	4.60	17.73	3.85	70.40	11.16	6.56
33	0.5450	114.600	92.2	9.2	13.32	4.70	18.02	3.83	70.30	11.36	6.66
34	0.5620	115.300	92.9	9.5	13.38	4.70	18.08	3.85	70.30	11.39	6.69
35	0.5790	116.700	94.3	9.8	13.54	4.80	18.34	3.82	70.20	11.57	6.77
36	0.5960	116.900	94.5	10.1	13.52	4.90	18.42	3.76	70.10	11.66	6.76
37	0.6140	118.400	96.0	10.4	13.69	5.00	18.69	3.74	70.00	11.84	6.84
38	0.6310	119.700	97.3	10.7	13.83	5.00	18.83	3.77	70.00	11.91	6.91
39	0.6490	120.000	97.6	11.0	13.82	5.00	18.82	3.76	70.00	11.91	6.91
40	0.6680	120.700	98.3	11.3	13.87	5.10	18.97	3.72	69.90	12.04	6.94
41	0.6820	122.300	99.9	11.6	14.06	5.20	19.26	3.70	69.80	12.23	7.03
42	0.6990	123.100	100.7	11.9	14.13	5.20	19.33	3.72	69.80	12.26	7.06
43	0.7160	124.600	102.2	12.1	14.29	5.30	19.59	3.70	69.70	12.45	7.15
44	0.7320	126.200	103.8	12.4	14.47	5.30	19.77	3.73	69.70	12.54	7.24
45	0.7490	126.900	104.5	12.7	14.52	5.30	19.82	3.74	69.70	12.56	7.26
46	0.7660	127.700	105.3	13.0	14.58	5.40	19.98	3.70	69.60	12.69	7.29

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
47	0.8090	128.500	106.1	13.7	14.57	5.50	20.07	3.65	69.50	12.79	7.29
48	0.8180	129.300	106.9	13.9	14.65	5.50	20.15	3.66	69.50	12.83	7.33
49	0.8360	130.800	108.4	14.2	14.81	5.60	20.41	3.64	69.40	13.00	7.40

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	313.700			n/a
Moisture content: Dry soil+tare, gms.	273.050			n/a
Moisture content: Tare, gms.	113.380			n/a
Moisture, %	25.5	31.6	30.0	
Moist specimen weight, gms.	1141.96			
Diameter, in.	2.877	2.862	2.841	
Area, in.²	6.502	6.435	6.340	
Height, in.	6.012	5.981	5.937	
Net decrease in height, in.		0.031	0.044	
Wet density, pcf	111.3	118.5	119.8	
Dry density, pcf	88.7	90.1	92.1	
Void ratio	0.8651	0.8363	0.7959	
Saturation, %	78.0	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 80.00 psi
Consolidation back pressure = 70.00 psi
Consolidation effective confining stress = 10.00 psi
Strain rate, in./min. = 0.008
Fail. Stress = 9.90 psi **at reading no.** 7
Ult. Stress = 14.02 psi **at reading no.** 53

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
0	0.0000	24.800	0.0	0.0	0.00	10.00	10.00	1.00	70.00	10.00	0.00
1	0.0150	73.500	48.7	0.3	7.66	5.30	12.96	2.45	74.70	9.13	3.83
2	0.0320	80.500	55.7	0.5	8.74	4.40	13.14	2.99	75.60	8.77	4.37
3	0.0480	82.800	58.0	0.8	9.07	3.80	12.87	3.39	76.20	8.34	4.54
4	0.0650	83.600	58.8	1.1	9.17	3.40	12.57	3.70	76.60	7.99	4.59
5	0.0810	85.900	61.1	1.4	9.51	3.10	12.61	4.07	76.90	7.85	4.75
6	0.0980	88.700	63.9	1.7	9.91	3.00	12.91	4.30	77.00	7.96	4.96
7	0.1330	89.000	64.2	2.2	9.90	3.00	12.90	4.30	77.00	7.95	4.95
8	0.1500	89.800	65.0	2.5	9.99	3.10	13.09	4.22	76.90	8.10	5.00
9	0.1670	90.600	65.8	2.8	10.09	3.10	13.19	4.25	76.90	8.14	5.04
10	0.1840	91.300	66.5	3.1	10.16	3.20	13.36	4.18	76.80	8.28	5.08
11	0.2010	92.100	67.3	3.4	10.26	3.20	13.46	4.20	76.80	8.33	5.13
12	0.2180	92.900	68.1	3.7	10.35	3.30	13.65	4.14	76.70	8.47	5.17
13	0.2350	93.700	68.9	4.0	10.44	3.40	13.84	4.07	76.60	8.62	5.22
14	0.2510	93.700	68.9	4.2	10.41	3.40	13.81	4.06	76.60	8.60	5.20
15	0.2670	95.200	70.4	4.5	10.60	3.50	14.10	4.03	76.50	8.80	5.30
16	0.2830	96.000	71.2	4.8	10.70	3.40	14.10	4.15	76.60	8.75	5.35
17	0.3000	97.500	72.7	5.1	10.89	3.50	14.39	4.11	76.50	8.94	5.44
18	0.3180	98.300	73.5	5.4	10.97	3.50	14.47	4.13	76.50	8.99	5.49

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
19	0.3350	99.100	74.3	5.6	11.06	3.60	14.66	4.07	76.40	9.13	5.53
20	0.3520	99.800	75.0	5.9	11.13	3.70	14.83	4.01	76.30	9.26	5.56
21	0.3680	100.600	75.8	6.2	11.21	3.70	14.91	4.03	76.30	9.31	5.61
22	0.3850	102.200	77.4	6.5	11.42	3.80	15.22	4.00	76.20	9.51	5.71
23	0.4020	102.200	77.4	6.8	11.38	3.80	15.18	4.00	76.20	9.49	5.69
24	0.4190	102.900	78.1	7.1	11.45	3.90	15.35	3.94	76.10	9.62	5.72
25	0.4360	104.500	79.7	7.3	11.65	4.00	15.65	3.91	76.00	9.82	5.82
26	0.4510	105.300	80.5	7.6	11.73	3.90	15.63	4.01	76.10	9.77	5.87
27	0.4590	106.800	82.0	7.7	11.93	4.00	15.93	3.98	76.00	9.97	5.97
28	0.4760	107.600	82.8	8.0	12.01	4.00	16.01	4.00	76.00	10.01	6.01
29	0.4930	107.600	82.8	8.3	11.98	4.10	16.08	3.92	75.90	10.09	5.99
30	0.5100	108.400	83.6	8.6	12.05	4.10	16.15	3.94	75.90	10.13	6.03
31	0.5270	109.900	85.1	8.9	12.23	4.10	16.33	3.98	75.90	10.22	6.12
32	0.5440	110.700	85.9	9.2	12.31	4.20	16.51	3.93	75.80	10.35	6.15
33	0.5610	111.500	86.7	9.4	12.38	4.30	16.68	3.88	75.70	10.49	6.19
34	0.5780	112.200	87.4	9.7	12.44	4.30	16.74	3.89	75.70	10.52	6.22
35	0.5950	113.000	88.2	10.0	12.52	4.40	16.92	3.84	75.60	10.66	6.26
36	0.6200	114.600	89.8	10.4	12.69	4.40	17.09	3.88	75.60	10.74	6.34
37	0.6360	115.300	90.5	10.7	12.75	4.40	17.15	3.90	75.60	10.77	6.37
38	0.6520	116.100	91.3	11.0	12.82	4.50	17.32	3.85	75.50	10.91	6.41
39	0.6690	117.600	92.8	11.3	12.99	4.50	17.49	3.89	75.50	10.99	6.49
40	0.6860	117.600	92.8	11.6	12.95	4.50	17.45	3.88	75.50	10.97	6.47
41	0.7020	117.200	92.4	11.8	12.85	4.60	17.45	3.79	75.40	11.03	6.43
42	0.7190	120.000	95.2	12.1	13.20	4.60	17.80	3.87	75.40	11.20	6.60
43	0.7360	120.700	95.9	12.4	13.25	4.70	17.95	3.82	75.30	11.33	6.63
44	0.7530	121.500	96.7	12.7	13.32	4.70	18.02	3.83	75.30	11.36	6.66
45	0.7700	122.000	97.2	13.0	13.34	4.80	18.14	3.78	75.20	11.47	6.67
46	0.7870	123.100	98.3	13.3	13.45	4.90	18.35	3.74	75.10	11.62	6.72
47	0.8040	123.800	99.0	13.5	13.50	4.90	18.40	3.76	75.10	11.65	6.75
48	0.8210	124.600	99.8	13.8	13.56	4.90	18.46	3.77	75.10	11.68	6.78
49	0.8280	125.400	100.6	13.9	13.65	4.90	18.55	3.79	75.10	11.73	6.83
50	0.8450	126.800	102.0	14.2	13.80	5.00	18.80	3.76	75.00	11.90	6.90
51	0.8620	127.100	102.3	14.5	13.79	5.00	18.79	3.76	75.00	11.90	6.90
52	0.8700	127.700	102.9	14.7	13.85	5.10	18.95	3.72	74.90	12.03	6.93
53	0.8880	129.300	104.5	15.0	14.02	5.10	19.12	3.75	74.90	12.11	7.01

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	499.260			n/a
Moisture content: Dry soil+tare, gms.	423.520			n/a
Moisture content: Tare, gms.	126.200			n/a
Moisture, %	25.5	31.7	29.7	
Moist specimen weight, gms.	1142.09			
Diameter, in.	2.874	2.864	2.836	
Area, in.²	6.490	6.444	6.319	
Height, in.	6.004	5.983	5.925	
Net decrease in height, in.		0.021	0.058	
Wet density, pcf	111.7	118.4	120.1	
Dry density, pcf	89.0	89.9	92.6	
Void ratio	0.8589	0.8394	0.7862	
Saturation, %	78.6	100.0	100.0	

Test Readings for Specimen No. 3

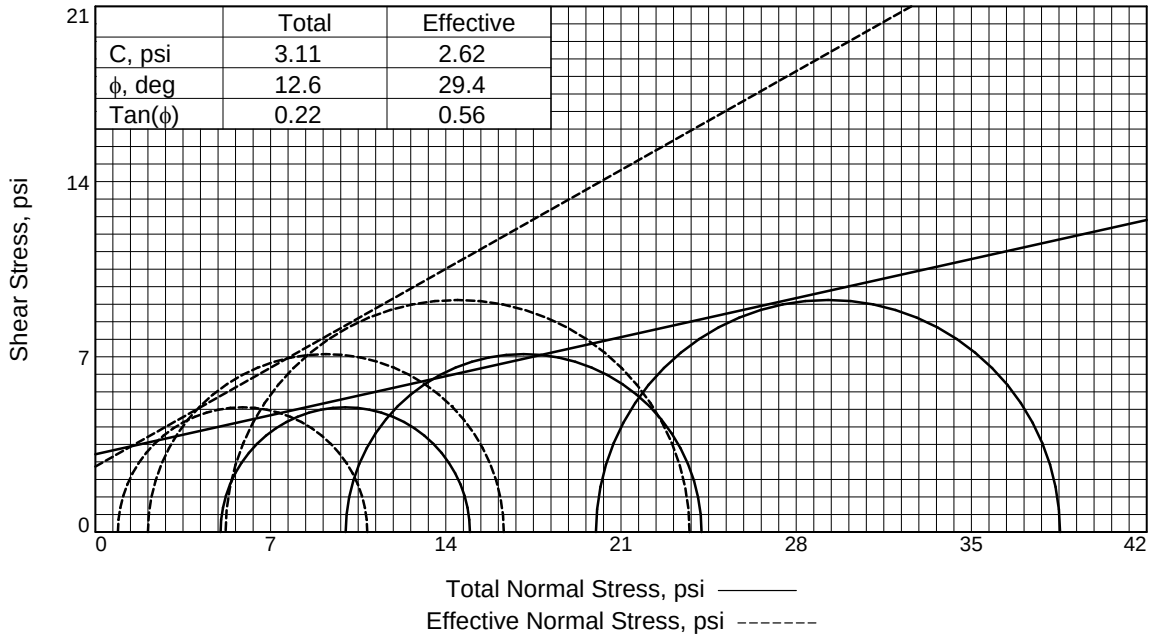
Consolidation cell pressure = 90.00 psi
Consolidation back pressure = 70.00 psi
Consolidation effective confining stress = 20.00 psi
Strain rate, in./min. = 0.008
Fail. Stress = 17.00 psi **at reading no.** 15
Ult. Stress = 21.18 psi **at reading no.** 51

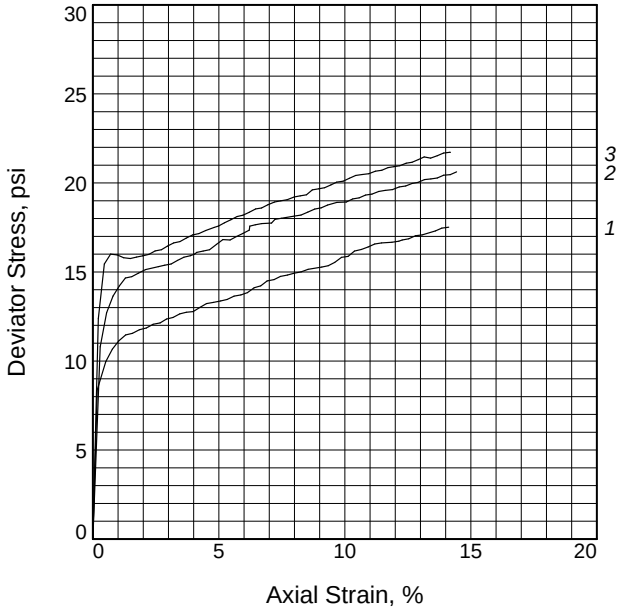
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
0	0.0000	27.900	0.0	0.0	0.00	20.00	20.00	1.00	70.00	20.00	0.00
1	0.0150	81.300	53.4	0.3	8.43	13.00	21.43	1.65	77.00	17.21	4.21
2	0.0320	99.800	71.9	0.5	11.32	10.50	21.82	2.08	79.50	16.16	5.66
3	0.0490	110.700	82.8	0.8	13.00	9.10	22.10	2.43	80.90	15.60	6.50
4	0.0660	117.600	89.7	1.1	14.04	8.20	22.24	2.71	81.80	15.22	7.02
5	0.0830	121.500	93.6	1.4	14.61	7.50	22.11	2.95	82.50	14.80	7.30
6	0.1000	126.200	98.3	1.7	15.29	7.10	22.39	3.15	82.90	14.75	7.65
7	0.1160	130.000	102.1	2.0	15.84	6.80	22.64	3.33	83.20	14.72	7.92
8	0.1330	132.400	104.5	2.2	16.17	6.60	22.77	3.45	83.40	14.68	8.08
9	0.1490	133.900	106.0	2.5	16.35	6.40	22.75	3.56	83.60	14.58	8.18
10	0.1660	134.700	106.8	2.8	16.43	6.30	22.73	3.61	83.70	14.51	8.21
11	0.1830	136.200	108.3	3.1	16.61	6.30	22.91	3.64	83.70	14.61	8.31
12	0.2000	137.800	109.9	3.4	16.81	6.30	23.11	3.67	83.70	14.70	8.40
13	0.2170	137.800	109.9	3.7	16.76	6.30	23.06	3.66	83.70	14.68	8.38
14	0.2340	139.300	111.4	3.9	16.93	6.20	23.13	3.73	83.80	14.67	8.47
15	0.2520	140.100	112.2	4.3	17.00	6.20	23.20	3.74	83.80	14.70	8.50
16	0.2690	141.600	113.7	4.5	17.18	6.30	23.48	3.73	83.70	14.89	8.59
17	0.2860	142.400	114.5	4.8	17.25	6.30	23.55	3.74	83.70	14.92	8.62
18	0.3200	144.700	116.8	5.4	17.49	6.30	23.79	3.78	83.70	15.04	8.74
19	0.3190	146.300	118.4	5.4	17.73	6.40	24.13	3.77	83.60	15.26	8.86
20	0.3350	147.800	119.9	5.7	17.90	6.40	24.30	3.80	83.60	15.35	8.95
21	0.3510	149.400	121.5	5.9	18.09	6.50	24.59	3.78	83.50	15.54	9.04
22	0.3680	150.200	122.3	6.2	18.15	6.50	24.65	3.79	83.50	15.58	9.08
23	0.3840	150.900	123.0	6.5	18.20	6.50	24.70	3.80	83.50	15.60	9.10
24	0.4100	151.700	123.8	6.9	18.24	6.60	24.84	3.76	83.40	15.72	9.12
25	0.4180	152.500	124.6	7.1	18.33	6.60	24.93	3.78	83.40	15.76	9.16

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
26	0.4360	154.000	126.1	7.4	18.49	6.70	25.19	3.76	83.30	15.94	9.24
27	0.4530	154.800	126.9	7.6	18.55	6.70	25.25	3.77	83.30	15.97	9.27
28	0.4700	156.300	128.4	7.9	18.71	6.80	25.51	3.75	83.20	16.15	9.35
29	0.4880	157.900	130.0	8.2	18.88	6.80	25.68	3.78	83.20	16.24	9.44
30	0.5030	160.200	132.3	8.5	19.16	6.80	25.96	3.82	83.20	16.38	9.58
31	0.5200	161.800	133.9	8.8	19.33	6.90	26.23	3.80	83.10	16.57	9.67
32	0.5360	162.500	134.6	9.0	19.37	6.90	26.27	3.81	83.10	16.59	9.69
33	0.5520	164.100	136.2	9.3	19.55	7.00	26.55	3.79	83.00	16.77	9.77
34	0.5900	164.900	137.0	10.0	19.52	7.10	26.62	3.75	82.90	16.86	9.76
35	0.5950	165.600	137.7	10.0	19.60	7.10	26.70	3.76	82.90	16.90	9.80
36	0.6020	167.200	139.3	10.2	19.81	7.20	27.01	3.75	82.80	17.10	9.90
37	0.6200	168.000	140.1	10.5	19.85	7.30	27.15	3.72	82.70	17.23	9.93
38	0.6370	169.500	141.6	10.8	20.00	7.30	27.30	3.74	82.70	17.30	10.00
39	0.6550	170.300	142.4	11.1	20.04	7.30	27.34	3.75	82.70	17.32	10.02
40	0.6720	171.100	143.2	11.3	20.09	7.40	27.49	3.72	82.60	17.45	10.05
41	0.6890	172.600	144.7	11.6	20.24	7.50	27.74	3.70	82.50	17.62	10.12
42	0.7050	174.100	146.2	11.9	20.38	7.50	27.88	3.72	82.50	17.69	10.19
43	0.7210	176.500	148.6	12.2	20.66	7.60	28.26	3.72	82.40	17.93	10.33
44	0.7380	177.200	149.3	12.5	20.68	7.60	28.28	3.72	82.40	17.94	10.34
45	0.7540	178.800	150.9	12.7	20.84	7.70	28.54	3.71	82.30	18.12	10.42
46	0.7700	179.600	151.7	13.0	20.89	7.80	28.69	3.68	82.20	18.24	10.44
47	0.7870	180.300	152.4	13.3	20.92	7.80	28.72	3.68	82.20	18.26	10.46
48	0.8040	181.100	153.2	13.6	20.96	7.90	28.86	3.65	82.10	18.38	10.48
49	0.8220	181.900	154.0	13.9	20.99	7.90	28.89	3.66	82.10	18.40	10.50
50	0.8390	183.400	155.5	14.2	21.12	8.00	29.12	3.64	82.00	18.56	10.56
51	0.8510	184.200	156.3	14.4	21.18	8.00	29.18	3.65	82.00	18.59	10.59

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1	2	3
Initial	Water Content, %	28.5	28.8	28.7
	Dry Density, pcf	88.0	87.7	87.0
	Saturation, %	85.8	85.9	84.5
	Void Ratio	0.8807	0.8872	0.9005
	Diameter, in.	2.877	2.880	2.880
	Height, in.	5.967	5.967	6.007
At Test	Water Content, %	29.4	31.0	33.5
	Dry Density, pcf	93.0	90.8	87.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7779	0.8213	0.8873
	Diameter, in.	2.823	2.846	2.873
	Height, in.	5.857	5.897	5.993
Strain rate, in./min.		0.008	0.008	0.007
Eff. Cell Pressure, psi		5.0	10.0	20.0
Fail. Stress, psi		10.0	14.2	18.5
Total Pore Pr., psi		64.1	67.9	74.8
Strain, %		0.5	1.1	6.5
Ult. Stress, psi		17.5	20.6	21.7
Total Pore Pr., psi		58.8	63.3	72.8
Strain, %		14.1	14.4	14.2
$\bar{\sigma}_1$ Failure, psi		10.9	16.3	23.7
$\bar{\sigma}_3$ Failure, psi		0.9	2.1	5.2

Type of Test:
CU with Pore Pressures

Sample Type: Remolded

Description: Red Medium to Fine Sandy Elastic Silt (MH) A-7-5(12)

LL= 53 **PL=** 31 **PI=** 22

Assumed Specific Gravity= 2.65

Remarks: Remolded to approximately 95% MDD at -1 to +2% over optimum moisture content (AASHTO T-99). Specimens S-1 and S-2 failed in shear, S-3 failed in bulge (AASHTO T-296).

B-17

Client: STV Inc.

Project: SCDOT US 21 to SC 51

Location: Borings

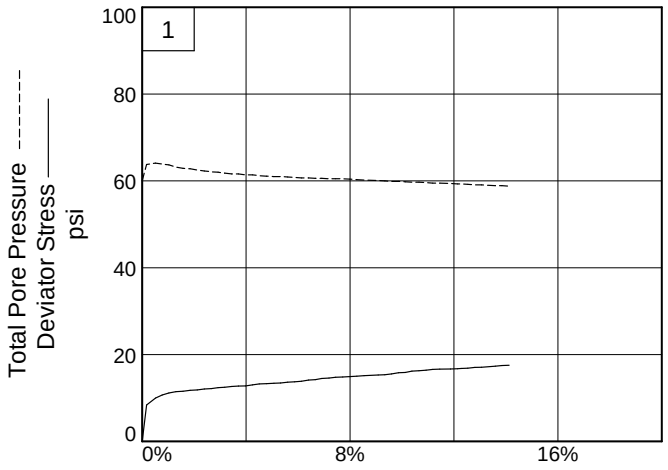
Sample Number: B-17 **Depth:** 0.5-10'

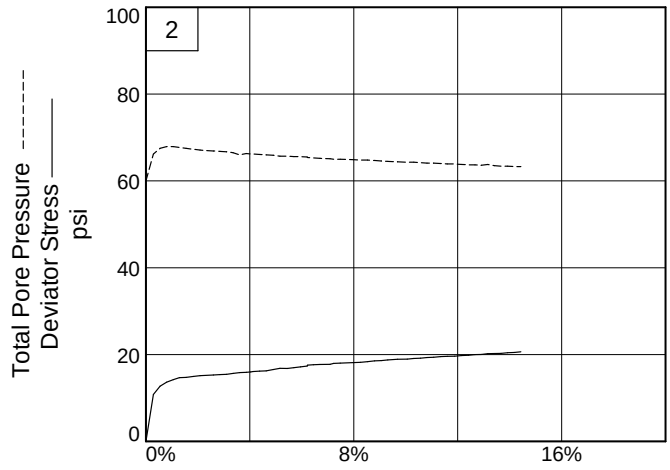
Proj. No.: 1351-12-037 **Date Sampled:** 3/25/22

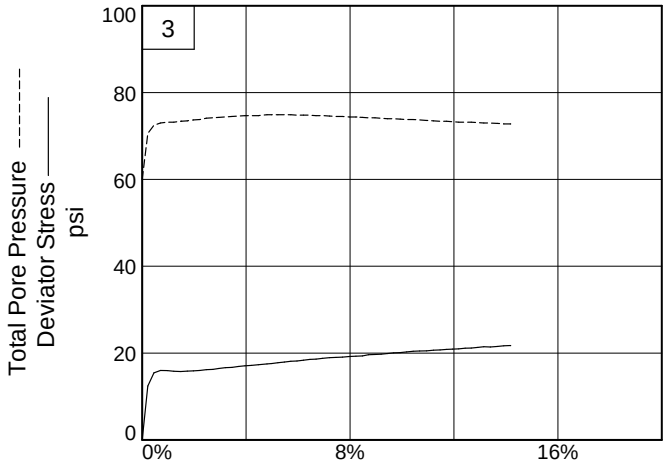
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Charlotte, North Carolina

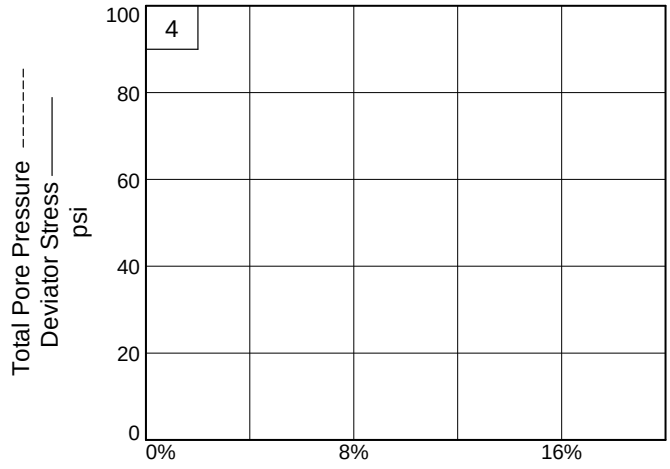
Tested By: Karen Warner **Checked By:** Kristen Hill, P.E.

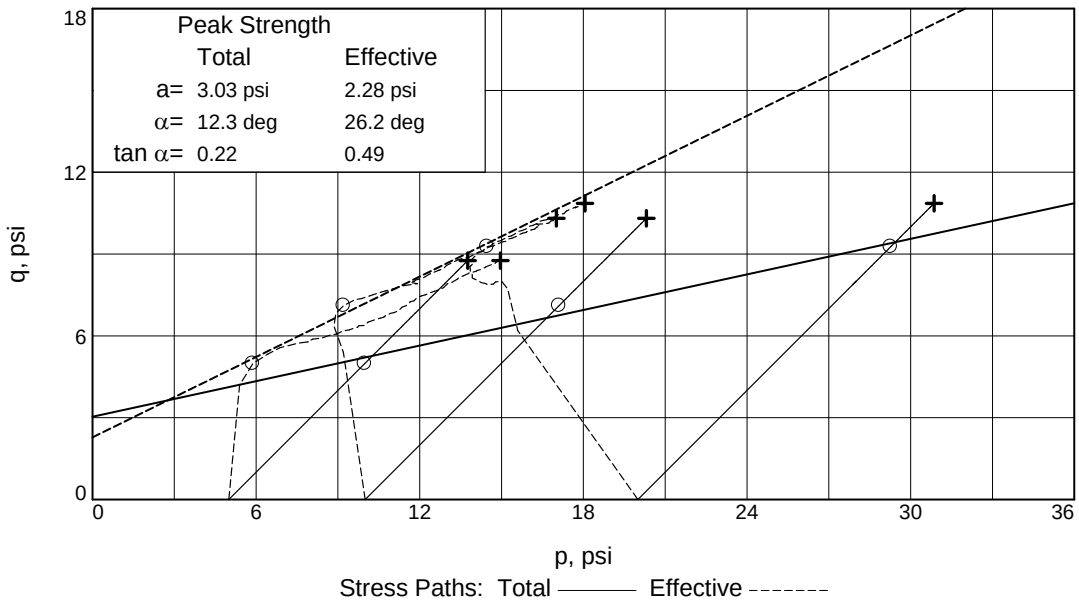
C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.











Client: STV Inc.
Project: SCDOT US 21 to SC 51
Location: Borings **Depth:** 0.5-10' **Sample Number:** B-17
B-17
Project No.: 1351-12-037

S & ME, INC.

Tested By: Karen Warner **Checked By:** Kristen Hill, P.E.

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

4/14/2022
9:53 AM

Date: 3/25/22
Client: STV Inc.
Project: SCDOT US 21 to SC 51
Project No.: 1351-12-037
Location: Borings
Depth: 0.5-10' **Sample Number:** B-17
Description: Red Medium to Fine Sandy Elastic Silt (MH) A-7-5(12)
Remarks: Remolded to approximately 95% MDD at -1 to +2% over optimum moisture content (AASHTO T-99). Specimens S-1 and S-2 failed in shear, S-3 failed in bulge (AASHTO T-296).
Type of Sample: Remolded
Assumed Specific Gravity=2.65 **LL=**53 **PL=**31 **PI=**22
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	147.130			1325.720
Moisture content: Dry soil+tare, gms.	116.290			1036.350
Moisture content: Tare, gms.	8.090			124.720
Moisture, %	28.5	33.1	29.4	31.7
Moist specimen weight, gms.	1150.99			
Diameter, in.	2.877	2.875	2.823	
Area, in.²	6.501	6.492	6.261	
Height, in.	5.967	5.963	5.857	
Net decrease in height, in.		0.004	0.106	
Wet density, pcf	113.0	117.3	120.4	
Dry density, pcf	88.0	88.1	93.0	
Void ratio	0.8807	0.8769	0.7779	
Saturation, %	85.8	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 65.00 psi
Consolidation back pressure = 60.00 psi
Consolidation effective confining stress = 5.00 psi
Strain rate, in./min. = 0.008
Fail. Stress = 9.96 psi **at reading no.** 2
Ult. Stress = 17.52 psi **at reading no.** 51

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
0	0.0000	24.800	0.0	0.0	0.00	5.00	5.00	1.00	60.00	5.00	0.00
1	0.0100	77.400	52.6	0.2	8.39	1.20	9.59	7.99	63.80	5.39	4.19
2	0.0300	87.500	62.7	0.5	9.96	0.90	10.86	12.07	64.10	5.88	4.98
3	0.0450	92.100	67.3	0.8	10.67	1.10	11.77	10.70	63.90	6.43	5.33
4	0.0600	95.200	70.4	1.0	11.13	1.30	12.43	9.56	63.70	6.86	5.56
5	0.0760	97.500	72.7	1.3	11.46	1.80	13.26	7.37	63.20	7.53	5.73
6	0.0920	98.300	73.5	1.6	11.55	2.10	13.65	6.50	62.90	7.88	5.78
7	0.1080	99.800	75.0	1.8	11.76	2.20	13.96	6.34	62.80	8.08	5.88
8	0.1240	100.600	75.8	2.1	11.85	2.50	14.35	5.74	62.50	8.43	5.93
9	0.1400	102.200	77.4	2.4	12.07	2.70	14.77	5.47	62.30	8.73	6.03
10	0.1560	102.900	78.1	2.7	12.14	2.90	15.04	5.19	62.10	8.97	6.07
11	0.1710	104.500	79.7	2.9	12.36	3.00	15.36	5.12	62.00	9.18	6.18
12	0.1860	105.300	80.5	3.2	12.45	3.20	15.65	4.89	61.80	9.42	6.22
13	0.2020	106.800	82.0	3.4	12.64	3.40	16.04	4.72	61.60	9.72	6.32
14	0.2170	107.600	82.8	3.7	12.73	3.40	16.13	4.75	61.60	9.77	6.37
15	0.2330	108.100	83.3	4.0	12.77	3.60	16.37	4.55	61.40	9.99	6.39
16	0.2490	109.900	85.1	4.3	13.01	3.60	16.61	4.61	61.40	10.11	6.51
17	0.2640	111.500	86.7	4.5	13.22	3.80	17.02	4.48	61.20	10.41	6.61
18	0.2800	112.200	87.4	4.8	13.29	3.90	17.19	4.41	61.10	10.55	6.65
19	0.2970	113.000	88.2	5.1	13.37	4.00	17.37	4.34	61.00	10.69	6.69
20	0.3120	113.800	89.0	5.3	13.46	4.00	17.46	4.36	61.00	10.73	6.73
21	0.3280	115.300	90.5	5.6	13.64	4.10	17.74	4.33	60.90	10.92	6.82
22	0.3440	116.000	91.2	5.9	13.71	4.20	17.91	4.26	60.80	11.06	6.86
23	0.3590	117.100	92.3	6.1	13.84	4.30	18.14	4.22	60.70	11.22	6.92
24	0.3750	119.200	94.4	6.4	14.11	4.30	18.41	4.28	60.70	11.36	7.06
25	0.3900	120.200	95.4	6.7	14.22	4.40	18.62	4.23	60.60	11.51	7.11
26	0.4050	122.300	97.5	6.9	14.50	4.40	18.90	4.29	60.60	11.65	7.25
27	0.4210	123.100	98.3	7.2	14.57	4.50	19.07	4.24	60.50	11.79	7.29
28	0.4360	124.600	99.8	7.4	14.75	4.50	19.25	4.28	60.50	11.88	7.38
29	0.4520	125.400	100.6	7.7	14.83	4.50	19.33	4.29	60.50	11.91	7.41
30	0.4680	126.400	101.6	8.0	14.93	4.60	19.53	4.25	60.40	12.07	7.47
31	0.4840	127.200	102.4	8.3	15.00	4.70	19.70	4.19	60.30	12.20	7.50
32	0.5000	128.500	103.7	8.5	15.15	4.80	19.95	4.16	60.20	12.37	7.57
33	0.5320	130.000	105.2	9.1	15.28	4.90	20.18	4.12	60.10	12.54	7.64
34	0.5470	130.800	106.0	9.3	15.35	5.00	20.35	4.07	60.00	12.67	7.67
35	0.5620	132.400	107.6	9.6	15.54	5.10	20.64	4.05	59.90	12.87	7.77
36	0.5780	134.700	109.9	9.9	15.82	5.10	20.92	4.10	59.90	13.01	7.91
37	0.5930	135.400	110.6	10.1	15.88	5.20	21.08	4.05	59.80	13.14	7.94
38	0.6080	137.800	113.0	10.4	16.17	5.30	21.47	4.05	59.70	13.39	8.09
39	0.6240	138.800	114.0	10.7	16.27	5.30	21.57	4.07	59.70	13.43	8.13
40	0.6400	140.100	115.3	10.9	16.40	5.40	21.80	4.04	59.60	13.60	8.20
41	0.6550	141.600	116.8	11.2	16.57	5.50	22.07	4.01	59.50	13.78	8.28
42	0.6710	142.400	117.6	11.5	16.63	5.50	22.13	4.02	59.50	13.82	8.32
43	0.6950	143.200	118.4	11.9	16.67	5.60	22.27	3.98	59.40	13.93	8.33
44	0.7110	144.000	119.2	12.1	16.73	5.70	22.43	3.93	59.30	14.06	8.36
45	0.7190	144.700	119.9	12.3	16.80	5.70	22.50	3.95	59.30	14.10	8.40
46	0.7340	145.500	120.7	12.5	16.86	5.80	22.66	3.91	59.20	14.23	8.43

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
47	0.7500	147.100	122.3	12.8	17.03	5.90	22.93	3.89	59.10	14.42	8.52
48	0.7650	147.800	123.0	13.1	17.08	5.90	22.98	3.89	59.10	14.44	8.54
49	0.7960	150.200	125.4	13.6	17.31	6.10	23.41	3.84	58.90	14.75	8.65
50	0.8110	151.700	126.9	13.8	17.46	6.10	23.56	3.86	58.90	14.83	8.73
51	0.8270	152.500	127.7	14.1	17.52	6.20	23.72	3.83	58.80	14.96	8.76

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	218.690			1348.140
Moisture content: Dry soil+tare, gms.	171.690			1061.320
Moisture content: Tare, gms.	8.330			151.000
Moisture, %	28.8	33.3	31.0	31.5
Moist specimen weight, gms.	1151.83			
Diameter, in.	2.880	2.878	2.846	
Area, in.²	6.514	6.503	6.362	
Height, in.	5.967	5.962	5.897	
Net decrease in height, in.		0.005	0.065	
Wet density, pcf	112.9	117.1	119.0	
Dry density, pcf	87.7	87.9	90.8	
Void ratio	0.8872	0.8824	0.8213	
Saturation, %	85.9	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 70.00 psi
Consolidation back pressure = 60.00 psi
Consolidation effective confining stress = 10.00 psi
Strain rate, in./min. = 0.008
Fail. Stress = 14.22 psi **at reading no.** 4
Ult. Stress = 20.62 psi **at reading no.** 55

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
0	0.0000	13.900	0.0	0.0	0.00	10.00	10.00	1.00	60.00	10.00	0.00
1	0.0170	82.800	68.9	0.3	10.80	3.80	14.60	3.84	66.20	9.20	5.40
2	0.0320	95.200	81.3	0.5	12.71	2.50	15.21	6.08	67.50	8.86	6.36
3	0.0470	101.400	87.5	0.8	13.64	2.10	15.74	7.50	67.90	8.92	6.82
4	0.0620	105.300	91.4	1.1	14.22	2.10	16.32	7.77	67.90	9.21	7.11
5	0.0760	108.400	94.5	1.3	14.66	2.30	16.96	7.38	67.70	9.63	7.33
6	0.0910	109.100	95.2	1.5	14.73	2.50	17.23	6.89	67.50	9.87	7.37
7	0.1070	110.700	96.8	1.8	14.94	2.70	17.64	6.53	67.30	10.17	7.47
8	0.1230	112.200	98.3	2.1	15.13	2.90	18.03	6.22	67.10	10.46	7.56
9	0.1530	113.800	99.9	2.6	15.30	3.10	18.40	5.93	66.90	10.75	7.65
10	0.1680	114.600	100.7	2.8	15.38	3.20	18.58	5.81	66.80	10.89	7.69
11	0.1830	115.300	101.4	3.1	15.44	3.30	18.74	5.68	66.70	11.02	7.72
12	0.1980	116.900	103.0	3.4	15.65	3.50	19.15	5.47	66.50	11.32	7.82
13	0.2130	118.400	104.5	3.6	15.83	4.00	19.83	4.96	66.00	11.92	7.92
14	0.2280	119.200	105.3	3.9	15.91	3.70	19.61	5.30	66.30	11.66	7.96
15	0.2380	120.000	106.1	4.0	16.01	3.80	19.81	5.21	66.20	11.80	8.00
16	0.2430	120.700	106.8	4.1	16.10	3.80	19.90	5.24	66.20	11.85	8.05

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
17	0.2580	121.500	107.6	4.4	16.17	3.90	20.07	5.15	66.10	11.99	8.09
18	0.2730	122.300	108.4	4.6	16.25	4.00	20.25	5.06	66.00	12.13	8.13
19	0.2890	124.600	110.7	4.9	16.55	4.10	20.65	5.04	65.90	12.37	8.27
20	0.3040	126.700	112.8	5.2	16.82	4.30	21.12	4.91	65.70	12.71	8.41
21	0.3210	126.900	113.0	5.4	16.80	4.30	21.10	4.91	65.70	12.70	8.40
22	0.3360	128.500	114.6	5.7	16.99	4.40	21.39	4.86	65.60	12.89	8.49
23	0.3510	130.000	116.1	6.0	17.16	4.40	21.56	4.90	65.60	12.98	8.58
24	0.3660	131.600	117.7	6.2	17.35	4.50	21.85	4.86	65.50	13.18	8.68
25	0.3670	133.100	119.2	6.2	17.57	4.60	22.17	4.82	65.40	13.39	8.79
26	0.3800	133.900	120.0	6.4	17.65	4.70	22.35	4.75	65.30	13.52	8.82
27	0.3950	134.700	120.8	6.7	17.72	4.80	22.52	4.69	65.20	13.66	8.86
28	0.4180	135.400	121.5	7.1	17.75	4.90	22.65	4.62	65.10	13.77	8.87
29	0.4260	137.000	123.1	7.2	17.95	5.00	22.95	4.59	65.00	13.98	8.98
30	0.4410	137.800	123.9	7.5	18.02	5.00	23.02	4.60	65.00	14.01	9.01
31	0.4710	139.300	125.4	8.0	18.14	5.10	23.24	4.56	64.90	14.17	9.07
32	0.4870	140.100	126.2	8.3	18.20	5.20	23.40	4.50	64.80	14.30	9.10
33	0.5030	141.600	127.7	8.5	18.36	5.20	23.56	4.53	64.80	14.38	9.18
34	0.5190	143.200	129.3	8.8	18.54	5.30	23.84	4.50	64.70	14.57	9.27
35	0.5340	144.000	130.1	9.1	18.60	5.40	24.00	4.44	64.60	14.70	9.30
36	0.5490	145.500	131.6	9.3	18.76	5.50	24.26	4.41	64.50	14.88	9.38
37	0.5710	147.100	133.2	9.7	18.91	5.60	24.51	4.38	64.40	15.06	9.46
38	0.5930	147.800	133.9	10.1	18.93	5.70	24.63	4.32	64.30	15.17	9.47
39	0.6080	149.400	135.5	10.3	19.10	5.70	24.80	4.35	64.30	15.25	9.55
40	0.6230	150.200	136.3	10.6	19.16	5.80	24.96	4.30	64.20	15.38	9.58
41	0.6380	151.700	137.8	10.8	19.32	5.90	25.22	4.27	64.10	15.56	9.66
42	0.6530	152.500	138.6	11.1	19.37	5.90	25.27	4.28	64.10	15.59	9.69
43	0.6690	154.000	140.1	11.3	19.52	6.00	25.52	4.25	64.00	15.76	9.76
44	0.6840	154.800	140.9	11.6	19.58	6.10	25.68	4.21	63.90	15.89	9.79
45	0.7010	155.600	141.7	11.9	19.63	6.10	25.73	4.22	63.90	15.91	9.81
46	0.7170	157.100	143.2	12.2	19.77	6.20	25.97	4.19	63.80	16.09	9.89
47	0.7320	157.900	144.0	12.4	19.83	6.30	26.13	4.15	63.70	16.21	9.91
48	0.7470	159.400	145.5	12.7	19.97	6.30	26.27	4.17	63.70	16.29	9.99
49	0.7610	160.200	146.3	12.9	20.03	6.40	26.43	4.13	63.60	16.41	10.01
50	0.7760	161.800	147.9	13.2	20.19	6.20	26.39	4.26	63.80	16.29	10.09
51	0.7910	162.500	148.6	13.4	20.23	6.50	26.73	4.11	63.50	16.61	10.11
52	0.8060	163.300	149.4	13.7	20.27	6.60	26.87	4.07	63.40	16.74	10.14
53	0.8210	164.900	151.0	13.9	20.43	6.60	27.03	4.10	63.40	16.82	10.22
54	0.8360	165.600	151.7	14.2	20.47	6.70	27.17	4.05	63.30	16.93	10.23
55	0.8510	167.200	153.3	14.4	20.62	6.70	27.32	4.08	63.30	17.01	10.31

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	390.980			1323.370
Moisture content: Dry soil+tare, gms.	329.030			1037.250
Moisture content: Tare, gms.	113.360			126.520
Moisture, %	28.7	33.6	33.5	31.4
Moist specimen weight, gms.	1150.98			
Diameter, in.	2.880	2.874	2.873	
Area, in.²	6.514	6.488	6.484	
Height, in.	6.007	5.995	5.993	
Net decrease in height, in.		0.012	0.002	
Wet density, pcf	112.1	117.0	117.0	
Dry density, pcf	87.0	87.6	87.7	
Void ratio	0.9005	0.8891	0.8873	
Saturation, %	84.5	100.0	100.0	

Test Readings for Specimen No. 3

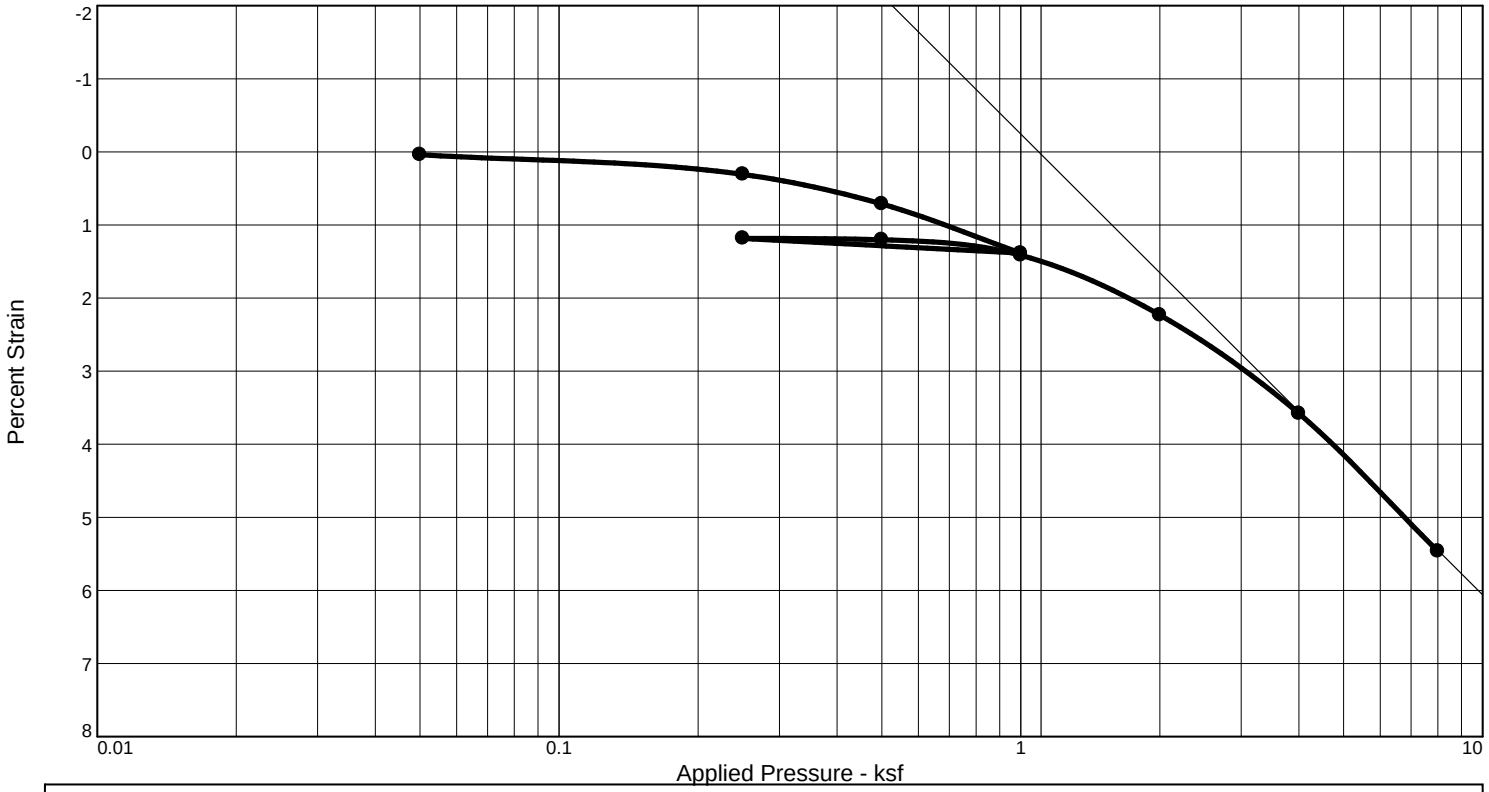
Consolidation cell pressure = 80.00 psi
Consolidation back pressure = 60.00 psi
Consolidation effective confining stress = 20.00 psi
Strain rate, in./min. = 0.007
Fail. Stress = 18.54 psi **at reading no.** 26
Ult. Stress = 21.72 psi **at reading no.** 58

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
0	0.0000	12.400	0.0	0.0	0.00	20.00	20.00	1.00	60.00	20.00	0.00
1	0.0130	92.900	80.5	0.2	12.39	9.40	21.79	2.32	70.60	15.59	6.19
2	0.0270	113.000	100.6	0.5	15.45	7.50	22.95	3.06	72.50	15.22	7.72
3	0.0420	116.900	104.5	0.7	16.00	7.00	23.00	3.29	73.00	15.00	8.00
4	0.0580	116.900	104.5	1.0	15.96	6.80	22.76	3.35	73.20	14.78	7.98
5	0.0730	116.100	103.7	1.2	15.80	6.80	22.60	3.32	73.20	14.70	7.90
6	0.0890	116.100	103.7	1.5	15.76	6.60	22.36	3.39	73.40	14.48	7.88
7	0.1040	116.900	104.5	1.7	15.84	6.50	22.34	3.44	73.50	14.42	7.92
8	0.1180	117.600	105.2	2.0	15.90	6.30	22.20	3.52	73.70	14.25	7.95
9	0.1330	118.400	106.0	2.2	15.99	6.20	22.19	3.58	73.80	14.19	7.99
10	0.1480	120.000	107.6	2.5	16.18	5.90	22.08	3.74	74.10	13.99	8.09
11	0.1630	120.700	108.3	2.7	16.25	5.80	22.05	3.80	74.20	13.92	8.12
12	0.1770	122.300	109.9	3.0	16.45	5.70	22.15	3.89	74.30	13.92	8.22
13	0.1920	123.800	111.4	3.2	16.63	5.60	22.23	3.97	74.40	13.92	8.32
14	0.2070	124.600	112.2	3.5	16.71	5.50	22.21	4.04	74.50	13.85	8.35
15	0.2220	126.200	113.8	3.7	16.90	5.40	22.30	4.13	74.60	13.85	8.45
16	0.2370	127.700	115.3	4.0	17.08	5.30	22.38	4.22	74.70	13.84	8.54
17	0.2520	128.500	116.1	4.2	17.15	5.30	22.45	4.24	74.70	13.88	8.58
18	0.2680	130.000	117.6	4.5	17.33	5.30	22.63	4.27	74.70	13.96	8.66
19	0.2880	131.600	119.2	4.8	17.50	5.10	22.60	4.43	74.90	13.85	8.75
20	0.2990	132.400	120.0	5.0	17.58	5.10	22.68	4.45	74.90	13.89	8.79
21	0.3130	133.900	121.5	5.2	17.76	5.10	22.86	4.48	74.90	13.98	8.88
22	0.3280	135.400	123.0	5.5	17.93	5.10	23.03	4.52	74.90	14.07	8.97
23	0.3430	137.000	124.6	5.7	18.12	5.10	23.22	4.55	74.90	14.16	9.06
24	0.3570	137.800	125.4	6.0	18.19	5.20	23.39	4.50	74.80	14.29	9.09
25	0.3720	139.300	126.9	6.2	18.36	5.20	23.56	4.53	74.80	14.38	9.18

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Eff. Stress psi	Major Eff. Stress psi	1:3 Ratio	Pore Press. psi	P psi	Q psi
26	0.3870	140.900	128.5	6.5	18.54	5.20	23.74	4.57	74.80	14.47	9.27
27	0.4010	141.600	129.2	6.7	18.59	5.30	23.89	4.51	74.70	14.60	9.30
28	0.4160	143.200	130.8	6.9	18.77	5.30	24.07	4.54	74.70	14.69	9.39
29	0.4320	144.700	132.3	7.2	18.93	5.40	24.33	4.51	74.60	14.87	9.47
30	0.4470	145.500	133.1	7.5	19.00	5.50	24.50	4.45	74.50	15.00	9.50
31	0.4620	146.300	133.9	7.7	19.06	5.50	24.56	4.47	74.50	15.03	9.53
32	0.4790	147.800	135.4	8.0	19.21	5.60	24.81	4.43	74.40	15.21	9.61
33	0.4930	148.600	136.2	8.2	19.28	5.60	24.88	4.44	74.40	15.24	9.64
34	0.5080	149.400	137.0	8.5	19.34	5.70	25.04	4.39	74.30	15.37	9.67
35	0.5220	151.700	139.3	8.7	19.61	5.80	25.41	4.38	74.20	15.61	9.81
36	0.5370	152.500	140.1	9.0	19.67	5.80	25.47	4.39	74.20	15.64	9.84
37	0.5510	153.300	140.9	9.2	19.73	5.90	25.63	4.34	74.10	15.77	9.87
38	0.5660	154.800	142.4	9.4	19.89	6.00	25.89	4.31	74.00	15.94	9.94
39	0.5800	156.300	143.9	9.7	20.05	6.00	26.05	4.34	74.00	16.02	10.02
40	0.5950	157.100	144.7	9.9	20.10	6.10	26.20	4.30	73.90	16.15	10.05
41	0.6100	158.700	146.3	10.2	20.27	6.20	26.47	4.27	73.80	16.33	10.13
42	0.6250	160.200	147.8	10.4	20.42	6.20	26.62	4.29	73.80	16.41	10.21
43	0.6400	161.000	148.6	10.7	20.47	6.30	26.77	4.25	73.70	16.54	10.24
44	0.6560	161.800	149.4	10.9	20.52	6.40	26.92	4.21	73.60	16.66	10.26
45	0.6720	163.300	150.9	11.2	20.66	6.50	27.16	4.18	73.50	16.83	10.33
46	0.6870	164.100	151.7	11.5	20.71	6.60	27.31	4.14	73.40	16.96	10.36
47	0.7020	165.600	153.2	11.7	20.86	6.60	27.46	4.16	73.40	17.03	10.43
48	0.7160	166.400	154.0	11.9	20.91	6.70	27.61	4.12	73.30	17.16	10.46
49	0.7300	167.200	154.8	12.2	20.97	6.80	27.77	4.08	73.20	17.28	10.48
50	0.7450	168.700	156.3	12.4	21.11	6.80	27.91	4.10	73.20	17.35	10.55
51	0.7590	169.500	157.1	12.7	21.16	6.80	27.96	4.11	73.20	17.38	10.58
52	0.7740	171.100	158.7	12.9	21.31	6.90	28.21	4.09	73.10	17.56	10.66
53	0.7880	172.600	160.2	13.1	21.46	7.00	28.46	4.07	73.00	17.73	10.73
54	0.8030	172.600	160.2	13.4	21.40	7.00	28.40	4.06	73.00	17.70	10.70
55	0.8190	174.100	161.7	13.7	21.53	7.10	28.63	4.03	72.90	17.87	10.77
56	0.8340	175.700	163.3	13.9	21.68	7.20	28.88	4.01	72.80	18.04	10.84
57	0.8490	176.500	164.1	14.2	21.72	7.20	28.92	4.02	72.80	18.06	10.86
58	0.8500	176.500	164.1	14.2	21.72	7.20	28.92	4.02	72.80	18.06	10.86

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
3	0.50	2.758		10	8.00	0.835					
4	1.00	1.765									
5	0.25	3.496									
6	0.50	0.037									
7	1.00	2.871									
8	2.00	1.233									
9	4.00	1.489									

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
80.6 %	19.4 %	101.0	37	16	2.65	2.2	0.10	0.640

MATERIAL DESCRIPTION	USCS	AASHTO
Brown Red Medium to Fine Sandy Lean Clay (CL) A-6(8)	CL	A-6(8)

Project No. 1351-12-037 **Client:** STV Inc.

Project: SCDOT US 21 to SC 51

Location: Borings **Depth:** 2.0-4.0 **Sample Number:** B-15 ST-1

S & ME, INC.

Charlotte, North Carolina

Remarks:
AASHTO T-216 Method B-Inundated

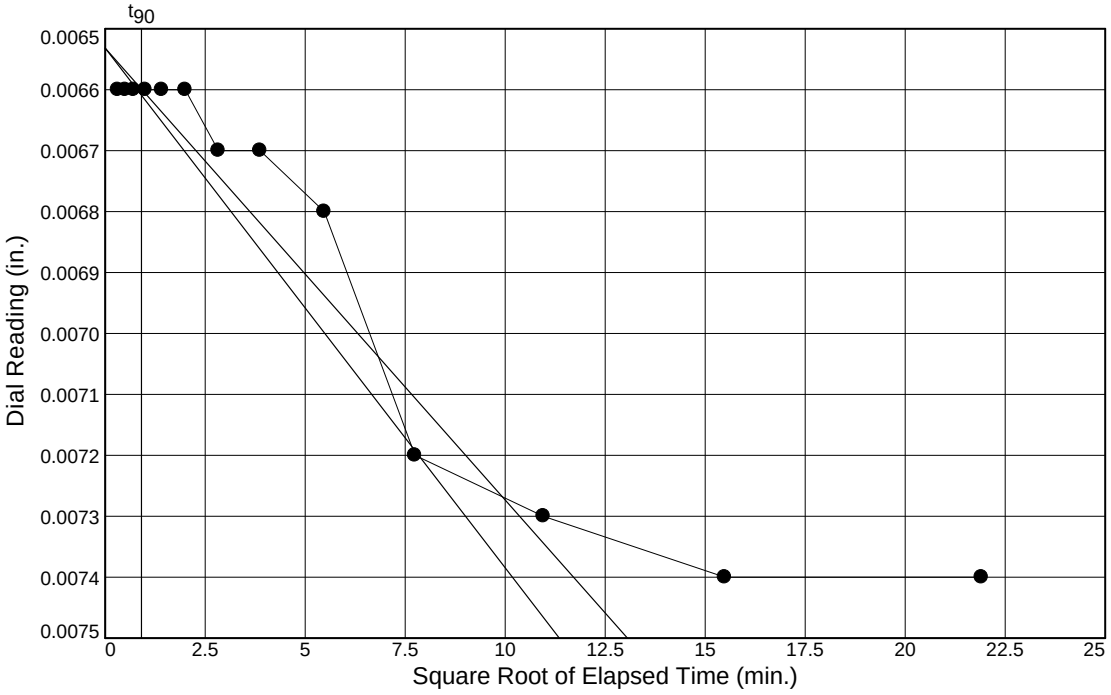
B-15 ST-1

Tested By: Karen Warner **Checked By:** Jason Reeves, P.E.

Dial Reading vs. Time

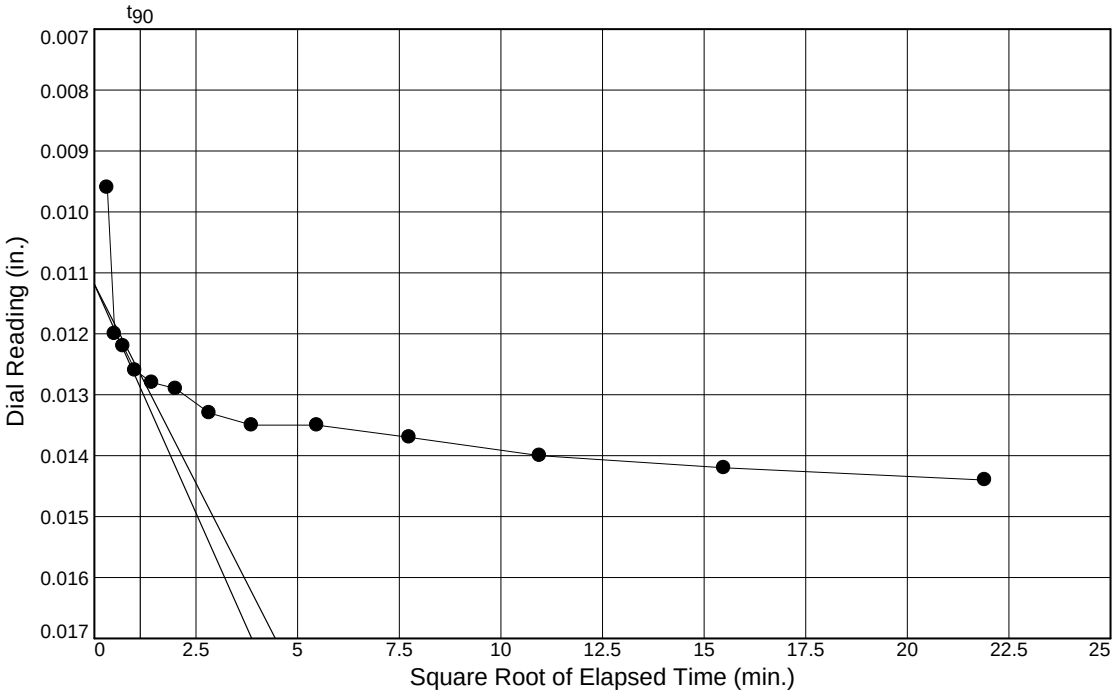
Project No.: 1351-12-037
Project: SCDOT US 21 to SC 51

Location: Borings Depth: 2.0-4.0 Sample Number: B-15 ST-1



Load No.= 3
Load= 0.50 ksf
D_0 = 0.0065
D_{90} = 0.0066
D_{100} = 0.0066
T_{90} = 0.82 min.

C_v @ T_{90}
2.758 ft.^{2}/day



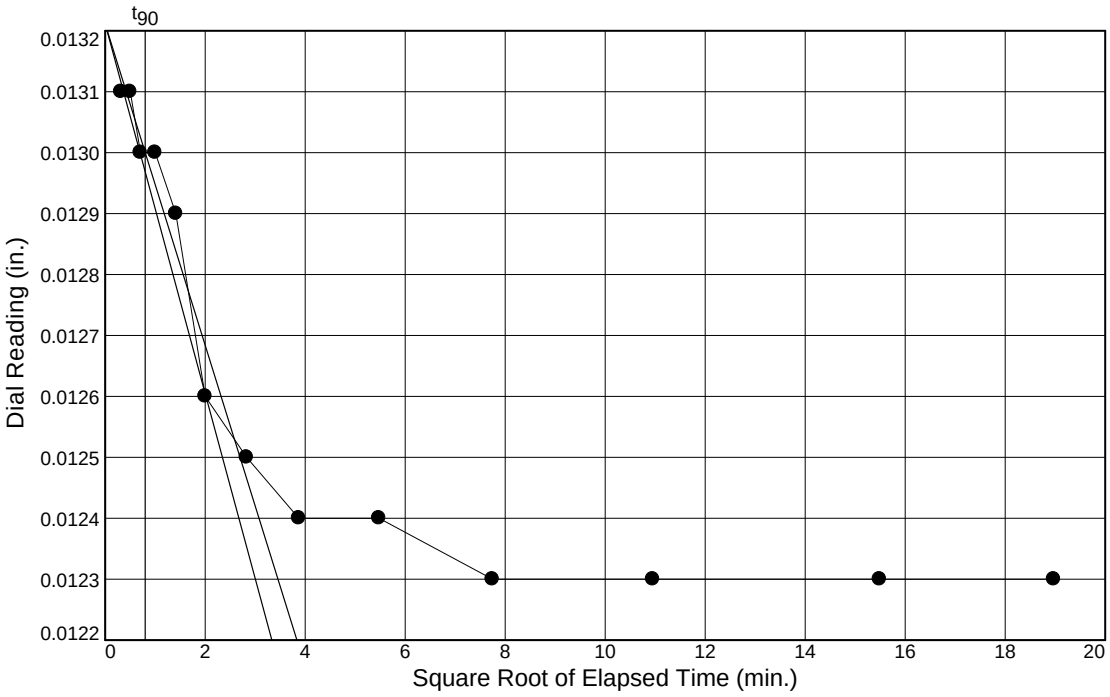
Load No.= 4
Load= 1.00 ksf
D_0 = 0.0112
D_{90} = 0.0127
D_{100} = 0.0128
T_{90} = 1.27 min.

C_v @ T_{90}
1.765 ft.^{2}/day

Dial Reading vs. Time

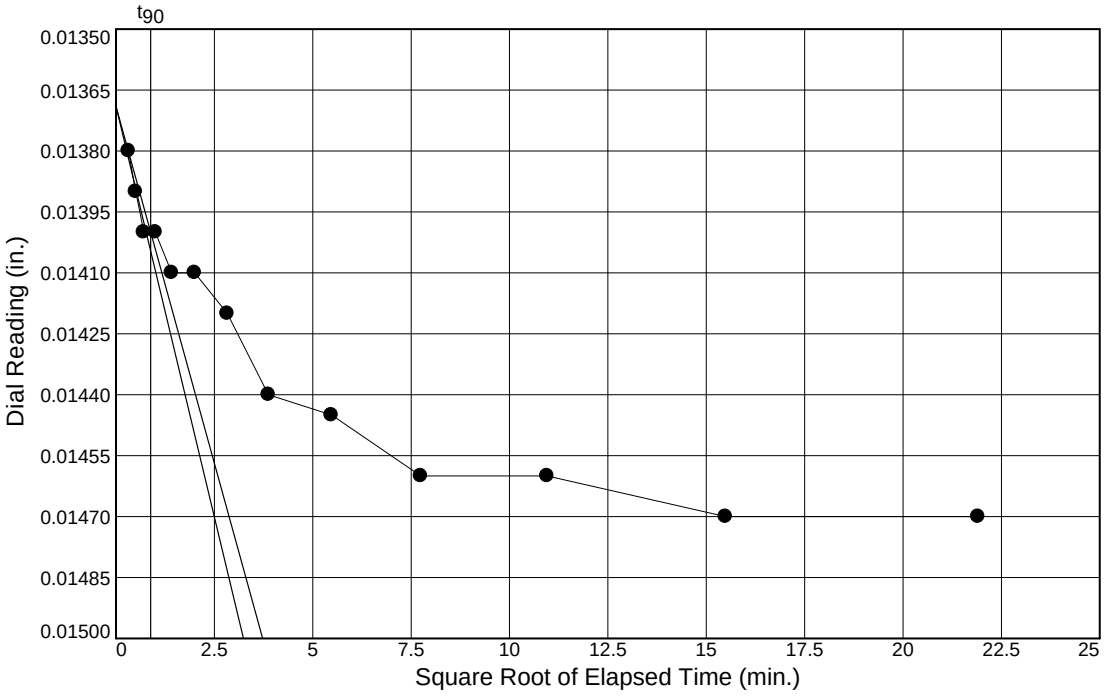
Project No.: 1351-12-037
Project: SCDOT US 21 to SC 51

Location: Borings Depth: 2.0-4.0 Sample Number: B-15 ST-1



Load No.= 5
Load= 0.25 ksf
D_0 = 0.0132
D_{90} = 0.0130
D_{100} = 0.0130
T_{90} = 0.64 min.

C_v @ T_{90}
3.496 ft.^{2}/day



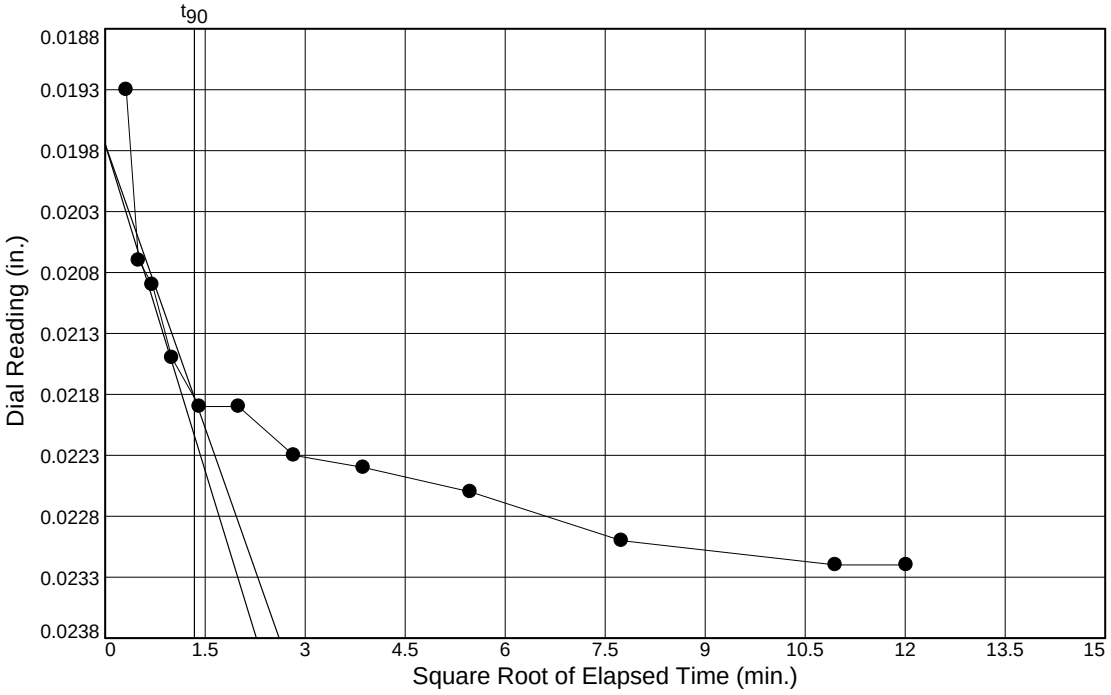
Load No.= 7
Load= 1.00 ksf
D_0 = 0.0137
D_{90} = 0.0140
D_{100} = 0.0140
T_{90} = 0.78 min.

C_v @ T_{90}
2.871 ft.^{2}/day

Dial Reading vs. Time

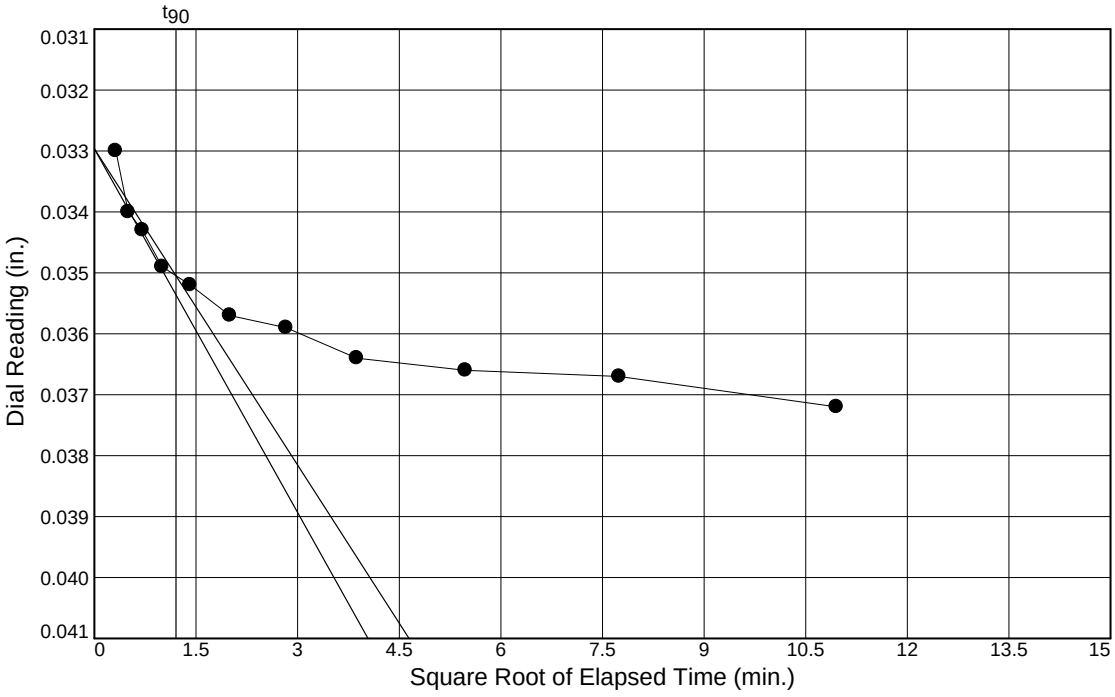
Project No.: 1351-12-037
Project: SCDOT US 21 to SC 51

Location: Borings Depth: 2.0-4.0 Sample Number: B-15 ST-1



Load No.= 8
Load= 2.00 ksf
D_0 = 0.0197
D_{90} = 0.0218
D_{100} = 0.0221
T_{90} = 1.79 min.

C_v @ T_{90}
1.233 ft.^{2}/day



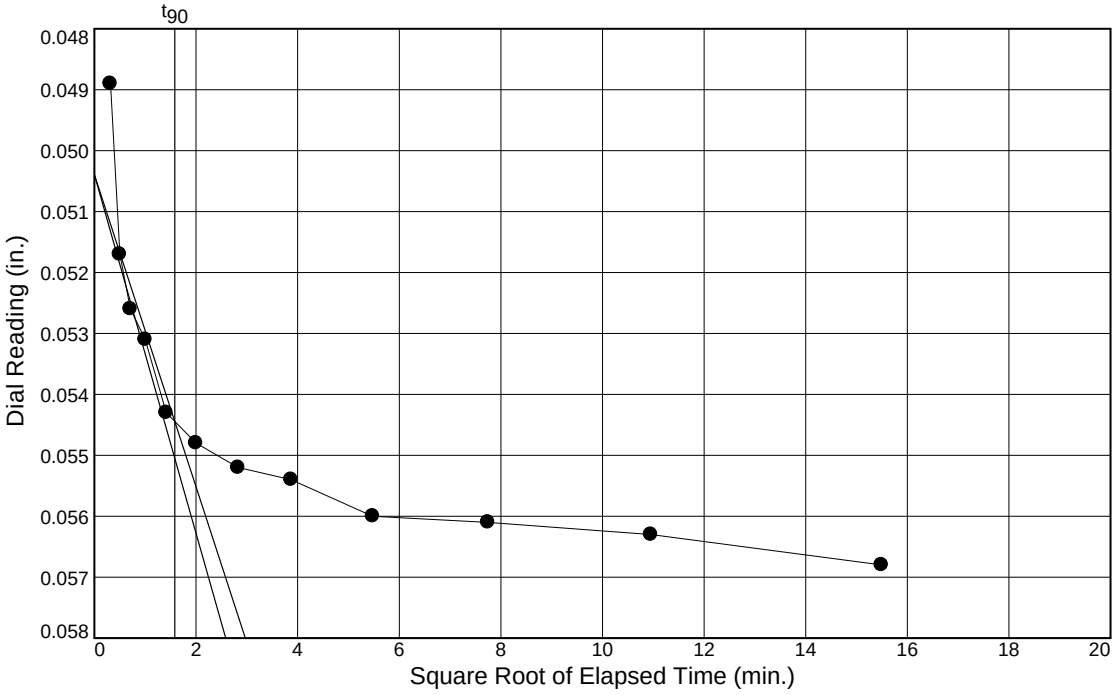
Load No.= 9
Load= 4.00 ksf
D_0 = 0.0330
D_{90} = 0.0350
D_{100} = 0.0353
T_{90} = 1.45 min.

C_v @ T_{90}
1.489 ft.^{2}/day

Dial Reading vs. Time

Project No.: 1351-12-037
Project: SCDOT US 21 to SC 51

Location: Borings Depth: 2.0-4.0 Sample Number: B-15 ST-1



Load No.= 10
Load= 8.00 ksf
D_0 = 0.0504
D_{90} = 0.0544
D_{100} = 0.0549
T_{90} = 2.50 min.

C_v @ T_{90}
0.835 ft.^{2}/day

CONSOLIDATION TEST DATA

4/6/2022

Client: STV Inc.
Project: SCDOT US 21 to SC 51
Project Number: 1351-12-037
Location: Borings
Depth: 2.0-4.0 **Sample Number:** B-15 ST-1
Material Description: Brown Red Medium to Fine Sandy Lean Clay (CL) A-6(8)
Liquid Limit: 37 **Plasticity Index:** 16
USCS: CL **AASHTO:** A-6(8)
Figure No.: B-15 ST-1
Testing Remarks: AASHTO T-216 Method B-Inundated
Tested by: Karen Warner **Checked by:** Jason Reeves, P.E.

Test Specimen Data

NATURAL MOISTURE
Wet w+t = 339.78 g.
Dry w+t = 301.46 g.
Tare Wt. = 104.43 g.
Moisture = 19.4 %

VOID RATIO
Spec. Gr. = 2.65
Est. Ht. Solids = 0.634 in.
Init. V.R. = 0.640
Init. Sat. = 80.6 %

AFTER TEST
Wet w+t = 269.93 g.
Dry w+t = 241.14 g.
Tare Wt. = 106.23 g.
Moisture = 21.3 %

UNIT WEIGHT
Height = 1.040 in.
Diameter = 2.498 in.
Weight = 161.31 g.
Dry Dens. = 101.0 pcf

TEST START
Height = 1.040 in.
Diameter = 2.498 in.

Dry Wt. = 134.91* g.

* **Final dry weight used as mineral solids weight**

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000	0.00000			0.640	
0.05	0.00040	0.00040			0.639	0.0 Comprs.
0.25	0.00320	0.00320			0.635	0.3 Comprs.
0.50	0.00740	0.00740	2.758		0.628	0.7 Comprs.
1.00	0.01440	0.01440	1.765		0.617	1.4 Comprs.
0.25	0.01230	0.01230	3.496		0.620	1.2 Comprs.
0.50	0.01250	0.01250	0.037		0.620	1.2 Comprs.
1.00	0.01470	0.01470	2.871		0.616	1.4 Comprs.
2.00	0.02320	0.02320	1.233		0.603	2.2 Comprs.
4.00	0.03720	0.03720	1.489		0.581	3.6 Comprs.
8.00	0.05680	0.05680	0.835		0.550	5.5 Comprs.

Compression index (C_c), ksf = 0.10 **Preconsolidation pressure (P_p), ksf =** 2.2 **Void ratio at P_p (e_m) =** 0.601
Recompression index (C_r) = 0.02

Pressure: 0.05 ksf | **TEST READINGS** | **Load No. 1**

No.	Clock Time	Dial Reading
1	+0 00:00:00	0.00000
2	+0 00:00:06	0.00060
3	+0 00:00:15	0.00060
4	+0 00:00:30	0.00060
5	+0 00:00:60	0.00050
6	+0 00:02:00	0.00040

Void Ratio = 0.639 **Compression =** 0.0%

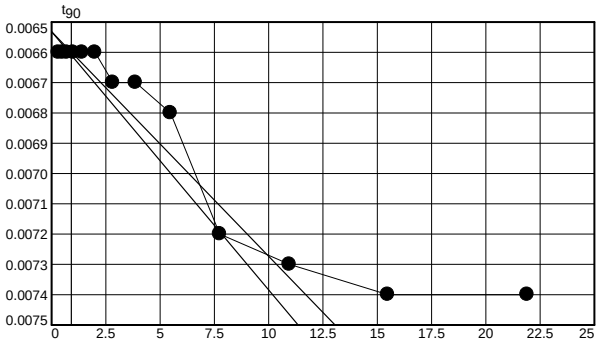
Pressure: 0.25 ksf | **TEST READINGS** | **Load No. 2**

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.00040	11	+0 00:60:00	0.00320
2	+0 00:00:06	0.00230	12	+0 02:00:00	0.00320
3	+0 00:00:15	0.00240	13	+0 04:00:00	0.00320
4	+0 00:00:30	0.00250	14	+0 08:00:00	0.00320
5	+0 00:00:60	0.00250	15	+0 14:18:13	0.00320
6	+0 00:02:00	0.00260			
7	+0 00:04:00	0.00280			
8	+0 00:08:00	0.00300			
9	+0 00:15:00	0.00310			
10	+0 00:30:00	0.00320			

Void Ratio = 0.635 **Compression =** 0.3%

Pressure: 0.50 ksf | **TEST READINGS** | **Load No. 3**

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.00320	11	+0 00:60:00	0.00720
2	+0 00:00:06	0.00660	12	+0 02:00:00	0.00730
3	+0 00:00:15	0.00660	13	+0 04:00:00	0.00740
4	+0 00:00:30	0.00660	14	+0 08:00:00	0.00740
5	+0 00:00:60	0.00660			
6	+0 00:02:00	0.00660			
7	+0 00:04:00	0.00660			
8	+0 00:08:00	0.00670			
9	+0 00:15:00	0.00670			
10	+0 00:30:00	0.00680			



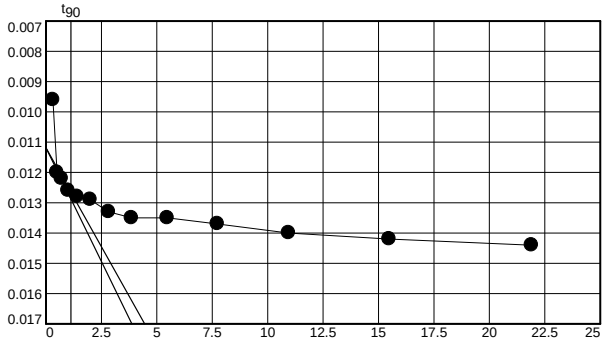
Void Ratio = 0.628 **Compression =** 0.7%

D_0 = 0.0065 **D_{90} =** 0.0066 **D_{100} =** 0.0066 **C_V at 0.82 min. =** 2.758 ft.^{2}/day

S & ME, INC.

Pressure: 1.00 ksf **TEST READINGS** **Load No. 4**

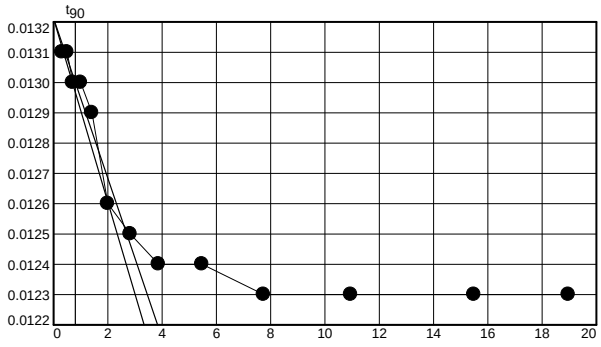
No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.00740	11	+0 00:60:00	0.01370
2	+0 00:00:06	0.00960	12	+0 02:00:00	0.01400
3	+0 00:00:15	0.01200	13	+0 04:00:00	0.01420
4	+0 00:00:30	0.01220	14	+0 08:00:00	0.01440
5	+0 00:00:60	0.01260			
6	+0 00:02:00	0.01280			
7	+0 00:04:00	0.01290			
8	+0 00:08:00	0.01330			
9	+0 00:15:00	0.01350			
10	+0 00:30:00	0.01350			



Void Ratio = 0.617 **Compression =** 1.4%
D_0 = 0.0112 **D_{90} =** 0.0127 **D_{100} =** 0.0128 **C_V at 1.27 min. =** 1.765 ft.^{2}/day

Pressure: 0.25 ksf **TEST READINGS** **Load No. 5**

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.01440	11	+0 00:60:00	0.01230
2	+0 00:00:06	0.01310	12	+0 02:00:00	0.01230
3	+0 00:00:15	0.01310	13	+0 04:00:00	0.01230
4	+0 00:00:30	0.01300	14	+0 06:00:00	0.01230
5	+0 00:00:60	0.01300			
6	+0 00:02:00	0.01290			
7	+0 00:04:00	0.01260			
8	+0 00:08:00	0.01250			
9	+0 00:15:00	0.01240			
10	+0 00:30:00	0.01240			



Void Ratio = 0.620 **Compression =** 1.2%
D_0 = 0.0132 **D_{90} =** 0.0130 **D_{100} =** 0.0130 **C_V at 0.64 min. =** 3.496 ft.^{2}/day

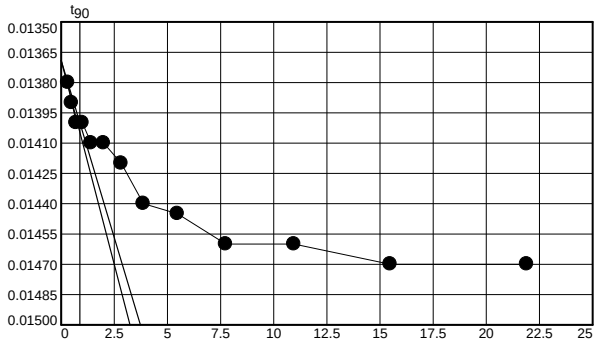
Pressure: 0.50 ksf | **TEST READINGS** | **Load No. 6**

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.01230	11	+0 00:60:00	0.01250
2	+0 00:00:06	0.01250			
3	+0 00:00:15	0.01250			
4	+0 00:00:30	0.01250			
5	+0 00:00:60	0.01250			
6	+0 00:02:00	0.01250			
7	+0 00:04:00	0.01250			
8	+0 00:08:00	0.01250			
9	+0 00:15:00	0.01250			
10	+0 00:30:00	0.01250			

Void Ratio = 0.620 **Compression =** 1.2%
D_0 = 0.0125 **D_{90} =** 0.0125 **D_{100} =** 0.0125 **C_V at 60.00 min. =** 0.037 ft.^{2}/day

Pressure: 1.00 ksf | **TEST READINGS** | **Load No. 7**

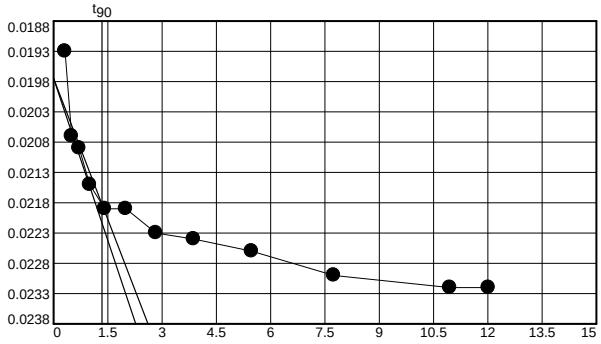
No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.01250	11	+0 00:60:00	0.01460
2	+0 00:00:06	0.01380	12	+0 02:00:00	0.01460
3	+0 00:00:15	0.01390	13	+0 04:00:0	0.01470
4	+0 00:00:30	0.01400	14	+0 08:00:00	0.01470
5	+0 00:00:60	0.01400			
6	+0 00:02:00	0.01410			
7	+0 00:04:00	0.01410			
8	+0 00:08:00	0.01420			
9	+0 00:15:00	0.01440			
10	+0 00:30:00	0.01445			



Void Ratio = 0.616 **Compression =** 1.4%
D_0 = 0.0137 **D_{90} =** 0.0140 **D_{100} =** 0.0140 **C_V at 0.78 min. =** 2.871 ft.^{2}/day

Pressure: 2.00 ksf **TEST READINGS** **Load No. 8**

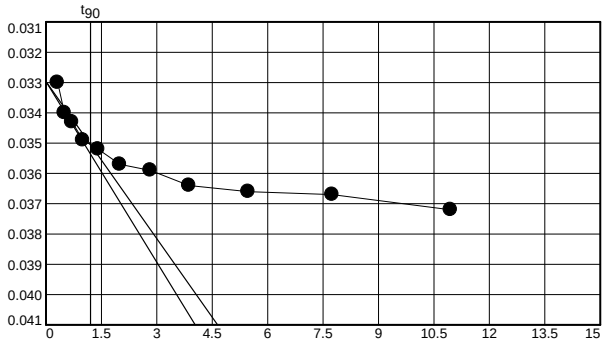
No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.01470	11	+0 00:60:00	0.02300
2	+0 00:00:06	0.01930	12	+0 02:00:00	0.02320
3	+0 00:00:15	0.02070	13	+0 02:24:27	0.02320
4	+0 00:00:30	0.02090			
5	+0 00:00:60	0.02150			
6	+0 00:02:00	0.02190			
7	+0 00:04:00	0.02190			
8	+0 00:08:00	0.02230			
9	+0 00:15:00	0.02240			
10	+0 00:30:00	0.02260			



Void Ratio = 0.603 **Compression =** 2.2%
D_0 = 0.0197 **D_{90} =** 0.0218 **D_{100} =** 0.0221 **C_V at 1.79 min. =** 1.233 ft.^{2}/day

Pressure: 4.00 ksf **TEST READINGS** **Load No. 9**

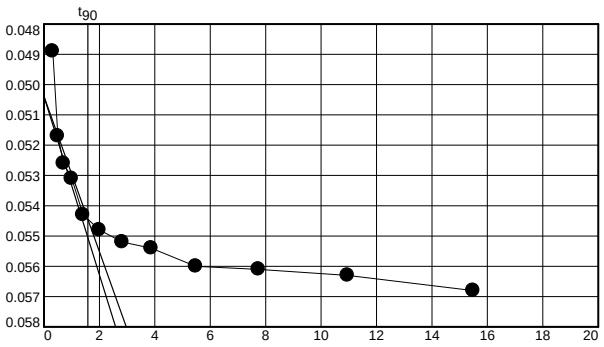
No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.02320	11	+0 00:60:00	0.03670
2	+0 00:00:06	0.03300	12	+0 02:00:00	0.03720
3	+0 00:00:15	0.03400			
4	+0 00:00:30	0.03430			
5	+0 00:00:60	0.03490			
6	+0 00:02:00	0.03520			
7	+0 00:04:00	0.03570			
8	+0 00:08:00	0.03590			
9	+0 00:15:00	0.03640			
10	+0 00:30:00	0.03660			



Void Ratio = 0.581 **Compression =** 3.6%
D_0 = 0.0330 **D_{90} =** 0.0350 **D_{100} =** 0.0353 **C_V at 1.45 min. =** 1.489 ft.^{2}/day

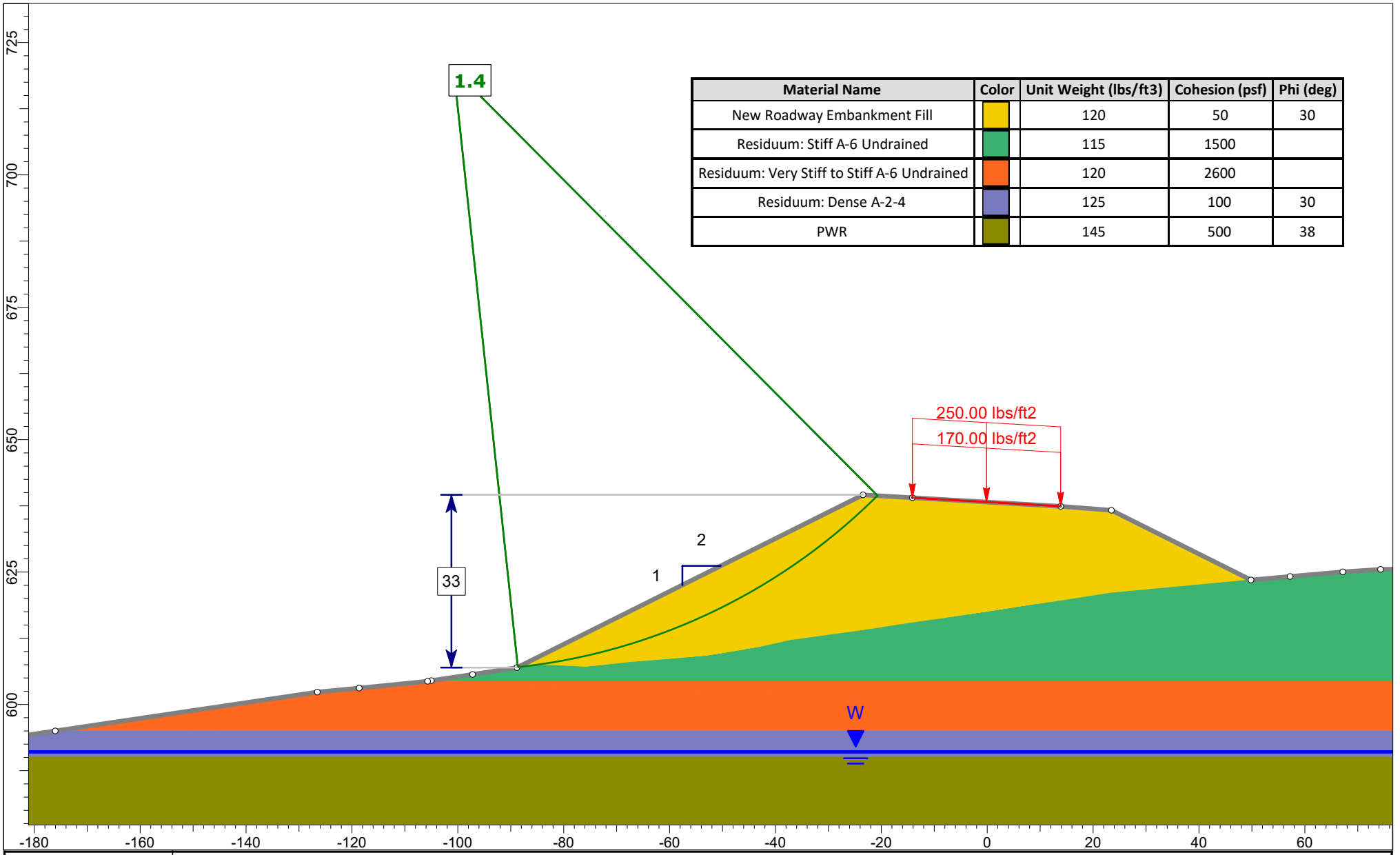
Pressure: 8.00 ksf **TEST READINGS** **Load No. 10**

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	0	0.03720	11	+0 00:60:00	0.05610
2	+0 00:00:06	0.04890	12	+0 02:00:00	0.05630
3	+0 00:00:15	0.05170	13	+0 04:00:00	0.05680
4	+0 00:00:30	0.05260			
5	+0 00:00:60	0.05310			
6	+0 00:02:00	0.05430			
7	+0 00:04:00	0.05480			
8	+0 00:08:00	0.05520			
9	+0 00:15:00	0.05540			
10	+0 00:30:00	0.05600			



Void Ratio = 0.550 **Compression =** 5.5%
D_0 = 0.0504 **D_{90} =** 0.0544 **D_{100} =** 0.0549 **C_V at 2.50 min. =** 0.835 ft.^{2}/day

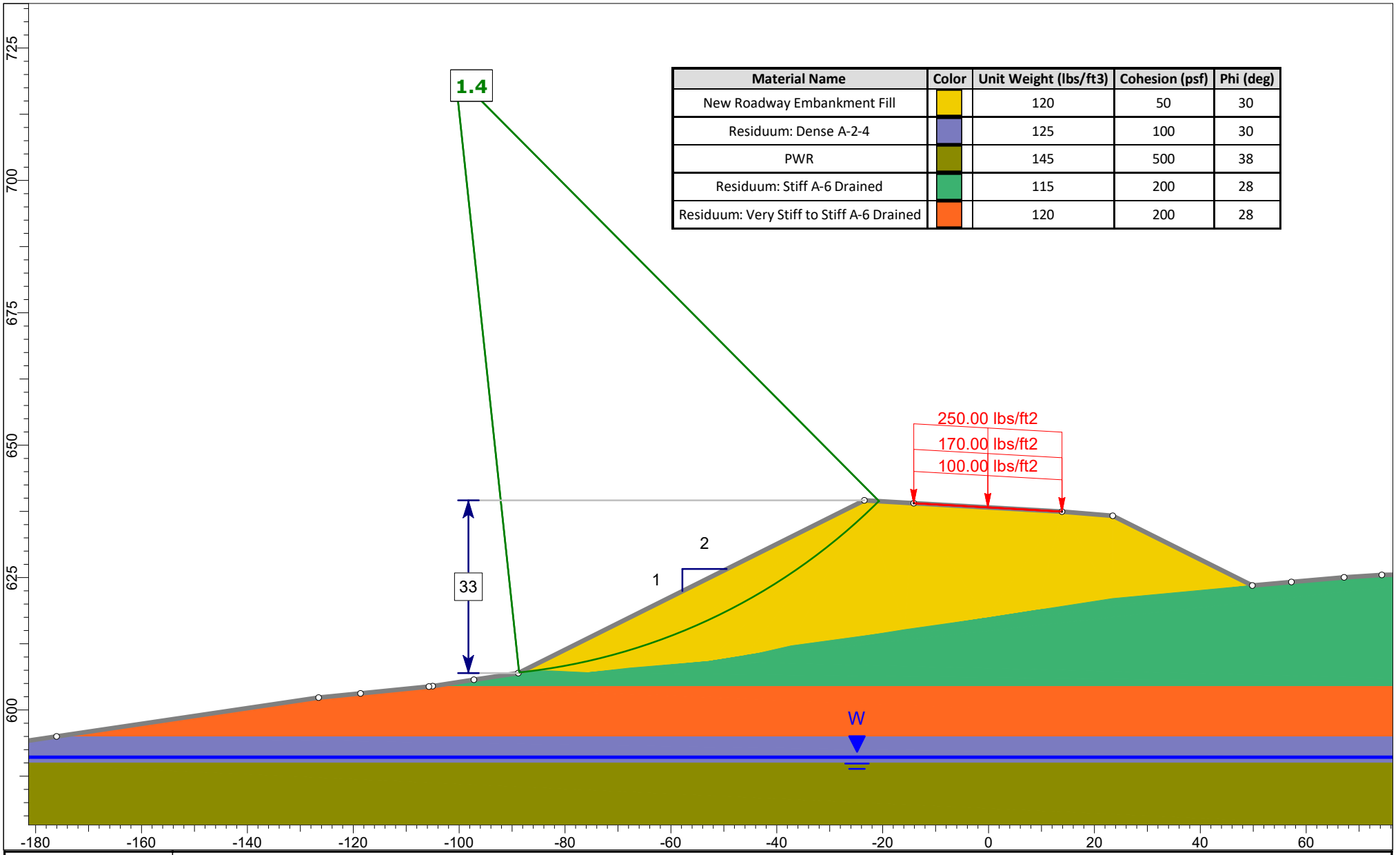
Appendix IV – Slope Stability Analyses



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Roadway Embankment Fill		120	50	30
Residuum: Stiff A-6 Undrained		115	1500	
Residuum: Very Stiff to Stiff A-6 Undrained		120	2600	
Residuum: Dense A-2-4		125	100	30
PWR		145	500	38

Project: US 21 to SC 51 - Gold Hill Rd			
Analysis: Station 24+00 LT		Description: Service - End-of-Construction	
Drawn By: NRB	Project Number: 1351-12-037	Company: S&ME	Figure: A
Location: Gold Hill Rd 24+00 LT	File Name: Gold Hill Rd 2400 LT.slmd	Date: 4/8/2022	

SLIDEINTERPRET 9.020

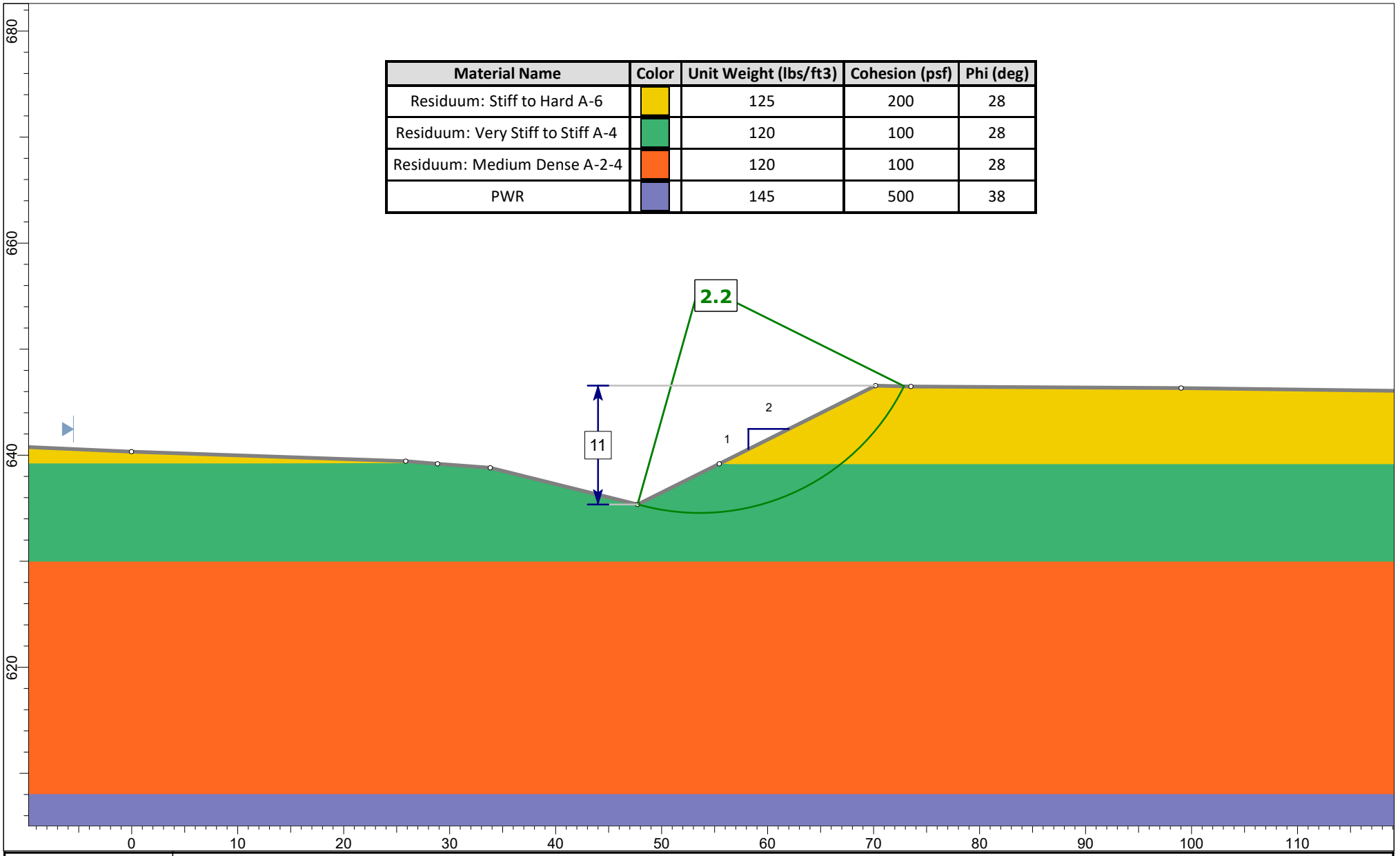


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Roadway Embankment Fill		120	50	30
Residuum: Dense A-2-4		125	100	30
PWR		145	500	38
Residuum: Stiff A-6 Drained		115	200	28
Residuum: Very Stiff to Stiff A-6 Drained		120	200	28

Project: US 21 to SC 51 - Gold Hill Rd			
Analysis: Station 24+00 LT		Description: Service - Long-Term	
Drawn By: NRB	Project Number: 1351-12-037	Company: S&ME	Figure: B
Location: Gold Hill Rd 24+00 LT	File Name: Gold Hill Rd 2400 LT.slmd	Date: 4/8/2022	

SLIDEINTERPRET 9.020

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Residuum: Stiff to Hard A-6		125	200	28
Residuum: Very Stiff to Stiff A-4		120	100	28
Residuum: Medium Dense A-2-4		120	100	28
PWR		145	500	38

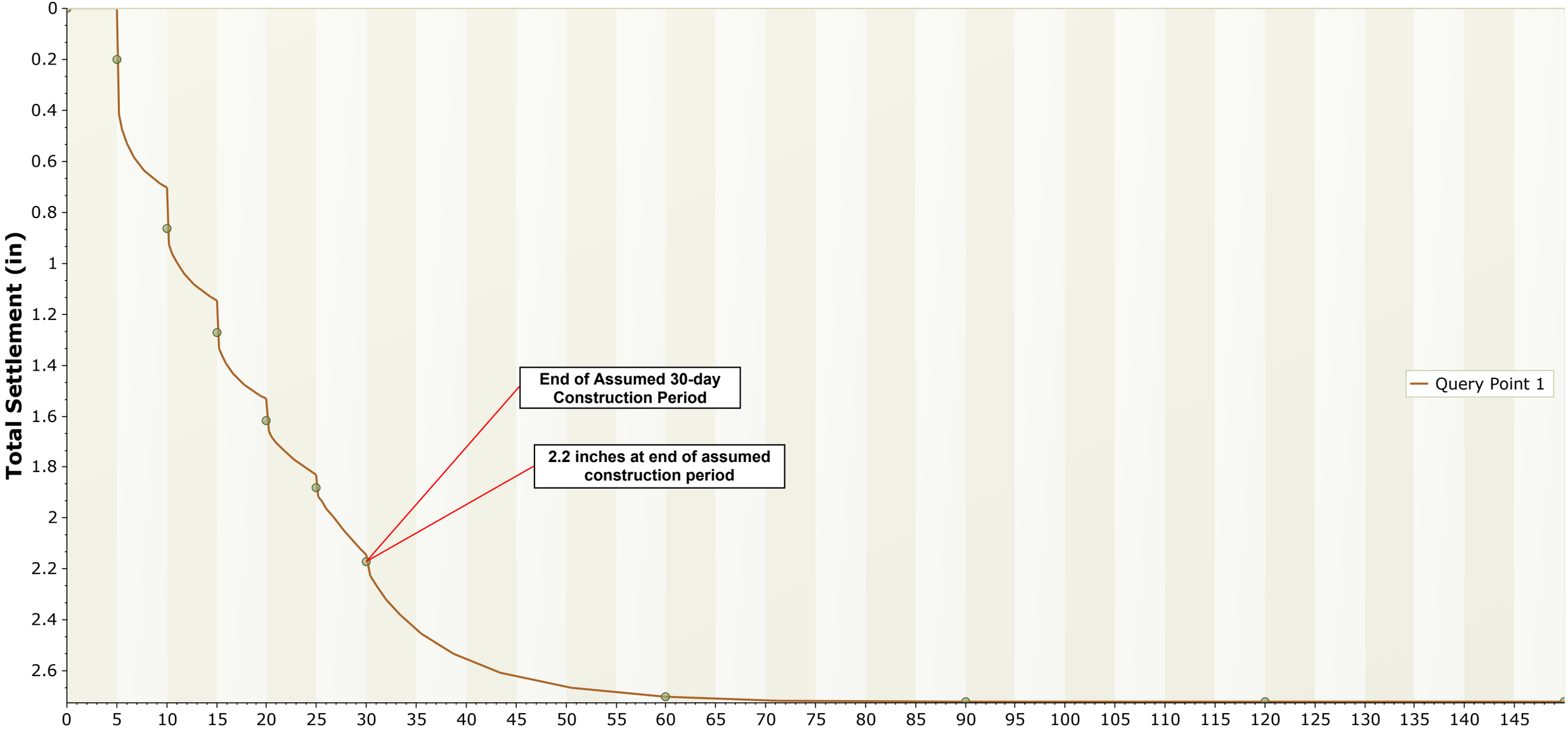


Project	US 21 to SC 51 - Gold Hill Rd			
Analysis	Station 31+00 RT		Description	Service - End-of-Construction and Long-Term
Drawn By	NRB	Project Number	1351-12-037	Company S&ME / Figure C
Location	Gold Hill Rd 31+00 RT	File Name	Gold Hill Rd 3100 RT.slmd	Date 3/30/2022

SLIDEINTERPRET 9.020

Appendix V – Settlement Analysis

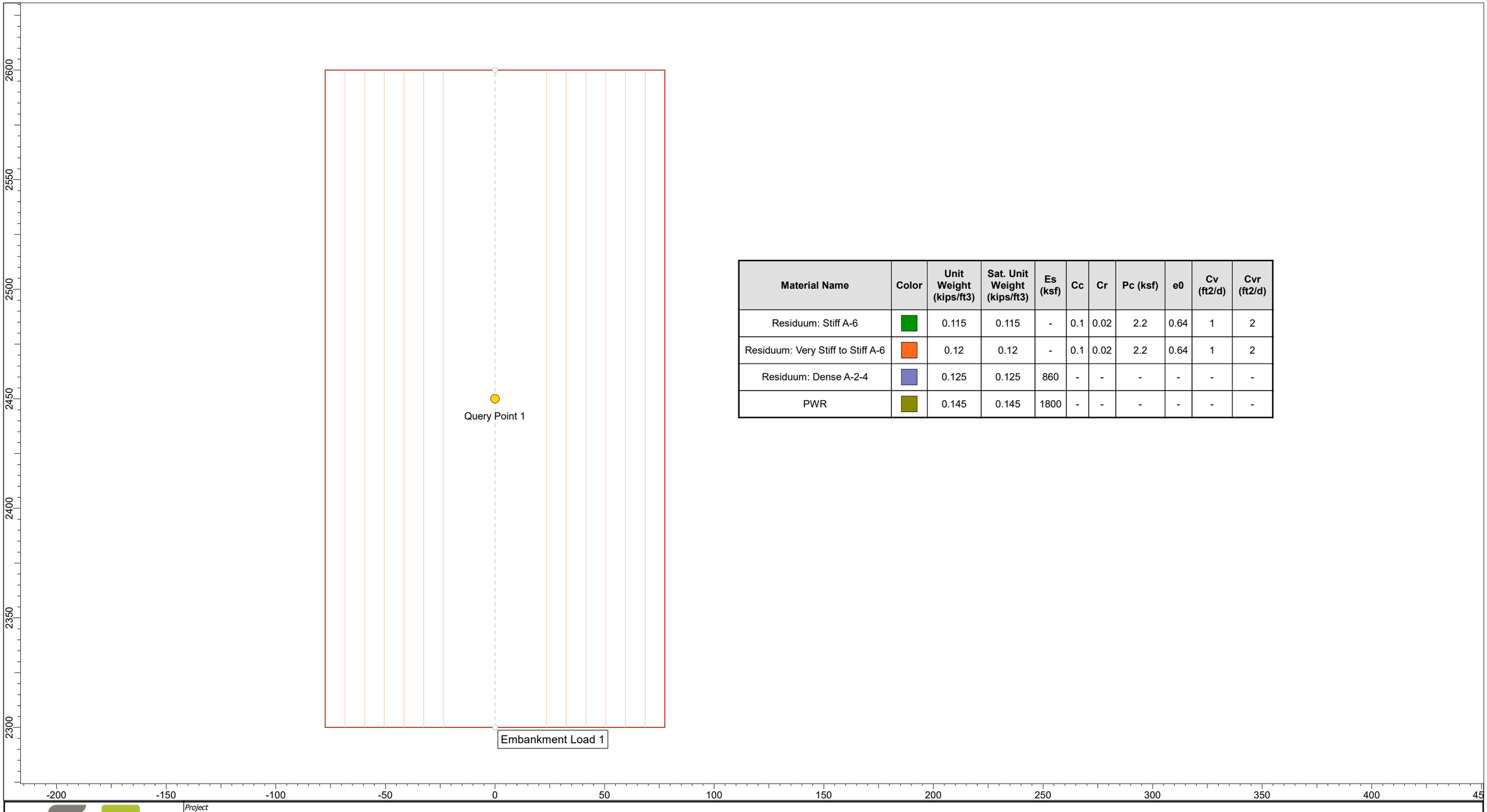
Gold Hill Rd Station 24+50: Time vs. Total Settlement



Reference Stage: None

Total Settlement at Depth = 0 ft

SETTLE3 5.013	Project	US 21 to SC 51 - Gold Hill Rd			
	Analysis	Settlement		Description	_
	Drawn By	NRB	Project Number	1351-12-037	Company S&ME
	Location	Gold Hill Rd Station 24+50	File Name	Gold Hill Rd 2450.s3z	Date 4/8/2022
					Figure X



Material Name	Color	Unit Weight (kips/ft3)	Sat. Unit Weight (kips/ft3)	Es (ksf)	Cc	Cr	Pc (ksf)	e0	Cv (ft2/d)	Cvr (ft2/d)
Residuum: Stiff A-6		0.115	0.115	-	0.1	0.02	2.2	0.64	1	2
Residuum: Very Stiff to Stiff A-6		0.12	0.12	-	0.1	0.02	2.2	0.64	1	2
Residuum: Dense A-2-4		0.125	0.125	860	-	-	-	-	-	-
PWR		0.145	0.145	1800	-	-	-	-	-	-

SETTLE3 5.013

Project: US 21 to SC 51 - Gold Hill Rd			
Analysis: Settlement		Description: _	
Drawn By: NRB	Project Number: 1351-12-037	Company: S&ME	Figure: X
Location: Gold Hill Rd Station 24+50	File Name: Gold Hill Rd 2450.s3z	Date: 4/8/2022	

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Settle3 Analysis Information

US 21 to SC 51 - Gold Hill Rd

Project Settings

Document Name	Gold Hill Rd 2450.s3z
Project Title	US 21 to SC 51 - Gold Hill Rd
Analysis	Station 24+50
Author	NRB
Company	S&ME
Date Created	3/31/2022, 5:23:01 PM
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	days
Permeability Units	feet/day
Minimum settlement ratio for subgrade modulus	0.9
Use average poisson's ratio to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Stage Settings

Stage #	Name	Time [days]
1	Stage 1	0
2	Stage 2	5
3	Stage 3	10
4	Stage 4	15
5	Stage 5	20
6	Stage 6	25
7	Stage 7	30
8	Stage 8	60
9	Stage 9	90
10	Stage 10	120
11	Stage 11	150
12	Stage 12	180
13	Stage 13	210
14	Stage 14	240
15	Stage 15	270
16	Stage 16	300
17	Stage 17	330
18	Stage 18	365
19	Stage 19	548
20	Stage 20	730
21	Stage 21	1095
22	Stage 22	1460
23	Stage 23	1825
24	Stage 24	3650
25	Stage 25	36500

Embankments

1. Embankment: "Embankment Load 1"

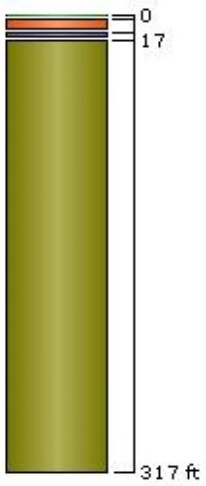
Label	Embankment Load 1
Center Line	(0, 2300) to (0, 2600)
Near End Angle	90 degrees
Far End Angle	90 degrees
Number of Layers	6
Base Width	155

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 2 = 5 d	0	26.5651	4.5	0.12	26.5651	0
2	Stage 3 = 10 d	0	26.5651	4.5	0.12	26.5651	0
3	Stage 4 = 15 d	0	26.5651	4.5	0.12	26.5651	0
4	Stage 5 = 20 d	0	26.5651	4.5	0.12	26.5651	0
5	Stage 6 = 25 d	0	26.5651	4.5	0.12	26.5651	0
6	Stage 7 = 30 d	0	26.5651	4.5	0.12	26.5651	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	Residuum: Stiff A-6	2.5	0	No
2	Residuum: Very Stiff to Stiff A-6	9.5	2.5	Yes
3	Residuum: Dense A-2-4	5	12	Yes
4	PWR	300	17	Yes



Soil Properties

Property	Residuum: Stiff A-6	Residuum: Very Stiff to Stiff A-6	Residuum: Dense A-2-4	PWR
Color				
Unit Weight [kips/ft3]	0.115	0.12	0.125	0.145
Saturated Unit Weight [kips/ft3]	0.115	0.12	0.125	0.145
K0	1	1	1	1
Immediate Settlement	Disabled	Disabled	Enabled	Enabled
Es [ksf]	-	-	860	1800
Esur [ksf]	-	-	860	1800
Primary Consolidation	Enabled	Enabled	Disabled	Disabled
Material Type	Non-Linear	Non-Linear		
Cc	0.1	0.1	-	-
Cr	0.02	0.02	-	-
e0	0.64	0.64	-	-
Pc [ksf]	2.2	2.2	-	-
Cv [ft2/d]	1	1	-	-
Cvr [ft2/d]	2	2	-	-
B-bar	1	1	-	-
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft3
Generating excess pore pressure above water table	

Piezometric Line Entities

ID	Depth (ft)
1	16 ft

Query Points

Point #	Query Point Name	(X,Y) Location	Number of Divisions
1	Query Point 1	0, 2450	Auto: 55

Limited Phase I Environmental Site Assessment

US Highway 21/SC Highway 51 Corridor Study
Fort Mill, South Carolina
Road Widening Project

Prepared For:

STV/Ralph Whitehead Associates

Rockhill, South Carolina

June 18, 2013

FUSS & O'NEILL

717 Lady Street, Suite E
Columbia, SC 29201

Project No. 20120285.A10

FUSS & O'NEILL

June 18, 2013

Ms. Sheri Williamson
STV/Ralph Whitehead Associates
Rock Hill Business Technology Center
454 S. Anderson Rd. BTC 517
Rock Hill, SC 29730

RE: Limited Phase I Environmental Site Assessment
US Highway 21/SC Highway 51 Road Widening Project
Fort Mill, South Carolina

Dear Ms. Williamson:

We are pleased to submit the enclosed report of the Phase I Environmental Site Assessment (Phase I ESA) for the above-referenced site. The assessment was conducted in conformance with Standard Practice E1527-05 for Environmental Site Assessments published by the ASTM International.

ASTM E1527-05 requires that certain elements of a Phase I ESA be updated if the data for the report is more than six months old. Therefore, if this report is to be relied on after September 2013, we recommend that you contact us to discuss options for an update.

We have identified **nine (9) recognized environmental conditions** (RECs) associated with the site. The findings, opinion and conclusions of this Phase I Environmental Site Assessment are discussed in *Section 9* and *Section 10* of this report.

In accordance with the requirements of the ASTM E1527-05 Standard, we declare that to the best of our professional knowledge and belief, we meet the definition of an environmental professional as defined in §312.10 of 40 CFR 312 and we have the specific qualifications based on education, training, and experience to assess the nature, history, and setting of the site. We have developed and performed all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Thank you for the opportunity to conduct this work. Please contact us at 803-376-6034 if we can be of further assistance.

Sincerely,

Reginald Butler
Environmental Technician III
Ext. 6109

Jeremy Grant, P.G.
Project Manager
Ext. 6107

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Connecticut
Massachusetts
Rhode Island
South Carolina

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STV/Ralph Whitehead Associates
US Highway 21/SC Highway 51, Fort Mill, SC

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STV/Ralph Whitehead Associates
US Highway 21/SC Highway 51, Fort Mill, SC

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F Environmental Professional Resume

1 Introduction

Fuss & O'Neill, Inc. (Fuss & O'Neill) conducted a Limited Phase I Environmental Site Assessment (Phase I ESA) at the request of Ms. Sheri Williamson of STV/Ralph Whitehead Associates, as due diligence for the acquisition of the right-of-way (ROW) property by the Pennies for Progress Program for road widening along US Highway 21/SC Highway 51 in Fort Mill, York County, South Carolina.

The section for improvement along US Highway 21/SC Highway 51 will extend approximately 2.5 miles from Springfield Parkway to the North Carolina State line (*Figure 1*). The existing highway is a two lane road with grass shoulders and drainage ditches. This project corridor will be known as the *property* throughout this report.

This assessment was conducted as a preliminary assessment that was restricted to non-invasive types of investigations. The conclusions reached and the representations contained herein, are based on the available data and on the contracted scope of work. Fuss & O'Neill makes no representations or conclusions or information beyond the scope of this assessment.

1.1 Objective

The objective of this Phase I ESA is to identify recognized environmental conditions (RECs) present at the *property*. As defined by Standard Practice for Environmental Site Assessments E1527 05 developed by the ASTM International (ASTM, 2005), REC means:

> *…the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.*

1.2 Scope of Services

Our Limited Phase I ESA was performed in general conformance with Standard Practice E1527-05 for Environmental Site Assessments by the ASTM International (ASTM, 2005). Since this Phase I ESA is was conducted for a corridor, some information for each individually owned parcel along the *property* was not reasonably ascertainable within the time and cost constraints of this investigation due to the large number of land parcels associated with individual property owners. Current and past uses of specific properties were identified through the review of the regulatory database search, site reconnaissance, and/or other publicly available sources of information. This information is discussed in detail in *Section 4* of this report.

This Limited Phase I ESA deviates from ASTM E1527-05 in the following ways:

- Past or current uses of the properties, adjoining properties, and/or the surrounding area were not identified through interviews with the past or present individual parcel owners and/or past or present occupants.
- Past uses prior to 1970 were not identified through the review of historic aerial photographs.
- Interior observations of the structures along the *property* were not identified.
- Recorded land title records, liens, and/or zoning/land use records on individual properties along the *property* were not assessed. This includes environmental liens or activity and use limitations (AULs).
- The *User* of the report, York County and its agents, was not given a "User Questionnaire" because it is unrealistic for a government entity to have specialized knowledge on small parcels of land along an extensive corridor. Therefore, the review of title and judicial records for environmental liens, AULs, or ascertainable recorded land title records were not supplied by the *User* of this report.

Assessments for asbestos-containing materials (ACM), lead-based paint or plumbing materials, radon gas, and mold were not conducted. Furthermore, we did not investigate the potential for the *property* to contain endangered species, ecological resources or historic/cultural resources. Additionally, environmental compliance or permitting issues were not considered during this investigation.

It is our understanding that this work is not being conducted under a United States Environmental Protection Agency (USEPA) Brownfield Assessment and Characterization Program grant awarded under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 9604(k)(2)(b); therefore, our investigation did not include an assessment of controlled substances. Refer to *Section 15* of this report for limitations on this work product.

2 *Property* Overview and Environmental Setting

2.1 *Property* Location

The US Highway 21/SC Highway 51 road widening project is located north of downtown Fort Mill between Springfield Parkway and the North Carolina/South Carolina state line (Figure 1). The project corridor has a linear roadway distance of approximately 13,200 feet. The proposed limits of construction for this project will require acquisition of additional right-of-way (ROW).

The *property* is located in an area of mixed residential, industrial, and commercial parcels. A site location map showing the approximate project corridor is provided as *Figure 1* and a site topographic map of the *property* is included as *Figure 2*.

2.2 Utilities

The City of Fort Mill and York County provides municipal water and sewer service in the area to the *property*. Electrical power is provided to the *property* by Duke Energy. Electric, cable, and telephone services to the *property* are provided via underground conduits and overhead transmission lines.

2.3 Adjoining Land Use

As with any Phase I ESA, nearby land usage is always a concern and investigating adjoining land uses that could potentially impact the surface and subsurface conditions of the *property* is a vital part of performing a complete Phase I ESA.

From observations made during the site reconnaissance and through review of historic and current aerial images, the *property* is located in an area of mixed residential, industrial, and commercial parcels. Specific uses of adjoining parcels are addressed in *Sections 4* and *Section 6*. A search of all public records for each individual parcel along the *property* was not reasonably ascertainable within the time and cost constraints of this project as outlined in *Section 1.2* of this report.

2.4 Environmental Setting

2.4.1 Geology

According to the Geologic Notes*, Volume 9, Number 2* (State Development Board, June 2010), York County is situated in the north-central Piedmont of South Carolina, adjacent to the North Carolina state line. Rocks of the Piedmont occur in belts that conform to the regional-northeasterly trend of major structural features. The belts are delineated by gross differences in rock types, grade of metamorphism, and structure. York County straddles the Charlotte Belt and extends into the Caro1ina Slate Belt to the east and into the Kings Mountain Belt to the northwest.

Rocks of the Carolina Slate Belt are mainly low rank metamorphic rocks of sedimentary and volcanic origin. The Charlotte Belt includes medium- to high-rank metamorphic rocks and a complicated sequence of igneous intrusions. Major rock types of the Kings Mountain Belt are phyllite, schist, gneiss, quartzite, conglomerate, and marble. The metamorphic grade of the Kings Mountain Belt ranges from medium to low.

2.4.2 Topography

According to the topographic maps reviewed for this assessment, the *property* and surrounding area ranges from approximately 590 feet to 650 feet above mean sea level (MSL). Topography of the *property* site generally slopes south to southeast towards tributaries of the Blackmanship Branch, Steele Creek, and the Sugar Creek. These creeks discharge into the Catawba River.

2.4.3 Hydrology & Hydrogeology

The soils encountered in this area are the residual product of in-place chemical weathering of rock presently underlying the site. In general, shallow unconfined groundwater movement within the overlying soils is controlled largely by topographic gradients. However, as the groundwater percolates downward to the bedrock, it becomes controlled by the orientation of the rock fracture systems. Thus the direction of groundwater movement may not be consistent with the reflection topography.

Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary with seasonal fluctuations in precipitation. Movement of groundwater under water table conditions is generally from higher to lower elevations. As such, shallow groundwater at the subject site appears to move to the north and northeast towards lower elevations and off-site water bodies.

Based on USGS mapping and field observations of the local topography regarding the physical setting, the groundwater flow direction of the *property* appears to vary throughout the corridor. The inferred dominant groundwater flow direction along the project corridor appears to be to the south/southeast toward tributaries of Sugar Creek and Sugar Creek. Groundwater along the project corridor is believed to vary from 5 feet to 60 feet below ground surface based on elevations of nearby water bodies.

The *property* is located west of Sugar Creek which discharges to the Catawba River. Surface runoff from the site would appear to flow to the south/southeast toward tributaries of Sugar Creek and Sugar Creek with components of flow to the southwest towards Blankmanship Branch which discharges to Steele Creek than eventually discharges to Sugar Creek.

2.4.4 Soils

According to the USDA Natural Resources Conservation Service Soil Survey, the soils along the corridor are classified as Cecil sandy clay loam (CeB2), Mecklenburg-Wynott complex (MeB2),and Pacolet clay loam (PcE3). Cecil sandy clay loam and Pacolet clay loam soils are well-drained members of Hydrologic Soil Group B. These soils have moderately high to high transmissivity in the most limiting layers of the soil unit along the project corridor. Mecklenburg-Wynott is not a well-drained soil and belongs to Hydrologic Soil Group C. A copy of the soil report is located in *Appendix C*.

2.4.5 Wetlands & Flood Zone Mapping

Based on the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI, 2012) and observations made during the site walkover, there are no mapped wetlands located on the *property*. The Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map Database (FEMA, 2010) shows no mapped floodplains within the *property*. A copy of the FEMA map is included in *Appendix D*. As a wetlands survey is beyond the scope of this Phase I ESA, it is recommended that a wetlands survey be performed for the *property* if it is needed.

2.5 Previous Environmental Investigations

The following environmental investigations of adjacent properties of the *property* were identified and reviewed during the performance of this assessment.

1) Underground Storage Tank closure Report by Steffen, Robertson and Kirsten, Inc. (SRK) for Municipal Engineering for Container Corporation of Carolina, report dated September 26, 1996. SRK concluded that the chance of future environmental impact on the groundwater from USTs at this site is very low. Container Corporation of Carolina is located at 3358 Highway 51.

2) Soil Sampling Analysis Report by Environmental Management Solutions, Inc. (EMS) dated February 26, 1997 for Partex, Inc. / Eumeric Holdings. SCDHEC concluded that the areas of concern had been adequately addressed with regard to the spill area on the exterior of this facility. Partex, Inc. / Eumeric Holdings is located at 3551 Highway 51.

3) Post Remediation Sampling Report conducted by Consultech Environmental, Inc. for Lords Armory dated August 18, 2003. Consultech Environmental, Inc. concluded that concentrations of the contaminants of concern in all of the monitoring wells that have site-specific target levels (SSTLs) are below SSTLs at the site, recommended that all of the monitoring wells be properly abandoned, and that no further action be taken at the site. Lords Armory is located at 3660 Highway 51.

3 Site History

The following sources were used to develop the history of the *property*.

- Aerial imagery of the project corridor dating back to 1970 was viewed utilizing York County's GIS interactive mapping. Aerial imagery was reviewed by Mr. Reginald Butler of Fuss & O'Neill.

4 Federal, State, and Local File Review

Fuss & O'Neill reviewed database information compiled by Environmental Data Resources Inc., (EDR) to help identify RECs in connection with the project corridor. EDR is an environmental database search service that provides access to publicly available environmental databases maintained by various federal, state, and local agencies. The sources of information listed in the following table were researched to identify properties of concern within a specified search radius from the *property* as specified by ASTM Practice E1527-05. These records are identified by the ASTM International as "standard environmental record sources" requiring review. The listed information sources are defined and described in detail in the EDR database report and included in *Appendix A*.

The results of the review are shown in the table below. Databases with listings identified on the *property* or within the minimum search are discussed in a brief narrative following the table.

4.1 Federal Regulatory Agency Review

Database	ASTM Minimum Search Distance	Listings w/in 1,000 Foot Buffer
NPL	1.0 Mile	No
Delisted NPL	0.5 Mile	No
CERCLIS	0.5 Mile	No
CERCLIS-NFRAP	0.5 Mile	No
RCRA - CORRACTS	1.0 Mile	No
RCRA -TSD	0.5 Mile	No
RCRA - GEN	0.25 Mile	1
IC/EC Registry	*Property*	No
ERNS	*Property*	No

Potential environmental conditions were identified along the project corridor during review of "Standard Environmental Record Sources" of Federal Regulatory Agencies. 33 non-geocoded were included within the "Orphan Summary" supplied by EDR. Non-geocoded sites, or orphan sites, are facilities that could not be precisely located due to inadequate address information. The EDR report provides further details of the orphan sites identified in the databases. Fuss & O'Neill personnel make every effort within reasonable time and cost to locate non-geocoded listings that could influence the *property*.

- **(RCRA GEN) –** The RCRA GEN database includes information on sites that generate, store, treat, or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act. Facilities are considered large quantity generators (LQGs) if they generate more than 1,000 kg of hazardous waste per month or more than1 kg of acutely hazardous waste per month. Facilities are considered SQGs if they generate between 100 kg and 1,000 kg of hazardous waste per month or less than 1 kg of acutely hazardous waste, or meet other applicable requirements of RCRA. Facilities producing less than 100kg of hazardous waste per month are classified as CESQGs. A review of the most recent database indicated that there is **one (1)** reported RCRA GEN site within the search radius for the project corridor.

    1. Container Corporation of Carolina (CCC) (EPA I.D No.1000395755) located at 3358 Highway 51, Fort Mill, SC, is listed as a municipal solid waste (MSW) facility. This site is the one RCRA GEN site listed through our database search.

4.2 State Regulatory Review

Database	ASTM Minimum Search Distance	Listings w/in 1,000 Foot Buffer
STATE CERCLIS	1.0 Mile	No
SWL	0.5 Mile	**1**
LUST	0.5 Mile	**4**
UST/AST	0.5 Mile	**5**
IC/EC Registry	1.0 Mile	No
VCC	0.5 Mile	No
BROWNFIELDS	0.25 Mile	No

- **State Solid Waste Landfill (SWL/LF) -** The SWL/LF database is a listing of those facilities, involved with the handling of solid waste and includes locations of solid waste landfilling or associated activities involving the handling of solid waste. A review of the most recent database indicated **one (1)** reported SWL/LF property within the project corridor search radius.

    1. Container Corporation of Carolina (CCC) (EPA I.D No.1000395755) located at 3358 Highway 51, Fort Mill, South Carolina, is listed as a municipal solid waste (MSW) facility. MSW facilities accept combined residential, commercial/institutional waste generated. Though classified as a MSW facility in the database search report, CCC is better classified as a Class 3 MSW Transfer Station. Transfer stations are facilities where municipal solid waste is unloaded from collection vehicles and briefly held while it is reloaded onto larger long-distance transport vehicles for shipment to landfills or other treatment or disposal facilities. The database search shows the facility as a handler of tetrachloroethylene a chlorinated compound that has been the contaminant of concern at many soil and groundwater contaminated sites throughout the state.

- **Leaking Underground Storage Tank (LUST) -** The South Carolina LUST summary database contains information pertaining to all reported leaking storage tank cases. A review of the EDR report and the SCDHEC database indicates that there are **four (4)** LUST listings within the project corridor search radius.

    1. Summerville Grocery (SCDHEC Site I.D 14057) located at the parcel adjacent to 3660 Highway 51, Fort Mill, SC, is listed as a LUST site within SCDHECs database system. The site was granted a no further action (NFA) from SCDHEC on May 9, 1997.

    2. Lords Armory (SCDHEC Site I.D 14058) located at 3660 Highway 51, Fort Mill, SC, is listed as a LUST site within SCDHECs database system. The site was granted a conditional no further action (CNFA) from SCDHEC on May 9, 1997. The site was granted the CNFA status because groundwater is not currently being used, is reasonably anticipated not to be used in the future within the actual or predicted area of petroleum impact, petroleum chemicals of concern (CoCs) associated with the release are below site specific target levels (SSTL), groundwater will not be used for drinking or irrigation within the area of petroleum impact, and land use of the site will not change without notifying SCDHEC.

    3. Pantry 3969 doing business as (DBA) Petro Express (SCDHEC Site I.D 10515) located at 3473 Highway 21, Fort Mill, SC, is listed as a LUST site within SCDHECs database system. The site was granted a NFA from SCDHEC on January 6, 1999.

    4. Handy Pantry 28 Food Mart (SCDHEC Site I.D 09316) located at 3004 Highway 21 Bypass, Fort Mill, SC, is listed as a LUST site within SCDHECs database system. The site has not been granted a NFA from SCDHEC and is undergoing active corrective action (remediation).

    The LUST sites found by the database search and included within the "orphan summary" are not considered to be RECs due to their physical or geographical location in reference to the *property*.

Potential historical RECs (HRECs) or RECs were identified for the *property* through review of Standard Environmental Record Sources of Federal Agencies. These RECs will be addressed in *Section 9*.

- **Underground Storage Tank (UST)/Aboveground Storage Tank (AST) Report -** The UST/AST report includes a listing of properties with USTs and ASTs that are registered with the SCDHEC. A review of the most recent listings reports there are **five (5)** sites within the project corridor search radius.

    1. Millers Produce & Farm Inc. (SCDHEC Site ID 12165) located at 3660 Highway 51, Fort Mill, SC, is listed as a UST site within SCDHECs database system. The site currently has five regulated USTs in use. A diesel fuel UST was previously used on this site but it has been properly abandoned.

    2. Summerville Grocery (SCDHEC Site ID 14057) located at the parcel adjacent to 3660 Highway 51, Fort Mill, SC is listed as a UST site within SCDHECs database system. The site formerly housed two regulated USTs but these tanks have been properly abandoned.

    3. Lords Armory (SCDHEC Site ID 14058) located at 3660 Highway 51, Fort Mill, SC, is listed as a UST site within SCDHECs database system. The site formerly housed two regulated USTs but these tanks have been properly abandoned.

    4. Pantry 3969 DBA Petro Express (SCDHEC Site ID 10515) located at 3473 Highway 21, Fort Mill, SC, is listed as a UST site within SCDHECs database system. The site currently houses four regulated USTs that are still in use.

    5. Handy Pantry 28 Food Mart (SCDHEC Site ID 09316) located at 3004 Highway 21 Bypass, Fort Mill, SC, is listed as a UST site within SCDHECs database system. The site formerly housed three regulated USTs but these tanks have been properly abandoned.

    6. The UST sites found by the database search and included within the "orphan summary" are not considered to be RECs due to their physical or geographical/topographical location in reference to the project corridor.

The EDR report in *Appendix A* provides further details of the "orphan sites" identified in the databases.

4.3 Additional Environmental Records Sources

Fuss & O'Neill reviewed additional environmental record sources as part of its due diligence in completing this Phase I ESA.

4.3.1 South Carolina Groundwater Contaminant Inventory

Fuss & O'Neill reviewed the South Carolina Groundwater Contaminant Inventory (GWCI) for sites along the project corridor and sites located within the project corridor search radius that may be of

interest. The GWCI is a listing of known groundwater contaminant plumes throughout the state of South Carolina as maintained by the SCDHEC.

At the time of the compilation of this inventory in 2008 by SCDHEC, there were 171 sites in York County with known present or past groundwater contamination. Through review of the GWCI in combination with Fuss & O'Neill personnel identifying common groundwater contamination characteristics (including monitoring well and/or soil borings) along the project corridor, two additional sites were identified in the *property* that are UST/LUST sites. The following additional sites along the project corridor were discovered during the review of the GWCI:

Times Turn Around 10 – This site is located at 2488 US 21 Bypass, Fort Mill SC. The site currently operates as a gasoline retailer, and is listed in the GWCI, and has a monitoring well network associated with the site.

T & G's Country Store – This site is located at 2976 Highway 21, Fort Mill SC. The site currently appears to not be in operation, is listed in the GWCI, and has a monitoring well network associated with the site.

A copy of the York County GWCI is included in *Appendix E*.

4.3.2 Freedom of Information Act File Review

Fuss & O'Neill requested a Freedom of Information Act (FOIA) file review on January 29, 2013 for properties located at 3660 Highway 51, 3578 Highway 51, 3550 Highway 51, 3551 Highway 51, 3490 Highway 51, 3410 Highway 51, 3358 Highway 51, and the intersection of Highway US 21 & SC 51. Of the ten parcels listed, information was available for four of the properties.

The SCDHEC files on the selected properties along the *property* were reviewed by Fuss & O'Neill personnel on April 8-9, 2013. Environmental investigations at the Lord's Armory (3578 Highway 51), Container Corporation of Carolina (3358 Highway 51), Miller Produce and Farm (3660 Highway 51), Partex/Eumeric Holdings (3551 Highway 51), and at Paving Equipment of the Carolinas (3550 Highway 51) were reviewed and utilized during this Phase I ESA. The following was found during this FOIA file review:

- Container Corporation of Carolina – A UST closure report dated February 27, 1997 for the Carolina Corporation of Carolina by Steffen Robertson and Kirsten (SRK), was reviewed by Fuss & O'Neill personnel. The findings of the report documented four areas of concern (AOCs) at the site where closure activities took place. The four AOCs consisted of three UST storage areas and one concrete pad. Cumulatively thirteen USTs, two oil water separators, and one concrete pad along with underlying soils were removed during closure activities. Post removal soil samples were taken at all four locations. Benzene, toluene, ethylbenzene, xylenes, and naphthalene were present in post removal sampling.

- The Lord's Armory – SCDHECs response letter dated October 6. 2003 and a closure letter report by Consultech Environmental for the Lord's Armory dated September 23, 2003 was found and reviewed during our search of additional environmental record sources. The closure letter report

stated that all wells associated with Lord's Armory were below applicable detection limits or below SSTLs during closure sampling events. A CNFA was granted at the site for a release that had previously occurred at the referenced site. The CNFA was granted with specific conditions in place for the site. These conditions are:

1) Groundwater is not currently being used and is reasonably anticipated not to be used in the future within the actual or predicted area of petroleum impact.
2) All petroleum CoCs associated with the referenced UST release are below the SSTLs in soil and groundwater. Based on these site specific conditions, the CoCs will not exceed RBSLs at any potential receptors and/or exposure points.
3) The groundwater should not be used as a source of drinking water of for irrigation within the area of petroleum impact.
4) Land use should not change without notifying the Bureau of the proposed use. Any site excavation activities may encounter petroleum impacted soil that must be disposed of in a method approved by the department.
5) If CoCs from the referenced release are detected at levels that present a risk to human health or the environment, this office, under authority established in the South Carolina UST Control Regulations (SCUSTCR) R.61-92 Part 280, may require additional site rehabilitation.
6) The Bureau will be notified within 30 days of any changes to any of the above assumptions and conditions until all petroleum constituents are at or below RBSL. If site conditions are changed without Department approval, the owner or operator will be in violation of a Department order enforceable pursuant to the 1976 Code Section 44-2-140.

- Partex, Inc. / Eumeric Holdings – Fuss & O'Neill personnel reviewed a SCDHEC memorandum regarding administrative order 97-11-HW. The administrative order was issued to Mr. Anthony R. Jans for violations of the South Carolina Hazardous Waste Management Regulations and the South Carolina Pollution Control Act. The findings of fact of this order stated that Partex did not have an EPA identification number, Partex had not made hazardous waste determinations for numerous wastes stored on-site, and a spill from an on-site air scrubber had impacted an area of soil approximately 144 square feet. Soil taken from the spill area detected the presence of Chromium. Additional information about the extent of this contamination was not in the SCDHEC files reviewed by Fuss & O'Neill personnel.

- Paving Equipment of the Carolinas – An air emissions report for the referenced facility was reviewed by Fuss & O'Neill personnel. The facility operated as an asphalt plant and stored #2 fuel oil on-site. These were the only files found for this site.

4.3.3 City Directories Summary

EDR provided city directories for years ranging from 1997 to 2013. Fuss & O'Neill reviewed address listings as applicable to individual sites in compiling properties of interest. No additional properties of interests were found during the review of city directories. City directories are provided in *Appendix A*.

5 User-Provided Information

ASTM Practice E1527-05 describes certain tasks to be performed by the *user* of this assessment that will help to identify RECs at the parcel if they exist. ASTM Practice E1527-05 defines the *user* as "the party seeking to use Practice E1527 to complete an environmental site assessment of the *property*". *User*s can include a potential purchaser or tenant of the *property*, a lender, a *property* manager, or a *property* owner. The users of this report will be York County and its agents.

As documented in *Section 1.2* of this report, the *User* of this report was not asked to complete the All Appropriate Inquiry Phase I User Questionnaire (AAI Questionnaire) during this scope of work. Due to the fact that this Limited Phase I ESA corridor study is linear in nature and not an individual property, a property record and liens review was not conducted during this scope of work.

6 Site Reconnaissance

A site reconnaissance of the *property* was conducted on January 21, 2013 by Mr. Reginald Butler of Fuss & O'Neill. The objective of the site reconnaissance for a Phase I ESA is to assess if there is evidence of hazardous substances or petroleum products that were disposed of or used on the site at any time in the past that may create potential liability for an owner of the *property*. This evidence can be circumstantial such as the observation of stressed vegetation, staining, unlabeled or suspicious containers or structures, unidentified oily substances, pooled liquids, odors and the like. If identified, these observations can be listed as RECs which may require additional investigation.

The site reconnaissance entailed driving the *property*, verifying the existence of sites that were identified by the environmental database search, searching for sites that may not have been identified on the database search, and by the visual observation of indicators of potential environmental concerns as outlined above. Photographs taken during the site reconnaissance are in *Appendix B*.

6.1 Site Access and Limitations

As this is a Limited Phase I ESA only public entry areas were accessible during this assessment.

The inaccessibility of structures within the proposed right of way expansion may be considered a data gap. However, it is believed that the thorough review of database searches, review of available aerial photography, and visual observations made during the site reconnaissance, sufficient information was gathered to assess those areas that Fuss & O'Neill personnel could not directly access.

6.1.1 Hazardous Substances in and not in Connection with Identified Uses

Several properties along the *property* are suspected of using and storing various chemical substances. Some of the suspected substances included degreasers, dry cleaner cleaning fluids, and unknowns. A full inventory of the types of chemicals and storage locations is beyond the scope of this investigation.

6.1.2 Petroleum Products in and not in Connection with Identified Uses

Several properties along the *property* are suspected of using and storing various petroleum products. Some of the petroleum products included gasoline, diesel fuel, used oil, fuel oil, and unknowns. A full inventory of the types of petroleum products and storage locations is beyond the scope of this investigation but properties that use or store these chemicals have been identified.

6.1.3 Storage Tanks

The EDR environmental database records indicated and Fuss & O'Neill reconnaissance confirmed the locations of underground storage tanks at the following locations:

- Millers Produce & Farm Inc., 3660 Highway 51
- Pantry 3969 DBA Petro Express, 3473 Highway 21
- Handy Pantry 28 Food Mart, 3004 US 21 Bypass
- Summerville Grocery, Highway 51

The following locations with USTs were found during the site reconnaissance but were not listed in the database search.

- Times Turn Around 10, 2448 US Highway 21
- T & G's Country Store, 2976 US Highway 21

Above ground storage tanks were not located during the corridor reconnaissance or on the database records search within the project corridor except at the following site.

- Container Corporation of the Carolinas – 2 ASTs

6.1.4 Polychlorinated Biphenyls (PCBs)

Electrical transformers manufactured prior to 1979 generally contained PCB-oils. PCBs are polychlorinated biphenyl's and have been determined to be a likely carcinogen. The production of PCB fluids were discontinued in the United States in 1977 and new PCB-oil containing equipment was banned on July 1, 1979. Pole-mounted and pad mounted transformers were observed during site reconnaissance. However, there was no indication that these transformers were leaking or had leaked in the past.

A power transmission station with numerous transformers was observed at 2014 Highway 21. The distance of the transmission station from the current road and proposed road widening area should limit the potential for PCB impact to the subsurface near the ROW.

6.1.5 Solid Waste Disposal

Container Corporation of Carolina (EPA I.D No.1000395755) located at 3358 Highway 51, Fort Mill, South Carolina was listed as a MSW facility within the database search and the facility was located and verified during the site reconnaissance.

6.1.6 Stormwater

Storm water runoff from the roadway along the project corridor flows by sheet drainage into roadside drainage swales, from the drainage swales, storm water flows into nearby surface water bodies.

6.1.7 Stained or Environmentally Stressed Areas

No major staining or stressed vegetation areas were observed along the project corridor during the site reconnaissance.

6.1.8 Wells

Several monitoring wells associated with petroleum releases were observed during the site reconnaissance at Millers Produce and Farm Inc., Southern Tree & Landscaping, T&G Country Store, and Time Turn Around 10.

6.1.9 Potable Water / Wastewater

Municipal water and sewer service is maintained and supplied to the majority of the project corridor by York County's public works department. There are still several private water supply wells on parcels throughout the corridor and suspected septic systems as well. A possible septic tank was seen at 2448 US Highway 21 during the site reconnaissance.

There was previously an oil water separator (OWS) at the Container Corporation of Carolina located at 3358 Highway 51, Fort Mill SC to handle wastewater from the facility according to the closure report for Carolina Corp of Carolina (*Section 4.3*). Though there is no knowledge of the discharge location of the OWS located at the referenced site, there is a high probability that this facility once did not have access to municipal water and sewer and could have utilized a leach field as a discharge point for effluent discharge from the OWS.

6.1.10 Additional Environmental Concerns

During the site reconnaissance evidence of a monitoring well network was found at the site of the former Southern Tree & Landscape Co. No information was found during FOI file review and Southern Tree & Landscape Co. was only mentioned as a small quantity generator during our database search.

6.2 Non-ASTM Scope Considerations

Unless otherwise specified, the following items were not considered in the course of completing this ASTM E1527-05 Phase I ESA:

- Asbestos, Lead (paint/plumbing), Radon, Mold, Fluorescent Light Ballasts
- Ecological Resources, Historical/Cultural Resources
- Regulatory and Health & Safety Compliance
- Endangered species

7 Interviews

7.1 Interview with Local Government Official

Fuss & O'Neill personnel contacted the Fort Mill Department (name of person spoken to, phone number) to obtain information regarding the *property*. Fuss & O'Neill personnel were informed that information could not be released without submitting an FOIA request. The fire department said these request normally take 6-8 weeks to process. The 6-8 week FOIA request and file review for sites listed in *Section 10* were not reasonably ascertainable within the time and cost constraints of this investigation.

8 Data Gaps and Deviations

8.1 Data Gaps & Failures

Standard Practice E 1527-05 requires the identification and evaluation of data gaps or data failures, which are defined as a lack of or inability to obtain information required by the practice despite good faith efforts by the environmental professional to gather such information.

Items that would normally be considered data gaps are addressed in *Section 8.2.*.

The city directories and aerial photographs did not go back to 1940 or the time of first use. This would be considered a data failure.

8.2 Deviations

The report was conducted in general accordance with ASTM E1527-05 guidance for conducting Phase I ESAs. Since this Phase I ESA is being developed for a corridor, specific information for each individually owned parcel along the *property* was not reasonably ascertainable within the time and cost constraints of this investigation.

This Limited Phase I ESA deviates from ASTM E1527-05 in the following ways:

- Past or current uses of the properties, adjoining properties, and/or the surrounding area were not identified through interviews with the past or present individual parcel owners and/or past or present occupants.
- Past uses prior to 1970 were not identified through the review of historic aerial photographs.
- Interior observations of the structures along the *property* were not identified.
- Recorded land title records, liens, and/or zoning/land use records on individual properties along the *property* were not assessed. This includes environmental liens or activity and use limitations (AULs).
- The *User* of the report, York County and its agents was not given a "User Questionnaire" because it is unrealistic for a government entity to have specialized knowledge on small parcels of land along an extensive corridor. Therefore, the review of title and judicial records for environmental liens, AULs, or ascertainable recorded land title records were not supplied by the *User* of this report.

9 Findings

Findings of this Phase I ESA identify known or suspect RECs and HRECs. ASTM E 1527-05 states that an HREC is "an environmental condition in the past would have been considered a *recognized environmental condition*, but which may or may not be considered a *recognized environmental condition* currently. If a past release of any hazardous substances or petroleum products has occurred in connection with the *property* and has been remediated, with such remediation accepted by the responsible regulatory agency (for example, as evidenced by the issuance of a no further action letter or equivalent), this condition shall be considered an historical recognized environmental condition" The following suspect RECs and HRECs were observed during the Phase I ESA.

RECs

Container Corporation of Carolina: This site is located approximately 700 feet to the south of Highway 51 in a down to side-gradient location in proximity to the *property*.. The site is known to have had subsurface petroleum contamination in the past.

Handy Pantry 28 Food Mart: This site is located within the project corridor on the eastern side of Highway 21, is a known LUST site with limited information available, and no longer operates as a fuel retailer

Lords Armory: This site is located within the project corridor on the southern side of Highway 51 and is a known LUST site that has undergone active remediation Underground Injection Control (UIC). Direct push injection of Regenesis Corporation's oxygen release compound (ORC) was the remediation technology used to remediate the groundwater contaminant plume at the site.

Millers Produce & Farm Inc.: This site is located within the project corridor on the eastern side of Highway 21, is a known UST site with limited information available. An FOIA request was submitted to obtain any documented information regarding the site. A letter from SCDHEC dated September 8, 2002stating that SCDHEC requires no further site assessment or

rehabilitation of the site was the only documentation obtained from the FOI request. The site currently operates as a fuel retailer.

Partex/Eumeric Holdings: This site is located within the project corridor on the northern side of Highway 51, is known to have had Chromium contaminated soilin the past, and has had violations of the South Carolina Hazardous Waste Management Regulations and the South Carolina Pollution Control Act. The violations at the site were for failure to comply with the following regulations:

1. R.61-79.262.11, a person who generates a solid waste, as defined in R.61-79.261.2 must accurately determine if that waste is a hazardous waste;
2. R.61-79.262.12(a), a generator must not treat, store, dispose of, or offer for transportation, hazardous waste without having received an EPA identification number from SCDHEC;
3. R.61-79.262, Subpart C, Pre-transport requirements for generators of hazardous waste
4. R.61-79.262, Subpart D, record keeping and reporting requirements for generators of hazardous waste;
5. R.61-79.262.80, a generator must clean up any hazardous waste discharge that occurs during generation of processing or storage and take such other action as may be required or approved by Federal, State, or local officials so that the hazardous waste discharge no longer presents a hazard to human health of the environment; and,
6. 48-1-90 of the South Carolina Pollution control Act in that it shall be unlawful for any person, directly or indirectly, top throw, drain, run, allow to seep or otherwise discharge into the environment of the state organic or inorganic matter, including sewage, industrial wastes and other wastes, except as in compliance with a permit issued by SCDHEC.

Paving Equipment of the Carolinas: This site is located within the project corridor on the southern side of Highway 51, is known to have stored #2 fuel oil in the past, and formerly operated as an asphalt manufacturing facility.

Pantry 3969 DBA Petro Express: This site (SCDHEC Site I.D 10515) is located at 3473 Highway 21, Fort Mill, SC (approximately 2000 feet north of the intersection of US 21 and SC 51) is listed as a LUST site within SCDHECs database system. The site was granted a no further action (NFA) from SCDHEC on January 6, 1999. A new leak was detected at the site in January 19, 2012. No additional information regarding the leak was able to be obtained during this scope of work.

Southern Tree & Landscaping: This parcel is located within the project corridor at the intersection of Highway 21 and Highway 51. A monitoring well network was observed on the parcel during the site reconnaissance.

Summerville Grocery: This parcel is located within the project corridor on the eastern side of Highway 21. This parcel is a known LUST site with limited information available. The site no longer operates as a fuel retailer

T&G Country Store: This parcel is located within the project corridor on the eastern side of Highway 21. This parcel is a known LUST site with limited information available.

Times Turn Around 10: This parcel is located within the project corridor on the eastern side of Highway 21. This parcel is a known LUST site with limited information available. The site currently operates as a fuel retailer.

Historical RECs

The first release at the Pantry 3969 site may be considered an HREC.

10 Opinions

We have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E 1527-05 for the *property*. Any exceptions to, or deletions from, this practice are described in *Section 8* of this report. This assessment has revealed no evidence of *recognized environmental conditions* in connection with the *property* except for the following:

- **Container Corporation of Carolina:** SCDHEC files reviewed by Fuss & O'Neill personnel did not to eliminate the possibility of contamination from this site moving off-site and potentially affecting adjoining parcels. The Container Corporation of Carolina site is located down to side-gradient of the project corridor and areas of the property with known or suspect hazardous chemical and/or petroleum usage are several hundred feet from the right-of-way. Therefore, previous or unreported releases would not affect the *property* and this site is not considered an REC.

- **Millers Produce & Farm Inc.:** This site is located within the project corridor on the eastern side of Highway 21, and is a known LUST site with limited information available. The site no longer operates as a fuel retailer. Due to the limited attainable information pertaining to this site and a known release of petroleum on the site, this site is considered an REC.

- **Summerville Grocery:** This site is located within the project corridor on the eastern side of Highway 21, is a known LUST site with limited information available, and no longer operates as a petroleum retailer. SCDHEC reported that information pertaining to the Summerville Grocery site has been purged from the SCDHEC file system. Due to the limited attainable information pertaining to this site, this site is considered an REC.

- **Lords Armory:** A former petroleum release at the site was granted a CNFA in 2003. The CNFA was granted with land use restrictions in place and varying amounts of petroleum contamination were allowed to remain in place at the site. Because of petroleum contamination remaining in place at the site and the potential for this contamination to be encountered during construction activities, this site is considered an REC.
- **Pantry 3969 DBA Petro Express**: Although this site was reported within our database search radius and a new leak was found at this site in 2012, due to this site's distance from the project corridor this site is not considered an REC.

- **Partex/Eumeric Holdings:** An administrative order (97-11-HW) was issued on the facility by SCDHEC in 1997 for violations of the South Carolina Hazardous Waste Management

Regulations and the South Carolina Pollution Control Act for failure to comply with regulations. Partex/Eumeric Holdings failed to comply with regulations listed in *Section 9*. Information regarding these violations and compliance or non-compliance of issues addressed in the administrative order were not found during FOI file review and have possibly been purged from SCHECs file system. Due to the lack of information on this facility and known past soil contamination the Environmental Professional conducting this Phase I ESA concludes this property is currently an REC.

- **Paving Equipment of the Carolinas:** This property formerly stored #2 fuel oil and was a manufacturer of petroleum-based asphalt. Because of the storage of #2 fuel oil and past use of the property, this site is considered an REC.

- **Southern Tree & Landscaping:** During the site reconnaissance, a monitoring well network was observed at the intersection of US 21 and SC 51 on a site which formerly operated as Southern Tree & Landscaping. Review of SCDHECs files did not return information pertaining to this site and it is believed that information on this site has been purged from SCDHECs file system. The presence of an on-site monitoring well network and limited attainable information pertaining to this site, this site is considered an REC.

- **Handy Pantry 28 Food Mart:** SCDHEC files did not contain information for the Handy Pantry 28 Food Mart. The facility is a former LUST site and was listed on the 2008 GWCI for York County. With the lack of available SCDHEC files and classification of the site as a LUST site, this site is considered an REC.

- **T&G Country Store:** This site is located within the project corridor on the eastern side of Highway 21 and is a known LUST site with limited information available. Because of the known release of petroleum at this site, the site is considered an REC.

- **Times Turn Around 10:** This site is located within the project corridor on the eastern side of Highway 21, Review of SCDHECs files did not return information pertaining to this site and it is believed that information on this site has been purged from SCDHECs file system. This site is a known LUST site with limited information available, and currently operates as a fuel retailer. Because of the known release of petroleum at this site, the site is considered an REC.

A map displaying the locations of these RECs is included as *Figure 3*.

11 Conclusions

We have performed a *Phase I Environmental Site Assessment* in conformance with the scope and limitations of ASTM Practice E1527 of the properties located along Highway 21/ Highway 51 in Fort Mill, York County, South Carolina, the *property* (project corridor). Any exceptions to, or deletions from, this practice are described in *Section8.2* of this *report*. This assessment has revealed no evidence of *recognized environmental conditions* in connection with the *property* except for the following:

- Millers Produce and Farm Inc.
- Summerville Grocery

- Lords Armory
- Partex/Eumeric Holdings
- Paving Equipment of the Carolinas
- Sothern Tree & Landscaping
- Handy Pantry 28 Food Mart
- T&G Country Store
- Times Turn Around 10

Although there were deviations from the ASTM E1527-05, this Limited Phase I ESA addressed the potential for environmental liabilities from the presence of soil or groundwater contamination and/or the presence of hazardous waste or hazardous materials within the reasonably ascertainable time and cost constraints.

12 Additional Investigation

In accordance with Section 12.6.1 of ASTM Standard Practice E1527-05, additional subsurface investigations are recommended due to RECs being present along the project corridor.

13 Qualifications

This Phase I Environmental Site Assessment was performed by Fuss & O'Neill staff members Mr. Reginald Butler and Mr. Jeremy Grant, P.G. Mr. Grant is a professional geologist in the state of South Carolina that served as the Project Manager for this project and senior reviewer of this report. He has 18 years of experience in the environmental industry and has a Bachelor of Arts degree and a Master of Science degree in Geology. Mr. Grant's resume is included in *Appendix F*.

13.1 Signature(s) of Environmental Professional(s)

I declare that, to the best of my professional knowledge and belief, I meet the definition of *Environmental Professionals* (EP) as defined in Part 312.10 of 40 CFR 312. I have the specific qualifications based on education, training, and experience to assess a *property* of the nature, history, and setting of the subject *property*. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Jeremy Grant, P.G.
Project Manager

6/18/13
Date

14 References

American Standard for Testing and Materials International, 2005;
Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process;
Designation: E 1527-05.

South Carolina Department of Health and Environmental Control, Bureau of Water, October 2008;
South Carolina Groundwater Contaminant Inventory

State Development Board, Division of Geology, South Carolina Department of Transportation, June 2010;
Geologic Notes;
Designation: Volume 9, Number 2.

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Wetlands Mapper, Information retrieved online from http://www.fws.gov/wetlands;
Accessed on May 18, 2013.

York County Geographic Information Systems, York County, South Carolina, 2013;
Retrieved online from http://www.maps2.yorkcountygov.com;
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FUSS & O'NEILL

15 Limitations of Work Product

This document was prepared for the sole use of **York County and its agents,** the only intended beneficiaries of our work. Those who may use or rely upon the report and the services (hereafter "work product") performed by Fuss & O'Neill, Inc. and/or its subsidiaries or independent professional associates, subconsultants and subcontractors (collectively the "Consultant") expressly accept the work product upon the following specific conditions.

1. Consultant represents that it prepared the work product in accordance with the professional and industry standards prevailing at the time such services were rendered.

2. The work product may contain information that is time sensitive. The work product was prepared by Consultant subject to the particular scope limitations, budgetary and time constraints and business objectives of the Client which are detailed therein or in the contract between Consultant and Client. Changes in use, tenants, work practices, storage, Federal, state or local laws, rules or regulations may affect the work product.

3. The observations described and upon which the work product was based were made under the conditions stated therein. Any conclusions presented in the work product were based solely upon the services described therein, and not on scientific or engineering tasks or procedures beyond the scope of described services.

4. In preparing its work product, Consultant may have relied on certain information provided by state and local officials and information and representations made by other parties referenced therein, and on information contained in the files of state and/or local agencies made available at the time of the project. To the extent that such files which may affect the conclusions of the work product are missing, incomplete, inaccurate or not provided, Consultant is not responsible. Although there may have been some degree of overlap in the information provided by these various sources, Consultant did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this project. Consultant assumes no responsibility or liability to discover or determine any defects in such information which could result in failure to identify contamination or other defect in, at or near the site. Unless specifically stated in the work product, Consultant assumes no responsibility or liability for the accuracy of drawings and reports obtained, received or reviewed.

5. If the purpose of this project was to assess the physical characteristics of the subject site with respect to the presence in the environment of hazardous substances, waste or petroleum and chemical products and wastes as defined in the work product, unless otherwise noted, no specific attempt was made to check the compliance of present or past owners or operators of the subject site with Federal, state, or local laws and regulations, environmental or otherwise.

6. If water level readings have been made, these observations were made at the times and under the conditions stated in the report. However, it must be noted that fluctuations in water levels

may occur due to variations in rainfall, passage of time and other factors and such fluctuations may affect the conclusions and recommendations presented herein.

7. Except as noted in the work product, no quantitative laboratory testing was performed as part of the project. Where such analyses have been conducted by an outside laboratory, Consultant has relied upon the data provided, and unless otherwise described in the work product has not conducted an independent evaluation of the reliability of these tests.

8. If the conclusions and recommendations contained in the work product are based, in part, upon various types of chemical data, then the conclusions and recommendations are contingent upon the validity of such data. These data (if obtained) have been reviewed and interpretations made by Consultant. If indicated in the work product, some of these data may be preliminary or screening-level data and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors.

9. Chemical analyses may have been performed for specific parameters during the course of this project, as described in the work product. However, it should be noted that additional chemical constituents not included in the analyses conducted for the project may be present in soil, groundwater, surface water, sediments or building materials at the subject site.

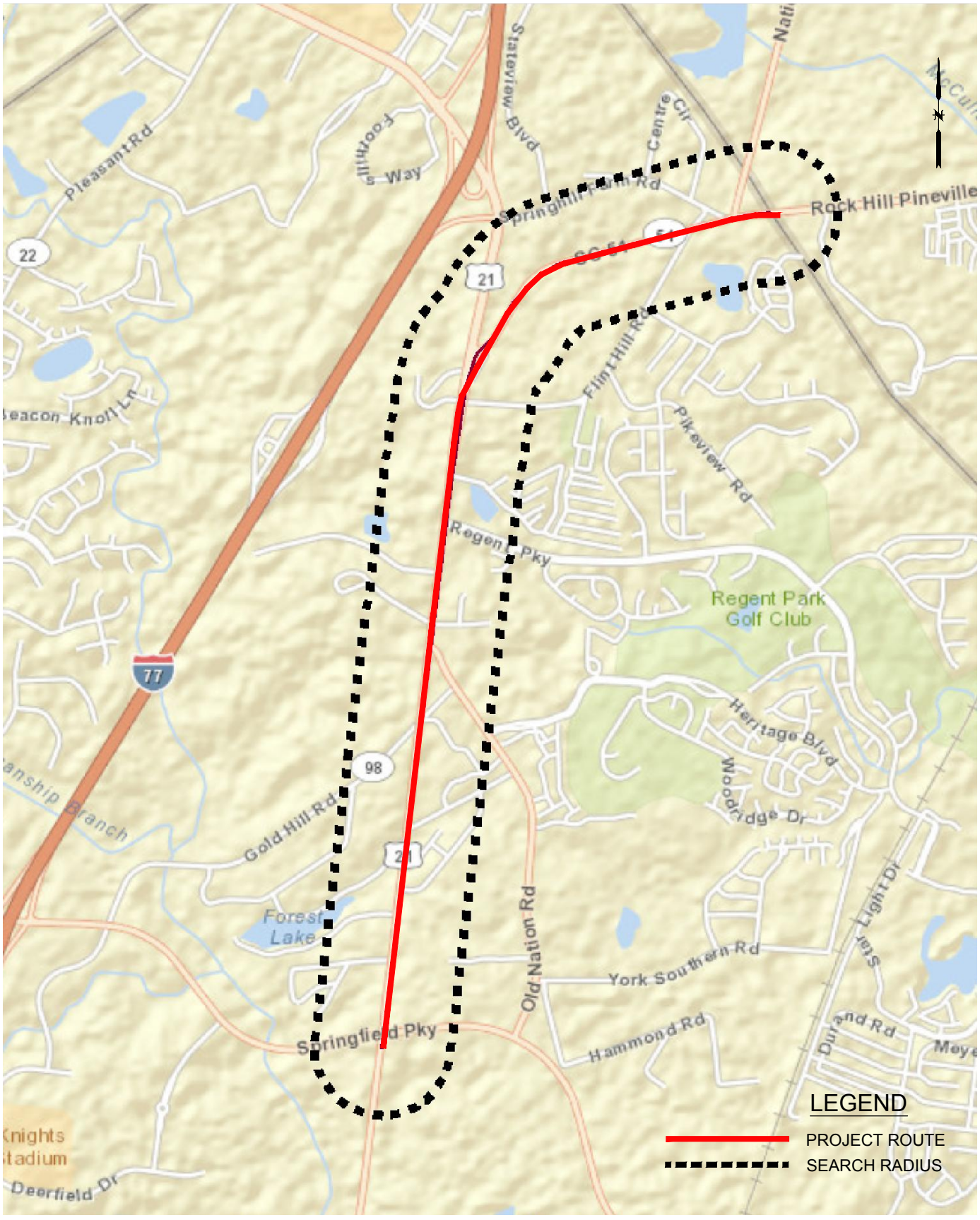
10. Ownership and property interests of all documents, including reports, electronic media, drawings and specifications, prepared or furnished by Consultant pursuant to this project are subject to the terms and conditions specified in the contract between the Consultant and Client, whether or not the project is completed.

11. Unless otherwise specifically noted in the work product or a requirement of the contract between the Consultant and Client, any reuse, modification or disbursement of documents to third parties will be at the sole risk of the third party and without liability or legal exposure to Consultant.

12. In the event that any questions arise with respect to the scope or meaning of Consultant's work product, immediately contact Consultant for clarification, explanation or to update the work product. In addition, Consultant has the right to verify, at the party's expense, the accuracy of the information contained in the work product, as deemed necessary by Consultant, based upon the passage of time or other material change in conditions since conducting the work.

13. Any use of or reliance on the work product shall constitute acceptance of the terms hereof.

Figures



SCALE:	
HORZ.: 1" = 2000'	
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 1000 2000

GRAPHIC SCALE

FUSS & O'NEILL
717 LADY ST, SUITE E
COLUMBIA, SOUTH CAROLINA 29201
803.376.6034
www.fando.com

STV/Ralph Whitehead Associates

SITE LOCATION MAP

US Highway 21 / SC Highway 51 Road Widening

Fort Mill South Carolina

PROJ. No.: 20120285.A10
DATE: MAY 2013

Figure 1

File Path: F:\P2012\0285 STV York County US 21 SC 51\A10\DWG\20091408A11_STP01_TOPOMAP.dwg Layout: FIGURE 1 Plotted: Tue, April 30, 2013 - 11:18 AM User: rbutler
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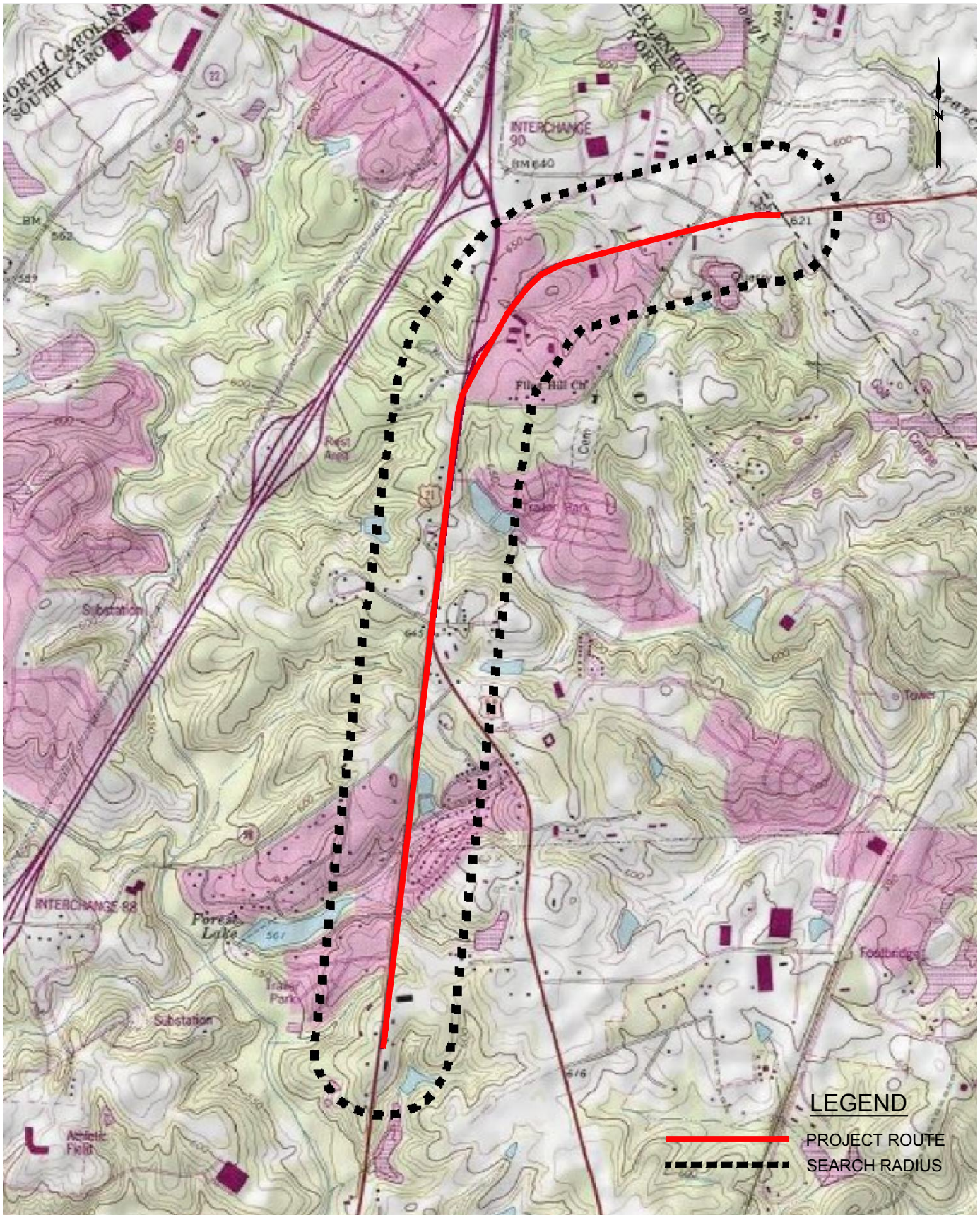

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STV/Ralph Whitehead Associates

TOPOGRAPHIC SITE LOCATION MAP

US Highway 21 / SC Highway 51 Road Widening

Fort Mill South Carolina

PROJ. No.: 20120285.A10
DATE: MAY 2013

Figure 2

File Path: F:\P2012\0285 STV York County US 21 SC 51\A10\DWG\20091408A11_STP01_TOPOMAP.dwg Layout: FIGURE 2 Plotted: Tue, April 30, 2013 - 10:31 AM User: rbutler
MS VIEW: LAYER STATE: Plotter: DWG TO PDF.PC3 CTB File: FO 2008 MONO (HALF).CTB



SCALE:
HORZ.: 1" = 2000'
VERT.:
DATUM:
HORZ.:
VERT.:
0 1000 2000
GRAPHIC SCALE

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803.376.6034
www.fando.com

STV/Ralph Whitehead Associates

REC LOCATION MAP

US Highway 21 / SC Highway 51 Road Widening

Fort Mill South Carolina

PROJ. No.: 20120285.A10
DATE: MAY 2013

Figure 3

File Path: F:\P2012\0285 STV York County US 21 SC 51\A10\DWG\20091408A11_STP01_TOPOMAP.dwg Layout: FIGURE 3 Plotted: Wed, May 01, 2013 - 9:05 AM User: rbutler
MS VIEW: LAYER STATE: Plotter: DWG TO PDF.PC3 CTB File: FO 2008 MONO (HALF).CTB

Appendix A

Environmental Database Search (EDR)

US Hwy 21/SC Hwy 51 Phase I Env Site Assessment
Fort Mill, SC 29715

Inquiry Number: 3490767.1s
January 09, 2013

EDR DataMap™ Corridor Study

Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

TARGET PROPERTY INFORMATION

ADDRESS

FORT MILL, SC 29715
FORT MILL, SC 29715

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records within the requested search area for the following databases:

FEDERAL RECORDS

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
Delisted NPL	National Priority List Deletions
NPL LIENS	Federal Superfund Liens
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP	CERCLIS No Further Remedial Action Planned
LIENS 2	CERCLA Lien Information
CORRACTS	Corrective Action Report
RCRA-TSDF	RCRA - Treatment, Storage and Disposal
RCRA-LQG	RCRA - Large Quantity Generators
RCRA-SQG	RCRA - Small Quantity Generators
US ENG CONTROLS	Engineering Controls Sites List
US INST CONTROL	Sites with Institutional Controls
ERNS	Emergency Response Notification System
HMIRS	Hazardous Materials Information Reporting System
DOT OPS	Incident and Accident Data
US CDL	Clandestine Drug Labs
US BROWNFIELDS	A Listing of Brownfields Sites
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
LUCIS	Land Use Control Information System
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
ODI	Open Dump Inventory
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System

MLTS ---- Material Licensing Tracking System
RADINFO ---- Radiation Information Database
RAATS ---- RCRA Administrative Action Tracking System
RMP ---- Risk Management Plans
COAL ASH EPA ---- Coal Combustion Residues Surface Impoundments List
SCRD DRYCLEANERS ---- State Coalition for Remediation of Drycleaners Listing
US HIST CDL ---- National Clandestine Laboratory Register
PCB TRANSFORMER ---- PCB Transformer Registration Database
FEDERAL FACILITY ---- Federal Facility Site Information listing
US FIN ASSUR ---- Financial Assurance Information
EPA WATCH LIST ---- EPA WATCH LIST
PRP ---- Potentially Responsible Parties
2020 COR ACTION ---- 2020 Corrective Action Program List
COAL ASH DOE ---- Steam-Electric Plant Operation Data
FEMA UST ---- Underground Storage Tank Listing
US AIRS ---- Aerometric Information Retrieval System Facility Subsystem

STATE AND LOCAL RECORDS

SC SHWS ---- Site Assessment Section Project List
NC SHWS ---- Inactive Hazardous Sites Inventory
SC ALLSITES ---- Site Assessment & Remediation Public Record Database
NC IMD ---- Incident Management Database
NC HSDS ---- Hazardous Substance Disposal Site
NC SWF/LF ---- List of Solid Waste Facilities
NC OLI ---- Old Landfill Inventory
NC UIC ---- Underground Injection Wells Listing
SC SWRCY ---- Solid Waste Recycling Facilities
NC SWRCY ---- Recycling Center Listing
NC HIST LF ---- Solid Waste Facility Listing
NC LUST ---- Regional UST Database
NC LUST TRUST ---- State Trust Fund Database
NC UST ---- Petroleum Underground Storage Tank Database
NC LAST ---- Leaking Aboveground Storage Tanks
SC AST ---- Aboveground Storage Tank List
NC AST ---- AST Database
SC SPILLS ---- Spills Database List
NC INST CONTROL ---- No Further Action Sites With Land Use Restrictions Monitoring
SC VCP ---- Voluntary Cleanup Sites
NC VCP ---- Responsible Party Voluntary Action Sites
SC DRYCLEANERS ---- Drycleaner Database
NC DRYCLEANERS ---- Drycleaning Sites
SC BROWNFIELDS ---- Brownfields Sites Listing
NC BROWNFIELDS ---- Brownfields Projects Inventory
SC CDL ---- Clandestine Drug Lab Sites
SC NPDES ---- Waste Water Treatment Facilities Listing
NC NPDES ---- NPDES Facility Location Listing
SC AIRS ---- Permitted Airs Facility Listing
SC Financial Assurance ---- Financial Assurance Information Listing
SC COAL ASH ---- Coal Ash Disposal Sites
NC COAL ASH ---- Coal Ash Disposal Sites
NC Financial Assurance ---- Financial Assurance Information Listing

TRIBAL RECORDS

INDIAN RESERV ---- Indian Reservations

EXECUTIVE SUMMARY

INDIAN ODI ---------- Report on the Status of Open Dumps on Indian Lands
INDIAN LUST ---------- Leaking Underground Storage Tanks on Indian Land
INDIAN UST ---------- Underground Storage Tanks on Indian Land
INDIAN VCP ---------- Voluntary Cleanup Priority Listing

EDR PROPRIETARY RECORDS

EDR MGP ---------- EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified.

Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

FEDERAL RECORDS

RCRA-CESQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-CESQG list, as provided by EDR, and dated 09/11/2012 has revealed that there is 1 RCRA-CESQG site within the searched area.

Site	Address	Map ID	Page
CONTAINER CORPORATION OF CAROL	***3358 HWY 51***	***9***	***19***

RCRA-NonGen: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA-NonGen list, as provided by EDR, and dated 09/11/2012 has revealed that there are 3 RCRA-NonGen sites within the searched area.

Site	Address	Map ID	Page
EUMERIC HOLDINGS NV	***3551 HWY 51***	***4***	***10***
DIENES APPARATUS INC	***3410 HWY 51***	***7***	***16***
SOUTHERN TREE & LANDSCAPE CO	***INTERSECTION US21 & SC5***	***10***	***22***

EXECUTIVE SUMMARY

FINDS: The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include: RCRIS; Permit Compliance System (PCS); Aerometric Information Retrieval System (AIRS); FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]; CERCLIS; DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); Federal Reporting Data System (FRDS); Surface Impoundments (SIA); TSCA Chemicals in Commerce Information System (CICS); PADS; RCRA-J (medical waste transporters/disposers); TRIS; and TSCA. The source of this database is the U.S. EPA/NTIS.

A review of the FINDS list, as provided by EDR, and dated 10/23/2011 has revealed that there are 16 FINDS sites within the searched area.

Site	Address	Map ID	Page
MILLERS PRODUCE & FARM INC	3660 HWY 51	2	6
LORDS ARMORY	3578 HWY 51	3	6
BYI LLC	3550 HWY 51	4	8
PAVING EQUIP CAROLINAS	3550 HWY 51	4	9
VIKING ENTERPRISES	3551 HWY 51	4	9
PARTEX INCORPORATED	3551 HWY 51	4	9
EUMERIC HOLDINGS NV	***3551 HWY 51***	***4***	***10***
DYNAMIC PROPERT	3490 HWY 51	5	15
DIENES APPARATUS INC	***3410 HWY 51***	***7***	***16***
CONTAINER CORPORATION OF CAROL	***3358 HWY 51***	***9***	***19***
SOUTHERN TREE & LANDSCAPE CO	***INTERSECTION US21 & SC5***	***10***	***22***
VANCEBURG READY MIX CONCRETE	3231 HIGHWAY 21	11	24
STATE STORE AND LOCK	3203 HWY 21	12	25
T & G S COUNTRY STORE	2976 HWY 21	13	25
HANDY PANTRY 28 FOOD MART	3004 US 21 BYPASS	13	27
DIAMONDS #1	3004 HWY 21	13	27

STATE AND LOCAL RECORDS

SC GWCI: Groundwater Contamination Inventory Cases. Any site that has groundwater contamination over a federal MCL.

A review of the SC GWCI list, as provided by EDR, and dated 07/01/2008 has revealed that there are 2 SC GWCI sites within the searched area.

Site	Address	Map ID	Page
LORDS ARMORY	***3578 HWY 51***	***3***	***6***
HANDY PANTRY 28 FOOD MART	***3004 US 21 BYPASS***	***13***	***25***

SC RCR: The Bureau of Land and Waste Management established this Registry to help monitor and maintain sites that have conditional remedies. A Conditional Remedy is an environmental remedy that includes certain qualifications. These qualifications are divided into two major categories: Remedies requiring Land Use Controls and Conditional No Further Actions.

A review of the SC RCR list, as provided by EDR, and dated 09/19/2012 has revealed that there is 1 SC RCR site within the searched area.

Site	Address	Map ID	Page
LORDS ARMORY	***3578 HWY 51***	***3***	***6***

EXECUTIVE SUMMARY

SC SWF/LF: The Solid Waste Facilities/Landfill Sites records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. The data come from the Department of Health & Environmental Control's Permitted Landfills List/Inactive MSWLF List.

A review of the SC SWF/LF list, as provided by EDR, and dated 08/13/2012 has revealed that there is 1 SC SWF/LF site within the searched area.

Site	Address	Map ID	Page
CONTAINER COMPANY OF CAROLINA		8	18

SC UIC: A listing of underground injection wells locations.

A review of the SC UIC list, as provided by EDR, and dated 11/16/2012 has revealed that there is 1 SC UIC site within the searched area.

Site	Address	Map ID	Page
LORDS ARMORY	***3578 HWY 51***	***3***	***6***

SC LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Health & Environmental Control's Leaking UST list.

A review of the SC LUST list, as provided by EDR, and dated 05/23/2012 has revealed that there are 4 SC LUST sites within the searched area.

Site	Address	Map ID	Page
SUMMERVILLE GROCERY No Action Required: 05/09/97	***HWY 51***	***2***	***5***
LORDS ARMORY No Action Required: 10/03/03	***3578 HWY 51***	***3***	***6***
PANTRY 3969 DBA PETRO EXPRESS No Action Required: 01/06/99	***3473 HWY 21***	***6***	***15***
HANDY PANTRY 28 FOOD MART	***3004 US 21 BYPASS***	***13***	***25***

SC UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Health & Environmental Control's list: Comprehensive Underground Storage Tanks.

A review of the SC UST list, as provided by EDR, and dated 11/26/2012 has revealed that there are 5 SC UST sites within the searched area.

Site	Address	Map ID	Page
MILLERS PRODUCE & FARM INC	3660 HWY 51	1	4
SUMMERVILLE GROCERY	***HWY 51***	***2***	***5***
LORDS ARMORY	***3578 HWY 51***	***3***	***6***
PANTRY 3969 DBA PETRO EXPRESS	***3473 HWY 21***	***6***	***15***
HANDY PANTRY 28 FOOD MART	***3004 US 21 BYPASS***	***13***	***25***

EXECUTIVE SUMMARY

Please refer to the end of the findings report for unmapped orphan sites due to poor or inadequate address information.

MAP FINDINGS SUMMARY

Database	Total Plotted
FEDERAL RECORDS	
NPL	0
Proposed NPL	0
Delisted NPL	0
NPL LIENS	0
CERCLIS	0
CERC-NFRAP	0
LIENS 2	0
CORRACTS	0
RCRA-TSDF	0
RCRA-LQG	0
RCRA-SQG	0
RCRA-CESQG	1
RCRA-NonGen	3
US ENG CONTROLS	0
US INST CONTROL	0
ERNS	0
HMIRS	0
DOT OPS	0
US CDL	0
US BROWNFIELDS	0
DOD	0
FUDS	0
LUCIS	0
CONSENT	0
ROD	0
UMTRA	0
DEBRIS REGION 9	0
ODI	0
MINES	0
TRIS	0
TSCA	0
FTTS	0
HIST FTTS	0
SSTS	0
ICIS	0
PADS	0
MLTS	0
RADINFO	0
FINDS	16
RAATS	0
RMP	0
COAL ASH EPA	0
SCRD DRYCLEANERS	0
US HIST CDL	0
PCB TRANSFORMER	0
FEDERAL FACILITY	0
US FIN ASSUR	0
EPA WATCH LIST	0

MAP FINDINGS SUMMARY

Database	Total Plotted
PRP	0
2020 COR ACTION	0
COAL ASH DOE	0
FEMA UST	0
US AIRS	0

STATE AND LOCAL RECORDS

SC SHWS	0
NC SHWS	0
SC ALLSITES	0
SC GWCI	2
NC IMD	0
NC HSDS	0
SC RCR	1
SC SWF/LF	1
NC SWF/LF	0
NC OLI	0
SC UIC	1
NC UIC	0
SC SWRCY	0
NC SWRCY	0
NC HIST LF	0
SC LUST	4
NC LUST	0
NC LUST TRUST	0
SC UST	5
NC UST	0
NC LAST	0
SC AST	0
NC AST	0
SC SPILLS	0
NC INST CONTROL	0
SC VCP	0
NC VCP	0
SC DRYCLEANERS	0
NC DRYCLEANERS	0
SC BROWNFIELDS	0
NC BROWNFIELDS	0
SC CDL	0
SC NPDES	0
NC NPDES	0
SC AIRS	0
SC Financial Assurance	0
SC COAL ASH	0
NC COAL ASH	0
NC Financial Assurance	0

TRIBAL RECORDS

INDIAN RESERV	0

MAP FINDINGS SUMMARY

Database	Total Plotted
INDIAN ODI	0
INDIAN LUST	0
INDIAN UST	0
INDIAN VCP	0
EDR PROPRIETARY RECORDS	
EDR MGP	0

NOTES:

Sites may be listed in more than one database

1 **MILLERS PRODUCE & FARM INC** **SC UST** **U003629500**
3660 HWY 51 **N/A**
FORT MILL, SC 29715

UST:

Facility ID:	12165
Owner:	MILLER
Owner Contact:	CHARLES MILLER
Owner Address:	3344 SCHOONER LN
Owner City,St,Zip:	CLOVER, SC 29710
Owner Phone:	000-000-0000
Contact:	PATRICIA PASTERNAK
Contact Tel:	803-548-1760
Tank ID:	1
Capacity:	8000
Product:	PREM
Calcage:	0
Status:	**Currently in use**
Tank ID:	2
Capacity:	8000
Product:	RUL
Calcage:	0
Status:	**Currently in use**
Tank ID:	3
Capacity:	10000
Product:	RUL
Calcage:	0
Status:	**Currently in use**
Tank ID:	4
Capacity:	8000
Product:	Diesel
Calcage:	0
Status:	**Abandoned**
Tank ID:	5
Capacity:	10000
Product:	Diesel
Calcage:	0
Status:	**Currently in use**
Tank ID:	6
Capacity:	30000
Product:	RUL
Calcage:	0
Status:	**Currently in use**

2 **SUMMERVILLE GROCERY** **SC LUST** **U003525696**
HWY 51 **SC UST** **N/A**
FORT MILL, SC 29715

LUST:

Facility ID:	14057
Release Number:	1
Facility Status:	conduct invest/risk assessment
Substance:	PETRO
Owner:	MILDRED FERGUSON
NFA Date:	**05/09/97**
Date Confirmed:	05/17/94
Report Date:	03/22/93
Rank:	3BF

LUST DETAIL:

Release Date:	03/22/1993
Cleanup Complete Date:	05/09/1997
RP Name:	FERGUSON
RP Address:	9106 PROVIDENCE RD W
RP City:	CHARLOTTE
RP State:	NC
RP Zip:	28277-1641
SCRBCA Class Code:	CLASS3BF
Depth to Ground Water:	Not reported
Ground Water Flow Direction:	Not reported
Project Manager:	MINER, READ S
Release Fin Type Code:	DHEC SUPERB with State Lead

UST:

Facility ID:	14057
Owner:	FERGUSON
Owner Contact:	O'NEAL STARNES
Owner Address:	9106 PROVIDENCE RD W
Owner City,St,Zip:	CHARLOTTE, NC 28277-1641
Owner Phone:	704-542-2649
Contact:	O'NEAL STARNES
Contact Tel:	Not reported
Tank ID:	1
Capacity:	1000
Product:	Gasoline
Calcage:	25
Status:	**Abandoned**

Tank ID:	2
Capacity:	1000
Product:	Gasoline
Calcage:	25
Status:	**Abandoned**

2 **MILLERS PRODUCE & FARM INC** **FINDS** **1007240903**
3660 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110017125617

Environmental Interest/Information System
SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

---

3 **LORDS ARMORY** **FINDS** **1007227176**
3578 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110016983264

Environmental Interest/Information System
SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

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3 **LORDS ARMORY** **SC GWCI** **U003525872**
3578 HWY 51 **SC RCR** **N/A**
FORT MILL, SC 29715 **SC UIC**
SC LUST
SC UST

SC GWIC:

Bureau:	BLWM
EAP ID:	Not reported
Solid Waste Permit #:	Not reported
Bureau of Land & Waste Management File #:	Not reported
Permit Number:	14058
WPC Permit:	Not reported
Program:	DUST
Contamination:	PETRO
Petroleum Products:	True
Volatile Organic Compounds:	False
Metals:	False
Nitrates or Potential to Nitrate:	False
Pesticides & Herbicides:	False
Polychlorinated Biphenyls:	False
Base, Neutral, & Acid Extractables:	False

LORDS ARMORY (Continued) **U003525872**

Phenols:	False
Radionuclides Over Max Contaminant Levels:	False
Sources Not In Other Categories:	False
Source:	UST
Underground Storage Tanks:	True
Pits, Ponds, & Lagoons:	False
Spills & Leaks:	False
Landfills:	False
Aboveground Storage Tank:	False
Spray Irrigation:	False
Single-Event Spill:	False
Unpermitted Disposal:	False
Septic Tank/Tile Field:	False
Substances Not In Other Categories:	False
Sources of Contamination Undetermined:	False
Assessment:	No
Monitoring:	No
Remediation:	Yes
Surface Impact:	No
Drinking Water Well Impact:	No
Remarks:	Site ID # 14058. RBCA Classification 2AA9. CNFA.

RCR:

Entity Responsibility:	O'Neal S Starnes & William Vick
Region:	3
Tax Id:	Not reported
Latitude:	35.08857
Longitude:	-80.92332
Tracking Number:	14058
Regulatory Program:	UST
Unit Type:	UST
Unit Number/Letter:	1
Area/Acres:	Not reported
Affected Media:	Groundwater
Site/Unit:	Regulated Petroleum Underground Storage Tank Location
Condtions:	Public Noticed Corrective Action Plan
Associated Response/Corrective Action:	Not reported
Associated Chemicals Requiring:	Naphthalene

UIC:

Facility Status:	Permanently Abandoned
Permit Number:	450
Number Of Wells:	5
Facility Status:	Permanently Abandoned
Permit Number:	450M
Number Of Wells:	1

LUST:

Facility ID:	14058
Release Number:	1
Facility Status:	closed > RBSLs
Substance:	PETRO
Owner:	O'NEAL S STARNES & WILLIAM VICK
NFA Date:	**10/03/03**
Date Confirmed:	03/23/95

LORDS ARMORY (Continued) **U003525872**

Report Date: 03/22/93
Rank: 2AA

LUST DETAIL:
Release Date: 03/22/1993
Cleanup Complete Date: Not reported
RP Name: O'NEAL S STARNES & WILLIAM VICK
RP Address: 9014 FOURMILE CREEK RD
RP City: CHARLOTTE
RP State: NC
RP Zip: 28277-9068
SCRBCA Class Code: CLASS2AA
Depth to Ground Water: 11
Ground Water Flow Direction: W
Project Manager: MINER, READ S
Release Fin Type Code: DHEC SUPERB with State Lead

UST:
Facility ID: 14058
Owner: O'NEAL S STARNES & WILLIAM VICK
Owner Contact: O'NEAL STARNES
Owner Address: 9014 FOURMILE CREEK RD
Owner City,St,Zip: CHARLOTTE, NC 28277-9068
Owner Phone: 704-542-7533
Contact: O'NEAL STARNES
Contact Tel: Not reported

Tank ID: 1
Capacity: 500
Product: Gasoline
Calcage: 25
Status: **Abandoned**

Tank ID: 2
Capacity: 500
Product: Gasoline
Calcage: 25
Status: **Abandoned**

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4 **BYI LLC** **FINDS** **1007650914**
3550 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110019917036

Environmental Interest/Information System
SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

4 **PAVING EQUIP CAROLINAS** **FINDS** **1007224350**
3550 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110016953956

Environmental Interest/Information System
AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

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4 **VIKING ENTERPRISES** **FINDS** **1007835716**
3551 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110019997066

Environmental Interest/Information System
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4 **PARTEX INCORPORATED** **FINDS** **1004593191**
3551 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110002329365

Environmental Interest/Information System
AFS (Aerometric Information Retrieval System (AIRS) Facility

PARTEX INCORPORATED (Continued) **1004593191**

Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

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4 **EUMERIC HOLDINGS NV** **RCRA-NonGen** **1001120786**
3551 HWY 51 **FINDS** **SCR000003723**
FORT MILL, SC 29715

RCRA-NonGen:

Date form received by agency:	05/03/1999
Facility name:	EUMERIC HOLDINGS NV
Facility address:	3551 HWY 51 FORT MILL, SC 29715
EPA ID:	SCR000003723
Mailing address:	HWY 51 FORT MILL, SC 29715
Contact:	HARRY DEHAAS
Contact address:	3551 HWY 51 FORT MILL, SC 29715
Contact country:	US
Contact telephone:	(999) 999-9999
Contact email:	Not reported
EPA Region:	04
Land type:	Private
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name:	EUMERIC HOLDINGS NV
Owner/operator address:	FRONT ST 7 ST MAARTEN, SC 99999
Owner/operator country:	Not reported
Owner/operator telephone:	(999) 999-9999
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No

EUMERIC HOLDINGS NV (Continued) **1001120786**

Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Hazardous Waste Summary:

Waste code:	D000
Waste name:	Not Defined
Waste code:	D007
Waste name:	CHROMIUM

Facility Has Received Notices of Violations:

Regulation violated:	SR - 262.11
Area of violation:	Generators - General
Date violation determined:	12/06/1994
Date achieved compliance:	12/19/1996
Violation lead agency:	State
Enforcement action:	Not reported
Enforcement action date:	08/27/1996
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	0
Final penalty amount:	0
Paid penalty amount:	0
Regulation violated:	SR - 262.11
Area of violation:	Generators - General
Date violation determined:	12/06/1994
Date achieved compliance:	12/19/1996
Violation lead agency:	State
Enforcement action:	INITIAL 3008(A) COMPLIANCE
Enforcement action date:	05/14/1997
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	0
Final penalty amount:	62000
Paid penalty amount:	0
Regulation violated:	SR - 262.11
Area of violation:	Generators - General
Date violation determined:	12/06/1994
Date achieved compliance:	12/19/1996
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL

EUMERIC HOLDINGS NV (Continued) **1001120786**

Enforcement action date: 03/18/1997
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.12(a)
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/18/1997
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.12(a)
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: 04/16/1997
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.12(a)
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: INITIAL 3008(A) COMPLIANCE
Enforcement action date: 05/14/1997
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 62000
Paid penalty amount: 0

Regulation violated: SR - 262.12(a)
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 12/19/1996

EUMERIC HOLDINGS NV (Continued) **1001120786**

Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.11
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: 04/16/1997
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.11
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/05/1996
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.12(a)
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/05/1996
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.12(a)
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: 08/27/1996
Enf. disposition status: Not reported

EUMERIC HOLDINGS NV (Continued) **1001120786**

Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Regulation violated: SR - 262.11
Area of violation: Generators - General
Date violation determined: 12/06/1994
Date achieved compliance: 12/19/1996
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 12/19/1996
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Evaluation Action Summary:
Evaluation date: 05/03/1999
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/19/1996
Evaluation: NOT A SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 10/01/1996
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/06/1994
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/06/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 12/19/1996
Evaluation lead agency: State

FINDS:

Registry ID: 110008870515

Environmental Interest/Information System
SC-EFIS (South Carolina - Environmental Facility Information System)

EUMERIC HOLDINGS NV (Continued) **1001120786**

integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

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5 **DYNAMIC PROPERT** **FINDS** **1007244702**
3490 HWY 51 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110017165235

Environmental Interest/Information System
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6 **PANTRY 3969 DBA PETRO EXPRESS** **SC LUST** **U003629280**
3473 HWY 21 **SC UST** **N/A**
FORT MILL, SC 29715

LUST:

Facility ID:	10515
Release Number:	1
Facility Status:	conduct invest/risk assessment
Substance:	PETRO
Owner:	PANTRY INC
NFA Date:	**01/06/99**
Date Confirmed:	12/19/94
Report Date:	06/22/93
Rank:	5B

LUST DETAIL:

Release Date:	06/22/1993
Cleanup Complete Date:	01/06/1999
RP Name:	RHK GROUP INC
RP Address:	PO BOX 2359
RP City:	GASTONIA
RP State:	NC
RP Zip:	28053-2359
SCRBCA Class Code:	CLASS5B

PANTRY 3969 DBA PETRO EXPRESS (Continued) **U003629280**

Depth to Ground Water: Not reported
Ground Water Flow Direction: Not reported
Project Manager: ABERNATHY, JOHN D
Release Fin Type Code: DHEC SUPERB with State Lead

UST:
Facility ID: 10515
Owner: PANTRY INC
Owner Contact: MARY BATCHELOR
Owner Address: 1801 DOUGLAS DR
Owner City,St,Zip: SANFORD, NC 27330
Owner Phone: 919-774-6700
Contact: MARY BATCHELOR
Contact Tel: 803-548-6266

Tank ID: 1
Capacity: 10000
Product: Kerosene
Calcage: 0
Status: **Currently in use**

Tank ID: 2
Capacity: 10000
Product: RUL
Calcage: 0
Status: **Currently in use**

Tank ID: 3
Capacity: 10000
Product: PREM
Calcage: 0
Status: **Currently in use**

Tank ID: 4
Capacity: 10000
Product: Diesel
Calcage: 0
Status: **Currently in use**

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7 **DIENES APPARATUS INC** **RCRA-NonGen** **1000914376**
3410 HWY 51 **FINDS** **SC0000322735**
FORT MILL, SC 29715

RCRA-NonGen:
Date form received by agency: 03/27/2002
Facility name: DIENES APPARATUS INC
Facility address: 3410 HWY 51
FORT MILL, SC 29715
EPA ID: SC0000322735
Mailing address: HWY 51
FORT MILL, SC 29715
Contact: CARL BOSSON
Contact address: 3410 HWY 51

DIENES APPARATUS INC (Continued) **1000914376**

FORT MILL, SC 29715
Contact country: US
Contact telephone: (803) 548-4874
Contact email: Not reported
EPA Region: 04
Land type: Private
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:
Owner/operator name: MARIE PAULE STONE
Owner/operator address: 3410 HWY 51
FORT MILL, SC 29715
Owner/operator country: Not reported
Owner/operator telephone: (803) 548-4874
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/0001
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 04/01/1994
Facility name: DIENES APPARATUS INC
Classification: Conditionally Exempt Small Quantity Generator

Hazardous Waste Summary:
Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: F001
Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE,

DIENES APPARATUS INC (Continued) **1000914376**

1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE, AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Waste code: 7777
Waste name: 7777

Violation Status: No violations found

Evaluation Action Summary:
Evaluation date: 12/06/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110006119501

Environmental Interest/Information System

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8 **CONTAINER COMPANY OF CAROLINA MSW TS (FORT MILL)** **SC SWF/LF** **S108237580**
N/A

YORK (County), SC

LF:
Mailing Address: PO Box 219
Mailing State: NC
Mailing City: Pineville
Mailing Zip: 28134
Facility ID: 463323-6001
Rate Restriction: 1200
Rate Units: tons per day
Cap Units: Not reported
Online Data: Transfer Station
EQC Region: 3
EQC Region Office: Lancaster
Total Capacity: Not reported
Status: Active

CONTAINER COMPANY OF CAROLINA MSW TS (FORT MILL) (Continued) **S108237580**

Class: Not reported
UTM-E: 506468.3125
UTM-N: 3882540
Contact Name: Jimmie Jones
Contact Phone: (803) 547-3184

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9 **CONTAINER CORPORATION OF CAROLINA** **RCRA-CESQG** **1000395755**
3358 HWY 51 **FINDS** **SCD079053401**
FORT MILL, SC 29715

RCRA-CESQG:
Date form received by agency: 12/28/2000
Facility name: CONTAINER CORPORATION OF CAROLINA
Facility address: 3358 HWY 51
FORT MILL, SC 29715
EPA ID: SCD079053401
Mailing address: PO BOX 219
PINEVILLE, NC 28134
Contact: CHRIS JOBSON
Contact address: 3358 HWY 51
FORT MILL, NC 29715
Contact country: US
Contact telephone: (803) 547-3184
Contact email: Not reported
EPA Region: 04
Land type: Private
Classification: Conditionally Exempt Small Quantity Generator
Description: Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:
Owner/operator name: OPERNAME
Owner/operator address: OPERSTREET
OPERCITY, WY 99999
Owner/operator country: Not reported
Owner/operator telephone: (404) 555-1212
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: ALLIED WASTE IND
Owner/operator address: 15880 N GREENWAY HEYDEN LOOP
SCOTTSDALE, AZ 85260
Owner/operator country: Not reported

CONTAINER CORPORATION OF CAROLINA (Continued) **1000395755**

Owner/operator telephone: (999) 999-9999
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/0001
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 12/10/1980
Facility name: CONTAINER CORPORATION OF CAROLINA
Classification: Not a generator, verified

Hazardous Waste Summary:
Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D039
Waste name: TETRACHLOROETHYLENE

Facility Has Received Notices of Violations:
Regulation violated: SR - 262.13(d)
Area of violation: Generators - Records/Reporting
Date violation determined: 12/14/2000
Date achieved compliance: 01/04/2001
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: 12/18/2000
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

CONTAINER CORPORATION OF CAROLINA (Continued) **1000395755**

Regulation violated: SR - 262.11
Area of violation: Generators - Records/Reporting
Date violation determined: 12/14/2000
Date achieved compliance: 01/04/2001
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: 12/18/2000
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 0
Final penalty amount: 0
Paid penalty amount: 0

Evaluation Action Summary:
Evaluation date: 01/04/2001
Evaluation: COMPLIANCE SCHEDULE EVALUATION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/14/2000
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Records/Reporting
Date achieved compliance: 01/04/2001
Evaluation lead agency: State

FINDS:

Registry ID: 110002329597

Environmental Interest/Information System

SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

PCS (Permit Compliance System) is a computerized management information system that contains data on National Pollutant Discharge Elimination System (NPDES) permit holding facilities. PCS tracks the permit, compliance, and enforcement status of NPDES facilities.

10 **SOUTHERN TREE & LANDSCAPE CO** **RCRA-NonGen** **1000835590**
INTERSECTION US21 & SC51 **FINDS** **SCD987596707**
FORT MILL, SC 29715

RCRA-NonGen:

Date form received by agency:	05/06/2002
Facility name:	SOUTHERN TREE & LANDSCAPE CO
Facility address:	INTERSECTION US21 & SC51 FORT MILL, SC 29715
EPA ID:	SCD987596707
Mailing address:	PO BOX 7067 CHARLOTTE, NC 282417067
Contact:	KERRY KOMENDAT
Contact address:	INTERSECTION US21 & SC51 FORT MILL, SC 29715
Contact country:	US
Contact telephone:	(803) 548-4788
Contact email:	Not reported
EPA Region:	04
Land type:	Private
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name:	JOHN R. BRANTLEY JR
Owner/operator address:	9820 KERR RD WAXHAW, NC 28079
Owner/operator country:	Not reported
Owner/operator telephone:	(704) 843-4063
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/01/0001
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Historical Generators:

Date form received by agency:	03/27/2002
Facility name:	SOUTHERN TREE & LANDSCAPE CO
Classification:	Conditionally Exempt Small Quantity Generator

Date form received by agency:	03/31/1993
Facility name:	SOUTHERN TREE & LANDSCAPE CO

SOUTHERN TREE & LANDSCAPE CO (Continued) **1000835590**

Classification: Small Quantity Generator

Hazardous Waste Summary:

Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Waste code: F001
Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE, AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Waste code: F002
Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2-TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE LISTED IN F001, F004, OR F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Waste code: F004
Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: CRESOLS AND CRESYLIC ACID, AND NITROBENZENE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Violation Status: No violations found

Evaluation Action Summary:

Evaluation date: 08/22/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported

SOUTHERN TREE & LANDSCAPE CO (Continued) **1000835590**

Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110007837305

Environmental Interest/Information System

SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

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11 **VANCEBURG READY MIX CONCRETE** **FINDS** **1005681231**
3231 HIGHWAY 21 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110010310207

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

12 **STATE STORE AND LOCK** **FINDS** **1008010065**
3203 HWY 21 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110002331138

Environmental Interest/Information System
SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

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13 **T & G S COUNTRY STORE** **FINDS** **1007228633**
2976 HWY 21 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110016998221

Environmental Interest/Information System
SC-EFIS (South Carolina - Environmental Facility Information System) integrates information on environmental facilities, permits, violations, enforcement actions, and compliance activities needed to support regulatory requirements and target environmental quality improvements for the water, air, solid waste, and hazardous waste program areas. The EFIS was developed by the state of South Carolina and Maine joined their system in 2004.

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13 **HANDY PANTRY 28 FOOD MART** **SC GWCI** **U001015802**
3004 US 21 BYPASS **SC LUST** **N/A**
FORT MILL, SC 29715 **SC UST**

SC GWIC:

Bureau:	BLWM
EAP ID:	Not reported
Solid Waste Permit #:	Not reported
Bureau of Land & Waste Management File #:	Not reported
Permit Number:	09316
WPC Permit:	Not reported
Program:	DUST
Contamination:	PETRO
Petroleum Products:	True
Volatile Organic Compounds:	False
Metals:	False
Nitrates or Potential to Nitrate:	False
Pesticides & Herbicides:	False
Polychlorinated Biphenyls:	False
Base, Neutral, & Acid Extractables:	False
Phenols:	False
Radionuclides Over Max Contaminant Levels:	False

HANDY PANTRY 28 FOOD MART (Continued) **U001015802**

Sources Not In Other Categories:	False
Source:	UST
Underground Storage Tanks:	True
Pits, Ponds, & Lagoons:	False
Spills & Leaks:	False
Landfills:	False
Aboveground Storage Tank:	False
Spray Irrigation:	False
Single-Event Spill:	False
Unpermitted Disposal:	False
Septic Tank/Tile Field:	False
Substances Not In Other Categories:	False
Sources of Contamination Undetermined:	False
Assessment:	No
Monitoring:	No
Remediation:	Yes
Surface Impact:	No
Drinking Water Well Impact:	No
Remarks:	Site ID # 09316. RBCA Classification 1D4. Active corrective action.

LUST:

Facility ID:	09316
Release Number:	1
Facility Status:	active corrective action
Substance:	PETRO
Owner:	ACME PETROLEUM AND FUEL COMPANY
NFA Date:	**Not reported**
Date Confirmed:	01/21/99
Report Date:	01/21/99
Rank:	1D

LUST DETAIL:

Release Date:	01/21/1999
Cleanup Complete Date:	Not reported
RP Name:	ACME PETROLEUM AND FUEL COMPANY
RP Address:	543 COX RD STE C
RP City:	GASTONIA
RP State:	NC
RP Zip:	28054-0611
SCRBCA Class Code:	CLASS1D
Depth to Ground Water:	Not reported
Ground Water Flow Direction:	Not reported
Project Manager:	THOMA, DEBRA L
Release Fin Type Code:	DHEC SUPERB with State Lead

UST:

Facility ID:	9316
Owner:	ACME PETROLEUM AND FUEL COMPANY
Owner Contact:	PETE OVERTON
Owner Address:	543 COX RD STE C
Owner City,St,Zip:	GASTONIA, NC 28054-0611
Owner Phone:	704-867-7281
Contact:	PETE OVERTON
Contact Tel:	803-548-0968
Tank ID:	1

HANDY PANTRY 28 FOOD MART (Continued) **U001015802**

Capacity: 10000
Product: Gasoline
Calcage: 10
Status: Abandoned

Tank ID: 2
Capacity: 10000
Product: Gasoline
Calcage: 10
Status: Abandoned

Tank ID: 3
Capacity: 10000
Product: Gasoline
Calcage: 10
Status: Abandoned

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13 **HANDY PANTRY 28 FOOD MART** **FINDS** **1007233028**
3004 US 21 BYPASS **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110017043518

Environmental Interest/Information System
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13 **DIAMONDS #1** **FINDS** **1007236341**
3004 HWY 21 **N/A**
FORT MILL, SC 29715

FINDS:

Registry ID: 110017078008

Environmental Interest/Information System
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Count: 33 records

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
CHARLOTTE	1007734258	BRIDGE MILL - PHASE I	8325-D ARROWBRIDGE BLVD	28273	FINDS
CHARLOTTE	1007734256	BRIDGEHAMPTON - PHASE 10	8325-D ARROWBRIDGE BLVD	28273	FINDS
CHARLOTTE	1004746368	WEST MARINE PRODUCTS INC	10125 W LAKE DR	28273	RCRA-CESQG, FINDS
FORT MILL	U003522021	H&S SEPTIC TANKS	RT 1		SC UST
FORT MILL	1004779753	DUKE POWER WYLIE HYDRO	RT 1	29715	RCRA-CESQG, FINDS
FORT MILL	1007233117	BIG HWY 160 AUTO PARTS	2471 HWY 160 W	29715	FINDS
FORT MILL	U003868976	GATE PETROLEUM 326	2911 HWY 160 W	29715	SC UST
FORT MILL	U003557742	C&A MARKET	HWY 160	29715	SC LUST, SC UST
FORT MILL	U003558411	RIVERSTOP GROCERY	HWY 160	29715	SC LUST, SC UST
FORT MILL	1014961224	CVS PHARMACY 1571	1740 HWY 160 W	29715	RCRA-SQG
FORT MILL	1004780614	SMITHS PAINT & BODY SHOP INC	2404 HWY 160 W	29715	RCRA-CESQG, FINDS
FORT MILL	U003994151	T & G'S COUNTRY STORE	2976 HWY 21 BYP	29715	SC GWCI, SC LUST, SC UST
FORT MILL	S112165802	CAROLINA BOAT AND CARS SITE	3310 HWY 51		SC RCR, SC VCP
FORT MILL	S111243487	CAROLINA BOAT AND CARS	3310 HWY 51 N		SC SHWS, SC BROWNFIELDS
FORT MILL	U003524736	WARRIOR SHOPPE	7770 HWY 521		SC GWCI, SC LUST, SC UST
FORT MILL	U003930245	F H YARBOROUGH USED CARS INC	7550 HWY 521	29715	SC LUST, SC UST
FORT MILL	1015731900	R-M INDUSTRIES INC	BANKS STREET EXT	29715	CERCLIS
FORT MILL	1005851368	WIKOFF COLOR/SC HWY 48 PLANT	PO BOX W	29715	FINDS
FORT MILL	1011841074	US FOODSERVICE - CAROLINAS DIVISION, FORT MILL	CAROLINAS DIVISION	29715	RMP
FORT MILL	1008405389	WELLMAN INC	1041 521 CORPORATE CENTER DR	29715	RCRA-NonGen
FORT MILL	1005488007	UTILS SRVS OF SC/FOXWOOD WWTP	0.6 MI E OF RD 674 & 1.4 MI N	29715	FINDS
FORT MILL	S111680916	UTILS SRVS OF SC/FOXWOOD SD WWTP	06 MI E OF RD 674 & 14 MI N OF	29715	SC NPDES
FORT MILL	1003868456	SOUTHERN RAILWAY/TANK CAR CLEANING SITE	2900 FORT OF MP S	29715	CERC-NFRAP, SC SHWS
FORT MILL	U003982810	CIRCLE K 2705963	1766 FORT MILL HWY	29715	SC UST
FORT MILL	U004017906	CRAFT BYPASS TRUCK STOP	2046 S HWY 21 BYP	29715	SC UST
FORT MILL	U003628972	SAMS MART 759	2891 WEST HWY	29715	SC GWCI, SC LUST, SC UST
FORT MILL	S109362346	SPRINGS INDUSTRIES - INDIAN LAND SERVICE CENTER	3223 KENDELL TRCE	29715	SC SHWS, SC BROWNFIELDS
FORT MILL	S110676080	UTILS SRVS OF SC/CAROWOOD SD	SSIDE OF GOLD HILL RD S	29715	SC NPDES
FORT MILL	1004595205	UTILS SRVS OF SC/CAROWOOD SD	SSIDE OF GOLD HILL RD S-46-98	29715	FINDS
PINEVILLE	U001200454	CHARLIE'S SUNOCO	RT 1	28134	NC UST
PINEVILLE	1007709876	WBT(AM) TRANSMITTER SITE	HIGHWAY 21, NORTH OF PINEVILLE	28134	FINDS
PINEVILLE	1000136440	SNO-WHITE CLEANERS	7629 HWY 51	28134	RCRA-NonGen, FINDS
YORK COUNTY	S108979395	W. L. POPE CONSTRUCTION C&D LANDFILL	OFF OF HIGHWAY 101		SC RCR

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

FEDERAL RECORDS

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 10/01/2012
Date Data Arrived at EDR: 10/11/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 70

Source: EPA
Telephone: N/A
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/22/2013
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 10/01/2012
Date Data Arrived at EDR: 10/11/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 70

Source: EPA
Telephone: N/A
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/22/2013
Data Release Frequency: Quarterly

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 10/01/2012
Date Data Arrived at EDR: 10/11/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 70

Source: EPA
Telephone: N/A
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/22/2013
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 11/02/2012
Date Data Arrived at EDR: 11/28/2012
Date Made Active in Reports: 01/07/2013
Number of Days to Update: 40

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Quarterly

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 11/02/2012
Date Data Arrived at EDR: 11/28/2012
Date Made Active in Reports: 01/07/2013
Number of Days to Update: 40

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Quarterly

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/16/2012
Date Data Arrived at EDR: 03/26/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 80

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 08/19/2011
Date Data Arrived at EDR: 08/31/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 132

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 11/12/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Quarterly

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/11/2012
Date Data Arrived at EDR: 10/04/2012
Date Made Active in Reports: 12/04/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Quarterly

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/11/2012
Date Data Arrived at EDR: 10/04/2012
Date Made Active in Reports: 12/04/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 09/11/2012
Date Data Arrived at EDR: 10/04/2012
Date Made Active in Reports: 12/04/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/11/2012
Date Data Arrived at EDR: 10/04/2012
Date Made Active in Reports: 12/04/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Varies

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 09/11/2012
Date Data Arrived at EDR: 10/04/2012
Date Made Active in Reports: 12/04/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 07/18/2012
Date Data Arrived at EDR: 07/24/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 104

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/10/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 07/18/2012
Date Data Arrived at EDR: 07/24/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 104

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/10/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Varies

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 04/02/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 72

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Annually

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 04/01/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 72

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Annually

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/06/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Varies

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/11/2012
Date Data Arrived at EDR: 09/12/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 54

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 12/03/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Quarterly

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 12/10/2012
Date Data Arrived at EDR: 12/11/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 9

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/11/2012
Next Scheduled EDR Contact: 04/08/2013
Data Release Frequency: Semi-Annually

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 10/18/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/10/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/15/2012
Next Scheduled EDR Contact: 03/04/2013
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 10/01/2012
Date Data Arrived at EDR: 10/19/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 62

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 12/28/2012
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 02/27/2012
Date Data Arrived at EDR: 03/14/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 92

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/11/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/28/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 07/03/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: No Update Planned

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 09/08/2011
Date Made Active in Reports: 09/29/2011
Number of Days to Update: 21

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/05/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 09/01/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 131

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 11/28/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/28/2012
Next Scheduled EDR Contact: 04/08/2013
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 11/26/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 11/26/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/19/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/10/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 98

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/19/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/21/2011
Date Data Arrived at EDR: 07/15/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 60

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/10/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/02/2012
Date Data Arrived at EDR: 10/02/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 34

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 01/09/2013
Next Scheduled EDR Contact: 04/22/2013
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 10/23/2011
Date Data Arrived at EDR: 12/13/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 79

Source: EPA
Telephone: (404) 562-9900
Last EDR Contact: 12/11/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 05/08/2012
Date Data Arrived at EDR: 05/25/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 03/01/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 62

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/30/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Biennially

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83
Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 11/02/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76
Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 10/16/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Varies

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55
Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/15/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77
Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/11/2012
Next Scheduled EDR Contact: 03/25/2013
Data Release Frequency: Varies

FEDERAL FACILITY: Federal Facility Site Information listing
A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 10/09/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 72
Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/09/2012
Next Scheduled EDR Contact: 01/21/2013
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information
All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 08/20/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 69
Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 11/16/2012
Next Scheduled EDR Contact: 03/04/2013
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST
EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/13/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 36

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/12/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Quarterly

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 01/18/2012
Date Data Arrived at EDR: 01/27/2012
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 34

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 12/28/2012
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Annually

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)
The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 01/18/2012
Date Data Arrived at EDR: 01/27/2012
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 34

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 12/28/2012
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 10/22/2012
Next Scheduled EDR Contact: 02/04/2013
Data Release Frequency: Varies

2020 COR ACTION: 2020 Corrective Action Program List
The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 08/16/2012
Next Scheduled EDR Contact: 11/26/2012
Data Release Frequency: Varies

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 10/01/2012
Date Data Arrived at EDR: 10/04/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 32

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE AND LOCAL RECORDS

SC SHWS: Site Assessment Section Project List

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 06/21/2012
Date Data Arrived at EDR: 06/27/2012
Date Made Active in Reports: 08/02/2012
Number of Days to Update: 36

Source: Department of Health and Environmental Control
Telephone: 803-734-5376
Last EDR Contact: 12/13/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Annually

NC SHWS: Inactive Hazardous Sites Inventory

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 08/24/2012
Date Data Arrived at EDR: 09/19/2012
Date Made Active in Reports: 10/15/2012
Number of Days to Update: 26

Source: Department of Environment, Health and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Quarterly

SC ALLSITES: Site Assessment & Remediation Public Record Database

The South Carolina Department of Health and Environmental Control is pleased to have the Public Record for your review. The purpose of this database is two-fold. First, it will provide to communities another form of notice of cleanup activity, allowing them to have more information about assessment and cleanup activities in their area and in the State. Second, it can assist those seeking to redevelop brownfield properties within South Carolina.

Date of Government Version: 03/02/2012
Date Data Arrived at EDR: 04/05/2012
Date Made Active in Reports: 05/04/2012
Number of Days to Update: 29

Source: Department of Health & Environmental Control
Telephone: 803-896-4000
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Quarterly

SC GWCI: Groundwater Contamination Inventory

An inventory of all groundwater contamination cases in the state.

Date of Government Version: 07/01/2008
Date Data Arrived at EDR: 11/06/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 13

Source: Department of Health and Environmental Control
Telephone: 803-898-3798
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Annually

NC IMD: Incident Management Database

Groundwater and/or soil contamination incidents

Date of Government Version: 07/21/2006
Date Data Arrived at EDR: 08/01/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 22

Source: Department of Environment and Natural Resources
Telephone: 919-733-3221
Last EDR Contact: 07/01/2011
Next Scheduled EDR Contact: 10/17/2011
Data Release Frequency: No Update Planned

NC HSDS: Hazardous Substance Disposal Site

Locations of uncontrolled and unregulated hazardous waste sites. The file includes sites on the National Priority List as well as those on the state priority list.

Date of Government Version: 08/09/2011
Date Data Arrived at EDR: 11/08/2011
Date Made Active in Reports: 12/05/2011
Number of Days to Update: 27

Source: North Carolina Center for Geographic Information and Analysis
Telephone: 919-754-6580
Last EDR Contact: 11/16/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Biennially

SC RCR: Registry of Conditional Remedies

The Bureau of Land and Waste Management established this Registry to help monitor and maintain sites that have conditional remedies. A Conditional Remedy is an environmental remedy that includes certain qualifications. These qualifications are divided into two major categories: Remedies requiring Land Use Controls and Conditional No Further Actions.

Date of Government Version: 09/19/2012
Date Data Arrived at EDR: 09/20/2012
Date Made Active in Reports: 10/22/2012
Number of Days to Update: 32

Source: Department of Health & Environmental Control
Telephone: 803-896-4000
Last EDR Contact: 12/21/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Varies

SC SWF/LF: Permitted Landfills List

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 08/13/2012
Date Data Arrived at EDR: 08/15/2012
Date Made Active in Reports: 10/10/2012
Number of Days to Update: 56

Source: Department of Health and Environmental Control
Telephone: 803-734-5165
Source: Department of Health and Environmental Control, GIS Section
Telephone: 803-896-4084
Last EDR Contact: 12/13/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Varies

NC SWF/LF: List of Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 09/25/2012
Date Data Arrived at EDR: 09/27/2012
Date Made Active in Reports: 10/26/2012
Number of Days to Update: 29

Source: Department of Environment and Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 01/02/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Semi-Annually

NC OLI: Old Landfill Inventory

Old landfill inventory location information. (Does not include no further action sites and other agency lead sites).

Date of Government Version: 07/03/2012
Date Data Arrived at EDR: 07/23/2012
Date Made Active in Reports: 08/06/2012
Number of Days to Update: 14

Source: Department of Environment & Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 11/30/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Varies

SC UIC: Underground Injection Wells Listing

A listing of underground injection wells locations.

Date of Government Version: 11/16/2012
Date Data Arrived at EDR: 11/16/2012
Date Made Active in Reports: 11/29/2012
Number of Days to Update: 13

Source: Department of Health & Environmental Control
Telephone: 803-898-3799
Last EDR Contact: 11/12/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Varies

NC UIC: Underground Injection Wells Listing
A listing of uncerground injection wells locations.

Date of Government Version: 11/13/2012
Date Data Arrived at EDR: 11/14/2012
Date Made Active in Reports: 12/27/2012
Number of Days to Update: 43

Source: Department of Environment & Natural Resources
Telephone: 919-807-6412
Last EDR Contact: 11/12/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Varies

SC SWRCY: Solid Waste Recycling Facilities
A listing of recycling center locations.

Date of Government Version: 03/06/2012
Date Data Arrived at EDR: 03/09/2012
Date Made Active in Reports: 04/04/2012
Number of Days to Update: 26

Source: Department of Health & Enviornmental Control
Telephone: 803-896-8985
Last EDR Contact: 12/03/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Varies

NC HIST LF: Solid Waste Facility Listing
A listing of solid waste facilities.

Date of Government Version: 11/06/2006
Date Data Arrived at EDR: 02/13/2007
Date Made Active in Reports: 03/02/2007
Number of Days to Update: 17

Source: Department of Environment & Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 01/19/2009
Next Scheduled EDR Contact: 04/19/2009
Data Release Frequency: Quarterly

NC SWRCY: Recycling Center Listing
A listing of recycling center locations.

Date of Government Version: 08/06/2012
Date Data Arrived at EDR: 08/08/2012
Date Made Active in Reports: 09/13/2012
Number of Days to Update: 36

Source: Department of Environment & Natural Resources
Telephone: 919-707-8137
Last EDR Contact: 12/04/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Varies

SC LUST: Leaking Underground Storage Tank List
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 05/23/2012
Date Data Arrived at EDR: 05/24/2012
Date Made Active in Reports: 06/28/2012
Number of Days to Update: 35

Source: Department of Health and Environmental Control
Telephone: 803-898-4350
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

NC LUST: Regional UST Database
This database contains information obtained from the Regional Offices. It provides a more detailed explanation of current and historic activity for individual sites, as well as what was previously found in the Incident Management Database. Sites in this database with Incident Numbers are considered LUSTs.

Date of Government Version: 11/09/2012
Date Data Arrived at EDR: 11/14/2012
Date Made Active in Reports: 12/27/2012
Number of Days to Update: 43

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 11/14/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Quarterly

NC LUST TRUST: State Trust Fund Database
This database contains information about claims against the State Trust Funds for reimbursements for expenses incurred while remediating Leaking USTs.

Date of Government Version: 10/12/2012
Date Data Arrived at EDR: 10/17/2012
Date Made Active in Reports: 11/06/2012
Number of Days to Update: 20

Source: Department of Environment and Natural Resources
Telephone: 919-733-1315
Last EDR Contact: 10/17/2013
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Semi-Annually

SC UST: Comprehensive Underground Storage Tanks

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 11/26/2012
Date Data Arrived at EDR: 11/28/2012
Date Made Active in Reports: 12/05/2012
Number of Days to Update: 7

Source: Department of Health and Environmental Control
Telephone: 803-896-7957
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

NC UST: Petroleum Underground Storage Tank Database

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 11/09/2012
Date Data Arrived at EDR: 11/14/2012
Date Made Active in Reports: 12/27/2012
Number of Days to Update: 43

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 11/14/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Quarterly

NC LAST: Leaking Aboveground Storage Tanks

A listing of leaking aboveground storage tank site locations.

Date of Government Version: 11/09/2012
Date Data Arrived at EDR: 11/14/2012
Date Made Active in Reports: 12/27/2012
Number of Days to Update: 43

Source: Department of Environment & Natural Resources
Telephone: 877-623-6748
Last EDR Contact: 11/14/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Quarterly

SC AST: Aboveground Storage Tank List

Registered Aboveground Storage Tanks.

Date of Government Version: 03/25/2004
Date Data Arrived at EDR: 08/04/2004
Date Made Active in Reports: 09/23/2004
Number of Days to Update: 50

Source: Department of Health and Environmental Control
Telephone: 803-898-4350
Last EDR Contact: 12/03/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Varies

NC AST: AST Database

Facilities with aboveground storage tanks that have a capacity greater than 21,000 gallons.

Date of Government Version: 09/24/2012
Date Data Arrived at EDR: 09/25/2012
Date Made Active in Reports: 11/06/2012
Number of Days to Update: 42

Source: Department of Environment and Natural Resources
Telephone: 919-715-6183
Last EDR Contact: 12/18/2012
Next Scheduled EDR Contact: 04/08/2013
Data Release Frequency: Semi-Annually

SC SPILLS: Spill List

Spills and releases of petroleum and hazardous chemicals reported to the Oil & Chemical Emergency Response division.

Date of Government Version: 10/25/2012
Date Data Arrived at EDR: 10/26/2012
Date Made Active in Reports: 11/28/2012
Number of Days to Update: 33

Source: Department of Health and Environmental Control
Telephone: 803-898-4111
Last EDR Contact: 12/03/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Varies

NC INST CONTROL: No Further Action Sites With Land Use Restrictions Monitoring
A land use restricted site is a property where there are limits or requirements on future use of the property due to varying levels of cleanup possible, practical, or necessary at the site.

Date of Government Version: 08/24/2012
Date Data Arrived at EDR: 09/19/2012
Date Made Active in Reports: 10/15/2012
Number of Days to Update: 26

Source: Department of Environment, Health and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 12/17/2110
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Quarterly

SC VCP: Voluntary Cleanup Sites
Sites participating in the Voluntary Cleanup Program. Once staff and a non-responsible party have agreed upon an approved scope of work for a site investigation and/or remediation, the party enters into a voluntary cleanup contract. Staff oversees the cleanup efforts to ensure that activities are performed to our satisfaction. Upon completion of the negotiated work in the voluntary cleanup contract, the non-responsible party receives State Superfund liability protection.

Date of Government Version: 09/19/2012
Date Data Arrived at EDR: 09/20/2012
Date Made Active in Reports: 10/22/2012
Number of Days to Update: 32

Source: Department of Health and Environmental Control
Telephone: 803-896-4049
Last EDR Contact: 12/21/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Varies

NC VCP: Responsible Party Voluntary Action Sites
Responsible Party Voluntary Action site locations.

Date of Government Version: 08/24/2012
Date Data Arrived at EDR: 09/19/2012
Date Made Active in Reports: 10/15/2012
Number of Days to Update: 26

Source: Department of Environment and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Semi-Annually

SC DRYCLEANERS: Drycleaner Database
The Drycleaning Facility Restoration Trust Fund database is used to access, prioritze and cleanup contaminated registered drycleaning sites.

Date of Government Version: 12/01/2010
Date Data Arrived at EDR: 02/11/2011
Date Made Active in Reports: 03/15/2011
Number of Days to Update: 32

Source: Department of Health & Environmental Control
Telephone: 803-898-3882
Last EDR Contact: 11/30/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Varies

NC DRYCLEANERS: Drycleaning Sites
Potential and known drycleaning sites, active and abandoned, that the Drycleaning Solvent Cleanup Program has knowledge of and entered into this database.

Date of Government Version: 09/12/2012
Date Data Arrived at EDR: 09/25/2012
Date Made Active in Reports: 10/25/2012
Number of Days to Update: 30

Source: Department of Environment & Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 12/28/2012
Next Scheduled EDR Contact: 04/08/2013
Data Release Frequency: Varies

SC BROWNFIELDS: Brownfields Sites Listing
The Brownfields component of the Voluntary Cleanup Program allows a non-responsible party to acquire a contaminated property with State Superfund liability protection for existing contamination by agreeing to perform an environmental assessment and/or remediation.

Date of Government Version: 10/15/2012
Date Data Arrived at EDR: 10/17/2012
Date Made Active in Reports: 10/22/2012
Number of Days to Update: 5

Source: Department of Health & Environmental Control
Telephone: 803-896-4069
Last EDR Contact: 01/02/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Varies

NC BROWNFIELDS: Brownfields Projects Inventory

A brownfield site is an abandoned, idled, or underused property where the threat of environmental contamination has hindered its redevelopment. All of the sites in the inventory are working toward a brownfield agreement for cleanup and liabitliy control.

Date of Government Version: 09/30/2010
Date Data Arrived at EDR: 04/15/2011
Date Made Active in Reports: 05/04/2011
Number of Days to Update: 19

Source: Department of Environment and Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 10/11/2012
Next Scheduled EDR Contact: 01/21/2013
Data Release Frequency: Varies

SC CDL: Clandestine Drug Lab Sites

A listing of clandestine drug lab site locations.

Date of Government Version: 01/24/2012
Date Data Arrived at EDR: 01/26/2012
Date Made Active in Reports: 02/24/2012
Number of Days to Update: 29

Source: Department of Health & Environmental Control
Telephone: 803-896-4288
Last EDR Contact: 10/22/2012
Next Scheduled EDR Contact: 02/04/2013
Data Release Frequency: Varies

SC NPDES: Waste Water Treatment Facilities Listing

A listing of waste water treatment facility locations.

Date of Government Version: 09/27/2012
Date Data Arrived at EDR: 09/28/2012
Date Made Active in Reports: 10/22/2012
Number of Days to Update: 24

Source: Department of Health & Environmental Control
Telephone: 803-898-4300
Last EDR Contact: 12/18/2012
Next Scheduled EDR Contact: 04/08/2013
Data Release Frequency: Varies

NC NPDES: NPDES Facility Location Listing

General information regarding NPDES(National Pollutant Discharge Elimination System) permits.

Date of Government Version: 05/12/2011
Date Data Arrived at EDR: 05/13/2011
Date Made Active in Reports: 06/16/2011
Number of Days to Update: 34

Source: Department of Environment & Natural Resources
Telephone: 919-733-7015
Last EDR Contact: 12/04/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Varies

SC AIRS: Permiited Airs Facility Listing

A listing of permitted airs facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 03/08/2012
Date Made Active in Reports: 04/04/2012
Number of Days to Update: 27

Source: Department of Health & Environmental Control
Telephone: 803-898-4279
Last EDR Contact: 12/03/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Varies

SC Financial Assurance 3: Financial Assurance Information Listing

UST financial assurance information.

Date of Government Version: 05/25/2011
Date Data Arrived at EDR: 05/27/2011
Date Made Active in Reports: 06/30/2011
Number of Days to Update: 34

Source: Department of Health & Environmental Control
Telephone: 803-898-3880
Last EDR Contact: 12/03/2012
Next Scheduled EDR Contact: 03/18/2013
Data Release Frequency: Varies

SC Financial Assurance 2: Financial Assurance Information Listing

Hazardous waste financial assurance information.

Date of Government Version: 08/08/2012
Date Data Arrived at EDR: 08/09/2012
Date Made Active in Reports: 09/28/2012
Number of Days to Update: 50

Source: Department of Health & Environmental Control
Telephone: 803-898-3880
Last EDR Contact: 12/13/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Varies

SC Financial Assurance 1: Financial Assurance Information Listing

Financial assurance information for aolid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 08/01/2012
Date Data Arrived at EDR: 08/10/2012
Date Made Active in Reports: 09/28/2012
Number of Days to Update: 49

Source: Department of Health & Environmental Control
Telephone: 803-896-4067
Last EDR Contact: 12/13/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Quarterly

SC COAL ASH: Coal Ash Disposal Sites

A listing of sites with coal ash ponds.

Date of Government Version: 07/31/2009
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 08/17/2009
Number of Days to Update: 10

Source: Department of Health & Environmental Control
Telephone: 803-898-3964
Last EDR Contact: 12/26/2012
Next Scheduled EDR Contact: 04/08/2013
Data Release Frequency: Varies

NC COAL ASH: Coal Ash Disposal Sites

A listing of coal combustion products distribution permits issued by the Division for the treatment, storage, transportation, use and disposal of coal combustion products.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/04/2009
Date Made Active in Reports: 08/17/2009
Number of Days to Update: 13

Source: Department of Environment & Natural Resources
Telephone: 919-807-6359
Last EDR Contact: 11/05/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Varies

NC Financial Assurance 3: Financial Assurance Information

Hazardous waste financial assurance information.

Date of Government Version: 09/30/2012
Date Data Arrived at EDR: 10/19/2012
Date Made Active in Reports: 11/29/2012
Number of Days to Update: 41

Source: Department of Environment & Natural Resources
Telephone: 919-707-8222
Last EDR Contact: 12/13/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Varies

NC Financial Assurance 1: Financial Assurance Information Listing

A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 09/23/2011
Date Data Arrived at EDR: 10/06/2011
Date Made Active in Reports: 11/01/2011
Number of Days to Update: 26

Source: Department of Environment & Natural Resources
Telephone: 919-733-1322
Last EDR Contact: 11/14/2012
Next Scheduled EDR Contact: 02/25/2013
Data Release Frequency: Quarterly

NC Financial Assurance 2: Financial Assurance Information Listing

Information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 10/02/2012
Date Data Arrived at EDR: 10/03/2012
Date Made Active in Reports: 10/26/2012
Number of Days to Update: 23

Source: Department of Environmental & Natural Resources
Telephone: 919-508-8496
Last EDR Contact: 01/02/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

TRIBAL RECORDS

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34
Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/18/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Semi-Annually

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52
Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/05/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 05/09/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 62
Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 08/01/2012
Date Data Arrived at EDR: 08/02/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 75
Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/30/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59
Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 12/14/2011
Date Data Arrived at EDR: 12/15/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 26
Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Semi-Annually

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 09/06/2012
Date Data Arrived at EDR: 09/07/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 39
Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 08/17/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 05/02/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 75

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/01/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/10/2011
Date Data Arrived at EDR: 05/11/2011
Date Made Active in Reports: 06/14/2011
Number of Days to Update: 34

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Semi-Annually

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 08/01/2012
Date Data Arrived at EDR: 08/02/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 75

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 09/06/2012
Date Data Arrived at EDR: 09/07/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 39

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 08/02/2012
Date Data Arrived at EDR: 08/03/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 94

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 08/17/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Quarterly

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 12/14/2011
Date Data Arrived at EDR: 12/15/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 26

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 02/11/2013
Data Release Frequency: Semi-Annually

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/28/2012
Date Data Arrived at EDR: 10/02/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 14

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 01/04/2013
Next Scheduled EDR Contact: 04/15/2013
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EDR PROPRIETARY RECORDS

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 11/19/2012
Date Data Arrived at EDR: 11/19/2012
Date Made Active in Reports: 01/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 11/19/2012
Next Scheduled EDR Contact: 03/04/2013
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 08/28/2012
Number of Days to Update: 40

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 10/16/2012
Next Scheduled EDR Contact: 01/28/2013
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 11/01/2012
Date Data Arrived at EDR: 11/07/2012
Date Made Active in Reports: 12/11/2012
Number of Days to Update: 34

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 11/07/2012
Next Scheduled EDR Contact: 02/18/2013
Data Release Frequency: Annually

PA MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/23/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 57

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/22/2012
Next Scheduled EDR Contact: 02/04/2013
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 06/22/2012
Date Made Active in Reports: 07/31/2012
Number of Days to Update: 39

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 11/26/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 09/27/2012
Number of Days to Update: 70

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 12/13/2012
Next Scheduled EDR Contact: 04/01/2013
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Day Care List
Source: Department of Social Services
Telephone: 803-898-7345

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Department of Natural Resources
Telephone: 803-734-9494

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STREET AND ADDRESS INFORMATION

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Appendix B

Site Photos

FUSS & O'NEILL		Site Photographs
Client Name: STV/Whitehead Associates	**Site Location:** US 21 and SC 51	**Project No.** 20120285.A10

Photo No. 1 **Direction of Photo:** East **Description:** 3310 Highway 21	

Photo No. 2 **Direction of Photo:** West **Description:** On-site well network	

FUSS & O'NEILL		Site Photographs
Client Name: STV/Whitehead Associates	**Site Location:** US 21 and SC 51	**Project No.** 20120285.A10

Photo No. 3	
Direction of Photo: West	
Description: 2488 Highway 21	

Photo No. 4	
Direction of Photo: West	
Description: On-site well network	

FUSS & O'NEILL		Site Photographs
Client Name: STV/Whitehead Associates	**Site Location:** US 21 and SC 51	**Project No.** 20120285.A10

Photo No. 5	
Direction of Photo: East	
Description: 2976 Highway 21	

Photo No. 6	
Direction of Photo: West	
Description: On-site well network	

FUSS & O'NEILL		**Site Photographs**
Client Name: STV/Whitehead Associates	**Site Location:** US 21 and SC 51	**Project No.** 20120285.A10

Photo No. 7 **Direction of Photo:** South **Description:** 3660 Highway 51	

Photo No. 8 **Direction of Photo:** East **Description:** 3004 Highway 21	

FUSS & O'NEILL		Site Photographs
Client Name: STV/Whitehead Associates	**Site Location:** US 21 and SC 51	**Project No.** 20120285.A10

Photo No. 9	
Direction of Photo: South	
Description: 3550 Highway 51	

Photo No. 10	
Direction of Photo: North	
Description: 3551 Highway 51	

Appendix C

Soil Survey

United States Department of Agriculture

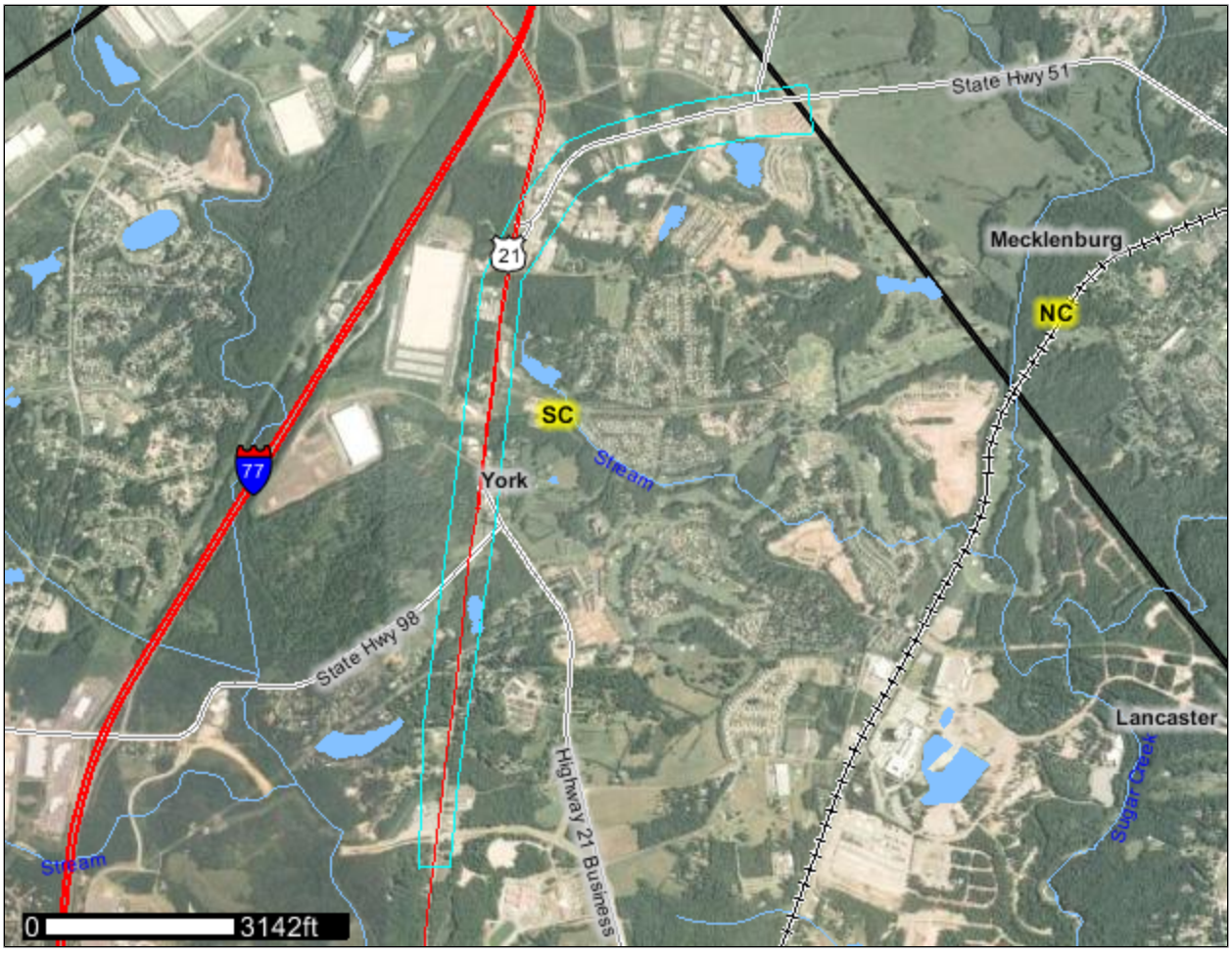
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Mecklenburg County, North Carolina, and York County, South Carolina

US 21 SC 51



April 29, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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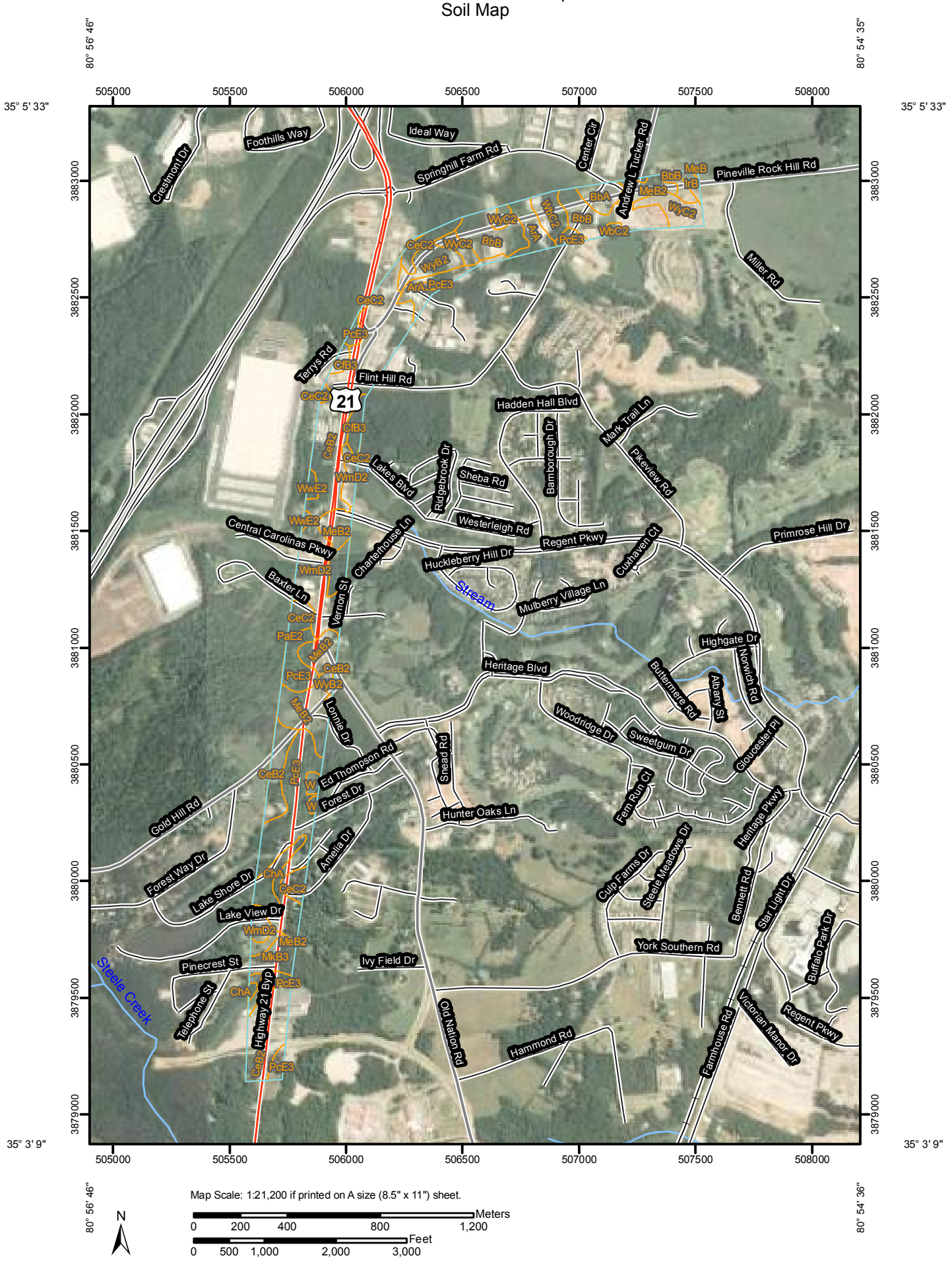
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:21,200 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,840 to 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mecklenburg County, North Carolina
Survey Area Data: Version 12, Jul 6, 2012

Soil Survey Area: York County, South Carolina
Survey Area Data: Version 9, Sep 29, 2011

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 7/10/2006; 7/17/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Mecklenburg County, North Carolina (NC119)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
IrB	Iredell fine sandy loam, 1 to 8 percent slopes	1.6	0.6%
MeB	Mecklenburg fine sandy loam, 2 to 8 percent slopes	0.2	0.1%
Subtotals for Soil Survey Area		**1.8**	**0.7%**
Totals for Area of Interest		**254.7**	**100.0%**

York County, South Carolina (SC091)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ArA	Armenia loam, 0 to 2 percent slopes, occasionally flooded	6.7	2.6%
BbA	Brewback fine sandy loam, 0 to 2 percent slopes	4.5	1.8%
BbB	Brewback fine sandy loam, 2 to 6 percent slopes	25.5	10.0%
CeB2	Cecil sandy clay loam, 2 to 6 percent slopes, moderately eroded	77.4	30.4%
CeC2	Cecil sandy clay loam, 6 to 10 percent slopes, moderately eroded	10.6	4.2%
CfB3	Cecil clay loam, 2 to 6 percent slopes, severely eroded	4.7	1.8%
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	5.9	2.3%
MeB2	Mecklenburg-Wynott complex, 2 to 6 percent slopes, moderately eroded	26.5	10.4%
MkB3	Mecklenburg-Wynott complex, 2 to 6 percent slopes, severely eroded	5.6	2.2%
MkC3	Mecklenburg-Wynott complex, 6 to 10 percent slopes, severely eroded	0.5	0.2%
PaE2	Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded	0.4	0.2%
PcE3	Pacolet clay loam, 15 to 25 percent slopes, severely eroded	46.9	18.4%
W	Water	1.8	0.7%
WbC2	Wynott-Brewback complex, 6 to 10 percent slopes, moderately eroded	6.2	2.4%
WmD2	Wynott-Mecklenburg complex, 10 to 15 percent slopes, moderately eroded	9.7	3.8%
WwE2	Wynott-Wilkes complex, 15 to 25 percent slopes, moderately eroded	1.7	0.7%
WyB2	Wynott-Winnsboro complex, 2 to 6 percent slopes, moderately eroded	7.8	3.0%
WyC2	Wynott-Winnsboro complex, 6 to 10 percent slopes, moderately eroded	10.5	4.1%
Subtotals for Soil Survey Area		**252.9**	**99.3%**
Totals for Area of Interest		**254.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly

indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Mecklenburg County, North Carolina

IrB—Iredell fine sandy loam, 1 to 8 percent slopes

Map Unit Setting

Landscape: Uplands
Elevation: 200 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days

Map Unit Composition

Iredell and similar soils: 85 percent
Minor components: 15 percent

Description of Iredell

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Saprolite derived from diorite and/or gabbro and/or diabase and/or gneiss

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C/D

Typical profile

0 to 6 inches: Fine sandy loam
6 to 24 inches: Clay
24 to 28 inches: Clay loam
28 to 80 inches: Loam

Minor Components

Sedgefield

Percent of map unit: 8 percent
Landform: Ridges
Landform position (two-dimensional): Summit, footslope
Down-slope shape: Concave
Across-slope shape: Concave

Wynott

Percent of map unit: 4 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex

Armenia, undrained

Percent of map unit: 3 percent
Landform: Drainageways on interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear

MeB—Mecklenburg fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

Landscape: Uplands
Elevation: 200 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days

Map Unit Composition

Mecklenburg and similar soils: 85 percent

Description of Mecklenburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from diorite and/or gabbro and/or diabase and/or gneiss

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.4 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 7 inches: Fine sandy loam
7 to 34 inches: Clay
34 to 80 inches: Loam

York County, South Carolina

ArA—Armenia loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

Landscape: Piedmonts
Elevation: 450 to 690 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Armenia, occasionally flooded, and similar soils: 86 percent
Minor components: 14 percent

Description of Armenia, Occasionally Flooded

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Alluvium derived from diabase and/or alluvium derived from gabbro and/or alluvium derived from diorite

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4w
Hydrologic Soil Group: D

Typical profile

0 to 4 inches: Loam
4 to 8 inches: Clay loam
8 to 51 inches: Clay
51 to 80 inches: Clay loam

Minor Components

Worsham, occasionally flooded

Percent of map unit: 14 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave

BbA—Brewback fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

Landscape: Piedmonts, uplands
Elevation: 200 to 1,400 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Brewback and similar soils: 80 percent
Minor components: 20 percent

Description of Brewback

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gabbro and/or residuum weathered from diorite and/or residuum weathered from diabase

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Fine sandy loam
4 to 10 inches: Sandy clay loam
10 to 30 inches: Clay
30 to 36 inches: Clay
36 to 80 inches: Weathered bedrock

Minor Components

Iredell

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear

BbB—Brewback fine sandy loam, 2 to 6 percent slopes

Map Unit Setting

Landscape: Piedmonts, uplands
Elevation: 200 to 1,400 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Brewback and similar soils: 80 percent
Minor components: 20 percent

Description of Brewback

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gabbro and/or residuum weathered from diorite and/or residuum weathered from diabase

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Fine sandy loam
4 to 10 inches: Sandy clay loam
10 to 30 inches: Clay
30 to 36 inches: Clay
36 to 80 inches: Weathered bedrock

Minor Components

Iredell

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear

CeB2—Cecil sandy clay loam, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Cecil, moderately eroded, and similar soils: 86 percent
Minor components: 14 percent

Description of Cecil, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 3e
Hydrologic Soil Group: B

Typical profile

0 to 3 inches: Sandy loam
3 to 48 inches: Clay
48 to 80 inches: Sandy clay loam

Minor Components

Cataula, moderately eroded

Percent of map unit: 14 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

CeC2—Cecil sandy clay loam, 6 to 10 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Cecil, moderately eroded, and similar soils: 90 percent
Minor components: 10 percent

Description of Cecil, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 4e
Hydrologic Soil Group: B

Typical profile

0 to 3 inches: Sandy loam
3 to 48 inches: Clay
48 to 80 inches: Sandy clay loam

Minor Components

Cataula, moderately eroded

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

CfB3—Cecil clay loam, 2 to 6 percent slopes, severely eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Cecil, severely eroded, and similar soils: 97 percent
Minor components: 3 percent

Description of Cecil, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 4e
Hydrologic Soil Group: B

Typical profile

0 to 1 inches: Sandy loam
1 to 3 inches: Sandy clay loam
3 to 80 inches: Clay

Minor Components

Cataula, moderately eroded

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

ChA—Chewacla loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

Landscape: Piedmonts, valleys
Elevation: 380 to 610 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Chewacla, frequently flooded, and similar soils: 80 percent
Minor components: 20 percent

Description of Chewacla, Frequently Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: High (about 11.3 inches)

Interpretive groups

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 10 inches: Loam
10 to 80 inches: Sandy clay loam

Minor Components

Riverview, frequently flooded

Percent of map unit: 15 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear

Wehadkee, inundated

Percent of map unit: 5 percent
Landform: Depressions on flood plains
Down-slope shape: Concave
Across-slope shape: Linear

MeB2—Mecklenburg-Wynott complex, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Mecklenburg, moderately eroded, and similar soils: 50 percent

Wynott, moderately eroded, and similar soils: 36 percent
Minor components: 14 percent

Description of Mecklenburg, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Sandy loam
4 to 35 inches: Clay
35 to 50 inches: Clay loam
50 to 80 inches: Loam

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 5 inches: Sandy loam
5 to 21 inches: Clay
21 to 29 inches: Sandy clay loam
29 to 80 inches: Weathered bedrock

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 14 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

MkB3—Mecklenburg-Wynott complex, 2 to 6 percent slopes, severely eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Mecklenburg, severely eroded, and similar soils: 50 percent
Wynott, severely eroded, and similar soils: 30 percent
Minor components: 20 percent

Description of Mecklenburg, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Sandy loam
2 to 26 inches: Clay
26 to 40 inches: Sandy clay loam
40 to 80 inches: Sandy loam

Description of Wynott, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Sandy loam
2 to 26 inches: Clay
26 to 32 inches: Sandy clay loam
32 to 80 inches: Weathered bedrock

Minor Components

Cecil, severely eroded

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

MkC3—Mecklenburg-Wynott complex, 6 to 10 percent slopes, severely eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Mecklenburg, severely eroded, and similar soils: 50 percent
Wynott, severely eroded, and similar soils: 30 percent
Minor components: 20 percent

Description of Mecklenburg, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Sandy loam
2 to 26 inches: Clay
26 to 40 inches: Sandy clay loam

40 to 80 inches: Sandy loam

Description of Wynott, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Sandy loam
2 to 26 inches: Clay
26 to 32 inches: Sandy clay loam
32 to 80 inches: Weathered bedrock

Minor Components

Cecil, severely eroded

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

PaE2—Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts

Elevation: 220 to 750 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition
Pacolet, moderately eroded, and similar soils: 95 percent
Minor components: 5 percent

Description of Pacolet, Moderately Eroded

Setting
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Properties and qualities
Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.2 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile
0 to 2 inches: Sandy loam
2 to 26 inches: Clay
26 to 43 inches: Clay loam
43 to 80 inches: Loam

Minor Components

Hard labor
Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

PcE3—Pacolet clay loam, 15 to 25 percent slopes, severely eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 220 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Pacolet, severely eroded, and similar soils: 90 percent
Minor components: 10 percent

Description of Pacolet, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 1 inches: Sandy clay loam
1 to 26 inches: Clay
26 to 80 inches: Clay loam

Minor Components

Wynott, moderately eroded

Percent of map unit: 5 percent
Landform: Interfluves

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Winnsboro, moderately eroded
Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

W—Water

Map Unit Setting
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition
Water: 100 percent

WbC2—Wynott-Brewback complex, 6 to 10 percent slopes, moderately eroded

Map Unit Setting
Landscape: Piedmonts
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition
Wynott, moderately eroded, and similar soils: 45 percent
Brewback, moderately eroded, and similar soils: 35 percent
Minor components: 20 percent

Description of Wynott, Moderately Eroded

Setting
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 5 inches: Sandy loam
5 to 21 inches: Clay
21 to 29 inches: Sandy clay loam
29 to 80 inches: Weathered bedrock

Description of Brewback, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Sandy loam
2 to 9 inches: Sandy clay loam
9 to 36 inches: Clay
36 to 38 inches: Sandy clay loam
38 to 80 inches: Weathered bedrock

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

WmD2—Wynott-Mecklenburg complex, 10 to 15 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Wynott, moderately eroded, and similar soils: 45 percent
Mecklenburg, moderately eroded, and similar soils: 40 percent
Minor components: 15 percent

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 5 inches: Sandy loam
5 to 21 inches: Clay
21 to 29 inches: Sandy clay loam
29 to 80 inches: Weathered bedrock

Description of Mecklenburg, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Sandy loam
4 to 35 inches: Clay
35 to 50 inches: Clay loam
50 to 80 inches: Loam

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 15 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

WwE2—Wynott-Wilkes complex, 15 to 25 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Wynott, moderately eroded, and similar soils: 55 percent
Wilkes, moderately eroded, and similar soils: 40 percent
Minor components: 5 percent

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C

Typical profile

0 to 5 inches: Sandy loam
5 to 21 inches: Clay
21 to 29 inches: Sandy clay loam
29 to 80 inches: Weathered bedrock

Description of Wilkes, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock; 40 to 72 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Sandy loam
4 to 15 inches: Sandy clay loam
15 to 18 inches: Sandy loam
18 to 45 inches: Weathered bedrock
45 to 80 inches: Unweathered bedrock

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

WyB2—Wynott-Winnsboro complex, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Wynott, moderately eroded, and similar soils: 55 percent
Winnsboro, moderately eroded, and similar soils: 30 percent
Minor components: 15 percent

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 5 inches: Sandy loam
5 to 21 inches: Clay
21 to 29 inches: Sandy clay loam
29 to 80 inches: Weathered bedrock

Description of Winnsboro, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Sandy loam
4 to 25 inches: Clay
25 to 32 inches: Sandy clay loam
32 to 52 inches: Sandy loam
52 to 80 inches: Weathered bedrock

Minor Components

Mecklenburg, moderately eroded

Percent of map unit: 15 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear

WyC2—Wynott-Winnsboro complex, 6 to 10 percent slopes, moderately eroded

Map Unit Setting

Landscape: Piedmonts

Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days

Map Unit Composition

Wynott, moderately eroded, and similar soils: 55 percent
Winnsboro, moderately eroded, and similar soils: 35 percent
Minor components: 10 percent

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 5 inches: Sandy loam
5 to 21 inches: Clay
21 to 29 inches: Sandy clay loam
29 to 80 inches: Weathered bedrock

Description of Winnsboro, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 4 inches: Sandy loam
4 to 25 inches: Clay
25 to 32 inches: Sandy clay loam
32 to 52 inches: Sandy loam
52 to 80 inches: Weathered bedrock

Minor Components

Wilkes, moderately eroded

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

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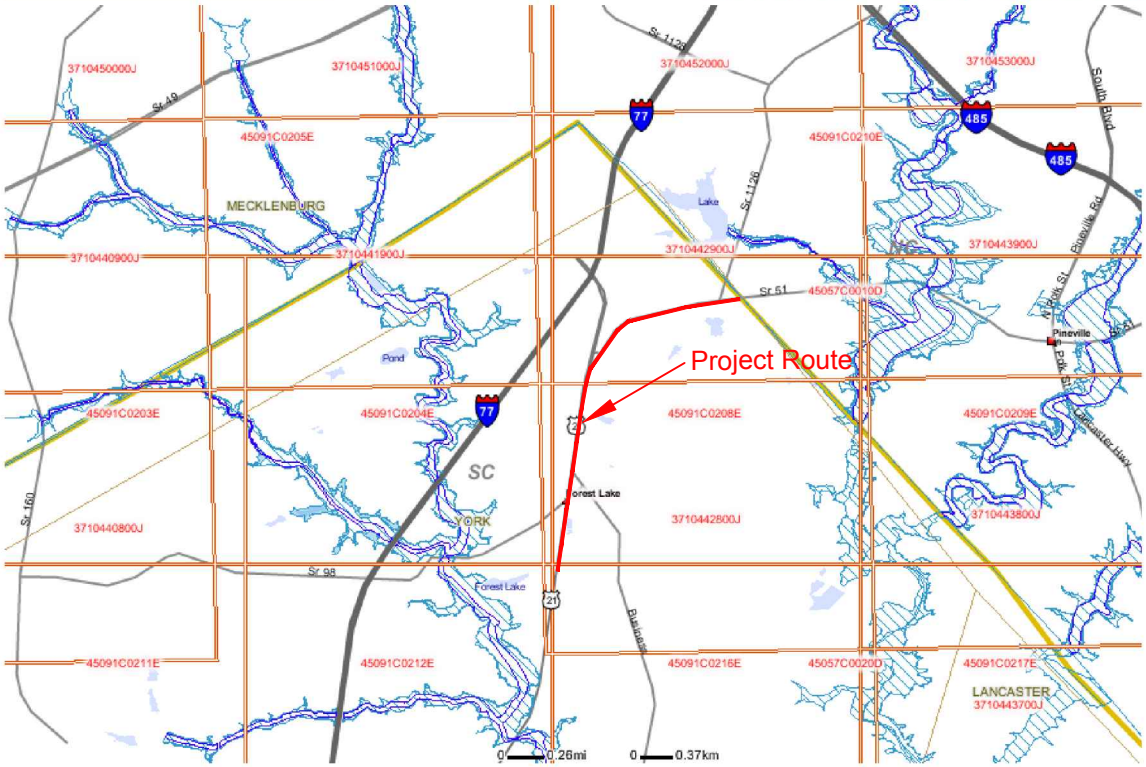
Appendix D

FEMA Map

Mapping Information Platform

US 21 / SC 51

This Map Is For Advisory Purposes Only



Legend

- Cities
  - Other Places
  - Small Towns
  - Small Cities
  - State Largest Cities
  - Major Cities
- DFIRM Data Availability
- DFIRM Panels
- Political Jurisdictions
- Floodways
- Flood Hazard Zone Boundaries
- Q3 Flood Hazards
  - Special Flood Hazard Areas
- Flood Hazard Zones
  - Zone A (cont)
  - Zone AE
  - Zone AH
  - Zone AO
  - Zone AR
  - Zone A99
  - Zone V
  - Zone VE
  - Zone D
  - 0.2% Annual Chance Flood Hazard Zone
- County Boundary
- Highways
  - Major Highways
  - Highways
- Major Roads
  - Major Roads
- States
- Lakes, Major Rivers
- Land Areas
  - US
  - Other Countries

Tuesday, 30 April 2013 10:55

FEMA

SCALE:	
HORZ.:	1" = 2000'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 1000 2000

GRAPHIC SCALE

FUSS & O'NEILL
717 LADY ST, SUITE E
COLUMBIA, SOUTH CAROLINA 29201
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www.fando.com

STV/Ralph Whitehead Associates

FEMA MAP

US Highway 21 / SC Highway 51 Road Widening

Fort Mill South Carolina

PROJ. No.: 20120285.A10
DATE: MAY 2013

Appendix F

File Path: F:\P2012\0285 STV York County US 21 SC 51\A10\DWG\20091408A11_STP01_TOPOMAP.dwg Layout: APPENDIX Plotted: Tue, April 30, 2013 - 11:20 AM User: rbutler
Plotter: DWG TO PDF.PC3 CTB File: FO 2008 MONO (HALF).CTB
LAYER STATE:
MS VIEW:

Appendix E

Environmental Professional Resume



Jeremy B. Grant, PG
Project Manager

Education
BA, Geology - 1993
University of New York
MS, Geology - 1998
University of South Carolina

Licenses & Registrations
SC Professional Geologist

Professional Affiliations
National Groundwater Association

11 years with Fuss & O'Neill
18 years Professional Experience

Mr. Grant is the manager of the assessment and remediation division of our South Carolina office and the office's emergency response team. During his career, he has completed a wide range of multi-media assessments from simple to complex. Based upon the results of these assessments, Mr. Grant has designed and implemented site-specific remediation systems for the sites, when needed. Remedial technologies include dual phase extraction, enhanced bioremediation, bioventing, air sparge/vapor extraction, and chemical oxidation. Mr. Grant also heads the company-wide PCB work group. His principal strength is understanding State and Federal regulations and how they relate to the needs of our clients. The following highlights some of his experience related to your needs.

ENVIRONMENTAL ASSESSMENT AND REMEDIATION

Mr. Grant has conducted and/or directed a wide variety of environmental assessments. Representative projects include:

Columbia, SC: Project manager for the Phase I/II ESA and remediation of an industrial property containing 51 55-gallon drums and 31 5-gallon buckets of unidentified waste and metals contaminated soils. The unknown waste was characterized and properly disposed of and the metals contaminated soils were excavated to allow the closing to occur for the real estate transaction.

North Charleston, SC: Responded to an overturned petroleum tanker truck that ruptured, releasing over 8,000 gallons of petroleum product onto the I-526 West on-ramp and subsequently into Filbin Creek and its associated salt marsh. Oversaw an inter-agency spill response and clean-up effort designed to keep bulk product from impacting the nearby Cooper River.

Brookneal, VA: Project manager for the assessment of the extent of the free and dissolved phase petroleum hydrocarbon plume from two petroleum releases at the site. Oversaw the hook up of several residences and businesses with private water supply wells to the municipal water. Designed and implemented a dual phase extraction remediation system to remove the free phase petroleum product from the subsurface.

Johns Island, SC: Lead scientist in the preparation of documents used for drafting of a Voluntary Cleanup Contract (VCC) for the Former Trident Landfill, Johns Island, SC. Performed site reconnaissance of landfill cap conditions and potential groundwater contaminant migratory pathways. Conducted a soil vapor and groundwater assessment along the adjacent property boundary to assess whether methane and/or groundwater contaminants had impacted the property prior to the property's proposed development.

Irmo, SC: Project manager for the emergency spill response for a leaking high concentration PCB transformer and the assessment of the extent of the PCB contamination. Achieved a solution within the USEPA PCB regulations that allowed the client to continue to use their property without interuption.

Rustburg, VA: Project manager for the assessment of the extent of the free and dissolved phase petroleum hydrocarbon plumes from a petroleum release at the site. Conducted fate and transport modelling of the dissolved phase petroleum plume to determine remedial endpoints. Designed and implemented a dual phase extraction remediation system to remove the free phase petroleum product from the subsurface. Remedial endpoints achieved in June 2009.

Summerville, SC: Project manager for litigation support for a lawsuit between a private property owner and the responsible party/State of South Carolina. Sale of the property was halted due to the discovery of dissolved phase petroleum hydrocarbons in the groundwater on the property.

West Columbia, SC: Team scientist on an assessment of a former transformer storage area within a former utility company crew quarters. Conducted a multi-media assessment to assess the vertical and horizontal extent of the PCB contamination. Consulted with the client about remedial options for the contamination. Calculated the volume of materials necessary to remediate the site under a performance-based remediation prior to the sale of the property.

Phase II
Environmental Site Assessment

US 21 & SC 51 Corridor
York County, South Carolina
STV Project #1149-004

Prepared for:

STV Inc.

Rock Hill Business Technology Center
454 S. Anderson Road, Suite # BTC 517
Rock Hill, SC 29730

May 19, 2015

FUSS & O'NEILL

717 Lady Street, Suite E
Columbia, SC 29201
(803) 376-6034

Project No. 20120285.A12

FUSS & O'NEILL

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US Highway 21 & SC Highway 51

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2 Soil and Groundwater Sampling Location Map STA. 41 to STA. 73
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1 Introduction

Fuss & O'Neill, Inc. was retained by STV, Inc., to conduct a Phase II Environmental Site Assessment (ESA) in conjunction with a South Carolina Department of Transportation (SCDOT) road widening and right-of-way (ROW) expansion along U.S. Highway 21 and S.C. Highway 51 in York County, South Carolina. STV, under a York County "Pennies for Progress"/ SCDOT contract has designed and will manage construction of the project. The objectives of this ESA are to determine whether releases of hazardous substances or petroleum products have occurred associated with "recognized environmental conditions" (RECs) identified in a Limited Phase I ESA, prepared by Fuss & O'Neill, Inc. dated June 18, 2013. This Phase II ESA was performed as part of STV's and the SCDOTs due diligence as outlined in SCDOTs *Environmental Reference Document* (revision 2008) Section 6.2.7(e). It is the SCDOT's policy to avoid the acquisition of underground storage tanks and other hazardous materials, if possible.

Nine (9) properties that possessed RECs were identified during the Limited Phase I ESA conducted in 2013. Fuss & O'Neill identified the following sites as having RECs in the Limited Phase I ESA:

- Millers Produce & Farm (3660 SC Highway 51) – Petroleum leaking underground storage tank (LUST) site and currently operates as a petroleum retailer;
- Summerville Grocery (SC Highway 51) – Petroleum LUST site and petroleum retailer;
- Lords Armory (3578 SC Highway 51) – Petroleum LUST site;
- Partex / Eumeric Holdings (3551 SC Highway 51) – known to have had chromium contaminated soil; violations of the South Carolina (SC) Hazardous Waste Management Regulations and SC Pollution Control Act; and, non-compliance with administrative order issued by SC Department of Health and Environmental Control (SCDHEC);
- Paving Equipment of the Carolinas (3550 SC Highway 51) – formerly stored #2 fuel oil and manufactured petroleum-based asphalt;
- Southern Tree & Landscaping (Intersection US 21 / SC 51) – presence of on-site monitoring well network and limited available information;
- Handy Pantry 28 Food Mart (3004 US Highway 21 Bypass) – Petroleum LUST site;
- T&G Country Store (2976 US Highway 21) – Petroleum LUST site; and,
- Times Turn Around 10 (2488 Highway US 21 Bypass) – Petroleum LUST site and currently operates as a petroleum retailer.

Additional investigation revealed that the sites identified as Millers Produce & Farm and Summerville Grocery are the same parcel, but there are different responsible parties for the release of petroleum into the subsurface at the site. Although Southern Tree & Landscaping was within the search radius of the Limited Phase I ESA, this site was eliminated from requiring additional assessment during the Phase II ESA because no lands associated with the Southern Tree & Landscaping site will be acquired during this road-widening project. Therefore, seven (7) parcels require further investigation under this scope of work. These remaining seven (7) parcels will be referred to as Areas of Concern (AOCs) for the remainder of the report.

This assessment allows the potential property acquirer (i.e., SCDOT) to determine if environmental conditions exist that indicate an existing release, a past release, or a material threat of a release of petroleum products or hazardous materials into the vadose zone soils or groundwater in the vicinity of the proposed road widening and ROW expansion.

It should be noted that no ESA could wholly eliminate uncertainty regarding the potential for RECs in connection with a property or properties. This assessment was performed in conformance with ASTM E1903-11 (2011) *Standard Practice for Environmental Site Assessments: Phase II ESA Process* and SCDOTs *Environmental Reference Document* Section 6.2.7(e) (2008). The Phase II Environmental Site Assessment process is designed to reduce, but not eliminate, uncertainty regarding the RECs about the property within reasonable time and costs constraints.

2 Introduction

This section provides a summary of the information used to construct the initial conceptual model for the Site, which, in turn, guided the investigations. Information such as the Site's operational history, geology, hydrogeology, and potential receptors help identify areas where releases of hazardous materials could occur and how they might impact human health and the environment.

2.1 Physical Description

The US Highway 21/SC Highway 51 road-widening project is located north of downtown Fort Mill between Springfield Parkway and the North Carolina/South Carolina state line (*Figure 1*). The project corridor has a linear roadway distance of approximately 13,200 feet. The proposed limits of construction for this project will require acquisition of additional ROW.

The corridor is located in an area of mixed residential, industrial, and commercial parcels. A site location map showing the approximate project corridor is provided as *Figure 1* and site sample location maps are included as *Figures 2 through 4*.

Site Utilities

The City of Fort Mill and York County provides municipal water and sewer service in the area to the property. Duke Energy provides electrical power to the corridor. Electric, cable, and telephone services to the corridor are provided via a combination of underground conduits and overhead transmission lines.

2.2 Physiographic Setting

According to the topographic maps reviewed for this assessment, the corridor and surrounding area ranges from approximately 590 feet to 650 feet above mean sea level (MSL). Topography of the corridor site generally slopes south to southeast towards tributaries of the Blackmanship Branch, Steele Creek, and Sugar Creek. These creeks each ultimately discharge into the Catawba River.

2.3 Environmental Setting

2.3.1 Geology

According to the *Geologic Notes, Volume 9, Number 2* (State Development Board, June 2010), York County is situated in the north-central Piedmont of South Carolina, adjacent to the North Carolina state line. Rocks of the Piedmont occur in belts that conform to the regional-northeasterly trend of major structural features. The belts are delineated by gross differences in rock types, grade of metamorphism, and structure. York County straddles the Charlotte Belt and extends into the Carolina Slate Belt to the east and into the Kings Mountain Belt to the northwest.

Rocks of the Carolina Slate Belt are mainly low rank metamorphic rocks of sedimentary and volcanic origin. The Charlotte Belt includes medium- to high-rank metamorphic rocks and a complicated sequence of igneous intrusions. Major rock types of the Kings Mountain Belt are phyllite, schist, gneiss, quartzite, conglomerate, and marble. The metamorphic grade of the Kings Mountain Belt ranges from medium to low.

2.3.2 Hydrology & Hydrogeology

The soils encountered in this area are the residual product of in-place chemical weathering of rock presently underlying the site. In general, shallow unconfined groundwater movement within the overlying soils is controlled largely by topographic gradients. However, as the groundwater percolates downward to the bedrock, it becomes controlled by the orientation of the rock fracture systems. Thus, the direction of groundwater movement may not be consistent with the reflection topography.

Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary with seasonal fluctuations in precipitation. Movement of groundwater under water table conditions is generally from higher to lower elevations. As such, shallow groundwater at the subject site appears to move to the south and southeast towards lower elevations and off-site water bodies.

Based on USGS mapping and field observations of the local topography regarding the physical setting, the groundwater flow direction of the corridor appears to vary throughout the corridor. The inferred dominant groundwater flow direction along the project corridor appears to be to the south/southeast toward tributaries of Sugar Creek and the Sugar Creek. Groundwater along the project corridor is believed to vary from 5 feet to 60 feet below ground surface based on elevations of nearby water bodies.

The corridor is located west of Sugar Creek, which discharges to the Catawba River. Surface runoff from the site would appear to flow to the south/southeast toward Sugar Creek and its tributaries, with components of flow to the southwest towards Blankmanship Branch, which discharges to Steele Creek and eventually discharges to Sugar Creek.

2.4 Phase II Areas of Concern

The following is a description of the AOCs that were identified in the Fuss & O'Neill's Limited Phase I ESA and were investigated as part of this Phase II ESA. Maps displaying the locations of the listed AOCs are included as *Figures 2 through 4*.

Millers Produce & Farm / Summerville Grocery

The Millers Produce & Farm and Summerville Grocery refer to the same parcel, but there are different responsible parties for the distinct releases of petroleum into the subsurface at the site. Due to the limited available information pertaining to this site, its current operation as a fuel retailer, and known releases of petroleum on the site, this site is an AOC during this Phase II ESA.

Lords Armory

A former petroleum release at the Lords Armory site was granted a status of "Conditional No Further Action" (CNFA) by SCDHEC in 2003. The CNFA status was granted provided land use restrictions were in place and varying amounts of petroleum contamination were allowed to remain in place at the site. Because of petroleum contamination remaining in place at the site and the potential for this contamination to be encountered during construction activities, this site is an AOC during this Phase II ESA.

Partex / Eumeric Holdings

An administrative order (97-11-HW) was issued on the Partex/Eumeric Holdings facility by SCDHEC in 1997 for violations of the South Carolina Hazardous Waste Management Regulations and the South Carolina Pollution Control Act. Partex/Eumeric Holdings failed to comply with the following regulations.

1. R.61-79.262.11, a person who generates a solid waste, as defined in R.61-79.261.2 must accurately determine if that waste is a hazardous waste;
2. R.61-79.262.12(a), a generator must not treat, store, dispose of, or offer for transportation, hazardous waste without having received an US Environmental Protection Agency (EPA) identification number from SCDHEC;
3. R.61-79.262, Subpart C, pre-transport requirements for generators of hazardous waste;
4. R.61-79.262, Subpart D, record keeping and reporting requirements for generators of hazardous waste;
5. R.61-79.262.80, a generator must clean up any hazardous waste discharge that occurs during generation of processing or storage and take such other action as may be required or approved by Federal, State, or local officials so that the hazardous waste discharge no longer presents a hazard to human health of the environment;
6. 48-1-90 of the South Carolina Pollution control Act in that it shall be unlawful for any person, directly or indirectly, top throw, drain, run, allow to seep or otherwise discharge into the environment of the state organic or inorganic matter, including sewage, industrial wastes and other wastes, except as in compliance with a permit issued by SCDHEC.

Additional information regarding these violations and compliance or non-compliance of issues addressed in the administrative order was not found during file review and have likely been purged from SCDHECs file system. Due to the lack of information on this facility and known past soil contamination, this site is an AOC during this Phase II ESA.

Paving Equipment of the Carolinas

This property formerly stored #2 fuel oil and was a manufacturer of petroleum-based asphalt. Because of the storage of #2 fuel oil and past use of the property, this site is an AOC during this Phase II ESA.

Handy Pantry 28 Food Mart

The facility is a former LUST site and was listed on the 2008 Groundwater Contamination Inventory (GWCI) database compiled by SCDHEC. No additional information was available in the SCDHEC files. Due to the lack of additional information and the classification of the site as a LUST site, this site is an AOC during this Phase II ESA.

T&G Country Store

This site is located within the project corridor on the eastern side of Highway 21 and is a known LUST site with limited information available. Because of the known release of petroleum at this site, this site is an AOC during this Phase II ESA.

Times Turn Around 10

This site is located within the project corridor on the eastern side of Highway 21. This site is a known LUST site with limited information available, and currently operates as a fuel retailer. Because of the known release of petroleum at this site, the site is considered an AOC.

2.5 Previous Environmental Investigation Summary

Numerous soil and groundwater investigations have been conducted at different locations throughout the corridor. The following environmental investigations regarding AOCs involved in this Phase II ESA were reviewed during the performance of this assessment.

1. *Soil Sampling Analysis Report* by Environmental Management Solutions, Inc. (EMS) dated February 26, 1997 for Partex, Inc. / Eumeric Holdings. SCDHEC concluded that the areas of concern identified within the report had been adequately addressed with regard to the spill area on the exterior of this facility. Partex, Inc. / Eumeric Holdings is located at 3551 Highway 51.

2. *Post Remediation Sampling Report* conducted by Consultech Environmental, Inc. for Lords Armory dated August 18, 2003. Consultech Environmental, Inc. concluded that concentrations of the contaminants of concern in the monitoring wells that have site-specific target levels (SSTLs) are below SSTLs at the site, and recommended that all of the monitoring wells be properly abandoned, and that no further action be taken at the site. Lords Armory is located at 3660 Highway 51.

2.6 Potential Receptors

An assessment was conducted to evaluate the potential for sensitive human health or ecological receptors within or immediately down gradient project corridor. Our findings are summarized below:

- **Wetlands:** Based on the U.S. Fish and Wildlife Service's *National Wetlands Inventory* (NWI, 2012) and observations made during the site walkover, there are no **mapped** wetlands located within the project corridor. A wetlands survey is beyond the scope of this Phase II ESA and it is recommended that a wetlands survey be performed for the corridor if it is needed.

- **Tributaries of Sugar Creek and Blackmanship Branch:** Tributaries of Sugar Creek and Blackmanship Branch run through the project corridor and wetland soils may be present immediately adjacent to the tributaries. Groundwater and surface runoff from proposed construction areas also discharge to the tributaries.

- **Private Drinking Water Supply Wells:** The Site is located in an urbanized area where public water is available to nearby parcels. Therefore, private drinking water supply wells are not expected to be present.

- **Physical Contact with Impacted Media:** Contact with site soil and fill could potentially occur during activities requiring excavation (e.g., utility repair, repaving, etc.). Visitors to the site could also potentially encounter impacted soil or fill in unpaved areas.

3 Phase II Investigations

The Phase II investigations were conducted at the seven (7) AOCs listed in *Section 2.4* on March 3-5, 2015. This section provides an overview of the methods used to investigate the AOCs and evaluate the data collected, describes data quality objectives, constituents of concern, laboratory methods used to analyze environmental samples, and field investigation methods.

3.1 Data Quality Objectives and Reasonable Confidence Protocols

Data quality objectives (DQO) are used to ensure that data is collected in a manner that permits it to be used to evaluate a site and support decisions based on those evaluations. Procedures used to ensure that the DQOs for the project were met include:

- Development of preliminary conceptual models used to guide the selection of appropriate constituents of concern and sampling locations;
- Selection of analytical methods with applicable detection limits;
- Use of pre-determined sample handling and custody procedures;
- Use of pre-determined data management and documentation procedures;
- Selection of sampling locations and constituents of concern appropriate to the potential release areas; and,
- Use of trip blanks, equipment blanks, duplicates, and laboratory matrix spikes (MS) for quality assurance/quality control (QA/QC).

3.2 Constituents of Concern

A list of constituents of concern to be investigated was developed for each AOC. The constituent list comprises those compounds most likely to be released based on knowledge of site operations and results of any previous investigation. The constituents of concern include:

- Volatile Organic Compounds (VOCs);
- Semi-volatile Organic Compounds (SVOCs); and,
- Metals.

The analytical methods presented in the following table were selected to identify and evaluate potential releases because they are capable of achieving analytical detection limits less than the baseline numeric screening levels applicable to the sampled media.

Constituent of Concern	Analytical Method
VOCs	Field screening using a photoionization detector (PID). Where suspected, VOCs were confirmed with analysis by EPA Method 8260.
SVOCs	Field screening using visual and olfactory cues. Where suspected, SVOCs were confirmed with analysis by EPA Method 8270.
Metals	EPA Method 6010 (arsenic, barium, cadmium, chromium, lead, nickel, selenium, and silver). EPA Method 7471 (mercury).

Pace Analytical Laboratory of Huntersville, North Carolina conducted the laboratory sample analyses. Pace Analytical Laboratory is a South Carolina-certified laboratory.

3.3 Phase II Investigation Procedures

The Phase II investigation can be broken down into the following general field methods used to develop lines of evidence for each AOC based on its initial conceptual model:

- AOC Inspections
- Soil screening (40 Locations)
- Soil sampling (34 locations)
- Temporary Monitoring well installation (6 locations)
- Groundwater sampling (7 locations)

Sample locations are depicted on *Figures 2 through 4*. The following subsections provide overviews of the site characterization methods identified above.

3.3.1 AOC Inspections

During planning, each AOC was inspected to determine whether a mechanism was present for the release of hazardous substances or petroleum products to the environment. During the inspections, specific attention was given to materials present, processes and raw material/waste management, evidence of releases (e.g. staining, residue, etc.), and migration pathways. Where the potential for releases of hazardous materials or petroleum products to the environment was determined to be non-existent or highly unlikely, no further action was recommended. Where it was determined that there was a reasonable potential for a release to have occurred, investigations targeting the area most likely to be impacted and analysis for AOC-specific constituents of concern were conducted.

3.3.2 Soil Sampling

Soil borings were advanced at 40 locations (SB-1 through SB-40) using direct-push technology which can be utilized in relatively tight fitting areas due to its small footprint and large areas due to its high mobility and minimal assembly and disassembly time. Direct push technology was chosen due to the need to be highly mobile and because this method is unobtrusive to retail operations.

For the purpose of this report, the following definitions will be used: surface soils (0-1 foot below ground surface, no letter designation) and subsurface soils (2-foot minimum depth, denoted as with an "A" identifier). Specific sample depth for each boring is located in *Table 1*. The locations of these soil borings are displayed on *Figures 2 through 4*.

Soil borings were drilled using a direct-push drilling rig. Soil samples were collected continuously from the ground surface to the terminus of the boring using a macrocore. A macrocore is a five-foot long stainless steel tube fitted with a polyethylene sleeve. This tube is pushed into the ground, filling the sleeve with an undisturbed core of subsurface soils.

Each soil sample was inspected by a field scientist from Fuss & O'Neill for physical evidence of contamination, such as staining or odors. Where VOCs were a potential constituent of concern, samples were also field screened using a PID.

Soil sampling intervals were selected to characterize the maximum concentrations of constituents of concern within a potential release area and confirm the extent of impacted soil. If visual inspection and field screening did not yield evidence of impacted soil, samples were selected for laboratory analysis from predetermined intervals based on the conceptual release model for each AOC.

3.3.3 Temporary Monitoring Well Installation & Groundwater Sampling

As part of this scope of work, six (6) temporary monitoring wells were installed utilizing Geoprobe® direct-push technology. The locations of the the temporary wells are displayed on *Figures 2 through 4*. Additionally, one (1) existing monitoring well on the Times Turn Around parcel (i.e., MW-6) was also sampled and submitted for laboratory analysis.

Groundwater samples from the temporary wells were collected with a discrete sampler developed for use with direct-push technology. The discrete sampler is a four-foot long stainless steel screen housed inside the direct push rods. Upon reaching the desired sampling interval, the direct push rods were pulled up four feet allowing the screen to be released at the desired sampling interval. SCDHEC Water Well Record forms are included as *Appendix B*.

After the discrete sampler screen was exposed to the water table, dedicated disposable polyethylene tubing containing a check valve was inserted into the direct push rods. This tubing was moved up and down forcing groundwater into the tubing until it reached the surface where it was collected in the appropriate bottles for laboratory analytical use. This sampling technique limits turbidity and helps prevent volatilization of potential VOCs.

Groundwater samples for laboratory analysis were collected from the temporary monitoring wells and the existing permanent monitoring well MW-6 on the Times Turn Around property using dedicated disposable polyethylene tubing. The water was slowly poured into the sample bottles to prevent aeration and to ensure the bottles are not overfilled. Once the samples were collected, they were placed in a cooler filled with ice and kept at approximately four degrees centigrade (4°C) throughout the operation. Samples were transported to the laboratory under proper Chain of Custody protocols.

After groundwater samples were collected from temporary monitoring wells, the borings were properly abandoned using a neat cement grout. The neat cement grout was injected through a tremie pipe set

approximately one foot above the total depth of the boring and filled from the bottom of the bore hole upward.

4 AOC Sample Collection & Analytical Results

This section presents the findings of the investigations conducted at each AOC and the analytical results. Samples were transported to Pace Analytical Services, Inc. for laboratory analyses. Samples were kept at approximately 4°C throughout the operation and during the transport to the laboratory. A chain of custody was maintained and documented during the shipping and handling process to ensure sample integrity. A copy of the chain of custody is included with the analytical report in *Appendix A*. Refer to *Figures 2 through 4* for locations of collected samples.

All samples were measured against EPA's Regional Screening Levels (RSLs) for residential and industrial soils and the EPAs National Primary Drinking Water Maximum Contaminant Levels (MCLs) for water samples.

4.1 Times Turn Around 10

4.1.1 Soil Sample Collection & Analysis

Soil Sample Collection

Ten (10) soil boings (SB-1 through SB-10) were installed to investigate the AOC associated with the Times Turn Around 10 site. Soil samples were collected using a macrocore. Each soil boring at the Times Turn Around AOC had a total depth of 10 feet below land surface (bls). Soils were screened with an organic vapor analyzer (OVA) PID for the presence of organic vapors. The highest OVA reading during field screening dictated the depth at which the subsurface sample was obtained.

Soil Analytical Results

Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 2.4*. Soil samples at this AOC were analyzed for benzene, toluene, ethylbenzene, xylene, methyl-tert-butyl ether (MTBE), and naphthalene. *Table2* is a summary of soil analytical results for VOCs identified during this Phase II ESA. Only detected constituents are reported in the tables. Sample analysis results were compared to EPA's RSLs for residential and industrial soils.

The concentration of ethylbenzene from soil boring SB-9 exceeded the industrial RSL for soils.

4.1.2 Groundwater Collection & Analysis

Groundwater Sample Collection

Two (2) temporary monitoring wells (TW-1 and TW-2) were installed to investigate the AOC associated with the Times Turn Around 10 site. Groundwater samples were collected from each temporary well using a discrete sampler. Groundwater was also collected from existing monitoring well identified as MW-6 that was part of the previous onsite monitoring well network. Groundwater from monitoring well MW-6 was collected using a dedicated polyethylene bailer.

Groundwater Analytical Results

Groundwater samples were analyzed for benzene, toluene, ethylbenzene, xylene, MTBE, and naphthalene. Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*.

Table3 is a summary of groundwater analytical results for VOCs identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's MCL for drinking water. However, since no MCL's exist for MTBE and naphthalene, SCHDEC's Risk-Based Screening Level (RBSL) as used to screen the groundwater analytical results.

Concentrations of benzene and MTBE exceeded their respective EPA MCLs or SCDHEC RBSLs in samples TW-1 and TW-2. Concentrations of toluene, ethylbenzene and naphthalene from temporary well TW-1 exceeded the EPAs MCL or SCHDEC RBSLs for groundwater.

4.2 T&G Country Store

4.2.1 Soil Sample Collection & Analysis

Soil Sample Collection

Three (3) soil boings (SB-11 through SB-13) were installed to investigate the AOC associated with the T&G Country Store site. Soil samples were collected using a macrocore. Each soil boring at the T&G Country Store AOC had a total depth of 10 feet bls. Soils were screened with an OVA PID for the presence of organic vapors. The highest OVA reading during field screening dictated the depth at which the deeper sample was obtained.

Soil Analytical Results

Soil samples were analyzed for benzene, toluene, ethylbenzene, xylene, MTBE, and naphthalene. Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*.

Table2 is a summary of soil analytical results for VOCs identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's current RSLs for residential and industrial soil.

No analyzed constituents exceeded their respective screening levels in soil samples SB-11 through SB-13.

4.2.2 Groundwater Collection & Analysis

Groundwater Sample Collection

Fuss & O'Neill had anticipated utilizing an existing monitoring well network on the T&G Country Store site in order to assess the groundwater conditions on this site. However, the monitoring well network that had been previously associated with the T&G Country Store had been abandoned after the Phase I activities had been completed but before Phase II ESA activities could commence. Fuss & O'Neill personnel attempted to install two (2) temporary monitoring wells at two (2) distinct locations associated with the T&G Country Store AOC investigation. Groundwater was not encountered within 30 feet bls. Fuss & O'Neill terminated efforts to collect groundwater at the AOC. Based on our understanding of the proposed road improvements,

no construction activities will extend to a depth of 30 feet bls, thereby making groundwater collection efforts less relevant.

4.3 Handy Pantry 28 Food Mart

4.3.1 Soil Sample Collection & Analysis

Soil Sample Collection

Three (3) soil boings (SB-14 through SB-16) were installed to investigate the AOC associated with the Handy Pantry 28 Food Mart site. Soil samples were collected using a macrocore. Each soil boring at the Handy Pantry 28 Food Mart AOC had a total depth of 10 feet bls. Soils were screened with an organic vapor analyzer OVA PID for the presence of organic vapors. The highest OVA reading during field screening dictated the depth at which the deeper sample was obtained.

Soil Analytical Results

Soil samples were analyzed for benzene, toluene, ethylbenzene, xylene, MTBE, and naphthalene. Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*.

Table2 is a summary of soil analytical results for VOCs identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's current RSLs for residential and industrial soils.

No analyzed constituents exceeded their respective screening levels in soil samples SB-14 through SB-16.

4.3.2 Groundwater Collection & Analysis

Groundwater Sample Collection

Fuss & O'Neill had anticipated utilizing an existing monitoring well network on the Handy Pantry 28 Food Mart site in order to assess the groundwater conditions on this site. However, the monitoring well network that had been previously associated with the Handy Pantry 28 Food Mart had been abandoned before Phase II ESA activities could commence. Based on proposed road improvements and anticipated depth to groundwater, no attempts to were made to collect groundwater via temporary well installation during the investigation of the AOC associated with Handy Pantry 28 Food Mart. Refer to *Section 4.2.2* above.

4.4 Paving Equipment of the Carolinas

4.4.1 Soil Sample Collection & Analysis

Soil Sample Collection

Six (6) soil boings (SB-17 through SB-22) were installed to investigate the AOC associated with the Paving Equipment of the Carolinas site. Soil samples were collected using a macrocore. Each soil boring at the Paving Equipment of the Carolinas AOC had a total depth of 10 feet bls. Soils were screened with an OVA PID for the presence of organic vapors. Since no OVA readings were observed, three (3) of the six borings

(6) were selected and sampled at the terminus of the boring. Soil samples were collected from boring locations SB-18, SB-20, and SB-22.

Soil Analytical Results

Soil samples were analyzed for VOCs and SVOCs. Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*.

Table2 is a summary of soil analytical results for VOCs and *Table 4* is a summary of soil analytical results for SVOCs identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's residential and industrial RSLs.

No concentrations of SVOCs or VOCs in soil samples SB-18, SB-20, or SB-22 exceeded their respective EPA screening levels for soils.

4.4.2 Groundwater Collection & Analysis

Groundwater Sample Collection

Two (2) temporary monitoring wells (TW-3 and TW-4) were installed to investigate the AOC associated with the Paving Equipment of the Carolinas site. Groundwater samples were collected from each temporary well using a discrete sampler.

Groundwater Analytical Results

Groundwater samples were analyzed for VOCs and SVOCs. Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*.

Table 3 is a summary of groundwater analytical results for VOCs and *Table 5* is a summary of groundwater analytical results for SVOCs identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA MCLs. However, since no MCL's exist for MTBE and naphthalene, SCHDEC's RBSL was used to screen the groundwater analytical results.

No concentrations of SVOCs or VOCs in groundwater samples TW-3 or TW-4 exceeded their respective EPA MCLs or SCDHEC RBSLs.

4.5 Partex / Eumeric Holdings

4.5.1 Soil Sample Collection & Analysis

Soil Sample Collection

Four (4) soil boings (SB-23/23A through SB-26/26A) were installed to investigate the AOC associated with the Partex / Eumeric Holdings site. Soil samples were collected using a macrocore. Each soil boring at the Partex / Eumeric Holdings AOC had a total depth of 10 feet bls. Surface soils (0-1 foot below ground surface, no letter designation) and subsurface soils (2-foot minimum depth, denoted as with an "A" identifier) were collected from this AOC. Soils were screened with an OVA PID for the presence of organic vapors.

Soil Analytical Results

Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*. Each collected soil sample (SB-23/23A through SB-26/26A) was analyzed for metals. Soil samples SB-23 and SB-24 were also analyzed for VOCs and SVOCs. Since no measurable OVA readings were observed, two (2) of the six (6) borings were also sampled at the termination depth of the boring for VOCs and SVOCs.

Table 2 is a summary of soil analytical results for VOCs, *Table 4* is a summary of soil analytical results for SVOCs, and *Table 1* is a summary of analytical results for metals identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's RSLs for residential and industrial soils.

Soil samples SB-23, SB-24, SB-25, SB-25A, SB-26 and SB-26A exceed the EPAs Residential RSL for arsenic in soils, but were less than the Industrial RSL. Naturally occurring background arsenic conditions are further discussed in *Section 4.6.1* below. Soil sample SB-24 exceeded the EPAs Residential RSL for benzo(a)pyrene but was less than the Industrial RSL.

4.5.2 Groundwater Collection & Analysis

Groundwater Sample Collection

Two (2) temporary monitoring wells (TW-5 and TW-6) were installed to investigate the AOC associated with the Partex / Eumeric Holdings site. Groundwater samples were collected from each temporary well using a discrete sampler.

Groundwater Analytical Results

Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*.Groundwater samples were analyzed for metals, VOCs, and SVOCs.

Table 3 is a summary of groundwater analytical results for VOCs, *Table 5* is a summary of groundwater analytical results for SVOCs, and *Table 1* is a summary of analytical results for metals identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's MCLs. In the absence of an MCL (e.g., silver), analyzed concentrations are compared to the respective SCDHEC's RBSLs.

Groundwater samples TW-5 and TW-6 exceeded EPA MCLs for barium, chromium, and lead. Groundwater sample TW-5 exceeded the EPA MCL for arsenic. Groundwater sample TW-6 exceeded the SCDHEC RBSL for silver. However, it should be noted that the collected groundwater samples were obtained from temporary, unfiltered wells. Installation of a permanent, traditional sand-pack wells may address the elevated metal concentrations seen in these groundwater samples collected from temporary well points.

4.6 Lords Armory

4.6.1 Soil Sample Collection & Analysis

Soil Sample Collection

Eight (8) soil boings (SB-27 through SB-34) were installed to investigate the AOC associated with the Lords Armory site. Soil samples were collected using a macrocore. Each soil boring at the Lords Armory AOC had a total depth of 10 feet bls. Soils were screened with an OVA PID for the presence of organic vapors. Two (2) of the eight (8) borings were sampled at the termination depth of the boring for VOCs. Additionally, two (2) samples from this AOC were submitted for laboratory analysis for metals. The collected metal concentrations served as background samples for metals concentrations to compare to the metals concentrations of the Parex/Eumeric Holdings AOC.

Soil Analytical Results

Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*. Soil samples SB-33 and SB-34 were analyzed for metals. Additionally, soil samples SB-31 and SB-32 were analyzed for benzene, toluene, ethylbenzene, xylene, MTBE, and naphthalene.

Table2 is a summary of soil analytical results for VOCs and *Table 1* is a summary of analytical results for metals identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's residential and industrial RSL.

Soil samples SB-33 and SB-34, which were meant to represent naturally occurring background soil conditions, were above EPA residential screening level for arsenic. However, arsenic is frequently found within South Carolina soils at naturally occurring concentrations that exceed the Residential and Industrial RSLs. According to a SCDHEC study (Canova, 1999), naturally occurring concentrations of arsenic have a mean concentration of 2 mg/kg within South Carolina's Coastal Plain, which exceeds the Residential RSL, and a mean concentration of 11.0 mg/kg within the Piedmont Section of South Carolina, which exceeds both the Residential and Industrial RSLs. The statewide average for arsenic within the soil samples collected for the SCDHEC/Canova study was 6.1 mg/kg, with collected background samples ranging from 0.23 mg/kg to 45.0 mg/kg arsenic. Therefore, it does not appear that the arsenic results obtained from the Partex/Eumeric Holdings or the Lords Armory AOCs represent anything outside normal, background elemental soil conditions in South Carolina.

Groundwater Sample Collection

Due to the anticipated depth of groundwater at this site and the anticipated direction of groundwater flow, groundwater was not collected from the Lord's Armory AOC during this Phase II ESA scope of work.

4.7 Millers Produce & Farm / Summerville Grocery

4.7.1 Soil Sample Collection & Analysis

Soil Sample Collection

Six (6) soil boings (SB-35 through SB-40) were installed to investigate the AOC associated with the Millers Produce & Farm / Summerville Grocery site. Soil samples were collected using a macrocore. Each soil boring at the Lords Armory AOC had a total depth of 10 feet bls. Soils were screened with an OVA PID for the presence of organic vapors. Since no OVA readings were observed, three (3) of the six (6) borings were sampled at the termination depth of the boring. Three (3) soil samples (i.e., SB-38, SB-39, SB-40) were submitted to the laboratory for this AOC.

Soil Analytical Results

Analysis for each collected sample was determined by known activities associated with the AOC discussed in *Section 1.4*. Soil samples SB-38 through SB-40 were analyzed for benzene, toluene, ethylbenzene, xylene, MTBE, and naphthalene.

Table2 is a summary of soil analytical results for VOCs identified during this Phase II ESA. Only detected constituents are reported. Sample analysis results were compared to EPA's residential and industrial RSLs.

No samples collected from this AOC had concentrations above EPA screening levels for soils.

Groundwater Sample Collection

Due to the anticipated depth of groundwater at this site and the anticipated direction of groundwater flow, groundwater was not collected from the Millers Produce & Farm / Summerville Grocery AOC during this Phase II ESA scope of work.

4.8 Quality Assurance/Quality control (QA/QC)

Care was taken throughout the sampling activities to avoid cross contamination. Direct push drilling equipment was steam cleaned between boreholes. Samples were kept at approximately four degrees centigrade (4ºC) throughout the operation and during transport to Pace Analytical Laboratory. Chain-of-custody forms were maintained and signed during the shipping and handling process to ensure sample integrity.

After the soil and groundwater samples were collected, the borings were properly abandoned using a neat cement grout.

5 Conclusions

Times Turn Around 10

High concentrations of benzene, toluene, ethylbenzene, MTBE, and naphthalene were found in groundwater samples collected along the eastern property boundary of the investigated area associated with Times Turn Around 10 AOC. One soil sample from the Times Turn Around 10 site (i.e., SB-9) also exceeded the Residential and Industrial RSL for ethylbezene.

T&G Country Store

No elevated levels of any constituents of concern were observed in soil or groundwatersamples collected from the T&G Country Store AOC during this Phase II ESA.

Handy Pantry 28 Food Mart

No elevated levels of any constituents of concern were observed in soil or groundwater samples collected from the Handy Pantry 28 Food Mart AOC during this investigation.

Paving Equipment of the Carolinas

No elevated levels of any constituents of concern were observed in samples of media collected from the Paving Equipment of the Carolinas AOC during this Phase II ESA.

Partex / Eumeric Holdings

Partex / Eumeric Holdings had the following samples exceed either the EPAs Regional Screening Level or SCHECS RBSL during this Phase II ESA.

- Soil samples SB-23, SB-24, SB-25, SB-25A, SB-26, and SB-26A exceeded the EPAs Residential RSL for arsenic. However, analyzed concentrations of arsenic appear to be consistent with naturally occurring background soil conditions found within South Carolina (Canova, 1999).
- Soil sample SB-24 exceeded EPAs Residential RSL for benzo(a)pyrene in soils, but was below the Industrial RSL.
- Groundwater sample TW-5 exceeded EPA MCLs in Groundwater arsenic, barium, total chromium, and lead. Groundwater samples TW-6 exceeded EPA MCLs for barium, total chromium, lead and SCDHECs groundwater RBSL for silver. It should be noted that the collected groundwater samples were obtained from temporary, unfiltered wells. Installation of a permanent, traditional sand-pack well may address the elevated metal concentrations seen in these groundwater samples collected from temporary well points. However, it is unknown whether the concentrations of metals are naturally occurring in groundwater, as conditions can vary greatly depending on the method of collecting the groundwater sample and subsurface geology.

Lords Armory

Lords had the following samples exceed the EPAs Residential RSL during this Phase II ESA.

- Soil samples SB-33 and SB-34 exceeded the EPAs RSL for arsenic in soils. However, as stated above, analyzed concentrations of arsenic appear to be consistent with naturally occurring background soil conditions found within South Carolina (Canova, 1999).

Millers Produce & Farm / Summerville Grocery

No elevated levels of analyzed constituents were observed in soil or groundwater samples collected from the Millers Produce & Farm / Summerville Grocery AOC during this Phase II ESA.

6 Qualifications

Reginald Butler and Christine Cafagna prepared this Phase II Environmental Site Assessment on behalf of STV, Inc. in conjunction with STV project #1149-004. Mr. Butler has 7 years of experience and Ms. Cafagna has 11 years of experience with environmental site assessments.

Reginald Butler
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5/19/15
Date

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5/19/2015
Date

Tables

FUSS & O'NEILL

TABLE 1

SUMMARY OF DETECTED METALS IN SOIL AND GROUNDWATER
US 21 SC 51
YORK, SC

SUMMARY OF METALS IN SOIL									
Sample Numbers	**Date Collected**	**Arsenic**	**Barium**	**Cadmium**	**Chromium**	**Lead**	**Mercury**	**Selenium**	**Silver**
		mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
PARTEX / EUMERIC HOLDINGS									
SB-23	3/3/2015	**1.2**	261	0.080 J	14.7	6.9	0.017	0.94 J	<0.56
SB-23A	3/3/2015	0.51 J	158	0.091	14.0	17.9	N/A	0.75 J	0.82
SB-24	3/3/2015	**0.81 J**	14.9	0.1	2.5	3.1	0.0320	1.20	<0.44
SB-24A	3/3/2015	0.66 J	210	0.13	27.2	5.7	N/A	0.80 J	<0.48
SB-25	3/3/2015	**<0.90**	157	0.1	50.2	3.1	N/A	1.20	1.1
SB-25A	3/3/2015	**<1.3**	504	0.096 J	48.2	6.20	N/A	1.1 J	<0.63
SB-26	3/3/2015	**<1.1**	129	0.16	75.8	10.8	N/A	1.50	0.58
SB-26A	3/3/2015	**<1.2**	157	0.10 J	36.9	2.2	N/A	1.30	0.70
LORDS ARMORY									
SB-33*	3/3/2015	**<0.99**	150.0	0.12	64.1	1.9	0.0096	1.30	0.45 J
SB-34*	3/3/2015	**<1.1**	87.5	<0.11	2.2	2.0	0.0017 J	0.84 J	0.590
EPA Residential RSL (mg/kg)		0.67	15,000	70	NS	400	23	390	390
EPA Industrial RSL (mg/kg)		3.0	220,000	980	NS	800	350	5,800	5,800

SUMMARY OF METALS IN GROUNDWATER									
Sample Numbers	**Date Collected**	**Arsenic**	**Barium**	**Cadmium**	**Chromium**	**Lead**	**Mercury**	**Selenium**	**Silver**
		µg/L	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
PARTEX / EUMERIC HOLDINGS									
TW-5	3/3/2015	31.3	**5,120**	4	**684**	**789**	0.64	17.2	<5.0
TW-6	3/3/2015	<10.0	**16,700**	3	**2,900**	**215**	0.46	30.2	6.5
EPA MCL (µg/L)		10	2,000	5	100	15	2	50	5[1]

Notes: **Bold/Highlighted** values exceed EPA Residential / Industrial Regional Screening Level for soils , or EPAs MCLs or SCDHECs RBSL for groundwater

A - Indicates subsurface sample

NS - No standard exists

N/A - Not Analyzed

J - Concentration is between the method detection limit and the reporting limit; estimated value

Screening Levels Based on Region 9 Regional Screening Level Summary Table (TR= 1E-06, HQ = 1.0) January 2015

[1]: The value indicated is the SCDHEC UST Risk Based Screening Level (RBSL). No EPA MCL primary drinking water standard exists for this constituent

* - Sample collected to represent naturally occurring background conditions

FUSS & O'NEILL

TABLE 2

SUMMARY OF DETECTED VOCs IN SOIL
US 21 SC 51
YORK, SC

Sample Numbers	Date Collected	Benzene	Toulene	Ethylbenzene	Xylene	MTBE	Naphthalene
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TIMES TURN AROUND							
SB-1	3/3/2015	<0.0031	<0.0031	<0.0031	<0.0063	<0.0031	<0.0031
SB-2	3/3/2015	<0.0028	<0.0028	<0.0028	<0.0056	<0.0028	<0.0028
SB-3	3/3/2015	<0.003	<0.003	<0.003	<0.0061	<0.003	<0.003
SB-4	3/3/2015	<0.0029	<0.0029	<0.0029	<0.0059	<0.0029	<0.0029
SB-5	3/3/2015	<0.0026	<0.0026	<0.0026	<0.0051	<0.0026	<0.0026
SB-6	3/3/2015	<0.0036	<0.0036	<0.0036	<0.0073	<0.0036	<0.0036
SB-7	3/3/2015	<0.0021	<0.0021	<0.0021	<0.0043	<0.0021	<0.0021
SB-8	3/3/2015	<0.072	<0.072	0.0447 J	<0.144	<0.072	0.0573 J
SB-9	3/3/2015	0.58	0.426	**29.5**	138	0.068 J	12.7
SB-10	3/3/2015	<0.0026	<0.0026	<0.0026	<0.0051	<0.0026	<0.0026
T & G COUNTRY STORE							
SB-11	3/4/2015	<0.0028	<0.0028	<0.0028	<0.0055	<0.0028	0.00099 J
SB-12	3/4/2015	<0.0024	<0.0024	<0.0024	<0.0049	<0.0024	<0.0024
SB-13	3/4/2015	<0.0025	<0.0025	<0.0025	<0.0050	<0.0025	<0.0025
HANDY PANTRY 28							
SB-14	3/4/2015	<0.0031	<0.0031	<0.0031	<0.0062	<0.0031	<0.0031
SB-15	3/4/2015	<0.0029	<0.0029	<0.0029	<0.0059	<0.0029	<0.0029
SB-16	3/4/2015	0.0114	<0.0037	<0.0037	<0.0074	<0.0037	<0.0037
PAVING EQUIPMENT							
SB-18	3/4/2015	<0.0040	<0.0040	<0.0040	<0.0080	<0.0040	<0.0040
SB-20	3/4/2015	<0.0023	<0.0023	<0.0023	<0.0046	<0.0023	<0.0023
SB-22	3/4/2015	<0.0025	<0.0025	<0.0025	<0.0049	<0.0025	<0.0025
PARTEX / EUMERIC HOLDINGS							
SB-23	3/4/2015	<0.0027	<0.0027	<0.0027	<0.0054	<0.0027	<0.0027
SB-24	3/4/2015	<0.0027	<0.0027	<0.0027	<0.0055	<0.0027	<0.0027
LORDS ARMORY							
SB-31	3/5/2015	<0.291	<0.291	0.879	1.11	<0.291	6.18
SB-32	3/5/2015	<0.126	<0.126	3.12	4.42	<0.126	7.64
MILLERS PRODUCE AND SUMMERVILLE GROCERY							
SB-38	3/5/2015	<0.0034	<0.0034	<0.0034	<0.0069	<0.0034	0.0024 J
SB-39	3/5/2015	<0.0029	<0.0029	<0.0029	<0.0057	<0.0029	<0.0029
SB-40	3/5/2015	<0.0023	<0.0023	<0.0023	<0.0046	<0.0023	<0.0023
EPA Residential RSL (mg/kg)		1.2	4,900	6	580	47	38
EPA Industrial RSL (mg/kg)		5.1	47,000	25	2,500	210	17

Notes: **Bold/Highlighte**d values exceed EPA Residential / Industrial Regional Screening Level for soil
NS - No standard Exists
J - Concentration is between the method detection limit and the reporting limit
Screening Levels Based on Region 9 Regional Screening Level Summary Table (TR= 1E-06, HQ = 1.0) January 2015

FUSS & O'NEILL

TABLE 3
SUMMARY OF DETECTED VOCs IN GROUNDWATER
US 21 SC 51
YORK, SC

Sample Numbers	Date Collected	Benzene	Toluene	Ethylbenzene	Xylene	MTBE	Naphthalene
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
TIMES TURN AROUND							
TW-1	3/3/2015	**6480**	**1,120**	**702**	536.0	**2,820**	**111**
TW-2	3/3/2015	**13.5**	0.95 J	7.8	16.4	**59.5**	2.8
MW-6	3/3/2015	<2.8	<1.0	<1.0	<2.0	1.3	<2.8
PAVING EQUIPMENT							
TW-3	3/4/2015	0.74 J	0.44 J	0.43 J	<2.0	0.41 J	<1.0
TW-4	3/4/2015	0.41 J	0.27 J	<1.0	<2.0	<1.0	<1.0
PARTEX / EUMERIC HOLDINGS							
TW-5	3/4/2015	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0
TW-6	3/4/2015	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0
EPA MCL (µg/L)		5.0	1,000	700	10,000	40[1]	25[1]

Notes: **Bold/Highlighted** values exceed EPAs MCLs or SCDHEC RBSL

J - Concentration is between the method detection limit and the reporting limit

[1]: The value indicated is the SCDHEC UST Risk Based Screening Level (RBSL). No EPA MCL drinking water standard exists for this constituent

FUSS & O'NEILL

TABLE 4
SUMMARY OF DETECTED SVOCs IN SOIL
US 21 SC 51
YORK, SC

Sample Numbers	SB-18	S-20	S-22	SB-23	SB-24	Residential RSL (MG/KG)	Industrial RSL (MG/KG)
Date Collected	3/4/15	3/4/15	3/4/15	3/4/15	3/4/15		
Site	Paving Equimpent			Partex / Eumeric			
Compounds							
Benzo(a)anthracene	<0.0139	<0.0104	<0.0111	<0.0122	0.0169 J	0.15	2.9
Benzo(a)pyrene	<0.0139	<0.0104	<0.0111	<0.0122	**0.0185 J**	0.015	0.29
Benzo(b)fluoranthene	<0.0139	<0.0104	<0.0111	<0.0122	0.0204 J	0.15	2.9
Benzo(k)fluoranthene	<0.0139	<0.0104	<0.0111	<0.0122	0.0179 J	1.5	29
Chrysene	<0.0139	<0.0104	<0.0111	<0.0122	0.0217 J	15	290
Fluoranthene	<0.0139	<0.0104	<0.0111	<0.0122	0.0396 J	2,300	30,000
Phenanthrene	<0.0139	<0.0104	<0.0111	<0.0122	0.0183 J	NS	NS
Pyrene	<0.0139	<0.0104	<0.0111	<0.0122	0.0346 J	1,700	23,000

Notes:

Bold/Highlighted values exceed EPA Residential / Industrial RSLs

J - Concentration is between the method detection limit and the reporting limit; estimated value

Screening Levels Based on Regoin 9 Regional Screening Level Summary Table (TR= 1E-06, HQ = 1.0) January 2015

NS - No standard exists

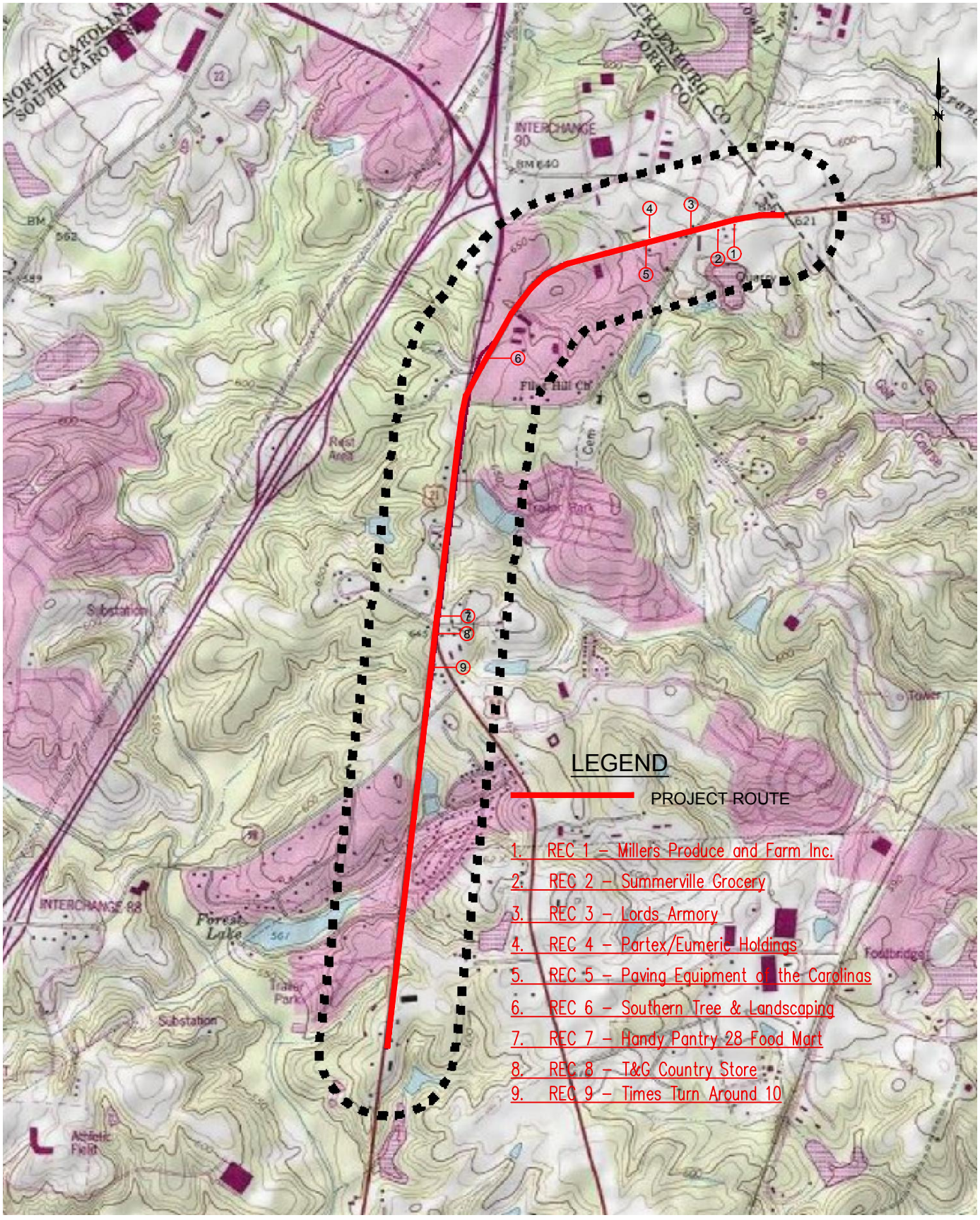
FUSS & O'NEILL

TABLE 5
SUMMARY OF DETECTED SVOCs IN GROUNDWATER
US 21 SC 51
YORK, SC

Sample Numbers	TW-3	TW-4	TW-5	TW-6	RBSL (µg/L)
Date Collected	3/4/15	3/4/15	3/4/15	3/4/15	
Site	Paving Equimpent		Partex / Eumeric		
Compounds					
Benzo(a)anthracene	<0.0139	<0.0104	<0.0111	<0.0122	10
Benzo(a)pyrene	<0.0139	<0.0104	<0.0111	<0.0122	NS
Benzo(b)fluoranthene	<0.0139	<0.0104	<0.0111	<0.0122	10
Benzo(k)fluoranthene	<0.0139	<0.0104	<0.0111	<0.0122	10
Chrysene	<0.0139	<0.0104	<0.0111	<0.0122	10
Fluoranthene	<0.0139	<0.0104	<0.0111	<0.0122	NS
Phenanthrene	<0.0139	<0.0104	<0.0111	<0.0122	NS
Pyrene	<0.0139	<0.0104	<0.0111	<0.0122	NS

Notes: Values screened using SCDHEC RBSLs
NS - No standard exists

Figures



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GRAPHIC SCALE

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803.376.6034
www.fando.com

STV, Inc.

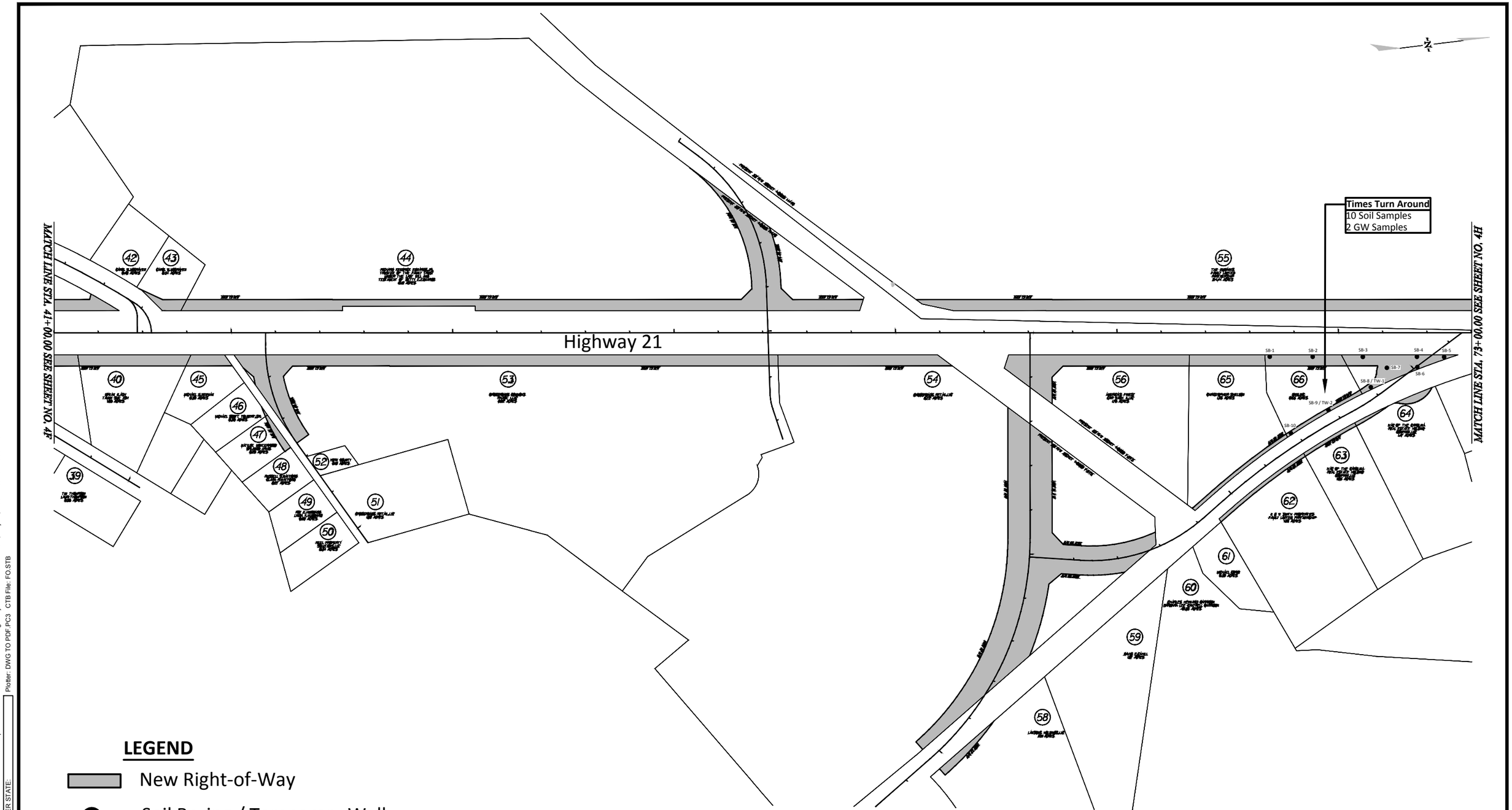
TOPOGRAPHIC SITE LOCATION MAP

US HIGHWAY 21 / SC HIGHWAY 51 PHASE II ESA

Fort Mill South Carolina

PROJ. No.: 20120285.A12
DATE: MAY 2015

Figure 1



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SOIL BORING / TEMPORARY WELL LOCATION MAP

US HIGHWAY 21 / SC HIGHWAY 51 PHASE II ESA

Fort Mill SOUTH CAROLINA

PROJ. No.: 20120285.A12
DATE: May 2015

Figure 2

File Path: F:\P20120285 STV York County US 21 SC 51\A12\Deliverables\Report\DWG\20120285A12STP0002.dwg Layout: FIG 2 Plotted: Mon, May 18, 2015 - 9:57 AM User: rbutler
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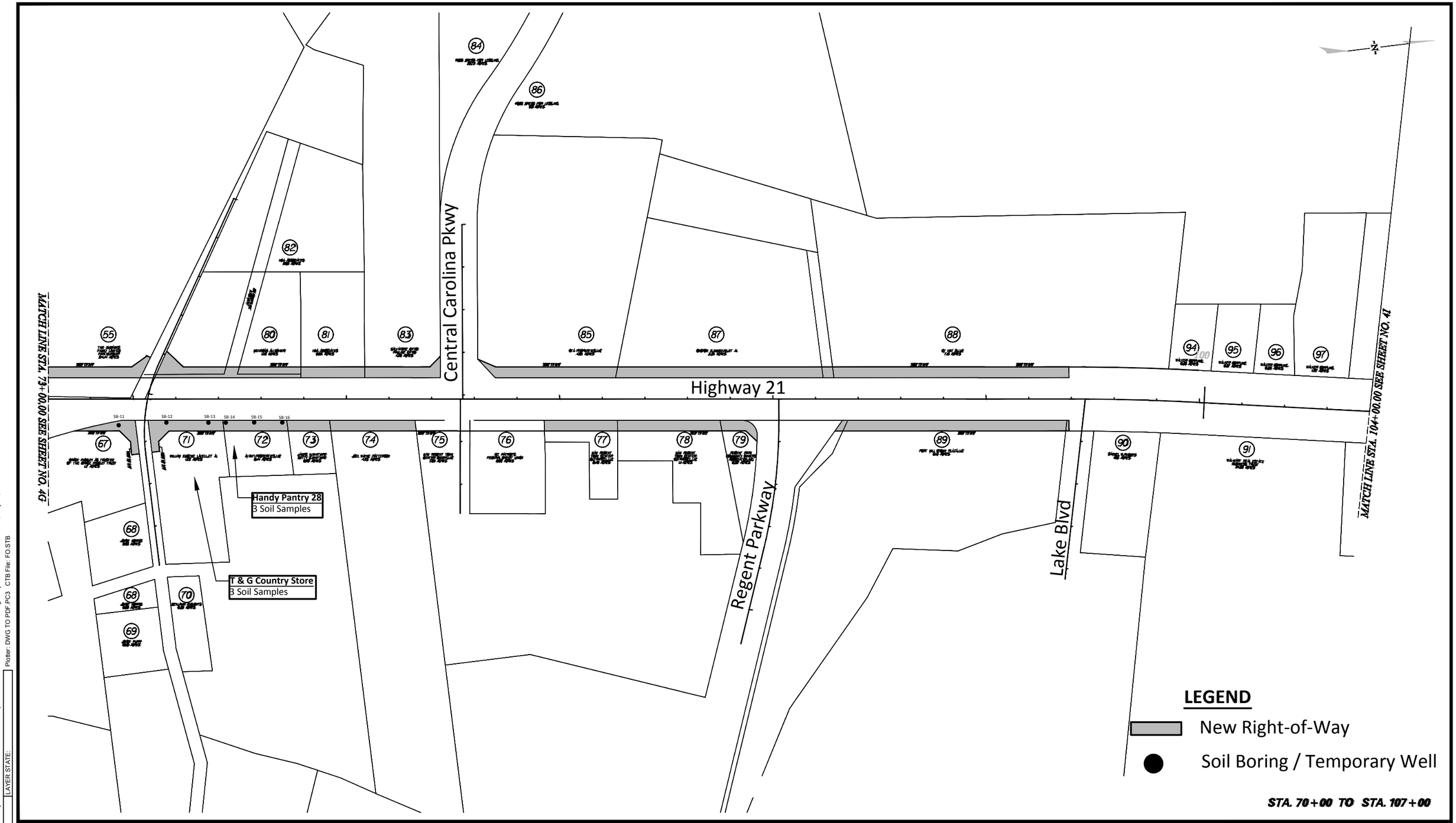

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GRAPHIC SCALE

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SOIL BORING / TEMPORARY WELL LOCATION MAP

US HIGHWAY 21 / SC HIGHWAY 51 PHASE II ESA

Fort Mill SOUTH CAROLINA

PROJ. No.: 20120285.A12
DATE: May 2015

Figure 3

File Path: F:\P20120285 STV York County US 21 SC 51\A12\Deliverables\Report\DWG\20120285A12STP0002.dwg Layout: FIG 3 Plotted: Mon, May 18, 2015 - 9:57 AM User: rbutler
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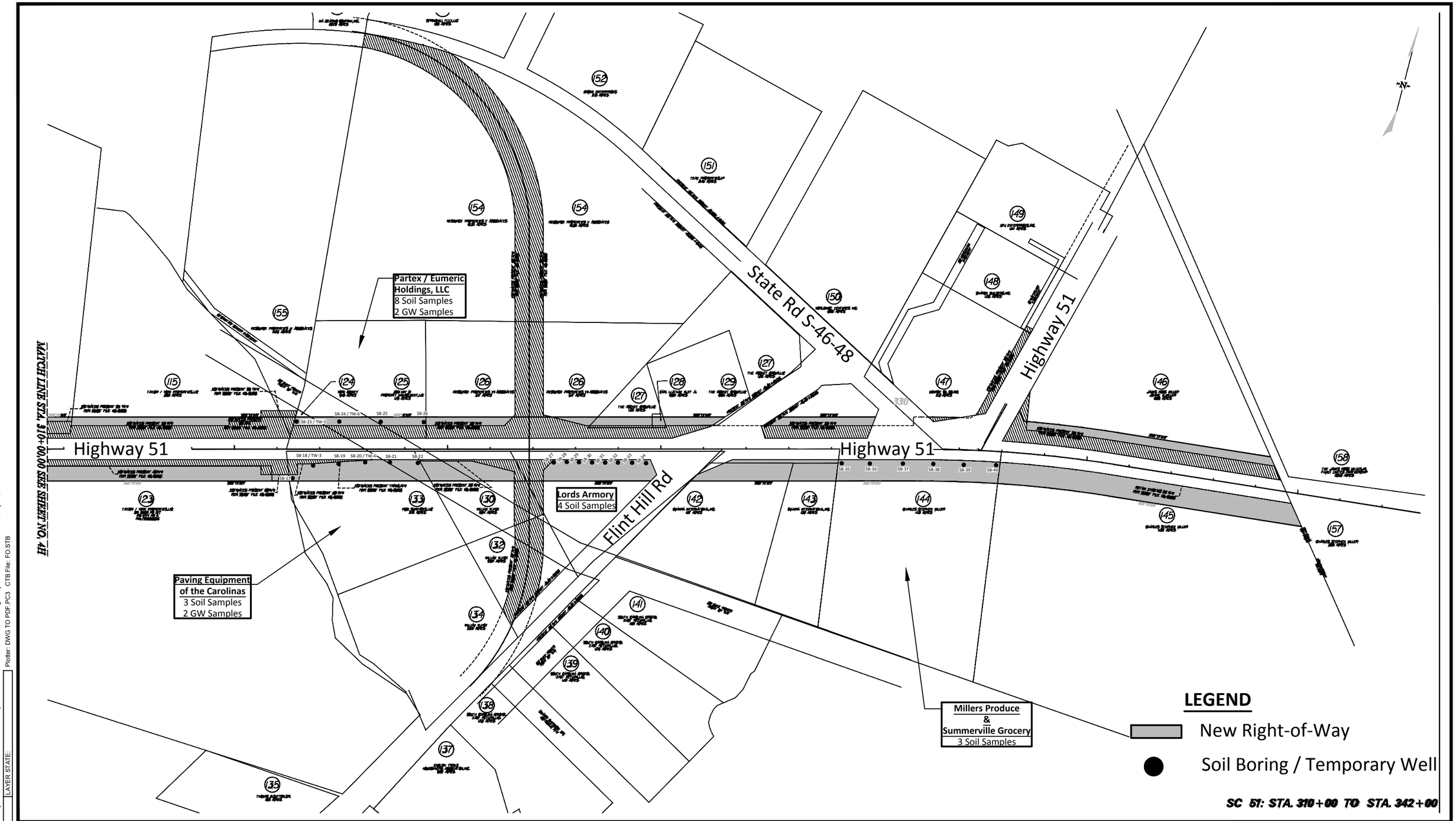

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GRAPHIC SCALE

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SOIL BORING / TEMPORARY WELL LOCATION MAP

US HIGHWAY 21 / SC HIGHWAY 51 PHASE II ESA

Fort Mill SOUTH CAROLINA

PROJ. No.: 20120285.A12
DATE: May 2015

Figure 4

File Path: F:\P2012\0285 STV York County US 21 SC 51\A12\Deliverables\Report\DWG\20120285A12STP0002.dwg Layout: FIG 4 Plotted: Mon, May 18, 2015 - 9:57 AM User: rbutler
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FUSS & O'NEILL

Appendix A

Laboratory Analytical Results

Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

March 23, 2015

Reggie Butler
Fuss & Oneill
717 Lady Street
Suite E
Columbia, SC 29201

RE: Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Dear Reggie Butler:
Enclosed are the analytical results for sample(s) received by the laboratory on March 09, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Analyses were performed at the Pace Analytical Services location indicated on the sample analyte page for analysis unless otherwise footnoted.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Herring for
Nicole Benjamin
nicole.benjamin@pacelabs.com
Project Manager

Enclosures

cc: Christine Cafagna
Andrew Derrick, Fuss & O'Neill Columbia

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

CERTIFICATIONS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Charlotte Certification IDs
9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
West Virginia Certification #: 357
Virginia/VELAP Certification #: 460221

Asheville Certification IDs
2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
West Virginia Certification #: 356
Virginia/VELAP Certification #: 460222

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Huntersville, NC 28078
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SAMPLE SUMMARY

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92240289001	**SB-1**	Solid	03/03/15 10:40	03/09/15 14:25
92240289002	**SB-2**	Solid	03/03/15 11:00	03/09/15 14:25
92240289003	**SB-3**	Solid	03/03/15 11:15	03/09/15 14:25
92240289004	**SB-4**	Solid	03/03/15 11:30	03/09/15 14:25
92240289005	**SB-5**	Solid	03/03/15 12:00	03/09/15 14:25
92240289006	**SB-6**	Solid	03/03/15 12:20	03/09/15 14:25
92240289007	**SB-7**	Solid	03/03/15 12:05	03/09/15 14:25
92240289008	**SB-8**	Solid	03/03/15 13:05	03/09/15 14:25
92240289009	**SB-9**	Solid	03/03/15 14:00	03/09/15 14:25
92240289010	**SB-10**	Solid	03/03/15 14:30	03/09/15 14:25
92240289011	**SB-11**	Solid	03/04/15 08:45	03/09/15 14:25
92240289012	**SB-12**	Solid	03/04/15 09:00	03/09/15 14:25
92240289013	**SB-13**	Solid	03/04/15 09:50	03/09/15 14:25
92240289014	**SB-14**	Solid	03/04/15 10:20	03/09/15 14:25
92240289015	**SB-15**	Solid	03/04/15 10:35	03/09/15 14:25
92240289016	**SB-16**	Solid	03/04/15 10:50	03/09/15 14:25
92240289017	**SB-18**	Solid	03/04/15 13:30	03/09/15 14:25
92240289018	**SB-20**	Solid	03/04/15 14:00	03/09/15 14:25
92240289019	**SB-22**	Solid	03/04/15 14:25	03/09/15 14:25
92240289020	**SB-23**	Solid	03/04/15 17:30	03/09/15 14:25
92240289021	**SB-24**	Solid	03/04/15 16:30	03/09/15 14:25
92240289022	**SB-23A**	Solid	03/04/15 17:35	03/09/15 14:25
92240289023	**SB-24A**	Solid	03/04/15 16:35	03/09/15 14:25
92240289024	**SB-25**	Solid	03/04/15 16:15	03/09/15 14:25
92240289025	**SB-25A**	Solid	03/04/15 16:26	03/09/15 14:25
92240289026	**SB-26**	Solid	03/04/15 16:00	03/09/15 14:25
92240289027	**SB-26A**	Solid	03/04/15 16:05	03/09/15 14:25
92240289028	**SB-33**	Solid	03/05/15 09:40	03/09/15 16:55
92240289029	**SB-34**	Solid	03/05/15 09:45	03/09/15 16:55
92240289030	**SB-31**	Solid	03/05/15 09:15	03/09/15 16:55
92240289031	**SB-32**	Solid	03/05/15 09:30	03/09/15 16:55
92240289032	**SB-38**	Solid	03/05/15 11:10	03/09/15 16:55
92240289033	**SB-39**	Solid	03/05/15 11:20	03/09/15 16:55
92240289034	**SB-40**	Solid	03/05/15 11:33	03/09/15 16:55
92240289035	**MW-6**	Water	03/03/15 11:30	03/09/15 16:55
92240289036	**TW-1**	Water	03/03/15 13:30	03/09/15 16:55
92240289037	**TW-2**	Water	03/03/15 14:30	03/09/15 16:55

REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92240289038	**TW-3**	Water	03/04/15 14:40	03/09/15 16:55
92240289039	**TW-4**	Water	03/04/15 14:55	03/09/15 16:55
92240289040	**TW-5**	Water	03/03/15 17:50	03/09/15 16:55
92240289041	**TW-6**	Water	03/03/15 16:30	03/09/15 16:55

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SAMPLE ANALYTE COUNT

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92240289001	**SB-1**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289002	**SB-2**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289003	**SB-3**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289004	**SB-4**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289005	**SB-5**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289006	**SB-6**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289007	**SB-7**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289008	**SB-8**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289009	**SB-9**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289010	**SB-10**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289011	**SB-11**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289012	**SB-12**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289013	**SB-13**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289014	**SB-14**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289015	**SB-15**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289016	**SB-16**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289017	**SB-18**	EPA 8270 by SIM	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289018	**SB-20**	EPA 8270 by SIM	RES	21	PASI-C

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SAMPLE ANALYTE COUNT

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289019	**SB-22**	EPA 8270 by SIM	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289020	**SB-23**	EPA 6010	JMW	7	PASI-A
		EPA 7471	HVK	1	PASI-A
		EPA 8270 by SIM	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289021	**SB-24**	EPA 6010	JMW	7	PASI-A
		EPA 7471	HVK	1	PASI-A
		EPA 8270 by SIM	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289022	**SB-23A**	EPA 6010	JMW	7	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289023	**SB-24A**	EPA 6010	JMW	7	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289024	**SB-25**	EPA 6010	JMW	7	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289025	**SB-25A**	EPA 6010	JMW	7	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289026	**SB-26**	EPA 6010	JMW	7	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289027	**SB-26A**	EPA 6010	JMW	7	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289028	**SB-33**	EPA 6010	JMW	7	PASI-A
		EPA 7471	HVK	1	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C
92240289029	**SB-34**	EPA 6010	JMW	7	PASI-A
		EPA 7471	HVK	1	PASI-A
		ASTM D2974-87	SLJ	1	PASI-C

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SAMPLE ANALYTE COUNT

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92240289030	**SB-31**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289031	**SB-32**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289032	**SB-38**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289033	**SB-39**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289034	**SB-40**	EPA 8260	DLK	11	PASI-C
		ASTM D2974-87	SLJ	1	PASI-C
92240289035	**MW-6**	EPA 8260	GAW	11	PASI-C
92240289036	**TW-1**	EPA 8260	GAW	11	PASI-C
92240289037	**TW-2**	EPA 8260	GAW	11	PASI-C
92240289038	**TW-3**	EPA 8270	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	GAW	62	PASI-C
92240289039	**TW-4**	EPA 8270	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	GAW	62	PASI-C
92240289040	**TW-5**	EPA 6010	JMW	7	PASI-A
		EPA 7470	HVK	1	PASI-A
		EPA 8270	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	GAW	62	PASI-C
92240289041	**TW-6**	EPA 6010	JMW	7	PASI-A
		EPA 7470	HVK	1	PASI-A
		EPA 8270	RES	21	PASI-C
		EPA 8270	BPJ	74	PASI-C
		EPA 8260	GAW	62	PASI-C

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SUMMARY OF DETECTION

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92240289001	**SB-1**					
ASTM D2974-87	Percent Moisture	19.9	%	0.10	03/10/15 16:22	
92240289002	**SB-2**					
ASTM D2974-87	Percent Moisture	10.2	%	0.10	03/10/15 16:22	
92240289003	**SB-3**					
ASTM D2974-87	Percent Moisture	20.8	%	0.10	03/10/15 16:26	
92240289004	**SB-4**					
ASTM D2974-87	Percent Moisture	14.2	%	0.10	03/10/15 16:26	
92240289005	**SB-5**					
ASTM D2974-87	Percent Moisture	11.4	%	0.10	03/10/15 16:26	
92240289006	**SB-6**					
ASTM D2974-87	Percent Moisture	15.0	%	0.10	03/10/15 16:27	
92240289007	**SB-7**					
ASTM D2974-87	Percent Moisture	16.7	%	0.10	03/10/15 16:27	
92240289008	**SB-8**					
EPA 8260	Ethylbenzene	44.7J	ug/kg	72.0	03/10/15 20:29	
EPA 8260	Naphthalene	57.3J	ug/kg	72.0	03/10/15 20:29	
ASTM D2974-87	Percent Moisture	7.4	%	0.10	03/10/15 16:27	
92240289009	**SB-9**					
EPA 8260	Benzene	580	ug/kg	69.2	03/10/15 20:49	
EPA 8260	Ethylbenzene	29500	ug/kg	3460	03/11/15 13:17	
EPA 8260	Methyl-tert-butyl ether	68.0J	ug/kg	69.2	03/10/15 20:49	B
EPA 8260	Naphthalene	12700	ug/kg	3460	03/11/15 13:17	
EPA 8260	Toluene	426	ug/kg	69.2	03/10/15 20:49	
EPA 8260	Xylene (Total)	138000	ug/kg	6920	03/11/15 13:17	
EPA 8260	m&p-Xylene	106000	ug/kg	6920	03/11/15 13:17	
EPA 8260	o-Xylene	32200	ug/kg	3460	03/11/15 13:17	
ASTM D2974-87	Percent Moisture	7.8	%	0.10	03/10/15 16:27	
92240289010	**SB-10**					
ASTM D2974-87	Percent Moisture	20.2	%	0.10	03/10/15 16:27	
92240289011	**SB-11**					
EPA 8260	Naphthalene	0.99J	ug/kg	2.8	03/10/15 21:29	
ASTM D2974-87	Percent Moisture	18.6	%	0.10	03/10/15 16:28	
92240289012	**SB-12**					
ASTM D2974-87	Percent Moisture	28.8	%	0.10	03/10/15 16:28	
92240289013	**SB-13**					
ASTM D2974-87	Percent Moisture	19.7	%	0.10	03/10/15 16:28	
92240289014	**SB-14**					
ASTM D2974-87	Percent Moisture	26.4	%	0.10	03/10/15 19:28	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92240289015	**SB-15**					
ASTM D2974-87	Percent Moisture	26.2	%	0.10	03/10/15 19:28	
92240289016	**SB-16**					
EPA 8260	Benzene	11.4	ug/kg	3.7	03/10/15 16:13	
ASTM D2974-87	Percent Moisture	22.8	%	0.10	03/10/15 19:28	
92240289017	**SB-18**					
ASTM D2974-87	Percent Moisture	28.0	%	0.10	03/11/15 10:16	
92240289018	**SB-20**					
ASTM D2974-87	Percent Moisture	3.5	%	0.10	03/11/15 10:16	
92240289019	**SB-22**					
ASTM D2974-87	Percent Moisture	9.9	%	0.10	03/11/15 10:16	
92240289020	**SB-23**					
EPA 6010	Arsenic	1.2	mg/kg	1.1	03/10/15 22:59	
EPA 6010	Barium	261	mg/kg	0.56	03/10/15 22:59	
EPA 6010	Cadmium	0.080J	mg/kg	0.11	03/10/15 22:59	
EPA 6010	Chromium	14.7	mg/kg	0.56	03/10/15 22:59	
EPA 6010	Lead	6.9	mg/kg	0.56	03/10/15 22:59	
EPA 6010	Selenium	0.94J	mg/kg	1.1	03/10/15 22:59	
EPA 7471	Mercury	0.017	mg/kg	0.0044	03/11/15 14:07	
ASTM D2974-87	Percent Moisture	18.1	%	0.10	03/11/15 10:16	
92240289021	**SB-24**					
EPA 6010	Arsenic	0.81J	mg/kg	0.88	03/10/15 23:02	
EPA 6010	Barium	14.9	mg/kg	0.44	03/10/15 23:02	
EPA 6010	Cadmium	0.10	mg/kg	0.088	03/10/15 23:02	
EPA 6010	Chromium	2.5	mg/kg	0.44	03/10/15 23:02	
EPA 6010	Lead	3.1	mg/kg	0.44	03/10/15 23:02	
EPA 6010	Selenium	1.2	mg/kg	0.88	03/10/15 23:02	
EPA 7471	Mercury	0.032	mg/kg	0.0046	03/11/15 14:15	
EPA 8270 by SIM	Benzo(a)anthracene	16.9J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Benzo(a)pyrene	18.5J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Benzo(b)fluoranthene	20.4J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Benzo(k)fluoranthene	17.9J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Chrysene	21.7J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Fluoranthene	39.6J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Phenanthrene	18.3J	ug/kg	64.1	03/13/15 19:54	
EPA 8270 by SIM	Pyrene	34.6J	ug/kg	64.1	03/13/15 19:54	
ASTM D2974-87	Percent Moisture	22.0	%	0.10	03/11/15 10:16	
92240289022	**SB-23A**					
EPA 6010	Arsenic	0.51J	mg/kg	0.90	03/10/15 23:05	
EPA 6010	Barium	158	mg/kg	0.45	03/10/15 23:05	
EPA 6010	Cadmium	0.091	mg/kg	0.090	03/10/15 23:05	
EPA 6010	Chromium	14.0	mg/kg	0.45	03/10/15 23:05	
EPA 6010	Lead	17.9	mg/kg	0.45	03/10/15 23:05	
EPA 6010	Selenium	0.75J	mg/kg	0.90	03/10/15 23:05	

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SUMMARY OF DETECTION

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92240289022	**SB-23A**					
EPA 6010	Silver	0.82	mg/kg	0.45	03/10/15 23:05	
ASTM D2974-87	Percent Moisture	10.8	%	0.10	03/11/15 10:17	
92240289023	**SB-24A**					
EPA 6010	Arsenic	0.66J	mg/kg	0.97	03/10/15 23:17	
EPA 6010	Barium	210	mg/kg	0.48	03/10/15 23:17	
EPA 6010	Cadmium	0.13	mg/kg	0.097	03/10/15 23:17	
EPA 6010	Chromium	27.2	mg/kg	0.48	03/10/15 23:17	
EPA 6010	Lead	5.7	mg/kg	0.48	03/10/15 23:17	
EPA 6010	Selenium	0.80J	mg/kg	0.97	03/10/15 23:17	
ASTM D2974-87	Percent Moisture	21.6	%	0.10	03/11/15 10:17	
92240289024	**SB-25**					
EPA 6010	Barium	157	mg/kg	0.45	03/10/15 23:20	
EPA 6010	Cadmium	0.098	mg/kg	0.090	03/10/15 23:20	
EPA 6010	Chromium	50.2	mg/kg	0.45	03/10/15 23:20	
EPA 6010	Lead	3.1	mg/kg	0.45	03/10/15 23:20	
EPA 6010	Selenium	1.2	mg/kg	0.90	03/10/15 23:20	
EPA 6010	Silver	1.1	mg/kg	0.45	03/10/15 23:20	
ASTM D2974-87	Percent Moisture	24.3	%	0.10	03/11/15 10:17	
92240289025	**SB-25A**					
EPA 6010	Barium	504	mg/kg	0.63	03/10/15 23:23	
EPA 6010	Cadmium	0.096J	mg/kg	0.13	03/10/15 23:23	
EPA 6010	Chromium	48.2	mg/kg	0.63	03/10/15 23:23	
EPA 6010	Lead	6.2	mg/kg	0.63	03/10/15 23:23	
EPA 6010	Selenium	1.1J	mg/kg	1.3	03/10/15 23:23	
ASTM D2974-87	Percent Moisture	29.3	%	0.10	03/11/15 10:17	
92240289026	**SB-26**					
EPA 6010	Barium	129	mg/kg	0.57	03/10/15 23:26	
EPA 6010	Cadmium	0.16	mg/kg	0.11	03/10/15 23:26	
EPA 6010	Chromium	75.8	mg/kg	0.57	03/10/15 23:26	
EPA 6010	Lead	10.8	mg/kg	0.57	03/10/15 23:26	
EPA 6010	Selenium	1.5	mg/kg	1.1	03/10/15 23:26	
EPA 6010	Silver	0.58	mg/kg	0.57	03/10/15 23:26	
ASTM D2974-87	Percent Moisture	29.5	%	0.10	03/11/15 10:18	
92240289027	**SB-26A**					
EPA 6010	Barium	157	mg/kg	0.61	03/10/15 23:29	
EPA 6010	Cadmium	0.10J	mg/kg	0.12	03/10/15 23:29	
EPA 6010	Chromium	36.9	mg/kg	0.61	03/10/15 23:29	
EPA 6010	Lead	2.2	mg/kg	0.61	03/10/15 23:29	
EPA 6010	Selenium	1.3	mg/kg	1.2	03/10/15 23:29	
EPA 6010	Silver	0.70	mg/kg	0.61	03/10/15 23:29	
ASTM D2974-87	Percent Moisture	27.3	%	0.10	03/11/15 10:18	
92240289028	**SB-33**					
EPA 6010	Barium	150	mg/kg	0.50	03/10/15 23:35	
EPA 6010	Cadmium	0.12	mg/kg	0.099	03/10/15 23:35	

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SUMMARY OF DETECTION

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92240289028	**SB-33**					
EPA 6010	Chromium	64.1	mg/kg	0.50	03/10/15 23:35	
EPA 6010	Lead	1.9	mg/kg	0.50	03/10/15 23:35	
EPA 6010	Selenium	1.3	mg/kg	0.99	03/10/15 23:35	
EPA 6010	Silver	0.45J	mg/kg	0.50	03/10/15 23:35	
EPA 7471	Mercury	0.0096	mg/kg	0.0054	03/12/15 13:41	
ASTM D2974-87	Percent Moisture	24.8	%	0.10	03/11/15 10:18	
92240289029	**SB-34**					
EPA 6010	Barium	87.5	mg/kg	0.53	03/10/15 23:38	
EPA 6010	Chromium	2.2	mg/kg	0.53	03/10/15 23:38	
EPA 6010	Lead	2.0	mg/kg	0.53	03/10/15 23:38	
EPA 6010	Selenium	0.84J	mg/kg	1.1	03/10/15 23:38	
EPA 6010	Silver	0.59	mg/kg	0.53	03/10/15 23:38	
EPA 7471	Mercury	0.0017J	mg/kg	0.0041	03/12/15 13:44	
ASTM D2974-87	Percent Moisture	10	%	0.10	03/11/15 10:19	
92240289030	**SB-31**					
EPA 8260	Ethylbenzene	879	ug/kg	291	03/11/15 15:56	
EPA 8260	Naphthalene	6180	ug/kg	291	03/11/15 15:56	
EPA 8260	Xylene (Total)	1110	ug/kg	583	03/11/15 15:56	
EPA 8260	m&p-Xylene	1110	ug/kg	583	03/11/15 15:56	
EPA 8260	o-Xylene	126J	ug/kg	291	03/11/15 15:56	
ASTM D2974-87	Percent Moisture	19.2	%	0.10	03/10/15 19:28	
92240289031	**SB-32**					
EPA 8260	Ethylbenzene	3120	ug/kg	126	03/11/15 16:16	
EPA 8260	Naphthalene	7640	ug/kg	504	03/12/15 14:16	
EPA 8260	Xylene (Total)	4420	ug/kg	252	03/11/15 16:16	
EPA 8260	m&p-Xylene	4420	ug/kg	252	03/11/15 16:16	
EPA 8260	o-Xylene	116J	ug/kg	126	03/11/15 16:16	
ASTM D2974-87	Percent Moisture	15.8	%	0.10	03/10/15 19:29	
92240289032	**SB-38**					
EPA 8260	Naphthalene	2.4J	ug/kg	3.4	03/11/15 16:36	
ASTM D2974-87	Percent Moisture	17.0	%	0.10	03/10/15 19:29	
92240289033	**SB-39**					
ASTM D2974-87	Percent Moisture	18.4	%	0.10	03/10/15 19:29	
92240289034	**SB-40**					
ASTM D2974-87	Percent Moisture	13.1	%	0.10	03/10/15 19:29	
92240289035	**MW-6**					
EPA 8260	Methyl-tert-butyl ether	1.3	ug/L	1.0	03/11/15 21:06	
92240289036	**TW-1**					
EPA 8260	Benzene	6480	ug/L	100	03/12/15 14:53	
EPA 8260	Ethylbenzene	702	ug/L	100	03/12/15 14:53	
EPA 8260	Methyl-tert-butyl ether	2820	ug/L	100	03/12/15 14:53	
EPA 8260	Naphthalene	111	ug/L	1.0	03/11/15 21:23	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92240289036	**TW-1**					
EPA 8260	Toluene	1120	ug/L	100	03/12/15 14:53	
EPA 8260	Xylene (Total)	536	ug/L	2.0	03/11/15 21:23	
EPA 8260	m&p-Xylene	383	ug/L	2.0	03/11/15 21:23	
EPA 8260	o-Xylene	153	ug/L	1.0	03/11/15 21:23	
92240289037	**TW-2**					
EPA 8260	Benzene	13.5	ug/L	1.0	03/12/15 20:14	
EPA 8260	Ethylbenzene	7.8	ug/L	1.0	03/12/15 20:14	
EPA 8260	Methyl-tert-butyl ether	59.5	ug/L	1.0	03/12/15 20:14	
EPA 8260	Naphthalene	2.8	ug/L	1.0	03/12/15 20:14	
EPA 8260	Toluene	0.95J	ug/L	1.0	03/12/15 20:14	
EPA 8260	Xylene (Total)	16.4	ug/L	2.0	03/12/15 20:14	
EPA 8260	m&p-Xylene	15.1	ug/L	2.0	03/12/15 20:14	
EPA 8260	o-Xylene	1.3	ug/L	1.0	03/12/15 20:14	
92240289038	**TW-3**					
EPA 8270	Benzo(a)anthracene	2.5J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Benzo(a)pyrene	1.5J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Benzo(b)fluoranthene	1.9J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Benzo(g,h,i)perylene	1.5J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Benzo(k)fluoranthene	1.9J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Butylbenzylphthalate	2.5J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Chrysene	3.0J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Dibenz(a,h)anthracene	1.2J	ug/L	10.0	03/13/15 11:39	
EPA 8270	3,3'-Dichlorobenzidine	2.3J	ug/L	50.0	03/13/15 11:39	
EPA 8270	Di-n-octylphthalate	1.4J	ug/L	10.0	03/13/15 11:39	
EPA 8270	bis(2-Ethylhexyl)phthalate	2.0J	ug/L	6.0	03/13/15 11:39	
EPA 8270	Fluoranthene	4.1J	ug/L	10.0	03/13/15 11:39	
EPA 8270	Indeno(1,2,3-cd)pyrene	1.3J	ug/L	10.0	03/13/15 11:39	
EPA 8270	4-Nitroaniline	3.2J	ug/L	50.0	03/13/15 11:39	
EPA 8270	4-Nitrophenol	8.8J	ug/L	50.0	03/13/15 11:39	
EPA 8270	Pentachlorophenol	2.9J	ug/L	50.0	03/13/15 11:39	
EPA 8270	Pyrene	3.8J	ug/L	10.0	03/13/15 11:39	
EPA 8260	Benzene	0.74J	ug/L	1.0	03/11/15 21:57	
EPA 8260	Diisopropyl ether	0.17J	ug/L	1.0	03/11/15 21:57	
EPA 8260	Ethylbenzene	0.43J	ug/L	1.0	03/11/15 21:57	
EPA 8260	Methyl-tert-butyl ether	0.41J	ug/L	1.0	03/11/15 21:57	
EPA 8260	Toluene	0.44J	ug/L	1.0	03/11/15 21:57	
92240289039	**TW-4**					
EPA 8260	Benzene	0.41J	ug/L	1.0	03/11/15 22:14	
EPA 8260	Toluene	0.27J	ug/L	1.0	03/11/15 22:14	
92240289040	**TW-5**					
EPA 6010	Arsenic	31.3	ug/L	10.0	03/11/15 03:00	
EPA 6010	Barium	5120	ug/L	5.0	03/11/15 03:00	
EPA 6010	Cadmium	4.1	ug/L	1.0	03/11/15 03:00	
EPA 6010	Chromium	684	ug/L	5.0	03/11/15 03:00	
EPA 6010	Lead	789	ug/L	5.0	03/11/15 03:00	

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SUMMARY OF DETECTION

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92240289040	**TW-5**					
EPA 6010	Selenium	17.2	ug/L	10.0	03/11/15 03:00	M1
EPA 7470	Mercury	0.64	ug/L	0.20	03/11/15 13:25	
92240289041	**TW-6**					
EPA 6010	Barium	16700	ug/L	50.0	03/11/15 16:06	
EPA 6010	Cadmium	3.3	ug/L	1.0	03/11/15 03:18	
EPA 6010	Chromium	2900	ug/L	5.0	03/11/15 03:18	
EPA 6010	Lead	215	ug/L	5.0	03/11/15 03:18	
EPA 6010	Selenium	30.2	ug/L	10.0	03/11/15 03:18	
EPA 6010	Silver	6.5	ug/L	5.0	03/11/15 03:18	
EPA 7470	Mercury	0.46	ug/L	0.20	03/14/15 13:44	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-1 **Lab ID: 92240289001** Collected: 03/03/15 10:40 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	3.1	1.0	1		03/10/15 18:10	71-43-2	
Ethylbenzene	ND	ug/kg	3.1	1.1	1		03/10/15 18:10	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	3.1	0.94	1		03/10/15 18:10	1634-04-4	
Naphthalene	ND	ug/kg	3.1	0.75	1		03/10/15 18:10	91-20-3	
Toluene	ND	ug/kg	3.1	1.1	1		03/10/15 18:10	108-88-3	
Xylene (Total)	ND	ug/kg	6.3	2.3	1		03/10/15 18:10	1330-20-7	
m&p-Xylene	ND	ug/kg	6.3	2.3	1		03/10/15 18:10	179601-23-1	
o-Xylene	ND	ug/kg	3.1	1.2	1		03/10/15 18:10	95-47-6	
Surrogates									
Toluene-d8 (S)	103	%	70-130		1		03/10/15 18:10	2037-26-5	
4-Bromofluorobenzene (S)	104	%	70-130		1		03/10/15 18:10	460-00-4	
1,2-Dichloroethane-d4 (S)	115	%	70-130		1		03/10/15 18:10	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**19.9**	%	0.10	0.10	1		03/10/15 16:22		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-2 **Lab ID: 92240289002** Collected: 03/03/15 11:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.8	0.89	1		03/10/15 18:30	71-43-2	
Ethylbenzene	ND	ug/kg	2.8	1.0	1		03/10/15 18:30	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.8	0.84	1		03/10/15 18:30	1634-04-4	
Naphthalene	ND	ug/kg	2.8	0.67	1		03/10/15 18:30	91-20-3	
Toluene	ND	ug/kg	2.8	1.0	1		03/10/15 18:30	108-88-3	
Xylene (Total)	ND	ug/kg	5.6	2.0	1		03/10/15 18:30	1330-20-7	
m&p-Xylene	ND	ug/kg	5.6	2.0	1		03/10/15 18:30	179601-23-1	
o-Xylene	ND	ug/kg	2.8	1.1	1		03/10/15 18:30	95-47-6	
Surrogates									
Toluene-d8 (S)	104	%	70-130		1		03/10/15 18:30	2037-26-5	
4-Bromofluorobenzene (S)	104	%	70-130		1		03/10/15 18:30	460-00-4	
1,2-Dichloroethane-d4 (S)	115	%	70-130		1		03/10/15 18:30	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**10.2**	%	0.10	0.10	1		03/10/15 16:22		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-3 **Lab ID: 92240289003** Collected: 03/03/15 11:15 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	3.0	0.97	1		03/10/15 18:50	71-43-2	
Ethylbenzene	ND	ug/kg	3.0	1.1	1		03/10/15 18:50	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	3.0	0.91	1		03/10/15 18:50	1634-04-4	
Naphthalene	ND	ug/kg	3.0	0.73	1		03/10/15 18:50	91-20-3	
Toluene	ND	ug/kg	3.0	1.1	1		03/10/15 18:50	108-88-3	
Xylene (Total)	ND	ug/kg	6.1	2.2	1		03/10/15 18:50	1330-20-7	
m&p-Xylene	ND	ug/kg	6.1	2.2	1		03/10/15 18:50	179601-23-1	
o-Xylene	ND	ug/kg	3.0	1.1	1		03/10/15 18:50	95-47-6	
Surrogates									
Toluene-d8 (S)	104	%	70-130		1		03/10/15 18:50	2037-26-5	
4-Bromofluorobenzene (S)	103	%	70-130		1		03/10/15 18:50	460-00-4	
1,2-Dichloroethane-d4 (S)	119	%	70-130		1		03/10/15 18:50	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**20.8**	%	0.10	0.10	1		03/10/15 16:26		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-4 **Lab ID: 92240289004** Collected: 03/03/15 11:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.9	0.94	1		03/10/15 19:10	71-43-2	
Ethylbenzene	ND	ug/kg	2.9	1.1	1		03/10/15 19:10	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.9	0.88	1		03/10/15 19:10	1634-04-4	
Naphthalene	ND	ug/kg	2.9	0.70	1		03/10/15 19:10	91-20-3	
Toluene	ND	ug/kg	2.9	1.1	1		03/10/15 19:10	108-88-3	
Xylene (Total)	ND	ug/kg	5.9	2.1	1		03/10/15 19:10	1330-20-7	
m&p-Xylene	ND	ug/kg	5.9	2.1	1		03/10/15 19:10	179601-23-1	
o-Xylene	ND	ug/kg	2.9	1.1	1		03/10/15 19:10	95-47-6	
Surrogates									
Toluene-d8 (S)	103	%	70-130		1		03/10/15 19:10	2037-26-5	
4-Bromofluorobenzene (S)	100	%	70-130		1		03/10/15 19:10	460-00-4	
1,2-Dichloroethane-d4 (S)	120	%	70-130		1		03/10/15 19:10	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**14.2**	%	0.10	0.10	1		03/10/15 16:26		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-5 **Lab ID: 92240289005** Collected: 03/03/15 12:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.6	0.82	1		03/10/15 19:30	71-43-2	
Ethylbenzene	ND	ug/kg	2.6	0.92	1		03/10/15 19:30	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.6	0.77	1		03/10/15 19:30	1634-04-4	
Naphthalene	ND	ug/kg	2.6	0.62	1		03/10/15 19:30	91-20-3	
Toluene	ND	ug/kg	2.6	0.92	1		03/10/15 19:30	108-88-3	
Xylene (Total)	ND	ug/kg	5.1	1.8	1		03/10/15 19:30	1330-20-7	
m&p-Xylene	ND	ug/kg	5.1	1.8	1		03/10/15 19:30	179601-23-1	
o-Xylene	ND	ug/kg	2.6	0.97	1		03/10/15 19:30	95-47-6	
Surrogates									
Toluene-d8 (S)	105	%	70-130		1		03/10/15 19:30	2037-26-5	
4-Bromofluorobenzene (S)	105	%	70-130		1		03/10/15 19:30	460-00-4	
1,2-Dichloroethane-d4 (S)	120	%	70-130		1		03/10/15 19:30	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**11.4**	%	0.10	0.10	1		03/10/15 16:26		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-6 **Lab ID: 92240289006** Collected: 03/03/15 12:20 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	3.6	1.2	1		03/10/15 19:49	71-43-2	
Ethylbenzene	ND	ug/kg	3.6	1.3	1		03/10/15 19:49	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	3.6	1.1	1		03/10/15 19:49	1634-04-4	
Naphthalene	ND	ug/kg	3.6	0.87	1		03/10/15 19:49	91-20-3	
Toluene	ND	ug/kg	3.6	1.3	1		03/10/15 19:49	108-88-3	
Xylene (Total)	ND	ug/kg	7.3	2.6	1		03/10/15 19:49	1330-20-7	
m&p-Xylene	ND	ug/kg	7.3	2.6	1		03/10/15 19:49	179601-23-1	
o-Xylene	ND	ug/kg	3.6	1.4	1		03/10/15 19:49	95-47-6	
Surrogates									
Toluene-d8 (S)	106	%	70-130		1		03/10/15 19:49	2037-26-5	
4-Bromofluorobenzene (S)	102	%	70-130		1		03/10/15 19:49	460-00-4	
1,2-Dichloroethane-d4 (S)	122	%	70-130		1		03/10/15 19:49	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**15.0**	%	0.10	0.10	1		03/10/15 16:27		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-7 **Lab ID: 92240289007** Collected: 03/03/15 12:05 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.1	0.69	1		03/10/15 20:09	71-43-2	
Ethylbenzene	ND	ug/kg	2.1	0.77	1		03/10/15 20:09	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.1	0.64	1		03/10/15 20:09	1634-04-4	
Naphthalene	ND	ug/kg	2.1	0.51	1		03/10/15 20:09	91-20-3	
Toluene	ND	ug/kg	2.1	0.77	1		03/10/15 20:09	108-88-3	
Xylene (Total)	ND	ug/kg	4.3	1.5	1		03/10/15 20:09	1330-20-7	
m&p-Xylene	ND	ug/kg	4.3	1.5	1		03/10/15 20:09	179601-23-1	
o-Xylene	ND	ug/kg	2.1	0.81	1		03/10/15 20:09	95-47-6	
Surrogates									
Toluene-d8 (S)	102	%	70-130		1		03/10/15 20:09	2037-26-5	
4-Bromofluorobenzene (S)	103	%	70-130		1		03/10/15 20:09	460-00-4	
1,2-Dichloroethane-d4 (S)	125	%	70-130		1		03/10/15 20:09	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**16.7**	%	0.10	0.10	1		03/10/15 16:27		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-8 **Lab ID: 92240289008** Collected: 03/03/15 13:05 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	72.0	23.0	25		03/10/15 20:29	71-43-2	
Ethylbenzene	**44.7J**	ug/kg	72.0	25.9	25		03/10/15 20:29	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	72.0	21.6	25		03/10/15 20:29	1634-04-4	
Naphthalene	**57.3J**	ug/kg	72.0	17.3	25		03/10/15 20:29	91-20-3	
Toluene	ND	ug/kg	72.0	25.9	25		03/10/15 20:29	108-88-3	
Xylene (Total)	ND	ug/kg	144	51.9	25		03/10/15 20:29	1330-20-7	
m&p-Xylene	ND	ug/kg	144	51.9	25		03/10/15 20:29	179601-23-1	
o-Xylene	ND	ug/kg	72.0	27.4	25		03/10/15 20:29	95-47-6	
Surrogates									
Toluene-d8 (S)	104	%	70-130		25		03/10/15 20:29	2037-26-5	D3
4-Bromofluorobenzene (S)	99	%	70-130		25		03/10/15 20:29	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	70-130		25		03/10/15 20:29	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**7.4**	%	0.10	0.10	1		03/10/15 16:27		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-9 **Lab ID: 92240289009** Collected: 03/03/15 14:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	**580**	ug/kg	69.2	22.2	25		03/10/15 20:49	71-43-2	
Ethylbenzene	**29500**	ug/kg	3460	1250	1250		03/11/15 13:17	100-41-4	
Methyl-tert-butyl ether	**68.0J**	ug/kg	69.2	20.8	25		03/10/15 20:49	1634-04-4	B
Naphthalene	**12700**	ug/kg	3460	831	1250		03/11/15 13:17	91-20-3	
Toluene	**426**	ug/kg	69.2	24.9	25		03/10/15 20:49	108-88-3	
Xylene (Total)	**138000**	ug/kg	6920	2490	1250		03/11/15 13:17	1330-20-7	
m&p-Xylene	**106000**	ug/kg	6920	2490	1250		03/11/15 13:17	179601-23-1	
o-Xylene	**32200**	ug/kg	3460	1320	1250		03/11/15 13:17	95-47-6	
Surrogates									
Toluene-d8 (S)	76	%	70-130		25		03/10/15 20:49	2037-26-5	
4-Bromofluorobenzene (S)	116	%	70-130		25		03/10/15 20:49	460-00-4	
1,2-Dichloroethane-d4 (S)	326	%	70-130		25		03/10/15 20:49	17060-07-0	S1
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**7.8**	%	0.10	0.10	1		03/10/15 16:27		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-10 **Lab ID: 92240289010** Collected: 03/03/15 14:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.6	0.82	1		03/11/15 14:56	71-43-2	
Ethylbenzene	ND	ug/kg	2.6	0.92	1		03/11/15 14:56	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.6	0.77	1		03/11/15 14:56	1634-04-4	
Naphthalene	ND	ug/kg	2.6	0.62	1		03/11/15 14:56	91-20-3	
Toluene	ND	ug/kg	2.6	0.92	1		03/11/15 14:56	108-88-3	
Xylene (Total)	ND	ug/kg	5.1	1.8	1		03/11/15 14:56	1330-20-7	
m&p-Xylene	ND	ug/kg	5.1	1.8	1		03/11/15 14:56	179601-23-1	
o-Xylene	ND	ug/kg	2.6	0.97	1		03/11/15 14:56	95-47-6	
Surrogates									
Toluene-d8 (S)	104	%	70-130		1		03/11/15 14:56	2037-26-5	
4-Bromofluorobenzene (S)	103	%	70-130		1		03/11/15 14:56	460-00-4	
1,2-Dichloroethane-d4 (S)	120	%	70-130		1		03/11/15 14:56	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**20.2**	%	0.10	0.10	1		03/10/15 16:27		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-11 **Lab ID: 92240289011** Collected: 03/04/15 08:45 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.8	0.88	1		03/10/15 21:29	71-43-2	
Ethylbenzene	ND	ug/kg	2.8	0.99	1		03/10/15 21:29	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.8	0.83	1		03/10/15 21:29	1634-04-4	
Naphthalene	**0.99J**	ug/kg	2.8	0.66	1		03/10/15 21:29	91-20-3	
Toluene	ND	ug/kg	2.8	0.99	1		03/10/15 21:29	108-88-3	
Xylene (Total)	ND	ug/kg	5.5	2.0	1		03/10/15 21:29	1330-20-7	
m&p-Xylene	ND	ug/kg	5.5	2.0	1		03/10/15 21:29	179601-23-1	
o-Xylene	ND	ug/kg	2.8	1.0	1		03/10/15 21:29	95-47-6	
Surrogates									
Toluene-d8 (S)	103	%	70-130		1		03/10/15 21:29	2037-26-5	
4-Bromofluorobenzene (S)	101	%	70-130		1		03/10/15 21:29	460-00-4	
1,2-Dichloroethane-d4 (S)	109	%	70-130		1		03/10/15 21:29	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**18.6**	%	0.10	0.10	1		03/10/15 16:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-12 **Lab ID: 92240289012** Collected: 03/04/15 09:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.4	0.78	1		03/10/15 21:49	71-43-2	
Ethylbenzene	ND	ug/kg	2.4	0.88	1		03/10/15 21:49	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.4	0.73	1		03/10/15 21:49	1634-04-4	
Naphthalene	ND	ug/kg	2.4	0.58	1		03/10/15 21:49	91-20-3	
Toluene	ND	ug/kg	2.4	0.88	1		03/10/15 21:49	108-88-3	
Xylene (Total)	ND	ug/kg	4.9	1.8	1		03/10/15 21:49	1330-20-7	
m&p-Xylene	ND	ug/kg	4.9	1.8	1		03/10/15 21:49	179601-23-1	
o-Xylene	ND	ug/kg	2.4	0.93	1		03/10/15 21:49	95-47-6	
Surrogates									
Toluene-d8 (S)	106	%	70-130		1		03/10/15 21:49	2037-26-5	
4-Bromofluorobenzene (S)	101	%	70-130		1		03/10/15 21:49	460-00-4	
1,2-Dichloroethane-d4 (S)	100	%	70-130		1		03/10/15 21:49	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**28.8**	%	0.10	0.10	1		03/10/15 16:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-13 **Lab ID: 92240289013** Collected: 03/04/15 09:50 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.5	0.79	1		03/10/15 22:08	71-43-2	
Ethylbenzene	ND	ug/kg	2.5	0.89	1		03/10/15 22:08	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.5	0.74	1		03/10/15 22:08	1634-04-4	
Naphthalene	ND	ug/kg	2.5	0.59	1		03/10/15 22:08	91-20-3	
Toluene	ND	ug/kg	2.5	0.89	1		03/10/15 22:08	108-88-3	
Xylene (Total)	ND	ug/kg	5.0	1.8	1		03/10/15 22:08	1330-20-7	
m&p-Xylene	ND	ug/kg	5.0	1.8	1		03/10/15 22:08	179601-23-1	
o-Xylene	ND	ug/kg	2.5	0.94	1		03/10/15 22:08	95-47-6	
Surrogates									
Toluene-d8 (S)	104	%	70-130		1		03/10/15 22:08	2037-26-5	
4-Bromofluorobenzene (S)	101	%	70-130		1		03/10/15 22:08	460-00-4	
1,2-Dichloroethane-d4 (S)	107	%	70-130		1		03/10/15 22:08	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**19.7**	%	0.10	0.10	1		03/10/15 16:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-14 **Lab ID: 92240289014** Collected: 03/04/15 10:20 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	3.1	0.99	1		03/10/15 22:28	71-43-2	
Ethylbenzene	ND	ug/kg	3.1	1.1	1		03/10/15 22:28	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	3.1	0.93	1		03/10/15 22:28	1634-04-4	
Naphthalene	ND	ug/kg	3.1	0.75	1		03/10/15 22:28	91-20-3	
Toluene	ND	ug/kg	3.1	1.1	1		03/10/15 22:28	108-88-3	
Xylene (Total)	ND	ug/kg	6.2	2.2	1		03/10/15 22:28	1330-20-7	
m&p-Xylene	ND	ug/kg	6.2	2.2	1		03/10/15 22:28	179601-23-1	
o-Xylene	ND	ug/kg	3.1	1.2	1		03/10/15 22:28	95-47-6	
Surrogates									
Toluene-d8 (S)	108	%	70-130		1		03/10/15 22:28	2037-26-5	
4-Bromofluorobenzene (S)	103	%	70-130		1		03/10/15 22:28	460-00-4	
1,2-Dichloroethane-d4 (S)	110	%	70-130		1		03/10/15 22:28	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**26.4**	%	0.10	0.10	1		03/10/15 19:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-15 **Lab ID: 92240289015** Collected: 03/04/15 10:35 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.9	0.94	1		03/11/15 15:16	71-43-2	
Ethylbenzene	ND	ug/kg	2.9	1.1	1		03/11/15 15:16	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.9	0.88	1		03/11/15 15:16	1634-04-4	
Naphthalene	ND	ug/kg	2.9	0.70	1		03/11/15 15:16	91-20-3	
Toluene	ND	ug/kg	2.9	1.1	1		03/11/15 15:16	108-88-3	
Xylene (Total)	ND	ug/kg	5.9	2.1	1		03/11/15 15:16	1330-20-7	
m&p-Xylene	ND	ug/kg	5.9	2.1	1		03/11/15 15:16	179601-23-1	
o-Xylene	ND	ug/kg	2.9	1.1	1		03/11/15 15:16	95-47-6	
Surrogates									
Toluene-d8 (S)	105	%	70-130		1		03/11/15 15:16	2037-26-5	
4-Bromofluorobenzene (S)	106	%	70-130		1		03/11/15 15:16	460-00-4	
1,2-Dichloroethane-d4 (S)	119	%	70-130		1		03/11/15 15:16	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**26.2**	%	0.10	0.10	1		03/10/15 19:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-16 **Lab ID: 92240289016** Collected: 03/04/15 10:50 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	**11.4**	ug/kg	3.7	1.2	1		03/10/15 16:13	71-43-2	
Ethylbenzene	ND	ug/kg	3.7	1.3	1		03/10/15 16:13	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	3.7	1.1	1		03/10/15 16:13	1634-04-4	
Naphthalene	ND	ug/kg	3.7	0.89	1		03/10/15 16:13	91-20-3	
Toluene	ND	ug/kg	3.7	1.3	1		03/10/15 16:13	108-88-3	
Xylene (Total)	ND	ug/kg	7.4	2.7	1		03/10/15 16:13	1330-20-7	
m&p-Xylene	ND	ug/kg	7.4	2.7	1		03/10/15 16:13	179601-23-1	
o-Xylene	ND	ug/kg	3.7	1.4	1		03/10/15 16:13	95-47-6	
Surrogates									
Toluene-d8 (S)	109	%	70-130		1		03/10/15 16:13	2037-26-5	
4-Bromofluorobenzene (S)	97	%	70-130		1		03/10/15 16:13	460-00-4	
1,2-Dichloroethane-d4 (S)	115	%	70-130		1		03/10/15 16:13	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**22.8**	%	0.10	0.10	1		03/10/15 19:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-18 **Lab ID: 92240289017** Collected: 03/04/15 13:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV MW PAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	13.9	2.1	1	03/16/15 08:55	03/16/15 13:01	83-32-9	
Acenaphthylene	ND	ug/kg	13.9	1.8	1	03/16/15 08:55	03/16/15 13:01	208-96-8	
Anthracene	ND	ug/kg	13.9	1.9	1	03/16/15 08:55	03/16/15 13:01	120-12-7	
Benzo(a)anthracene	ND	ug/kg	13.9	0.99	1	03/16/15 08:55	03/16/15 13:01	56-55-3	
Benzo(a)pyrene	ND	ug/kg	13.9	1.5	1	03/16/15 08:55	03/16/15 13:01	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	13.9	0.93	1	03/16/15 08:55	03/16/15 13:01	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	13.9	3.6	1	03/16/15 08:55	03/16/15 13:01	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	13.9	2.1	1	03/16/15 08:55	03/16/15 13:01	207-08-9	
Chrysene	ND	ug/kg	13.9	2.5	1	03/16/15 08:55	03/16/15 13:01	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	13.9	2.5	1	03/16/15 08:55	03/16/15 13:01	53-70-3	
Fluoranthene	ND	ug/kg	13.9	1.2	1	03/16/15 08:55	03/16/15 13:01	206-44-0	
Fluorene	ND	ug/kg	13.9	2.2	1	03/16/15 08:55	03/16/15 13:01	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	13.9	3.9	1	03/16/15 08:55	03/16/15 13:01	193-39-5	
1-Methylnaphthalene	ND	ug/kg	13.9	1.7	1	03/16/15 08:55	03/16/15 13:01	90-12-0	
2-Methylnaphthalene	ND	ug/kg	13.9	1.5	1	03/16/15 08:55	03/16/15 13:01	91-57-6	
Naphthalene	ND	ug/kg	13.9	3.2	1	03/16/15 08:55	03/16/15 13:01	91-20-3	
Phenanthrene	ND	ug/kg	13.9	2.1	1	03/16/15 08:55	03/16/15 13:01	85-01-8	
Pyrene	ND	ug/kg	13.9	2.5	1	03/16/15 08:55	03/16/15 13:01	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	51	%	10-128		1	03/16/15 08:55	03/16/15 13:01	4165-60-0	
2-Fluorobiphenyl (S)	45	%	10-110		1	03/16/15 08:55	03/16/15 13:01	321-60-8	
Terphenyl-d14 (S)	53	%	39-119		1	03/16/15 08:55	03/16/15 13:01	1718-51-0	
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	458	106	1	03/10/15 13:35	03/11/15 16:42	83-32-9	
Acenaphthylene	ND	ug/kg	458	108	1	03/10/15 13:35	03/11/15 16:42	208-96-8	
Aniline	ND	ug/kg	458	124	1	03/10/15 13:35	03/11/15 16:42	62-53-3	
Anthracene	ND	ug/kg	458	103	1	03/10/15 13:35	03/11/15 16:42	120-12-7	
Benzo(a)anthracene	ND	ug/kg	458	84.7	1	03/10/15 13:35	03/11/15 16:42	56-55-3	
Benzo(a)pyrene	ND	ug/kg	458	87.5	1	03/10/15 13:35	03/11/15 16:42	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	458	79.2	1	03/10/15 13:35	03/11/15 16:42	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	458	117	1	03/10/15 13:35	03/11/15 16:42	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	458	90.3	1	03/10/15 13:35	03/11/15 16:42	207-08-9	
Benzoic Acid	ND	ug/kg	2290	83.3	1	03/10/15 13:35	03/11/15 16:42	65-85-0	
Benzyl alcohol	ND	ug/kg	917	91.7	1	03/10/15 13:35	03/11/15 16:42	100-51-6	
4-Bromophenylphenyl ether	ND	ug/kg	458	83.3	1	03/10/15 13:35	03/11/15 16:42	101-55-3	
Butylbenzylphthalate	ND	ug/kg	458	97.2	1	03/10/15 13:35	03/11/15 16:42	85-68-7	
4-Chloro-3-methylphenol	ND	ug/kg	917	94.4	1	03/10/15 13:35	03/11/15 16:42	59-50-7	
4-Chloroaniline	ND	ug/kg	2290	128	1	03/10/15 13:35	03/11/15 16:42	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/kg	458	107	1	03/10/15 13:35	03/11/15 16:42	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/kg	458	117	1	03/10/15 13:35	03/11/15 16:42	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/kg	458	122	1	03/10/15 13:35	03/11/15 16:42	108-60-1	
2-Chloronaphthalene	ND	ug/kg	458	90.3	1	03/10/15 13:35	03/11/15 16:42	91-58-7	
2-Chlorophenol	ND	ug/kg	458	125	1	03/10/15 13:35	03/11/15 16:42	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/kg	458	94.4	1	03/10/15 13:35	03/11/15 16:42	7005-72-3	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-18 **Lab ID: 92240289017** Collected: 03/04/15 13:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Chrysene	ND	ug/kg	458	61.1	1	03/10/15 13:35	03/11/15 16:42	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	458	97.2	1	03/10/15 13:35	03/11/15 16:42	53-70-3	
Dibenzofuran	ND	ug/kg	458	75.0	1	03/10/15 13:35	03/11/15 16:42	132-64-9	
1,2-Dichlorobenzene	ND	ug/kg	458	122	1	03/10/15 13:35	03/11/15 16:42	95-50-1	
1,3-Dichlorobenzene	ND	ug/kg	458	104	1	03/10/15 13:35	03/11/15 16:42	541-73-1	
1,4-Dichlorobenzene	ND	ug/kg	458	129	1	03/10/15 13:35	03/11/15 16:42	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/kg	2290	100	1	03/10/15 13:35	03/11/15 16:42	91-94-1	
2,4-Dichlorophenol	ND	ug/kg	458	100	1	03/10/15 13:35	03/11/15 16:42	120-83-2	
Diethylphthalate	ND	ug/kg	458	70.8	1	03/10/15 13:35	03/11/15 16:42	84-66-2	
2,4-Dimethylphenol	ND	ug/kg	458	181	1	03/10/15 13:35	03/11/15 16:42	105-67-9	
Dimethylphthalate	ND	ug/kg	458	93.0	1	03/10/15 13:35	03/11/15 16:42	131-11-3	
Di-n-butylphthalate	ND	ug/kg	458	75.0	1	03/10/15 13:35	03/11/15 16:42	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/kg	917	91.7	1	03/10/15 13:35	03/11/15 16:42	534-52-1	
2,4-Dinitrophenol	ND	ug/kg	2290	75.0	1	03/10/15 13:35	03/11/15 16:42	51-28-5	
2,4-Dinitrotoluene	ND	ug/kg	458	86.1	1	03/10/15 13:35	03/11/15 16:42	121-14-2	
2,6-Dinitrotoluene	ND	ug/kg	458	95.8	1	03/10/15 13:35	03/11/15 16:42	606-20-2	
Di-n-octylphthalate	ND	ug/kg	458	95.8	1	03/10/15 13:35	03/11/15 16:42	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/kg	458	125	1	03/10/15 13:35	03/11/15 16:42	117-81-7	
Fluoranthene	ND	ug/kg	458	66.7	1	03/10/15 13:35	03/11/15 16:42	206-44-0	
Fluorene	ND	ug/kg	458	94.4	1	03/10/15 13:35	03/11/15 16:42	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/kg	458	79.2	1	03/10/15 13:35	03/11/15 16:42	87-68-3	
Hexachlorobenzene	ND	ug/kg	458	58.3	1	03/10/15 13:35	03/11/15 16:42	118-74-1	
Hexachlorocyclopentadiene	ND	ug/kg	458	84.7	1	03/10/15 13:35	03/11/15 16:42	77-47-4	
Hexachloroethane	ND	ug/kg	458	121	1	03/10/15 13:35	03/11/15 16:42	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	458	94.4	1	03/10/15 13:35	03/11/15 16:42	193-39-5	
Isophorone	ND	ug/kg	458	103	1	03/10/15 13:35	03/11/15 16:42	78-59-1	
1-Methylnaphthalene	ND	ug/kg	458	119	1	03/10/15 13:35	03/11/15 16:42	90-12-0	
2-Methylnaphthalene	ND	ug/kg	458	98.6	1	03/10/15 13:35	03/11/15 16:42	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/kg	458	139	1	03/10/15 13:35	03/11/15 16:42	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/kg	458	181	1	03/10/15 13:35	03/11/15 16:42		
Naphthalene	ND	ug/kg	458	112	1	03/10/15 13:35	03/11/15 16:42	91-20-3	
2-Nitroaniline	ND	ug/kg	2290	142	1	03/10/15 13:35	03/11/15 16:42	88-74-4	
3-Nitroaniline	ND	ug/kg	2290	125	1	03/10/15 13:35	03/11/15 16:42	99-09-2	
4-Nitroaniline	ND	ug/kg	917	129	1	03/10/15 13:35	03/11/15 16:42	100-01-6	
Nitrobenzene	ND	ug/kg	458	125	1	03/10/15 13:35	03/11/15 16:42	98-95-3	
2-Nitrophenol	ND	ug/kg	458	111	1	03/10/15 13:35	03/11/15 16:42	88-75-5	
4-Nitrophenol	ND	ug/kg	2290	81.9	1	03/10/15 13:35	03/11/15 16:42	100-02-7	
N-Nitrosodimethylamine	ND	ug/kg	458	149	1	03/10/15 13:35	03/11/15 16:42	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/kg	458	87.5	1	03/10/15 13:35	03/11/15 16:42	621-64-7	
N-Nitrosodiphenylamine	ND	ug/kg	458	136	1	03/10/15 13:35	03/11/15 16:42	86-30-6	
Pentachlorophenol	ND	ug/kg	2290	83.3	1	03/10/15 13:35	03/11/15 16:42	87-86-5	
Phenanthrene	ND	ug/kg	458	76.4	1	03/10/15 13:35	03/11/15 16:42	85-01-8	
Phenol	ND	ug/kg	458	137	1	03/10/15 13:35	03/11/15 16:42	108-95-2	
Pyrene	ND	ug/kg	458	77.8	1	03/10/15 13:35	03/11/15 16:42	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/kg	458	88.9	1	03/10/15 13:35	03/11/15 16:42	120-82-1	

REPORT OF LABORATORY ANALYSIS

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(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-18 **Lab ID: 92240289017** Collected: 03/04/15 13:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
2,4,5-Trichlorophenol	ND	ug/kg	458	142	1	03/10/15 13:35	03/11/15 16:42	95-95-4	
2,4,6-Trichlorophenol	ND	ug/kg	458	101	1	03/10/15 13:35	03/11/15 16:42	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	58	%	23-110		1	03/10/15 13:35	03/11/15 16:42	4165-60-0	
2-Fluorobiphenyl (S)	67	%	30-110		1	03/10/15 13:35	03/11/15 16:42	321-60-8	
Terphenyl-d14 (S)	75	%	28-110		1	03/10/15 13:35	03/11/15 16:42	1718-51-0	
Phenol-d6 (S)	59	%	22-110		1	03/10/15 13:35	03/11/15 16:42	13127-88-3	
2-Fluorophenol (S)	56	%	13-110		1	03/10/15 13:35	03/11/15 16:42	367-12-4	
2,4,6-Tribromophenol (S)	62	%	27-110		1	03/10/15 13:35	03/11/15 16:42	118-79-6	
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	4.0	1.3	1		03/11/15 15:36	71-43-2	
Ethylbenzene	ND	ug/kg	4.0	1.4	1		03/11/15 15:36	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	4.0	1.2	1		03/11/15 15:36	1634-04-4	
Naphthalene	ND	ug/kg	4.0	0.96	1		03/11/15 15:36	91-20-3	
Toluene	ND	ug/kg	4.0	1.4	1		03/11/15 15:36	108-88-3	
Xylene (Total)	ND	ug/kg	8.0	2.9	1		03/11/15 15:36	1330-20-7	
m&p-Xylene	ND	ug/kg	8.0	2.9	1		03/11/15 15:36	179601-23-1	
o-Xylene	ND	ug/kg	4.0	1.5	1		03/11/15 15:36	95-47-6	
Surrogates									
Toluene-d8 (S)	103	%	70-130		1		03/11/15 15:36	2037-26-5	
4-Bromofluorobenzene (S)	104	%	70-130		1		03/11/15 15:36	460-00-4	
1,2-Dichloroethane-d4 (S)	117	%	70-130		1		03/11/15 15:36	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**28.0**	%	0.10	0.10	1		03/11/15 10:16		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-20 **Lab ID: 92240289018** Collected: 03/04/15 14:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV MW PAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	10.4	1.6	1	03/11/15 10:07	03/13/15 18:54	83-32-9	
Acenaphthylene	ND	ug/kg	10.4	1.3	1	03/11/15 10:07	03/13/15 18:54	208-96-8	
Anthracene	ND	ug/kg	10.4	1.5	1	03/11/15 10:07	03/13/15 18:54	120-12-7	
Benzo(a)anthracene	ND	ug/kg	10.4	0.74	1	03/11/15 10:07	03/13/15 18:54	56-55-3	
Benzo(a)pyrene	ND	ug/kg	10.4	1.1	1	03/11/15 10:07	03/13/15 18:54	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	10.4	0.69	1	03/11/15 10:07	03/13/15 18:54	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	10.4	2.7	1	03/11/15 10:07	03/13/15 18:54	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	10.4	1.6	1	03/11/15 10:07	03/13/15 18:54	207-08-9	
Chrysene	ND	ug/kg	10.4	1.9	1	03/11/15 10:07	03/13/15 18:54	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	10.4	1.9	1	03/11/15 10:07	03/13/15 18:54	53-70-3	
Fluoranthene	ND	ug/kg	10.4	0.86	1	03/11/15 10:07	03/13/15 18:54	206-44-0	
Fluorene	ND	ug/kg	10.4	1.7	1	03/11/15 10:07	03/13/15 18:54	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	10.4	2.9	1	03/11/15 10:07	03/13/15 18:54	193-39-5	
1-Methylnaphthalene	ND	ug/kg	10.4	1.2	1	03/11/15 10:07	03/13/15 18:54	90-12-0	
2-Methylnaphthalene	ND	ug/kg	10.4	1.1	1	03/11/15 10:07	03/13/15 18:54	91-57-6	
Naphthalene	ND	ug/kg	10.4	2.4	1	03/11/15 10:07	03/13/15 18:54	91-20-3	
Phenanthrene	ND	ug/kg	10.4	1.6	1	03/11/15 10:07	03/13/15 18:54	85-01-8	
Pyrene	ND	ug/kg	10.4	1.9	1	03/11/15 10:07	03/13/15 18:54	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	57	%	10-128		1	03/11/15 10:07	03/13/15 18:54	4165-60-0	
2-Fluorobiphenyl (S)	50	%	10-110		1	03/11/15 10:07	03/13/15 18:54	321-60-8	
Terphenyl-d14 (S)	61	%	39-119		1	03/11/15 10:07	03/13/15 18:54	1718-51-0	
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	342	78.7	1	03/10/15 13:35	03/11/15 17:09	83-32-9	
Acenaphthylene	ND	ug/kg	342	80.8	1	03/10/15 13:35	03/11/15 17:09	208-96-8	
Aniline	ND	ug/kg	342	92.2	1	03/10/15 13:35	03/11/15 17:09	62-53-3	
Anthracene	ND	ug/kg	342	76.7	1	03/10/15 13:35	03/11/15 17:09	120-12-7	
Benzo(a)anthracene	ND	ug/kg	342	63.2	1	03/10/15 13:35	03/11/15 17:09	56-55-3	
Benzo(a)pyrene	ND	ug/kg	342	65.3	1	03/10/15 13:35	03/11/15 17:09	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	342	59.0	1	03/10/15 13:35	03/11/15 17:09	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	342	87.0	1	03/10/15 13:35	03/11/15 17:09	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	342	67.3	1	03/10/15 13:35	03/11/15 17:09	207-08-9	
Benzoic Acid	ND	ug/kg	1710	62.2	1	03/10/15 13:35	03/11/15 17:09	65-85-0	
Benzyl alcohol	ND	ug/kg	684	68.4	1	03/10/15 13:35	03/11/15 17:09	100-51-6	
4-Bromophenylphenyl ether	ND	ug/kg	342	62.2	1	03/10/15 13:35	03/11/15 17:09	101-55-3	
Butylbenzylphthalate	ND	ug/kg	342	72.5	1	03/10/15 13:35	03/11/15 17:09	85-68-7	
4-Chloro-3-methylphenol	ND	ug/kg	684	70.4	1	03/10/15 13:35	03/11/15 17:09	59-50-7	
4-Chloroaniline	ND	ug/kg	1710	95.3	1	03/10/15 13:35	03/11/15 17:09	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/kg	342	79.8	1	03/10/15 13:35	03/11/15 17:09	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/kg	342	87.0	1	03/10/15 13:35	03/11/15 17:09	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/kg	342	91.2	1	03/10/15 13:35	03/11/15 17:09	108-60-1	
2-Chloronaphthalene	ND	ug/kg	342	67.3	1	03/10/15 13:35	03/11/15 17:09	91-58-7	
2-Chlorophenol	ND	ug/kg	342	93.2	1	03/10/15 13:35	03/11/15 17:09	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/kg	342	70.4	1	03/10/15 13:35	03/11/15 17:09	7005-72-3	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-20 **Lab ID: 92240289018** Collected: 03/04/15 14:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Chrysene	ND	ug/kg	342	45.6	1	03/10/15 13:35	03/11/15 17:09	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	342	72.5	1	03/10/15 13:35	03/11/15 17:09	53-70-3	
Dibenzofuran	ND	ug/kg	342	55.9	1	03/10/15 13:35	03/11/15 17:09	132-64-9	
1,2-Dichlorobenzene	ND	ug/kg	342	91.2	1	03/10/15 13:35	03/11/15 17:09	95-50-1	
1,3-Dichlorobenzene	ND	ug/kg	342	77.7	1	03/10/15 13:35	03/11/15 17:09	541-73-1	
1,4-Dichlorobenzene	ND	ug/kg	342	96.3	1	03/10/15 13:35	03/11/15 17:09	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/kg	1710	74.6	1	03/10/15 13:35	03/11/15 17:09	91-94-1	
2,4-Dichlorophenol	ND	ug/kg	342	74.6	1	03/10/15 13:35	03/11/15 17:09	120-83-2	
Diethylphthalate	ND	ug/kg	342	52.8	1	03/10/15 13:35	03/11/15 17:09	84-66-2	
2,4-Dimethylphenol	ND	ug/kg	342	135	1	03/10/15 13:35	03/11/15 17:09	105-67-9	
Dimethylphthalate	ND	ug/kg	342	69.4	1	03/10/15 13:35	03/11/15 17:09	131-11-3	
Di-n-butylphthalate	ND	ug/kg	342	55.9	1	03/10/15 13:35	03/11/15 17:09	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/kg	684	68.4	1	03/10/15 13:35	03/11/15 17:09	534-52-1	
2,4-Dinitrophenol	ND	ug/kg	1710	55.9	1	03/10/15 13:35	03/11/15 17:09	51-28-5	
2,4-Dinitrotoluene	ND	ug/kg	342	64.2	1	03/10/15 13:35	03/11/15 17:09	121-14-2	
2,6-Dinitrotoluene	ND	ug/kg	342	71.5	1	03/10/15 13:35	03/11/15 17:09	606-20-2	
Di-n-octylphthalate	ND	ug/kg	342	71.5	1	03/10/15 13:35	03/11/15 17:09	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/kg	342	93.2	1	03/10/15 13:35	03/11/15 17:09	117-81-7	
Fluoranthene	ND	ug/kg	342	49.7	1	03/10/15 13:35	03/11/15 17:09	206-44-0	
Fluorene	ND	ug/kg	342	70.4	1	03/10/15 13:35	03/11/15 17:09	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/kg	342	59.0	1	03/10/15 13:35	03/11/15 17:09	87-68-3	
Hexachlorobenzene	ND	ug/kg	342	43.5	1	03/10/15 13:35	03/11/15 17:09	118-74-1	
Hexachlorocyclopentadiene	ND	ug/kg	342	63.2	1	03/10/15 13:35	03/11/15 17:09	77-47-4	
Hexachloroethane	ND	ug/kg	342	90.1	1	03/10/15 13:35	03/11/15 17:09	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	342	70.4	1	03/10/15 13:35	03/11/15 17:09	193-39-5	
Isophorone	ND	ug/kg	342	76.7	1	03/10/15 13:35	03/11/15 17:09	78-59-1	
1-Methylnaphthalene	ND	ug/kg	342	89.1	1	03/10/15 13:35	03/11/15 17:09	90-12-0	
2-Methylnaphthalene	ND	ug/kg	342	73.5	1	03/10/15 13:35	03/11/15 17:09	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/kg	342	104	1	03/10/15 13:35	03/11/15 17:09	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/kg	342	135	1	03/10/15 13:35	03/11/15 17:09		
Naphthalene	ND	ug/kg	342	83.9	1	03/10/15 13:35	03/11/15 17:09	91-20-3	
2-Nitroaniline	ND	ug/kg	1710	106	1	03/10/15 13:35	03/11/15 17:09	88-74-4	
3-Nitroaniline	ND	ug/kg	1710	93.2	1	03/10/15 13:35	03/11/15 17:09	99-09-2	
4-Nitroaniline	ND	ug/kg	684	96.3	1	03/10/15 13:35	03/11/15 17:09	100-01-6	
Nitrobenzene	ND	ug/kg	342	93.2	1	03/10/15 13:35	03/11/15 17:09	98-95-3	
2-Nitrophenol	ND	ug/kg	342	82.9	1	03/10/15 13:35	03/11/15 17:09	88-75-5	
4-Nitrophenol	ND	ug/kg	1710	61.1	1	03/10/15 13:35	03/11/15 17:09	100-02-7	
N-Nitrosodimethylamine	ND	ug/kg	342	111	1	03/10/15 13:35	03/11/15 17:09	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/kg	342	65.3	1	03/10/15 13:35	03/11/15 17:09	621-64-7	
N-Nitrosodiphenylamine	ND	ug/kg	342	102	1	03/10/15 13:35	03/11/15 17:09	86-30-6	
Pentachlorophenol	ND	ug/kg	1710	62.2	1	03/10/15 13:35	03/11/15 17:09	87-86-5	
Phenanthrene	ND	ug/kg	342	57.0	1	03/10/15 13:35	03/11/15 17:09	85-01-8	
Phenol	ND	ug/kg	342	103	1	03/10/15 13:35	03/11/15 17:09	108-95-2	
Pyrene	ND	ug/kg	342	58.0	1	03/10/15 13:35	03/11/15 17:09	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/kg	342	66.3	1	03/10/15 13:35	03/11/15 17:09	120-82-1	

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-20 **Lab ID: 92240289018** Collected: 03/04/15 14:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
2,4,5-Trichlorophenol	ND	ug/kg	342	106	1	03/10/15 13:35	03/11/15 17:09	95-95-4	
2,4,6-Trichlorophenol	ND	ug/kg	342	75.6	1	03/10/15 13:35	03/11/15 17:09	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	38	%	23-110		1	03/10/15 13:35	03/11/15 17:09	4165-60-0	
2-Fluorobiphenyl (S)	40	%	30-110		1	03/10/15 13:35	03/11/15 17:09	321-60-8	
Terphenyl-d14 (S)	52	%	28-110		1	03/10/15 13:35	03/11/15 17:09	1718-51-0	
Phenol-d6 (S)	45	%	22-110		1	03/10/15 13:35	03/11/15 17:09	13127-88-3	
2-Fluorophenol (S)	44	%	13-110		1	03/10/15 13:35	03/11/15 17:09	367-12-4	
2,4,6-Tribromophenol (S)	40	%	27-110		1	03/10/15 13:35	03/11/15 17:09	118-79-6	
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.3	0.74	1		03/10/15 16:52	71-43-2	
Ethylbenzene	ND	ug/kg	2.3	0.84	1		03/10/15 16:52	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.3	0.70	1		03/10/15 16:52	1634-04-4	
Naphthalene	ND	ug/kg	2.3	0.56	1		03/10/15 16:52	91-20-3	
Toluene	ND	ug/kg	2.3	0.84	1		03/10/15 16:52	108-88-3	
Xylene (Total)	ND	ug/kg	4.6	1.7	1		03/10/15 16:52	1330-20-7	
m&p-Xylene	ND	ug/kg	4.6	1.7	1		03/10/15 16:52	179601-23-1	
o-Xylene	ND	ug/kg	2.3	0.88	1		03/10/15 16:52	95-47-6	
Surrogates									
Toluene-d8 (S)	109	%	70-130		1		03/10/15 16:52	2037-26-5	
4-Bromofluorobenzene (S)	97	%	70-130		1		03/10/15 16:52	460-00-4	
1,2-Dichloroethane-d4 (S)	127	%	70-130		1		03/10/15 16:52	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**3.5**	%	0.10	0.10	1		03/11/15 10:16		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-22 **Lab ID: 92240289019** Collected: 03/04/15 14:25 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV MW PAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	11.1	1.7	1	03/11/15 10:07	03/13/15 19:14	83-32-9	
Acenaphthylene	ND	ug/kg	11.1	1.4	1	03/11/15 10:07	03/13/15 19:14	208-96-8	
Anthracene	ND	ug/kg	11.1	1.6	1	03/11/15 10:07	03/13/15 19:14	120-12-7	
Benzo(a)anthracene	ND	ug/kg	11.1	0.79	1	03/11/15 10:07	03/13/15 19:14	56-55-3	
Benzo(a)pyrene	ND	ug/kg	11.1	1.2	1	03/11/15 10:07	03/13/15 19:14	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	11.1	0.74	1	03/11/15 10:07	03/13/15 19:14	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	11.1	2.9	1	03/11/15 10:07	03/13/15 19:14	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	11.1	1.7	1	03/11/15 10:07	03/13/15 19:14	207-08-9	
Chrysene	ND	ug/kg	11.1	2.0	1	03/11/15 10:07	03/13/15 19:14	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	11.1	2.0	1	03/11/15 10:07	03/13/15 19:14	53-70-3	
Fluoranthene	ND	ug/kg	11.1	0.92	1	03/11/15 10:07	03/13/15 19:14	206-44-0	
Fluorene	ND	ug/kg	11.1	1.8	1	03/11/15 10:07	03/13/15 19:14	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	11.1	3.1	1	03/11/15 10:07	03/13/15 19:14	193-39-5	
1-Methylnaphthalene	ND	ug/kg	11.1	1.3	1	03/11/15 10:07	03/13/15 19:14	90-12-0	
2-Methylnaphthalene	ND	ug/kg	11.1	1.2	1	03/11/15 10:07	03/13/15 19:14	91-57-6	
Naphthalene	ND	ug/kg	11.1	2.6	1	03/11/15 10:07	03/13/15 19:14	91-20-3	
Phenanthrene	ND	ug/kg	11.1	1.7	1	03/11/15 10:07	03/13/15 19:14	85-01-8	
Pyrene	ND	ug/kg	11.1	2.0	1	03/11/15 10:07	03/13/15 19:14	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	46	%	10-128		1	03/11/15 10:07	03/13/15 19:14	4165-60-0	
2-Fluorobiphenyl (S)	38	%	10-110		1	03/11/15 10:07	03/13/15 19:14	321-60-8	
Terphenyl-d14 (S)	44	%	39-119		1	03/11/15 10:07	03/13/15 19:14	1718-51-0	
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	366	84.4	1	03/10/15 13:35	03/11/15 17:37	83-32-9	
Acenaphthylene	ND	ug/kg	366	86.6	1	03/10/15 13:35	03/11/15 17:37	208-96-8	
Aniline	ND	ug/kg	366	98.8	1	03/10/15 13:35	03/11/15 17:37	62-53-3	
Anthracene	ND	ug/kg	366	82.2	1	03/10/15 13:35	03/11/15 17:37	120-12-7	
Benzo(a)anthracene	ND	ug/kg	366	67.7	1	03/10/15 13:35	03/11/15 17:37	56-55-3	
Benzo(a)pyrene	ND	ug/kg	366	70.0	1	03/10/15 13:35	03/11/15 17:37	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	366	63.3	1	03/10/15 13:35	03/11/15 17:37	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	366	93.3	1	03/10/15 13:35	03/11/15 17:37	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	366	72.2	1	03/10/15 13:35	03/11/15 17:37	207-08-9	
Benzoic Acid	ND	ug/kg	1830	66.6	1	03/10/15 13:35	03/11/15 17:37	65-85-0	
Benzyl alcohol	ND	ug/kg	733	73.3	1	03/10/15 13:35	03/11/15 17:37	100-51-6	
4-Bromophenylphenyl ether	ND	ug/kg	366	66.6	1	03/10/15 13:35	03/11/15 17:37	101-55-3	
Butylbenzylphthalate	ND	ug/kg	366	77.7	1	03/10/15 13:35	03/11/15 17:37	85-68-7	
4-Chloro-3-methylphenol	ND	ug/kg	733	75.5	1	03/10/15 13:35	03/11/15 17:37	59-50-7	
4-Chloroaniline	ND	ug/kg	1830	102	1	03/10/15 13:35	03/11/15 17:37	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/kg	366	85.5	1	03/10/15 13:35	03/11/15 17:37	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/kg	366	93.3	1	03/10/15 13:35	03/11/15 17:37	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/kg	366	97.7	1	03/10/15 13:35	03/11/15 17:37	108-60-1	
2-Chloronaphthalene	ND	ug/kg	366	72.2	1	03/10/15 13:35	03/11/15 17:37	91-58-7	
2-Chlorophenol	ND	ug/kg	366	99.9	1	03/10/15 13:35	03/11/15 17:37	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/kg	366	75.5	1	03/10/15 13:35	03/11/15 17:37	7005-72-3	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-22 **Lab ID: 92240289019** Collected: 03/04/15 14:25 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Chrysene	ND	ug/kg	366	48.9	1	03/10/15 13:35	03/11/15 17:37	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	366	77.7	1	03/10/15 13:35	03/11/15 17:37	53-70-3	
Dibenzofuran	ND	ug/kg	366	60.0	1	03/10/15 13:35	03/11/15 17:37	132-64-9	
1,2-Dichlorobenzene	ND	ug/kg	366	97.7	1	03/10/15 13:35	03/11/15 17:37	95-50-1	
1,3-Dichlorobenzene	ND	ug/kg	366	83.3	1	03/10/15 13:35	03/11/15 17:37	541-73-1	
1,4-Dichlorobenzene	ND	ug/kg	366	103	1	03/10/15 13:35	03/11/15 17:37	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/kg	1830	79.9	1	03/10/15 13:35	03/11/15 17:37	91-94-1	
2,4-Dichlorophenol	ND	ug/kg	366	79.9	1	03/10/15 13:35	03/11/15 17:37	120-83-2	
Diethylphthalate	ND	ug/kg	366	56.6	1	03/10/15 13:35	03/11/15 17:37	84-66-2	
2,4-Dimethylphenol	ND	ug/kg	366	144	1	03/10/15 13:35	03/11/15 17:37	105-67-9	
Dimethylphthalate	ND	ug/kg	366	74.4	1	03/10/15 13:35	03/11/15 17:37	131-11-3	
Di-n-butylphthalate	ND	ug/kg	366	60.0	1	03/10/15 13:35	03/11/15 17:37	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/kg	733	73.3	1	03/10/15 13:35	03/11/15 17:37	534-52-1	
2,4-Dinitrophenol	ND	ug/kg	1830	60.0	1	03/10/15 13:35	03/11/15 17:37	51-28-5	
2,4-Dinitrotoluene	ND	ug/kg	366	68.8	1	03/10/15 13:35	03/11/15 17:37	121-14-2	
2,6-Dinitrotoluene	ND	ug/kg	366	76.6	1	03/10/15 13:35	03/11/15 17:37	606-20-2	
Di-n-octylphthalate	ND	ug/kg	366	76.6	1	03/10/15 13:35	03/11/15 17:37	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/kg	366	99.9	1	03/10/15 13:35	03/11/15 17:37	117-81-7	
Fluoranthene	ND	ug/kg	366	53.3	1	03/10/15 13:35	03/11/15 17:37	206-44-0	
Fluorene	ND	ug/kg	366	75.5	1	03/10/15 13:35	03/11/15 17:37	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/kg	366	63.3	1	03/10/15 13:35	03/11/15 17:37	87-68-3	
Hexachlorobenzene	ND	ug/kg	366	46.6	1	03/10/15 13:35	03/11/15 17:37	118-74-1	
Hexachlorocyclopentadiene	ND	ug/kg	366	67.7	1	03/10/15 13:35	03/11/15 17:37	77-47-4	
Hexachloroethane	ND	ug/kg	366	96.6	1	03/10/15 13:35	03/11/15 17:37	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	366	75.5	1	03/10/15 13:35	03/11/15 17:37	193-39-5	
Isophorone	ND	ug/kg	366	82.2	1	03/10/15 13:35	03/11/15 17:37	78-59-1	
1-Methylnaphthalene	ND	ug/kg	366	95.5	1	03/10/15 13:35	03/11/15 17:37	90-12-0	
2-Methylnaphthalene	ND	ug/kg	366	78.8	1	03/10/15 13:35	03/11/15 17:37	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/kg	366	111	1	03/10/15 13:35	03/11/15 17:37	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/kg	366	144	1	03/10/15 13:35	03/11/15 17:37		
Naphthalene	ND	ug/kg	366	89.9	1	03/10/15 13:35	03/11/15 17:37	91-20-3	
2-Nitroaniline	ND	ug/kg	1830	113	1	03/10/15 13:35	03/11/15 17:37	88-74-4	
3-Nitroaniline	ND	ug/kg	1830	99.9	1	03/10/15 13:35	03/11/15 17:37	99-09-2	
4-Nitroaniline	ND	ug/kg	733	103	1	03/10/15 13:35	03/11/15 17:37	100-01-6	
Nitrobenzene	ND	ug/kg	366	99.9	1	03/10/15 13:35	03/11/15 17:37	98-95-3	
2-Nitrophenol	ND	ug/kg	366	88.8	1	03/10/15 13:35	03/11/15 17:37	88-75-5	
4-Nitrophenol	ND	ug/kg	1830	65.5	1	03/10/15 13:35	03/11/15 17:37	100-02-7	
N-Nitrosodimethylamine	ND	ug/kg	366	119	1	03/10/15 13:35	03/11/15 17:37	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/kg	366	70.0	1	03/10/15 13:35	03/11/15 17:37	621-64-7	
N-Nitrosodiphenylamine	ND	ug/kg	366	109	1	03/10/15 13:35	03/11/15 17:37	86-30-6	
Pentachlorophenol	ND	ug/kg	1830	66.6	1	03/10/15 13:35	03/11/15 17:37	87-86-5	
Phenanthrene	ND	ug/kg	366	61.1	1	03/10/15 13:35	03/11/15 17:37	85-01-8	
Phenol	ND	ug/kg	366	110	1	03/10/15 13:35	03/11/15 17:37	108-95-2	
Pyrene	ND	ug/kg	366	62.2	1	03/10/15 13:35	03/11/15 17:37	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/kg	366	71.1	1	03/10/15 13:35	03/11/15 17:37	120-82-1	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-22 **Lab ID: 92240289019** Collected: 03/04/15 14:25 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
2,4,5-Trichlorophenol	ND	ug/kg	366	113	1	03/10/15 13:35	03/11/15 17:37	95-95-4	
2,4,6-Trichlorophenol	ND	ug/kg	366	81.1	1	03/10/15 13:35	03/11/15 17:37	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	36	%	23-110		1	03/10/15 13:35	03/11/15 17:37	4165-60-0	
2-Fluorobiphenyl (S)	39	%	30-110		1	03/10/15 13:35	03/11/15 17:37	321-60-8	
Terphenyl-d14 (S)	56	%	28-110		1	03/10/15 13:35	03/11/15 17:37	1718-51-0	
Phenol-d6 (S)	40	%	22-110		1	03/10/15 13:35	03/11/15 17:37	13127-88-3	
2-Fluorophenol (S)	36	%	13-110		1	03/10/15 13:35	03/11/15 17:37	367-12-4	
2,4,6-Tribromophenol (S)	37	%	27-110		1	03/10/15 13:35	03/11/15 17:37	118-79-6	
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.5	0.79	1		03/10/15 17:12	71-43-2	
Ethylbenzene	ND	ug/kg	2.5	0.89	1		03/10/15 17:12	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.5	0.74	1		03/10/15 17:12	1634-04-4	
Naphthalene	ND	ug/kg	2.5	0.59	1		03/10/15 17:12	91-20-3	
Toluene	ND	ug/kg	2.5	0.89	1		03/10/15 17:12	108-88-3	
Xylene (Total)	ND	ug/kg	4.9	1.8	1		03/10/15 17:12	1330-20-7	
m&p-Xylene	ND	ug/kg	4.9	1.8	1		03/10/15 17:12	179601-23-1	
o-Xylene	ND	ug/kg	2.5	0.94	1		03/10/15 17:12	95-47-6	
Surrogates									
Toluene-d8 (S)	109	%	70-130		1		03/10/15 17:12	2037-26-5	
4-Bromofluorobenzene (S)	93	%	70-130		1		03/10/15 17:12	460-00-4	
1,2-Dichloroethane-d4 (S)	132	%	70-130		1		03/10/15 17:12	17060-07-0	S3
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**9.9**	%	0.10	0.10	1		03/11/15 10:16		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-23 **Lab ID: 92240289020** Collected: 03/04/15 17:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**1.2**	mg/kg	1.1	0.56	1	03/10/15 16:30	03/10/15 22:59	7440-38-2	
Barium	**261**	mg/kg	0.56	0.28	1	03/10/15 16:30	03/10/15 22:59	7440-39-3	
Cadmium	**0.080J**	mg/kg	0.11	0.056	1	03/10/15 16:30	03/10/15 22:59	7440-43-9	
Chromium	**14.7**	mg/kg	0.56	0.28	1	03/10/15 16:30	03/10/15 22:59	7440-47-3	
Lead	**6.9**	mg/kg	0.56	0.28	1	03/10/15 16:30	03/10/15 22:59	7439-92-1	
Selenium	**0.94J**	mg/kg	1.1	0.56	1	03/10/15 16:30	03/10/15 22:59	7782-49-2	
Silver	ND	mg/kg	0.56	0.28	1	03/10/15 16:30	03/10/15 22:59	7440-22-4	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.017**	mg/kg	0.0044	0.000087	1	03/10/15 18:30	03/11/15 14:07	7439-97-6	
8270 MSSV MW PAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	12.2	1.8	1	03/11/15 10:07	03/13/15 19:34	83-32-9	
Acenaphthylene	ND	ug/kg	12.2	1.6	1	03/11/15 10:07	03/13/15 19:34	208-96-8	
Anthracene	ND	ug/kg	12.2	1.7	1	03/11/15 10:07	03/13/15 19:34	120-12-7	
Benzo(a)anthracene	ND	ug/kg	12.2	0.87	1	03/11/15 10:07	03/13/15 19:34	56-55-3	
Benzo(a)pyrene	ND	ug/kg	12.2	1.3	1	03/11/15 10:07	03/13/15 19:34	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	12.2	0.82	1	03/11/15 10:07	03/13/15 19:34	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	12.2	3.2	1	03/11/15 10:07	03/13/15 19:34	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	12.2	1.8	1	03/11/15 10:07	03/13/15 19:34	207-08-9	
Chrysene	ND	ug/kg	12.2	2.2	1	03/11/15 10:07	03/13/15 19:34	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	12.2	2.2	1	03/11/15 10:07	03/13/15 19:34	53-70-3	
Fluoranthene	ND	ug/kg	12.2	1.0	1	03/11/15 10:07	03/13/15 19:34	206-44-0	
Fluorene	ND	ug/kg	12.2	2.0	1	03/11/15 10:07	03/13/15 19:34	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	12.2	3.4	1	03/11/15 10:07	03/13/15 19:34	193-39-5	
1-Methylnaphthalene	ND	ug/kg	12.2	1.5	1	03/11/15 10:07	03/13/15 19:34	90-12-0	
2-Methylnaphthalene	ND	ug/kg	12.2	1.3	1	03/11/15 10:07	03/13/15 19:34	91-57-6	
Naphthalene	ND	ug/kg	12.2	2.8	1	03/11/15 10:07	03/13/15 19:34	91-20-3	
Phenanthrene	ND	ug/kg	12.2	1.8	1	03/11/15 10:07	03/13/15 19:34	85-01-8	
Pyrene	ND	ug/kg	12.2	2.2	1	03/11/15 10:07	03/13/15 19:34	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	61	%	10-128		1	03/11/15 10:07	03/13/15 19:34	4165-60-0	
2-Fluorobiphenyl (S)	54	%	10-110		1	03/11/15 10:07	03/13/15 19:34	321-60-8	
Terphenyl-d14 (S)	53	%	39-119		1	03/11/15 10:07	03/13/15 19:34	1718-51-0	
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	403	92.8	1	03/10/15 13:35	03/11/15 18:05	83-32-9	
Acenaphthylene	ND	ug/kg	403	95.3	1	03/10/15 13:35	03/11/15 18:05	208-96-8	
Aniline	ND	ug/kg	403	109	1	03/10/15 13:35	03/11/15 18:05	62-53-3	
Anthracene	ND	ug/kg	403	90.4	1	03/10/15 13:35	03/11/15 18:05	120-12-7	
Benzo(a)anthracene	ND	ug/kg	403	74.5	1	03/10/15 13:35	03/11/15 18:05	56-55-3	
Benzo(a)pyrene	ND	ug/kg	403	77.0	1	03/10/15 13:35	03/11/15 18:05	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	403	69.6	1	03/10/15 13:35	03/11/15 18:05	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	403	103	1	03/10/15 13:35	03/11/15 18:05	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	403	79.4	1	03/10/15 13:35	03/11/15 18:05	207-08-9	

REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-23 **Lab ID: 92240289020** Collected: 03/04/15 17:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Benzoic Acid	ND	ug/kg	2020	73.3	1	03/10/15 13:35	03/11/15 18:05	65-85-0	
Benzyl alcohol	ND	ug/kg	806	80.6	1	03/10/15 13:35	03/11/15 18:05	100-51-6	
4-Bromophenylphenyl ether	ND	ug/kg	403	73.3	1	03/10/15 13:35	03/11/15 18:05	101-55-3	
Butylbenzylphthalate	ND	ug/kg	403	85.5	1	03/10/15 13:35	03/11/15 18:05	85-68-7	
4-Chloro-3-methylphenol	ND	ug/kg	806	83.1	1	03/10/15 13:35	03/11/15 18:05	59-50-7	
4-Chloroaniline	ND	ug/kg	2020	112	1	03/10/15 13:35	03/11/15 18:05	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/kg	403	94.1	1	03/10/15 13:35	03/11/15 18:05	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/kg	403	103	1	03/10/15 13:35	03/11/15 18:05	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/kg	403	108	1	03/10/15 13:35	03/11/15 18:05	108-60-1	
2-Chloronaphthalene	ND	ug/kg	403	79.4	1	03/10/15 13:35	03/11/15 18:05	91-58-7	
2-Chlorophenol	ND	ug/kg	403	110	1	03/10/15 13:35	03/11/15 18:05	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/kg	403	83.1	1	03/10/15 13:35	03/11/15 18:05	7005-72-3	
Chrysene	ND	ug/kg	403	53.8	1	03/10/15 13:35	03/11/15 18:05	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	403	85.5	1	03/10/15 13:35	03/11/15 18:05	53-70-3	
Dibenzofuran	ND	ug/kg	403	66.0	1	03/10/15 13:35	03/11/15 18:05	132-64-9	
1,2-Dichlorobenzene	ND	ug/kg	403	108	1	03/10/15 13:35	03/11/15 18:05	95-50-1	
1,3-Dichlorobenzene	ND	ug/kg	403	91.6	1	03/10/15 13:35	03/11/15 18:05	541-73-1	
1,4-Dichlorobenzene	ND	ug/kg	403	114	1	03/10/15 13:35	03/11/15 18:05	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/kg	2020	88.0	1	03/10/15 13:35	03/11/15 18:05	91-94-1	
2,4-Dichlorophenol	ND	ug/kg	403	88.0	1	03/10/15 13:35	03/11/15 18:05	120-83-2	
Diethylphthalate	ND	ug/kg	403	62.3	1	03/10/15 13:35	03/11/15 18:05	84-66-2	
2,4-Dimethylphenol	ND	ug/kg	403	159	1	03/10/15 13:35	03/11/15 18:05	105-67-9	
Dimethylphthalate	ND	ug/kg	403	81.8	1	03/10/15 13:35	03/11/15 18:05	131-11-3	
Di-n-butylphthalate	ND	ug/kg	403	66.0	1	03/10/15 13:35	03/11/15 18:05	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/kg	806	80.6	1	03/10/15 13:35	03/11/15 18:05	534-52-1	
2,4-Dinitrophenol	ND	ug/kg	2020	66.0	1	03/10/15 13:35	03/11/15 18:05	51-28-5	
2,4-Dinitrotoluene	ND	ug/kg	403	75.7	1	03/10/15 13:35	03/11/15 18:05	121-14-2	
2,6-Dinitrotoluene	ND	ug/kg	403	84.3	1	03/10/15 13:35	03/11/15 18:05	606-20-2	
Di-n-octylphthalate	ND	ug/kg	403	84.3	1	03/10/15 13:35	03/11/15 18:05	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/kg	403	110	1	03/10/15 13:35	03/11/15 18:05	117-81-7	
Fluoranthene	ND	ug/kg	403	58.6	1	03/10/15 13:35	03/11/15 18:05	206-44-0	
Fluorene	ND	ug/kg	403	83.1	1	03/10/15 13:35	03/11/15 18:05	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/kg	403	69.6	1	03/10/15 13:35	03/11/15 18:05	87-68-3	
Hexachlorobenzene	ND	ug/kg	403	51.3	1	03/10/15 13:35	03/11/15 18:05	118-74-1	
Hexachlorocyclopentadiene	ND	ug/kg	403	74.5	1	03/10/15 13:35	03/11/15 18:05	77-47-4	
Hexachloroethane	ND	ug/kg	403	106	1	03/10/15 13:35	03/11/15 18:05	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	403	83.1	1	03/10/15 13:35	03/11/15 18:05	193-39-5	
Isophorone	ND	ug/kg	403	90.4	1	03/10/15 13:35	03/11/15 18:05	78-59-1	
1-Methylnaphthalene	ND	ug/kg	403	105	1	03/10/15 13:35	03/11/15 18:05	90-12-0	
2-Methylnaphthalene	ND	ug/kg	403	86.7	1	03/10/15 13:35	03/11/15 18:05	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/kg	403	122	1	03/10/15 13:35	03/11/15 18:05	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/kg	403	159	1	03/10/15 13:35	03/11/15 18:05		
Naphthalene	ND	ug/kg	403	99.0	1	03/10/15 13:35	03/11/15 18:05	91-20-3	
2-Nitroaniline	ND	ug/kg	2020	125	1	03/10/15 13:35	03/11/15 18:05	88-74-4	
3-Nitroaniline	ND	ug/kg	2020	110	1	03/10/15 13:35	03/11/15 18:05	99-09-2	

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(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-23 **Lab ID: 92240289020** Collected: 03/04/15 17:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
4-Nitroaniline	ND	ug/kg	806	114	1	03/10/15 13:35	03/11/15 18:05	100-01-6	
Nitrobenzene	ND	ug/kg	403	110	1	03/10/15 13:35	03/11/15 18:05	98-95-3	
2-Nitrophenol	ND	ug/kg	403	97.7	1	03/10/15 13:35	03/11/15 18:05	88-75-5	
4-Nitrophenol	ND	ug/kg	2020	72.1	1	03/10/15 13:35	03/11/15 18:05	100-02-7	
N-Nitrosodimethylamine	ND	ug/kg	403	131	1	03/10/15 13:35	03/11/15 18:05	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/kg	403	77.0	1	03/10/15 13:35	03/11/15 18:05	621-64-7	
N-Nitrosodiphenylamine	ND	ug/kg	403	120	1	03/10/15 13:35	03/11/15 18:05	86-30-6	
Pentachlorophenol	ND	ug/kg	2020	73.3	1	03/10/15 13:35	03/11/15 18:05	87-86-5	
Phenanthrene	ND	ug/kg	403	67.2	1	03/10/15 13:35	03/11/15 18:05	85-01-8	
Phenol	ND	ug/kg	403	121	1	03/10/15 13:35	03/11/15 18:05	108-95-2	
Pyrene	ND	ug/kg	403	68.4	1	03/10/15 13:35	03/11/15 18:05	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/kg	403	78.2	1	03/10/15 13:35	03/11/15 18:05	120-82-1	
2,4,5-Trichlorophenol	ND	ug/kg	403	125	1	03/10/15 13:35	03/11/15 18:05	95-95-4	
2,4,6-Trichlorophenol	ND	ug/kg	403	89.2	1	03/10/15 13:35	03/11/15 18:05	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	50	%	23-110		1	03/10/15 13:35	03/11/15 18:05	4165-60-0	
2-Fluorobiphenyl (S)	64	%	30-110		1	03/10/15 13:35	03/11/15 18:05	321-60-8	
Terphenyl-d14 (S)	71	%	28-110		1	03/10/15 13:35	03/11/15 18:05	1718-51-0	
Phenol-d6 (S)	61	%	22-110		1	03/10/15 13:35	03/11/15 18:05	13127-88-3	
2-Fluorophenol (S)	56	%	13-110		1	03/10/15 13:35	03/11/15 18:05	367-12-4	
2,4,6-Tribromophenol (S)	62	%	27-110		1	03/10/15 13:35	03/11/15 18:05	118-79-6	
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.7	0.86	1		03/10/15 17:32	71-43-2	
Ethylbenzene	ND	ug/kg	2.7	0.96	1		03/10/15 17:32	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.7	0.80	1		03/10/15 17:32	1634-04-4	
Naphthalene	ND	ug/kg	2.7	0.64	1		03/10/15 17:32	91-20-3	
Toluene	ND	ug/kg	2.7	0.96	1		03/10/15 17:32	108-88-3	
Xylene (Total)	ND	ug/kg	5.4	1.9	1		03/10/15 17:32	1330-20-7	
m&p-Xylene	ND	ug/kg	5.4	1.9	1		03/10/15 17:32	179601-23-1	
o-Xylene	ND	ug/kg	2.7	1.0	1		03/10/15 17:32	95-47-6	
Surrogates									
Toluene-d8 (S)	108	%	70-130		1		03/10/15 17:32	2037-26-5	
4-Bromofluorobenzene (S)	92	%	70-130		1		03/10/15 17:32	460-00-4	
1,2-Dichloroethane-d4 (S)	129	%	70-130		1		03/10/15 17:32	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**18.1**	%	0.10	0.10	1		03/11/15 10:16		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-24 **Lab ID: 92240289021** Collected: 03/04/15 16:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**0.81J**	mg/kg	0.88	0.44	1	03/10/15 16:30	03/10/15 23:02	7440-38-2	
Barium	**14.9**	mg/kg	0.44	0.22	1	03/10/15 16:30	03/10/15 23:02	7440-39-3	
Cadmium	**0.10**	mg/kg	0.088	0.044	1	03/10/15 16:30	03/10/15 23:02	7440-43-9	
Chromium	**2.5**	mg/kg	0.44	0.22	1	03/10/15 16:30	03/10/15 23:02	7440-47-3	
Lead	**3.1**	mg/kg	0.44	0.22	1	03/10/15 16:30	03/10/15 23:02	7439-92-1	
Selenium	**1.2**	mg/kg	0.88	0.44	1	03/10/15 16:30	03/10/15 23:02	7782-49-2	
Silver	ND	mg/kg	0.44	0.22	1	03/10/15 16:30	03/10/15 23:02	7440-22-4	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.032**	mg/kg	0.0046	0.000092	1	03/10/15 18:30	03/11/15 14:15	7439-97-6	
8270 MSSV MW PAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	64.1	9.6	5	03/11/15 10:07	03/13/15 19:54	83-32-9	
Acenaphthylene	ND	ug/kg	64.1	8.3	5	03/11/15 10:07	03/13/15 19:54	208-96-8	
Anthracene	ND	ug/kg	64.1	9.0	5	03/11/15 10:07	03/13/15 19:54	120-12-7	
Benzo(a)anthracene	**16.9J**	ug/kg	64.1	4.5	5	03/11/15 10:07	03/13/15 19:54	56-55-3	
Benzo(a)pyrene	**18.5J**	ug/kg	64.1	7.0	5	03/11/15 10:07	03/13/15 19:54	50-32-8	
Benzo(b)fluoranthene	**20.4J**	ug/kg	64.1	4.3	5	03/11/15 10:07	03/13/15 19:54	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	64.1	16.7	5	03/11/15 10:07	03/13/15 19:54	191-24-2	
Benzo(k)fluoranthene	**17.9J**	ug/kg	64.1	9.6	5	03/11/15 10:07	03/13/15 19:54	207-08-9	
Chrysene	**21.7J**	ug/kg	64.1	11.5	5	03/11/15 10:07	03/13/15 19:54	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	64.1	11.5	5	03/11/15 10:07	03/13/15 19:54	53-70-3	
Fluoranthene	**39.6J**	ug/kg	64.1	5.3	5	03/11/15 10:07	03/13/15 19:54	206-44-0	
Fluorene	ND	ug/kg	64.1	10.3	5	03/11/15 10:07	03/13/15 19:54	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	64.1	17.9	5	03/11/15 10:07	03/13/15 19:54	193-39-5	
1-Methylnaphthalene	ND	ug/kg	64.1	7.7	5	03/11/15 10:07	03/13/15 19:54	90-12-0	
2-Methylnaphthalene	ND	ug/kg	64.1	7.0	5	03/11/15 10:07	03/13/15 19:54	91-57-6	
Naphthalene	ND	ug/kg	64.1	14.7	5	03/11/15 10:07	03/13/15 19:54	91-20-3	
Phenanthrene	**18.3J**	ug/kg	64.1	9.6	5	03/11/15 10:07	03/13/15 19:54	85-01-8	
Pyrene	**34.6J**	ug/kg	64.1	11.5	5	03/11/15 10:07	03/13/15 19:54	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	60	%	10-128		5	03/11/15 10:07	03/13/15 19:54	4165-60-0	D3
2-Fluorobiphenyl (S)	54	%	10-110		5	03/11/15 10:07	03/13/15 19:54	321-60-8	
Terphenyl-d14 (S)	68	%	39-119		5	03/11/15 10:07	03/13/15 19:54	1718-51-0	
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Acenaphthene	ND	ug/kg	423	97.4	1	03/10/15 13:35	03/11/15 18:32	83-32-9	
Acenaphthylene	ND	ug/kg	423	100	1	03/10/15 13:35	03/11/15 18:32	208-96-8	
Aniline	ND	ug/kg	423	114	1	03/10/15 13:35	03/11/15 18:32	62-53-3	
Anthracene	ND	ug/kg	423	94.8	1	03/10/15 13:35	03/11/15 18:32	120-12-7	
Benzo(a)anthracene	ND	ug/kg	423	78.2	1	03/10/15 13:35	03/11/15 18:32	56-55-3	
Benzo(a)pyrene	ND	ug/kg	423	80.7	1	03/10/15 13:35	03/11/15 18:32	50-32-8	
Benzo(b)fluoranthene	ND	ug/kg	423	73.1	1	03/10/15 13:35	03/11/15 18:32	205-99-2	
Benzo(g,h,i)perylene	ND	ug/kg	423	108	1	03/10/15 13:35	03/11/15 18:32	191-24-2	
Benzo(k)fluoranthene	ND	ug/kg	423	83.3	1	03/10/15 13:35	03/11/15 18:32	207-08-9	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-24 **Lab ID: 92240289021** Collected: 03/04/15 16:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
Benzoic Acid	ND	ug/kg	2110	76.9	1	03/10/15 13:35	03/11/15 18:32	65-85-0	
Benzyl alcohol	ND	ug/kg	846	84.6	1	03/10/15 13:35	03/11/15 18:32	100-51-6	
4-Bromophenylphenyl ether	ND	ug/kg	423	76.9	1	03/10/15 13:35	03/11/15 18:32	101-55-3	
Butylbenzylphthalate	ND	ug/kg	423	89.7	1	03/10/15 13:35	03/11/15 18:32	85-68-7	
4-Chloro-3-methylphenol	ND	ug/kg	846	87.2	1	03/10/15 13:35	03/11/15 18:32	59-50-7	
4-Chloroaniline	ND	ug/kg	2110	118	1	03/10/15 13:35	03/11/15 18:32	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/kg	423	98.7	1	03/10/15 13:35	03/11/15 18:32	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/kg	423	108	1	03/10/15 13:35	03/11/15 18:32	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/kg	423	113	1	03/10/15 13:35	03/11/15 18:32	108-60-1	
2-Chloronaphthalene	ND	ug/kg	423	83.3	1	03/10/15 13:35	03/11/15 18:32	91-58-7	
2-Chlorophenol	ND	ug/kg	423	115	1	03/10/15 13:35	03/11/15 18:32	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/kg	423	87.2	1	03/10/15 13:35	03/11/15 18:32	7005-72-3	
Chrysene	ND	ug/kg	423	56.4	1	03/10/15 13:35	03/11/15 18:32	218-01-9	
Dibenz(a,h)anthracene	ND	ug/kg	423	89.7	1	03/10/15 13:35	03/11/15 18:32	53-70-3	
Dibenzofuran	ND	ug/kg	423	69.2	1	03/10/15 13:35	03/11/15 18:32	132-64-9	
1,2-Dichlorobenzene	ND	ug/kg	423	113	1	03/10/15 13:35	03/11/15 18:32	95-50-1	
1,3-Dichlorobenzene	ND	ug/kg	423	96.1	1	03/10/15 13:35	03/11/15 18:32	541-73-1	
1,4-Dichlorobenzene	ND	ug/kg	423	119	1	03/10/15 13:35	03/11/15 18:32	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/kg	2110	92.3	1	03/10/15 13:35	03/11/15 18:32	91-94-1	
2,4-Dichlorophenol	ND	ug/kg	423	92.3	1	03/10/15 13:35	03/11/15 18:32	120-83-2	
Diethylphthalate	ND	ug/kg	423	65.4	1	03/10/15 13:35	03/11/15 18:32	84-66-2	
2,4-Dimethylphenol	ND	ug/kg	423	167	1	03/10/15 13:35	03/11/15 18:32	105-67-9	
Dimethylphthalate	ND	ug/kg	423	85.9	1	03/10/15 13:35	03/11/15 18:32	131-11-3	
Di-n-butylphthalate	ND	ug/kg	423	69.2	1	03/10/15 13:35	03/11/15 18:32	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/kg	846	84.6	1	03/10/15 13:35	03/11/15 18:32	534-52-1	
2,4-Dinitrophenol	ND	ug/kg	2110	69.2	1	03/10/15 13:35	03/11/15 18:32	51-28-5	
2,4-Dinitrotoluene	ND	ug/kg	423	79.5	1	03/10/15 13:35	03/11/15 18:32	121-14-2	
2,6-Dinitrotoluene	ND	ug/kg	423	88.4	1	03/10/15 13:35	03/11/15 18:32	606-20-2	
Di-n-octylphthalate	ND	ug/kg	423	88.4	1	03/10/15 13:35	03/11/15 18:32	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/kg	423	115	1	03/10/15 13:35	03/11/15 18:32	117-81-7	
Fluoranthene	ND	ug/kg	423	61.5	1	03/10/15 13:35	03/11/15 18:32	206-44-0	
Fluorene	ND	ug/kg	423	87.2	1	03/10/15 13:35	03/11/15 18:32	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/kg	423	73.1	1	03/10/15 13:35	03/11/15 18:32	87-68-3	
Hexachlorobenzene	ND	ug/kg	423	53.8	1	03/10/15 13:35	03/11/15 18:32	118-74-1	
Hexachlorocyclopentadiene	ND	ug/kg	423	78.2	1	03/10/15 13:35	03/11/15 18:32	77-47-4	
Hexachloroethane	ND	ug/kg	423	112	1	03/10/15 13:35	03/11/15 18:32	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	423	87.2	1	03/10/15 13:35	03/11/15 18:32	193-39-5	
Isophorone	ND	ug/kg	423	94.8	1	03/10/15 13:35	03/11/15 18:32	78-59-1	
1-Methylnaphthalene	ND	ug/kg	423	110	1	03/10/15 13:35	03/11/15 18:32	90-12-0	
2-Methylnaphthalene	ND	ug/kg	423	91.0	1	03/10/15 13:35	03/11/15 18:32	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/kg	423	128	1	03/10/15 13:35	03/11/15 18:32	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/kg	423	167	1	03/10/15 13:35	03/11/15 18:32		
Naphthalene	ND	ug/kg	423	104	1	03/10/15 13:35	03/11/15 18:32	91-20-3	
2-Nitroaniline	ND	ug/kg	2110	131	1	03/10/15 13:35	03/11/15 18:32	88-74-4	
3-Nitroaniline	ND	ug/kg	2110	115	1	03/10/15 13:35	03/11/15 18:32	99-09-2	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-24 **Lab ID: 92240289021** Collected: 03/04/15 16:30 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Microwave SC	Analytical Method: EPA 8270 Preparation Method: EPA 3546								
4-Nitroaniline	ND	ug/kg	846	119	1	03/10/15 13:35	03/11/15 18:32	100-01-6	
Nitrobenzene	ND	ug/kg	423	115	1	03/10/15 13:35	03/11/15 18:32	98-95-3	
2-Nitrophenol	ND	ug/kg	423	103	1	03/10/15 13:35	03/11/15 18:32	88-75-5	
4-Nitrophenol	ND	ug/kg	2110	75.6	1	03/10/15 13:35	03/11/15 18:32	100-02-7	
N-Nitrosodimethylamine	ND	ug/kg	423	137	1	03/10/15 13:35	03/11/15 18:32	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/kg	423	80.7	1	03/10/15 13:35	03/11/15 18:32	621-64-7	
N-Nitrosodiphenylamine	ND	ug/kg	423	126	1	03/10/15 13:35	03/11/15 18:32	86-30-6	
Pentachlorophenol	ND	ug/kg	2110	76.9	1	03/10/15 13:35	03/11/15 18:32	87-86-5	
Phenanthrene	ND	ug/kg	423	70.5	1	03/10/15 13:35	03/11/15 18:32	85-01-8	
Phenol	ND	ug/kg	423	127	1	03/10/15 13:35	03/11/15 18:32	108-95-2	
Pyrene	ND	ug/kg	423	71.8	1	03/10/15 13:35	03/11/15 18:32	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/kg	423	82.0	1	03/10/15 13:35	03/11/15 18:32	120-82-1	
2,4,5-Trichlorophenol	ND	ug/kg	423	131	1	03/10/15 13:35	03/11/15 18:32	95-95-4	
2,4,6-Trichlorophenol	ND	ug/kg	423	93.6	1	03/10/15 13:35	03/11/15 18:32	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	51	%	23-110		1	03/10/15 13:35	03/11/15 18:32	4165-60-0	
2-Fluorobiphenyl (S)	50	%	30-110		1	03/10/15 13:35	03/11/15 18:32	321-60-8	
Terphenyl-d14 (S)	58	%	28-110		1	03/10/15 13:35	03/11/15 18:32	1718-51-0	
Phenol-d6 (S)	37	%	22-110		1	03/10/15 13:35	03/11/15 18:32	13127-88-3	
2-Fluorophenol (S)	34	%	13-110		1	03/10/15 13:35	03/11/15 18:32	367-12-4	
2,4,6-Tribromophenol (S)	37	%	27-110		1	03/10/15 13:35	03/11/15 18:32	118-79-6	
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.7	0.88	1		03/10/15 17:52	71-43-2	
Ethylbenzene	ND	ug/kg	2.7	0.99	1		03/10/15 17:52	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.7	0.82	1		03/10/15 17:52	1634-04-4	
Naphthalene	ND	ug/kg	2.7	0.66	1		03/10/15 17:52	91-20-3	
Toluene	ND	ug/kg	2.7	0.99	1		03/10/15 17:52	108-88-3	
Xylene (Total)	ND	ug/kg	5.5	2.0	1		03/10/15 17:52	1330-20-7	
m&p-Xylene	ND	ug/kg	5.5	2.0	1		03/10/15 17:52	179601-23-1	
o-Xylene	ND	ug/kg	2.7	1.0	1		03/10/15 17:52	95-47-6	
Surrogates									
Toluene-d8 (S)	104	%	70-130		1		03/10/15 17:52	2037-26-5	
4-Bromofluorobenzene (S)	100	%	70-130		1		03/10/15 17:52	460-00-4	
1,2-Dichloroethane-d4 (S)	123	%	70-130		1		03/10/15 17:52	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**22.0**	%	0.10	0.10	1		03/11/15 10:16		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-23A **Lab ID: 92240289022** Collected: 03/04/15 17:35 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**0.51J**	mg/kg	0.90	0.45	1	03/10/15 16:30	03/10/15 23:05	7440-38-2	
Barium	**158**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:05	7440-39-3	
Cadmium	**0.091**	mg/kg	0.090	0.045	1	03/10/15 16:30	03/10/15 23:05	7440-43-9	
Chromium	**14.0**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:05	7440-47-3	
Lead	**17.9**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:05	7439-92-1	
Selenium	**0.75J**	mg/kg	0.90	0.45	1	03/10/15 16:30	03/10/15 23:05	7782-49-2	
Silver	**0.82**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:05	7440-22-4	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**10.8**	%	0.10	0.10	1		03/11/15 10:17		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-24A **Lab ID: 92240289023** Collected: 03/04/15 16:35 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**0.66J**	mg/kg	0.97	0.48	1	03/10/15 16:30	03/10/15 23:17	7440-38-2	
Barium	**210**	mg/kg	0.48	0.24	1	03/10/15 16:30	03/10/15 23:17	7440-39-3	
Cadmium	**0.13**	mg/kg	0.097	0.048	1	03/10/15 16:30	03/10/15 23:17	7440-43-9	
Chromium	**27.2**	mg/kg	0.48	0.24	1	03/10/15 16:30	03/10/15 23:17	7440-47-3	
Lead	**5.7**	mg/kg	0.48	0.24	1	03/10/15 16:30	03/10/15 23:17	7439-92-1	
Selenium	**0.80J**	mg/kg	0.97	0.48	1	03/10/15 16:30	03/10/15 23:17	7782-49-2	
Silver	ND	mg/kg	0.48	0.24	1	03/10/15 16:30	03/10/15 23:17	7440-22-4	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**21.6**	%	0.10	0.10	1		03/11/15 10:17		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-25 **Lab ID: 92240289024** Collected: 03/04/15 16:15 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	ND	mg/kg	0.90	0.45	1	03/10/15 16:30	03/10/15 23:20	7440-38-2	
Barium	**157**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:20	7440-39-3	
Cadmium	**0.098**	mg/kg	0.090	0.045	1	03/10/15 16:30	03/10/15 23:20	7440-43-9	
Chromium	**50.2**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:20	7440-47-3	
Lead	**3.1**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:20	7439-92-1	
Selenium	**1.2**	mg/kg	0.90	0.45	1	03/10/15 16:30	03/10/15 23:20	7782-49-2	
Silver	**1.1**	mg/kg	0.45	0.23	1	03/10/15 16:30	03/10/15 23:20	7440-22-4	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**24.3**	%	0.10	0.10	1		03/11/15 10:17		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-25A **Lab ID: 92240289025** Collected: 03/04/15 16:26 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	ND	mg/kg	1.3	0.63	1	03/10/15 16:30	03/10/15 23:23	7440-38-2	
Barium	**504**	mg/kg	0.63	0.32	1	03/10/15 16:30	03/10/15 23:23	7440-39-3	
Cadmium	**0.096J**	mg/kg	0.13	0.063	1	03/10/15 16:30	03/10/15 23:23	7440-43-9	
Chromium	**48.2**	mg/kg	0.63	0.32	1	03/10/15 16:30	03/10/15 23:23	7440-47-3	
Lead	**6.2**	mg/kg	0.63	0.32	1	03/10/15 16:30	03/10/15 23:23	7439-92-1	
Selenium	**1.1J**	mg/kg	1.3	0.63	1	03/10/15 16:30	03/10/15 23:23	7782-49-2	
Silver	ND	mg/kg	0.63	0.32	1	03/10/15 16:30	03/10/15 23:23	7440-22-4	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**29.3**	%	0.10	0.10	1		03/11/15 10:17		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-26 **Lab ID: 92240289026** Collected: 03/04/15 16:00 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	ND	mg/kg	1.1	0.57	1	03/10/15 16:30	03/10/15 23:26	7440-38-2	
Barium	**129**	mg/kg	0.57	0.29	1	03/10/15 16:30	03/10/15 23:26	7440-39-3	
Cadmium	**0.16**	mg/kg	0.11	0.057	1	03/10/15 16:30	03/10/15 23:26	7440-43-9	
Chromium	**75.8**	mg/kg	0.57	0.29	1	03/10/15 16:30	03/10/15 23:26	7440-47-3	
Lead	**10.8**	mg/kg	0.57	0.29	1	03/10/15 16:30	03/10/15 23:26	7439-92-1	
Selenium	**1.5**	mg/kg	1.1	0.57	1	03/10/15 16:30	03/10/15 23:26	7782-49-2	
Silver	**0.58**	mg/kg	0.57	0.29	1	03/10/15 16:30	03/10/15 23:26	7440-22-4	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**29.5**	%	0.10	0.10	1		03/11/15 10:18		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-26A **Lab ID: 92240289027** Collected: 03/04/15 16:05 Received: 03/09/15 14:25 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	ND	mg/kg	1.2	0.61	1	03/10/15 16:30	03/10/15 23:29	7440-38-2	
Barium	**157**	mg/kg	0.61	0.31	1	03/10/15 16:30	03/10/15 23:29	7440-39-3	
Cadmium	**0.10J**	mg/kg	0.12	0.061	1	03/10/15 16:30	03/10/15 23:29	7440-43-9	
Chromium	**36.9**	mg/kg	0.61	0.31	1	03/10/15 16:30	03/10/15 23:29	7440-47-3	
Lead	**2.2**	mg/kg	0.61	0.31	1	03/10/15 16:30	03/10/15 23:29	7439-92-1	
Selenium	**1.3**	mg/kg	1.2	0.61	1	03/10/15 16:30	03/10/15 23:29	7782-49-2	
Silver	**0.70**	mg/kg	0.61	0.31	1	03/10/15 16:30	03/10/15 23:29	7440-22-4	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**27.3**	%	0.10	0.10	1		03/11/15 10:18		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-33 **Lab ID: 92240289028** Collected: 03/05/15 09:40 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	ND	mg/kg	0.99	0.50	1	03/10/15 16:30	03/10/15 23:35	7440-38-2	
Barium	**150**	mg/kg	0.50	0.25	1	03/10/15 16:30	03/10/15 23:35	7440-39-3	
Cadmium	**0.12**	mg/kg	0.099	0.050	1	03/10/15 16:30	03/10/15 23:35	7440-43-9	
Chromium	**64.1**	mg/kg	0.50	0.25	1	03/10/15 16:30	03/10/15 23:35	7440-47-3	
Lead	**1.9**	mg/kg	0.50	0.25	1	03/10/15 16:30	03/10/15 23:35	7439-92-1	
Selenium	**1.3**	mg/kg	0.99	0.50	1	03/10/15 16:30	03/10/15 23:35	7782-49-2	
Silver	**0.45J**	mg/kg	0.50	0.25	1	03/10/15 16:30	03/10/15 23:35	7440-22-4	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.0096**	mg/kg	0.0054	0.00011	1	03/11/15 13:50	03/12/15 13:41	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**24.8**	%	0.10	0.10	1		03/11/15 10:18		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-34 **Lab ID: 92240289029** Collected: 03/05/15 09:45 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	ND	mg/kg	1.1	0.53	1	03/10/15 16:30	03/10/15 23:38	7440-38-2	
Barium	**87.5**	mg/kg	0.53	0.27	1	03/10/15 16:30	03/10/15 23:38	7440-39-3	
Cadmium	ND	mg/kg	0.11	0.053	1	03/10/15 16:30	03/10/15 23:38	7440-43-9	
Chromium	**2.2**	mg/kg	0.53	0.27	1	03/10/15 16:30	03/10/15 23:38	7440-47-3	
Lead	**2.0**	mg/kg	0.53	0.27	1	03/10/15 16:30	03/10/15 23:38	7439-92-1	
Selenium	**0.84J**	mg/kg	1.1	0.53	1	03/10/15 16:30	03/10/15 23:38	7782-49-2	
Silver	**0.59**	mg/kg	0.53	0.27	1	03/10/15 16:30	03/10/15 23:38	7440-22-4	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.0017J**	mg/kg	0.0041	0.000081	1	03/11/15 13:50	03/12/15 13:44	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**10**	%	0.10	0.10	1		03/11/15 10:19		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-31 **Lab ID: 92240289030** Collected: 03/05/15 09:15 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	291	93.3	100		03/11/15 15:56	71-43-2	
Ethylbenzene	**879**	ug/kg	291	105	100		03/11/15 15:56	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	291	87.4	100		03/11/15 15:56	1634-04-4	
Naphthalene	**6180**	ug/kg	291	69.9	100		03/11/15 15:56	91-20-3	
Toluene	ND	ug/kg	291	105	100		03/11/15 15:56	108-88-3	
Xylene (Total)	**1110**	ug/kg	583	210	100		03/11/15 15:56	1330-20-7	
m&p-Xylene	**1110**	ug/kg	583	210	100		03/11/15 15:56	179601-23-1	
o-Xylene	**126J**	ug/kg	291	111	100		03/11/15 15:56	95-47-6	
Surrogates									
Toluene-d8 (S)	114	%	70-130		100		03/11/15 15:56	2037-26-5	
4-Bromofluorobenzene (S)	109	%	70-130		100		03/11/15 15:56	460-00-4	
1,2-Dichloroethane-d4 (S)	117	%	70-130		100		03/11/15 15:56	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**19.2**	%	0.10	0.10	1		03/10/15 19:28		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-32 **Lab ID: 92240289031** Collected: 03/05/15 09:30 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	126	40.3	50		03/11/15 16:16	71-43-2	
Ethylbenzene	**3120**	ug/kg	126	45.3	50		03/11/15 16:16	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	126	37.8	50		03/11/15 16:16	1634-04-4	
Naphthalene	**7640**	ug/kg	504	121	200		03/12/15 14:16	91-20-3	
Toluene	ND	ug/kg	126	45.3	50		03/11/15 16:16	108-88-3	
Xylene (Total)	**4420**	ug/kg	252	90.7	50		03/11/15 16:16	1330-20-7	
m&p-Xylene	**4420**	ug/kg	252	90.7	50		03/11/15 16:16	179601-23-1	
o-Xylene	**116J**	ug/kg	126	47.8	50		03/11/15 16:16	95-47-6	
Surrogates									
Toluene-d8 (S)	114	%	70-130		50		03/11/15 16:16	2037-26-5	
4-Bromofluorobenzene (S)	115	%	70-130		50		03/11/15 16:16	460-00-4	
1,2-Dichloroethane-d4 (S)	114	%	70-130		50		03/11/15 16:16	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**15.8**	%	0.10	0.10	1		03/10/15 19:29		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-38 **Lab ID: 92240289032** Collected: 03/05/15 11:10 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	3.4	1.1	1		03/11/15 16:36	71-43-2	
Ethylbenzene	ND	ug/kg	3.4	1.2	1		03/11/15 16:36	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	3.4	1.0	1		03/11/15 16:36	1634-04-4	
Naphthalene	**2.4J**	ug/kg	3.4	0.82	1		03/11/15 16:36	91-20-3	
Toluene	ND	ug/kg	3.4	1.2	1		03/11/15 16:36	108-88-3	
Xylene (Total)	ND	ug/kg	6.9	2.5	1		03/11/15 16:36	1330-20-7	
m&p-Xylene	ND	ug/kg	6.9	2.5	1		03/11/15 16:36	179601-23-1	
o-Xylene	ND	ug/kg	3.4	1.3	1		03/11/15 16:36	95-47-6	
Surrogates									
Toluene-d8 (S)	102	%	70-130		1		03/11/15 16:36	2037-26-5	
4-Bromofluorobenzene (S)	102	%	70-130		1		03/11/15 16:36	460-00-4	
1,2-Dichloroethane-d4 (S)	112	%	70-130		1		03/11/15 16:36	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**17.0**	%	0.10	0.10	1		03/10/15 19:29		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-39 **Lab ID: 92240289033** Collected: 03/05/15 11:20 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.9	0.92	1		03/11/15 16:56	71-43-2	
Ethylbenzene	ND	ug/kg	2.9	1.0	1		03/11/15 16:56	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.9	0.86	1		03/11/15 16:56	1634-04-4	
Naphthalene	ND	ug/kg	2.9	0.69	1		03/11/15 16:56	91-20-3	
Toluene	ND	ug/kg	2.9	1.0	1		03/11/15 16:56	108-88-3	
Xylene (Total)	ND	ug/kg	5.7	2.1	1		03/11/15 16:56	1330-20-7	
m&p-Xylene	ND	ug/kg	5.7	2.1	1		03/11/15 16:56	179601-23-1	
o-Xylene	ND	ug/kg	2.9	1.1	1		03/11/15 16:56	95-47-6	
Surrogates									
Toluene-d8 (S)	102	%	70-130		1		03/11/15 16:56	2037-26-5	
4-Bromofluorobenzene (S)	104	%	70-130		1		03/11/15 16:56	460-00-4	
1,2-Dichloroethane-d4 (S)	106	%	70-130		1		03/11/15 16:56	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**18.4**	%	0.10	0.10	1		03/10/15 19:29		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: SB-40 **Lab ID: 92240289034** Collected: 03/05/15 11:33 Received: 03/09/15 16:55 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260/5035A SC Volatile Org	Analytical Method: EPA 8260								
Benzene	ND	ug/kg	2.3	0.73	1		03/11/15 17:15	71-43-2	
Ethylbenzene	ND	ug/kg	2.3	0.82	1		03/11/15 17:15	100-41-4	
Methyl-tert-butyl ether	ND	ug/kg	2.3	0.69	1		03/11/15 17:15	1634-04-4	
Naphthalene	ND	ug/kg	2.3	0.55	1		03/11/15 17:15	91-20-3	
Toluene	ND	ug/kg	2.3	0.82	1		03/11/15 17:15	108-88-3	
Xylene (Total)	ND	ug/kg	4.6	1.6	1		03/11/15 17:15	1330-20-7	
m&p-Xylene	ND	ug/kg	4.6	1.6	1		03/11/15 17:15	179601-23-1	
o-Xylene	ND	ug/kg	2.3	0.87	1		03/11/15 17:15	95-47-6	
Surrogates									
Toluene-d8 (S)	105	%	70-130		1		03/11/15 17:15	2037-26-5	
4-Bromofluorobenzene (S)	98	%	70-130		1		03/11/15 17:15	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	70-130		1		03/11/15 17:15	17060-07-0	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**13.1**	%	0.10	0.10	1		03/10/15 19:29		

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: MW-6 **Lab ID: 92240289035** Collected: 03/03/15 11:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Benzene	ND	ug/L	1.0	0.25	1		03/11/15 21:06	71-43-2	
Ethylbenzene	ND	ug/L	1.0	0.30	1		03/11/15 21:06	100-41-4	
Methyl-tert-butyl ether	**1.3**	ug/L	1.0	0.21	1		03/11/15 21:06	1634-04-4	
Naphthalene	ND	ug/L	1.0	0.24	1		03/11/15 21:06	91-20-3	
Toluene	ND	ug/L	1.0	0.26	1		03/11/15 21:06	108-88-3	
Xylene (Total)	ND	ug/L	2.0	0.66	1		03/11/15 21:06	1330-20-7	
m&p-Xylene	ND	ug/L	2.0	0.66	1		03/11/15 21:06	179601-23-1	
o-Xylene	ND	ug/L	1.0	0.23	1		03/11/15 21:06	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	101	%	70-130		1		03/11/15 21:06	460-00-4	
1,2-Dichloroethane-d4 (S)	114	%	70-130		1		03/11/15 21:06	17060-07-0	
Toluene-d8 (S)	95	%	70-130		1		03/11/15 21:06	2037-26-5	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-1 **Lab ID: 92240289036** Collected: 03/03/15 13:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Benzene	**6480**	ug/L	100	25.0	100		03/12/15 14:53	71-43-2	
Ethylbenzene	**702**	ug/L	100	30.0	100		03/12/15 14:53	100-41-4	
Methyl-tert-butyl ether	**2820**	ug/L	100	21.0	100		03/12/15 14:53	1634-04-4	
Naphthalene	**111**	ug/L	1.0	0.24	1		03/11/15 21:23	91-20-3	
Toluene	**1120**	ug/L	100	26.0	100		03/12/15 14:53	108-88-3	
Xylene (Total)	**536**	ug/L	2.0	0.66	1		03/11/15 21:23	1330-20-7	
m&p-Xylene	**383**	ug/L	2.0	0.66	1		03/11/15 21:23	179601-23-1	
o-Xylene	**153**	ug/L	1.0	0.23	1		03/11/15 21:23	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	94	%	70-130		1		03/11/15 21:23	460-00-4	
1,2-Dichloroethane-d4 (S)	100	%	70-130		1		03/11/15 21:23	17060-07-0	
Toluene-d8 (S)	102	%	70-130		1		03/11/15 21:23	2037-26-5	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-2 **Lab ID: 92240289037** Collected: 03/03/15 14:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Benzene	**13.5**	ug/L	1.0	0.25	1		03/12/15 20:14	71-43-2	
Ethylbenzene	**7.8**	ug/L	1.0	0.30	1		03/12/15 20:14	100-41-4	
Methyl-tert-butyl ether	**59.5**	ug/L	1.0	0.21	1		03/12/15 20:14	1634-04-4	
Naphthalene	**2.8**	ug/L	1.0	0.24	1		03/12/15 20:14	91-20-3	
Toluene	**0.95J**	ug/L	1.0	0.26	1		03/12/15 20:14	108-88-3	
Xylene (Total)	**16.4**	ug/L	2.0	0.66	1		03/12/15 20:14	1330-20-7	
m&p-Xylene	**15.1**	ug/L	2.0	0.66	1		03/12/15 20:14	179601-23-1	
o-Xylene	**1.3**	ug/L	1.0	0.23	1		03/12/15 20:14	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	105	%	70-130		1		03/12/15 20:14	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130		1		03/12/15 20:14	17060-07-0	
Toluene-d8 (S)	96	%	70-130		1		03/12/15 20:14	2037-26-5	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-3 **Lab ID: 92240289038** Collected: 03/04/15 14:40 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH by SIM 3510	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:13	83-32-9	
Acenaphthylene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 17:13	208-96-8	
Anthracene	ND	ug/L	0.050	0.050	1	03/10/15 16:00	03/13/15 17:13	120-12-7	
Benzo(a)anthracene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:13	56-55-3	
Benzo(a)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	207-08-9	
Chrysene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:13	218-01-9	
Dibenz(a,h)anthracene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	53-70-3	
Fluoranthene	ND	ug/L	0.30	0.30	1	03/10/15 16:00	03/13/15 17:13	206-44-0	
Fluorene	ND	ug/L	0.31	0.31	1	03/10/15 16:00	03/13/15 17:13	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	193-39-5	
1-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:13	90-12-0	
2-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:13	91-57-6	
Naphthalene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 17:13	91-20-3	
Phenanthrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:13	85-01-8	
Pyrene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:13	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	83	%	70-130		1	03/10/15 16:00	03/13/15 17:13	4165-60-0	
2-Fluorobiphenyl (S)	62	%	70-130		1	03/10/15 16:00	03/13/15 17:13	321-60-8	2g,S0
Terphenyl-d14 (S)	67	%	70-130		1	03/10/15 16:00	03/13/15 17:13	1718-51-0	2g,S0
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/13/15 11:39	83-32-9	
Acenaphthylene	ND	ug/L	10.0	0.99	1	03/10/15 08:15	03/13/15 11:39	208-96-8	
Aniline	ND	ug/L	10.0	0.80	1	03/10/15 08:15	03/13/15 11:39	62-53-3	
Anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/13/15 11:39	120-12-7	
Benzo(a)anthracene	**2.5J**	ug/L	10.0	0.47	1	03/10/15 08:15	03/13/15 11:39	56-55-3	
Benzo(a)pyrene	**1.5J**	ug/L	10.0	0.55	1	03/10/15 08:15	03/13/15 11:39	50-32-8	
Benzo(b)fluoranthene	**1.9J**	ug/L	10.0	0.44	1	03/10/15 08:15	03/13/15 11:39	205-99-2	
Benzo(g,h,i)perylene	**1.5J**	ug/L	10.0	0.45	1	03/10/15 08:15	03/13/15 11:39	191-24-2	
Benzo(k)fluoranthene	**1.9J**	ug/L	10.0	0.53	1	03/10/15 08:15	03/13/15 11:39	207-08-9	
Benzoic Acid	ND	ug/L	50.0	4.9	1	03/10/15 08:15	03/13/15 11:39	65-85-0	
Benzyl alcohol	ND	ug/L	20.0	2.1	1	03/10/15 08:15	03/13/15 11:39	100-51-6	
4-Bromophenylphenyl ether	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	101-55-3	
Butylbenzylphthalate	**2.5J**	ug/L	10.0	0.48	1	03/10/15 08:15	03/13/15 11:39	85-68-7	
4-Chloro-3-methylphenol	ND	ug/L	20.0	2.0	1	03/10/15 08:15	03/13/15 11:39	59-50-7	
4-Chloroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/13/15 11:39	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/13/15 11:39	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/L	10.0	0.89	1	03/10/15 08:15	03/13/15 11:39	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/L	10.0	0.86	1	03/10/15 08:15	03/13/15 11:39	108-60-1	
2-Chloronaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	91-58-7	
2-Chlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/13/15 11:39	7005-72-3	
Chrysene	**3.0J**	ug/L	10.0	0.49	1	03/10/15 08:15	03/13/15 11:39	218-01-9	

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(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-3 **Lab ID: 92240289038** Collected: 03/04/15 14:40 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Dibenz(a,h)anthracene	**1.2J**	ug/L	10.0	0.49	1	03/10/15 08:15	03/13/15 11:39	53-70-3	
Dibenzofuran	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	132-64-9	
1,2-Dichlorobenzene	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/13/15 11:39	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	10.0	0.78	1	03/10/15 08:15	03/13/15 11:39	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/13/15 11:39	106-46-7	
3,3'-Dichlorobenzidine	**2.3J**	ug/L	50.0	0.67	1	03/10/15 08:15	03/13/15 11:39	91-94-1	
2,4-Dichlorophenol	ND	ug/L	10.0	1.7	1	03/10/15 08:15	03/13/15 11:39	120-83-2	
Diethylphthalate	ND	ug/L	10.0	0.91	1	03/10/15 08:15	03/13/15 11:39	84-66-2	
2,4-Dimethylphenol	ND	ug/L	10.0	0.96	1	03/10/15 08:15	03/13/15 11:39	105-67-9	
Dimethylphthalate	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/13/15 11:39	131-11-3	
Di-n-butylphthalate	ND	ug/L	10.0	0.37	1	03/10/15 08:15	03/13/15 11:39	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/L	20.0	1.1	1	03/10/15 08:15	03/13/15 11:39	534-52-1	
2,4-Dinitrophenol	ND	ug/L	50.0	2.5	1	03/10/15 08:15	03/13/15 11:39	51-28-5	
2,4-Dinitrotoluene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/13/15 11:39	121-14-2	
2,6-Dinitrotoluene	ND	ug/L	10.0	2.1	1	03/10/15 08:15	03/13/15 11:39	606-20-2	
Di-n-octylphthalate	**1.4J**	ug/L	10.0	0.12	1	03/10/15 08:15	03/13/15 11:39	117-84-0	
bis(2-Ethylhexyl)phthalate	**2.0J**	ug/L	6.0	0.49	1	03/10/15 08:15	03/13/15 11:39	117-81-7	
Fluoranthene	**4.1J**	ug/L	10.0	0.41	1	03/10/15 08:15	03/13/15 11:39	206-44-0	
Fluorene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/13/15 11:39	87-68-3	
Hexachlorobenzene	ND	ug/L	10.0	0.76	1	03/10/15 08:15	03/13/15 11:39	118-74-1	
Hexachlorocyclopentadiene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/13/15 11:39	77-47-4	
Hexachloroethane	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/13/15 11:39	67-72-1	
Indeno(1,2,3-cd)pyrene	**1.3J**	ug/L	10.0	0.53	1	03/10/15 08:15	03/13/15 11:39	193-39-5	
Isophorone	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/13/15 11:39	78-59-1	
1-Methylnaphthalene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/13/15 11:39	90-12-0	
2-Methylnaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39		
Naphthalene	ND	ug/L	10.0	0.93	1	03/10/15 08:15	03/13/15 11:39	91-20-3	
2-Nitroaniline	ND	ug/L	50.0	1.5	1	03/10/15 08:15	03/13/15 11:39	88-74-4	
3-Nitroaniline	ND	ug/L	50.0	1.3	1	03/10/15 08:15	03/13/15 11:39	99-09-2	
4-Nitroaniline	**3.2J**	ug/L	50.0	1.6	1	03/10/15 08:15	03/13/15 11:39	100-01-6	
Nitrobenzene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	98-95-3	
2-Nitrophenol	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/13/15 11:39	88-75-5	
4-Nitrophenol	**8.8J**	ug/L	50.0	3.9	1	03/10/15 08:15	03/13/15 11:39	100-02-7	
N-Nitrosodimethylamine	ND	ug/L	10.0	0.94	1	03/10/15 08:15	03/13/15 11:39	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/13/15 11:39	621-64-7	
N-Nitrosodiphenylamine	ND	ug/L	10.0	0.64	1	03/10/15 08:15	03/13/15 11:39	86-30-6	
Pentachlorophenol	**2.9J**	ug/L	50.0	1.2	1	03/10/15 08:15	03/13/15 11:39	87-86-5	
Phenanthrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/13/15 11:39	85-01-8	
Phenol	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/13/15 11:39	108-95-2	
Pyrene	**3.8J**	ug/L	10.0	0.49	1	03/10/15 08:15	03/13/15 11:39	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/13/15 11:39	120-82-1	
2,4,5-Trichlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/13/15 11:39	95-95-4	
2,4,6-Trichlorophenol	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/13/15 11:39	88-06-2	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-3 **Lab ID: 92240289038** Collected: 03/04/15 14:40 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Surrogates									
Nitrobenzene-d5 (S)	61	%	21-110		1	03/10/15 08:15	03/13/15 11:39	4165-60-0	
2-Fluorobiphenyl (S)	69	%	27-110		1	03/10/15 08:15	03/13/15 11:39	321-60-8	
Terphenyl-d14 (S)	84	%	31-107		1	03/10/15 08:15	03/13/15 11:39	1718-51-0	
Phenol-d6 (S)	32	%	10-110		1	03/10/15 08:15	03/13/15 11:39	13127-88-3	
2-Fluorophenol (S)	41	%	12-110		1	03/10/15 08:15	03/13/15 11:39	367-12-4	
2,4,6-Tribromophenol (S)	71	%	27-110		1	03/10/15 08:15	03/13/15 11:39	118-79-6	
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Acetone	ND	ug/L	25.0	10.0	1		03/11/15 21:57	67-64-1	
Benzene	**0.74J**	ug/L	1.0	0.25	1		03/11/15 21:57	71-43-2	
Bromobenzene	ND	ug/L	1.0	0.30	1		03/11/15 21:57	108-86-1	
Bromochloromethane	ND	ug/L	1.0	0.17	1		03/11/15 21:57	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		03/11/15 21:57	75-27-4	
Bromoform	ND	ug/L	1.0	0.26	1		03/11/15 21:57	75-25-2	
Bromomethane	ND	ug/L	5.0	0.29	1		03/11/15 21:57	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	0.96	1		03/11/15 21:57	78-93-3	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		03/11/15 21:57	56-23-5	
Chlorobenzene	ND	ug/L	1.0	0.23	1		03/11/15 21:57	108-90-7	
Chloroethane	ND	ug/L	1.0	0.54	1		03/11/15 21:57	75-00-3	
Chloroform	ND	ug/L	1.0	0.14	1		03/11/15 21:57	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		03/11/15 21:57	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0	0.35	1		03/11/15 21:57	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0	0.31	1		03/11/15 21:57	106-43-4	
1,2-Dibromo-3-chloropropane	ND	ug/L	2.0	2.0	1		03/11/15 21:57	96-12-8	
Dibromochloromethane	ND	ug/L	1.0	0.21	1		03/11/15 21:57	124-48-1	
Dibromomethane	ND	ug/L	1.0	0.21	1		03/11/15 21:57	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	0.30	1		03/11/15 21:57	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0	0.24	1		03/11/15 21:57	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		03/11/15 21:57	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0	0.21	1		03/11/15 21:57	75-71-8	
1,1-Dichloroethane	ND	ug/L	1.0	0.32	1		03/11/15 21:57	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		03/11/15 21:57	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	0.56	1		03/11/15 21:57	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	0.19	1		03/11/15 21:57	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	0.49	1		03/11/15 21:57	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		03/11/15 21:57	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0	0.28	1		03/11/15 21:57	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0	0.13	1		03/11/15 21:57	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0	0.49	1		03/11/15 21:57	563-58-6	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		03/11/15 21:57	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		03/11/15 21:57	10061-02-6	
Diisopropyl ether	**0.17J**	ug/L	1.0	0.12	1		03/11/15 21:57	108-20-3	
Ethylbenzene	**0.43J**	ug/L	1.0	0.30	1		03/11/15 21:57	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0	0.71	1		03/11/15 21:57	87-68-3	
2-Hexanone	ND	ug/L	5.0	0.46	1		03/11/15 21:57	591-78-6	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-3 **Lab ID: 92240289038** Collected: 03/04/15 14:40 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
p-Isopropyltoluene	ND	ug/L	1.0	0.31	1		03/11/15 21:57	99-87-6	
Methylene Chloride	ND	ug/L	2.0	0.97	1		03/11/15 21:57	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	0.33	1		03/11/15 21:57	108-10-1	
Methyl-tert-butyl ether	**0.41J**	ug/L	1.0	0.21	1		03/11/15 21:57	1634-04-4	
Naphthalene	ND	ug/L	1.0	0.24	1		03/11/15 21:57	91-20-3	
Styrene	ND	ug/L	1.0	0.26	1		03/11/15 21:57	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	0.33	1		03/11/15 21:57	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	0.40	1		03/11/15 21:57	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		03/11/15 21:57	127-18-4	
Toluene	**0.44J**	ug/L	1.0	0.26	1		03/11/15 21:57	108-88-3	
1,2,3-Trichlorobenzene	ND	ug/L	1.0	0.33	1		03/11/15 21:57	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	1.0	0.35	1		03/11/15 21:57	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		03/11/15 21:57	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		03/11/15 21:57	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		03/11/15 21:57	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		03/11/15 21:57	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		03/11/15 21:57	96-18-4	
Vinyl acetate	ND	ug/L	2.0	0.35	1		03/11/15 21:57	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		03/11/15 21:57	75-01-4	
Xylene (Total)	ND	ug/L	2.0	0.66	1		03/11/15 21:57	1330-20-7	
m&p-Xylene	ND	ug/L	2.0	0.66	1		03/11/15 21:57	179601-23-1	
o-Xylene	ND	ug/L	1.0	0.23	1		03/11/15 21:57	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	97	%	70-130		1		03/11/15 21:57	460-00-4	
1,2-Dichloroethane-d4 (S)	107	%	70-130		1		03/11/15 21:57	17060-07-0	
Toluene-d8 (S)	96	%	70-130		1		03/11/15 21:57	2037-26-5	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-4 **Lab ID: 92240289039** Collected: 03/04/15 14:55 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH by SIM 3510	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:33	83-32-9	
Acenaphthylene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 17:33	208-96-8	
Anthracene	ND	ug/L	0.050	0.050	1	03/10/15 16:00	03/13/15 17:33	120-12-7	
Benzo(a)anthracene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:33	56-55-3	
Benzo(a)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	207-08-9	
Chrysene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:33	218-01-9	
Dibenz(a,h)anthracene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	53-70-3	
Fluoranthene	ND	ug/L	0.30	0.30	1	03/10/15 16:00	03/13/15 17:33	206-44-0	
Fluorene	ND	ug/L	0.31	0.31	1	03/10/15 16:00	03/13/15 17:33	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	193-39-5	
1-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:33	90-12-0	
2-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:33	91-57-6	
Naphthalene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 17:33	91-20-3	
Phenanthrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:33	85-01-8	
Pyrene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:33	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	86	%	70-130		1	03/10/15 16:00	03/13/15 17:33	4165-60-0	
2-Fluorobiphenyl (S)	67	%	70-130		1	03/10/15 16:00	03/13/15 17:33	321-60-8	2g,S0
Terphenyl-d14 (S)	76	%	70-130		1	03/10/15 16:00	03/13/15 17:33	1718-51-0	
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 15:06	83-32-9	
Acenaphthylene	ND	ug/L	10.0	0.99	1	03/10/15 08:15	03/12/15 15:06	208-96-8	
Aniline	ND	ug/L	10.0	0.80	1	03/10/15 08:15	03/12/15 15:06	62-53-3	
Anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/12/15 15:06	120-12-7	
Benzo(a)anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/12/15 15:06	56-55-3	
Benzo(a)pyrene	ND	ug/L	10.0	0.55	1	03/10/15 08:15	03/12/15 15:06	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	10.0	0.44	1	03/10/15 08:15	03/12/15 15:06	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	10.0	0.45	1	03/10/15 08:15	03/12/15 15:06	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 15:06	207-08-9	
Benzoic Acid	ND	ug/L	50.0	4.9	1	03/10/15 08:15	03/12/15 15:06	65-85-0	
Benzyl alcohol	ND	ug/L	20.0	2.1	1	03/10/15 08:15	03/12/15 15:06	100-51-6	
4-Bromophenylphenyl ether	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	101-55-3	
Butylbenzylphthalate	ND	ug/L	10.0	0.48	1	03/10/15 08:15	03/12/15 15:06	85-68-7	
4-Chloro-3-methylphenol	ND	ug/L	20.0	2.0	1	03/10/15 08:15	03/12/15 15:06	59-50-7	
4-Chloroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/12/15 15:06	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/12/15 15:06	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/L	10.0	0.89	1	03/10/15 08:15	03/12/15 15:06	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/L	10.0	0.86	1	03/10/15 08:15	03/12/15 15:06	108-60-1	
2-Chloronaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	91-58-7	
2-Chlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 15:06	7005-72-3	
Chrysene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 15:06	218-01-9	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-4 **Lab ID: 92240289039** Collected: 03/04/15 14:55 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Dibenz(a,h)anthracene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 15:06	53-70-3	
Dibenzofuran	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	132-64-9	
1,2-Dichlorobenzene	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/12/15 15:06	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	10.0	0.78	1	03/10/15 08:15	03/12/15 15:06	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/12/15 15:06	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/L	50.0	0.67	1	03/10/15 08:15	03/12/15 15:06	91-94-1	
2,4-Dichlorophenol	ND	ug/L	10.0	1.7	1	03/10/15 08:15	03/12/15 15:06	120-83-2	
Diethylphthalate	ND	ug/L	10.0	0.91	1	03/10/15 08:15	03/12/15 15:06	84-66-2	
2,4-Dimethylphenol	ND	ug/L	10.0	0.96	1	03/10/15 08:15	03/12/15 15:06	105-67-9	
Dimethylphthalate	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/12/15 15:06	131-11-3	
Di-n-butylphthalate	ND	ug/L	10.0	0.37	1	03/10/15 08:15	03/12/15 15:06	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/L	20.0	1.1	1	03/10/15 08:15	03/12/15 15:06	534-52-1	
2,4-Dinitrophenol	ND	ug/L	50.0	2.5	1	03/10/15 08:15	03/12/15 15:06	51-28-5	
2,4-Dinitrotoluene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 15:06	121-14-2	
2,6-Dinitrotoluene	ND	ug/L	10.0	2.1	1	03/10/15 08:15	03/12/15 15:06	606-20-2	
Di-n-octylphthalate	ND	ug/L	10.0	0.12	1	03/10/15 08:15	03/12/15 15:06	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/L	6.0	0.49	1	03/10/15 08:15	03/12/15 15:06	117-81-7	
Fluoranthene	ND	ug/L	10.0	0.41	1	03/10/15 08:15	03/12/15 15:06	206-44-0	
Fluorene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/12/15 15:06	87-68-3	
Hexachlorobenzene	ND	ug/L	10.0	0.76	1	03/10/15 08:15	03/12/15 15:06	118-74-1	
Hexachlorocyclopentadiene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 15:06	77-47-4	
Hexachloroethane	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/12/15 15:06	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 15:06	193-39-5	
Isophorone	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 15:06	78-59-1	
1-Methylnaphthalene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 15:06	90-12-0	
2-Methylnaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06		
Naphthalene	ND	ug/L	10.0	0.93	1	03/10/15 08:15	03/12/15 15:06	91-20-3	
2-Nitroaniline	ND	ug/L	50.0	1.5	1	03/10/15 08:15	03/12/15 15:06	88-74-4	
3-Nitroaniline	ND	ug/L	50.0	1.3	1	03/10/15 08:15	03/12/15 15:06	99-09-2	
4-Nitroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/12/15 15:06	100-01-6	
Nitrobenzene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	98-95-3	
2-Nitrophenol	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/12/15 15:06	88-75-5	
4-Nitrophenol	ND	ug/L	50.0	3.9	1	03/10/15 08:15	03/12/15 15:06	100-02-7	
N-Nitrosodimethylamine	ND	ug/L	10.0	0.94	1	03/10/15 08:15	03/12/15 15:06	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/12/15 15:06	621-64-7	
N-Nitrosodiphenylamine	ND	ug/L	10.0	0.64	1	03/10/15 08:15	03/12/15 15:06	86-30-6	
Pentachlorophenol	ND	ug/L	50.0	1.2	1	03/10/15 08:15	03/12/15 15:06	87-86-5	
Phenanthrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 15:06	85-01-8	
Phenol	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 15:06	108-95-2	
Pyrene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 15:06	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/12/15 15:06	120-82-1	
2,4,5-Trichlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 15:06	95-95-4	
2,4,6-Trichlorophenol	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/12/15 15:06	88-06-2	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-4 **Lab ID: 92240289039** Collected: 03/04/15 14:55 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Surrogates									
Nitrobenzene-d5 (S)	77	%	21-110		1	03/10/15 08:15	03/12/15 15:06	4165-60-0	
2-Fluorobiphenyl (S)	77	%	27-110		1	03/10/15 08:15	03/12/15 15:06	321-60-8	
Terphenyl-d14 (S)	92	%	31-107		1	03/10/15 08:15	03/12/15 15:06	1718-51-0	
Phenol-d6 (S)	35	%	10-110		1	03/10/15 08:15	03/12/15 15:06	13127-88-3	
2-Fluorophenol (S)	47	%	12-110		1	03/10/15 08:15	03/12/15 15:06	367-12-4	
2,4,6-Tribromophenol (S)	85	%	27-110		1	03/10/15 08:15	03/12/15 15:06	118-79-6	
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Acetone	ND	ug/L	25.0	10.0	1		03/11/15 22:14	67-64-1	
Benzene	**0.41J**	ug/L	1.0	0.25	1		03/11/15 22:14	71-43-2	
Bromobenzene	ND	ug/L	1.0	0.30	1		03/11/15 22:14	108-86-1	
Bromochloromethane	ND	ug/L	1.0	0.17	1		03/11/15 22:14	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		03/11/15 22:14	75-27-4	
Bromoform	ND	ug/L	1.0	0.26	1		03/11/15 22:14	75-25-2	
Bromomethane	ND	ug/L	5.0	0.29	1		03/11/15 22:14	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	0.96	1		03/11/15 22:14	78-93-3	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		03/11/15 22:14	56-23-5	
Chlorobenzene	ND	ug/L	1.0	0.23	1		03/11/15 22:14	108-90-7	
Chloroethane	ND	ug/L	1.0	0.54	1		03/11/15 22:14	75-00-3	
Chloroform	ND	ug/L	1.0	0.14	1		03/11/15 22:14	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		03/11/15 22:14	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0	0.35	1		03/11/15 22:14	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0	0.31	1		03/11/15 22:14	106-43-4	
1,2-Dibromo-3-chloropropane	ND	ug/L	2.0	2.0	1		03/11/15 22:14	96-12-8	
Dibromochloromethane	ND	ug/L	1.0	0.21	1		03/11/15 22:14	124-48-1	
Dibromomethane	ND	ug/L	1.0	0.21	1		03/11/15 22:14	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	0.30	1		03/11/15 22:14	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0	0.24	1		03/11/15 22:14	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		03/11/15 22:14	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0	0.21	1		03/11/15 22:14	75-71-8	
1,1-Dichloroethane	ND	ug/L	1.0	0.32	1		03/11/15 22:14	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		03/11/15 22:14	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	0.56	1		03/11/15 22:14	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	0.19	1		03/11/15 22:14	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	0.49	1		03/11/15 22:14	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		03/11/15 22:14	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0	0.28	1		03/11/15 22:14	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0	0.13	1		03/11/15 22:14	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0	0.49	1		03/11/15 22:14	563-58-6	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		03/11/15 22:14	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		03/11/15 22:14	10061-02-6	
Diisopropyl ether	ND	ug/L	1.0	0.12	1		03/11/15 22:14	108-20-3	
Ethylbenzene	ND	ug/L	1.0	0.30	1		03/11/15 22:14	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0	0.71	1		03/11/15 22:14	87-68-3	
2-Hexanone	ND	ug/L	5.0	0.46	1		03/11/15 22:14	591-78-6	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-4 **Lab ID: 92240289039** Collected: 03/04/15 14:55 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
p-Isopropyltoluene	ND	ug/L	1.0	0.31	1		03/11/15 22:14	99-87-6	
Methylene Chloride	ND	ug/L	2.0	0.97	1		03/11/15 22:14	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	0.33	1		03/11/15 22:14	108-10-1	
Methyl-tert-butyl ether	ND	ug/L	1.0	0.21	1		03/11/15 22:14	1634-04-4	
Naphthalene	ND	ug/L	1.0	0.24	1		03/11/15 22:14	91-20-3	
Styrene	ND	ug/L	1.0	0.26	1		03/11/15 22:14	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	0.33	1		03/11/15 22:14	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	0.40	1		03/11/15 22:14	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		03/11/15 22:14	127-18-4	
Toluene	**0.27J**	ug/L	1.0	0.26	1		03/11/15 22:14	108-88-3	
1,2,3-Trichlorobenzene	ND	ug/L	1.0	0.33	1		03/11/15 22:14	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	1.0	0.35	1		03/11/15 22:14	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		03/11/15 22:14	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		03/11/15 22:14	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		03/11/15 22:14	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		03/11/15 22:14	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		03/11/15 22:14	96-18-4	
Vinyl acetate	ND	ug/L	2.0	0.35	1		03/11/15 22:14	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		03/11/15 22:14	75-01-4	
Xylene (Total)	ND	ug/L	2.0	0.66	1		03/11/15 22:14	1330-20-7	
m&p-Xylene	ND	ug/L	2.0	0.66	1		03/11/15 22:14	179601-23-1	
o-Xylene	ND	ug/L	1.0	0.23	1		03/11/15 22:14	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	96	%	70-130		1		03/11/15 22:14	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130		1		03/11/15 22:14	17060-07-0	
Toluene-d8 (S)	95	%	70-130		1		03/11/15 22:14	2037-26-5	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-5 **Lab ID: 92240289040** Collected: 03/03/15 17:50 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Arsenic	**31.3**	ug/L	10.0	5.0	1	03/10/15 15:05	03/11/15 03:00	7440-38-2	
Barium	**5120**	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:00	7440-39-3	
Cadmium	**4.1**	ug/L	1.0	0.050	1	03/10/15 15:05	03/11/15 03:00	7440-43-9	
Chromium	**684**	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:00	7440-47-3	
Lead	**789**	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:00	7439-92-1	
Selenium	**17.2**	ug/L	10.0	5.0	1	03/10/15 15:05	03/11/15 03:00	7782-49-2	M1
Silver	ND	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:00	7440-22-4	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**0.64**	ug/L	0.20	0.10	1	03/10/15 15:30	03/11/15 13:25	7439-97-6	
8270 MSSV PAH by SIM 3510	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:53	83-32-9	
Acenaphthylene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 17:53	208-96-8	
Anthracene	ND	ug/L	0.050	0.050	1	03/10/15 16:00	03/13/15 17:53	120-12-7	
Benzo(a)anthracene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:53	56-55-3	
Benzo(a)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	207-08-9	
Chrysene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:53	218-01-9	
Dibenz(a,h)anthracene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	53-70-3	
Fluoranthene	ND	ug/L	0.30	0.30	1	03/10/15 16:00	03/13/15 17:53	206-44-0	
Fluorene	ND	ug/L	0.31	0.31	1	03/10/15 16:00	03/13/15 17:53	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	193-39-5	
1-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:53	90-12-0	
2-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 17:53	91-57-6	
Naphthalene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 17:53	91-20-3	
Phenanthrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 17:53	85-01-8	
Pyrene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 17:53	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	88	%	70-130		1	03/10/15 16:00	03/13/15 17:53	4165-60-0	
2-Fluorobiphenyl (S)	66	%	70-130		1	03/10/15 16:00	03/13/15 17:53	321-60-8	2g,S0
Terphenyl-d14 (S)	76	%	70-130		1	03/10/15 16:00	03/13/15 17:53	1718-51-0	
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 13:31	83-32-9	
Acenaphthylene	ND	ug/L	10.0	0.99	1	03/10/15 08:15	03/12/15 13:31	208-96-8	
Aniline	ND	ug/L	10.0	0.80	1	03/10/15 08:15	03/12/15 13:31	62-53-3	
Anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/12/15 13:31	120-12-7	
Benzo(a)anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/12/15 13:31	56-55-3	
Benzo(a)pyrene	ND	ug/L	10.0	0.55	1	03/10/15 08:15	03/12/15 13:31	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	10.0	0.44	1	03/10/15 08:15	03/12/15 13:31	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	10.0	0.45	1	03/10/15 08:15	03/12/15 13:31	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 13:31	207-08-9	
Benzoic Acid	ND	ug/L	50.0	4.9	1	03/10/15 08:15	03/12/15 13:31	65-85-0	

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-5 **Lab ID: 92240289040** Collected: 03/03/15 17:50 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Benzyl alcohol	ND	ug/L	20.0	2.1	1	03/10/15 08:15	03/12/15 13:31	100-51-6	
4-Bromophenylphenyl ether	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	101-55-3	
Butylbenzylphthalate	ND	ug/L	10.0	0.48	1	03/10/15 08:15	03/12/15 13:31	85-68-7	
4-Chloro-3-methylphenol	ND	ug/L	20.0	2.0	1	03/10/15 08:15	03/12/15 13:31	59-50-7	
4-Chloroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/12/15 13:31	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/12/15 13:31	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/L	10.0	0.89	1	03/10/15 08:15	03/12/15 13:31	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/L	10.0	0.86	1	03/10/15 08:15	03/12/15 13:31	108-60-1	
2-Chloronaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	91-58-7	
2-Chlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 13:31	7005-72-3	
Chrysene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 13:31	218-01-9	
Dibenz(a,h)anthracene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 13:31	53-70-3	
Dibenzofuran	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	132-64-9	
1,2-Dichlorobenzene	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/12/15 13:31	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	10.0	0.78	1	03/10/15 08:15	03/12/15 13:31	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/12/15 13:31	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/L	50.0	0.67	1	03/10/15 08:15	03/12/15 13:31	91-94-1	
2,4-Dichlorophenol	ND	ug/L	10.0	1.7	1	03/10/15 08:15	03/12/15 13:31	120-83-2	
Diethylphthalate	ND	ug/L	10.0	0.91	1	03/10/15 08:15	03/12/15 13:31	84-66-2	
2,4-Dimethylphenol	ND	ug/L	10.0	0.96	1	03/10/15 08:15	03/12/15 13:31	105-67-9	
Dimethylphthalate	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/12/15 13:31	131-11-3	
Di-n-butylphthalate	ND	ug/L	10.0	0.37	1	03/10/15 08:15	03/12/15 13:31	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/L	20.0	1.1	1	03/10/15 08:15	03/12/15 13:31	534-52-1	
2,4-Dinitrophenol	ND	ug/L	50.0	2.5	1	03/10/15 08:15	03/12/15 13:31	51-28-5	
2,4-Dinitrotoluene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 13:31	121-14-2	
2,6-Dinitrotoluene	ND	ug/L	10.0	2.1	1	03/10/15 08:15	03/12/15 13:31	606-20-2	
Di-n-octylphthalate	ND	ug/L	10.0	0.12	1	03/10/15 08:15	03/12/15 13:31	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/L	6.0	0.49	1	03/10/15 08:15	03/12/15 13:31	117-81-7	
Fluoranthene	ND	ug/L	10.0	0.41	1	03/10/15 08:15	03/12/15 13:31	206-44-0	
Fluorene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/12/15 13:31	87-68-3	
Hexachlorobenzene	ND	ug/L	10.0	0.76	1	03/10/15 08:15	03/12/15 13:31	118-74-1	
Hexachlorocyclopentadiene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 13:31	77-47-4	
Hexachloroethane	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/12/15 13:31	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 13:31	193-39-5	
Isophorone	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 13:31	78-59-1	
1-Methylnaphthalene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 13:31	90-12-0	
2-Methylnaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31		
Naphthalene	ND	ug/L	10.0	0.93	1	03/10/15 08:15	03/12/15 13:31	91-20-3	
2-Nitroaniline	ND	ug/L	50.0	1.5	1	03/10/15 08:15	03/12/15 13:31	88-74-4	
3-Nitroaniline	ND	ug/L	50.0	1.3	1	03/10/15 08:15	03/12/15 13:31	99-09-2	
4-Nitroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/12/15 13:31	100-01-6	
Nitrobenzene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	98-95-3	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-5 **Lab ID: 92240289040** Collected: 03/03/15 17:50 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
2-Nitrophenol	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/12/15 13:31	88-75-5	
4-Nitrophenol	ND	ug/L	50.0	3.9	1	03/10/15 08:15	03/12/15 13:31	100-02-7	
N-Nitrosodimethylamine	ND	ug/L	10.0	0.94	1	03/10/15 08:15	03/12/15 13:31	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/12/15 13:31	621-64-7	
N-Nitrosodiphenylamine	ND	ug/L	10.0	0.64	1	03/10/15 08:15	03/12/15 13:31	86-30-6	
Pentachlorophenol	ND	ug/L	50.0	1.2	1	03/10/15 08:15	03/12/15 13:31	87-86-5	
Phenanthrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 13:31	85-01-8	
Phenol	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 13:31	108-95-2	
Pyrene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 13:31	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/12/15 13:31	120-82-1	
2,4,5-Trichlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 13:31	95-95-4	
2,4,6-Trichlorophenol	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/12/15 13:31	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	78	%	21-110		1	03/10/15 08:15	03/12/15 13:31	4165-60-0	
2-Fluorobiphenyl (S)	77	%	27-110		1	03/10/15 08:15	03/12/15 13:31	321-60-8	
Terphenyl-d14 (S)	97	%	31-107		1	03/10/15 08:15	03/12/15 13:31	1718-51-0	
Phenol-d6 (S)	33	%	10-110		1	03/10/15 08:15	03/12/15 13:31	13127-88-3	
2-Fluorophenol (S)	47	%	12-110		1	03/10/15 08:15	03/12/15 13:31	367-12-4	
2,4,6-Tribromophenol (S)	84	%	27-110		1	03/10/15 08:15	03/12/15 13:31	118-79-6	
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Acetone	ND	ug/L	25.0	10.0	1		03/10/15 21:26	67-64-1	
Benzene	ND	ug/L	1.0	0.25	1		03/10/15 21:26	71-43-2	
Bromobenzene	ND	ug/L	1.0	0.30	1		03/10/15 21:26	108-86-1	
Bromochloromethane	ND	ug/L	1.0	0.17	1		03/10/15 21:26	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		03/10/15 21:26	75-27-4	
Bromoform	ND	ug/L	1.0	0.26	1		03/10/15 21:26	75-25-2	
Bromomethane	ND	ug/L	5.0	0.29	1		03/10/15 21:26	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	0.96	1		03/10/15 21:26	78-93-3	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		03/10/15 21:26	56-23-5	
Chlorobenzene	ND	ug/L	1.0	0.23	1		03/10/15 21:26	108-90-7	
Chloroethane	ND	ug/L	1.0	0.54	1		03/10/15 21:26	75-00-3	
Chloroform	ND	ug/L	1.0	0.14	1		03/10/15 21:26	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		03/10/15 21:26	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0	0.35	1		03/10/15 21:26	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0	0.31	1		03/10/15 21:26	106-43-4	
1,2-Dibromo-3-chloropropane	ND	ug/L	2.0	2.0	1		03/10/15 21:26	96-12-8	
Dibromochloromethane	ND	ug/L	1.0	0.21	1		03/10/15 21:26	124-48-1	
Dibromomethane	ND	ug/L	1.0	0.21	1		03/10/15 21:26	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	0.30	1		03/10/15 21:26	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0	0.24	1		03/10/15 21:26	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		03/10/15 21:26	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0	0.21	1		03/10/15 21:26	75-71-8	
1,1-Dichloroethane	ND	ug/L	1.0	0.32	1		03/10/15 21:26	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		03/10/15 21:26	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	0.56	1		03/10/15 21:26	75-35-4	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-5 **Lab ID: 92240289040** Collected: 03/03/15 17:50 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
cis-1,2-Dichloroethene	ND	ug/L	1.0	0.19	1		03/10/15 21:26	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	0.49	1		03/10/15 21:26	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		03/10/15 21:26	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0	0.28	1		03/10/15 21:26	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0	0.13	1		03/10/15 21:26	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0	0.49	1		03/10/15 21:26	563-58-6	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		03/10/15 21:26	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		03/10/15 21:26	10061-02-6	
Diisopropyl ether	ND	ug/L	1.0	0.12	1		03/10/15 21:26	108-20-3	
Ethylbenzene	ND	ug/L	1.0	0.30	1		03/10/15 21:26	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0	0.71	1		03/10/15 21:26	87-68-3	
2-Hexanone	ND	ug/L	5.0	0.46	1		03/10/15 21:26	591-78-6	
p-Isopropyltoluene	ND	ug/L	1.0	0.31	1		03/10/15 21:26	99-87-6	
Methylene Chloride	ND	ug/L	2.0	0.97	1		03/10/15 21:26	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	0.33	1		03/10/15 21:26	108-10-1	
Methyl-tert-butyl ether	ND	ug/L	1.0	0.21	1		03/10/15 21:26	1634-04-4	
Naphthalene	ND	ug/L	1.0	0.24	1		03/10/15 21:26	91-20-3	
Styrene	ND	ug/L	1.0	0.26	1		03/10/15 21:26	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	0.33	1		03/10/15 21:26	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	0.40	1		03/10/15 21:26	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		03/10/15 21:26	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		03/10/15 21:26	108-88-3	
1,2,3-Trichlorobenzene	ND	ug/L	1.0	0.33	1		03/10/15 21:26	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	1.0	0.35	1		03/10/15 21:26	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		03/10/15 21:26	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		03/10/15 21:26	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		03/10/15 21:26	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		03/10/15 21:26	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		03/10/15 21:26	96-18-4	
Vinyl acetate	ND	ug/L	2.0	0.35	1		03/10/15 21:26	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		03/10/15 21:26	75-01-4	
Xylene (Total)	ND	ug/L	2.0	0.66	1		03/10/15 21:26	1330-20-7	
m&p-Xylene	ND	ug/L	2.0	0.66	1		03/10/15 21:26	179601-23-1	
o-Xylene	ND	ug/L	1.0	0.23	1		03/10/15 21:26	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	100	%	70-130		1		03/10/15 21:26	460-00-4	
1,2-Dichloroethane-d4 (S)	108	%	70-130		1		03/10/15 21:26	17060-07-0	
Toluene-d8 (S)	97	%	70-130		1		03/10/15 21:26	2037-26-5	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-6 **Lab ID: 92240289041** Collected: 03/03/15 16:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Arsenic	ND	ug/L	10.0	5.0	1	03/10/15 15:05	03/11/15 03:18	7440-38-2	
Barium	**16700**	ug/L	50.0	25.0	10	03/10/15 15:05	03/11/15 16:06	7440-39-3	
Cadmium	**3.3**	ug/L	1.0	0.050	1	03/10/15 15:05	03/11/15 03:18	7440-43-9	
Chromium	**2900**	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:18	7440-47-3	
Lead	**215**	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:18	7439-92-1	
Selenium	**30.2**	ug/L	10.0	5.0	1	03/10/15 15:05	03/11/15 03:18	7782-49-2	
Silver	**6.5**	ug/L	5.0	2.5	1	03/10/15 15:05	03/11/15 03:18	7440-22-4	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	**0.46**	ug/L	0.20	0.10	1	03/13/15 12:00	03/14/15 13:44	7439-97-6	
8270 MSSV PAH by SIM 3510	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 18:14	83-32-9	
Acenaphthylene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 18:14	208-96-8	
Anthracene	ND	ug/L	0.050	0.050	1	03/10/15 16:00	03/13/15 18:14	120-12-7	
Benzo(a)anthracene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 18:14	56-55-3	
Benzo(a)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	207-08-9	
Chrysene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 18:14	218-01-9	
Dibenz(a,h)anthracene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	53-70-3	
Fluoranthene	ND	ug/L	0.30	0.30	1	03/10/15 16:00	03/13/15 18:14	206-44-0	
Fluorene	ND	ug/L	0.31	0.31	1	03/10/15 16:00	03/13/15 18:14	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	193-39-5	
1-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 18:14	90-12-0	
2-Methylnaphthalene	ND	ug/L	2.0	2.0	1	03/10/15 16:00	03/13/15 18:14	91-57-6	
Naphthalene	ND	ug/L	1.5	1.5	1	03/10/15 16:00	03/13/15 18:14	91-20-3	
Phenanthrene	ND	ug/L	0.20	0.20	1	03/10/15 16:00	03/13/15 18:14	85-01-8	
Pyrene	ND	ug/L	0.10	0.10	1	03/10/15 16:00	03/13/15 18:14	129-00-0	
Surrogates									
Nitrobenzene-d5 (S)	85	%	70-130		1	03/10/15 16:00	03/13/15 18:14	4165-60-0	
2-Fluorobiphenyl (S)	68	%	70-130		1	03/10/15 16:00	03/13/15 18:14	321-60-8	2g,S0
Terphenyl-d14 (S)	72	%	70-130		1	03/10/15 16:00	03/13/15 18:14	1718-51-0	
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Acenaphthene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 14:03	83-32-9	
Acenaphthylene	ND	ug/L	10.0	0.99	1	03/10/15 08:15	03/12/15 14:03	208-96-8	
Aniline	ND	ug/L	10.0	0.80	1	03/10/15 08:15	03/12/15 14:03	62-53-3	
Anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/12/15 14:03	120-12-7	
Benzo(a)anthracene	ND	ug/L	10.0	0.47	1	03/10/15 08:15	03/12/15 14:03	56-55-3	
Benzo(a)pyrene	ND	ug/L	10.0	0.55	1	03/10/15 08:15	03/12/15 14:03	50-32-8	
Benzo(b)fluoranthene	ND	ug/L	10.0	0.44	1	03/10/15 08:15	03/12/15 14:03	205-99-2	
Benzo(g,h,i)perylene	ND	ug/L	10.0	0.45	1	03/10/15 08:15	03/12/15 14:03	191-24-2	
Benzo(k)fluoranthene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 14:03	207-08-9	
Benzoic Acid	ND	ug/L	50.0	4.9	1	03/10/15 08:15	03/12/15 14:03	65-85-0	

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(704)875-9092

ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-6 **Lab ID: 92240289041** Collected: 03/03/15 16:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
Benzyl alcohol	ND	ug/L	20.0	2.1	1	03/10/15 08:15	03/12/15 14:03	100-51-6	
4-Bromophenylphenyl ether	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	101-55-3	
Butylbenzylphthalate	ND	ug/L	10.0	0.48	1	03/10/15 08:15	03/12/15 14:03	85-68-7	
4-Chloro-3-methylphenol	ND	ug/L	20.0	2.0	1	03/10/15 08:15	03/12/15 14:03	59-50-7	
4-Chloroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/12/15 14:03	106-47-8	
bis(2-Chloroethoxy)methane	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/12/15 14:03	111-91-1	
bis(2-Chloroethyl) ether	ND	ug/L	10.0	0.89	1	03/10/15 08:15	03/12/15 14:03	111-44-4	
bis(2-Chloroisopropyl) ether	ND	ug/L	10.0	0.86	1	03/10/15 08:15	03/12/15 14:03	108-60-1	
2-Chloronaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	91-58-7	
2-Chlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	95-57-8	
4-Chlorophenylphenyl ether	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 14:03	7005-72-3	
Chrysene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 14:03	218-01-9	
Dibenz(a,h)anthracene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 14:03	53-70-3	
Dibenzofuran	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	132-64-9	
1,2-Dichlorobenzene	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/12/15 14:03	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	10.0	0.78	1	03/10/15 08:15	03/12/15 14:03	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/12/15 14:03	106-46-7	
3,3'-Dichlorobenzidine	ND	ug/L	50.0	0.67	1	03/10/15 08:15	03/12/15 14:03	91-94-1	
2,4-Dichlorophenol	ND	ug/L	10.0	1.7	1	03/10/15 08:15	03/12/15 14:03	120-83-2	
Diethylphthalate	ND	ug/L	10.0	0.91	1	03/10/15 08:15	03/12/15 14:03	84-66-2	
2,4-Dimethylphenol	ND	ug/L	10.0	0.96	1	03/10/15 08:15	03/12/15 14:03	105-67-9	
Dimethylphthalate	ND	ug/L	10.0	0.62	1	03/10/15 08:15	03/12/15 14:03	131-11-3	
Di-n-butylphthalate	ND	ug/L	10.0	0.37	1	03/10/15 08:15	03/12/15 14:03	84-74-2	
4,6-Dinitro-2-methylphenol	ND	ug/L	20.0	1.1	1	03/10/15 08:15	03/12/15 14:03	534-52-1	
2,4-Dinitrophenol	ND	ug/L	50.0	2.5	1	03/10/15 08:15	03/12/15 14:03	51-28-5	
2,4-Dinitrotoluene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 14:03	121-14-2	
2,6-Dinitrotoluene	ND	ug/L	10.0	2.1	1	03/10/15 08:15	03/12/15 14:03	606-20-2	
Di-n-octylphthalate	ND	ug/L	10.0	0.12	1	03/10/15 08:15	03/12/15 14:03	117-84-0	
bis(2-Ethylhexyl)phthalate	ND	ug/L	6.0	0.49	1	03/10/15 08:15	03/12/15 14:03	117-81-7	
Fluoranthene	ND	ug/L	10.0	0.41	1	03/10/15 08:15	03/12/15 14:03	206-44-0	
Fluorene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	86-73-7	
Hexachloro-1,3-butadiene	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/12/15 14:03	87-68-3	
Hexachlorobenzene	ND	ug/L	10.0	0.76	1	03/10/15 08:15	03/12/15 14:03	118-74-1	
Hexachlorocyclopentadiene	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 14:03	77-47-4	
Hexachloroethane	ND	ug/L	10.0	0.90	1	03/10/15 08:15	03/12/15 14:03	67-72-1	
Indeno(1,2,3-cd)pyrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 14:03	193-39-5	
Isophorone	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 14:03	78-59-1	
1-Methylnaphthalene	ND	ug/L	10.0	0.92	1	03/10/15 08:15	03/12/15 14:03	90-12-0	
2-Methylnaphthalene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	91-57-6	
2-Methylphenol(o-Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	95-48-7	
3&4-Methylphenol(m&p Cresol)	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03		
Naphthalene	ND	ug/L	10.0	0.93	1	03/10/15 08:15	03/12/15 14:03	91-20-3	
2-Nitroaniline	ND	ug/L	50.0	1.5	1	03/10/15 08:15	03/12/15 14:03	88-74-4	
3-Nitroaniline	ND	ug/L	50.0	1.3	1	03/10/15 08:15	03/12/15 14:03	99-09-2	
4-Nitroaniline	ND	ug/L	50.0	1.6	1	03/10/15 08:15	03/12/15 14:03	100-01-6	
Nitrobenzene	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	98-95-3	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-6 **Lab ID: 92240289041** Collected: 03/03/15 16:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV Semivolatile Org SC	Analytical Method: EPA 8270 Preparation Method: EPA 3510								
2-Nitrophenol	ND	ug/L	10.0	0.71	1	03/10/15 08:15	03/12/15 14:03	88-75-5	
4-Nitrophenol	ND	ug/L	50.0	3.9	1	03/10/15 08:15	03/12/15 14:03	100-02-7	
N-Nitrosodimethylamine	ND	ug/L	10.0	0.94	1	03/10/15 08:15	03/12/15 14:03	62-75-9	
N-Nitroso-di-n-propylamine	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/12/15 14:03	621-64-7	
N-Nitrosodiphenylamine	ND	ug/L	10.0	0.64	1	03/10/15 08:15	03/12/15 14:03	86-30-6	
Pentachlorophenol	ND	ug/L	50.0	1.2	1	03/10/15 08:15	03/12/15 14:03	87-86-5	
Phenanthrene	ND	ug/L	10.0	0.53	1	03/10/15 08:15	03/12/15 14:03	85-01-8	
Phenol	ND	ug/L	10.0	1.1	1	03/10/15 08:15	03/12/15 14:03	108-95-2	
Pyrene	ND	ug/L	10.0	0.49	1	03/10/15 08:15	03/12/15 14:03	129-00-0	
1,2,4-Trichlorobenzene	ND	ug/L	10.0	1.3	1	03/10/15 08:15	03/12/15 14:03	120-82-1	
2,4,5-Trichlorophenol	ND	ug/L	10.0	1.0	1	03/10/15 08:15	03/12/15 14:03	95-95-4	
2,4,6-Trichlorophenol	ND	ug/L	10.0	0.85	1	03/10/15 08:15	03/12/15 14:03	88-06-2	
Surrogates									
Nitrobenzene-d5 (S)	77	%	21-110		1	03/10/15 08:15	03/12/15 14:03	4165-60-0	
2-Fluorobiphenyl (S)	77	%	27-110		1	03/10/15 08:15	03/12/15 14:03	321-60-8	
Terphenyl-d14 (S)	96	%	31-107		1	03/10/15 08:15	03/12/15 14:03	1718-51-0	
Phenol-d6 (S)	36	%	10-110		1	03/10/15 08:15	03/12/15 14:03	13127-88-3	
2-Fluorophenol (S)	47	%	12-110		1	03/10/15 08:15	03/12/15 14:03	367-12-4	
2,4,6-Tribromophenol (S)	79	%	27-110		1	03/10/15 08:15	03/12/15 14:03	118-79-6	
8260 MSV Low Level SC	Analytical Method: EPA 8260								
Acetone	ND	ug/L	25.0	10.0	1		03/10/15 21:43	67-64-1	
Benzene	ND	ug/L	1.0	0.25	1		03/10/15 21:43	71-43-2	
Bromobenzene	ND	ug/L	1.0	0.30	1		03/10/15 21:43	108-86-1	
Bromochloromethane	ND	ug/L	1.0	0.17	1		03/10/15 21:43	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	0.18	1		03/10/15 21:43	75-27-4	
Bromoform	ND	ug/L	1.0	0.26	1		03/10/15 21:43	75-25-2	
Bromomethane	ND	ug/L	5.0	0.29	1		03/10/15 21:43	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	0.96	1		03/10/15 21:43	78-93-3	
Carbon tetrachloride	ND	ug/L	1.0	0.25	1		03/10/15 21:43	56-23-5	
Chlorobenzene	ND	ug/L	1.0	0.23	1		03/10/15 21:43	108-90-7	
Chloroethane	ND	ug/L	1.0	0.54	1		03/10/15 21:43	75-00-3	
Chloroform	ND	ug/L	1.0	0.14	1		03/10/15 21:43	67-66-3	
Chloromethane	ND	ug/L	1.0	0.11	1		03/10/15 21:43	74-87-3	
2-Chlorotoluene	ND	ug/L	1.0	0.35	1		03/10/15 21:43	95-49-8	
4-Chlorotoluene	ND	ug/L	1.0	0.31	1		03/10/15 21:43	106-43-4	
1,2-Dibromo-3-chloropropane	ND	ug/L	2.0	2.0	1		03/10/15 21:43	96-12-8	
Dibromochloromethane	ND	ug/L	1.0	0.21	1		03/10/15 21:43	124-48-1	
Dibromomethane	ND	ug/L	1.0	0.21	1		03/10/15 21:43	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	0.30	1		03/10/15 21:43	95-50-1	
1,3-Dichlorobenzene	ND	ug/L	1.0	0.24	1		03/10/15 21:43	541-73-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	0.33	1		03/10/15 21:43	106-46-7	
Dichlorodifluoromethane	ND	ug/L	1.0	0.21	1		03/10/15 21:43	75-71-8	
1,1-Dichloroethane	ND	ug/L	1.0	0.32	1		03/10/15 21:43	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	0.12	1		03/10/15 21:43	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	0.56	1		03/10/15 21:43	75-35-4	

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ANALYTICAL RESULTS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Sample: TW-6 **Lab ID: 92240289041** Collected: 03/03/15 16:30 Received: 03/09/15 16:55 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level SC	Analytical Method: EPA 8260								
cis-1,2-Dichloroethene	ND	ug/L	1.0	0.19	1		03/10/15 21:43	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	0.49	1		03/10/15 21:43	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	0.27	1		03/10/15 21:43	78-87-5	
1,3-Dichloropropane	ND	ug/L	1.0	0.28	1		03/10/15 21:43	142-28-9	
2,2-Dichloropropane	ND	ug/L	1.0	0.13	1		03/10/15 21:43	594-20-7	
1,1-Dichloropropene	ND	ug/L	1.0	0.49	1		03/10/15 21:43	563-58-6	
cis-1,3-Dichloropropene	ND	ug/L	1.0	0.13	1		03/10/15 21:43	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	0.26	1		03/10/15 21:43	10061-02-6	
Diisopropyl ether	ND	ug/L	1.0	0.12	1		03/10/15 21:43	108-20-3	
Ethylbenzene	ND	ug/L	1.0	0.30	1		03/10/15 21:43	100-41-4	
Hexachloro-1,3-butadiene	ND	ug/L	1.0	0.71	1		03/10/15 21:43	87-68-3	
2-Hexanone	ND	ug/L	5.0	0.46	1		03/10/15 21:43	591-78-6	
p-Isopropyltoluene	ND	ug/L	1.0	0.31	1		03/10/15 21:43	99-87-6	
Methylene Chloride	ND	ug/L	2.0	0.97	1		03/10/15 21:43	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	0.33	1		03/10/15 21:43	108-10-1	
Methyl-tert-butyl ether	ND	ug/L	1.0	0.21	1		03/10/15 21:43	1634-04-4	
Naphthalene	ND	ug/L	1.0	0.24	1		03/10/15 21:43	91-20-3	
Styrene	ND	ug/L	1.0	0.26	1		03/10/15 21:43	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	0.33	1		03/10/15 21:43	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	0.40	1		03/10/15 21:43	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	0.46	1		03/10/15 21:43	127-18-4	
Toluene	ND	ug/L	1.0	0.26	1		03/10/15 21:43	108-88-3	
1,2,3-Trichlorobenzene	ND	ug/L	1.0	0.33	1		03/10/15 21:43	87-61-6	
1,2,4-Trichlorobenzene	ND	ug/L	1.0	0.35	1		03/10/15 21:43	120-82-1	
1,1,1-Trichloroethane	ND	ug/L	1.0	0.48	1		03/10/15 21:43	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	0.29	1		03/10/15 21:43	79-00-5	
Trichloroethene	ND	ug/L	1.0	0.47	1		03/10/15 21:43	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	0.20	1		03/10/15 21:43	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	0.41	1		03/10/15 21:43	96-18-4	
Vinyl acetate	ND	ug/L	2.0	0.35	1		03/10/15 21:43	108-05-4	
Vinyl chloride	ND	ug/L	1.0	0.62	1		03/10/15 21:43	75-01-4	
Xylene (Total)	ND	ug/L	2.0	0.66	1		03/10/15 21:43	1330-20-7	
m&p-Xylene	ND	ug/L	2.0	0.66	1		03/10/15 21:43	179601-23-1	
o-Xylene	ND	ug/L	1.0	0.23	1		03/10/15 21:43	95-47-6	
Surrogates									
4-Bromofluorobenzene (S)	99	%	70-130		1		03/10/15 21:43	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130		1		03/10/15 21:43	17060-07-0	
Toluene-d8 (S)	97	%	70-130		1		03/10/15 21:43	2037-26-5	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MERP/7648
QC Batch Method: EPA 7470
Analysis Method: EPA 7470
Analysis Description: 7470 Mercury
Associated Lab Samples: 92240289040

METHOD BLANK: 1406658 Matrix: Water
Associated Lab Samples: 92240289040

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	03/11/15 12:14	

LABORATORY CONTROL SAMPLE: 1406659

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.5	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1406660 1406661

Parameter	Units	92240070001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	1.5	1.4	58	54	75-125	7	25	M1

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MERP/7662
QC Batch Method: EPA 7470
Analysis Method: EPA 7470
Analysis Description: 7470 Mercury
Associated Lab Samples: 92240289041

METHOD BLANK: 1410177 Matrix: Water
Associated Lab Samples: 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	03/14/15 13:36	

LABORATORY CONTROL SAMPLE: 1410178

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.6	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1410179 1410180

Parameter	Units	92240608001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.4	2.5	94	100	75-125	5	25	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MERP/7650 Analysis Method: EPA 7471
QC Batch Method: EPA 7471 Analysis Description: 7471 Mercury
Associated Lab Samples: 92240289020, 92240289021, 92240289022, 92240289023, 92240289024, 92240289025, 92240289026

METHOD BLANK: 1407297 Matrix: Solid
Associated Lab Samples: 92240289020, 92240289021, 92240289022, 92240289023, 92240289024, 92240289025, 92240289026

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	mg/kg	0.00035J	0.0050	03/11/15 13:43	

LABORATORY CONTROL SAMPLE: 1407298

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/kg	.067	0.068	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1407299 1407300

Parameter	Units	92240137001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	mg/kg	0.029	.057	.049	0.084	0.078	98	101	75-125	7	20	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MERP/7652 Analysis Method: EPA 7471
QC Batch Method: EPA 7471 Analysis Description: 7471 Mercury
Associated Lab Samples: 92240289027, 92240289028, 92240289029

METHOD BLANK: 1407883 Matrix: Solid
Associated Lab Samples: 92240289027, 92240289028, 92240289029

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	mg/kg	ND	0.0050	03/12/15 13:28	

LABORATORY CONTROL SAMPLE: 1407884

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/kg	.067	0.057	86	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1407885 1407886

Parameter	Units	92240289027 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	mg/kg	0.0084	.066	.056	0.066	0.061	88	94	75-125	8	20	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MPRP/18045 Analysis Method: EPA 6010
QC Batch Method: EPA 3050 Analysis Description: 6010 MET
Associated Lab Samples: 92240289020, 92240289021, 92240289022, 92240289023, 92240289024, 92240289025, 92240289026, 92240289027, 92240289028, 92240289029

METHOD BLANK: 1407132 Matrix: Solid
Associated Lab Samples: 92240289020, 92240289021, 92240289022, 92240289023, 92240289024, 92240289025, 92240289026, 92240289027, 92240289028, 92240289029

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Arsenic	mg/kg	ND	1.0	03/10/15 22:19	
Barium	mg/kg	ND	0.50	03/10/15 22:19	
Cadmium	mg/kg	ND	0.10	03/10/15 22:19	
Chromium	mg/kg	ND	0.50	03/10/15 22:19	
Lead	mg/kg	ND	0.50	03/10/15 22:19	
Selenium	mg/kg	ND	1.0	03/10/15 22:19	
Silver	mg/kg	ND	0.50	03/10/15 22:19	

LABORATORY CONTROL SAMPLE: 1407133

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	mg/kg	50	49.0	98	80-120	
Barium	mg/kg	50	46.1	92	80-120	
Cadmium	mg/kg	50	48.7	97	80-120	
Chromium	mg/kg	50	46.3	93	80-120	
Lead	mg/kg	50	48.3	97	80-120	
Selenium	mg/kg	50	49.4	99	80-120	
Silver	mg/kg	25	24.2	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1407134 1407135

Parameter	Units	92239874001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	mg/kg	ND	47.7	44.7	45.0	42.7	92	94	75-125	5	20	
Barium	mg/kg	52.0	47.7	44.7	93.8	104	88	115	75-125	10	20	
Cadmium	mg/kg	ND	47.7	44.7	44.1	41.2	92	92	75-125	7	20	
Chromium	mg/kg	2.3	47.7	44.7	44.7	42.3	89	90	75-125	6	20	
Lead	mg/kg	ND	47.7	44.7	43.5	40.4	90	89	75-125	7	20	
Selenium	mg/kg	ND	47.7	44.7	45.0	41.8	94	93	75-125	7	20	
Silver	mg/kg	ND	23.9	22.3	22.2	20.8	93	92	75-125	7	20	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MPRP/18042
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET
Associated Lab Samples: 92240289040, 92240289041

METHOD BLANK: 1406886 Matrix: Water
Associated Lab Samples: 92240289040, 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Arsenic	ug/L	ND	10.0	03/11/15 02:54	
Barium	ug/L	ND	5.0	03/11/15 02:54	
Cadmium	ug/L	0.082J	1.0	03/11/15 02:54	
Chromium	ug/L	ND	5.0	03/11/15 02:54	
Lead	ug/L	ND	5.0	03/11/15 02:54	
Selenium	ug/L	ND	10.0	03/11/15 02:54	
Silver	ug/L	ND	5.0	03/11/15 02:54	

LABORATORY CONTROL SAMPLE: 1406887

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	ug/L	500	467	93	80-120	
Barium	ug/L	500	454	91	80-120	
Cadmium	ug/L	500	472	94	80-120	
Chromium	ug/L	500	453	91	80-120	
Lead	ug/L	500	464	93	80-120	
Selenium	ug/L	500	474	95	80-120	
Silver	ug/L	250	234	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1406888 1406889

Parameter	Units	92240289040 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	ug/L	31.3	500	500	405	414	75	76	75-125	2	20	
Barium	ug/L	5120	500	500	5690	5630	114	101	75-125	1	20	
Cadmium	ug/L	4.1	500	500	410	415	81	82	75-125	1	20	
Chromium	ug/L	684	500	500	1090	1080	81	80	75-125	0	20	
Lead	ug/L	789	500	500	1170	1180	77	78	75-125	0	20	
Selenium	ug/L	17.2	500	500	359	369	68	70	75-125	3	20	M1
Silver	ug/L	ND	250	250	206	208	82	83	75-125	1	20	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30666 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level SC
Associated Lab Samples: 92240289040, 92240289041

METHOD BLANK: 1407128 Matrix: Water
Associated Lab Samples: 92240289040, 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	03/10/15 20:18	
1,1,1-Trichloroethane	ug/L	ND	1.0	03/10/15 20:18	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	03/10/15 20:18	
1,1,2-Trichloroethane	ug/L	ND	1.0	03/10/15 20:18	
1,1-Dichloroethane	ug/L	ND	1.0	03/10/15 20:18	
1,1-Dichloroethene	ug/L	ND	1.0	03/10/15 20:18	
1,1-Dichloropropene	ug/L	ND	1.0	03/10/15 20:18	
1,2,3-Trichlorobenzene	ug/L	ND	1.0	03/10/15 20:18	
1,2,3-Trichloropropane	ug/L	ND	1.0	03/10/15 20:18	
1,2,4-Trichlorobenzene	ug/L	ND	1.0	03/10/15 20:18	
1,2-Dibromo-3-chloropropane	ug/L	ND	2.0	03/10/15 20:18	
1,2-Dichlorobenzene	ug/L	ND	1.0	03/10/15 20:18	
1,2-Dichloroethane	ug/L	0.29J	1.0	03/10/15 20:18	
1,2-Dichloropropane	ug/L	ND	1.0	03/10/15 20:18	
1,3-Dichlorobenzene	ug/L	ND	1.0	03/10/15 20:18	
1,3-Dichloropropane	ug/L	ND	1.0	03/10/15 20:18	
1,4-Dichlorobenzene	ug/L	ND	1.0	03/10/15 20:18	
2,2-Dichloropropane	ug/L	ND	1.0	03/10/15 20:18	
2-Butanone (MEK)	ug/L	ND	5.0	03/10/15 20:18	
2-Chlorotoluene	ug/L	ND	1.0	03/10/15 20:18	
2-Hexanone	ug/L	ND	5.0	03/10/15 20:18	
4-Chlorotoluene	ug/L	ND	1.0	03/10/15 20:18	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	03/10/15 20:18	
Acetone	ug/L	ND	25.0	03/10/15 20:18	
Benzene	ug/L	ND	1.0	03/10/15 20:18	
Bromobenzene	ug/L	ND	1.0	03/10/15 20:18	
Bromochloromethane	ug/L	ND	1.0	03/10/15 20:18	
Bromodichloromethane	ug/L	ND	1.0	03/10/15 20:18	
Bromoform	ug/L	ND	1.0	03/10/15 20:18	
Bromomethane	ug/L	ND	5.0	03/10/15 20:18	
Carbon tetrachloride	ug/L	ND	1.0	03/10/15 20:18	
Chlorobenzene	ug/L	ND	1.0	03/10/15 20:18	
Chloroethane	ug/L	ND	1.0	03/10/15 20:18	
Chloroform	ug/L	ND	1.0	03/10/15 20:18	
Chloromethane	ug/L	ND	1.0	03/10/15 20:18	
cis-1,2-Dichloroethene	ug/L	ND	1.0	03/10/15 20:18	
cis-1,3-Dichloropropene	ug/L	ND	1.0	03/10/15 20:18	
Dibromochloromethane	ug/L	ND	1.0	03/10/15 20:18	
Dibromomethane	ug/L	ND	1.0	03/10/15 20:18	
Dichlorodifluoromethane	ug/L	ND	1.0	03/10/15 20:18	
Diisopropyl ether	ug/L	ND	1.0	03/10/15 20:18	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

METHOD BLANK: 1407128 Matrix: Water
Associated Lab Samples: 92240289040, 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Ethylbenzene	ug/L	ND	1.0	03/10/15 20:18	
Hexachloro-1,3-butadiene	ug/L	ND	1.0	03/10/15 20:18	
m&p-Xylene	ug/L	ND	2.0	03/10/15 20:18	
Methyl-tert-butyl ether	ug/L	ND	1.0	03/10/15 20:18	
Methylene Chloride	ug/L	ND	2.0	03/10/15 20:18	
Naphthalene	ug/L	ND	1.0	03/10/15 20:18	
o-Xylene	ug/L	ND	1.0	03/10/15 20:18	
p-Isopropyltoluene	ug/L	ND	1.0	03/10/15 20:18	
Styrene	ug/L	ND	1.0	03/10/15 20:18	
Tetrachloroethene	ug/L	ND	1.0	03/10/15 20:18	
Toluene	ug/L	ND	1.0	03/10/15 20:18	
trans-1,2-Dichloroethene	ug/L	ND	1.0	03/10/15 20:18	
trans-1,3-Dichloropropene	ug/L	ND	1.0	03/10/15 20:18	
Trichloroethene	ug/L	ND	1.0	03/10/15 20:18	
Trichlorofluoromethane	ug/L	ND	1.0	03/10/15 20:18	
Vinyl acetate	ug/L	ND	2.0	03/10/15 20:18	
Vinyl chloride	ug/L	ND	1.0	03/10/15 20:18	
Xylene (Total)	ug/L	ND	2.0	03/10/15 20:18	
1,2-Dichloroethane-d4 (S)	%	105	70-130	03/10/15 20:18	
4-Bromofluorobenzene (S)	%	100	70-130	03/10/15 20:18	
Toluene-d8 (S)	%	97	70-130	03/10/15 20:18	

LABORATORY CONTROL SAMPLE: 1407129

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	49.9	100	70-130	
1,1,1-Trichloroethane	ug/L	50	50.0	100	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	46.7	93	70-130	
1,1,2-Trichloroethane	ug/L	50	50.9	102	70-130	
1,1-Dichloroethane	ug/L	50	48.6	97	70-130	
1,1-Dichloroethene	ug/L	50	45.6	91	70-130	
1,1-Dichloropropene	ug/L	50	52.5	105	70-130	
1,2,3-Trichlorobenzene	ug/L	50	53.6	107	70-130	
1,2,3-Trichloropropane	ug/L	50	46.9	94	70-130	
1,2,4-Trichlorobenzene	ug/L	50	53.7	107	70-130	
1,2-Dibromo-3-chloropropane	ug/L	50	51.5	103	70-130	
1,2-Dichlorobenzene	ug/L	50	50.0	100	70-130	
1,2-Dichloroethane	ug/L	50	49.2	98	70-130	
1,2-Dichloropropane	ug/L	50	50.2	100	70-130	
1,3-Dichlorobenzene	ug/L	50	49.9	100	70-130	
1,3-Dichloropropane	ug/L	50	49.1	98	70-130	
1,4-Dichlorobenzene	ug/L	50	49.1	98	70-130	
2,2-Dichloropropane	ug/L	50	49.1	98	70-130	
2-Butanone (MEK)	ug/L	100	101	101	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1407129

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2-Chlorotoluene	ug/L	50	45.9	92	70-130	
2-Hexanone	ug/L	100	108	108	70-130	
4-Chlorotoluene	ug/L	50	49.5	99	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	100	114	114	70-130	
Acetone	ug/L	100	106	106	70-130	
Benzene	ug/L	50	51.3	103	70-130	
Bromobenzene	ug/L	50	50.3	101	70-130	
Bromochloromethane	ug/L	50	50.6	101	70-130	
Bromodichloromethane	ug/L	50	46.9	94	70-130	
Bromoform	ug/L	50	45.6	91	70-130	
Bromomethane	ug/L	50	52.8	106	70-130	
Carbon tetrachloride	ug/L	50	51.1	102	70-130	
Chlorobenzene	ug/L	50	48.6	97	70-130	
Chloroethane	ug/L	50	49.2	98	70-130	
Chloroform	ug/L	50	45.1	90	70-130	
Chloromethane	ug/L	50	50.2	100	70-130	
cis-1,2-Dichloroethene	ug/L	50	50.7	101	70-130	
cis-1,3-Dichloropropene	ug/L	50	52.8	106	70-130	
Dibromochloromethane	ug/L	50	45.3	91	70-130	
Dibromomethane	ug/L	50	48.7	97	70-130	
Dichlorodifluoromethane	ug/L	50	59.7	119	70-130	
Diisopropyl ether	ug/L	50	52.2	104	70-130	
Ethylbenzene	ug/L	50	49.3	99	70-130	
Hexachloro-1,3-butadiene	ug/L	50	49.7	99	70-130	
m&p-Xylene	ug/L	100	98.6	99	70-130	
Methyl-tert-butyl ether	ug/L	50	52.5	105	70-130	
Methylene Chloride	ug/L	50	50.8	102	70-130	
Naphthalene	ug/L	50	47.1	94	70-130	
o-Xylene	ug/L	50	50.0	100	70-130	
p-Isopropyltoluene	ug/L	50	50.3	101	70-130	
Styrene	ug/L	50	53.2	106	70-130	
Tetrachloroethene	ug/L	50	50.1	100	70-130	
Toluene	ug/L	50	49.5	99	70-130	
trans-1,2-Dichloroethene	ug/L	50	48.7	97	70-130	
trans-1,3-Dichloropropene	ug/L	50	52.8	106	70-130	
Trichloroethene	ug/L	50	49.5	99	70-130	
Trichlorofluoromethane	ug/L	50	48.0	96	70-130	
Vinyl acetate	ug/L	100	101	101	70-130	
Vinyl chloride	ug/L	50	52.2	104	70-130	
Xylene (Total)	ug/L	150	149	99	70-130	
1,2-Dichloroethane-d4 (S)	%			98	70-130	
4-Bromofluorobenzene (S)	%			100	70-130	
Toluene-d8 (S)	%			101	70-130	

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Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1407131

Parameter	Units	92240143001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	22.1	110	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	23.0	115	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	19.9	99	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	21.1	105	70-130	
1,1-Dichloroethane	ug/L	ND	20	21.3	106	70-130	
1,1-Dichloroethene	ug/L	ND	20	20.5	102	70-130	
1,1-Dichloropropene	ug/L	ND	20	22.5	113	70-130	
1,2,3-Trichlorobenzene	ug/L	ND	20	20.1	100	70-130	
1,2,3-Trichloropropane	ug/L	ND	20	21.1	106	70-130	
1,2,4-Trichlorobenzene	ug/L	ND	20	19.3	97	70-130	
1,2-Dibromo-3-chloropropane	ug/L	ND	20	20.0	100	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	20.8	104	70-130	
1,2-Dichloroethane	ug/L	ND	20	21.6	108	70-130	
1,2-Dichloropropane	ug/L	ND	20	21.0	105	70-130	
1,3-Dichlorobenzene	ug/L	ND	20	21.2	106	70-130	
1,3-Dichloropropane	ug/L	ND	20	20.7	103	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	21.3	107	70-130	
2,2-Dichloropropane	ug/L	ND	20	19.4	97	70-130	
2-Butanone (MEK)	ug/L	ND	40	38.9	97	70-130	
2-Chlorotoluene	ug/L	ND	20	19.4	97	70-130	
2-Hexanone	ug/L	ND	40	44.6	112	70-130	
4-Chlorotoluene	ug/L	ND	20	21.6	108	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	44.6	111	70-130	
Acetone	ug/L	ND	40	52.7	132	70-130	M1
Benzene	ug/L	ND	20	22.0	110	70-130	
Bromobenzene	ug/L	ND	20	20.6	103	70-130	
Bromochloromethane	ug/L	ND	20	22.7	113	70-130	
Bromodichloromethane	ug/L	ND	20	20.0	100	70-130	
Bromoform	ug/L	ND	20	19.0	95	70-130	
Bromomethane	ug/L	ND	20	13.5	68	70-130	M1
Carbon tetrachloride	ug/L	ND	20	24.3	122	70-130	
Chlorobenzene	ug/L	ND	20	21.6	108	70-130	
Chloroethane	ug/L	ND	20	23.2	116	70-130	
Chloroform	ug/L	ND	20	19.3	96	70-130	
Chloromethane	ug/L	ND	20	20.2	101	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	21.2	106	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	18.6	93	70-130	
Dibromochloromethane	ug/L	ND	20	19.1	95	70-130	
Dibromomethane	ug/L	ND	20	20.2	101	70-130	
Dichlorodifluoromethane	ug/L	ND	20	27.1	136	70-130	M1
Diisopropyl ether	ug/L	ND	20	20.4	102	70-130	
Ethylbenzene	ug/L	ND	20	21.8	109	70-130	
Hexachloro-1,3-butadiene	ug/L	ND	20	24.2	121	70-130	
m&p-Xylene	ug/L	ND	40	44.2	110	70-130	
Methyl-tert-butyl ether	ug/L	ND	20	20.4	102	70-130	
Methylene Chloride	ug/L	ND	20	20.7	103	70-130	
Naphthalene	ug/L	ND	20	18.0	90	70-130	

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(704)875-9092

QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1407131

Parameter	Units	92240143001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
o-Xylene	ug/L	ND	20	20.4	102	70-130	
p-Isopropyltoluene	ug/L	ND	20	20.9	105	70-130	
Styrene	ug/L	ND	20	21.8	109	70-130	
Tetrachloroethene	ug/L	ND	20	22.1	110	70-130	
Toluene	ug/L	ND	20	21.1	105	70-130	
trans-1,2-Dichloroethene	ug/L	ND	20	21.6	108	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	20.9	105	70-130	
Trichloroethene	ug/L	ND	20	22.9	114	70-130	
Trichlorofluoromethane	ug/L	ND	20	23.8	119	70-130	
Vinyl acetate	ug/L	ND	40	32.5	81	70-130	
Vinyl chloride	ug/L	ND	20	21.7	108	70-130	
1,2-Dichloroethane-d4 (S)	%				99	70-130	
4-Bromofluorobenzene (S)	%				96	70-130	
Toluene-d8 (S)	%				97	70-130	

SAMPLE DUPLICATE: 1407130

Parameter	Units	92240143002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,1-Dichloropropene	ug/L	ND	ND		30	
1,2,3-Trichlorobenzene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2,4-Trichlorobenzene	ug/L	ND	ND		30	
1,2-Dibromo-3-chloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,3-Dichlorobenzene	ug/L	ND	ND		30	
1,3-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2,2-Dichloropropane	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Chlorotoluene	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Chlorotoluene	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromobenzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

SAMPLE DUPLICATE: 1407130

Parameter	Units	92240143002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	
Bromomethane	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Dichlorodifluoromethane	ug/L	ND	ND		30	
Diisopropyl ether	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Hexachloro-1,3-butadiene	ug/L	ND	ND		30	
m&p-Xylene	ug/L	ND	ND		30	
Methyl-tert-butyl ether	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Naphthalene	ug/L	ND	ND		30	
o-Xylene	ug/L	ND	ND		30	
p-Isopropyltoluene	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	108	111	2		
4-Bromofluorobenzene (S)	%	100	101	1		
Toluene-d8 (S)	%	96	97	1		

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30684 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level SC
Associated Lab Samples: 92240289035, 92240289036, 92240289038, 92240289039

METHOD BLANK: 1408410 Matrix: Water
Associated Lab Samples: 92240289035, 92240289036, 92240289038, 92240289039

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	03/11/15 16:02	
1,1,1-Trichloroethane	ug/L	ND	1.0	03/11/15 16:02	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	03/11/15 16:02	
1,1,2-Trichloroethane	ug/L	ND	1.0	03/11/15 16:02	
1,1-Dichloroethane	ug/L	ND	1.0	03/11/15 16:02	
1,1-Dichloroethene	ug/L	ND	1.0	03/11/15 16:02	
1,1-Dichloropropene	ug/L	ND	1.0	03/11/15 16:02	
1,2,3-Trichlorobenzene	ug/L	ND	1.0	03/11/15 16:02	
1,2,3-Trichloropropane	ug/L	ND	1.0	03/11/15 16:02	
1,2,4-Trichlorobenzene	ug/L	ND	1.0	03/11/15 16:02	
1,2-Dibromo-3-chloropropane	ug/L	ND	2.0	03/11/15 16:02	
1,2-Dichlorobenzene	ug/L	ND	1.0	03/11/15 16:02	
1,2-Dichloroethane	ug/L	0.20J	1.0	03/11/15 16:02	
1,2-Dichloropropane	ug/L	ND	1.0	03/11/15 16:02	
1,3-Dichlorobenzene	ug/L	ND	1.0	03/11/15 16:02	
1,3-Dichloropropane	ug/L	ND	1.0	03/11/15 16:02	
1,4-Dichlorobenzene	ug/L	ND	1.0	03/11/15 16:02	
2,2-Dichloropropane	ug/L	ND	1.0	03/11/15 16:02	
2-Butanone (MEK)	ug/L	ND	5.0	03/11/15 16:02	
2-Chlorotoluene	ug/L	ND	1.0	03/11/15 16:02	
2-Hexanone	ug/L	ND	5.0	03/11/15 16:02	
4-Chlorotoluene	ug/L	ND	1.0	03/11/15 16:02	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	03/11/15 16:02	
Acetone	ug/L	ND	25.0	03/11/15 16:02	
Benzene	ug/L	ND	1.0	03/11/15 16:02	
Bromobenzene	ug/L	ND	1.0	03/11/15 16:02	
Bromochloromethane	ug/L	ND	1.0	03/11/15 16:02	
Bromodichloromethane	ug/L	ND	1.0	03/11/15 16:02	
Bromoform	ug/L	ND	1.0	03/11/15 16:02	
Bromomethane	ug/L	ND	5.0	03/11/15 16:02	
Carbon tetrachloride	ug/L	ND	1.0	03/11/15 16:02	
Chlorobenzene	ug/L	ND	1.0	03/11/15 16:02	
Chloroethane	ug/L	ND	1.0	03/11/15 16:02	
Chloroform	ug/L	ND	1.0	03/11/15 16:02	
Chloromethane	ug/L	ND	1.0	03/11/15 16:02	
cis-1,2-Dichloroethene	ug/L	ND	1.0	03/11/15 16:02	
cis-1,3-Dichloropropene	ug/L	ND	1.0	03/11/15 16:02	
Dibromochloromethane	ug/L	ND	1.0	03/11/15 16:02	
Dibromomethane	ug/L	ND	1.0	03/11/15 16:02	
Dichlorodifluoromethane	ug/L	ND	1.0	03/11/15 16:02	
Diisopropyl ether	ug/L	ND	1.0	03/11/15 16:02	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

METHOD BLANK: 1408410 Matrix: Water
Associated Lab Samples: 92240289035, 92240289036, 92240289038, 92240289039

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Ethylbenzene	ug/L	ND	1.0	03/11/15 16:02	
Hexachloro-1,3-butadiene	ug/L	ND	1.0	03/11/15 16:02	
m&p-Xylene	ug/L	ND	2.0	03/11/15 16:02	
Methyl-tert-butyl ether	ug/L	ND	1.0	03/11/15 16:02	
Methylene Chloride	ug/L	ND	2.0	03/11/15 16:02	
Naphthalene	ug/L	ND	1.0	03/11/15 16:02	
o-Xylene	ug/L	ND	1.0	03/11/15 16:02	
p-Isopropyltoluene	ug/L	ND	1.0	03/11/15 16:02	
Styrene	ug/L	ND	1.0	03/11/15 16:02	
Tetrachloroethene	ug/L	ND	1.0	03/11/15 16:02	
Toluene	ug/L	ND	1.0	03/11/15 16:02	
trans-1,2-Dichloroethene	ug/L	ND	1.0	03/11/15 16:02	
trans-1,3-Dichloropropene	ug/L	ND	1.0	03/11/15 16:02	
Trichloroethene	ug/L	ND	1.0	03/11/15 16:02	
Trichlorofluoromethane	ug/L	ND	1.0	03/11/15 16:02	
Vinyl acetate	ug/L	ND	2.0	03/11/15 16:02	
Vinyl chloride	ug/L	ND	1.0	03/11/15 16:02	
Xylene (Total)	ug/L	ND	2.0	03/11/15 16:02	
1,2-Dichloroethane-d4 (S)	%	109	70-130	03/11/15 16:02	
4-Bromofluorobenzene (S)	%	98	70-130	03/11/15 16:02	
Toluene-d8 (S)	%	95	70-130	03/11/15 16:02	

LABORATORY CONTROL SAMPLE: 1408411

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	51.6	103	70-130	
1,1,1-Trichloroethane	ug/L	50	52.6	105	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	48.2	96	70-130	
1,1,2-Trichloroethane	ug/L	50	50.9	102	70-130	
1,1-Dichloroethane	ug/L	50	51.5	103	70-130	
1,1-Dichloroethene	ug/L	50	48.3	97	70-130	
1,1-Dichloropropene	ug/L	50	55.8	112	70-130	
1,2,3-Trichlorobenzene	ug/L	50	55.7	111	70-130	
1,2,3-Trichloropropane	ug/L	50	49.6	99	70-130	
1,2,4-Trichlorobenzene	ug/L	50	56.7	113	70-130	
1,2-Dibromo-3-chloropropane	ug/L	50	54.3	109	70-130	
1,2-Dichlorobenzene	ug/L	50	52.0	104	70-130	
1,2-Dichloroethane	ug/L	50	51.0	102	70-130	
1,2-Dichloropropane	ug/L	50	51.4	103	70-130	
1,3-Dichlorobenzene	ug/L	50	51.2	102	70-130	
1,3-Dichloropropane	ug/L	50	51.1	102	70-130	
1,4-Dichlorobenzene	ug/L	50	51.6	103	70-130	
2,2-Dichloropropane	ug/L	50	53.4	107	70-130	
2-Butanone (MEK)	ug/L	100	113	113	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1408411

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2-Chlorotoluene	ug/L	50	46.8	94	70-130	
2-Hexanone	ug/L	100	117	117	70-130	
4-Chlorotoluene	ug/L	50	50.7	101	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	100	121	121	70-130	
Acetone	ug/L	100	114	114	70-130	
Benzene	ug/L	50	52.8	106	70-130	
Bromobenzene	ug/L	50	49.7	99	70-130	
Bromochloromethane	ug/L	50	50.7	101	70-130	
Bromodichloromethane	ug/L	50	48.0	96	70-130	
Bromoform	ug/L	50	47.8	96	70-130	
Bromomethane	ug/L	50	56.0	112	70-130	
Carbon tetrachloride	ug/L	50	52.9	106	70-130	
Chlorobenzene	ug/L	50	49.5	99	70-130	
Chloroethane	ug/L	50	53.3	107	70-130	
Chloroform	ug/L	50	46.3	93	70-130	
Chloromethane	ug/L	50	50.9	102	70-130	
cis-1,2-Dichloroethene	ug/L	50	52.1	104	70-130	
cis-1,3-Dichloropropene	ug/L	50	54.0	108	70-130	
Dibromochloromethane	ug/L	50	45.9	92	70-130	
Dibromomethane	ug/L	50	51.1	102	70-130	
Dichlorodifluoromethane	ug/L	50	60.7	121	70-130	
Diisopropyl ether	ug/L	50	54.5	109	70-130	
Ethylbenzene	ug/L	50	50.3	101	70-130	
Hexachloro-1,3-butadiene	ug/L	50	63.1	126	70-130	
m&p-Xylene	ug/L	100	101	101	70-130	
Methyl-tert-butyl ether	ug/L	50	54.5	109	70-130	
Methylene Chloride	ug/L	50	53.5	107	70-130	
Naphthalene	ug/L	50	49.0	98	70-130	
o-Xylene	ug/L	50	50.9	102	70-130	
p-Isopropyltoluene	ug/L	50	53.6	107	70-130	
Styrene	ug/L	50	54.6	109	70-130	
Tetrachloroethene	ug/L	50	51.6	103	70-130	
Toluene	ug/L	50	50.8	102	70-130	
trans-1,2-Dichloroethene	ug/L	50	52.5	105	70-130	
trans-1,3-Dichloropropene	ug/L	50	54.6	109	70-130	
Trichloroethene	ug/L	50	51.5	103	70-130	
Trichlorofluoromethane	ug/L	50	51.9	104	70-130	
Vinyl acetate	ug/L	100	106	106	70-130	
Vinyl chloride	ug/L	50	54.6	109	70-130	
Xylene (Total)	ug/L	150	152	101	70-130	
1,2-Dichloroethane-d4 (S)	%			97	70-130	
4-Bromofluorobenzene (S)	%			95	70-130	
Toluene-d8 (S)	%			101	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1408413

Parameter	Units	92240301016 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	24.5	122	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	25.9	130	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	22.0	110	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	23.0	115	70-130	
1,1-Dichloroethane	ug/L	ND	20	23.3	117	70-130	
1,1-Dichloroethene	ug/L	ND	20	23.7	119	70-130	
1,1-Dichloropropene	ug/L	ND	20	24.8	124	70-130	
1,2,3-Trichlorobenzene	ug/L	ND	20	20.0	100	70-130	
1,2,3-Trichloropropane	ug/L	ND	20	23.2	116	70-130	
1,2,4-Trichlorobenzene	ug/L	ND	20	19.9	99	70-130	
1,2-Dibromo-3-chloropropane	ug/L	ND	20	22.6	113	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	21.7	108	70-130	
1,2-Dichloroethane	ug/L	ND	20	24.4	122	70-130	
1,2-Dichloropropane	ug/L	ND	20	22.7	113	70-130	
1,3-Dichlorobenzene	ug/L	ND	20	22.1	111	70-130	
1,3-Dichloropropane	ug/L	ND	20	22.8	114	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	21.8	109	70-130	
2,2-Dichloropropane	ug/L	ND	20	23.3	117	70-130	
2-Butanone (MEK)	ug/L	ND	40	43.4	109	70-130	
2-Chlorotoluene	ug/L	ND	20	19.8	99	70-130	
2-Hexanone	ug/L	ND	40	49.6	124	70-130	
4-Chlorotoluene	ug/L	ND	20	22.4	112	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	50.2	125	70-130	
Acetone	ug/L	ND	40	50.9	127	70-130	
Benzene	ug/L	ND	20	24.3	121	70-130	
Bromobenzene	ug/L	ND	20	21.4	107	70-130	
Bromochloromethane	ug/L	ND	20	23.9	119	70-130	
Bromodichloromethane	ug/L	ND	20	22.6	113	70-130	
Bromoform	ug/L	ND	20	21.6	108	70-130	
Bromomethane	ug/L	ND	20	15.9	80	70-130	
Carbon tetrachloride	ug/L	ND	20	27.6	138	70-130	M1
Chlorobenzene	ug/L	ND	20	23.4	117	70-130	
Chloroethane	ug/L	ND	20	25.2	126	70-130	
Chloroform	ug/L	ND	20	22.1	110	70-130	
Chloromethane	ug/L	ND	20	21.3	106	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	22.4	112	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	20.5	103	70-130	
Dibromochloromethane	ug/L	ND	20	20.7	103	70-130	
Dibromomethane	ug/L	ND	20	22.8	114	70-130	
Dichlorodifluoromethane	ug/L	ND	20	28.7	144	70-130	M1
Diisopropyl ether	ug/L	ND	20	22.4	112	70-130	
Ethylbenzene	ug/L	ND	20	23.6	118	70-130	
Hexachloro-1,3-butadiene	ug/L	ND	20	22.3	111	70-130	
m&p-Xylene	ug/L	ND	40	47.6	118	70-130	
Methyl-tert-butyl ether	ug/L	ND	20	23.2	116	70-130	
Methylene Chloride	ug/L	ND	20	23.2	116	70-130	
Naphthalene	ug/L	ND	20	17.3	86	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1408413

Parameter	Units	92240301016 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
o-Xylene	ug/L	ND	20	22.5	113	70-130	
p-Isopropyltoluene	ug/L	ND	20	21.6	108	70-130	
Styrene	ug/L	ND	20	24.0	120	70-130	
Tetrachloroethene	ug/L	ND	20	23.6	118	70-130	
Toluene	ug/L	ND	20	23.4	117	70-130	
trans-1,2-Dichloroethene	ug/L	ND	20	23.4	117	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	23.4	117	70-130	
Trichloroethene	ug/L	ND	20	24.6	123	70-130	
Trichlorofluoromethane	ug/L	ND	20	27.0	135	70-130	M1
Vinyl acetate	ug/L	ND	40	39.7	99	70-130	
Vinyl chloride	ug/L	ND	20	22.9	114	70-130	
1,2-Dichloroethane-d4 (S)	%				96	70-130	
4-Bromofluorobenzene (S)	%				98	70-130	
Toluene-d8 (S)	%				97	70-130	

SAMPLE DUPLICATE: 1408412

Parameter	Units	92240301015 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,1-Dichloropropene	ug/L	ND	ND		30	
1,2,3-Trichlorobenzene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2,4-Trichlorobenzene	ug/L	ND	ND		30	
1,2-Dibromo-3-chloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,3-Dichlorobenzene	ug/L	ND	ND		30	
1,3-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2,2-Dichloropropane	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Chlorotoluene	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Chlorotoluene	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromobenzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

SAMPLE DUPLICATE: 1408412

Parameter	Units	92240301015 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	
Bromomethane	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Dichlorodifluoromethane	ug/L	ND	ND		30	
Diisopropyl ether	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Hexachloro-1,3-butadiene	ug/L	ND	ND		30	
m&p-Xylene	ug/L	ND	ND		30	
Methyl-tert-butyl ether	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Naphthalene	ug/L	ND	ND		30	
o-Xylene	ug/L	ND	ND		30	
p-Isopropyltoluene	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	107	110	3		
4-Bromofluorobenzene (S)	%	101	100	1		
Toluene-d8 (S)	%	96	96	0		

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30694
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV Low Level SC
Associated Lab Samples: 92240289037

METHOD BLANK: 1409522
Matrix: Water
Associated Lab Samples: 92240289037

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	03/12/15 16:18	
Ethylbenzene	ug/L	ND	1.0	03/12/15 16:18	
m&p-Xylene	ug/L	ND	2.0	03/12/15 16:18	
Methyl-tert-butyl ether	ug/L	ND	1.0	03/12/15 16:18	
Naphthalene	ug/L	ND	1.0	03/12/15 16:18	
o-Xylene	ug/L	ND	1.0	03/12/15 16:18	
Toluene	ug/L	ND	1.0	03/12/15 16:18	
Xylene (Total)	ug/L	ND	2.0	03/12/15 16:18	
1,2-Dichloroethane-d4 (S)	%	109	70-130	03/12/15 16:18	
4-Bromofluorobenzene (S)	%	103	70-130	03/12/15 16:18	
Toluene-d8 (S)	%	95	70-130	03/12/15 16:18	

LABORATORY CONTROL SAMPLE: 1409523

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	50.6	101	70-130	
Ethylbenzene	ug/L	50	49.2	98	70-130	
m&p-Xylene	ug/L	100	97.9	98	70-130	
Methyl-tert-butyl ether	ug/L	50	52.2	104	70-130	
Naphthalene	ug/L	50	46.0	92	70-130	
o-Xylene	ug/L	50	49.3	99	70-130	
Toluene	ug/L	50	49.5	99	70-130	
Xylene (Total)	ug/L	150	147	98	70-130	
1,2-Dichloroethane-d4 (S)	%			98	70-130	
4-Bromofluorobenzene (S)	%			100	70-130	
Toluene-d8 (S)	%			101	70-130	

MATRIX SPIKE SAMPLE: 1409525

Parameter	Units	92240421006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	ND	20	24.3	121	70-130	
Ethylbenzene	ug/L	ND	20	23.2	116	70-130	
m&p-Xylene	ug/L	ND	40	47.6	119	70-130	
Methyl-tert-butyl ether	ug/L	ND	20	22.0	110	70-130	
Naphthalene	ug/L	ND	20	17.0	85	70-130	
o-Xylene	ug/L	ND	20	22.2	111	70-130	
Toluene	ug/L	ND	20	23.6	118	70-130	
1,2-Dichloroethane-d4 (S)	%				97	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1409525

Parameter	Units	92240421006 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
4-Bromofluorobenzene (S)	%				96	70-130	
Toluene-d8 (S)	%				99	70-130	

SAMPLE DUPLICATE: 1409524

Parameter	Units	92240421005 Result	Dup Result	RPD	Max RPD	Qualifiers
Benzene	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
m&p-Xylene	ug/L	ND	ND		30	
Methyl-tert-butyl ether	ug/L	ND	ND		30	
Naphthalene	ug/L	ND	ND		30	
o-Xylene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	112	114	2		
4-Bromofluorobenzene (S)	%	107	107	0		
Toluene-d8 (S)	%	96	96	1		

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30656 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV 5035A Volatile Organics
Associated Lab Samples: 92240289001, 92240289002, 92240289003, 92240289004, 92240289005, 92240289006, 92240289007, 92240289008, 92240289009

METHOD BLANK: 1406624 Matrix: Solid
Associated Lab Samples: 92240289001, 92240289002, 92240289003, 92240289004, 92240289005, 92240289006, 92240289007, 92240289008, 92240289009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	6.7	03/10/15 12:33	
Ethylbenzene	ug/kg	ND	6.7	03/10/15 12:33	
m&p-Xylene	ug/kg	ND	13.5	03/10/15 12:33	
Methyl-tert-butyl ether	ug/kg	ND	6.7	03/10/15 12:33	
Naphthalene	ug/kg	ND	6.7	03/10/15 12:33	
o-Xylene	ug/kg	ND	6.7	03/10/15 12:33	
Toluene	ug/kg	ND	6.7	03/10/15 12:33	
Xylene (Total)	ug/kg	ND	13.5	03/10/15 12:33	
1,2-Dichloroethane-d4 (S)	%	94	70-130	03/10/15 12:33	
4-Bromofluorobenzene (S)	%	95	70-130	03/10/15 12:33	
Toluene-d8 (S)	%	102	70-130	03/10/15 12:33	

LABORATORY CONTROL SAMPLE: 1406625

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	69.6	71.2	102	70-130	
Ethylbenzene	ug/kg	69.6	70.1	101	70-130	
m&p-Xylene	ug/kg	139	139	100	70-130	
Methyl-tert-butyl ether	ug/kg	69.6	61.8	89	70-130	
Naphthalene	ug/kg	69.6	72.2	104	70-130	
o-Xylene	ug/kg	69.6	70.5	101	70-130	
Toluene	ug/kg	69.6	68.8	99	70-130	
Xylene (Total)	ug/kg	209	210	100	70-130	
1,2-Dichloroethane-d4 (S)	%			96	70-130	
4-Bromofluorobenzene (S)	%			102	70-130	
Toluene-d8 (S)	%			100	70-130	

MATRIX SPIKE SAMPLE: 1407692

Parameter	Units	92240301001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	ND	13.3	11.4	85	70-130	
Ethylbenzene	ug/kg	ND	13.3	11.2	84	70-130	
m&p-Xylene	ug/kg	ND	26.6	23.0	86	70-130	
Methyl-tert-butyl ether	ug/kg	ND	13.3	12.5	94	70-130	
Naphthalene	ug/kg	ND	13.3	12.3	92	70-130	
o-Xylene	ug/kg	ND	13.3	11.3	85	70-130	
Toluene	ug/kg	ND	13.3	11.9	89	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1407692

Parameter	Units	92240301001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,2-Dichloroethane-d4 (S)	%				106	70-130	
4-Bromofluorobenzene (S)	%				104	70-130	
Toluene-d8 (S)	%				101	70-130	

SAMPLE DUPLICATE: 1407691

Parameter	Units	92240289001 Result	Dup Result	RPD	Max RPD	Qualifiers
Benzene	ug/kg	ND	ND		30	
Ethylbenzene	ug/kg	ND	ND		30	
m&p-Xylene	ug/kg	ND	ND		30	
Methyl-tert-butyl ether	ug/kg	ND	ND		30	
Naphthalene	ug/kg	ND	ND		30	
o-Xylene	ug/kg	ND	ND		30	
Toluene	ug/kg	ND	ND		30	
Xylene (Total)	ug/kg	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	115	114	5		
4-Bromofluorobenzene (S)	%	104	103	5		
Toluene-d8 (S)	%	103	103	5		

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30657 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV 5035A Volatile Organics
Associated Lab Samples: 92240289011, 92240289012, 92240289013, 92240289014

METHOD BLANK: 1406626 Matrix: Solid
Associated Lab Samples: 92240289011, 92240289012, 92240289013, 92240289014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	5.6	03/10/15 12:13	
Ethylbenzene	ug/kg	ND	5.6	03/10/15 12:13	
m&p-Xylene	ug/kg	ND	11.2	03/10/15 12:13	
Methyl-tert-butyl ether	ug/kg	ND	5.6	03/10/15 12:13	
Naphthalene	ug/kg	1.7J	5.6	03/10/15 12:13	
o-Xylene	ug/kg	ND	5.6	03/10/15 12:13	
Toluene	ug/kg	ND	5.6	03/10/15 12:13	
Xylene (Total)	ug/kg	ND	11.2	03/10/15 12:13	
1,2-Dichloroethane-d4 (S)	%	94	70-130	03/10/15 12:13	
4-Bromofluorobenzene (S)	%	95	70-130	03/10/15 12:13	
Toluene-d8 (S)	%	103	70-130	03/10/15 12:13	

LABORATORY CONTROL SAMPLE: 1406627

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	65.8	72.2	110	70-130	
Ethylbenzene	ug/kg	65.8	72.4	110	70-130	
m&p-Xylene	ug/kg	132	142	108	70-130	
Methyl-tert-butyl ether	ug/kg	65.8	67.4	102	70-130	
Naphthalene	ug/kg	65.8	71.4	108	70-130	
o-Xylene	ug/kg	65.8	71.0	108	70-130	
Toluene	ug/kg	65.8	72.0	109	70-130	
Xylene (Total)	ug/kg	197	213	108	70-130	
1,2-Dichloroethane-d4 (S)	%			99	70-130	
4-Bromofluorobenzene (S)	%			103	70-130	
Toluene-d8 (S)	%			100	70-130	

MATRIX SPIKE SAMPLE: 1407699

Parameter	Units	92240289012 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	ND	11.1	10.0	90	70-130	
Ethylbenzene	ug/kg	ND	11.1	9.7	87	70-130	
m&p-Xylene	ug/kg	ND	22.3	19.4	86	70-130	
Methyl-tert-butyl ether	ug/kg	ND	11.1	10.1	91	70-130	
Naphthalene	ug/kg	ND	11.1	10	86	70-130	
o-Xylene	ug/kg	ND	11.1	9.5	85	70-130	
Toluene	ug/kg	ND	11.1	10.1	90	70-130	
1,2-Dichloroethane-d4 (S)	%				107	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1407699

Parameter	Units	92240289012 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
4-Bromofluorobenzene (S)	%				102	70-130	
Toluene-d8 (S)	%				103	70-130	

SAMPLE DUPLICATE: 1407698

Parameter	Units	92240289011 Result	Dup Result	RPD	Max RPD	Qualifiers
Benzene	ug/kg	ND	ND		30	
Ethylbenzene	ug/kg	ND	ND		30	
m&p-Xylene	ug/kg	ND	ND		30	
Methyl-tert-butyl ether	ug/kg	ND	ND		30	
Naphthalene	ug/kg	0.99J	ND		30	
o-Xylene	ug/kg	ND	ND		30	
Toluene	ug/kg	ND	ND		30	
Xylene (Total)	ug/kg	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	109	117	4		
4-Bromofluorobenzene (S)	%	101	105	1		
Toluene-d8 (S)	%	103	104	3		

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30661 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV 5035A Volatile Organics
Associated Lab Samples: 92240289016, 92240289018, 92240289019, 92240289020, 92240289021

METHOD BLANK: 1406819 Matrix: Solid
Associated Lab Samples: 92240289016, 92240289018, 92240289019, 92240289020, 92240289021

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	5.7	03/10/15 15:33	
Ethylbenzene	ug/kg	ND	5.7	03/10/15 15:33	
m&p-Xylene	ug/kg	ND	11.4	03/10/15 15:33	
Methyl-tert-butyl ether	ug/kg	ND	5.7	03/10/15 15:33	
Naphthalene	ug/kg	2.0J	5.7	03/10/15 15:33	
o-Xylene	ug/kg	ND	5.7	03/10/15 15:33	
Toluene	ug/kg	ND	5.7	03/10/15 15:33	
Xylene (Total)	ug/kg	ND	11.4	03/10/15 15:33	
1,2-Dichloroethane-d4 (S)	%	101	70-130	03/10/15 15:33	
4-Bromofluorobenzene (S)	%	98	70-130	03/10/15 15:33	
Toluene-d8 (S)	%	110	70-130	03/10/15 15:33	

LABORATORY CONTROL SAMPLE: 1406820

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	58.8	58.0	99	70-130	
Ethylbenzene	ug/kg	58.8	57.3	97	70-130	
m&p-Xylene	ug/kg	118	112	96	70-130	
Methyl-tert-butyl ether	ug/kg	58.8	55.7	95	70-130	
Naphthalene	ug/kg	58.8	66.4	113	70-130	
o-Xylene	ug/kg	58.8	56.0	95	70-130	
Toluene	ug/kg	58.8	55.6	94	70-130	
Xylene (Total)	ug/kg	176	168	95	70-130	
1,2-Dichloroethane-d4 (S)	%			96	70-130	
4-Bromofluorobenzene (S)	%			97	70-130	
Toluene-d8 (S)	%			101	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: MSV/30674 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV 5035A Volatile Organics
Associated Lab Samples: 92240289010, 92240289015, 92240289017, 92240289030, 92240289031, 92240289032, 92240289033, 92240289034

METHOD BLANK: 1407870 Matrix: Solid
Associated Lab Samples: 92240289010, 92240289015, 92240289017, 92240289030, 92240289031, 92240289032, 92240289033, 92240289034

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	6.2	03/11/15 12:17	
Ethylbenzene	ug/kg	ND	6.2	03/11/15 12:17	
m&p-Xylene	ug/kg	ND	12.5	03/11/15 12:17	
Methyl-tert-butyl ether	ug/kg	ND	6.2	03/11/15 12:17	
Naphthalene	ug/kg	ND	6.2	03/11/15 12:17	
o-Xylene	ug/kg	ND	6.2	03/11/15 12:17	
Toluene	ug/kg	ND	6.2	03/11/15 12:17	
Xylene (Total)	ug/kg	ND	12.5	03/11/15 12:17	
1,2-Dichloroethane-d4 (S)	%	97	70-130	03/11/15 12:17	
4-Bromofluorobenzene (S)	%	101	70-130	03/11/15 12:17	
Toluene-d8 (S)	%	102	70-130	03/11/15 12:17	

LABORATORY CONTROL SAMPLE: 1407871

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	61.7	67.4	109	70-130	
Ethylbenzene	ug/kg	61.7	68.4	111	70-130	
m&p-Xylene	ug/kg	123	135	110	70-130	
Methyl-tert-butyl ether	ug/kg	61.7	61.9	100	70-130	
Naphthalene	ug/kg	61.7	68.1	110	70-130	
o-Xylene	ug/kg	61.7	66.2	107	70-130	
Toluene	ug/kg	61.7	67.1	109	70-130	
Xylene (Total)	ug/kg	185	202	109	70-130	
1,2-Dichloroethane-d4 (S)	%			98	70-130	
4-Bromofluorobenzene (S)	%			103	70-130	
Toluene-d8 (S)	%			100	70-130	

MATRIX SPIKE SAMPLE: 1409136

Parameter	Units	92240537003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	ND	26.7	28.7	107	70-130	
Ethylbenzene	ug/kg	ND	26.7	26.2	98	70-130	
m&p-Xylene	ug/kg	ND	53.3	52.2	97	70-130	
Methyl-tert-butyl ether	ug/kg	ND	26.7	34.9	131	70-130	M1
Naphthalene	ug/kg	ND	26.7	20.9	74	70-130	
o-Xylene	ug/kg	ND	26.7	26.1	97	70-130	
Toluene	ug/kg	ND	26.7	26.4	98	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE SAMPLE: 1409136

Parameter	Units	92240537003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,2-Dichloroethane-d4 (S)	%				108	70-130	
4-Bromofluorobenzene (S)	%				98	70-130	
Toluene-d8 (S)	%				99	70-130	

SAMPLE DUPLICATE: 1409135

Parameter	Units	92240289015 Result	Dup Result	RPD	Max RPD	Qualifiers
Benzene	ug/kg	ND	ND		30	
Ethylbenzene	ug/kg	ND	ND		30	
m&p-Xylene	ug/kg	ND	ND		30	
Methyl-tert-butyl ether	ug/kg	ND	ND		30	
Naphthalene	ug/kg	ND	ND		30	
o-Xylene	ug/kg	ND	ND		30	
Toluene	ug/kg	ND	ND		30	
Xylene (Total)	ug/kg	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	119	107	6		
4-Bromofluorobenzene (S)	%	106	100	2		
Toluene-d8 (S)	%	105	104	3		

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: OEXT/33485 Analysis Method: EPA 8270 by SIM
QC Batch Method: EPA 3546 Analysis Description: 8270 MSSV PAH by SIM
Associated Lab Samples: 92240289018, 92240289019, 92240289020, 92240289021

METHOD BLANK: 1407753 Matrix: Solid
Associated Lab Samples: 92240289018, 92240289019, 92240289020, 92240289021

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1-Methylnaphthalene	ug/kg	ND	10.0	03/12/15 18:49	
2-Methylnaphthalene	ug/kg	ND	10.0	03/12/15 18:49	
Acenaphthene	ug/kg	ND	10.0	03/12/15 18:49	
Acenaphthylene	ug/kg	ND	10.0	03/12/15 18:49	
Anthracene	ug/kg	ND	10.0	03/12/15 18:49	
Benzo(a)anthracene	ug/kg	ND	10.0	03/12/15 18:49	
Benzo(a)pyrene	ug/kg	ND	10.0	03/12/15 18:49	
Benzo(b)fluoranthene	ug/kg	ND	10.0	03/12/15 18:49	
Benzo(g,h,i)perylene	ug/kg	ND	10.0	03/12/15 18:49	
Benzo(k)fluoranthene	ug/kg	ND	10.0	03/12/15 18:49	
Chrysene	ug/kg	ND	10.0	03/12/15 18:49	
Dibenz(a,h)anthracene	ug/kg	ND	10.0	03/12/15 18:49	
Fluoranthene	ug/kg	ND	10.0	03/12/15 18:49	
Fluorene	ug/kg	ND	10.0	03/12/15 18:49	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	10.0	03/12/15 18:49	
Naphthalene	ug/kg	ND	10.0	03/12/15 18:49	
Phenanthrene	ug/kg	ND	10.0	03/12/15 18:49	
Pyrene	ug/kg	ND	10.0	03/12/15 18:49	
2-Fluorobiphenyl (S)	%	55	10-110	03/12/15 18:49	
Nitrobenzene-d5 (S)	%	64	10-128	03/12/15 18:49	
Terphenyl-d14 (S)	%	60	39-119	03/12/15 18:49	

LABORATORY CONTROL SAMPLE: 1407754

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1-Methylnaphthalene	ug/kg	33.3	21.2	64	44-130	
2-Methylnaphthalene	ug/kg	33.3	20.8	62	41-134	
Acenaphthene	ug/kg	33.3	24.2	73	52-123	
Acenaphthylene	ug/kg	33.3	24.3	73	49-116	
Anthracene	ug/kg	33.3	23.2	69	41-133	
Benzo(a)anthracene	ug/kg	33.3	22.6	68	56-130	
Benzo(a)pyrene	ug/kg	33.3	22.8	68	51-136	
Benzo(b)fluoranthene	ug/kg	33.3	21.8	65	37-149	
Benzo(g,h,i)perylene	ug/kg	33.3	16.1	48	39-127	
Benzo(k)fluoranthene	ug/kg	33.3	22.9	69	45-139	
Chrysene	ug/kg	33.3	23.4	70	59-127	
Dibenz(a,h)anthracene	ug/kg	33.3	17.7	53	37-139	
Fluoranthene	ug/kg	33.3	22.7	68	53-132	
Fluorene	ug/kg	33.3	25.0	75	45-127	
Indeno(1,2,3-cd)pyrene	ug/kg	33.3	17.9	54	35-145	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1407754

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Naphthalene	ug/kg	33.3	22.5	67	45-123	
Phenanthrene	ug/kg	33.3	23.9	72	50-125	
Pyrene	ug/kg	33.3	22.7	68	52-132	
2-Fluorobiphenyl (S)	%			56	10-110	
Nitrobenzene-d5 (S)	%			67	10-128	
Terphenyl-d14 (S)	%			61	39-119	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1407755 1407756

Parameter	Units	92240123004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1-Methylnaphthalene	ug/kg	ND	41	41	23.9	22.8	58	56	50-150	5	30	
2-Methylnaphthalene	ug/kg	ND	41	41	23.7	22.4	58	55	50-150	6	30	
Acenaphthene	ug/kg	ND	41	41	27.2	26.3	66	64	50-150	3	30	
Acenaphthylene	ug/kg	ND	41	41	27.0	25.5	66	62	50-150	6	30	
Anthracene	ug/kg	ND	41	41	25.6	31.2	63	76	50-150	19	30	
Benzo(a)anthracene	ug/kg	ND	41	41	23.3	35.0	57	85	50-150	40	30	R1
Benzo(a)pyrene	ug/kg	ND	41	41	22.7	37.2	55	91	50-150	49	30	R1
Benzo(b)fluoranthene	ug/kg	ND	41	41	26.9	44.1	66	107	50-150	49	30	R1
Benzo(g,h,i)perylene	ug/kg	ND	41	41	21.9	40.4	53	99	50-150	60	30	R1
Benzo(k)fluoranthene	ug/kg	ND	41	41	22.6	37.1	55	91	50-150	48	30	R1
Chrysene	ug/kg	ND	41	41	24.4	37.7	60	92	50-150	43	30	R1
Dibenz(a,h)anthracene	ug/kg	ND	41	41	21.7	38.8	53	95	50-150	57	30	R1
Fluoranthene	ug/kg	ND	41	41	24.6	35.2	60	86	50-150	36	30	R1
Fluorene	ug/kg	ND	41	41	28.5	29.3	69	71	50-150	3	30	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	41	41	22.7	40.5	55	99	50-150	57	30	R1
Naphthalene	ug/kg	ND	41	41	26.1	24.5	64	60	50-150	6	30	
Phenanthrene	ug/kg	ND	41	41	26.6	32.8	65	80	50-150	21	30	
Pyrene	ug/kg	ND	41	41	25.0	35.5	61	86	50-150	35	30	R1
2-Fluorobiphenyl (S)	%						51	49	10-110			
Nitrobenzene-d5 (S)	%						60	59	10-128			
Terphenyl-d14 (S)	%						61	59	39-119			

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: OEXT/33588
QC Batch Method: EPA 3546
Analysis Method: EPA 8270 by SIM
Analysis Description: 8270 MSSV PAH by SIM
Associated Lab Samples: 92240289017

METHOD BLANK: 1411585 Matrix: Solid
Associated Lab Samples: 92240289017

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1-Methylnaphthalene	ug/kg	ND	10.0	03/16/15 12:00	
2-Methylnaphthalene	ug/kg	ND	10.0	03/16/15 12:00	
Acenaphthene	ug/kg	ND	10.0	03/16/15 12:00	
Acenaphthylene	ug/kg	ND	10.0	03/16/15 12:00	
Anthracene	ug/kg	ND	10.0	03/16/15 12:00	
Benzo(a)anthracene	ug/kg	ND	10.0	03/16/15 12:00	
Benzo(a)pyrene	ug/kg	ND	10.0	03/16/15 12:00	
Benzo(b)fluoranthene	ug/kg	ND	10.0	03/16/15 12:00	
Benzo(g,h,i)perylene	ug/kg	ND	10.0	03/16/15 12:00	
Benzo(k)fluoranthene	ug/kg	ND	10.0	03/16/15 12:00	
Chrysene	ug/kg	ND	10.0	03/16/15 12:00	
Dibenz(a,h)anthracene	ug/kg	ND	10.0	03/16/15 12:00	
Fluoranthene	ug/kg	ND	10.0	03/16/15 12:00	
Fluorene	ug/kg	ND	10.0	03/16/15 12:00	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	10.0	03/16/15 12:00	
Naphthalene	ug/kg	ND	10.0	03/16/15 12:00	
Phenanthrene	ug/kg	ND	10.0	03/16/15 12:00	
Pyrene	ug/kg	ND	10.0	03/16/15 12:00	
2-Fluorobiphenyl (S)	%	45	10-110	03/16/15 12:00	
Nitrobenzene-d5 (S)	%	55	10-128	03/16/15 12:00	
Terphenyl-d14 (S)	%	68	39-119	03/16/15 12:00	

LABORATORY CONTROL SAMPLE & LCSD: 1411586 1411587

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
1-Methylnaphthalene	ug/kg	33.3	23.3	24.2	70	73	44-130	4	30	
2-Methylnaphthalene	ug/kg	33.3	22.7	23.4	68	70	41-134	3	30	
Acenaphthene	ug/kg	33.3	27.3	28.4	82	85	52-123	4	30	
Acenaphthylene	ug/kg	33.3	27.1	28.4	81	85	49-116	5	30	
Anthracene	ug/kg	33.3	28.4	29.8	85	89	41-133	5	30	
Benzo(a)anthracene	ug/kg	33.3	28.8	29.9	86	90	56-130	4	30	
Benzo(a)pyrene	ug/kg	33.3	29.1	30.4	87	91	51-136	4	30	
Benzo(b)fluoranthene	ug/kg	33.3	32.9	35.3	99	106	37-149	7	30	
Benzo(g,h,i)perylene	ug/kg	33.3	30.6	31.9	92	96	39-127	4	30	
Benzo(k)fluoranthene	ug/kg	33.3	31.1	31.9	93	96	45-139	3	30	
Chrysene	ug/kg	33.3	30.4	31.9	91	96	59-127	5	30	
Dibenz(a,h)anthracene	ug/kg	33.3	29.8	31.2	89	93	37-139	4	30	
Fluoranthene	ug/kg	33.3	27.9	29.7	84	89	53-132	6	30	
Fluorene	ug/kg	33.3	29.4	30.9	88	93	45-127	5	30	
Indeno(1,2,3-cd)pyrene	ug/kg	33.3	30.7	32.0	92	96	35-145	4	30	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE & LCSD: 1411586 1411587

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Naphthalene	ug/kg	33.3	24.8	25.7	74	77	45-123	4	30	
Phenanthrene	ug/kg	33.3	29.6	31.1	89	93	50-125	5	30	
Pyrene	ug/kg	33.3	28.2	29.8	85	89	52-132	5	30	
2-Fluorobiphenyl (S)	%				64	67	10-110			
Nitrobenzene-d5 (S)	%				75	78	10-128			
Terphenyl-d14 (S)	%				75	79	39-119			

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: OEXT/33453 Analysis Method: EPA 8270
QC Batch Method: EPA 3546 Analysis Description: 8270 Solid MSSV Microwave SC
Associated Lab Samples: 92240289017, 92240289018, 92240289019, 92240289020, 92240289021

METHOD BLANK: 1406782 Matrix: Solid
Associated Lab Samples: 92240289017, 92240289018, 92240289019, 92240289020, 92240289021

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,2,4-Trichlorobenzene	ug/kg	ND	330	03/11/15 16:14	
1,2-Dichlorobenzene	ug/kg	ND	330	03/11/15 16:14	
1,3-Dichlorobenzene	ug/kg	ND	330	03/11/15 16:14	
1,4-Dichlorobenzene	ug/kg	ND	330	03/11/15 16:14	
1-Methylnaphthalene	ug/kg	ND	330	03/11/15 16:14	
2,4,5-Trichlorophenol	ug/kg	ND	330	03/11/15 16:14	
2,4,6-Trichlorophenol	ug/kg	ND	330	03/11/15 16:14	
2,4-Dichlorophenol	ug/kg	ND	330	03/11/15 16:14	
2,4-Dimethylphenol	ug/kg	ND	330	03/11/15 16:14	
2,4-Dinitrophenol	ug/kg	ND	1650	03/11/15 16:14	
2,4-Dinitrotoluene	ug/kg	ND	330	03/11/15 16:14	
2,6-Dinitrotoluene	ug/kg	ND	330	03/11/15 16:14	
2-Chloronaphthalene	ug/kg	ND	330	03/11/15 16:14	
2-Chlorophenol	ug/kg	ND	330	03/11/15 16:14	
2-Methylnaphthalene	ug/kg	ND	330	03/11/15 16:14	
2-Methylphenol(o-Cresol)	ug/kg	ND	330	03/11/15 16:14	
2-Nitroaniline	ug/kg	ND	1650	03/11/15 16:14	
2-Nitrophenol	ug/kg	ND	330	03/11/15 16:14	
3&4-Methylphenol(m&p Cresol)	ug/kg	ND	330	03/11/15 16:14	
3,3'-Dichlorobenzidine	ug/kg	ND	1650	03/11/15 16:14	
3-Nitroaniline	ug/kg	ND	1650	03/11/15 16:14	
4,6-Dinitro-2-methylphenol	ug/kg	ND	660	03/11/15 16:14	
4-Bromophenylphenyl ether	ug/kg	ND	330	03/11/15 16:14	
4-Chloro-3-methylphenol	ug/kg	ND	660	03/11/15 16:14	
4-Chloroaniline	ug/kg	ND	1650	03/11/15 16:14	
4-Chlorophenylphenyl ether	ug/kg	ND	330	03/11/15 16:14	
4-Nitroaniline	ug/kg	ND	660	03/11/15 16:14	
4-Nitrophenol	ug/kg	ND	1650	03/11/15 16:14	
Acenaphthene	ug/kg	ND	330	03/11/15 16:14	
Acenaphthylene	ug/kg	ND	330	03/11/15 16:14	
Aniline	ug/kg	ND	330	03/11/15 16:14	
Anthracene	ug/kg	ND	330	03/11/15 16:14	
Benzo(a)anthracene	ug/kg	ND	330	03/11/15 16:14	
Benzo(a)pyrene	ug/kg	ND	330	03/11/15 16:14	
Benzo(b)fluoranthene	ug/kg	ND	330	03/11/15 16:14	
Benzo(g,h,i)perylene	ug/kg	ND	330	03/11/15 16:14	
Benzo(k)fluoranthene	ug/kg	ND	330	03/11/15 16:14	
Benzoic Acid	ug/kg	ND	1650	03/11/15 16:14	
Benzyl alcohol	ug/kg	ND	660	03/11/15 16:14	
bis(2-Chloroethoxy)methane	ug/kg	ND	330	03/11/15 16:14	
bis(2-Chloroethyl) ether	ug/kg	ND	330	03/11/15 16:14	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

METHOD BLANK: 1406782 Matrix: Solid
Associated Lab Samples: 92240289017, 92240289018, 92240289019, 92240289020, 92240289021

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
bis(2-Chloroisopropyl) ether	ug/kg	ND	330	03/11/15 16:14	
bis(2-Ethylhexyl)phthalate	ug/kg	ND	330	03/11/15 16:14	
Butylbenzylphthalate	ug/kg	ND	330	03/11/15 16:14	
Chrysene	ug/kg	ND	330	03/11/15 16:14	
Di-n-butylphthalate	ug/kg	ND	330	03/11/15 16:14	
Di-n-octylphthalate	ug/kg	ND	330	03/11/15 16:14	
Dibenz(a,h)anthracene	ug/kg	ND	330	03/11/15 16:14	
Dibenzofuran	ug/kg	ND	330	03/11/15 16:14	
Diethylphthalate	ug/kg	ND	330	03/11/15 16:14	
Dimethylphthalate	ug/kg	ND	330	03/11/15 16:14	
Fluoranthene	ug/kg	ND	330	03/11/15 16:14	
Fluorene	ug/kg	ND	330	03/11/15 16:14	
Hexachloro-1,3-butadiene	ug/kg	ND	330	03/11/15 16:14	
Hexachlorobenzene	ug/kg	ND	330	03/11/15 16:14	
Hexachlorocyclopentadiene	ug/kg	ND	330	03/11/15 16:14	
Hexachloroethane	ug/kg	ND	330	03/11/15 16:14	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	330	03/11/15 16:14	
Isophorone	ug/kg	ND	330	03/11/15 16:14	
N-Nitroso-di-n-propylamine	ug/kg	ND	330	03/11/15 16:14	
N-Nitrosodimethylamine	ug/kg	ND	330	03/11/15 16:14	
N-Nitrosodiphenylamine	ug/kg	ND	330	03/11/15 16:14	
Naphthalene	ug/kg	ND	330	03/11/15 16:14	
Nitrobenzene	ug/kg	ND	330	03/11/15 16:14	
Pentachlorophenol	ug/kg	ND	1650	03/11/15 16:14	
Phenanthrene	ug/kg	ND	330	03/11/15 16:14	
Phenol	ug/kg	ND	330	03/11/15 16:14	
Pyrene	ug/kg	ND	330	03/11/15 16:14	
2,4,6-Tribromophenol (S)	%	80	27-110	03/11/15 16:14	
2-Fluorobiphenyl (S)	%	69	30-110	03/11/15 16:14	
2-Fluorophenol (S)	%	66	13-110	03/11/15 16:14	
Nitrobenzene-d5 (S)	%	66	23-110	03/11/15 16:14	
Phenol-d6 (S)	%	69	22-110	03/11/15 16:14	
Terphenyl-d14 (S)	%	89	28-110	03/11/15 16:14	

LABORATORY CONTROL SAMPLE: 1406783

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,2,4-Trichlorobenzene	ug/kg	1670	1380	83	70-130	
1,2-Dichlorobenzene	ug/kg	1670	1320	79	70-130	
1,3-Dichlorobenzene	ug/kg	1670	1240	75	70-130	
1,4-Dichlorobenzene	ug/kg	1670	1300	78	70-130	
1-Methylnaphthalene	ug/kg	1670	1430	86	70-130	
2,4,5-Trichlorophenol	ug/kg	1670	1330	80	70-130	
2,4,6-Trichlorophenol	ug/kg	1670	1310	79	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1406783

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2,4-Dichlorophenol	ug/kg	1670	1350	81	70-130	
2,4-Dimethylphenol	ug/kg	1670	1480	89	70-130	
2,4-Dinitrophenol	ug/kg	8330	7340	88	28-103	
2,4-Dinitrotoluene	ug/kg	1670	1600	96	70-130	
2,6-Dinitrotoluene	ug/kg	1670	1500	90	70-130	
2-Chloronaphthalene	ug/kg	1670	1310	78	70-130	
2-Chlorophenol	ug/kg	1670	1330	80	70-130	
2-Methylnaphthalene	ug/kg	1670	1300	78	70-130	
2-Methylphenol(o-Cresol)	ug/kg	1670	1330	80	70-130	
2-Nitroaniline	ug/kg	3330	2800	84	70-130	
2-Nitrophenol	ug/kg	1670	1410	84	70-130	
3&4-Methylphenol(m&p Cresol)	ug/kg	1670	1360	82	70-130	
3,3'-Dichlorobenzidine	ug/kg	3330	2850	86	50-150	
3-Nitroaniline	ug/kg	3330	2780	83	35-110	
4,6-Dinitro-2-methylphenol	ug/kg	3330	3620	109	70-130	
4-Bromophenylphenyl ether	ug/kg	1670	1430	86	70-130	
4-Chloro-3-methylphenol	ug/kg	3330	2930	88	70-130	
4-Chloroaniline	ug/kg	3330	2750	82	70-130	
4-Chlorophenylphenyl ether	ug/kg	1670	1420	85	70-130	
4-Nitroaniline	ug/kg	3330	2920	88	70-130	
4-Nitrophenol	ug/kg	8330	6330	76	70-130	
Acenaphthene	ug/kg	1670	1340	80	70-130	
Acenaphthylene	ug/kg	1670	1330	80	70-130	
Aniline	ug/kg	1670	1130	68	29-110	
Anthracene	ug/kg	1670	1430	86	70-130	
Benzo(a)anthracene	ug/kg	1670	1440	86	70-130	
Benzo(a)pyrene	ug/kg	1670	1460	88	70-130	
Benzo(b)fluoranthene	ug/kg	1670	1430	86	70-130	
Benzo(g,h,i)perylene	ug/kg	1670	1510	91	70-130	
Benzo(k)fluoranthene	ug/kg	1670	1530	92	70-130	
Benzoic Acid	ug/kg	8330	6000	72	16-110	
Benzyl alcohol	ug/kg	3330	2850	86	70-130	
bis(2-Chloroethoxy)methane	ug/kg	1670	1430	86	70-130	
bis(2-Chloroethyl) ether	ug/kg	1670	1500	90	70-130	
bis(2-Chloroisopropyl) ether	ug/kg	1670	1320	79	70-130	
bis(2-Ethylhexyl)phthalate	ug/kg	1670	1380	83	70-130	
Butylbenzylphthalate	ug/kg	1670	1390	83	70-130	
Chrysene	ug/kg	1670	1520	91	70-130	
Di-n-butylphthalate	ug/kg	1670	1430	86	70-130	
Di-n-octylphthalate	ug/kg	1670	1370	82	70-130	
Dibenz(a,h)anthracene	ug/kg	1670	1550	93	70-130	
Dibenzofuran	ug/kg	1670	1410	85	70-130	
Diethylphthalate	ug/kg	1670	1410	85	70-130	
Dimethylphthalate	ug/kg	1670	1400	84	70-130	
Fluoranthene	ug/kg	1670	1440	87	70-130	
Fluorene	ug/kg	1670	1440	87	70-130	
Hexachloro-1,3-butadiene	ug/kg	1670	1330	80	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1406783

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Hexachlorobenzene	ug/kg	1670	1410	85	70-130	
Hexachlorocyclopentadiene	ug/kg	1670	1130	68	70-130	1g,L0
Hexachloroethane	ug/kg	1670	1240	74	70-130	
Indeno(1,2,3-cd)pyrene	ug/kg	1670	1600	96	70-130	
Isophorone	ug/kg	1670	1450	87	70-130	
N-Nitroso-di-n-propylamine	ug/kg	1670	1380	83	70-130	
N-Nitrosodimethylamine	ug/kg	1670	1250	75	70-130	
N-Nitrosodiphenylamine	ug/kg	1670	1450	87	70-130	
Naphthalene	ug/kg	1670	1380	83	70-130	
Nitrobenzene	ug/kg	1670	1330	80	70-130	
Pentachlorophenol	ug/kg	3330	2950	88	70-130	
Phenanthrene	ug/kg	1670	1380	83	70-130	
Phenol	ug/kg	1670	1530	92	70-130	
Pyrene	ug/kg	1670	1370	82	70-130	
2,4,6-Tribromophenol (S)	%			89	27-110	
2-Fluorobiphenyl (S)	%			73	30-110	
2-Fluorophenol (S)	%			76	13-110	
Nitrobenzene-d5 (S)	%			73	23-110	
Phenol-d6 (S)	%			80	22-110	
Terphenyl-d14 (S)	%			92	28-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1406784 1406785

Parameter	Units	92240289019 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1,2,4-Trichlorobenzene	ug/kg	ND	1850	1850	1020	827	55	45	70-130	20	30	
1,2-Dichlorobenzene	ug/kg	ND	1850	1850	1030	806	56	44	70-130	25	30	
1,3-Dichlorobenzene	ug/kg	ND	1850	1850	971	763	52	41	70-130	24	30	
1,4-Dichlorobenzene	ug/kg	ND	1850	1850	1020	799	55	43	70-130	24	30	
1-Methylnaphthalene	ug/kg	ND	1850	1850	1070	810	58	44	70-130	27	30	
2,4,5-Trichlorophenol	ug/kg	ND	1850	1850	1010	762	55	41	70-130	28	30	
2,4,6-Trichlorophenol	ug/kg	ND	1850	1850	1010	723	54	39	70-130	33	30	R1
2,4-Dichlorophenol	ug/kg	ND	1850	1850	1010	763	54	41	70-130	28	30	
2,4-Dimethylphenol	ug/kg	ND	1850	1850	1040	795	56	43	70-130	27	30	
2,4-Dinitrophenol	ug/kg	ND	9250	9250	5050	4750	55	51	70-130	6	30	
2,4-Dinitrotoluene	ug/kg	ND	1850	1850	1170	992	63	54	70-130	17	30	
2,6-Dinitrotoluene	ug/kg	ND	1850	1850	1170	912	63	49	70-130	25	30	
2-Chloronaphthalene	ug/kg	ND	1850	1850	1030	755	55	41	70-130	30	30	
2-Chlorophenol	ug/kg	ND	1850	1850	1050	786	57	42	70-130	28	30	
2-Methylnaphthalene	ug/kg	ND	1850	1850	986	743	53	40	70-130	28	30	
2-Methylphenol(o-Cresol)	ug/kg	ND	1850	1850	1020	764	55	41	70-130	29	30	
2-Nitroaniline	ug/kg	ND	3700	3700	2120	1690J	57	46	70-130		30	
2-Nitrophenol	ug/kg	ND	1850	1850	1060	782	57	42	70-130	31	30	R1
3&4-Methylphenol(m&p Cresol)	ug/kg	ND	1850	1850	1060	801	57	43	70-130	28	30	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1406784 1406785

Parameter	Units	92240289019 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
3,3'-Dichlorobenzidine	ug/kg	ND	3700	3700	2150	1790J	57	47	70-130		30	
3-Nitroaniline	ug/kg	ND	3700	3700	2130	1790J	57	48	70-130		30	
4,6-Dinitro-2-methylphenol	ug/kg	ND	3700	3700	2580	2210	70	60	70-130	15	30	
4-Bromophenylphenyl ether	ug/kg	ND	1850	1850	1110	856	60	46	70-130	26	30	
4-Chloro-3-methylphenol	ug/kg	ND	3700	3700	2140	1610	58	43	70-130	29	30	
4-Chloroaniline	ug/kg	ND	3700	3700	2070	1540J	56	42	70-130		30	
4-Chlorophenylphenyl ether	ug/kg	ND	1850	1850	1090	870	59	47	70-130	23	30	
4-Nitroaniline	ug/kg	ND	3700	3700	2190	2080	59	56	70-130	5	30	
4-Nitrophenol	ug/kg	ND	9250	9250	4630	4510	50	49	70-130	3	30	
Acenaphthene	ug/kg	ND	1850	1850	1040	783	56	42	70-130	28	30	
Acenaphthylene	ug/kg	ND	1850	1850	1010	757	55	41	70-130	29	30	
Aniline	ug/kg	ND	1850	1850	788	613	43	33	70-130	25	30	
Anthracene	ug/kg	ND	1850	1850	1100	901	59	49	70-130	20	30	
Benzo(a)anthracene	ug/kg	ND	1850	1850	1120	936	61	51	70-130	18	30	
Benzo(a)pyrene	ug/kg	ND	1850	1850	1110	944	58	49	70-130	16	30	
Benzo(b)fluoranthene	ug/kg	ND	1850	1850	1110	946	60	51	70-130	16	30	
Benzo(g,h,i)perylene	ug/kg	ND	1850	1850	1070	948	58	51	70-130	12	30	
Benzo(k)fluoranthene	ug/kg	ND	1850	1850	1150	974	62	53	70-130	17	30	
Benzoic Acid	ug/kg	ND	9250	9250	72.7J	1530J	1	17	70-130		30	
Benzyl alcohol	ug/kg	ND	3700	3700	2130	1640	58	44	70-130	26	30	
bis(2-Chloroethoxy)methane	ug/kg	ND	1850	1850	1060	810	58	44	70-130	27	30	
bis(2-Chloroethyl) ether	ug/kg	ND	1850	1850	1220	976	66	53	70-130	22	30	
bis(2-Chloroisopropyl) ether	ug/kg	ND	1850	1850	1030	803	56	43	70-130	25	30	
bis(2-Ethylhexyl)phthalate	ug/kg	ND	1850	1850	1040	799	56	43	70-130	26	30	
Butylbenzylphthalate	ug/kg	ND	1850	1850	1020	802	55	43	70-130	24	30	
Chrysene	ug/kg	ND	1850	1850	1180	982	64	53	70-130	19	30	
Di-n-butylphthalate	ug/kg	ND	1850	1850	1120	920	61	50	70-130	20	30	
Di-n-octylphthalate	ug/kg	ND	1850	1850	1000	789	54	43	70-130	24	30	
Dibenz(a,h)anthracene	ug/kg	ND	1850	1850	1140	965	61	52	70-130	16	30	
Dibenzofuran	ug/kg	ND	1850	1850	1090	851	59	46	70-130	25	30	
Diethylphthalate	ug/kg	ND	1850	1850	1110	904	60	49	70-130	20	30	
Dimethylphthalate	ug/kg	ND	1850	1850	1080	880	58	48	70-130	21	30	
Fluoranthene	ug/kg	ND	1850	1850	1100	987	59	53	70-130	11	30	
Fluorene	ug/kg	ND	1850	1850	1100	882	59	48	70-130	22	30	
Hexachloro-1,3-butadiene	ug/kg	ND	1850	1850	990	793	53	43	70-130	22	30	
Hexachlorobenzene	ug/kg	ND	1850	1850	1080	861	59	47	70-130	23	30	
Hexachlorocyclopentadiene	ug/kg	ND	1850	1850	838	622	45	34	70-130	30	30	
Hexachloroethane	ug/kg	ND	1850	1850	969	746	52	40	70-130	26	30	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	1850	1850	1140	992	62	54	70-130	14	30	
Isophorone	ug/kg	ND	1850	1850	1050	770	57	42	70-130	31	30	R1
N-Nitroso-di-n-propylamine	ug/kg	ND	1850	1850	1080	818	59	44	70-130	28	30	
N-Nitrosodimethylamine	ug/kg	ND	1850	1850	903	682	49	37	70-130	28	30	
N-Nitrosodiphenylamine	ug/kg	ND	1850	1850	1130	902	61	49	70-130	22	30	
Naphthalene	ug/kg	ND	1850	1850	1030	810	56	44	70-130	24	30	
Nitrobenzene	ug/kg	ND	1850	1850	997	756	54	41	70-130	28	30	
Pentachlorophenol	ug/kg	ND	3700	3700	2090	1870	57	51	70-130	11	30	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1406784 1406785

Parameter	Units	92240289019 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Phenanthrene	ug/kg	ND	1850	1850	1070	877	58	47	70-130	19	30	
Phenol	ug/kg	ND	1850	1850	1160	902	62	49	70-130	25	30	1g,4g, M0
Pyrene	ug/kg	ND	1850	1850	1070	885	58	48	70-130	19	30	
2,4,6-Tribromophenol (S)	%						62	52	27-110			
2-Fluorobiphenyl (S)	%						54	39	30-110			
2-Fluorophenol (S)	%						54	41	13-110			
Nitrobenzene-d5 (S)	%						53	40	23-110			
Phenol-d6 (S)	%						57	42	22-110			
Terphenyl-d14 (S)	%						67	54	28-110			

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: OEXT/33439 Analysis Method: EPA 8270
QC Batch Method: EPA 3510 Analysis Description: 8270 Water CPAH by SIM 3510 SC
Associated Lab Samples: 92240289038, 92240289039, 92240289040, 92240289041

METHOD BLANK: 1406230 Matrix: Water
Associated Lab Samples: 92240289038, 92240289039, 92240289040, 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1-Methylnaphthalene	ug/L	ND	2.0	03/12/15 16:27	
2-Methylnaphthalene	ug/L	ND	2.0	03/12/15 16:27	
Acenaphthene	ug/L	ND	2.0	03/12/15 16:27	
Acenaphthylene	ug/L	ND	1.5	03/12/15 16:27	
Anthracene	ug/L	ND	0.050	03/12/15 16:27	
Benzo(a)anthracene	ug/L	ND	0.10	03/12/15 16:27	
Benzo(a)pyrene	ug/L	ND	0.20	03/12/15 16:27	
Benzo(b)fluoranthene	ug/L	ND	0.20	03/12/15 16:27	
Benzo(g,h,i)perylene	ug/L	ND	0.20	03/12/15 16:27	
Benzo(k)fluoranthene	ug/L	ND	0.20	03/12/15 16:27	
Chrysene	ug/L	ND	0.10	03/12/15 16:27	
Dibenz(a,h)anthracene	ug/L	ND	0.20	03/12/15 16:27	
Fluoranthene	ug/L	ND	0.30	03/12/15 16:27	
Fluorene	ug/L	ND	0.31	03/12/15 16:27	
Indeno(1,2,3-cd)pyrene	ug/L	ND	0.20	03/12/15 16:27	
Naphthalene	ug/L	ND	1.5	03/12/15 16:27	
Phenanthrene	ug/L	ND	0.20	03/12/15 16:27	
Pyrene	ug/L	ND	0.10	03/12/15 16:27	
2-Fluorobiphenyl (S)	%	63	70-130	03/12/15 16:27	2g,S0
Nitrobenzene-d5 (S)	%	78	70-130	03/12/15 16:27	
Terphenyl-d14 (S)	%	87	70-130	03/12/15 16:27	

LABORATORY CONTROL SAMPLE & LCSD: 1406231 1406232

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
1-Methylnaphthalene	ug/L	1	ND	ND	83	83	70-130		30	
2-Methylnaphthalene	ug/L	1	ND	ND	83	81	70-130		30	
Acenaphthene	ug/L	1	ND	ND	95	94	70-130		30	
Acenaphthylene	ug/L	1	ND	ND	93	92	70-130		30	
Anthracene	ug/L	1	0.86	0.88	86	88	70-130	2	30	
Benzo(a)anthracene	ug/L	1	0.89	0.90	89	90	70-130	1	30	
Benzo(a)pyrene	ug/L	1	0.86	0.88	86	88	70-130	2	30	
Benzo(b)fluoranthene	ug/L	1	0.84	0.86	84	86	70-130	3	30	
Benzo(g,h,i)perylene	ug/L	1	0.52	0.45	52	45	70-130	14	30	2g,L0
Benzo(k)fluoranthene	ug/L	1	0.73	0.78	73	78	70-130	7	30	
Chrysene	ug/L	1	0.92	0.92	92	92	70-130	0	30	
Dibenz(a,h)anthracene	ug/L	1	0.59	0.49	59	49	70-130	18	30	2g,L0
Fluoranthene	ug/L	1	0.90	0.91	90	91	70-130	1	30	
Fluorene	ug/L	1	0.89	0.88	89	88	70-130	1	30	
Indeno(1,2,3-cd)pyrene	ug/L	1	0.66	0.65	66	65	70-130	0	30	2g,L0

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(704)875-9092

QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE & LCSD: 1406231 1406232

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Naphthalene	ug/L	1	ND	ND	91	89	70-130		30	
Phenanthrene	ug/L	1	0.94	0.94	94	94	70-130	1	30	
Pyrene	ug/L	1	0.89	0.90	89	90	70-130	1	30	
2-Fluorobiphenyl (S)	%				71	68	70-130			2g,S0
Nitrobenzene-d5 (S)	%				87	83	70-130			
Terphenyl-d14 (S)	%				90	89	70-130			

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: OEXT/33446 Analysis Method: EPA 8270
QC Batch Method: EPA 3510 Analysis Description: 8270 Water MSSV SC
Associated Lab Samples: 92240289038, 92240289039, 92240289040, 92240289041

METHOD BLANK: 1406486 Matrix: Water
Associated Lab Samples: 92240289038, 92240289039, 92240289040, 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,2,4-Trichlorobenzene	ug/L	ND	10.0	03/11/15 12:33	
1,2-Dichlorobenzene	ug/L	ND	10.0	03/11/15 12:33	
1,3-Dichlorobenzene	ug/L	ND	10.0	03/11/15 12:33	
1,4-Dichlorobenzene	ug/L	ND	10.0	03/11/15 12:33	
1-Methylnaphthalene	ug/L	ND	10.0	03/11/15 12:33	
2,4,5-Trichlorophenol	ug/L	ND	10.0	03/11/15 12:33	
2,4,6-Trichlorophenol	ug/L	ND	10.0	03/11/15 12:33	
2,4-Dichlorophenol	ug/L	ND	10.0	03/11/15 12:33	
2,4-Dimethylphenol	ug/L	ND	10.0	03/11/15 12:33	
2,4-Dinitrophenol	ug/L	ND	50.0	03/11/15 12:33	
2,4-Dinitrotoluene	ug/L	ND	10.0	03/11/15 12:33	
2,6-Dinitrotoluene	ug/L	ND	10.0	03/11/15 12:33	
2-Chloronaphthalene	ug/L	ND	10.0	03/11/15 12:33	
2-Chlorophenol	ug/L	ND	10.0	03/11/15 12:33	
2-Methylnaphthalene	ug/L	ND	10.0	03/11/15 12:33	
2-Methylphenol(o-Cresol)	ug/L	ND	10.0	03/11/15 12:33	
2-Nitroaniline	ug/L	ND	50.0	03/11/15 12:33	
2-Nitrophenol	ug/L	ND	10.0	03/11/15 12:33	
3&4-Methylphenol(m&p Cresol)	ug/L	ND	10.0	03/11/15 12:33	
3,3'-Dichlorobenzidine	ug/L	ND	50.0	03/11/15 12:33	
3-Nitroaniline	ug/L	ND	50.0	03/11/15 12:33	
4,6-Dinitro-2-methylphenol	ug/L	ND	20.0	03/11/15 12:33	
4-Bromophenylphenyl ether	ug/L	ND	10.0	03/11/15 12:33	
4-Chloro-3-methylphenol	ug/L	ND	20.0	03/11/15 12:33	
4-Chloroaniline	ug/L	ND	50.0	03/11/15 12:33	
4-Chlorophenylphenyl ether	ug/L	ND	10.0	03/11/15 12:33	
4-Nitroaniline	ug/L	ND	50.0	03/11/15 12:33	
4-Nitrophenol	ug/L	ND	50.0	03/11/15 12:33	
Acenaphthene	ug/L	ND	10.0	03/11/15 12:33	
Acenaphthylene	ug/L	ND	10.0	03/11/15 12:33	
Aniline	ug/L	ND	10.0	03/11/15 12:33	
Anthracene	ug/L	ND	10.0	03/11/15 12:33	
Benzo(a)anthracene	ug/L	ND	10.0	03/11/15 12:33	
Benzo(a)pyrene	ug/L	ND	10.0	03/11/15 12:33	
Benzo(b)fluoranthene	ug/L	ND	10.0	03/11/15 12:33	
Benzo(g,h,i)perylene	ug/L	ND	10.0	03/11/15 12:33	
Benzo(k)fluoranthene	ug/L	ND	10.0	03/11/15 12:33	
Benzoic Acid	ug/L	ND	50.0	03/11/15 12:33	
Benzyl alcohol	ug/L	ND	20.0	03/11/15 12:33	
bis(2-Chloroethoxy)methane	ug/L	ND	10.0	03/11/15 12:33	
bis(2-Chloroethyl) ether	ug/L	ND	10.0	03/11/15 12:33	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

METHOD BLANK: 1406486 Matrix: Water
Associated Lab Samples: 92240289038, 92240289039, 92240289040, 92240289041

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
bis(2-Chloroisopropyl) ether	ug/L	ND	10.0	03/11/15 12:33	
bis(2-Ethylhexyl)phthalate	ug/L	ND	6.0	03/11/15 12:33	
Butylbenzylphthalate	ug/L	ND	10.0	03/11/15 12:33	
Chrysene	ug/L	ND	10.0	03/11/15 12:33	
Di-n-butylphthalate	ug/L	ND	10.0	03/11/15 12:33	
Di-n-octylphthalate	ug/L	ND	10.0	03/11/15 12:33	
Dibenz(a,h)anthracene	ug/L	ND	10.0	03/11/15 12:33	
Dibenzofuran	ug/L	ND	10.0	03/11/15 12:33	
Diethylphthalate	ug/L	ND	10.0	03/11/15 12:33	
Dimethylphthalate	ug/L	ND	10.0	03/11/15 12:33	
Fluoranthene	ug/L	ND	10.0	03/11/15 12:33	
Fluorene	ug/L	ND	10.0	03/11/15 12:33	
Hexachloro-1,3-butadiene	ug/L	ND	10.0	03/11/15 12:33	
Hexachlorobenzene	ug/L	ND	10.0	03/11/15 12:33	
Hexachlorocyclopentadiene	ug/L	ND	10.0	03/11/15 12:33	
Hexachloroethane	ug/L	ND	10.0	03/11/15 12:33	
Indeno(1,2,3-cd)pyrene	ug/L	ND	10.0	03/11/15 12:33	
Isophorone	ug/L	ND	10.0	03/11/15 12:33	
N-Nitroso-di-n-propylamine	ug/L	ND	10.0	03/11/15 12:33	
N-Nitrosodimethylamine	ug/L	ND	10.0	03/11/15 12:33	
N-Nitrosodiphenylamine	ug/L	ND	10.0	03/11/15 12:33	
Naphthalene	ug/L	ND	10.0	03/11/15 12:33	
Nitrobenzene	ug/L	ND	10.0	03/11/15 12:33	
Pentachlorophenol	ug/L	ND	50.0	03/11/15 12:33	
Phenanthrene	ug/L	ND	10.0	03/11/15 12:33	
Phenol	ug/L	ND	10.0	03/11/15 12:33	
Pyrene	ug/L	ND	10.0	03/11/15 12:33	
2,4,6-Tribromophenol (S)	%	88	27-110	03/11/15 12:33	
2-Fluorobiphenyl (S)	%	78	27-110	03/11/15 12:33	
2-Fluorophenol (S)	%	41	12-110	03/11/15 12:33	
Nitrobenzene-d5 (S)	%	77	21-110	03/11/15 12:33	
Phenol-d6 (S)	%	27	10-110	03/11/15 12:33	
Terphenyl-d14 (S)	%	100	31-107	03/11/15 12:33	

LABORATORY CONTROL SAMPLE: 1406487

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,2,4-Trichlorobenzene	ug/L	50	27.8	56	70-130	
1,2-Dichlorobenzene	ug/L	50	32.8	66	70-130	
1,3-Dichlorobenzene	ug/L	50	29.9	60	70-130	
1,4-Dichlorobenzene	ug/L	50	32.6	65	70-130	
1-Methylnaphthalene	ug/L	50	33.1	66	70-130	
2,4,5-Trichlorophenol	ug/L	50	43.7	87	70-130	
2,4,6-Trichlorophenol	ug/L	50	44.0	88	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1406487

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
2,4-Dichlorophenol	ug/L	50	33.7	67	70-130	
2,4-Dimethylphenol	ug/L	50	32.4	65	70-130	
2,4-Dinitrophenol	ug/L	250	219	88	70-130	
2,4-Dinitrotoluene	ug/L	50	48.6	97	70-130	
2,6-Dinitrotoluene	ug/L	50	51.1	102	70-130	
2-Chloronaphthalene	ug/L	50	49.0	98	70-130	
2-Chlorophenol	ug/L	50	37.8	76	70-130	
2-Methylnaphthalene	ug/L	50	30.3	61	70-130	
2-Methylphenol(o-Cresol)	ug/L	50	32.1	64	70-130	
2-Nitroaniline	ug/L	100	92.6	93	70-130	
2-Nitrophenol	ug/L	50	36.1	72	70-130	
3&4-Methylphenol(m&p Cresol)	ug/L	50	24.2	48	70-130	
3,3'-Dichlorobenzidine	ug/L	100	93.0	93	70-130	
3-Nitroaniline	ug/L	100	87.3	87	70-130	
4,6-Dinitro-2-methylphenol	ug/L	100	107	107	70-130	
4-Bromophenylphenyl ether	ug/L	50	48.3	97	70-130	
4-Chloro-3-methylphenol	ug/L	100	63.7	64	70-130	
4-Chloroaniline	ug/L	100	67.6	68	70-130	
4-Chlorophenylphenyl ether	ug/L	50	46.2	92	70-130	
4-Nitroaniline	ug/L	100	89.5	89	70-130	
4-Nitrophenol	ug/L	250	81.3	33	70-130	
Acenaphthene	ug/L	50	44.0	88	70-130	
Acenaphthylene	ug/L	50	44.0	88	70-130	
Aniline	ug/L	50	29.5	59	70-130	
Anthracene	ug/L	50	45.7	91	70-130	
Benzo(a)anthracene	ug/L	50	45.4	91	70-130	
Benzo(a)pyrene	ug/L	50	47.3	95	70-130	
Benzo(b)fluoranthene	ug/L	50	52.7	105	70-130	
Benzo(g,h,i)perylene	ug/L	50	47.6	95	70-130	
Benzo(k)fluoranthene	ug/L	50	47.6	95	70-130	
Benzoic Acid	ug/L	250	41.1J	16	70-130	
Benzyl alcohol	ug/L	100	73.0	73	70-130	
bis(2-Chloroethoxy)methane	ug/L	50	47.7	95	70-130	
bis(2-Chloroethyl) ether	ug/L	50	48.8	98	70-130	
bis(2-Chloroisopropyl) ether	ug/L	50	43.2	86	70-130	
bis(2-Ethylhexyl)phthalate	ug/L	50	44.3	89	70-130	
Butylbenzylphthalate	ug/L	50	44.2	88	70-130	
Chrysene	ug/L	50	47.6	95	70-130	
Di-n-butylphthalate	ug/L	50	48.5	97	70-130	
Di-n-octylphthalate	ug/L	50	42.1	84	70-130	
Dibenz(a,h)anthracene	ug/L	50	49.4	99	70-130	
Dibenzofuran	ug/L	50	46.2	92	70-130	
Diethylphthalate	ug/L	50	45.9	92	70-130	
Dimethylphthalate	ug/L	50	45.9	92	70-130	
Fluoranthene	ug/L	50	44.4	89	70-130	
Fluorene	ug/L	50	47.2	94	70-130	
Hexachloro-1,3-butadiene	ug/L	50	24.6	49	70-130	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

LABORATORY CONTROL SAMPLE: 1406487

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Hexachlorobenzene	ug/L	50	46.6	93	70-130	
Hexachlorocyclopentadiene	ug/L	50	33.1	66	70-130	
Hexachloroethane	ug/L	50	32.5	65	70-130	
Indeno(1,2,3-cd)pyrene	ug/L	50	50.6	101	70-130	
Isophorone	ug/L	50	35.8	72	70-130	
N-Nitroso-di-n-propylamine	ug/L	50	44.4	89	70-130	
N-Nitrosodimethylamine	ug/L	50	25.3	51	70-130	
N-Nitrosodiphenylamine	ug/L	50	47.4	95	70-130	
Naphthalene	ug/L	50	31.0	62	70-130	
Nitrobenzene	ug/L	50	34.4	69	70-130	
Pentachlorophenol	ug/L	100	84.4	84	70-130	
Phenanthrene	ug/L	50	44.8	90	70-130	
Phenol	ug/L	50	21.8	44	70-130	1g,3g,L0
Pyrene	ug/L	50	43.0	86	70-130	
2,4,6-Tribromophenol (S)	%			96	27-110	
2-Fluorobiphenyl (S)	%			90	27-110	
2-Fluorophenol (S)	%			46	12-110	
Nitrobenzene-d5 (S)	%			65	21-110	
Phenol-d6 (S)	%			31	10-110	
Terphenyl-d14 (S)	%			100	31-107	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: PMST/7596 Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 92240289017, 92240289018, 92240289019, 92240289020, 92240289021, 92240289022, 92240289023, 92240289024, 92240289025, 92240289026, 92240289027, 92240289028, 92240289029

SAMPLE DUPLICATE: 1406446

Parameter	Units	92240273001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	15.8	14.0	12	25	

SAMPLE DUPLICATE: 1406447

Parameter	Units	92240297004 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	14.6	13.3	9	25	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: PMST/7598 Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 92240289001, 92240289002, 92240289003, 92240289004, 92240289005, 92240289006, 92240289007, 92240289008, 92240289009, 92240289010, 92240289011, 92240289012, 92240289013

SAMPLE DUPLICATE: 1406450

Parameter	Units	92239870001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	20.4	21.8	6	25	

SAMPLE DUPLICATE: 1406451

Parameter	Units	92240289013 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	19.7	20.1	2	25	

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QUALITY CONTROL DATA

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

QC Batch: PMST/7599 Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 92240289014, 92240289015, 92240289016, 92240289030, 92240289031, 92240289032, 92240289033, 92240289034

SAMPLE DUPLICATE: 1406455

Parameter	Units	92239470001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	12.1	12.1	0	25	

SAMPLE DUPLICATE: 1406456

Parameter	Units	92240301008 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	19.0	23.8	23	25	

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QUALIFIERS

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether, Styrene, and Vinyl chloride.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte

ANALYTE QUALIFIERS

1g	Passes inhouse limits.
2g	Recovery meets in-house limits.
3g	These comments apply to all compounds with percent recovery less than 70%.
4g	These comments apply to all compounds with pescent recovery less than 70%.
B	Analyte was detected in the associated method blank.
D3	Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
L0	Analyte recovery in the laboratory control sample (LCS) was outside QC limits.
M0	Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.
S0	Surrogate recovery outside laboratory control limits.
S1	Surrogate recovery outside laboratory control limits (confirmed by re-analysis).
S3	Surrogate recovery exceeded laboratory control limits. Analyte presence below reporting limits in associated samples. Results unaffected by high bias.

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Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92240289020	**SB-23**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289021	**SB-24**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289022	**SB-23A**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289023	**SB-24A**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289024	**SB-25**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289025	**SB-25A**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289026	**SB-26**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289027	**SB-26A**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289028	**SB-33**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289029	**SB-34**	EPA 3050	MPRP/18045	EPA 6010	ICP/16219
92240289040	**TW-5**	EPA 3010	MPRP/18042	EPA 6010	ICP/16221
92240289041	**TW-6**	EPA 3010	MPRP/18042	EPA 6010	ICP/16221
92240289040	**TW-5**	EPA 7470	MERP/7648	EPA 7470	MERC/7338
92240289041	**TW-6**	EPA 7470	MERP/7662	EPA 7470	MERC/7347
92240289020	**SB-23**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289021	**SB-24**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289022	**SB-23A**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289023	**SB-24A**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289024	**SB-25**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289025	**SB-25A**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289026	**SB-26**	EPA 7471	MERP/7650	EPA 7471	MERC/7340
92240289027	**SB-26A**	EPA 7471	MERP/7652	EPA 7471	MERC/7342
92240289028	**SB-33**	EPA 7471	MERP/7652	EPA 7471	MERC/7342
92240289029	**SB-34**	EPA 7471	MERP/7652	EPA 7471	MERC/7342
92240289017	**SB-18**	EPA 3546	OEXT/33588	EPA 8270 by SIM	MSSV/10418
92240289018	**SB-20**	EPA 3546	OEXT/33485	EPA 8270 by SIM	MSSV/10405
92240289019	**SB-22**	EPA 3546	OEXT/33485	EPA 8270 by SIM	MSSV/10405
92240289020	**SB-23**	EPA 3546	OEXT/33485	EPA 8270 by SIM	MSSV/10405
92240289021	**SB-24**	EPA 3546	OEXT/33485	EPA 8270 by SIM	MSSV/10405
92240289017	**SB-18**	EPA 3546	OEXT/33453	EPA 8270	MSSV/10398
92240289018	**SB-20**	EPA 3546	OEXT/33453	EPA 8270	MSSV/10398
92240289019	**SB-22**	EPA 3546	OEXT/33453	EPA 8270	MSSV/10398
92240289020	**SB-23**	EPA 3546	OEXT/33453	EPA 8270	MSSV/10398
92240289021	**SB-24**	EPA 3546	OEXT/33453	EPA 8270	MSSV/10398
92240289038	**TW-3**	EPA 3510	OEXT/33439	EPA 8270	MSSV/10400
92240289039	**TW-4**	EPA 3510	OEXT/33439	EPA 8270	MSSV/10400
92240289040	**TW-5**	EPA 3510	OEXT/33439	EPA 8270	MSSV/10400
92240289041	**TW-6**	EPA 3510	OEXT/33439	EPA 8270	MSSV/10400
92240289038	**TW-3**	EPA 3510	OEXT/33446	EPA 8270	MSSV/10396
92240289039	**TW-4**	EPA 3510	OEXT/33446	EPA 8270	MSSV/10396
92240289040	**TW-5**	EPA 3510	OEXT/33446	EPA 8270	MSSV/10396
92240289041	**TW-6**	EPA 3510	OEXT/33446	EPA 8270	MSSV/10396
92240289035	**MW-6**	EPA 8260	MSV/30684		

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92240289036	**TW-1**	EPA 8260	MSV/30684		
92240289037	**TW-2**	EPA 8260	MSV/30694		
92240289038	**TW-3**	EPA 8260	MSV/30684		
92240289039	**TW-4**	EPA 8260	MSV/30684		
92240289040	**TW-5**	EPA 8260	MSV/30666		
92240289041	**TW-6**	EPA 8260	MSV/30666		
92240289001	**SB-1**	EPA 8260	MSV/30656		
92240289002	**SB-2**	EPA 8260	MSV/30656		
92240289003	**SB-3**	EPA 8260	MSV/30656		
92240289004	**SB-4**	EPA 8260	MSV/30656		
92240289005	**SB-5**	EPA 8260	MSV/30656		
92240289006	**SB-6**	EPA 8260	MSV/30656		
92240289007	**SB-7**	EPA 8260	MSV/30656		
92240289008	**SB-8**	EPA 8260	MSV/30656		
92240289009	**SB-9**	EPA 8260	MSV/30656		
92240289010	**SB-10**	EPA 8260	MSV/30674		
92240289011	**SB-11**	EPA 8260	MSV/30657		
92240289012	**SB-12**	EPA 8260	MSV/30657		
92240289013	**SB-13**	EPA 8260	MSV/30657		
92240289014	**SB-14**	EPA 8260	MSV/30657		
92240289015	**SB-15**	EPA 8260	MSV/30674		
92240289016	**SB-16**	EPA 8260	MSV/30661		
92240289017	**SB-18**	EPA 8260	MSV/30674		
92240289018	**SB-20**	EPA 8260	MSV/30661		
92240289019	**SB-22**	EPA 8260	MSV/30661		
92240289020	**SB-23**	EPA 8260	MSV/30661		
92240289021	**SB-24**	EPA 8260	MSV/30661		
92240289030	**SB-31**	EPA 8260	MSV/30674		
92240289031	**SB-32**	EPA 8260	MSV/30674		
92240289032	**SB-38**	EPA 8260	MSV/30674		
92240289033	**SB-39**	EPA 8260	MSV/30674		
92240289034	**SB-40**	EPA 8260	MSV/30674		
92240289001	**SB-1**	ASTM D2974-87	PMST/7598		
92240289002	**SB-2**	ASTM D2974-87	PMST/7598		
92240289003	**SB-3**	ASTM D2974-87	PMST/7598		
92240289004	**SB-4**	ASTM D2974-87	PMST/7598		
92240289005	**SB-5**	ASTM D2974-87	PMST/7598		
92240289006	**SB-6**	ASTM D2974-87	PMST/7598		
92240289007	**SB-7**	ASTM D2974-87	PMST/7598		
92240289008	**SB-8**	ASTM D2974-87	PMST/7598		
92240289009	**SB-9**	ASTM D2974-87	PMST/7598		
92240289010	**SB-10**	ASTM D2974-87	PMST/7598		
92240289011	**SB-11**	ASTM D2974-87	PMST/7598		

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: US Hwy 21/SC51 - 20120285.A12
Pace Project No.: 92240289

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92240289012	**SB-12**	ASTM D2974-87	PMST/7598		
92240289013	**SB-13**	ASTM D2974-87	PMST/7598		
92240289014	**SB-14**	ASTM D2974-87	PMST/7599		
92240289015	**SB-15**	ASTM D2974-87	PMST/7599		
92240289016	**SB-16**	ASTM D2974-87	PMST/7599		
92240289017	**SB-18**	ASTM D2974-87	PMST/7596		
92240289018	**SB-20**	ASTM D2974-87	PMST/7596		
92240289019	**SB-22**	ASTM D2974-87	PMST/7596		
92240289020	**SB-23**	ASTM D2974-87	PMST/7596		
92240289021	**SB-24**	ASTM D2974-87	PMST/7596		
92240289022	**SB-23A**	ASTM D2974-87	PMST/7596		
92240289023	**SB-24A**	ASTM D2974-87	PMST/7596		
92240289024	**SB-25**	ASTM D2974-87	PMST/7596		
92240289025	**SB-25A**	ASTM D2974-87	PMST/7596		
92240289026	**SB-26**	ASTM D2974-87	PMST/7596		
92240289027	**SB-26A**	ASTM D2974-87	PMST/7596		
92240289028	**SB-33**	ASTM D2974-87	PMST/7596		
92240289029	**SB-34**	ASTM D2974-87	PMST/7596		
92240289030	**SB-31**	ASTM D2974-87	PMST/7599		
92240289031	**SB-32**	ASTM D2974-87	PMST/7599		
92240289032	**SB-38**	ASTM D2974-87	PMST/7599		
92240289033	**SB-39**	ASTM D2974-87	PMST/7599		
92240289034	**SB-40**	ASTM D2974-87	PMST/7599		

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Pace Analytical	Sample Condition Upon Receipt (SCUR)	Page 1 of 2
	Document Number: F-CHR-CS-003-rev.15	Issuing Authority: Pace Huntersville Quality Office

Client Name: Fuss + Oneil

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☑ Commercial ☐ Pace Other_____

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other_____

Thermometer Used: IR Gun T1401 Type of Ice: Wet Blue None ☑ Samples on ice, cooling process has begun

Temp Correction Factor T1401 No Correction

Corrected Cooler Temp.: 3.8 °C Biological Tissue is Frozen: Yes No N/A

Temp should be above freezing to 6°C

Date and Initials of person examining contents: AP 3-9-15

		Comments:
Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☑Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☐Yes ☑No ☐N/A	4.
Samples Arrived within Hold Time:	☐Yes ☑No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☐No ☑N/A	6.
Rush Turn Around Time Requested:	☐Yes ☑No ☐N/A	7.
Sufficient Volume:	☑Yes ☐No ☐N/A	8.
Correct Containers Used:	☑Yes ☐No ☐N/A	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
Containers Intact:	☑Yes ☐No ☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☑N/A	11.
Sample Labels match COC:	AP 3-9-15 ☑Yes ☐No ☐N/A	12. 4 TB included not on COC
-Includes date/time/ID/Analysis Matrix:_____		
All containers needing preservation have been checked.	☑Yes ☐No ☐N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☑Yes ☐No ☐N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☑Yes ☐No	
Samples checked for dechlorination:	☑Yes ☐No ☑N/A	14. AP 3-9-15
Headspace in VOA Vials (>6mm):	☐Yes ☑No ☐N/A	15.
Trip Blank Present:	☑Yes ☑No ☐N/A	16.
Trip Blank Custody Seals Present	☑Yes ☐No ☐N/A	
Pace Trip Blank Lot # (if purchased):_____		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: C. CAFAGNA Date/Time: 3/10 + 3/11/15

Comments/ Resolution: VOC FULL - SB-19, SB-20, SB-22, TB, TW-3, TW-4, SB-25, ~~SB-23A~~ SB-24, RCRA 8 FOR METALS, SVOCs INC. PAH BY SIM. (NB)

SCURF Review:	[signature]	Date:	030915
SRF Review:	[signature]	Date:	3/10/15

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

WO# : 92240289

92240289

Revised 3/11/15

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 4

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Fuss & O'Neill	Report To: rbutler@fandn.com	Attention:
Address: 717 Lady St, Ste E Columbia, SC	Copy To: adeerick@fandn.com	Company Name: SAME
		Address:
Email To: rbutler@fandn.com	Purchase Order No.:	Pace Quote Reference:
Phone: 803-316-3626 Fax: 803-376-6055	Project Name: US Highway 21/SC51	Pace Project Manager:
Requested Due Date/TAT:	Project Number: 20120285.A12	Pace Profile #:

REGULATORY AGENCY
- NPDES
- GROUND WATER
- DRINKING WATER
- UST
- RCRA
- OTHER

Site Location STATE: SC

Section D Required Client Information

Matrix Codes MATRIX / CODE: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N) BTEXMN	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 92240289
1	SB-1	SL	G			3/3/15	1040		6	1	2					1	2	X		001
2	SB-2						1100		1									X		002
3	SB-3						1115											X		003
4	SB-4						1130											X		004
5	SB-5						1200											X		005
6	SB-6						1220											X		006
7	MW-6 *	WT					1130		3				3					X		035
8	SB-7	SL					1245		6	X	X					X	X	X		007
9	SB-8	SL					1305		6	X	X					X	X	X		008
10	TW-1	WT					1330		3				3					X		036
11	SB-9	SL					1400		6	X	X					X	X	X		009
12	TW-2	WT					1430		3				3					X		037

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Reginald Butler / FXO	3/6/15	1330	Beau Ex						
		3/9/15	1425	Alex Pas/Pun	3-9-15	1425	3.8	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

p in °C | ived on (Y/N) | stody d Cooler (Y/N) | es Intact (Y/N)

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Fuss & O'Neill	Report To: Matthew Fanderan	Attention:
Address: 317 Lud. St, 4th Fl Columbia SC	Copy To: adennix@fandoran	Company Name: SAME
Email To: mfanderan@fandoran	Purchase Order No.:	Address:
Phone: 803-731-3624 Fax: 803-376-6074	Project Name: CRS Bldg 21 / SCSI	Pace Quote Reference:
Requested Due Date/TAT:	Project Number: 20130285.A10	Pace Project Manager:
		Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: _____

Requested Analysis Filtered (Y/N)

ITEM #	Section D Required Client Information — SAMPLE ID (A-Z, 0-9 / -) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N	Analysis Test: BTEX MNV	5VOC.	Full VO	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 92240289
1	SB-10	S	G			1430	3/12/15		6	X	X					X	X		X				010
2	SB-11	"	"			0345	3/14/15		6	"	"					"	"		"				011
3	SB-12	"	"			0900	"		"	"	"					"	"		"				012
4	SB-13	"	"			0950	"		"	"	"					"	"		"				013
5	SB-14	"	"			1020	"		"	"	"					"	"		"				014
6	SB-15	"	"			1035	"		"	"	"					"	"		"				015
7	SB-16	V	V			1050	V		V	V	V					V	V		V				016
8	SB-18	"	"			1330	"		2	2	"					"	"		"	X	X		017
9	SB-20	"	"			1400	"		2	2	"					"	"		"	X	X		018
10	SB-22	V	V			1025	V		2	2	V					V	V		V	X	X		019
11	TW-3	WT	G			1440	"		5	2			3						X	X	X		020
12	TW-4	WT	"			1445	V		5	2			3						X	X	X		021

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	Reginald Butler/F&O	3/16/15	1330	Brown			
				Amy Parr/Pace	3-9-15	1430	7.5 V N Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 3 of 4

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company:	Report To: mtle@Fando.com	Attention:
Address:	Copy To: aderrick@fando.com	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name: GS21 / SCS1	Pace Project Manager:
Requested Due Date/TAT:	Project Number: 2012 6285.A12	Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☑ OTHER

Site Location STATE: SC

Section D Required Client Information

Matrix Codes MATRIX / CODE: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N)	metals	VOCs	SVOCs	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 92240289
1	SB-23	SL	G			3/4/15	1730		8	2		1				1	2		X	X	X		020
2	SB-23A	|	G			|	1735		1										X	X			022
3	SB-24	|	|			|	1630		5	2	2	1				1	2		X	X	X		021
4	SB-24A	|	|			|	1635		1	1									X				023
5	SB-25	|	|			|	1615		1	1									X				024
6	SB-25A	|	|			|	1626		1	1									X				025
7	SB-26	|	|			|	1600		1	1									X				026
8	SB-26M	W	|			↓	1605		1	1									X				027
9	TW-5	WT	|			|	1750		1	1									X	X	X		040
10	TW-6	WT	|			↓	1630		1	1									X	X	X		041
11	SB-31	SL	|			3/5/15	0915		6	1	2					1	2			X	BTEXMN		030
12	SB-32	SL	|			3/5/15	0930		6	1	2					1	2			X	BTEXMN		031

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Reginald Butler/FAO	3/6/15	1330	Amy Pay/Pad	3-9-15	1425	2.8	V	N	V

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

p in °C | ved on (Y/N) | stody l Cooler (Y/N) | es Intact (Y/N)

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CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 4 of 4

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: F20	Report To: rhutler@fando.com	Attention:
Address: 717 Lady St, Ste E Columbia, SC 29201	Copy To: aderrick@fando.com	Company Name: SAME
		Address:
Email To: rhutler@fando.com	Purchase Order No.:	Pace Quote Reference:
Phone: 803-376-6034 Fax: 803-376-6023	Project Name: US21 / SC51	Pace Project Manager:
Requested Due Date/TAT:	Project Number: 2017 0285.A12	Pace Profile #:

REGULATORY AGENCY

- ☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
- ☐ UST ☐ RCRA ☑ OTHER _____

Site Location STATE: SC

Section D Required Client Information

Matrix Codes MATRIX / CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N)	Metals	VOCs	BTEX, MTBE, Naph	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 92240289
1	SB-33	SL	G			3/5/15	0940		1	1									X				C28
2	SB-34	SL	G				0945		1	1									X				C29
3	SB-38	SL					1110		6	1	2					1	2				X		032
4	SB-39	SL					1120		6	1	2					1	2				X		033
5	SB-40	SL					1135		6	1	2					1	2				X		034
6																							
7																							TBs - 042
8																							
9																							
10																							
11																							
12																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Reginald Butler / F20	3/6/15	1330	Rec. rex						
				Quiz Pay Pac	3-9-15	1825	3.8	V	N	V

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

FUSS & O'NEILL

Appendix B

SCDHEC Water Well Records

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

DHEC — PROMOTE PROTECT PROSPER

1. WELL OWNER INFORMATION:
Name: (last) (first)
Address:
City: State: SC Zip:
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:**
Name:
Street Address:
City: Fort Mill Zip:
Latitude: 35.071658 Longitude: -80.935052

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**

4. ABANDONMENT: ☑ Yes ☐ No
Grouted Depth: from 0 ft. to 17 ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		

5. REMARKS:
TW-1

6. TYPE: ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☑ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 3-3-15
17 ft. Date Completed: 3-3-15

10. CASING: ☑ Threaded ☐ Welded
Diam.: 1.5 -Inch
Type: ☐ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 13 ft. depth
_____ in. to _____ ft. depth
Height: Above /Below ✓
Surface _____ ft.
Weight _____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: Stainless Steel Diam.: 1-Inch
Slot/Gauge: .010 Slot Length: 4-Feet
Set Between: 13 ft. and 17 ft.
_____ ft. and _____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☑ No

12. STATIC WATER LEVEL _____ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
_____ ft. after _____ hrs. Pumping _____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: _____

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☑ Yes ☐ No
Installed from _____ ft. to _____ ft.
Effective size _____ Uniformity Coefficient _____

16. WELL GROUTED? ☑ Yes ☐ No
☐ Neat Cement ☑ Bentonite ☑ Bentonite/Cement ☐ Other _____
Depth: From 0 ft. to 17 ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
Type _____
Well Disinfected ☐ Yes ☐ No Type: _____ Amount: _____

18. PUMP: Date installed: _____ Not installed ☑
Mfr. Name: _____ Model No.: _____
H.P._____ Volts_____ Length of drop pipe ___ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: Wayne Mowbray **CERT. NO.:** 2000
Address: (Print) Level: A B C D ✓ (circle one)
100 Bent Willow Way, Easley, SC
Telephone No.: 864-331-3745 Fax No.: 864-236-9097

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: Wayne Mowbray (Well Driller) Date: 3-3-15

If D Level Driller, provide supervising driller's name:
Jeffrey Grant-License No:2105, Level B

DHEC 1903 (07/2003) **COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)**

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

DHEC — PROMOTE PROTECT PROSPER

1. WELL OWNER INFORMATION:
Name: (last) (first)
Address:
City: State: SC Zip:
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:**
Name:
Street Address:
City: Fort Mill Zip:
Latitude: 35,071521 Longitude: -80,935076

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**

4. ABANDONMENT: ☑ Yes ☐ No
Grouted Depth: from 0 ft. to 19 ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		
5. REMARKS: TW-2		

6. TYPE: ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☑ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 3-3-15
19 ft. Date Completed: 3-3-15

10. CASING: ☑ Threaded ☐ Welded
Diam.: 1.5 -Inch
Type: ☐ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 15 ft. depth
_____ in. to _____ ft. depth
Height: Above /Below ✓
Surface _____ ft.
Weight _____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: Stainless Steel Diam.: 1-Inch
Slot/Gauge: .010 Slot Length: 4-Feet
Set Between: 15 ft. and 19 ft.
_____ ft. and _____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☑ No

12. STATIC WATER LEVEL _____ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
_____ ft. after _____ hrs. Pumping _____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: _____

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☑ Yes ☐ No
Installed from _____ ft. to _____ ft.
Effective size _____ Uniformity Coefficient _____

16. WELL GROUTED? ☑ Yes ☐ No
☐ Neat Cement ☑ Bentonite ☑ Bentonite/Cement ☐ Other _____
Depth: From 0 ft. to 19 ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
Type _____
Well Disinfected ☐ Yes ☐ No Type: _____ Amount: _____

18. PUMP: Date installed: _____ Not installed ☑
Mfr. Name: _____ Model No.: _____
H.P._____ Volts_____ Length of drop pipe ___ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: Wayne Mowbray **CERT. NO.:** 2000
Address: (Print) Level: A B C D ✓ (circle one)
100 Bent Willow Way, Easley, SC
Telephone No.: 864-331-3743 Fax No.: 864-236-9097

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: Wayne Mowbray (Well Driller) Date: 3-3-15

If D Level Driller, provide supervising driller's name:
Jeffrey Grant-License No:2105, Level B

DHEC 1903 (07/2003) **COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)**

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

DHEC — PROMOTE PROTECT PROSPER

1. WELL OWNER INFORMATION:
Name: (last) (first)
Address:
City: State: SC Zip:
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:**
Name:
Street Address:
City: Fort Mill Zip:
Latitude: 35.088207 Longitude: -80.925655

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**

4. ABANDONMENT: ☑ Yes ☐ No
Grouted Depth: from 0 ft. to 8 ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		

5. REMARKS: TW-3

6. TYPE: ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☑ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 3-4-15
8 ft. Date Completed: 3-4-15

10. CASING: ☑ Threaded ☐ Welded
Diam.: 1.5 -Inch
Type: ☐ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 4 ft. depth
_____ in. to _____ ft. depth
Height: Above /Below ✓
Surface _____ ft.
Weight _____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: Stainless Steel Diam.: 1-Inch
Slot/Gauge: .010 Slot Length: 4-Feet
Set Between: 4 ft. and 8 ft.
_____ ft. and _____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☑ No

12. STATIC WATER LEVEL _____ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
_____ ft. after _____ hrs. Pumping _____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: _____

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☑ Yes ☐ No
Installed from _____ ft. to _____ ft.
Effective size _____ Uniformity Coefficient _____

16. WELL GROUTED? ☑ Yes ☐ No
☐ Neat Cement ☑ Bentonite ☑ Bentonite/Cement ☐ Other _____
Depth: From 0 ft. to 8 ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
Type _____
Well Disinfected ☐ Yes ☐ No Type: _____ Amount: _____

18. PUMP: Date installed: _____ Not installed ☑
Mfr. Name: _____ Model No.: _____
H.P._____ Volts_____ Length of drop pipe ___ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: Wayne Mowbray **CERT. NO.:** 2000
Address: (Print) Level: A B C D ✓ (circle one)
100 Bent Willow Way, Easley, SC
Telephone No.: 864-331-3745 Fax No.: 864-236-9097

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: Wayne Mowbray (Well Driller) Date: 3-4-15

If D Level Driller, provide supervising driller's name:
Jeffrey Grant-License No:2105, Level B

DHEC 1903 (07/2003) **COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)**

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

DHEC — PROMOTE PROTECT PROSPER

1. WELL OWNER INFORMATION:
Name: (last) (first)
Address:
City: State: SC Zip:
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:**
Name:
Street Address:
City: Fort Mill Zip:
Latitude: 35.088242 Longitude: -80.925176

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**

4. ABANDONMENT: ☑ Yes ☐ No
Grouted Depth: from 0 ft. to 8 ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		

5. REMARKS:
Two 4

6. TYPE: ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☑ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) 8 ft. Date Started: 3-4-15 Date Completed: 3-4-15

10. CASING: ☑ Threaded ☐ Welded
Diam.: 1.5 -Inch
Type: ☐ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 4 ft. depth
_____ in. to _____ ft. depth
Height: Above /Below ✓
Surface _____ ft.
Weight _____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: Stainless Steel Diam.: 1-Inch
Slot/Gauge: .010 Slot Length: 4-Feet
Set Between: 4 ft. and 8 ft.
_____ ft. and _____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☑ No

12. STATIC WATER LEVEL _____ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
_____ ft. after _____ hrs. Pumping _____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: _____

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☑ Yes ☐ No
Installed from _____ ft. to _____ ft.
Effective size _____ Uniformity Coefficient _____

16. WELL GROUTED? ☑ Yes ☐ No
☐ Neat Cement ☑ Bentonite ☑ Bentonite/Cement ☐ Other _____
Depth: From 0 ft. to 8 ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
Type _____
Well Disinfected ☐ Yes ☐ No Type: _____ Amount: _____

18. PUMP: Date installed: _____ Not installed ☑
Mfr. Name: _____ Model No.: _____
H.P._____ Volts_____ Length of drop pipe ___ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: Wayne Mowbray **CERT. NO.:** 2000
Address: (Print) Level: A B C D ✓ (circle one)
100 Bent Willow Way, Easley, SC
Telephone No.: 864-331-3745 Fax No.: 864-236-9097

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: Wayne Mowbray (Well Driller) Date: 3-4-15

If D Level Driller, provide supervising driller's name:
Jeffrey Grant-License No:2105, Level B

DHEC 1903 (07/2003) **COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)**

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

DHEC — PROMOTE PROTECT PROSPER

1. WELL OWNER INFORMATION:
Name: (last) (first)
Address:
City: State: SC Zip:
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:**
Name:
Street Address:
City: Fort Mill Zip:
Latitude: 35,088357 Longitude: -80.925719

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**

4. ABANDONMENT: ☑ Yes ☐ No
Grouted Depth: from 0 ft. to 6 ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		

5. REMARKS:
TW-5

6. TYPE: ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☑ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 3-4-15
6 ft. Date Completed: 3-4-15

10. CASING: ☑ Threaded ☐ Welded
Diam.: 1.5 -Inch
Type: ☐ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 2 ft. depth
_____ in. to _____ ft. depth
Height: Above /Below ✓
Surface _____ ft.
Weight _____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: Stainless Steel Diam.: 1-Inch
Slot/Gauge: .010 Slot Length: 4-Feet
Set Between: 2 ft. and 6 ft.
_____ ft. and _____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☑ No

12. STATIC WATER LEVEL _____ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
_____ ft. after _____ hrs. Pumping _____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: _____

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☑ Yes ☐ No
Installed from _____ ft. to _____ ft.
Effective size _____ Uniformity Coefficient _____

16. WELL GROUTED? ☑ Yes ☐ No
☐ Neat Cement ☑ Bentonite ☑ Bentonite/Cement ☐ Other _____
Depth: From 0 ft. to 6 ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft.____ direction
Type _____
Well Disinfected ☐ Yes ☐ No Type: _____ Amount: _____

18. PUMP: Date installed: _____ Not installed ☑
Mfr. Name: _____ Model No.: _____
H.P._____ Volts_____ Length of drop pipe ___ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: Wayne Mowbray **CERT. NO.:** 2000
Address: (Print) Level: A B C D ✓ (circle one)
100 Bent Willow Way, Easley, SC
Telephone No.: 864-331-3745 Fax No.: 864-236-9097

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: Wayne Mowbray (Well Driller) Date: 3-4-15

If D Level Driller, provide supervising driller's name:
Jeffrey Grant-License No:2105, Level B

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

DHEC — PROMOTE PROTECT PROSPER

1. WELL OWNER INFORMATION:
Name: (last) (first)
Address:
City: State: SC Zip:
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:**
Name:
Street Address:
City: Fort Mill Zip:
Latitude: 35,088413 Longitude: -80,925457

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**

4. ABANDONMENT: ☑ Yes ☐ No
Grouted Depth: from 0 ft. to 15 ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		

5. REMARKS:
TW-6

6. TYPE: ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☑ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 3-4-15
15 ft. Date Completed: 3-4-15

10. CASING: ☑ Threaded ☐ Welded
Diam.: 1.5 -Inch
Type: ☐ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 11 ft. depth
_____ in. to _____ ft. depth
Height: Above /Below ✓
Surface _____ ft.
Weight _____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: Stainless Steel Diam.: 1-Inch
Slot/Gauge: .010 Slot Length: 4-Feet
Set Between: 11 ft. and 15 ft.
_____ ft. and _____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☑ No

12. STATIC WATER LEVEL _____ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
_____ ft. after _____ hrs. Pumping _____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: _____

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☑ Yes ☐ No
Installed from _____ ft. to _____ ft.
Effective size _____ Uniformity Coefficient _____

16. WELL GROUTED? ☑ Yes ☐ No
☐ Neat Cement ☑ Bentonite ☑ Bentonite/Cement ☐ Other _____
Depth: From 0 ft. to 15 ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
Type _____
Well Disinfected ☐ Yes ☐ No Type: _____ Amount: _____

18. PUMP: Date installed: _____ Not installed ☑
Mfr. Name: _____ Model No.: _____
H.P._____ Volts_____ Length of drop pipe ___ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: Wayne Mowbray **CERT. NO.:** 2000
Address: (Print) Level: A B C D ✓ (circle one)
100 Bent Willow Way, Easley, SC
Telephone No.: 864-331-3745 Fax No.: 864-236-9097

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: Wayne Mowbray (Well Driller) Date: 3-4-15

If D Level Driller, provide supervising driller's name:
Jeffrey Grant-License No:2105, Level B

DHEC 1903 (07/2003) **COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)**

FUSS & O'NEILL

Appendix C

Temporary Well Approval

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health
and Environmental Control

Temporary Monitoring Well Approval

Approval is hereby granted to:	Reginald Butler/Fuss & O'Neill
on behalf of:	Mike Barbee/SCDOT
Facility:	US 21 & SC 51 Corridor
County:	York

This approval is for the installation of 50 temporary groundwater-monitoring wells. The temporary wells are to be installed in the locations as illustrated on the submitted map and per the proposed construction details provided by your correspondence dated 2/23/15. The temporary wells are to be installed following all of the applicable requirements of R.61-71.

Please note that R.61-71 requires the following:

1. All wells shall be drilled, constructed, and abandoned by a South Carolina certified well driller per R.61-71.D.1.
2. A Water Well Record Form or other form provided or approved by the Department shall be completed and submitted to the Department within 30 days after well completion or abandonment unless the Department has approved another schedule. The form should contain the "as-built" construction details and all other information required by R.61-71.H.1.f
3. All analytical data and water levels obtained from each monitoring well shall be submitted to the Department within 30 days of receipt of laboratory results unless another schedule has been approved by the Department as required by R.61-71.H.1.d.
4. All temporary monitoring wells shall be abandoned within 5 days of borehole completion using appropriate methods as required by R.61-71.H.4.c.
5. If any of the information provided to the Department changes, Jonathan McInnis (803 896-4061, mcinnijg@dhec.sc.gov) shall be notified a minimum of twenty-four hours prior to well construction as required by R.61-71.H.1.a.

This approval is pursuant to the provisions of Section 44-55-40 of the 1976 South Carolina Code of Laws and R.61-71 of the South Carolina Well Standards and Regulations, dated April 26, 2002.

Date of Issuance: 2/24/15 **Approval #:** MW-10023

Jonathan G. McInnis, Program Manager
Federal & State Site Assessment
Site Assessment Remediation & Revitalization Division
Bureau of Land & Waste Management

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health
and Environmental Control

February 24, 2015

Mike Barbee
SCDOT
955 Park St
Columbia, SC 29201

Re: Temporary Monitoring Well Approval Request received 2/23/15
York County Well ID: MW-10023

Dear Mr Barbee :

The South Carolina Department of Health and Environmental Control (SCDHEC) has reviewed and approved the referenced temporary monitoring well approval request submitted 2/23/15. The original temporary monitoring well approval has been sent to Reginald Butler/Fuss & O'Neill, Inc. and a copy is enclosed for your records. The analytical results from the groundwater samples should be submitted to my attention on or before 4/24/15. Please note the following:

- Well construction and sampling derived waste including but not limited to drill cuttings, drilling fluids, and development/purge water should be managed properly and in compliance with applicable requirements. If containerized, each vessel should be clearly labeled with regards to contents, source, and date of activity.

- Monitoring wells are to yield groundwater samples representative of the zone monitored per R.61-71 H.1.c of the South Carolina Well Standards and Regulations (e.g. low flow sampling techniques are recommended for samples to be analyzed for metals to reduce induced turbidity).

- If this investigation is conducted as part of a potential real estate transaction, the potential purchaser may want to contact SCDHEC's Brownfields Program before this work is performed. The Brownfields Program offers a mechanism to avoid liability for contamination that may be found during this investigation. The investigation proposed may satisfy part or all of the required assessment if pre-approved by the Brownfields Program. The Brownfields Program may be reached at 1-866-576-3432.

If you have any questions, please contact me at (803) 898-0802.

Sincerely,

Jonathan G. McInnis, Program Manager
Federal & State Site Assessment Section

enc: Monitor well approval

cc: SCDHEC EQC Region
Reginald Butler – Fuss & O'Neill
717 Lady St, Ste E – Columbia, SC 29201

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health
and Environmental Control

February 24, 2015

Mike Barbee
SCDOT
955 Park St
Columbia, SC 29201

Re: Temporary Monitoring Well Approval Request received 2/23/15
York County Well ID: MW-10026

Dear Mr Barbee :

The South Carolina Department of Health and Environmental Control (SCDHEC) has reviewed and approved the referenced temporary monitoring well approval request submitted 2/23/15. The original temporary monitoring well approval has been sent to Reginald Butler/Fuss & O'Neill, Inc. and a copy is enclosed for your records. The analytical results from the groundwater samples should be submitted to my attention on or before 4/24/15. Please note the following:

- Well construction and sampling derived waste including but not limited to drill cuttings, drilling fluids, and development/purge water should be managed properly and in compliance with applicable requirements. If containerized, each vessel should be clearly labeled with regards to contents, source, and date of activity.

- Monitoring wells are to yield groundwater samples representative of the zone monitored per R.61-71 H.1.c of the South Carolina Well Standards and Regulations (e.g. low flow sampling techniques are recommended for samples to be analyzed for metals to reduce induced turbidity).

- If this investigation is conducted as part of a potential real estate transaction, the potential purchaser may want to contact SCDHEC's Brownfields Program before this work is performed. The Brownfields Program offers a mechanism to avoid liability for contamination that may be found during this investigation. The investigation proposed may satisfy part or all of the required assessment if pre-approved by the Brownfields Program. The Brownfields Program may be reached at 1-866-576-3432.

If you have any questions, please contact me at (803) 898-0802.

Sincerely,

Jonathan G. McInnis, Program Manager
Federal & State Site Assessment Section

enc: Monitor well approval

cc: SCDHEC EQC Region
Reginald Butler – Fuss & O'Neill
717 Lady St, Ste E – Columbia, SC 29201

FUSS & O'NEILL

Appendix D

Limitations of Work Product

LIMITATIONS OF WORK PRODUCT

This document was prepared for the sole use of STV, Inc. the only intended beneficiaries of our work. Those who may use or rely upon the report and the services (hereafter "work product") performed by Fuss & O'Neill, Inc. and/or its subsidiaries or independent professional associates, subconsultants and subcontractors (collectively the "Consultant") expressly accept the work product upon the following specific conditions.

1. Consultant represents that it prepared the work product in accordance with the professional and industry standards prevailing at the time such services were rendered.

2. The work product may contain information that is time sensitive. The work product was prepared by Consultant subject to the particular scope limitations, budgetary and time constraints and business objectives of the Client which are detailed therein or in the contract between Consultant and Client. Changes in use, tenants, work practices, storage, Federal, state or local laws, rules or regulations may affect the work product.

3. The observations described and upon which the work product was based were made under the conditions stated therein. Any conclusions presented in the work product were based solely upon the services described therein, and not on scientific or engineering tasks or procedures beyond the scope of described services.

4. In preparing its work product, Consultant may have relied on certain information provided by state and local officials and information and representations made by other parties referenced therein, and on information contained in the files of state and/or local agencies made available at the time of the project. To the extent that such files which may affect the conclusions of the work product are missing, incomplete, inaccurate or not provided, Consultant is not responsible. Although there may have been some degree of overlap in the information provided by these various sources, Consultant did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this project. Consultant assumes no responsibility or liability to discover or determine any defects in such information which could result in failure to identify contamination or other defect in, at or near the site. Unless specifically stated in the work product, Consultant assumes no responsibility or liability for the accuracy of drawings and reports obtained, received or reviewed.

5. If the purpose of this project was to assess the physical characteristics of the subject site with respect to the presence in the environment of hazardous substances, waste or petroleum and chemical products and wastes as defined in the work product, unless otherwise noted, no specific attempt was made to check the compliance of present or past owners or operators of the subject site with Federal, state, or local laws and regulations, environmental or otherwise.

6. If water level readings have been made, these observations were made at the times and under the conditions stated in the report. However, it must be noted that fluctuations in water levels may occur due to variations in rainfall, passage of time and other factors

and such fluctuations may effect the conclusions and recommendations presented herein.

7. Except as noted in the work product, no quantitative laboratory testing was performed as part of the project. Where such analyses have been conducted by an outside laboratory, Consultant has relied upon the data provided, and unless otherwise described in the work product has not conducted an independent evaluation of the reliability of these tests.

8. If the conclusions and recommendations contained in the work product are based, in part, upon various types of chemical data, then the conclusions and recommendations are contingent upon the validity of such data. These data (if obtained) have been reviewed and interpretations made by Consultant. If indicated in the work product, some of these data may be preliminary or screening-level data and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors.

9. Chemical analyses may have been performed for specific parameters during the course of this project, as described in the work product. However, it should be noted that additional chemical constituents not included in the analyses conducted for the project may be present in soil, groundwater, surface water, sediments or building materials at the subject site.

10. Ownership and property interests of all documents, including reports, electronic media, drawings and specifications, prepared or furnished by Consultant pursuant to this project are subject to the terms and conditions specified in the contract between the Consultant and Client, whether or not the project is completed.

11. Unless otherwise specifically noted in the work product or a requirement of the contract between the Consultant and Client, any reuse, modification or disbursement of documents to third parties will be at the sole risk of the third party and without liability or legal exposure to Consultant.

12. In the event that any questions arise with respect to the scope or meaning of Consultant's work product, immediately contact Consultant for clarification, explanation or to update the work product. In addition, Consultant has the right to verify, at the party's expense, the accuracy of the information contained in the work product, as deemed necessary by Consultant, based upon the passage of time or other material change in conditions since conducting the work.

13. Any use of or reliance on the work product shall constitute acceptance of the terms hereof.

PAVEMENT DESIGN RECOMMENDATIONS – REV5
US 21 AND SC 51 WIDENING
Fort Mill, South Carolina
S&ME Project No. 1351-12-037

PREPARED FOR:

STV Incorporated
454 South Anderson Rd, Suite 3 BTC 517
Rock Hill, South Carolina

PREPARED BY:

S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273

February 18, 2022

February 18, 2022

STV Incorporated
454 South Anderson Rd, Suite 3 BTC 517
Rock Hill, South Carolina

Attention: Ms. Thomas Mastillone, PE

Reference: **PAVEMENT DESIGN RECOMMENDATIONS – REV5**
US 21 AND SC 51 WIDENING
Fort Mill, South Carolina
S&ME Project No. 1351-12-037

Dear Mr. Mastillone:

The purpose of this revised report is to provide pavement design recommendations to the design team for the subject Pennies for Progress project. The information contained in this report pertains to the pavements for the roadway realignment of US 21 and SC 51 widening project which begins at its intersection Springfield Pkwy, continues to the intersection of SC 51 and then follows SC 51 to the North and South Carolina border. Our services are being performed in general accordance with the approved scope of services in the Master Agreement for Subcontracted Technical Services between S&ME, Inc. and STV dated October 4, 2012 and First Amendment to Subcontract for Professional Services dated April 2014.

Sincerely,

S&ME, Inc.

Stewart S. Laney, P.E.
Senior Project Manager

Kristen H. Hill, P.E.
Principal Engineer

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 22379 KRISTEN H. HILL

Mary Rawls, P.E. (NC)
Staff Engineer

SOUTH CAROLINA S&ME, INC. No. C00473 CERTIFICATE OF AUTHORIZATION

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1.0 Project Overview

The project generally consists of 2 mainline sections, the US 21 and SC 51 alignments and associated side streets. The following table presents how the project has been divided for the purposes of the pavement recommendations:

Table 1-1

Section	Route	Begin Sta.	End Sta.	No. Lanes	Curb & Gutter (y/n)	Pavement Design Life
1	US 21	10+00	60+00	4	Y	20*
2	US 21	60+00	135+00	4	Y	20
3	SC 51	295+62	340+00	4	Y	20
4	Residential Side Streets	Various	Various	2	Y	20
5	Old Nation/Old US 21 BUS	14+43	23+00	2	Y	20
6	Gold Hill Road	10+00	Old Nation Road	2	Y	20
7	Regent Parkway/Flint Hill Road	10+00/10+00	15+00/15+00	2	Y	20
8	Spring Hill Farm Road	Springhill Flex	SC 51	2	Y	20

* STV Recommended to keep design consistent through the project

Pavement designs are based on telephone conversations and e-mail correspondence between Stewart Laney, PE with S&ME and the STV design team as well as Jay Thompson, PE and Jason Johnston with SCDOT between February, 2015 and March, 2015. Revisions to include pavement designs for residential, industrial and collector side streets are based on correspondence between Mr. Laney and the STV design team and Mary Rawls, EI with S&ME and SCDOT between February and April 2017. The following documents have been provided and have incorporated into the pavement designs.

- SCDOT Pavement Design Guidelines dated July, 2008.
- E-mail from Sheri Williamson with SCDOT dated July 13, 2015.
- US-21 / SC-51 $AADT_{2012}$ = 34,700 $AADT_{2035}$ = 48,900
- 2012 & 2035 % Trucks = 8%
- 2012 and 2015 Peak Hour Volumes
- US 21 North Phase 1 & SC 51 Typical Sections, undated, provided July 2017.

Side streets are listed below based on local knowledge of the area and visual inspection. The streets are classified as residential, commercial, industrial, or collector. The Table below specifies these assigned classifications.

Table 1-2

Road	Classification
Lakeshore Road	Residential
Forest Drive	Residential
Baxter Lane	Residential
Old Nation/Old US 21 BUS	Collector
Flint Hill Road	Industrial
Gold Hill Road	Collector
Regent Parkway	Collector
Spring Hill Farm Road	Collector

2.0 Soil Conditions

Existing geotechnical conditions along the project alignment are based on the Preliminary Roadway Geotechnical Engineering Report (PRGER) prepared by S&ME which will be submitted at a later date. During this study, asphalt coring and subgrade evaluation was performed at seventeen (17) locations (C-1 through C-17) along the existing alignment. The subgrade was evaluated by Kessler Dynamic Cone Penetrometer Testing (KDCP) and by drilling the subgrade material to take measurements of the base material and visually classifying the subgrade soils. The KDCP is driven into the subgrade soils by dropping a Dual-Mass Hammer form a height of 22.6 inches. The depth of cone penetration is measures at selected penetration of hammer drop intervals and the soil shear strength is reported in terms of DCP index. The DCP index is used to estimate weighted average field California Bearing Ratio (CBR) values. The following table shows the testing that has been performed:

Table 2-1

Test ID	Route	Station (ft)	Offset (ft)	Depth (ft)	Asphalt Thickness (in.)	Concrete Thickness (in.)	Base Thickness (in.)	Base Type	Weighted Average CBR
C-1	Springfield Pkwy	12+98	23 RT	30	8.75	-	8.25	GABC	40
C-2	Springfield Pkwy	18+10	26 LT	30	9	-	4	GABC	35
C-3	Mercantile	11+03	14 LT	28.8	4	-	10	GABC	10
C-4	Lakeview Rd	13+40	6 RT	30	6.5	-	-	Sandy Silt	9
C-5	Amelea Dr	11+07	7 LT	30	1.5	-	3.5	GABC	17
C-6	Rain Forest Ct	11+52	5 LT	30	1.5	-	6	GABC	10
C-7	Lakeshore Dr	12+54	5 RT	30	3.5	-	3	GABC	12
C-8	Embassy Dr	10+89	3 LT	28.8	2	5.25	-	Clayey Silt	15
C-9	Old Nation Rd	15+10	5 RT	29.7	8	7.25	-	Concrete	3
C-10	Old Nation Rd	17+26	3 RT	30	7	-	5	GABC	
C-11	Baxter Ln	13+70	1 RT	30	-	-	9	GABC	15
C-12	Baxter Ln	12+02	1 LT	30	2	-	1.5	GABC	19
C-13	Central Carolinas Pkwy	11+11	8 RT	30	6	-	3	GABC	14
C-14	Regent Dr.	11+62	13 LT	30	2.5	-	7	GABC	9
C-15	Regent Pkwy	12+20	15 RT	30	4.25	-	3.5	GABC	16
C-16	Lakes Blvd	11+64	13 LT	30	5.25	-	1.5	GABC	13
C-17	Flint Hill Rd	12+01	7 LT	30	3.5	9.5	-	Concrete	

Based on the results of the testing program, pavement designs have considered a soaked laboratory CBR value of 4.0 (Soil Support Value (SSV) = 1.65).

3.0 Traffic Conditions

Traffic conditions are based on information provided by STV and SCDOT which have been detailed in Section 1.0. The project Road Groups have been provided by SCDOT and the Richland County Road Design Standards. The asphalt design procedures are based on the SCDOT Pavement Design Guidelines (2008). As shown in the table below, the following traffic conditions have been incorporated into our analyses:

Table 3-1

Alignment	SCDOT Road Group	Max 2015[1] ADT	Max 2035 ADT	% Trucks	Design Life[2] (years)	Lanes (per direction)	Directional Split
US 21	L	34,700	48,900	8	20	2	50
SC 51	L	34,700	48,900	8	20	2	50
Old Nation/Old US 21 BUS	D	17,900	26,586	8	20	1	50
Spring Hill Farm Road	D	12,300	17,700	5	20	1	50
Regent Parkway	D	10,667	15,053	5	20	1	50
Flint Hill Road	D	2,579	3,640	10	20	1	50
Gold Hill Road	D	11,000	15,000	5	20	1	50
Lakeshore Road/Residential	B	5,000	6,293	5	20	1	50

1 Based on 2012 and 2014 traffic volumes

Considering the SCODT pavement design procedures a required total number of 18 kip single axle load applications (ESALs) of **6,941,894** (target SN = 6.15) has been determined for both US 21 and SC 51 sections. The same was done for the side streets of US 21 and SC 51 and are listed below in Table 3-2.

Table 3-2

Alignment	Design ESALs	Target SN
Old Nation/Old US 21 BUS	2,092,298	5.2
Spring Hill Farm Road	1,213,184	5.0
Regent Parkway	751,136	4.5
Flint Hill Road	363,252	4.0
Gold Hill Road	1,219,576	5.0
Lakeshore Road/Residential	259,643	3.9

4.0 Existing Pavement Conditions

The existing pavements along the project are asphalt which have been overlaid, widened and patched multiple times. S&ME performed a visual condition survey of the existing pavements in general accordance with the FHWA "Distress Identification Manual for the Long-Term Pavement Performance Program (4th Edition)". S&ME has utilized the Coefficient Depreciation Method to evaluate the existing pavements for the project. Using this method, effective Structural Numbers (SN) have been determined for the existing pavements. The results of the visual condition survey and observations of the asphalt cores performed for the project were used to select depreciated layer coefficients for the overlay design sections.

S&ME has also performed a supplemental exploration of the existing pavements including a GPR survey and asphalt cores. The GPR survey was performed along the existing mainline travel lanes. GPR is an electromagnetic method that detects interfaces between subsurface materials with differing dielectric constants. The transmitter radiates electromagnetic waves into the earth from an antenna moving across the ground surface. Electromagnetic waves are reflected back to the receiver by interfaces between materials with differing dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant at the interface, the conductivity of the material that the wave is traveling through, and the frequency of the signal. Asphalt cores were also performed to supplement the GPR survey and to help calibrate the GPR data. Core results and the plots of the GPR data are attached to this letter for you review. The core and GRP data have been used to determine the in-place asphalt and ABC thicknesses along the project alignment.

An example of the results of the visual condition is provided in the following table and the full survey can be found within the tables of Appendix II:

Table 4-1

Section		1	2	3	4	5
Roadway		Springfield Pkwy	Springfield Pkwy	Mercantile Pl.	Lakeview Rd.	Amelia Dr.
Begin (Station)		**10+00**	**15+00**	**10+00**	**12+00**	**10+00**
End (Station)		**15+00**	**19+00**	**13+00**	**15+77**	**13+00**
Rutting	% of Roadway	20				
	Severity	Low				
Fatigue Cracking	% of Roadway					30
	Severity					Moderate
Potholes	% of Roadway					10
	Severity					Moderate
Patching	% of Roadway					10
	Severity					Low
Raveling	% of Roadway					10

Section		1	2	3	4	5
Roadway		Springfield Pkwy	Springfield Pkwy	Mercantile Pl.	Lakeview Rd.	Amelia Dr.
Begin (Station)		**10+00**	**15+00**	**10+00**	**12+00**	**10+00**
End (Station)		**15+00**	**19+00**	**13+00**	**15+77**	**13+00**
	Severity					Moderate
Bleeding	% of Roadway	20	20			
	Severity	Low	Low			
Edge Cracking	% of Roadway			10	70	90
	Severity			Low	High	High
Longitudinal Cracking	% of Roadway	10		10		
	Severity	Low		Low		
Transverse Cracking	% of Roadway			10		
	Severity			Low		

5.0 Pavement Design Recommendations

Based on the information provided to us and the results of our visual condition survey, we recommend two pavement design alternatives be considered for the US 21 / SC 51 project. Additionally, six designs have been recommended for the side streets. The alternatives for the mainline consist of a full depth new pavement section and an asphalt overlay section. Due to the severity of the distress observed at several of the existing intersections including Pinecrest Street, Lakeshore Drive and Goldhill Road, a significant amount of full depth patching will be required prior to overlaying the existing roadways at these locations. We recommend that the new pavement section be used to provide a full depth replacement of the existing pavements in these locations, existing shoulders and for all widened alignments. Plan sheets depicting the areas where removal and replacement of the existing travel lanes with the proposed full depth section are provided in the appendix.

Based on the information provided and a terminal serviceability (Pt) of 2.5, the following target structural numbers are recommended for the asphalt and subbase layer sections as shown in the table below. Appendix I also shows the all the calculations and assumptions made while following the AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Pavement Design Guidelines.

New Pavement Section-Mainline US-21 & SC 51

Table 5-1

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
	HMA Intermediate– B	200	2	0.34	0.68
3 & 4	HMA Base – A	1150	11	0.34	3.74
				Total SN	6.18
				Target SN	**6.15**

* Based on 105 lb/ft^3

New Pavement Section-Mainline-Alternate

Table 5-2

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
	HMA Intermediate– B	200	2	0.68	0.68
3 & 4	HMA Base – A	900	8	0.34	2.72
5	GABC	-	8	0.18	1.44
				Total SN	6.60
				Target SN	**6.15**

* Based on 105 lb/ft^3

New Pavement Section-Old Nation Road/Old US 21 BUS

Table 5-3

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
3, 4, 5	HMA Base – A	1,100	10.5	0.34	3.57
				Total SN	5.33
* Based on 105 lb/ft^3				**Target SN**	**5.23**

New Pavement Section-Lakeshore/Residential

Table 5-4

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
3 & 4	HMA Base – B	650	6.25	0.34	2.13
				Total SN	3.89
* Based on 105 lb/ft^3				**Target SN**	**3.89**

New Pavement Section- Gold Hill Rd

Table 5-5

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
3,4,5	HMA Base – A	1,000	9.5	0.34	3.23
				Total SN	5.0
* Based on 105 lb/ft^3				**Target SN**	**5.0**

New Pavement Section- Flint Hill Road

Table 5-6

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
3 & 4	HMA Base – A	700	6.7	0.34	2.7
				Total SN	4.0
* Based on 105 lb/ft^3				**Target SN**	**4.0**

New Pavement Section-Regent Parkway

Table 5-7

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
3 & 4	HMA Base – A	850	8	0.34	2.72
				Total SN	4.48
				Target SN	**4.51**

* Based on 105 lb/ft^3

New Pavement Section-Spring Hill Farm Road

Table 5-8

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
3,4,5	HMA Base – A	1,000	9.5	0.34	3.23
				Total SN	5.0
				Target SN	**5.0**

* Based on 105 lb/ft^3

Mainline Overlay Section

Table 5-9

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.88
2	HMA Intermediate – B	200	2	0.44	0.88
	Asphalt Build Up**	100	1	0.34	0.34
-	Existing Asphalt < 4"	-	4	0.26	1.04
-	Existing Asphalt > 4"	-	7	0.34	2.38
-	Existing Sand / Clay Base	-	6	0.12	0.72
				Total SN	6.24
				Target SN	**6.15**

* Based on 105 lb/ft^3

**- HMA Surface E (Lifts≤ 1.5 inches)
- HMA Intermediate B (Lifts > 1.5 inches)

Asphalt Overlay Section – With Reclamation Alternate

Table 5-10

Course	Material	Rate (psy)*	Thickness (in.)	Layer Coefficient	Layer SN
1	HMA Surface – B	200	2	0.44	0.66
2	HMA Intermediate – B	200	2	0.44	0.66
	Asphalt Build Up**	100	1	0.34	0.34
3	HMA Base -A	200	2	0.34	0.68
-	Mill min. 2" Existing Asphalt	-	-	-	-
-	CMRCB	-	12	0.26	3.12
				Total SN	5.16
				Target SN	**6.15**

* Based on 105 lb/ft^3

**- HMA Surface E (Lifts ≤ 1.5 inches)
- HMA Intermediate B (Lifts > 1.5 inches)

In lieu of full depth patching/replacement of highly distressed areas, full depth reclamation could be considered. In order to maintain planned grades and to allow for the reclamation to extend through the existing asphalt, 2 inches of asphalt should be milled prior to reclamation.

When widening pavements, a reflective crack will eventually form at the joint between the new and old pavements. If full depth reclamation is performed, this joint and subsequent crack could be prevented by building out the widened section prior to reclamation.

We understand that SCDOT prefers not to allow high levels of traffic (like those measured here) on unpaved reclaimed surfaces for an extended period of time. Depending on the timing and sequence of construction, consideration should be given to placing a chip seal over the newly reclaimed base until paving can be performed.

6.0 Closing

The information provided in this letter is based on our understanding of the project, information given in this report and on our interpretation of the information provided. We have made our recommendations based on our experience with similar subsurface conditions and similar projects. These analyses apply to the specific project discussed in this report; therefore, any changes in the project information should be provided to us so we may review our conclusions and make any appropriate modifications.

This report has been prepared for the exclusive use of the client for specific application to the subject project and project site. It has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made.

S&ME, Inc. appreciates the opportunity to assist you during this phase of the project. If you should have questions concerning this report, or if we may be of further assistance, please contact us.

Appendices

Appendix I – Pavement Design Calculations

ESAL Calculation

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Pavement Design Guidelines

Project:	US 21 and SC 51
Job No.:	1351-12-037
Design Life:	20
Design Life 2:	10
Alignment:	

Calculated By: JERW

Check By:

Alignment	SCDOT Road Group	2015			2035			Growth (%)	Construction Year ADT
		Max ADT		%Trucks	Max ADT		%Trucks		
US 21/ 51	L	34,700	0	8	48,900	0	8	1.72	35,300
Us 21 no Curb & Gutter	L	34,700	0	8	48,900	0	8	1.72	35,300
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!

Alignment	SCDOT Road Group	Dir %	Lanes / Direct	Lane Dist.	Dual Factor (0 for SCDOT)	TTST Factor	Construction Year	Additional ESALs	Total ESALs
US 21/ 51	L	50	2	0.8	0	0.7052	2016	0	6,941,894
Us 21 no Curb & Gutter	L	50	2	0.8	0	0.7052	2016	0	3,174,008
0				0.8				0	#DIV/0!
0				0.8				0	#DIV/0!
0				0.8				0	#DIV/0!
0				0.8				0	#DIV/0!
0				0.8				0	#DIV/0!
0				0.8				0	#DIV/0!

1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with NCDOT Revisions

Project: US 21 and SC 51 **Calculated By:** JERW

Job No.: 1351-12-037 **Check By:**

Design Life: 20

Alignment: US 21 Sta. 10+00 to 60+00

Required ESALs: **6,941,894**

Alt 1 Full Depth Replace

Thickness (in)	Material	Layer Coefficient	Layer SN	PSY
2	HMA Surface*	0.44	0.88	200
2	HMA Intermediate*	0.44	0.88	200
1	HMA S/I excess of 400psy	0.34	0.34	100
8	HMA Base, Type A, B & C	0.34	2.72	850
8	GABC	0.18	1.44	
0	CTABC	0.34	0	
0	Cement Modified Recycled Base	0.26	0	
0	Cement/Lime Subbase	0.15	0	
0	Sand / Clay Base	0.12	0	
0	Old Asphalt < 4 inches	0.26	0	
0	Old Asphalt > 4 inches	0.34	0	
21			**6.26**	1350

Alt 2 Full Depth Reclamation

Thickness (in)	Material	Layer Coefficient	Layer SN	PSY
	HMA Surface*	0.44	0	0
	HMA Intermediate*	0.44	0	0
	HMA S/I excess of 400psy	0.34	0	0
	HMA Base, Type A, B & C	0.34	0	0
	GABC	0.18	0	
	CTABC	0.34	0	
	Cement Modified Recycled Base	0.26	0	
	Cement/Lime Subbase	0.15	0	
	Sand / Clay Base	0.12	0	
	Old Asphalt < 4 inches	0.26	0	
	Old Asphalt > 4 inches	0.34	0	
0			**0**	0

Alt 3 Overlay

Thickness (in)	Material	Layer Coefficient	Layer SN	PSY
2	HMA Surface*	0.44	0.88	200
2	HMA Intermediate*	0.44	0.88	200
1	HMA S/I excess of 400psy	0.34	0.34	100
0	HMA Base, Type A, B & C	0.34	0.00	0
0	GABC	0.18	0.00	
0	CTABC	0.34	0.00	
0	Cement Modified Recycled Base	0.26	0.00	
0	Cement/Lime Subbase	0.15	0.00	
6	Sand / Clay Base	0.12	0.72	
4	Old Asphalt < 4 inches	0.26	1.04	
7	Old Asphalt > 4 inches	0.34	2.38	
22			**6.24**	**500**

* If combined new HMA Surface and HMA Intermediate course rate exceeds 400 psy then coefficient of the excess material over 400 psy is reduced to 0.34

Pt = 2.0 Available EASLs	14,322,067		Pt = 2.0 Available EASLs	0		Pt = 2.0Available EASLs	13,965,012	
Pt = 2.5 Available EASLs	**7,941,468**		**Pt = 2.5 Available EASLs**	**0**		**Pt = 2.5 Available EASLs**	**7,749,084**	
Pt = 3.0 Available EASLs	3,580,332		Pt = 3.0 Available EASLs	0		Pt = 3.0 Available EASLs	3,497,012	

ESAL Calculation

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Pavement Design Guidelines

Project:	US 21/SC 51 Side Streets	**Calculated By:**	MLR
Job No.:	12-037	**Check By:**	KHH
Design Life:	20		
Alignment:			

Alignment	SCDOT Road Group	2012			2035			Growth (%)	Construction Year ADT
		Max ADT	%Duals	%Trucks	Max ADT	%Duals	%Trucks		
Old Nation/Old US 21 BUS	D	17,900	0	8	26,586	0	8	1.72	19,846
Lakeshore/Residential	B	5,000	0	5	6,293	0	5	1.00	5,309
Gold Hill Road	D	11,000	0	8	15,000	0	8	1.40	11,964
Old Nation Road (From PHV)	D	4,967	0	6	11,100	0	6	3.50	6,126
Regent Parkway	D	10,667	0	5	15,053	0	5	1.50	11,670
Flint Hill Road	D	2,579	0	10	3,640	0	10	1.50	2,822
Spring Hill Farm Road	D	12,300	0	5	17,700	0	5	3.50	15,174

Alignment	SCDOT Road Group	Dir %	Lanes / Direct	Lane Dist.	Dual Factor (0 for SCDOT)	TTST Factor	Construction Year	Additional ESALs	Total ESALs
Old Nation/Old US 21 BUS	D	50	1	1	0	0.3023	2018	0	2,092,298
Lakeshore/Residential	B	50	1	1	0	0.2419	2018	0	259,643
Gold Hill Road	D	50	1	1	0	0.3023	2018	0	1,219,576
Old Nation Road (From PHV)	D	50	1	1	0	0.3023	2018	0	587,527
Regent Parkway	D	50	1	1	0	0.3023	2018	0	751,136
Flint Hill Road	D	50	1	1	0	0.3023	2018	0	363,252
Spring Hill Farm Road	D	50	1	1	0	0.3023	2018	0	1,213,184

1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Revisions

Project: US 21/51 Side Streets — **Calculated By:** SSL
Job No.: 1351-12-037 — **Check By:** KHH
Design Life: 20
Alignment: Old Nation/Old US 21 BUS
Required ESALs: 2,092,298 — **Design Lanes:** 1

Thickness (in)	Material	Layer Coefficient	Depreciation Coefficient	Depreciated Layer Coefficient	Layer SN	PSY
	OGFC	0.44	1	0.44	0.00	0
2	HMA Surface*	0.44	1	0.44	0.88	200
2	HMA Intermediate*	0.44	1	0.44	0.88	200
0	HMA S/I excess of 400psy	0.34	1	0.34	0.00	0
10.5	HMA Base, Type A, B & C	0.34	1	0.34	3.57	1100
	GABC	0.18	1	0.18	0.00	
	CTABC	0.34	1	0.34	0.00	
	Cement Modified Recycled Base	0.26	1	0.26	0.00	
	Cement/Lime Subbase	0.15	1	0.15	0.00	
	Macadam Base	0.1	1	0.10	0.00	
	Sand / Clay Base	0.12	1	0.12	0.00	
	Old Asphalt < 4 inches	0.44	0	0.00	0.00	0
	Old Asphalt > 4 inches	0.44	0	0.00	0.00	0
	Old Sand-Asphalt	0.4	0	0.00	0.00	0
	Existing Base (Macadam)	0.1	0	0.00	0.00	
	Existing Sub-Base	0.12	0	0.00	0.00	
14.5					**5.3**	1500

* If combined new HMA Surface and HMA Intermediate course rate exceeds 400 psy then coefficient of the excess material over 400 psy is reduced to 0.34

Pt = 2.0 Available EASLs	**4,123,607**
Pt = 2.5 Available EASLs	2,398,528
Pt = 3.0 Available EASLs	1,153,531

1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Revisions

Project: US 21/SC 51 Side Streets — **Calculated By:** SSL
Job No.: 12-037 — **Check By:** KHH
Design Life: 20
Alignment: Lakeshore/Residential
Required ESALs: 259,643 — **Design Lanes:** 1

Thickness (in)	Material	Layer Coefficient	Depreciation Coefficient	Depreciated Layer Coefficient	Layer SN	PSY
	OGFC	0.44	1	0.44	0.0	0
2	HMA Surface*	0.44	1	0.44	0.9	200
2	HMA Intermediate*	0.44	1	0.44	0.9	200
0	HMA S/I excess of 400psy	0.34	1	0.34	0.0	0
6.3	HMA Base, Type A, B & C	0.34	1	0.34	2.1	650
	GABC	0.18	1	0.18	0.0	
	CTABC	0.34	1	0.34	0.0	
	Cement Modified Recycled Base	0.26	1	0.26	0.0	
	Cement/Lime Subbase	0.15	1	0.15	0.0	
	Macadam Base	0.1	1	0.10	0.0	
	Sand / Clay Base	0.12	1	0.12	0.0	
	Old Asphalt < 4 inches	0.44	0.6	0.26	0.0	0
	Old Asphalt > 4 inches	0.44	0.7	0.31	0.0	0
	Old Sand-Asphalt	0.35		0.00	0.0	0
	Existing Base (Macadam)	0.1	0	0.00	0.0	
	Existing Sub-Base	0.12	1	0.12	0.0	
10.3					**3.9**	1050

Pt = 2.0 Available EASLs	**429,792**
Pt = 2.5 Available EASLs	295,101
Pt = 3.0 Available EASLs	177,575

1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Revisions

Project: US 21/SC 51 Side Streets — **Calculated By:** SSL
Job No.: 12-037 — **Check By:** KHH
Design Life: 20
Alignment: Gold Hill Road
Required ESALs: 1,219,576 — **Design Lanes:** 1

Thickness (in)	Material	Layer Coefficient	Depreciation Coefficient	Depreciated Layer Coefficient	Layer SN	PSY
	OGFC	0.44	1	0.44	0.0	0
2	HMA Surface*	0.44	1	0.44	0.9	200
2	HMA Intermediate*	0.44	1	0.44	0.9	200
0	HMA S/I excess of 400psy	0.34	1	0.34	0.0	0
9.5	HMA Base, Type A, B & C	0.34	1	0.34	3.2	1000
	GABC	0.18	1	0.18	0.0	
	CTABC	0.34	1	0.34	0.0	
	Cement Modified Recycled Base	0.26	1	0.26	0.0	
	Cement/Lime Subbase	0.15	1	0.15	0.0	
	Macadam Base	0.1	1	0.10	0.0	
	Sand / Clay Base	0.12	1	0.12	0.0	
	Old Asphalt < 4 inches	0.44		0.00	0.0	0
	Old Asphalt > 4 inches	0.44		0.00	0.0	0
	Old Sand-Asphalt	0.23		0.00	0.0	0
	Existing Base (Macadam)	0.1		0.00	0.0	
	Existing Sub-Base	0.12		0.00	0.0	
13.5					**5.0**	**1400**

Pt = 2.0Available EASLs	**2,513,272**
Pt = 2.5 Available EASLs	1,502,185
Pt = 3.0 Available EASLs	749,499

S&ME 1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Revisions

Project: 0 **Calculated By:** SSL

Job No.: 0 **Check By:** KHH

Design Life: 20

Alignment: Regent Parkway

Required ESALs: 751,136 **Design Lanes:** 1

Thickness (in)	Material	Layer Coefficient	Depreciation Coefficient	Depreciated Layer Coefficient	Layer SN	PSY
	OGFC	0.44	1	0.44	0.0	0
2	HMA Surface*	0.44	1	0.44	0.9	200
2	HMA Intermediate*	0.44	1	0.44	0.9	200
	HMA S/I excess of 400	0.34	1	0.34	0.0	0
8	HMA Base, Type A, B &	0.34	1	0.34	2.7	850
	GABC	0.18	1	0.18	0.0	
	CTABC	0.34	1	0.34	0.0	
	Cement Modified Recy	0.26	1	0.26	0.0	
	Cement/Lime Subbase	0.15	1	0.15	0.0	
	Macadam Base	0.1	1	0.10	0.0	
	Sand / Clay Base	0.12	1	0.12	0.0	
	Old Asphalt < 4 inches	0.44		0.00	0.0	0
	Old Asphalt > 4 inches	0.44		0.00	0.0	0
	Old Sand-Asphalt	0.23		0.00	0.0	0
	Existing Base (Macadar	0.1		0.00	0.0	
	Existing Sub-Base	0.12		0.00	0.0	
12					**4.5**	**1250**

Pt = 2.0Available EASLs **1,141,017**

Pt = 2.5 Available EASLs 720,147

Pt = 3.0 Available EASLs 386,733

S&ME 1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Revisions

Project: 0 **Calculated By:** SSL

Job No.: 0 **Check By:** KHH

Design Life: 20

Alignment: Flint Hill Road

Required ESALs: 363,252 **Design Lanes:** 1

Thickness (in)	Material	Layer Coefficient	Depreciation Coefficient	Depreciated Layer Coefficient	Layer SN	PSY
	OGFC	0.44	1	0.44	0.0	0
2	HMA Surface*	0.44	1	0.44	0.9	200
2	HMA Intermediate*	0.44	1	0.44	0.9	200
0	HMA S/I excess of 400psy	0.34	1	0.34	0.0	0
6.7	HMA Base, Type A, B & C	0.34	1	0.34	2.3	700
	GABC	0.18	1	0.18	0.0	
	CTABC	0.34	1	0.34	0.0	
	Cement Modified Recycled I	0.26	1	0.26	0.0	
	Cement/Lime Subbase	0.15	1	0.15	0.0	
	Macadam Base	0.1	1	0.10	0.0	
	Sand / Clay Base	0.12	1	0.12	0.0	
	Old Asphalt < 4 inches	0.44	0.6	0.26	0.0	0
	Old Asphalt > 4 inches	0.44	0.7	0.31	0.0	0
	Old Sand-Asphalt	0.35		0.00	0.0	0
	Existing Base (Macadam)	0.1	0	0.00	0.0	
	Existing Sub-Base	0.12	1	0.12	0.0	
10.7					**4.0**	1100

Pt = 2.0 Available EASLs **545,666**

Pt = 2.5 Available EASLs 366,526

Pt = 3.0 Available EASLs 214,109

S&ME 1972 Pavement Thickness Design

AASHTO Interim Guide for Design of Pavement Structures, 1972 with SCDOT Revisions

Project: 0 **Calculated By:** SSL

Job No.: 0 **Check By:** KHH

Design Life: 20

Alignment: Spring Hill Farm Road

Required ESALs: 1,213,184 **Design Lanes:** 1

Thickness (in)	Material	Layer Coefficient	Depreciation Coefficient	Depreciated Layer Coefficient	Layer SN	PSY
	OGFC	0.44	1	0.44	0.0	0
2	HMA Surface*	0.44	1	0.44	0.9	200
2	HMA Intermediat	0.44	1	0.44	0.9	200
	HMA S/I excess of	0.34	1	0.34	0.0	0
9.5	HMA Base, Type A	0.34	1	0.34	3.2	1000
0	GABC	0.18	1	0.18	0.0	0
	CTABC	0.34	1	0.34	0.0	
	Cement Modified	0.26	1	0.26	0.0	
	Cement/Lime Sub	0.15	1	0.15	0.0	
	Macadam Base	0.1	1	0.10	0.0	
	Sand / Clay Base	0.12	1	0.12	0.0	
	Old Asphalt < 4 in	0.44		0.00	0.0	0
	Old Asphalt > 4 in	0.44		0.00	0.0	0
	Old Sand-Asphalt	0.23		0.00	0.0	0
	Existing Base (Ma	0.1		0.00	0.0	
	Existing Sub-Base	0.12		0.00	0.0	
13.5					**5.0**	**1400**

Pt = 2.0Available EASLs **2,513,272**

Pt = 2.5 Available EASLs 1,502,185

Pt = 3.0 Available EASLs 749,499

Appendix II – Roadway Visual Condition Survey Tables

Section		1	2	3	4	5	6	7	8	9	10	11	12
Roadway		**Springfield Pkwy**	**Springfield Pkwy**	**Mercantile Pl.**	**Lakeview Rd.**	**Amelia Dr.**	**Fern Forest Ct.**	**Lake Shore Dr.**	**Forest Dr.**	**Embassy Dr.**	**Gold Hill Rd. (US-21 to Old Nation Rd.)**	**Old Nation Rd (US-21 to Gold Hill Rd.)**	**Old Nation Rd.**
Begin (Station)		10+00	15+00	10+00	12+00	10+00	10+00	10+00	10+00	10+00	Intersection to	14+43	Gold Hill Rd. to
End (Station)		15+00	19+00	13+00	15+77	13+00	13+00	14+61	15+00	12+45	Intersection	21+36	23+00
Rutting	% of Roadway	20											
	Severity	Low											
Fatigue Cracking	% of Roadway					30	70	20	30				
	Severity					Moderate	High	Moderate	Low to Mod.				
Potholes	% of Roadway					10	10						
	Severity					Moderate	Moderate						
Patching	% of Roadway					10	30	10					
	Severity					Low	Moderate	Low					
Raveling	% of Roadway					10	70						
	Severity					Moderate	Moderate						
Bleeding	% of Roadway	20	20										
	Severity	Low	Low										
Edge Cracking	% of Roadway			10	70	90	20	20			10	10	
	Severity			Low	High	High	Low to Mod.	Low			Low	Low	
Longitudinal Cracking	% of Roadway	10		10			10	20		10	10	10	10
	Severity	Low		Low			Low	Low		Low	Low	Low	Low
Transverse Cracking	% of Roadway			10			10				30		
	Severity			Low			Moderate				Low		

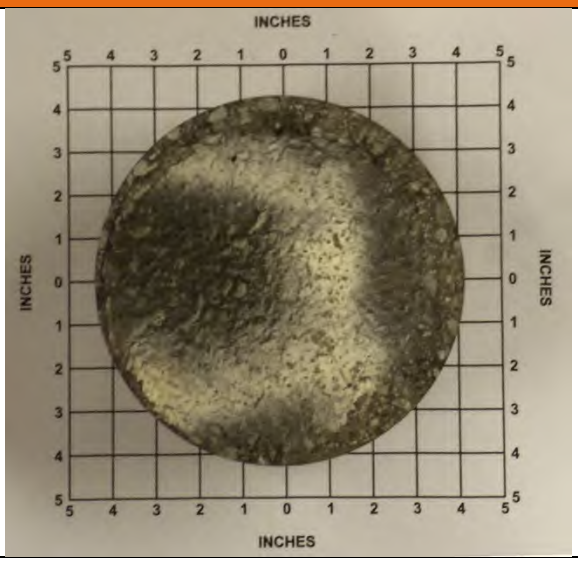
Section		13	14	15	16	17	18	19	20	21	22	23	24
Roadway		**Gold Hill Rd.**	**Baxter Ln.**	**Garrison Farm Rd.**	**Central Carolinas Pkwy**	**Regent Dr.**	**Regent Pkwy.**	**Lakes Blvd**	**Flint Hill Rd.**	**Retail Dr.**	**Terry's Rd**	**Springhill Farm Rd.**	**Andrew L Tucker Rd.**
Begin (Station)		10+00	12+00	10+00	10+00	10+00	10+00	10+00	10+00	10+00	10+00	Springhill Flex	5+00
End (Station)		US 21	15+12	13+00	14+09	12+68	15+00	13+00	15+00	14+02	12+66	SC 51	0+00
Rutting	% of Roadway	40		20			10					20	20
	Severity	Moderate		Low to Mod.			Low					Low	Moderate
Fatigue Cracking	% of Roadway	20		70				30		30		30	
	Severity	Low to Mod.		Mod. to High				Low to Mod.		Moderate		Moderate	
Potholes	% of Roadway			10									5
	Severity			Low									High
Patching	% of Roadway	10		70							5	40	
	Severity	Low		Moderate							Low	Moderate	
Raveling	% of Roadway			20						10	5		
	Severity			Low to Moderate						Low	Low		
Bleeding	% of Roadway	5							5				40
	Severity	Bleeding							Low				High
Edge Cracking	% of Roadway	30		50			10	20		20		30	
	Severity	Low		Moderate			Low	Moderate		Low		Moderate	
Longitudinal Cracking	% of Roadway	20			10	20	10			10		20	
	Severity	Low			Low	Low	Low			Low		Low	
Transverse Cracking	% of Roadway								20				
	Severity								Low				

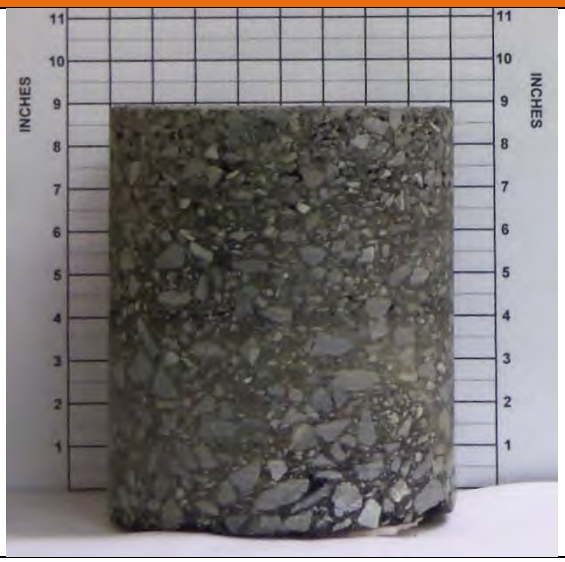
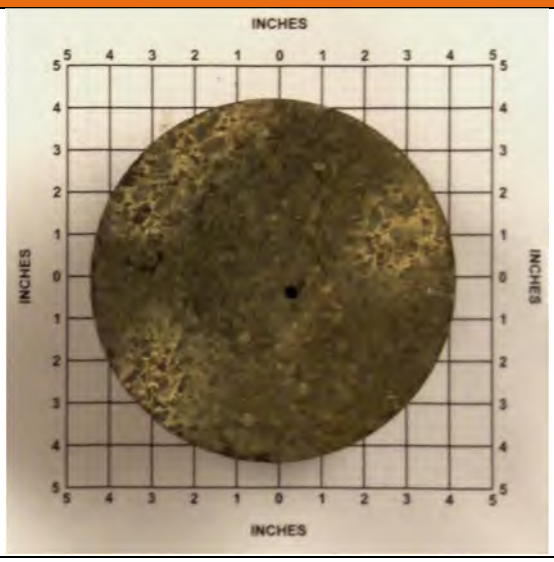
Section		25	26	27	28	29	30	31	32	33	34	35	36
Roadway		**Flint Hill Rd**	**Flint Hill Rd**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**
Begin (Station)		Quarry Overlook Dr.	SC 51	11+00	Springfield Pkwy	21+00	Mercantile Pl.	Lakeview Rd	Amelia Dr.	Fern Forest Ct.	Lakeshore Dr.	Forest Dr.	52+00
End (Station)		SC 51	Springhill Farm Rd.	Springfield Pkwy	21+00	Mercantile Pl.	Lakeview Rd	Amelia Dr.	Fern Forest Ct.	Lakeshore Dr.	Forest Dr.	52+00	Emabssy Dr.
Rutting	% of Roadway	10	40			30	30	30			10	10	10
	Severity	Low	Moderate			Low	Low to Mod.	Low to Mod.			Low to Mod.	Low to Mod.	Low to Mod.
Fatigue Cracking	% of Roadway			20	10	30	30	30	50	50	50	50	50
	Severity			Low	Low	Low to Mod.	Moderate	Moderate	Moderate	Low to Mod.	Low	Low	Low
Potholes	% of Roadway										10	10	10
	Severity										Moderate	Moderate	Moderate
Patching	% of Roadway			5									
	Severity			Low									
Raveling	% of Roadway												
	Severity												
Bleeding	% of Roadway						30	30	30	30	20	20	20
	Severity						Low	Low	Low	Low	Low	Low	Low
Edge Cracking	% of Roadway		50	10							30	30	30
	Severity		Moderate	Low							Moderate	Moderate	Moderate
Longitudinal Cracking	% of Roadway			10	20	20			20	20	20	20	20
	Severity			Low	Low	Low			Low	Low	Low	Low	Low
Transverse Cracking	% of Roadway	10	40	10					20	20	20	20	20
	Severity	Low	Moderate	Low					Low	Low	Low	Low	Low

Section		37	38	39	40	41	42	43	44	45	46	47	48	49
Roadway		**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**	**US 21**
Begin (Station)		Embassy Dr.	Gold Hill Rd	67+00	Old Nation Rd.	Baxter Ln.	Regent Dr.	Regent Pkwy	Lakes Blvd	103+00	Retail Dr. to	Terrys Dr.	SC 51	125+00
End (Station)		Gold Hill Rd	67+00	Old Nation Rd	Baxter Ln.	Regent Dr.	Regent Pkwy	Lakes Blvd.	103+00	Retail Dr.	Terrys Dr.	SC 51	125+00	130+00
Rutting	% of Roadway	50	20	20	20	20	20	20	20	20	20	20	30	30
	Severity	High	Low	Low	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low
Fatigue Cracking	% of Roadway	50	20	20	20	20	50	30	30	30	30	30	30	30
	Severity	Moderate	Moderate	Moderate	High	High	Mod. to High	Moderate	Moderate	Moderate	Moderate	Moderate	Low to Mod.	Low to Mod.
Potholes	% of Roadway	50												
	Severity	Moderate												
Patching	% of Roadway	60	10	10	20	20	10	5	5	5	5	5	10	10
	Severity	Moderate	Low to Mod.	Low to Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Raveling	% of Roadway						10							
	Severity						Moderate							
Bleeding	% of Roadway	50	10	10	10	10								
	Severity	Moderate	Low	Low	Low to Mod.	Low to Mod.								
Edge Cracking	% of Roadway	50	40	40	20	20	20						40	40
	Severity	Mod. to High	Moderate	Moderate	Low to Mod.	Low to Mod.	Moderate						Low	Low
Longitudinal Cracking	% of Roadway		20	20	20	20	30	30	30	30	30	30	30	30
	Severity		Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Transverse Cracking	% of Roadway		20	20	20	20	30	30	30	30	30	30	20	20
	Severity		Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low

Section		50	51	52	53	54	55	56	57
Roadway		**SC 51**	**SC 51**	**SC 51**	**SC 51**	**SC 51**	**SC 51**	**SC 51**	**SC 51**
Begin (Station)		US 21	310+00	305+00	310+00	315+00	Flint Hill Rd	Flint Hill Rd	Springhill Farm Rd
End (Station)		310+00	305+00	310+00	315+00	320+00	320+00	Springhill Farm Rd	NC/SC Stateline
Rutting	% of Roadway						50		20
	Severity						Moderate		Moderate
Fatigue Cracking	% of Roadway	20	20	20	20	20			30
	Severity	Low to Mod.	Low to Mod.	Low	Low	Low			Low
Potholes	% of Roadway							10	10
	Severity							Mod. to High	Mod. to High
Patching	% of Roadway							20	20
	Severity							Moderate	Moderate
Raveling	% of Roadway							10	10
	Severity							Low	Low
Bleeding	% of Roadway						20	20	10
	Severity						Moderate	High	Mod. to High
Edge Cracking	% of Roadway	20	20	20	20	20	70	30	30
	Severity	Moderate	Moderate	Low	Low	Low	Mod. to High	Mod. to High	Moderate
Longitudinal Cracking	% of Roadway	20	20	20	20	20		40	40
	Severity	Low	Low	Low	Low	Low		Low	Low
Transverse Cracking	% of Roadway	40	40	40	40	40	40	40	40
	Severity	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

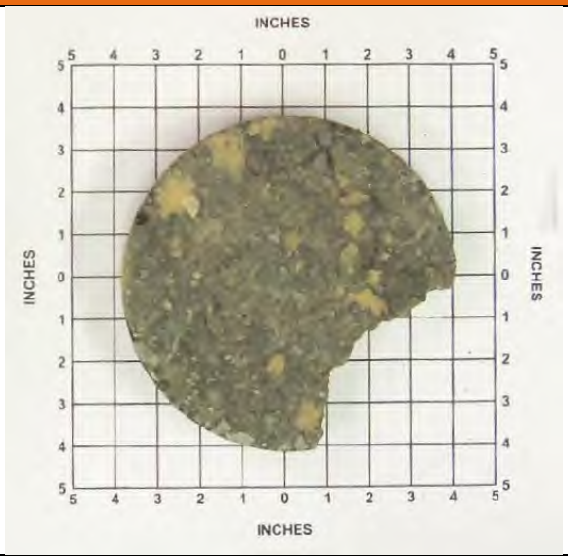
Appendix III – Core Photos

Test Location:	C-1
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	8 ¾
Aggregate Base Course Thickness (inches)	8 ¼

Test Location:	C-2
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	9
Aggregate Base Course Thickness (inches)	4

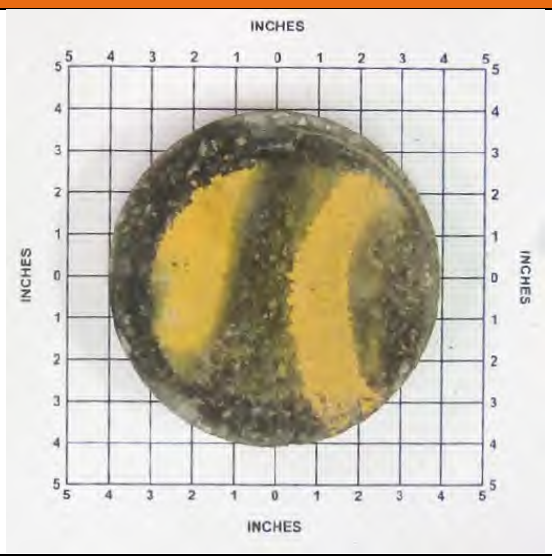
Test Location:	C-3
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	4
Aggregate Base Course Thickness (inches)	10

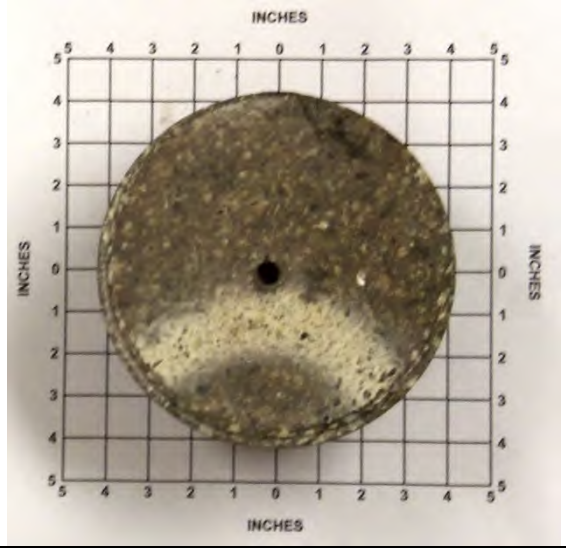
Test Location:	C-4
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	6 ½
Base Material Not Encountered	-

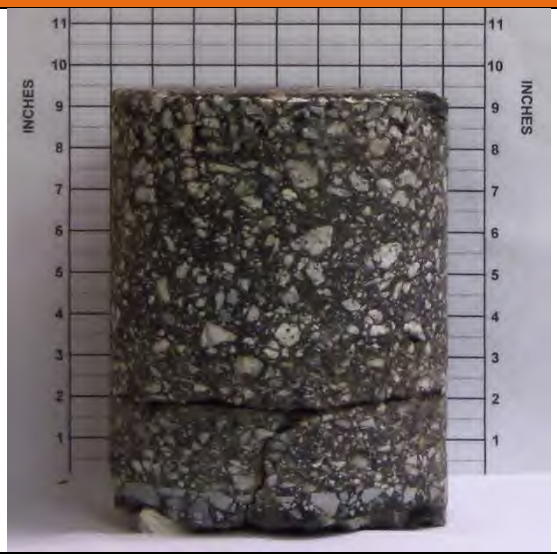
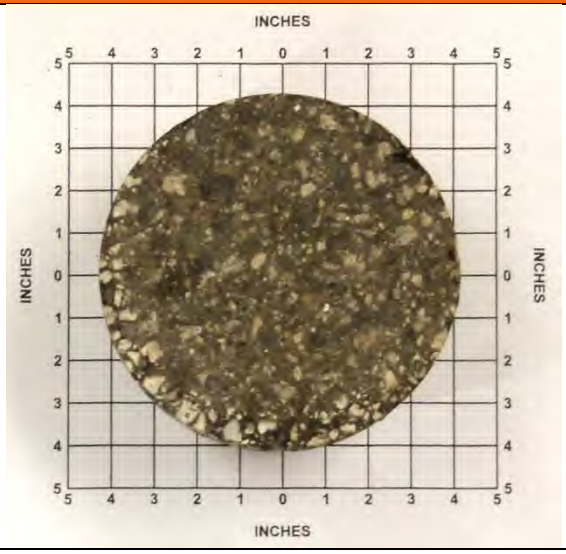
Test Location:	C-5
Elevation View of Core	**Plan View of Core**
	
Average Asphalt Thickness (inches)	1 ½
Aggregate Base Course Thickness (inches)	3 ½

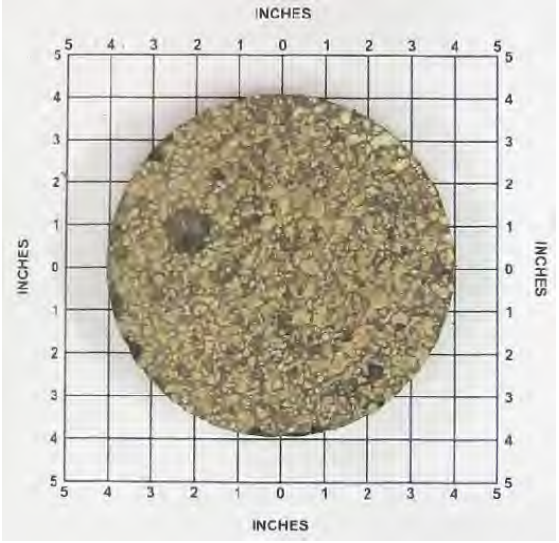
Test Location:	C-6
Elevation View of Core	**Plan View of Core**
	
Asphalt Thickness (inches)	1 ½
Aggregate Base Course Thickness (inches)	4 ¾

Test Location:	C-7
Elevation View of Core	**Plan View of Core**
	
Asphalt Thickness (inches)	3 ½
Aggregate Base Course Thickness (inches)	3

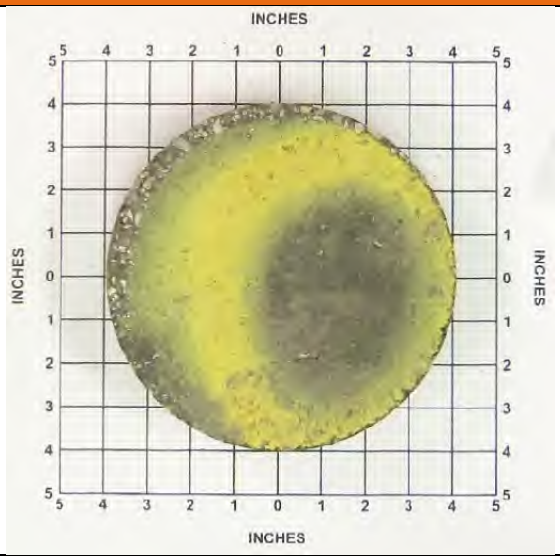
Test Location:	C-8
Elevation View of Core	**Plan View of Core**
	
Asphalt Thickness (inches)	2
Concrete Thickness (inches)	5 ¼

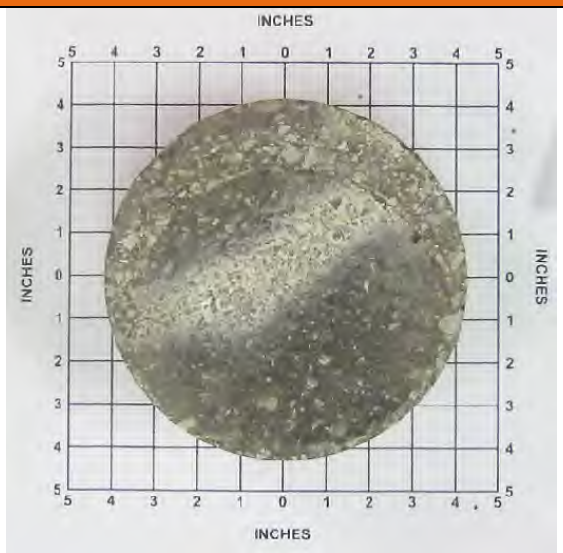
Test Location:	C-9
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	8
Concrete Thickness (inches)	7 ¼

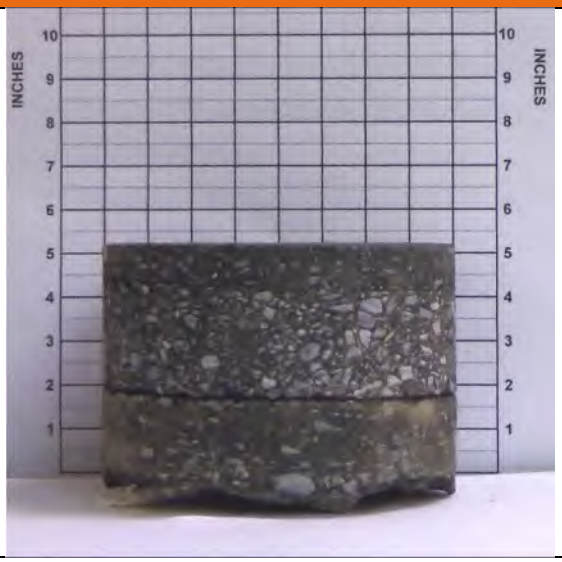
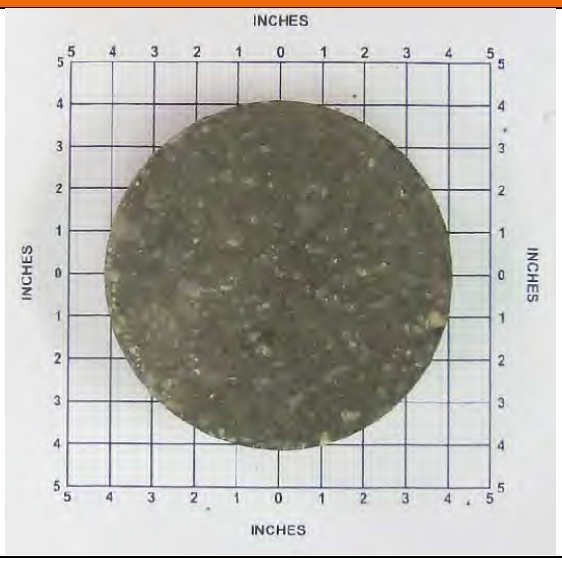
Test Location:	C-10
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	9 ½
Aggregate Base Course Thickness (inches)	5

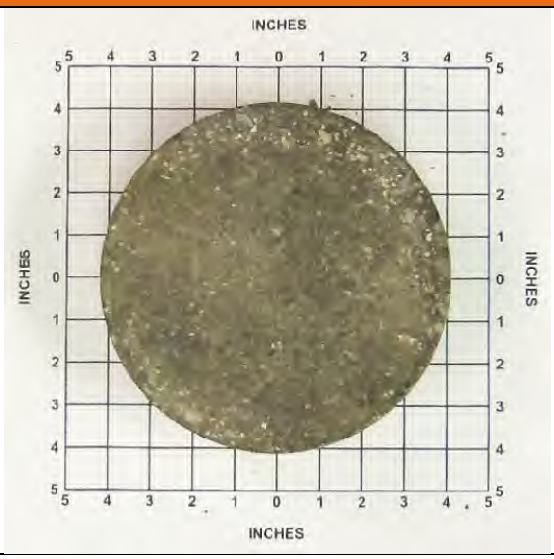
Test Location:	C-12
Elevation View of Core	**Plan View of Core**
	
Asphalt Not Encountered	2
Aggregate Base Course Thickness (inches)	1 ½

Test Location:	C-13
Elevation View of Core	**Plan View of Core**
	
Asphalt Thickness (inches)	6
Aggregate Base Course Thickness (inches)	3

Test Location:	C-14
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	2 ½
Aggregate Base Course Thickness (inches)	7

Test Location:	C-15
Elevation View of Core	Plan View of Core
	
Asphalt Thickness (inches)	4 ¼
Aggregate Base Course Thickness (inches)	3 ½

Test Location:	C-16
Elevation View of Core	**Plan View of Core**
	
Asphalt Thickness (inches)	5 ¼
Aggregate Base Course Thickness (inches)	1 ½

Test Location:	C-17
Elevation View of Core	**Plan View of Core**
	
Asphalt Thickness (inches)	3 ½
Concrete Thickness (inches)	8 ½

Appendix IV – Kessler DCP Test Results

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-1 **Date:** 7/30/2014 **Personnel:** JERW
Thickness of Stone (in): 8.25

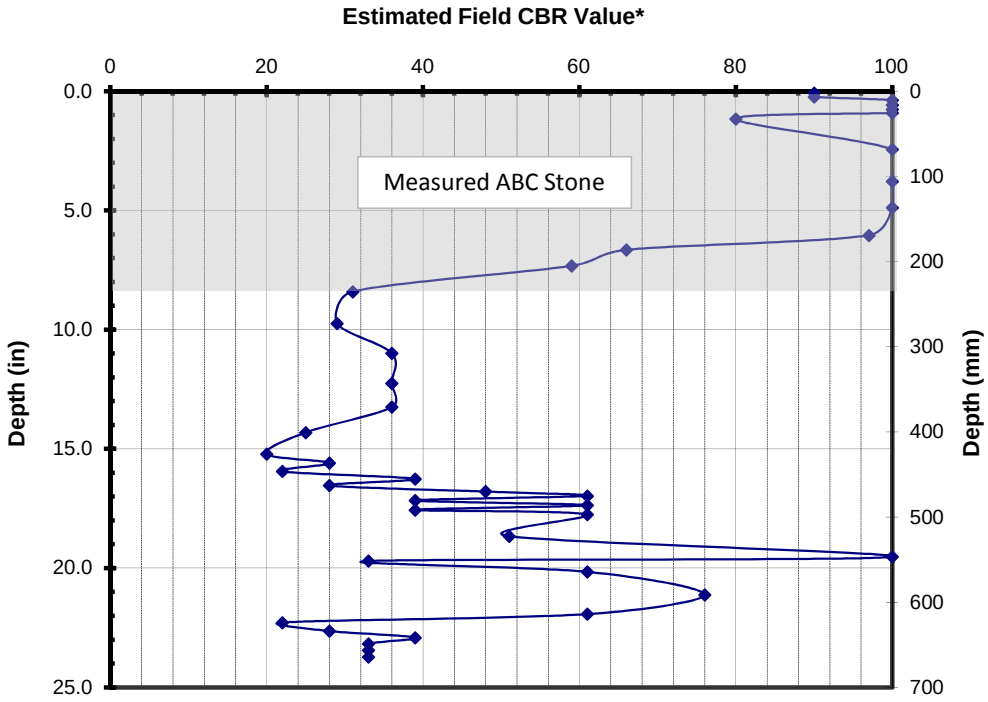
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	4
1	8
1	11
3	18
1	21
2	25
2	34
44	90
4	102
20	146
4	161
3	177
3	195
5	232
4	263
5	295
5	327
3	346
4	381
1	392
1	400
1	410
1	416
1	424
1	429
1	433
1	439
1	443
1	449
1	453
9	495
1	497
1	504
4	520
10	553
2	561
1	571
1	579
1	585
1	592
1	599
1	606

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	13	# Values	29
Average CBR	91	Average CBR	42
Weighted Average	92	Weighted Average	40
Max CBR	100	Max CBR	100
Min CBR	59	Min CBR	20



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-2 **Date:** 7/30/2014 **Personnel:** JERW
Thickness of Stone (in): 4

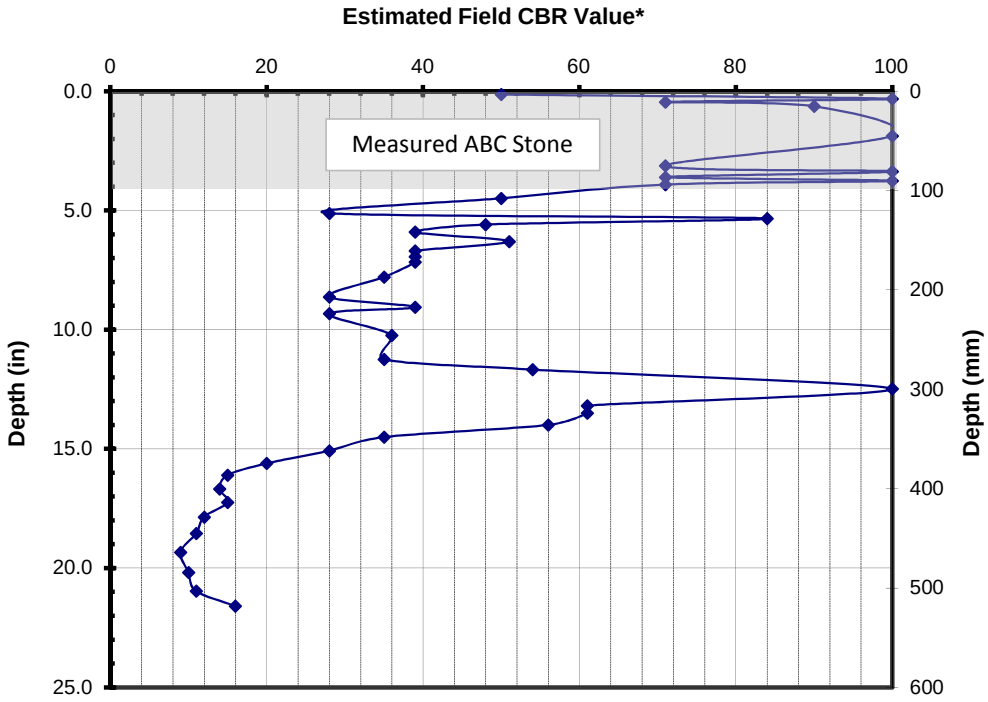
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	7
1	9
1	14
1	18
21	77
1	82
2	89
1	94
1	97
1	102
5	126
1	134
1	137
2	147
1	153
3	167
1	173
1	179
1	185
4	211
2	227
1	233
1	241
6	279
2	292
2	301
13	333
1	337
3	349
3	362
2	375
2	391
1	402
1	416
1	431
1	445
1	462
1	480
1	502
1	523
1	542
1	555

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	10	# Values	32
Average CBR	82	Average CBR	36
Weighted Average	90	Weighted Average	35
Max CBR	100	Max CBR	100
Min CBR	50	Min CBR	9



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-3 **Date:** 5/22/2015 **Personnel:** JERW
Thickness of Stone (in): 10

Test Data

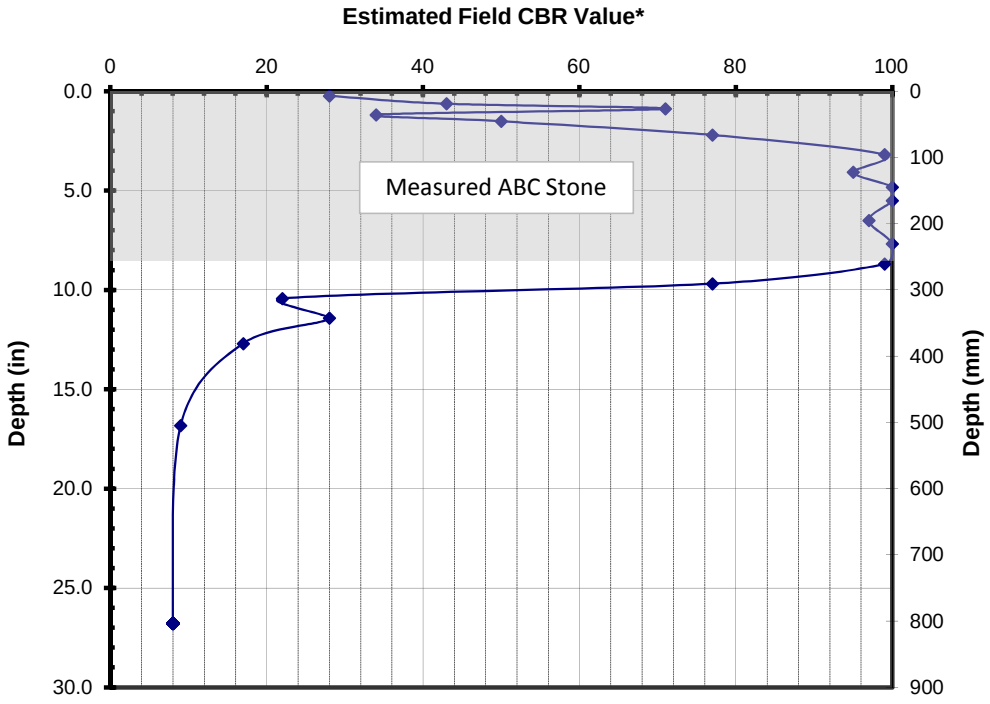
No. of Blows	Cummulative Penetration (mm)
1	12
1	20
1	25
1	35
1	42
6	70
6	92
6	115
6	130
7	150
8	180
9	210
6	232
6	260
1	270
5	310
2	335
8	520
13	840

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	14	# Values	5
Average CBR	76	Average CBR	17
Weighted Average	85	Weighted Average	10
Max CBR	100	Max CBR	28
Min CBR	28	Min CBR	8



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-4 **Date:** 8/5/2014 **Personnel:** JERW
Thickness of Stone (in): 0

Test Data	
No. of Blows	Cummulative Penetration (mm)
1	31
1	57
1	81
1	106
1	130
1	155
1	178
1	201
1	221
1	243
1	267
1	291
1	316
1	340
1	365
1	389
1	411
1	433
1	457
1	479
1	500
1	522
1	545
1	565
1	583
1	599
1	615
1	632
1	649
1	665
1	681
1	696
1	713
1	735
1	756
1	775

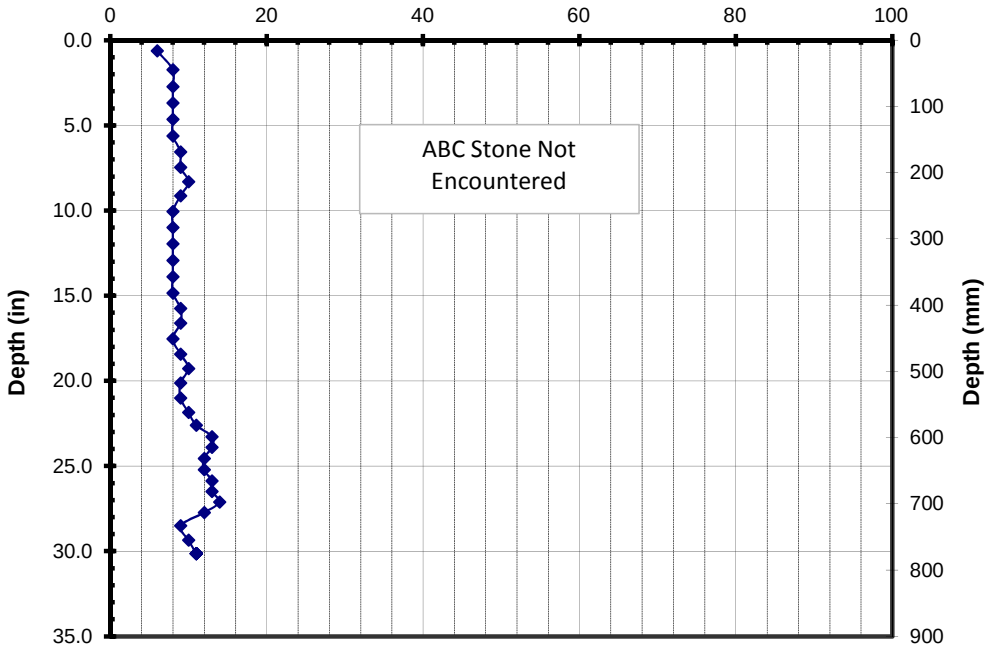
CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	36
Average CBR	n/a	Average CBR	10
Weighted Average	n/a	Weighted Average	9
Max CBR	n/a	Max CBR	14
Min CBR	n/a	Min CBR	6

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-5 **Date:** 8/5/2014 **Personnel:** JERW
Thickness of Stone (in): 3.5

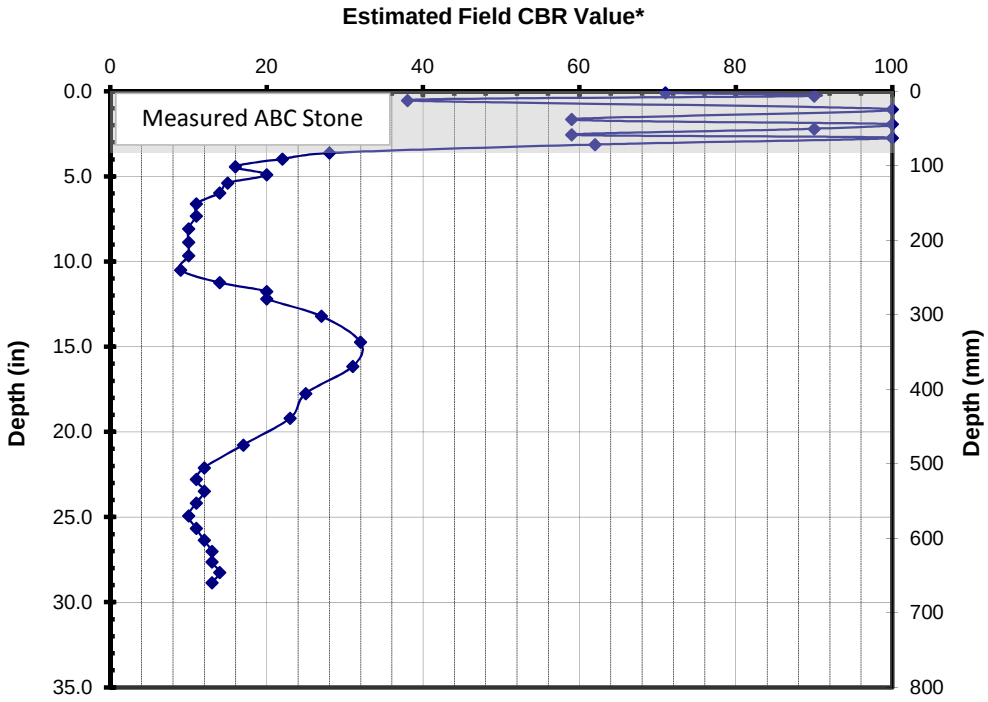
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	5
1	9
1	18
7	36
2	48
2	50
3	62
1	68
1	71
3	88
1	96
1	106
1	119
1	130
1	144
1	159
1	177
1	195
1	215
1	235
1	255
1	278
1	293
1	304
1	315
5	356
5	392
5	429
5	473
3	502
4	553
1	570
1	588
1	605
1	623
1	643
1	661
1	678
1	694
1	710
1	725
1	741

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	10	# Values	32
Average CBR	77	Average CBR	16
Weighted Average	74	Weighted Average	17
Max CBR	100	Max CBR	32
Min CBR	38	Min CBR	9



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-6 **Date:** 8/5/2014 **Personnel:** JERW
Thickness of Stone (in): 4.75

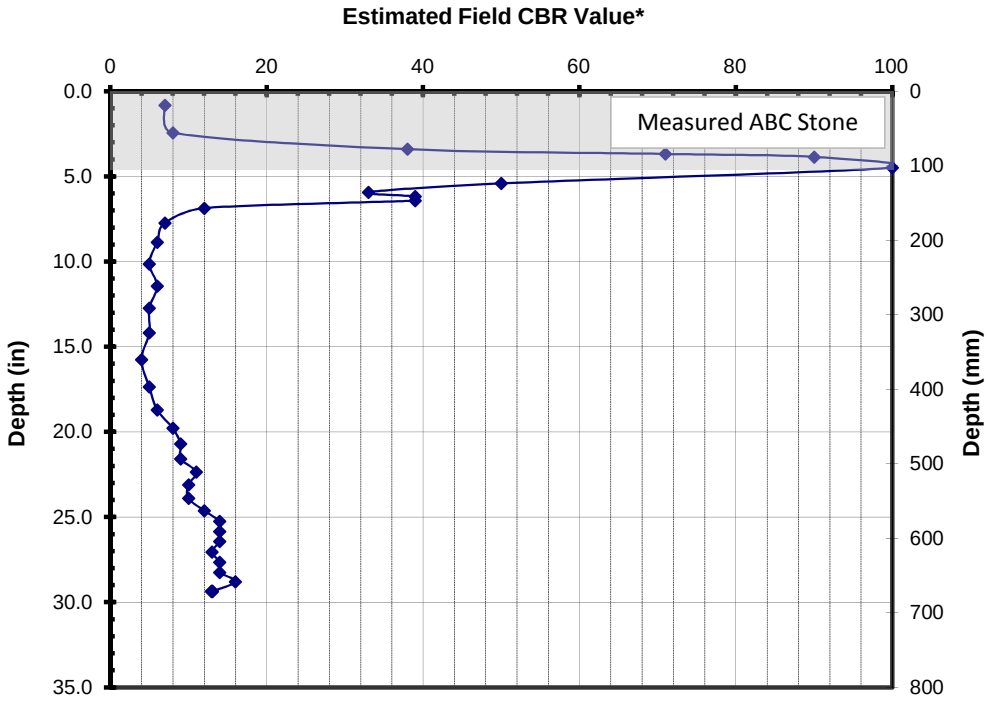
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	42
1	82
1	91
1	96
1	100
8	128
4	147
1	154
1	160
1	166
1	183
1	210
1	240
1	275
1	306
1	341
1	379
1	422
1	460
1	490
1	515
1	537
1	559
1	577
1	597
1	617
1	634
1	649
1	664
1	679
1	695
1	710
1	725
1	738
1	754

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	6	# Values	29
Average CBR	52	Average CBR	14
Weighted Average	35	Weighted Average	10
Max CBR	100	Max CBR	50
Min CBR	7	Min CBR	4



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-7 **Date:** 8/6/2014 **Personnel:** JERW
Thickness of Stone (in): 3

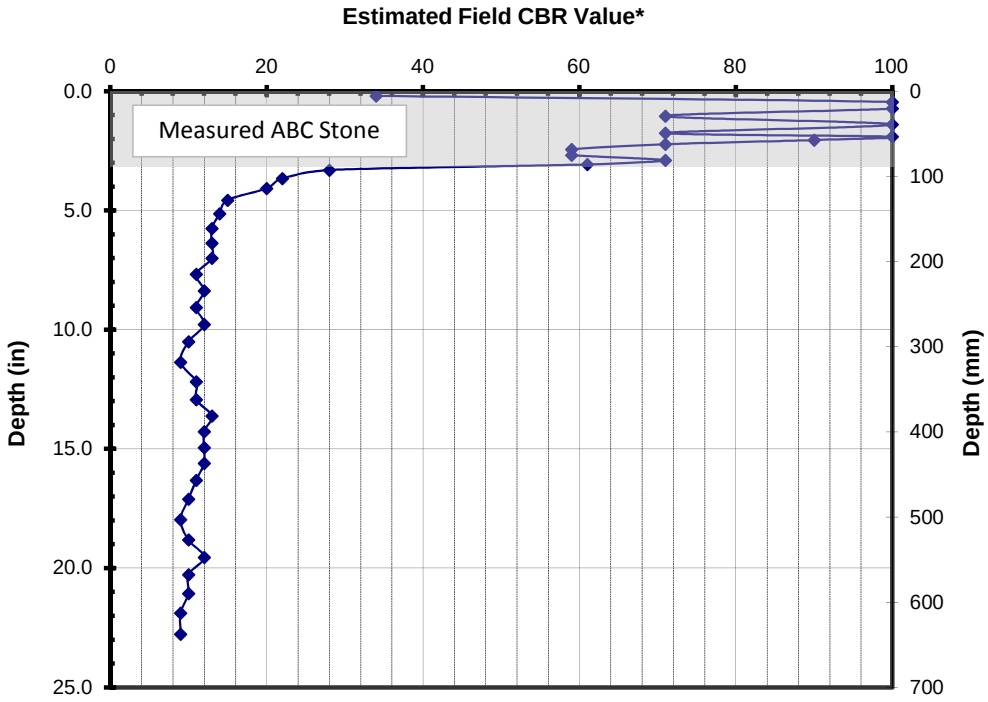
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	10
1	13
6	24
1	29
6	42
1	47
1	50
1	54
1	59
1	65
1	71
1	76
1	80
1	88
1	98
1	109
1	123
1	138
1	154
1	170
1	186
1	204
1	221
1	240
1	257
1	277
1	300
1	319
1	338
1	354
1	371
1	388
1	405
1	424
1	445
1	468
1	488
1	505
1	525
1	545
1	567
1	590

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	12	# Values	30
Average CBR	77	Average CBR	14
Weighted Average	77	Weighted Average	12
Max CBR	100	Max CBR	61
Min CBR	34	Min CBR	9



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-8 **Date:** 5/22/2015 **Personnel:** JERW
Thickness of Stone (in): 0

Test Data

No. of Blows	Cummulative Penetration (mm)
1	33
1	70
1	105
4	220
6	357
11	495
10	600
10	685
10	770

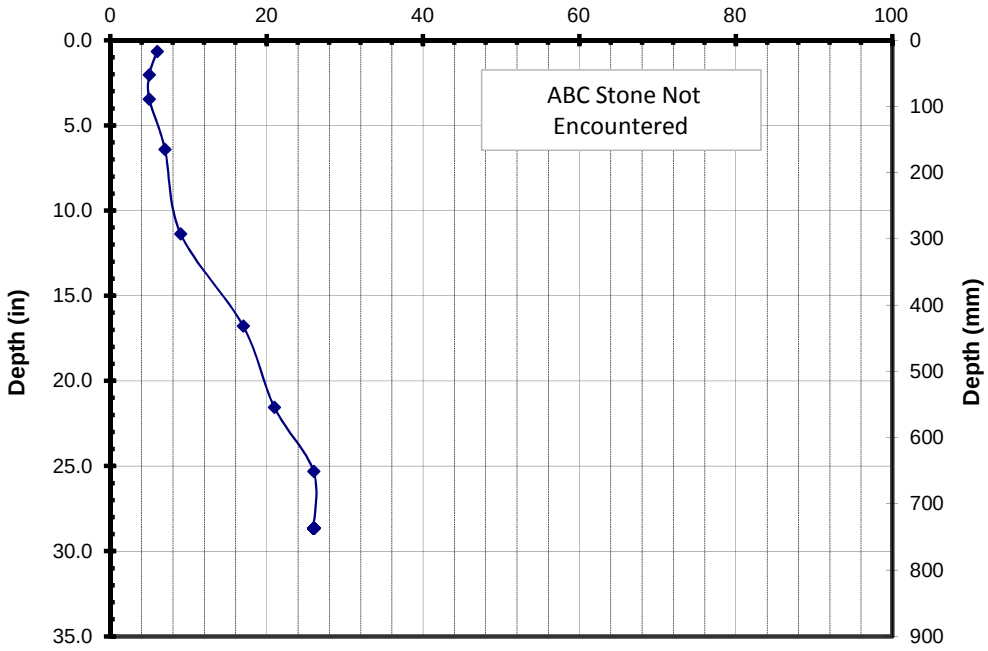
CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	9
Average CBR	n/a	Average CBR	14
Weighted Average	n/a	Weighted Average	15
Max CBR	n/a	Max CBR	26
Min CBR	n/a	Min CBR	5

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-9 **Date:** 5/21/2015 **Personnel:** JERW
Thickness of Stone (in): 0

Test Data	
No. of Blows	Cummulative Penetration (mm)
1	60
1	130
1	212
1	287
1	360
1	415
1	450
1	490
1	515
1	535
1	555

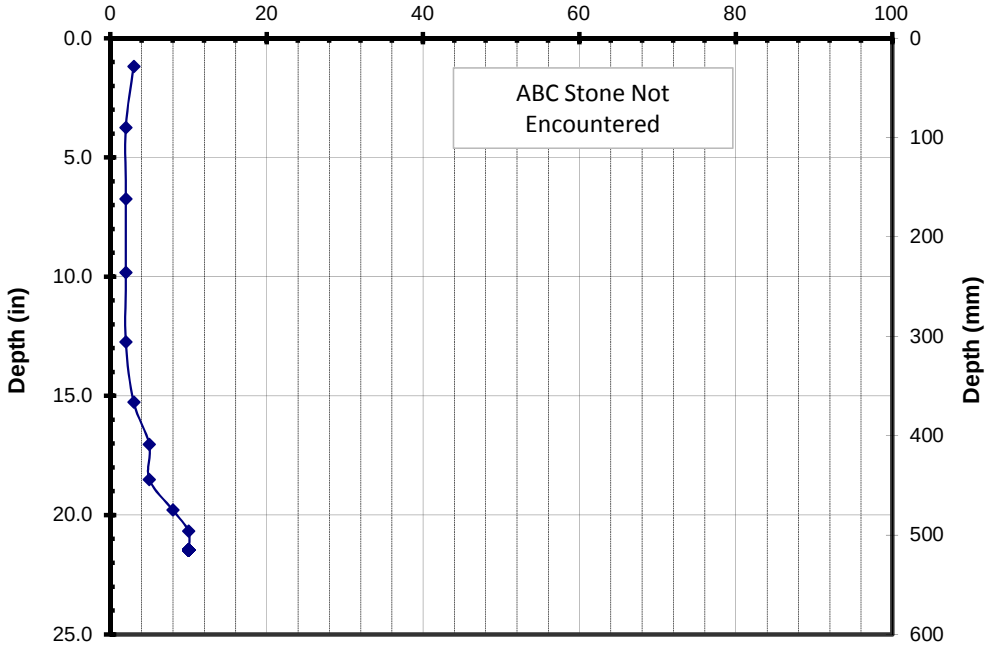
CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	11
Average CBR	n/a	Average CBR	5
Weighted Average	n/a	Weighted Average	3
Max CBR	n/a	Max CBR	10
Min CBR	n/a	Min CBR	2

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-10 **Date:** 7/23/2015 **Personnel:** JERW
Thickness of Stone (in): 5

Test Data

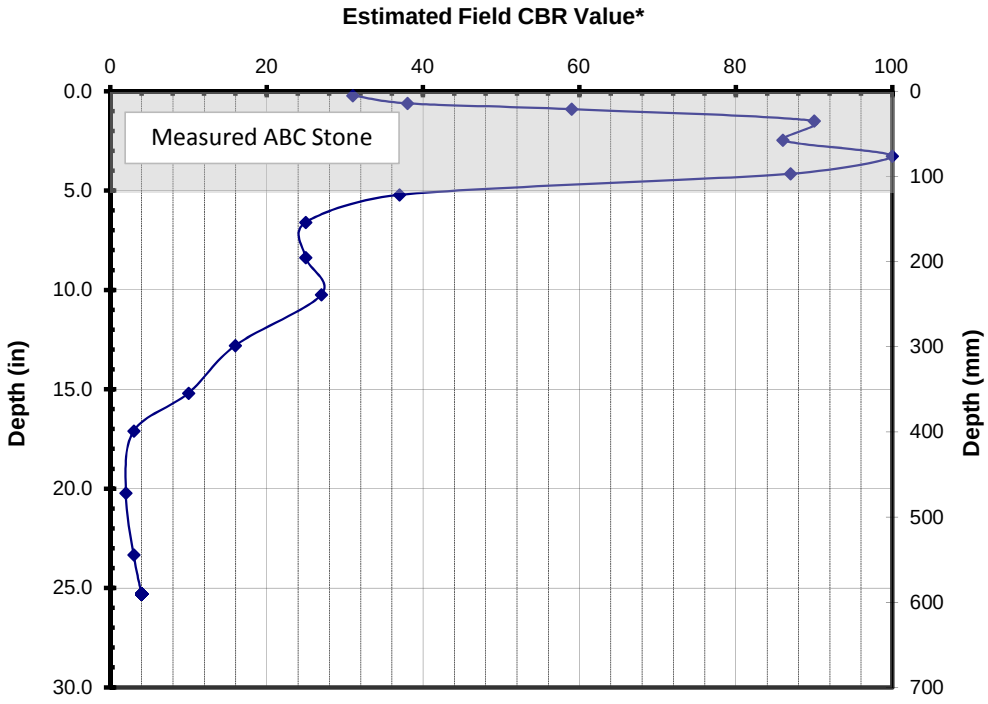
No. of Blows	Cummulative Penetration (mm)
1	11
1	20
1	26
6	50
6	75
7	91
7	120
4	145
5	190
5	235
6	285
6	365
2	407
1	462
1	565
1	620
1	665

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	7	# Values	10
Average CBR	70	Average CBR	15
Weighted Average	79	Weighted Average	13
Max CBR	100	Max CBR	37
Min CBR	31	Min CBR	2



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-11 **Date:** 8/6/2014 **Personnel:** JERW
Thickness of Stone (in): 9

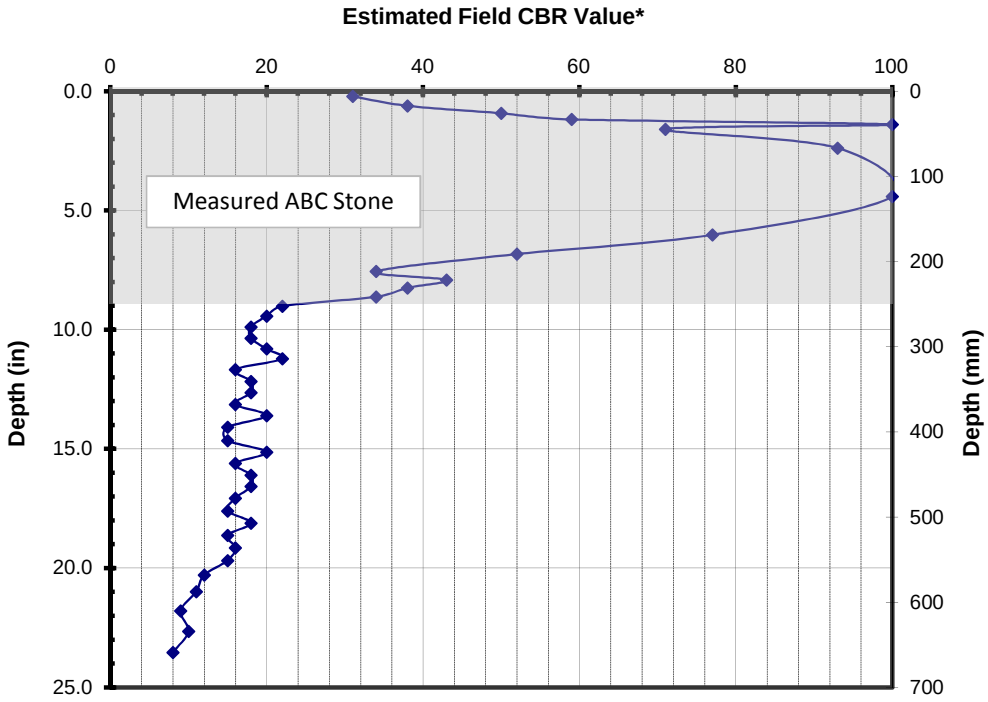
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	11
1	20
1	27
1	33
2	38
1	43
9	78
20	146
3	160
4	187
1	197
1	205
1	214
1	224
1	234
1	245
1	257
1	269
1	280
1	290
1	303
1	315
1	327
1	340
1	351
1	365
1	379
1	390
1	403
1	415
1	427
1	440
1	454
1	466
1	480
1	493
1	507
1	524
1	542
1	565
1	586
1	610

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	14	# Values	28
Average CBR	59	Average CBR	16
Weighted Average	72	Weighted Average	15
Max CBR	100	Max CBR	22
Min CBR	31	Min CBR	8



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-12 **Date:** 8/6/2014 **Personnel:** JERW
Thickness of Stone (in): 1.5

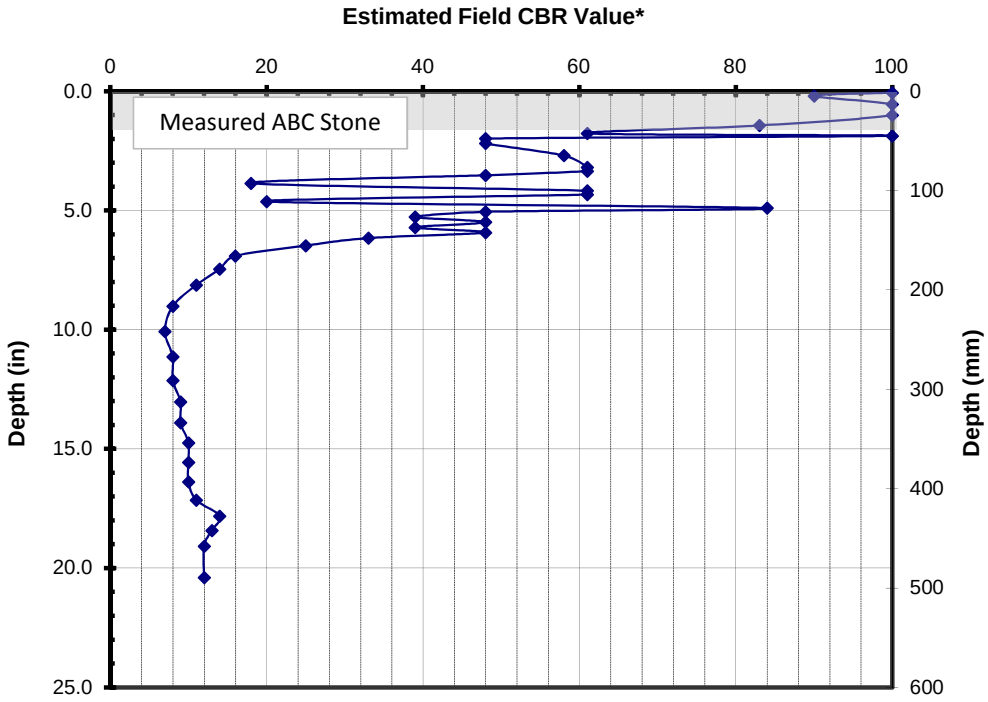
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	3
1	7
12	21
3	30
3	43
1	47
1	48
1	53
1	58
5	79
1	83
1	87
1	92
1	104
1	108
1	112
1	123
1	126
1	131
1	137
1	142
1	148
1	153
1	160
1	169
1	182
1	197
1	216
1	242
1	270
1	296
1	320
1	342
1	364
1	385
1	406
1	426
1	445
1	460
1	476
1	493
3	543

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	5	# Values	37
Average CBR	95	Average CBR	32
Weighted Average	94	Weighted Average	19
Max CBR	100	Max CBR	100
Min CBR	83	Min CBR	7



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-13 **Date:** 8/7/2014 **Personnel:** JERW
Thickness of Stone (in): 3

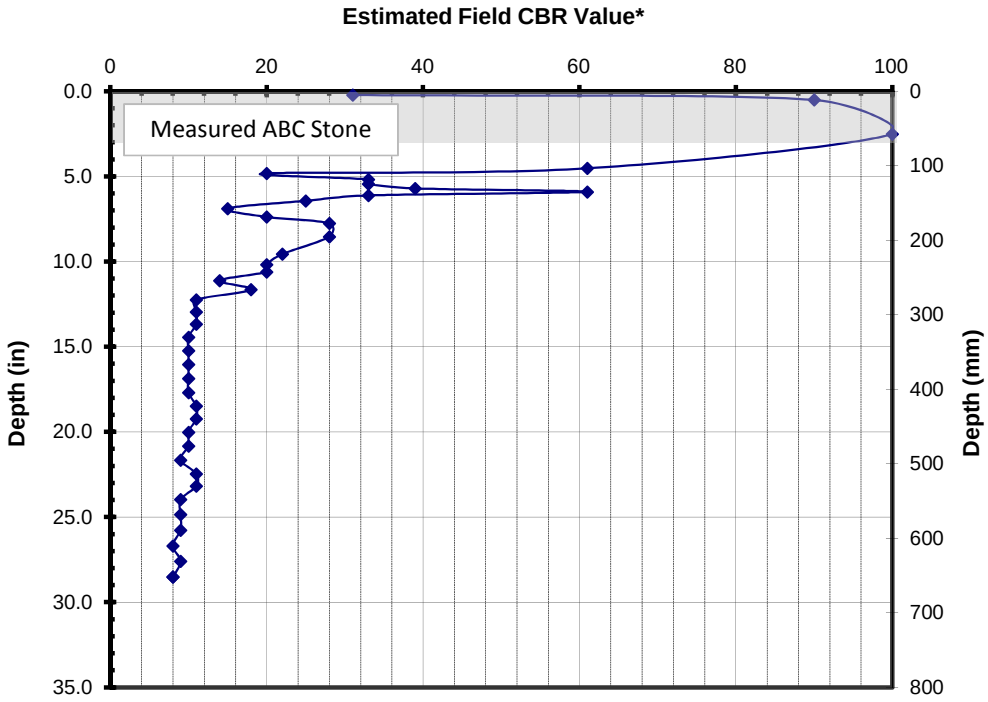
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	11
1	15
50	113
1	117
1	128
1	135
1	142
1	148
1	152
1	159
1	168
1	182
1	193
1	201
4	233
2	253
1	264
1	275
1	290
1	302
1	320
1	338
1	357
1	377
1	397
1	418
1	439
1	460
1	479
1	498
1	519
1	539
1	561
1	580
1	598
1	620
1	643
1	666
1	690
1	712
1	737

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	3	# Values	38
Average CBR	74	Average CBR	18
Weighted Average	93	Weighted Average	14
Max CBR	100	Max CBR	61
Min CBR	31	Min CBR	8



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-14 **Date:** 8/7/2014 **Personnel:** JERW
Thickness of Stone (in): 7

Test Data	
No. of Blows	Cummulative Penetration (mm)
1	8
1	15
1	17
1	23
25	96
1	101
10	149
4	175
3	200
1	218
1	238
1	259
1	283
1	310
1	337
1	362
1	390
1	416
1	447
1	476
1	508
1	540
1	570
1	598
1	626
1	650
1	669
1	682
1	698
1	720
1	741
1	765
1	785
1	809
1	830

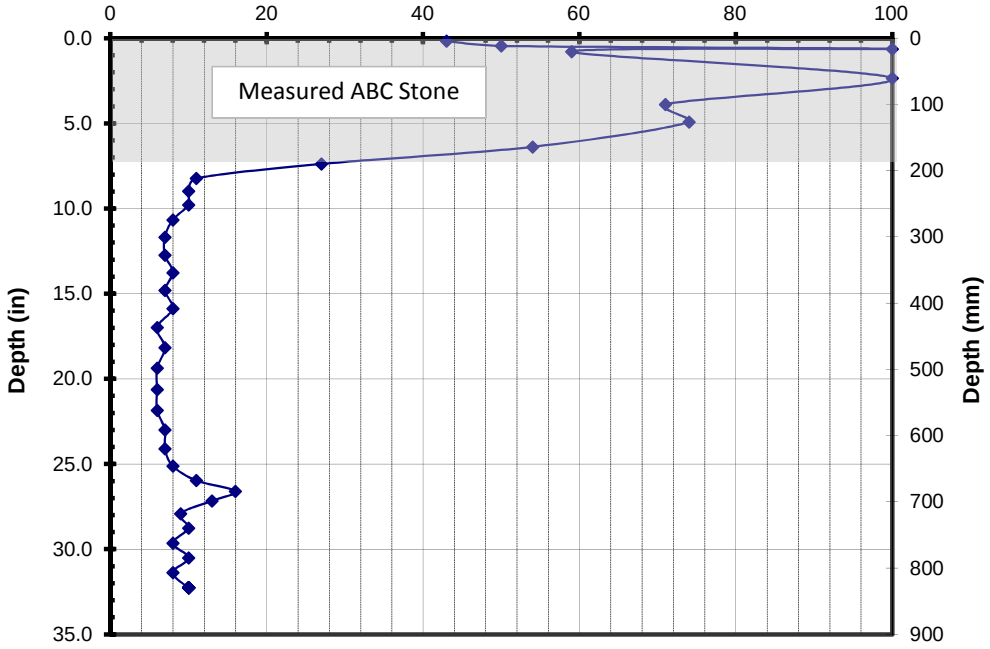
CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	8	# Values	27
Average CBR	69	Average CBR	9
Weighted Average	79	Weighted Average	9
Max CBR	100	Max CBR	27
Min CBR	43	Min CBR	6

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-15 **Date:** 8/7/2014 **Personnel:** JERW
Thickness of Stone (in): 3.5

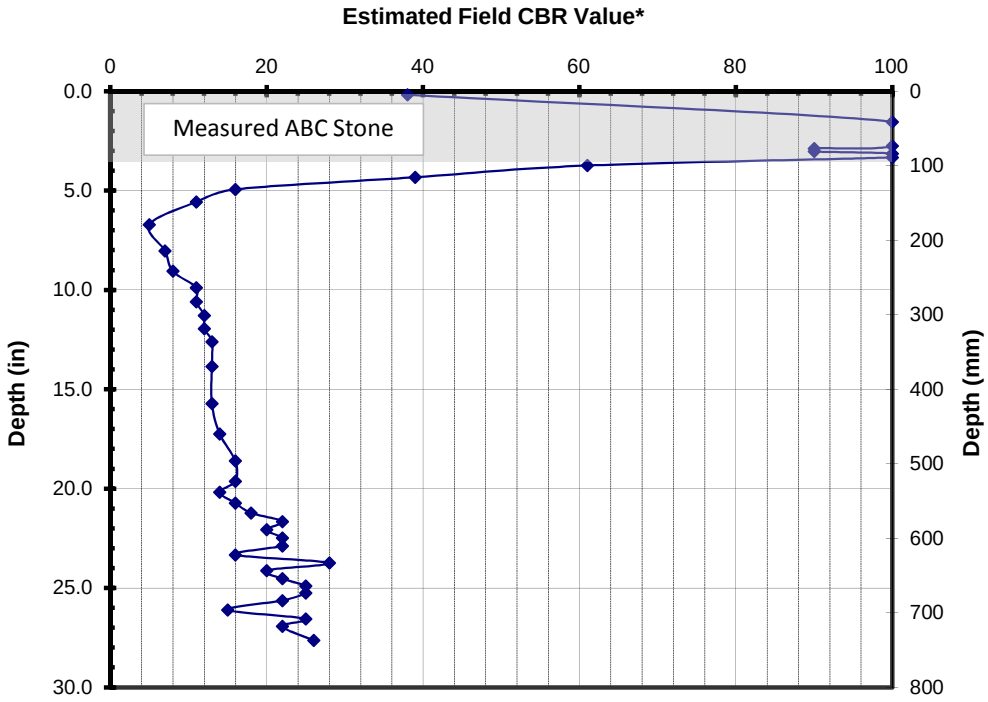
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	9
30	69
1	71
1	75
1	79
1	80
3	89
3	101
3	119
1	132
1	151
1	190
1	218
1	242
1	260
1	278
1	295
1	312
1	328
3	375
3	423
2	453
3	492
1	505
1	520
1	533
1	545
1	555
1	566
1	576
1	586
1	599
1	607
1	618
1	628
1	637
1	646
1	656
1	670
1	679
1	689
3	715

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	7	# Values	35
Average CBR	88	Average CBR	19
Weighted Average	93	Weighted Average	16
Max CBR	100	Max CBR	61
Min CBR	38	Min CBR	5



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-16 **Date:** 8/7/2014 **Personnel:** JERW
Thickness of Stone (in): 1.5

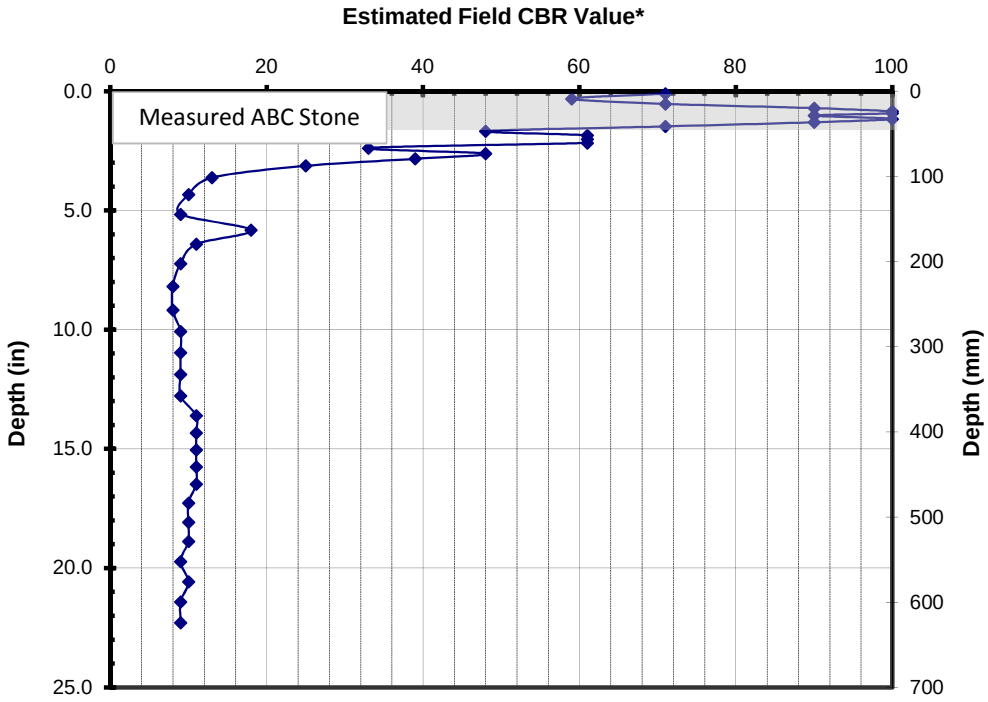
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	5
1	11
1	16
1	20
1	23
1	24
1	28
1	31
1	35
1	40
1	45
1	49
1	53
1	57
1	64
1	69
1	75
1	84
1	100
1	120
1	142
1	154
1	172
1	195
1	221
1	245
1	267
1	290
1	313
1	336
1	355
1	373
1	391
1	409
1	428
1	449
1	469
1	490
1	512
1	533
1	555
1	577

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	10	# Values	32
Average CBR	84	Average CBR	19
Weighted Average	80	Weighted Average	13
Max CBR	100	Max CBR	61
Min CBR	59	Min CBR	8



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: US 21 and SC 51
S&ME Project No.: 1351-12-037

Test Location: C-17 **Date:** 7/23/2015 **Personnel:** JERW
Thickness of Stone (in): 0

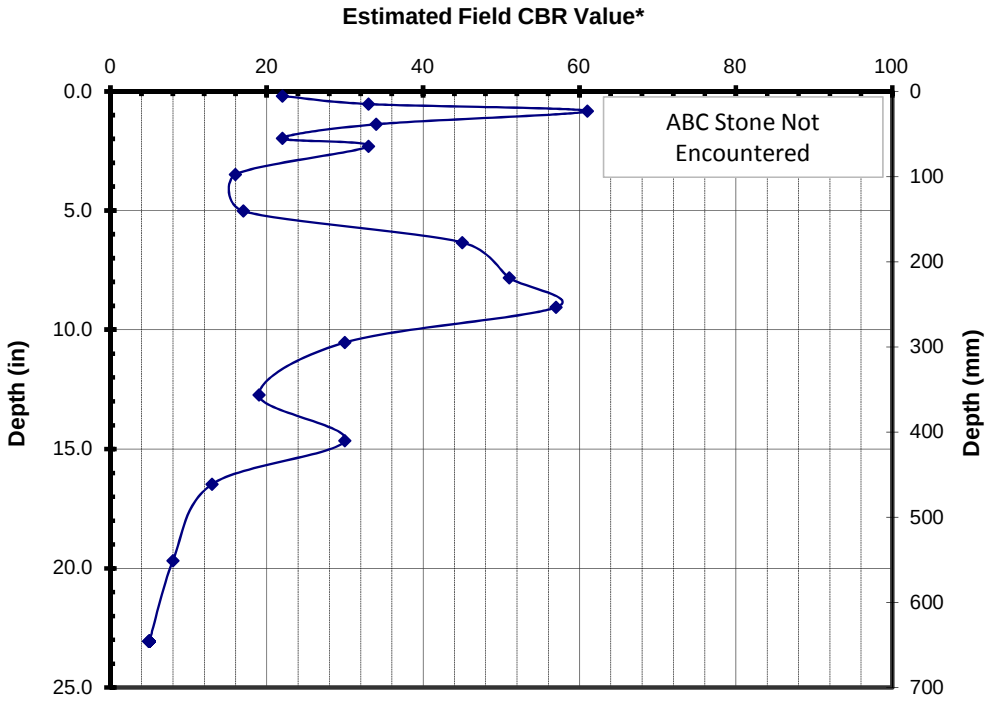
Test Data	
No. of Blows	Cummulative Penetration (mm)
1	10
1	17
2	25
3	45
1	55
1	62
4	115
2	140
8	182
7	215
7	245
6	290
6	357
4	387
4	450
4	550
2	622

CBR - DCP Correlation for Soil Subgrade

- ○ North Carolina Department of Transportation (Shin, et al 1989)
- ◉ U.S. Army Corps of Engineers (Webster, et al 1992)
- ○ Piedmont Residual Soils (Coonse 1999)

Test Summary

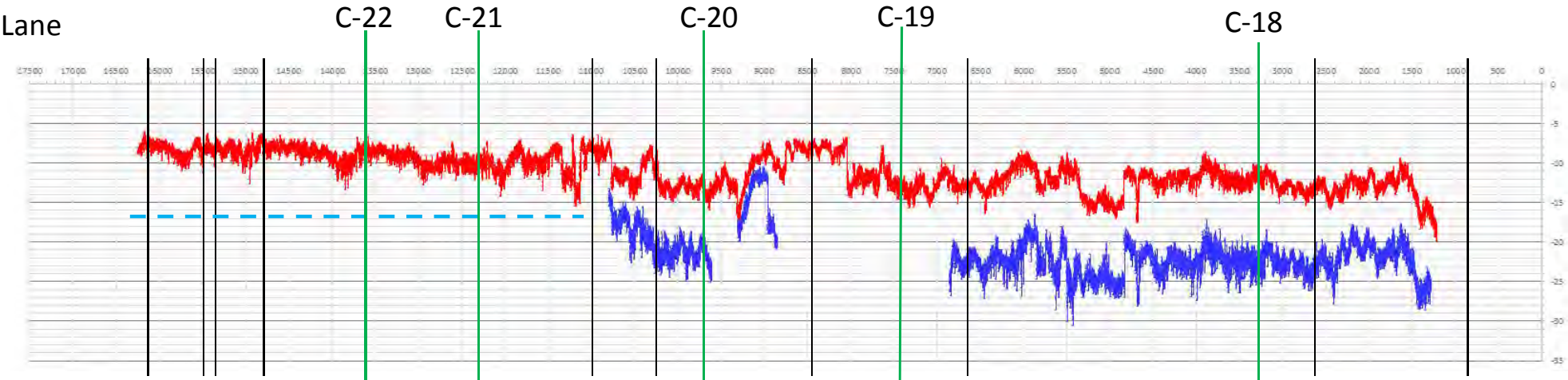
Stone		Soil Subgrade	
# Values	n/a	# Values	17
Average CBR	n/a	Average CBR	29
Weighted Average	n/a	Weighted Average	23
Max CBR	n/a	Max CBR	61
Min CBR	n/a	Min CBR	5



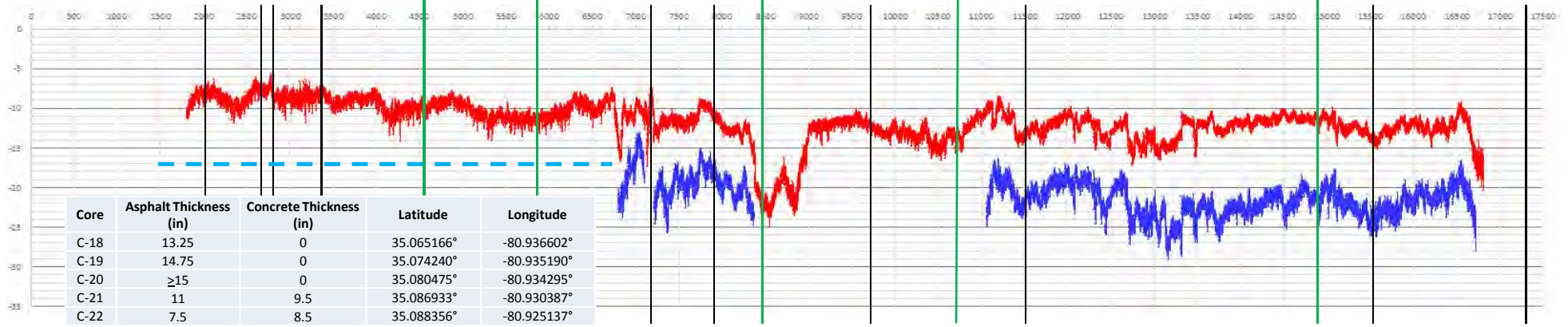
* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

Appendix V – GPR Survey Results

NB Lane

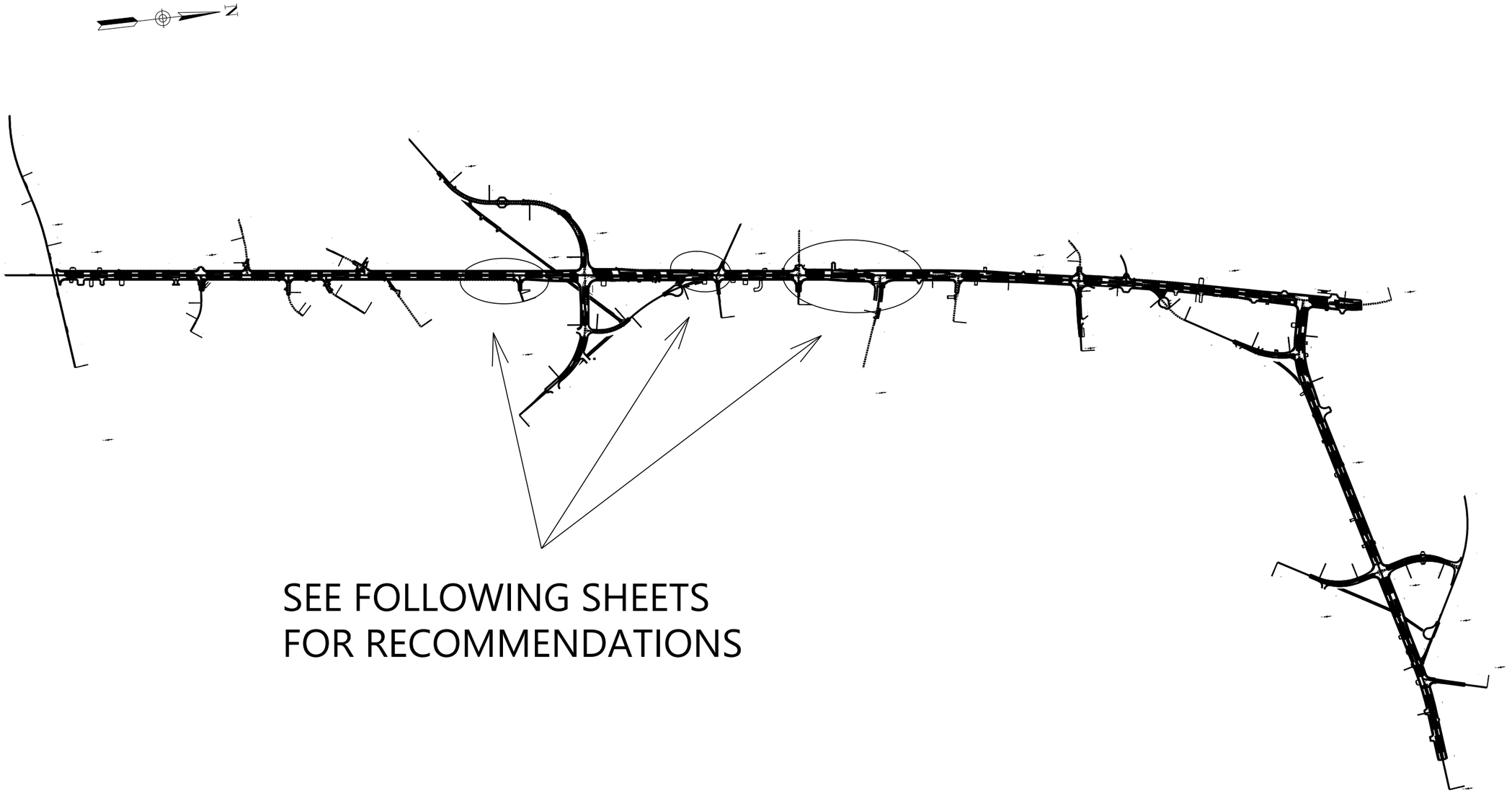


SB Lane



Core	Asphalt Thickness (in)	Concrete Thickness (in)	Latitude	Longitude
C-18	13.25	0	35.065166°	-80.936602°
C-19	14.75	0	35.074240°	-80.935190°
C-20	≥15	0	35.080475°	-80.934295°
C-21	11	9.5	35.086933°	-80.930387°
C-22	7.5	8.5	35.088356°	-80.925137°

Appendix VI – Proposed Full Depth Pavements

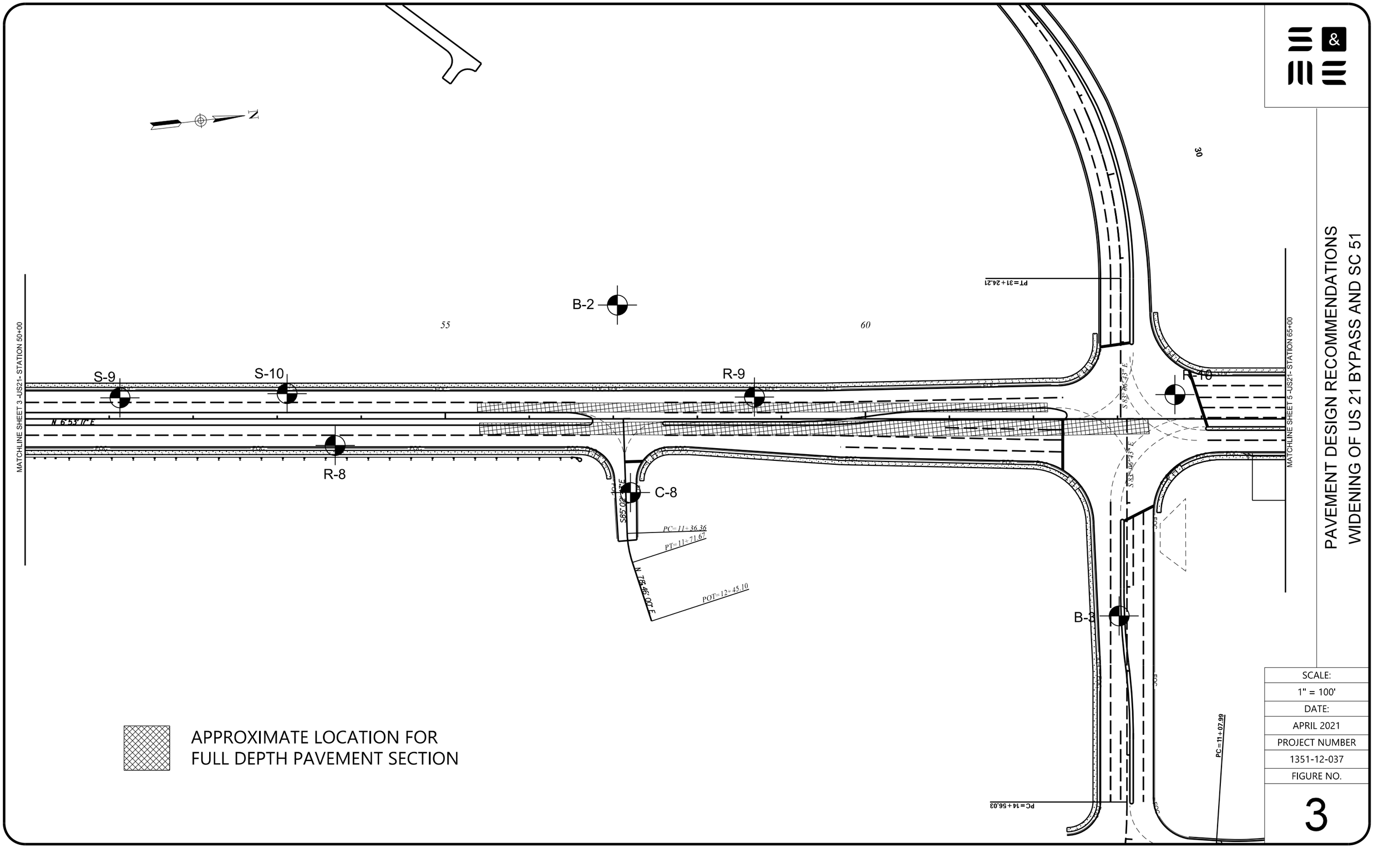


SEE FOLLOWING SHEETS
FOR RECOMMENDATIONS

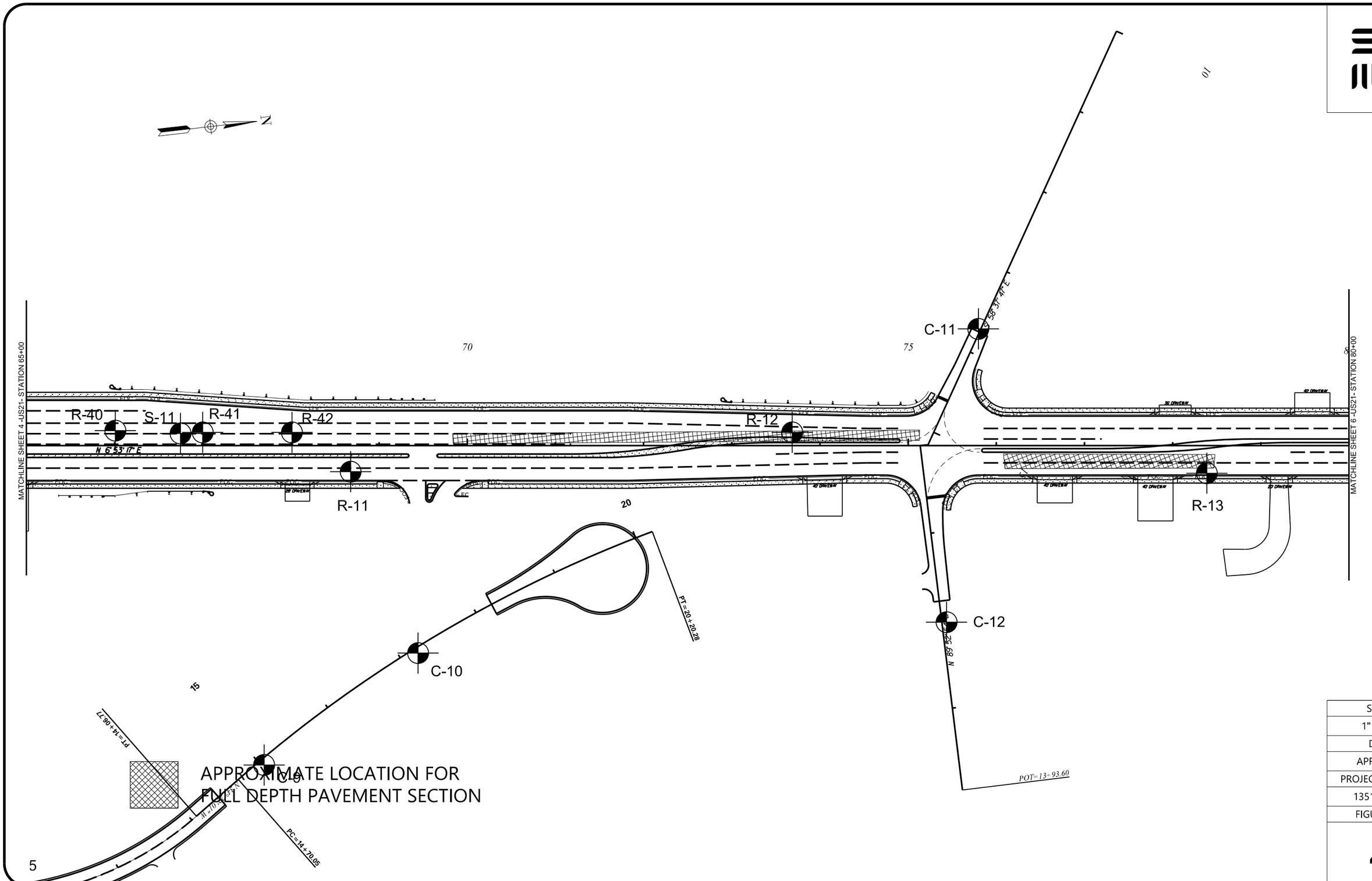
OVERALL SITE MAP - PAVEMENT DESIGN RECOMMENDATIONS
WIDENING OF US 21 BYPASS AND SC 51

SCALE:
1" = 1000'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
FIGURE NO.
2

PAVEMENT DESIGN RECOMMENDATIONS
WIDENING OF US 21 BYPASS AND SC 51



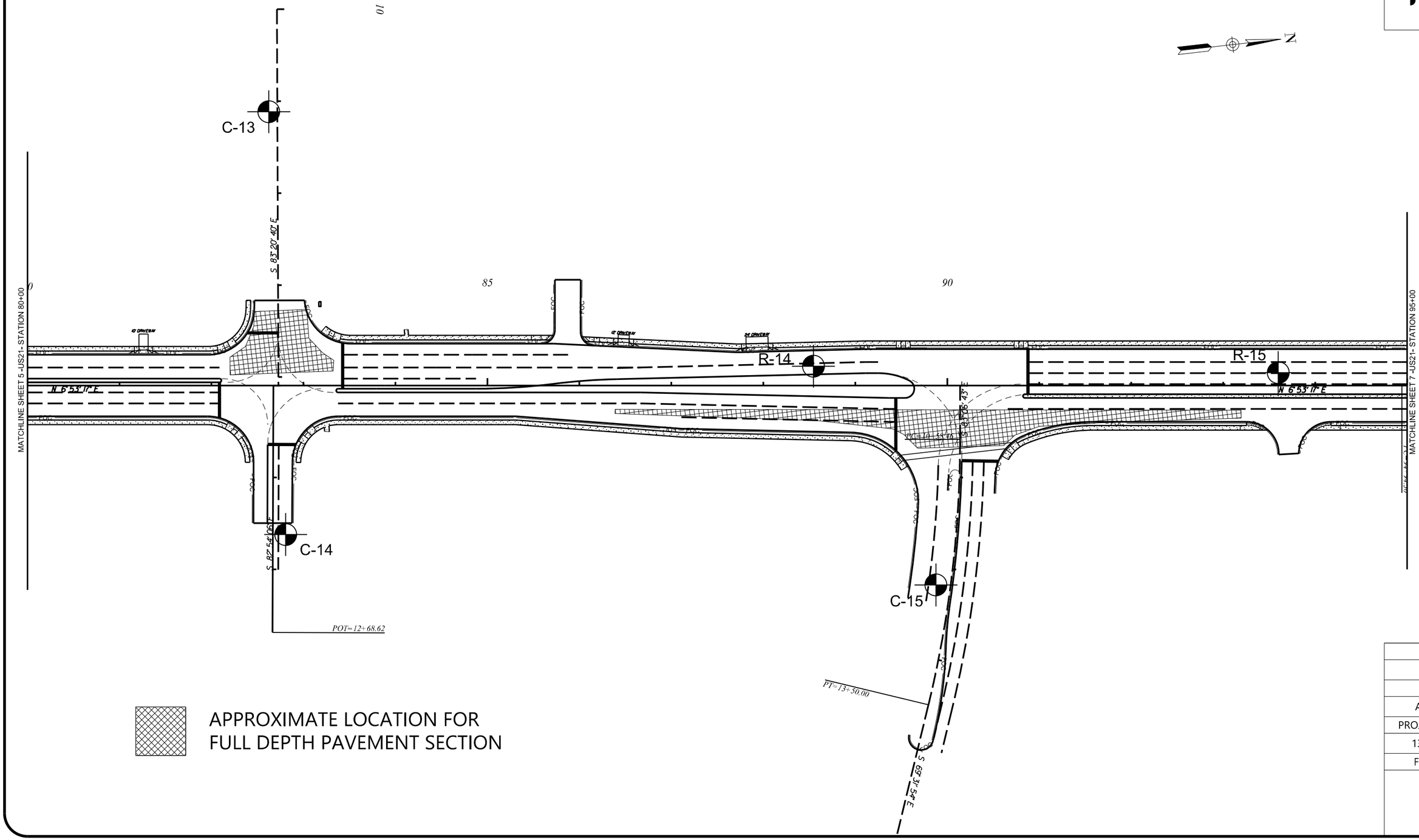
SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
FIGURE NO.
3



PAVEMENT DESIGN RECOMMENDATIONS
WIDENING OF US 21 BYPASS AND SC 51

SCALE:	
1" = 100'	
DATE:	
APRIL 2021	
PROJECT NUMBER	
1351-12-037	
FIGURE NO.	
4	

PAVEMENT DESIGN RECOMMENDATIONS
WIDENING OF US 21 BYPASS AND SC 51



SCALE:
1" = 100'
DATE:
APRIL 2021
PROJECT NUMBER
1351-12-037
FIGURE NO.
5

REPORT OF BACKFILL EVALUATION SERVICES

HIGHWAY U.S. 21 BYPASS WIDENING
FORT MILL, SOUTH CAROLINA
ESP Project No. E4-FX26.301

Prepared For:
York County Engineering
6 South Congress Street
York, South Carolina 29745

Prepared By:
ESP Associates, Inc.
3475 Lakemont Boulevard
Fort Mill, South Carolina 29708

May 9, 2018

May 9, 2018

York County Engineering
6 South Congress Street
York, South Carolina 29745

Attention: Mr. Patrick Hamilton, PE
Program Manager – Pennies for Progress

Reference: **REPORT OF BACKFILL EVALUATION SERVICES**
U.S. Highway 21 Bypass Widening
Fort Mill, South Carolina
ESP Project No. E4-FX26.301
SC Certificate No. 5839

Dear Mr. Hamilton:

ESP Associates, Inc. (ESP) has completed backfill evaluation services for the proposed widening of U.S. Highway 21 Bypass in Fort Mill, South Carolina. This exploration was performed in general accordance with our Proposal No. E4-171081 (Revision #1), dated January 23, 2018. Authorization to proceed with this study was provided by written execution of our proposal by you on January 24, 2018.

ESP appreciates the opportunity to assist you during this phase of the project. If you should have any questions concerning this report, or if we may be of further assistance, please contact us at 803-802-2440.

Sincerely,

ESP Associates, Inc.

C. Tyler Wenner, GIT
Project Manager

Christopher J. Brown, PE
SC Registration No. 30272

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 30272 5.9.18 CHRISTOPHER J. BROWN

CTW/CJB/JLS

Copies Submitted: (3)

ESP Associates, Inc.
3475 Lakemont Boulevard • Fort Mill, SC 29708
1.800.960.7317 • 803.802.2440, fax 803.802.2515
www.espassociates.com

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APPENDIX

FIELD EXPLORATION PROCEDURES
TEST PIT LOCATION PLAN WITH SITE VICINITY MAP, FIGURE 1
LEGEND TO SOIL CLASSIFICATION AND SYMBOLS
TEST PIT RECORDS (TP-01 THROUGH TP-04)
LABORATORY TEST RESULTS

1.0 INTRODUCTION

1.1 SITE AND PROJECT DESCRIPTION

Based on documents provided, and a meeting between York County representatives Mr. Patrick Hamilton and Mr. Ron Smith and Mr. Jake Sarna, PG of ESP, we understand that plans are to widen U.S. Highway 21 Bypass approximately from Springfield Parkway to State Road S-46-48 in Fort Mill, York County, South Carolina. It is our understanding that the planned widening will occur over recently installed 12 and 24-inch ductile iron waterlines which are located approximately 4 to 15 feet off the edge of the existing pavement. Plans show the waterlines were installed with a minimum of 4 feet of cover. York County desires to leave the existing waterlines in place as part of the proposed roadway widening. As such, South Carolina Department of Transportation (SCDOT) requested that the existing waterline backfill be evaluated to determine if it appears suitable for supporting the planned roadway.

1.2 PURPOSE OF SERVICES

The purpose of our services was to evaluate the general condition of the utility trench backfill covering the existing waterlines within the planned roadway widening. Our services consisted of evaluating the compaction, observing the character and continuity of the existing waterline backfill for its potential re-use, as well as its suitability to support the proposed pavement system. This report presents our findings, conclusions and recommendations for the backfill evaluation, as well as construction considerations for the proposed pavement system. This report also contains a brief description of the field and laboratory testing procedures performed for this study and a discussion of the soil conditions encountered at the site.

2.0 EXPLORATION PROCEDURES

2.1 FIELD

Four (4) test pits (TP-01 through TP-04) were excavated as shown on the attached "Test Pit Location Plan," Figure 1. The test pit locations were selected prior to fieldwork by an ESP representative using plans provided by York County Engineering, Google Earth Pro Imagery, and existing site features as location references. The test pits were performed approximately over the existing waterline and extended to depths up to approximately four feet below the existing ground surface, or to within approximately one foot of the waterline. Test pits were excavated by others utilizing a rubber-tired back hoe, and were backfilled upon completion of the excavations.

Field density tests were performed at approximate one foot intervals as the test pits were excavated. In conjunction with the field density testing a fiberglass probe rod was used to locate the presence or absence of the existing waterline within the test pit excavations. A brief description of the field testing procedures is included in the Appendix.

While in the field, a representative of the geotechnical engineer visually examined each test pit excavation to evaluate the type of soil encountered, soil plasticity, moisture condition, organic content, presence of lenses and seams, and colors. The results of the visual soil classifications for the test pits, as well as field test results, are presented on the individual "Test Pit Records," included in the Appendix. Similar soils were grouped into strata on the records. The strata lines represent approximate boundaries between the soil types; however, the actual transition between soil types encountered during the construction phase of this project may vary in both the horizontal and vertical directions.

2.2 LABORATORY

Select samples of the on-site soils obtained during the field testing program were tested in the laboratory. Tests performed included, Atterberg limits, grain size distribution, standard Proctor compaction, and organic content analysis. The limited testing program was designed to determine selected engineering properties of the on-site soils relative to their use for the project. The results of the soil tests performed for this study, along with a brief description of the laboratory procedures used, are presented in the Appendix.

In-situ moisture contents of the fill soils along the roadway range from 13.3 to 41.2 percent. Atterberg Limits tests (plastic limit and liquid limit) performed indicated that the fill soils have liquid limits ranging from 33 to 68 percent and plasticity indices (PI's) ranging from 8 to 41 percent with the high plasticity clays exhibiting the upper end of the range and the silty sand exhibiting the lower end of the range.

Standard Proctor compaction tests were performed on several bulk samples obtained from areas along the roadway alignments. Maximum dry density of the existing soils varied between 93.6 and 102.6 pounds per cubic foot (pcf) with optimum moisture content on the order of 22.0 and 26.1 percent. Organic content analysis performed on five samples indicates that the percent of organic matter in the existing fill soils ranging from 2 to 6 percent.

3.0 FINDINGS

3.1 SUBSURFACE CONDITIONS

The generalized subsurface conditions at the site are described below. For more detailed soil descriptions and stratifications at a particular test location, review the respective "Test Pit Record" included in the Appendix.

Surface: A topsoil layer approximately 3 to 5 inches thick was encountered at Test Locations TP-01 through TP-04. At Test Locations TP-01 and TP-02 excavations were conducted adjacent to the existing pavement, as such pavement and aggregate base course (ABC) stone thickness were noted at these locations. Pavement and ABC stone thickness at TP-01 was approximately 2 inches and 4 inches, respectively. At TP-02 two layers of pavement were noted, the top layer was approximately 6 inches in thickness, while the lower layer was approximately 8 inches in thickness. The ABC stone thickness at TP-02 was approximately 5 inches.

Fill: Underlying the topsoil in Test Locations TP-01 through TP-04 fill soils were encountered. The fill consists of sandy clays, clayey sands, and silty sands. The test pits were terminated in fill soils upon encountering the existing waterline.

ESP preformed in-place field density testing within the test pits at approximate one foot intervals. The tests indicate densities ranging from 78 to in excess of 100 percent of the soils maximum dry density based on a Standard Proctor moisture-density relationship. Ten of the twelve in-place field density tests indicated the in-situ moisture content to be approximately 1 to 19 percent wet of optimum moisture content with one test at approximately 8 percent dry of optimum moisture content. The results of the field density test preformed are included in the Appendix.

3.2 SUBSURFACE WATER

All test pits were dry at the time of excavation; however, subsurface water levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, water may be encountered during construction at depths not indicated during this study.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 GENERAL

Our conclusions and recommendations are based on the project information previously discussed and on the data obtained from the field and laboratory testing program. If the proposed construction locations are changed or significantly differ from those discussed, or if conditions are encountered during construction that differ from those encountered within the test pits, ESP requests the opportunity to review our recommendations based on the new information and make any necessary changes.

4.2 BACKFILL EVALUATION CONCULSIONS

Based upon the results of the field testing program and analysis indicates that the existing fill present over the installed waterlines does not currently meet the minimum compaction requirements per South Carolina Department of Transportation (SCDOT) Construction Manual. Existing backfill material is not suitable for re-use due to moisture conditions, plasticity, and organic content.

4.3 RECOMMENDATIONS

ESP recommends the following to remediate the existing backfill fill in preparation for the roadway widening:

- Undercut the existing fill to expose the top of the existing waterlines.
- Place a layer of #57 washed stone approximately 8 to 12 inches in thickness on top of the exposed waterlines.
- Place a layer of Mirafi HP270 (or approved equivalent) to provide separation between washed stone and replaced structural fill.
- Atop the geotextile place structural fill as described in Section 5.3 on this report.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 TEMPORARY EXCAVATION STABILITY

Excavations greater than four feet in depth should be sloped or shored in accordance with local, state, and federal regulations, including OSHA "Construction Standard for Excavations" (29 CFR Part 1926.650-652). The contractor is usually solely responsible for site safety. This information is provided only as a service and under no circumstances should ESP be assumed to be responsible for construction site safety.

5.2 FILL MATERIAL AND PLACEMENT

All fill used for the backfill replacement operations should consist of a clean (free of organics and debris), low plasticity soil (Plasticity Index less than 30). The proposed fill should have a maximum dry density of at least 90 pounds per cubic foot as determined by a Standard Proctor compaction test, SC-T-29. All fill should be placed in loose lifts not exceeding 8 inches in thickness and compacted to a minimum of 95 percent of its Standard Proctor maximum dry density, with at least 100 percent achieved in the upper 12 inches. We recommend that field

density tests, including one-point Proctor verification tests, be performed on the fill as it is being placed at a frequency determined by an experienced geotechnical engineer to verify the compaction criteria.

6.0 LIMITATIONS OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice with regard to the specific conditions and requirements of this site. The conclusions and recommendations contained in this report were based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made.

The analysis and recommendations submitted herein are based, in part, upon the data obtained from the test pit excavations. The nature and extent of variations between the test pits will not be known until construction is underway. If variations appear evident, then we request the opportunity to re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the construction planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by ESP.

In order to verify that our recommendations are properly interpreted and implemented, we recommend that ESP be provided the opportunity to review the final plans and specifications. Any concerns observed will be brought to our client's attention in writing.

FIELD EXPLORATION PROCEDURES

Test Pits: Four (4) test pits were excavated at the approximate locations indicated on the Test Pit Location Plan, Figure 1. The test pits were excavated by a rubber-tired mounted backhoe. A representative of the geotechnical engineer was present to observe excavation of the test pits. The soil excavated from the test pit was classified by the a representative of the geotechnical engineer.

Drive Cylinder Density Test: Twelve (12) drive cylinder density tests were preformed at test locations indicated on the Test Pit Location Plan, Figure 1. Drive cylinder density tests were performed at approximate one foot depth increments as the test pits were excavated. The tests were performed in general accordance with ASTM D2937-10.

LABORATORY PROCEDURES

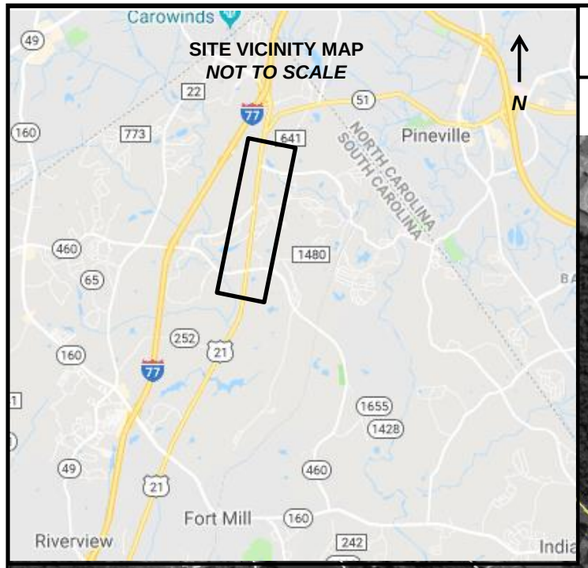
Grain Size Test: Grain size tests were performed to determine the particle size and distribution of the samples tested in general conformance with ASTM D 422. The grain size distribution of soils coarser than a No. 200 sieve was determined by passing the samples through a set of nested sieves. The results are presented on the attached Grain Size Distribution Sheets.

Soil Plasticity Tests (Atterberg Limits Test): Select samples were identified for Atterberg Limits testing to determine the soil's plasticity characteristics and is determined in accordance with ASTM D 4318. The Plasticity Index (PI) is representative of this characteristic and is determined utilizing the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil transitions between the plastic and semi-solid states. The data obtained is presented on the attached sheet.

Standard Proctor Compaction Test: Five (5) samples of the on-site soil were obtained from excavated soil to determine its suitability as fill material. Standard Proctor Compaction Tests (ASTM D 698) were performed on the soil samples to determine its compaction characteristics including maximum dry density and optimum moisture content. The test results are presented on the attached Moisture Density Relationship sheets.

Organic Content of Soils: **S**elect samples were identified for Organic Content of Soils testing to determine the percent of organic matter in the soil. The testing was performed in general accordance with ASTM D 2974.

THIS SHEET FOR TEST PIT INFORMATION PURPOSES ONLY.



LEGEND

APPROXIMATE TEST PIT LOCATION

THIS DRAWING IS INTENDED TO SHOW APPROXIMATE TEST PIT LOCATIONS ONLY. NO OTHER INFORMATION IS EXPRESSED OR IMPLIED.

PRELIMINARY- NOT FOR CONSTRUCTION

PROJECT NO.:	E4-FX26.301
SCALE:	NTS
DRAWN BY:	CTW
CHECKED BY:	CJB
DATE:	5/9/2018

SHEET TITLE:
TEST PIT LOCATION PLAN, FIGURE 1

PROJECT: U.S. HIGHWAY 21 BYPASS WIDENING

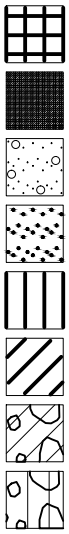
ROCK HILL, SOUTH CAROLINA

ESP Associates, Inc.
3475 Lakemont Blvd
Fort Mill, SC 29708
803.802.2440
www.espassociates.com

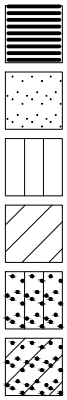
LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

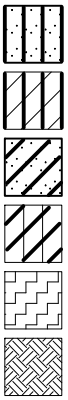
(Shown in Graphic Log)



Asphalt / Concrete
Topsoil
Gravel
Sand
Silt
Clay
Clayey Gravel
Silty Gravel



Organic
Sandy
Silty
Clayey
Silty Sand
Clayey Sand



Sandy Silt
Clayey Silt
Sandy Clay
Silty Clay
Partially Weathered Rock
Cored Rock

SAMPLER TYPES

(Shown in Samples Column)



Shelby Tube
Split Spoon
Rock Core
No Recovery

WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level at Termination of Boring

▼ = Water Level at 1 Day

◀ = Loss of Drilling Water

HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS / FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

CONSISTENCY OF COHESIONLESS SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS / FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

TERMS

Standard - Penetration Resistance The Number of Blows of a 140 lb. Hammer Falling 30 in. Required to Drive a 1.4 in I.D. Split Spoon Sampler 1 Foot (N-Value) As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100 (expressed as a percentage).

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks included) Divided by the Total Length of the Core Run Times 100 (expressed as a percentage).

Dynamic Cone - Penetrometer Test Data The Number of Blows of a 15 lb. Hammer Falling 20 in. Required to Drive a Cone Point 1 3/4 in. When Properly Evaluated, it can be compared to the Standard Penetration Resistance.

ESP

PROJECT:	US 21 Bypass Widening Fort Mill, South Carolina	TEST PIT RECORD TP-01

PROJECT No.:	ELEVATION:	EXCAVATION EQUIPMENT:	NOTES:
FX26.301	Existing Ground Surface		Existing water line encountered approximately 3.7 feet below ground surface
LOGGED BY:	**TEST PIT DEPTH:**		
Tyler Wenner	3.0 Feet		
DATE EXCAVATED:	**WATER LEVEL:**		
03/15/18	▽ N/A ▼ N/A		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	ELEV. (ft)	WATER LEVEL
		ABC Stone, (3 Inches) FILL: Reddish Brown Fine To Medium Sandy FAT CLAY, (moist)		
		Test pit was terminated at 3.0 feet. Backfilled with excavated test pit soil on 03/15/18.		
5			-5.0	
10			-10.0	
15			-15.0	
20			-20.0	
25			-25.0	
30			-30.0	

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE TEST PIT LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.

ESP

PROJECT:	US 21 Bypass Widening Fort Mill, South Carolina	TEST PIT RECORD TP-02

PROJECT No.:	ELEVATION:	EXCAVATION EQUIPMENT:	NOTES:
FX26.301	Existing Ground Surface		Existing water line encountered approximately 3.6 feet below ground surface
LOGGED BY:	**TEST PIT DEPTH:**		
Tyler Wenner	3.4 Feet		
DATE EXCAVATED:	**WATER LEVEL:**		
03/15/18	▽ N/A ▼ N/A		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	ELEV. (ft)	WATER LEVEL
		Topsoil, (6 Inches)		
		FILL: Reddish Brown Fine To Medium Sandy CLAY, (moist), with Approximately 6 Inch Coarse Sand Seam		
		FILL: Reddish Brown Clayey Fine to Medium SAND, (moist)		
		Test pit was terminated at 3.4 feet. Backfilled with excavated test pit soil on 03/15/18.		
5			-5.0	
10			-10.0	
15			-15.0	
20			-20.0	
25			-25.0	
30			-30.0	

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE TEST PIT LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.

PROJECT:	US 21 Bypass Widening Fort Mill, South Carolina	TEST PIT RECORD TP-03

PROJECT No.:	ELEVATION:	EXCAVATION EQUIPMENT:	NOTES:
FX26.301	Existing Ground Surface		Existing water line encountered approximately 5 feet below ground surface
LOGGED BY:	**TEST PIT DEPTH:**		
Tyler Wenner	4.0 Feet		
DATE EXCAVATED:	**WATER LEVEL:**		
03/15/18	▽ N/A ▼ N/A		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	ELEV. (ft)	WATER LEVEL
		Topsoil, (3 Inches) FILL: Reddish Brown Fine To Medium Sandy FAT CLAY, some organics, (moist), Roots, plant matter		
		Test pit was terminated at 4.0 feet. Backfilled with excavated test pit soil on 03/15/18.		
5			-5.0	
10			-10.0	
15			-15.0	
20			-20.0	
25			-25.0	
30			-30.0	

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE TEST PIT LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.

ESP

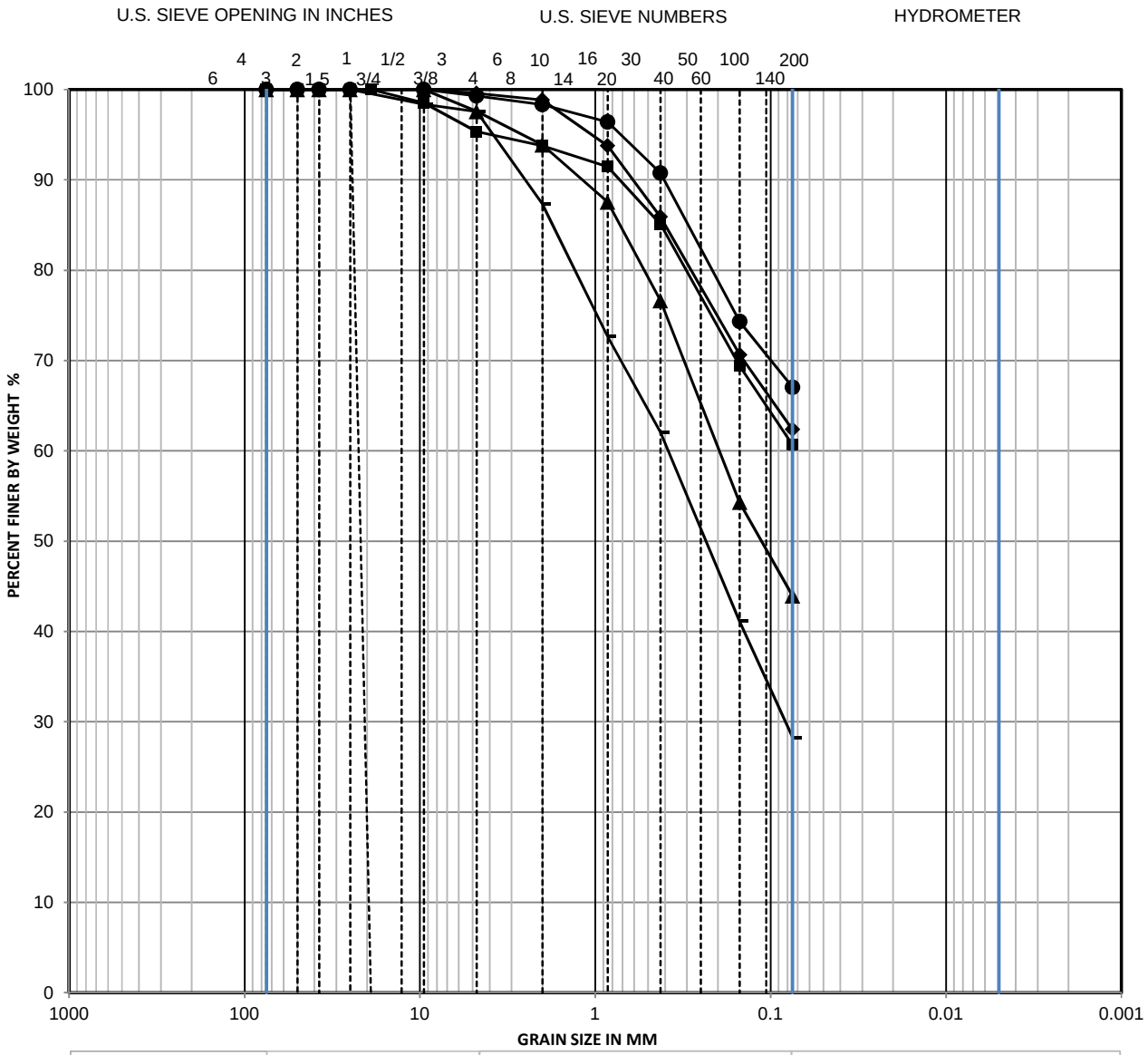
PROJECT:	US 21 Bypass Widening Fort Mill, South Carolina	TEST PIT RECORD TP-04

PROJECT No.:	ELEVATION:	EXCAVATION EQUIPMENT:	NOTES:
FX26.301	Existing Ground Surface		Existing water line encountered approximately 4.3 feet below existing ground surface
LOGGED BY:	**TEST PIT DEPTH:**		
Tyler Wenner	4.0 Feet		
DATE EXCAVATED:	**WATER LEVEL:**		
03/15/18	▽ N/A ▼ N/A		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	ELEV. (ft)	WATER LEVEL
		Topsoil, (5 Inches)		
		FILL: Dark Tan and Blackish Brown Silty Fine to Medium SAND, (moist), with Dense Coarse Sand Seams		
		Test pit was terminated at 4.0 feet. Backfilled with excavated test pit soil on 03/15/18.		
5			-5.0	
10			-10.0	
15			-15.0	
20			-20.0	
25			-25.0	
30			-30.0	

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE TEST PIT LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.

ESP



COBBLE	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
■	S-1	Sandy fat clay CH	62	28	34		
◆	S-2	Sandy fat clay CH	60	28	32		
▲	S-3	Clayey sand SC	68	27	41		
●	S-4	Sandy fat clay CH	57	23	34		
—	S-5	Silty sand SM	33	25	8		

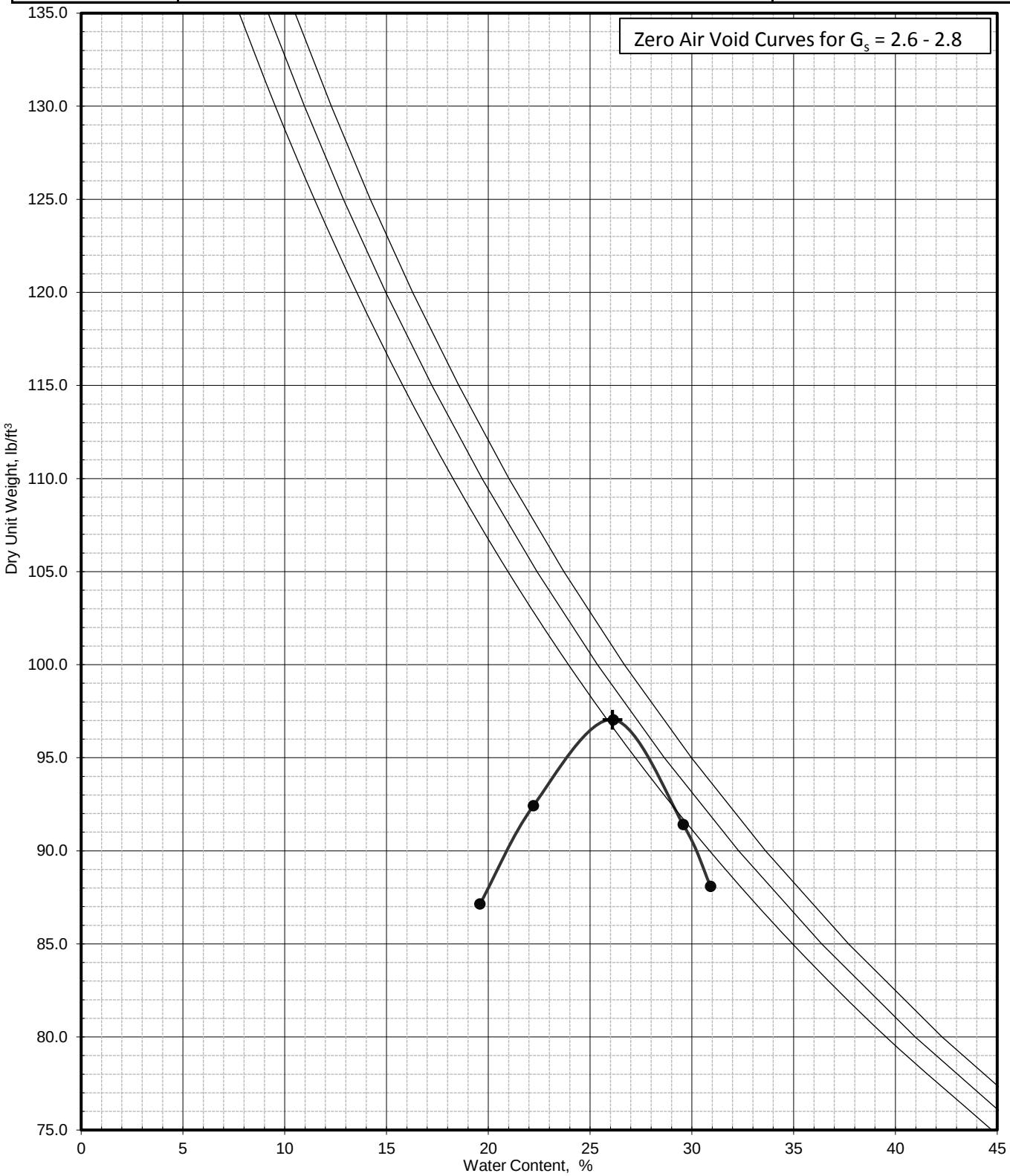
Specimen Identification		D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
■	S-1	19.0				4.6	34.7	60.7	
◆	S-2	9.5				0.4	37.2	62.3	
▲	S-3	9.5	0.2			2.4	53.6	43.9	
●	S-4	9.5				0.7	32.3	67.0	
—	S-5	19.0	0.4	0.1		2.4	69.3	28.3	

ESP
Address: 3475 Lakemont Blvd Fort Mill, SC 29708
Telephone: 803-802-2440

GRAIN SIZE DISTRIBUTION

Project:	US 21 Widening
Number:	FX26.301

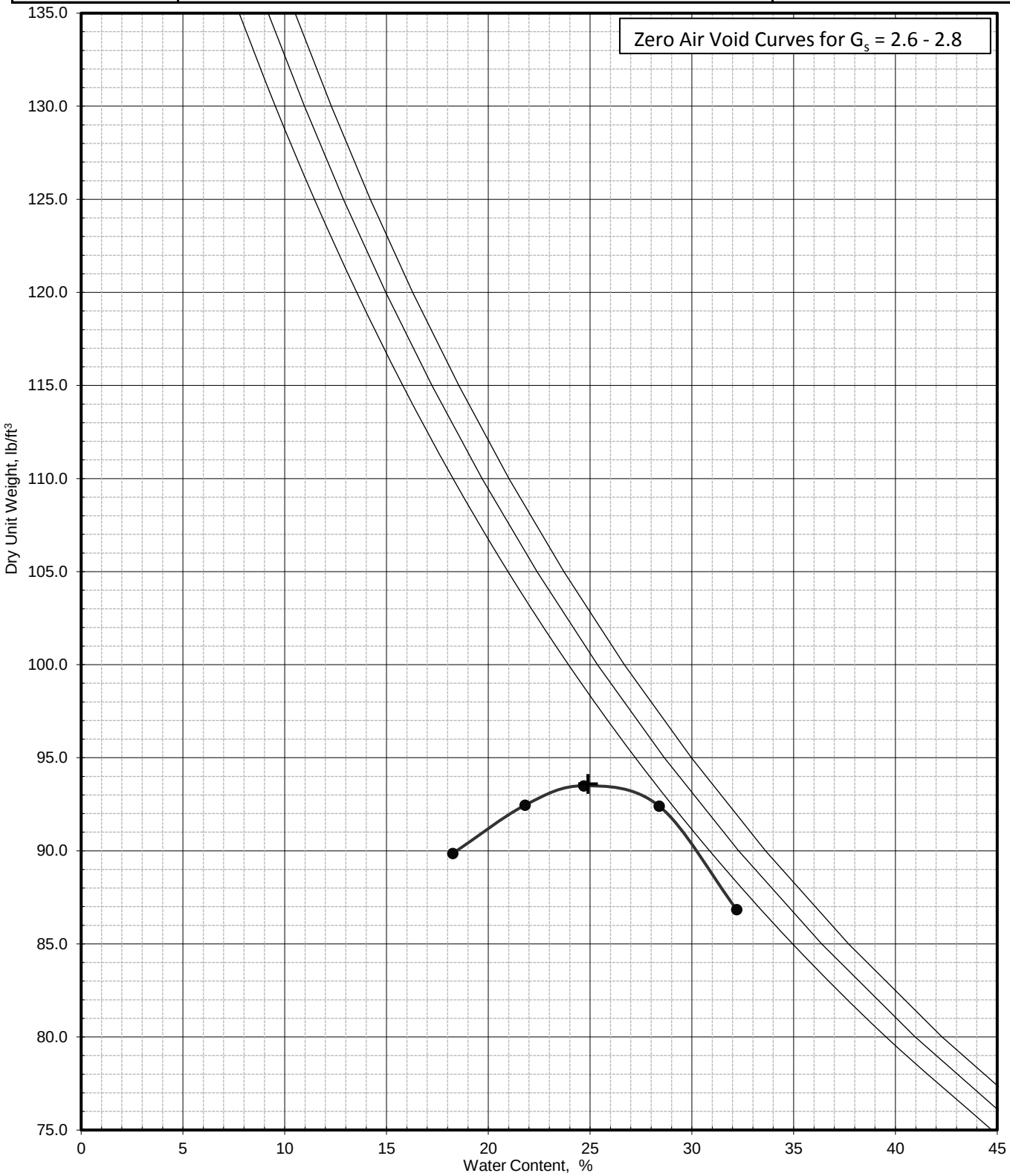
ESP	**Moisture - Density Relationship**	Project Number	**FX26.301**
		Sample Location	On Site
Project Name	**US 21 Widening**	Sample No.	S-1
Soil Description	Red Brown Sandy Fat CLAY CH	Depth	NA ft



Sample Type:	BLK	Plasticity Index:	34	**Optimum Water Content:**	26.1 %
Percent Fines:	60.7 %	Liquid Limit:	62	**Maximum Dry Unit Weight:**	97.0 lb/ft³
As received water content:	%	Plastic Limit:	28	Test Method:	ASTM D698 method A
Remarks:					

Keylab ID 400201803192

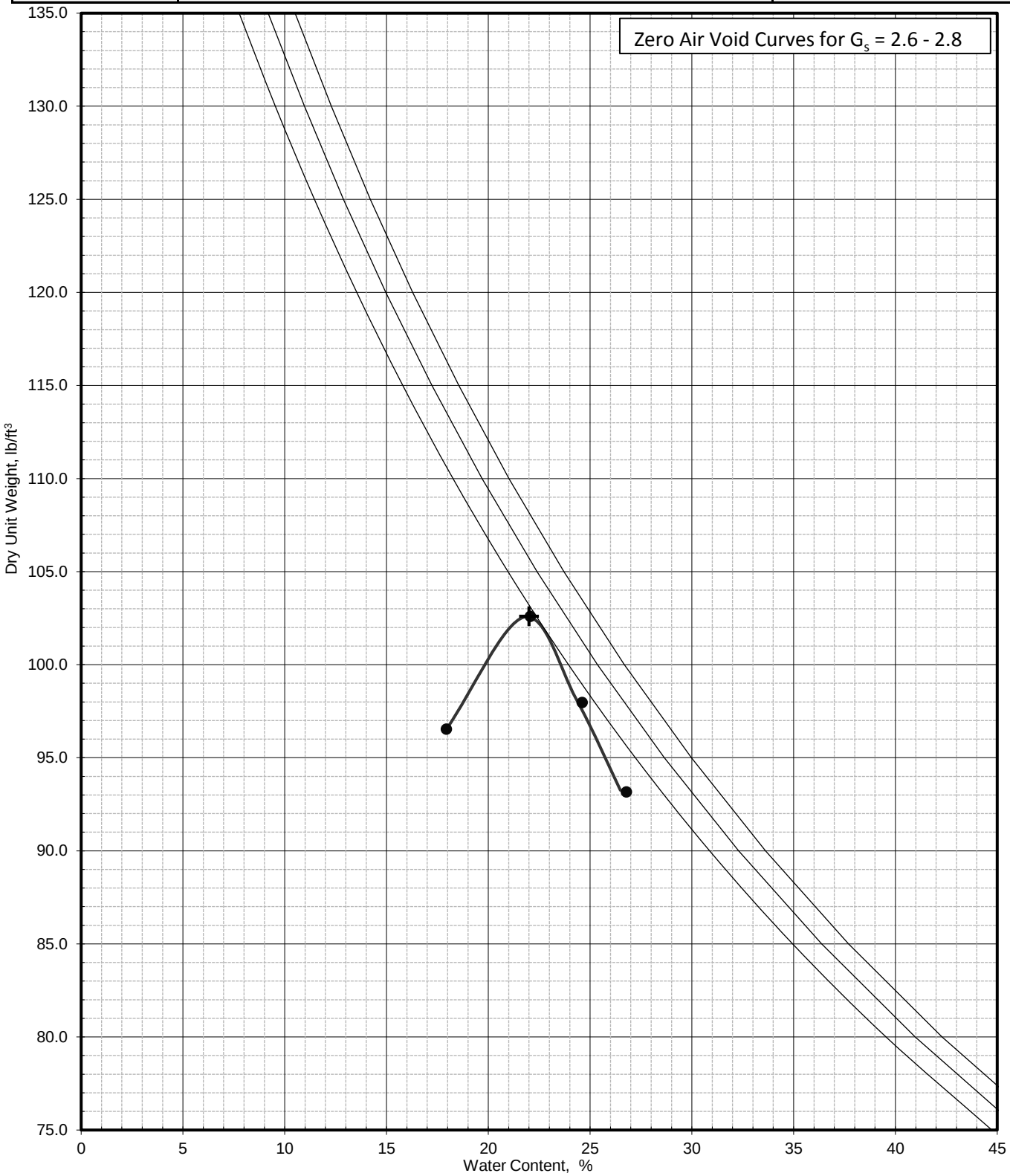
ESP	**Moisture - Density Relationship**	Project Number	**FX26.301**
		Sample Location	On Site
Project Name	**US 21 Widening**	Sample No.	S-2
Soil Description	Red Brown Sandy Fat CLAY CH	Depth	NA ft



Sample Type:	BLK	Plasticity Index:	32	**Optimum Water Content:**	24.9 %
Percent Fines:	62.3 %	Liquid Limit:	60	**Maximum Dry Unit Weight:**	93.6 lb/ft³
As received water content:	%	Plastic Limit:	28	Test Method:	ASTM D698 method A
Remarks:					

Keylab ID 400201803193

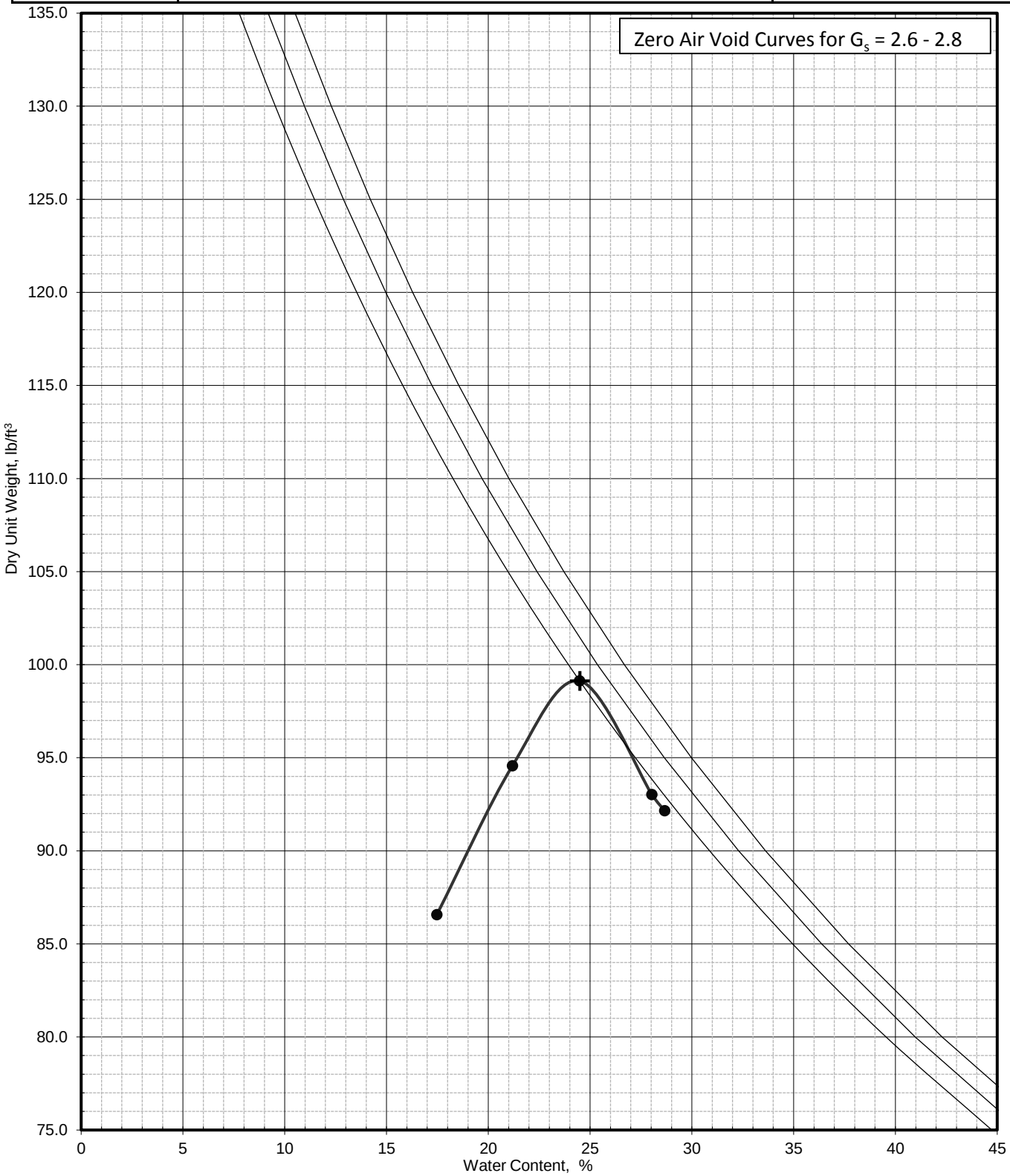
ESP	**Moisture - Density Relationship**	Project Number	**FX26.301**
		Sample Location	On Site
Project Name	**US 21 Widening**	Sample No.	S-3
Soil Description	Red Brown Clayey SAND SC	Depth	NA ft



Sample Type:	BLK	Plasticity Index:	41	**Optimum Water Content:**	22.0 %
Percent Fines:	43.9 %	Liquid Limit:	68	**Maximum Dry Unit Weight:**	102.6 lb/ft³
As received water content:	%	Plastic Limit:	27	Test Method:	ASTM D698 method A
Remarks:					

Keylab ID 400201803194

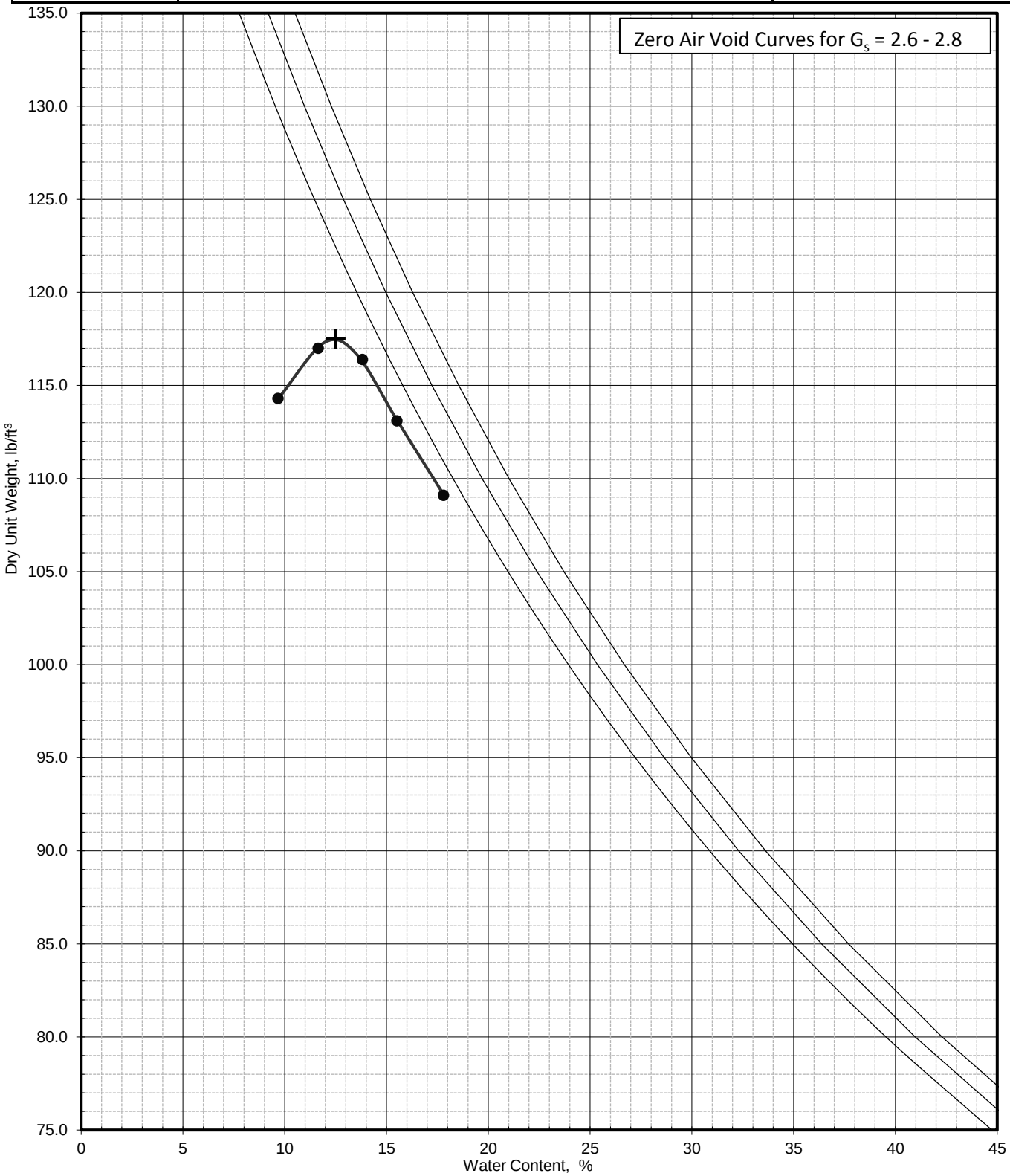
ESP	Moisture - Density Relationship	Project Number	FX26.301
		Sample Location	On Site
Project Name	US 21 Widening	Sample No.	S-4
Soil Description	Red Brown Sandy Fat CLAY CH	Depth	NA ft



Sample Type:	BLK	Plasticity Index:	34	**Optimum Water Content:**	24.5 %
Percent Fines:	67.0 %	Liquid Limit:	57	**Maximum Dry Unit Weight:**	99.1 lb/ft³
As received water content:	%	Plastic Limit:	23	Test Method:	ASTM D698 method A
Remarks:					

Keylab ID 400201803195

ESP	**Moisture - Density Relationship**	Project Number	**FX26.301**
		Sample Location	On Site
Project Name	**US 21 Widening**	Sample No.	S-5
Soil Description	Tan Brown Silty SAND SM	Depth	NA ft



Sample Type:	BLK	Plasticity Index:	8	**Optimum Water Content:**	12.5 %
Percent Fines:	28.3 %	Liquid Limit:	33	**Maximum Dry Unit Weight:**	117.5 lb/ft³
As received water content:	%	Plastic Limit:	25	Test Method:	ASTM D698 method A
Remarks:					

Keylab ID 400201803196



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Existing Culvert Assessment
US-21 / SC-51 Widening
Fort Mill, South Carolina

Submitted By:
KCI Technologies
3014 Southcross Blvd.
Rock Hill, South Carolina 29730

Assessment date: January 14, 2022

Prepared by: David Speer, P.E.

Culvert @ Sta. 33+79 US 21

The culvert was constructed as part of SCDOT File No. 46.240 with a plans date December 19, 1940 at approximately Station 319+28.8. It is a 5'x5' single reinforced concrete box culvert with a length of approximately 132 feet with approximately 25 feet of fill above the culvert. The culvert details were not included in the project files on SCDOT's Plans Online. The assessment of the west end of the culvert is in a sump and is almost 100% submerged under water and soil. Only the head wall was visible during the site visit (see figure 1). The east end of the culvert was approximately 90% filled with water and soil. The inside of the culvert was inaccessible (see figure 2).

The visible concrete was competent and no signs of deterioration were present. Additionally, there were no cracks shown in the roadway above or any disturbances in the slopes above the culvert. This indicates that the culvert is intact and its structure has not been compromised. Based on these observations and the fact that the structure has been in place for many years with no disturbance in the roadway above, KCI recommends that the existing culvert be left in place and extended.

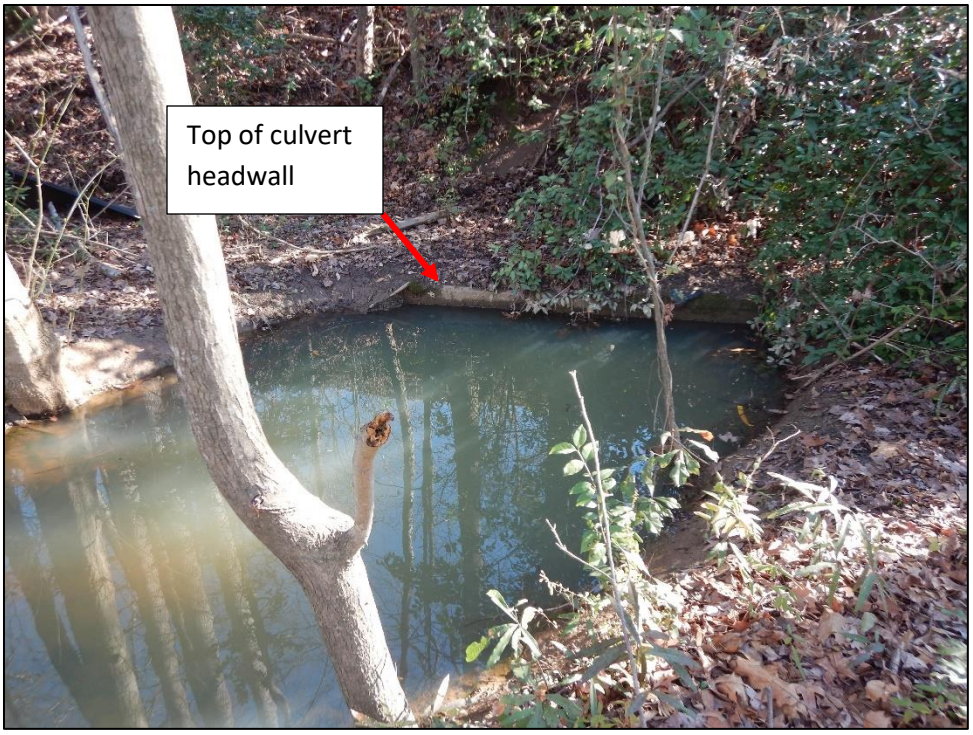

Figure 1: West end of culvert @ sta. 33+79



Figure 2: East end of culvert @ sta. 33+79

Culvert @ Sta. 41+06 US 21

The culvert was constructed as part of SCDOT File No. 46.240 with a plans date December 19, 1940, at approximately Station 326+57.1. It is a 5'x5' single reinforced concrete box culvert with a length of approximately 122 feet with approximately 17 feet of fill above the culvert. The culvert details were not included in the project files on SCDOT's Plans Online. The west end of the culvert did not show any signs of deterioration (see figure 3). On the interior of the culvert, the bottom of the top slab and inside face of the walls did not show any signs of deterioration or water intrusion. The east end of the culvert was inaccessible due to very steep slope and the presence of thick brush.

No signs of significant deterioration were observed during the structural assessment. The pavement and ground above and around the culvert did not show signs of cracking or settlement. Based on these observations, KCI recommends that the existing culvert be left in place and extended.



Figure 3:West End Culvert @ Sta. 41+06

Culvert @ Sta. 316+23 SC 51

The culvert was constructed as part of Federal Aid Project 216 (REOP) with a plans date July 18, 1927, at approximately Station 316+31. It is a 6'x6' single reinforced concrete box culvert with a length of approximately 30 feet with approximately 4 feet of fill above the culvert The original plans show a 6'x8' opening, however during a site visit conducted on May 30, 2019, it was determined that the culvert was a 6'x6' (see figures 4-6). The south end of the culvert did not show any signs of deterioration (see figure 7). Additionally, the north end of the culvert did not show any signs of deterioration (see figure 8). On the interior of the culvert, the bottom of the top slab and inside face of the walls did not show any signs of deterioration or water intrusion (see figure 8-9).

No signs of significant deterioration were observed during the structural assessment. The pavement and ground above and around the culvert did not show signs of cracking or settlement. Based on these observations, KCI recommends that the existing culvert be left in place and extended.



Figure 4: Measuring width of south end of culvert @ sta. 316+23



Figure 5: Measuring to top of soil at south end of culvert @ sta. 316+23



Figure 6: Measuring depth of soil at south end of culvert @ sta. 316+23



Figure 7: South end of culvert @ sta. 316+23



Figure 8: North end of culvert @ sta. 316+23



Figure 9: Inside of culvert @ sta. 316+23

CONCLUSION

Based on the condition of all three of the culverts during the site visits, KCI recommends that these culverts are suitable to be left in place and to have extensions added to the ends to facilitate the widening of the supported roadways.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, CHARLESTON DISTRICT
69A HAGOOD AVENUE
CHARLESTON, SC 29403-5107

November 23, 2021

Regulatory Division

Mr. Sean Connolly
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29202
ConnollyMS@scdot.org

Dear Mr. Connolly:

This is in response to your request for a preliminary jurisdictional determination (PJD) that is part of an overall project known as SCDOT US 21& SC 51 Intersection Improvements in York County (SCDOT PIN 42332), **Area #1**. Based on information submitted to the U.S. Army Corps of Engineers (Corps) we have determined there may be waters of the United States, including wetlands on your parcel located at the following:

Project Number:	SAC-2015-00812
County:	York County
Project/Site Size:	183 acres
Latitude:	35.076988°
Longitude:	-80.932637°
Project/Site Location:	US 21 & SC 51 Intersection Improvements in York County, Area #1
Waters (Acreage/Linear Feet):	Total: 1,175 lf tributaries & 0.506 ac wetlands

A copy of the PJD form and the depictions, Area-1 Figure 5A-5E, titled "US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 Approximated Waters of the U.S. and Wetlands Boundary Map" dated October 11, 2021, is enclosed. Please carefully read this form, then sign and return a copy to me at the following Stephen.A.Brumagin@usace.army.mil within 30 days from the date of this notification.

Please be advised a Department of the Army permit will be required for regulated work in all areas which may be waters of the United States, as indicated in this PJD. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a PJD will treat all waters and wetlands, which would be affected in any way by the permitted activity on the site, as if they are jurisdictional waters of the United States. Should you desire an approved Corps determination, one will be issued upon request.

You are cautioned that work performed in areas which may be waters of the United States, as indicated in the PJD, without a Department of the Army permit could subject you to enforcement action.

The delineation included herein has been conducted to identify the location and extent of the aquatic resource boundaries and/or the jurisdictional status of aquatic resources for purposes of the Clean Water Act for the particular site identified in this request. This delineation and/or jurisdictional determination may not be valid for the Wetland Conservation Provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should discuss the applicability of a certified wetland determination with the local USDA service center, prior to starting work.

If you submit a permit application as a result of this PJD, include a copy of this letter and the depiction as part of the application. Not submitting the letter and depiction will cause a delay while we confirm a PJD was performed for the proposed permit project area. Note that some or all of these areas may be regulated by other state or local government entities, and you should contact the South Carolina Department of Health and Environmental Control, Bureau of Water, to determine the limits of their jurisdiction.

In all future correspondence, please refer to file number SAC-2015-00812. A copy of this letter is forwarded to State and/or Federal agencies for their information. If you have any questions, please contact me at (803) 253-3445, or by email at Stephen.A.Brumagin@usace.army.mil.

Sincerely,



Stephen A. Brumagin
Project Manager

Enclosures:

Preliminary Jurisdictional Determination Form
Notification of Appeal Options
Area-1 Figure 5A-5E, "US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 Approximated Waters of the U.S. and Wetlands Boundary Map"

Copies Furnished:

Ms. Jackie Galloway
South Carolina Department of Transportation
955 Park Street
Columbia, SC 29202
GallowayJA@scdot.org

Mr. Joshua Kotheimer, PWS
STV Incorporated
900 West Trade St., Suite 715
Charlotte, NC 28202
joshua.kotheimer@stvinc.com

SC DHEC - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201
WQCWetlands@dhec.sc.gov

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. **REPORT COMPLETION DATE FOR PJD:** November 23, 2021

B. **NAME AND ADDRESS OF PERSON REQUESTING PJD:**

Agent:

Ms. Jackie Galloway
South Carolina Department of Transportation
955 Park Street
Columbia, SC 29202
GallowayJA@scdot.org

Consultant:

Mr. Joshua Kotheimer, PWS
STV Incorporated
900 West Trade St., Suite 715
Charlotte, NC 28202
joshua.kotheimer@stvinc.com

C. **DISTRICT OFFICE, FILE NAME, AND NUMBER:** Charleston District, SCDOT US 21& SC 51 Intersection in York County (SCDOT PIN 42332), SAC-2015-00812

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: South Carolina County: York County City: Fort Mill
Center coordinates of site (lat/long in degree decimal format):
Lat.: 35.076989° Long.: -80.932638°
Universal Transverse Mercator: 17
Name of nearest waterbody: Steele Creek

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
F.

X Office (Desk) Determination. Date: November 23, 2021
X Field Determination. Date(s): August 2, 2021

[1] Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
Non-wetland Water A	35.087959	-80.925706	392 feet	Non-wetland waters	Section 404
Non-wetland Water B	35.064674	-80.935632	12 feet	Non-wetland waters	Section 404
Non-wetland Water C	35.063728	-80.936619	434 feet	Non-wetland waters	Section 404
Non-wetland Water D	35.061556	-80.93688	259 feet	Non-wetland waters	Section 404
Non-wetland Water E	35.086392	-80.934445	78 feet	Non-wetland waters	Section 404
Wetland A	35.086709	-80.930377	0.114 acre	Wetland	Section 404
Wetland B	35.087488	-80.925539	0.001 acre	Wetland	Section 404
Wetland C	35.08801	-80.923097	0.044 acre	Wetland	Section 404
Wetland E	35.086436	-80.934311	0.014 acre	Wetland	Section 404
Wetland F	35.06181	-80.937576	0.222 acre	Wetland	Section 404
Wetland G	35.058751	-80.937869	0.111 acre	Wetland	Section 404

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the.JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can

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be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there "may be" waters of the U.S. and/or that there "may be" navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

_X_ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor: SCDOT Map: Area-1 Figure 5A-5E, titled "US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 Approximated Waters of the U.S. and Wetlands Boundary Map".

_X_ Data sheets prepared/submitted by or on behalf of the PJD requestor.

- _X_ Office concurs with data sheets/delineation report. The Corps agrees with the boundaries of aquatic resources represented in the drawings and based on the information provided.
- ___ Office does not concur with data sheets/delineation report. Rationale: _____.

___ Data sheets prepared by the Corps: _____.

_X_ Corps navigable waters' study: Charleston District Navigability Study 1977.

_X_ U.S. Geological Survey Hydrologic Atlas: HA 730-G, 1990.

- ___ USGS NHD data.
- _X_ USGS 8 and 12 digit HUC maps. 030501030103 Upper Sugar Creek, 030501030108 Steele Creek and 03050103 Lower Catawba River.

_X_ U.S. Geological Survey map(s). Cite scale & quad name: 1:24,000 Fort Mill, SC quadrangle.

_X_ Natural Resources Conservation Service Soil Survey. Citation: As provided by the Consultant in depictions, US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004, NRCS Soil Series Map Figures 3, 3A-3c: Amenia, Brewback, Cecil, Chewacla, Enon, Iredell, Mecklenburg, Mecklenburg-Wynott, Pacolet, Wynott-Brewback & Wynott-Winnsboro series.

_X_ National wetlands inventory map(s). Cite name: As provided by Consultant in depiction US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 National Wetland Inventory Map Figure 4 and the Corps Reg Viewer: R4SBC and PUBHh.

___ State/local wetland inventory map(s): _____.

___ FEMA/FIRM maps: _____

___ 100-year Floodplain Elevation is: _____. (National Geodetic Vertical Datum of 1929)

_X_ Photographs: _X_ Aerial (Name & Date): As provided by Consultant in JD request.
___ or _X_ Other (Name & Date): As provided by Consultant in JD request.

_X_ Previous determination(s). File no. and date of response letter: SAC 2015-00812 Approved Jurisdictional Determination dated July 1, 2016.

_X_ Other information (please specify): Field view on August 2, 2021.

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

[1] Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.



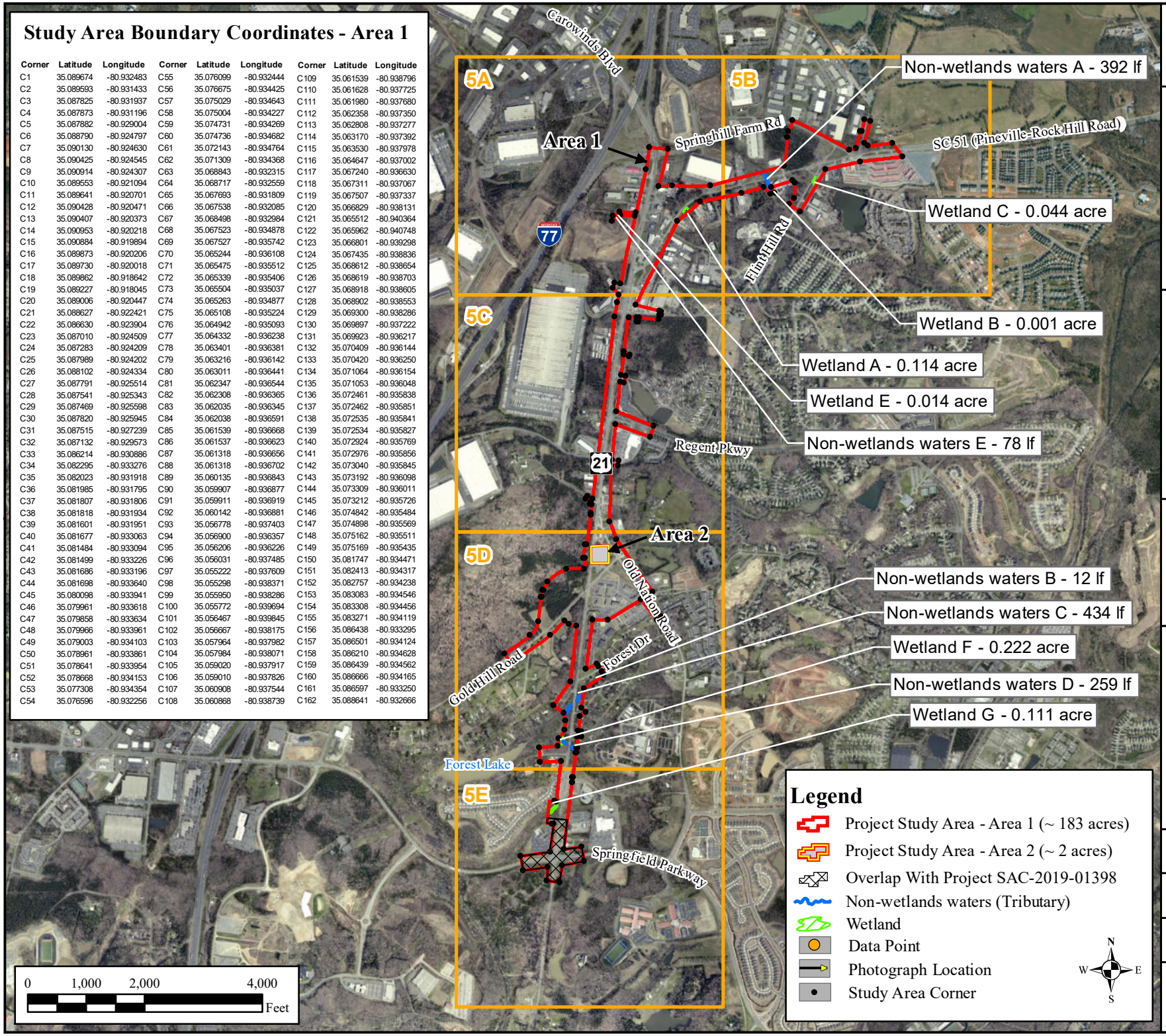
Signature and date of Regulatory staff member completing PJD

Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

Study Area Boundary Coordinates - Area 1

Corner	Latitude	Longitude	Corner	Latitude	Longitude	Corner	Latitude	Longitude
C1	35.089674	-80.932483	C55	35.076099	-80.932444	C109	35.061539	-80.938796
C2	35.089593	-80.931433	C56	35.076675	-80.934425	C110	35.061628	-80.937725
C3	35.087825	-80.931937	C57	35.075029	-80.934643	C111	35.061980	-80.937680
C4	35.087873	-80.931196	C58	35.075004	-80.934227	C112	35.062358	-80.937350
C5	35.087882	-80.929004	C59	35.074731	-80.934269	C113	35.062808	-80.937277
C6	35.088790	-80.924797	C60	35.074736	-80.934682	C114	35.063170	-80.937392
C7	35.090130	-80.924630	C61	35.072143	-80.934764	C115	35.063530	-80.937978
C8	35.090425	-80.924545	C62	35.071309	-80.934368	C116	35.064647	-80.937002
C9	35.090914	-80.924307	C63	35.068843	-80.932315	C117	35.067240	-80.936630
C10	35.089553	-80.921094	C64	35.068717	-80.932559	C118	35.067311	-80.937067
C11	35.089641	-80.920701	C65	35.067693	-80.931809	C119	35.067507	-80.937337
C12	35.090428	-80.920471	C66	35.067538	-80.932085	C120	35.066829	-80.938131
C13	35.090407	-80.920373	C67	35.068498	-80.932984	C121	35.065512	-80.940364
C14	35.090953	-80.920218	C68	35.067523	-80.934878	C122	35.065962	-80.940748
C15	35.090884	-80.919894	C69	35.067527	-80.935742	C123	35.066801	-80.939298
C16	35.089873	-80.920206	C70	35.065244	-80.936108	C124	35.067435	-80.938836
C17	35.089730	-80.920018	C71	35.065475	-80.935512	C125	35.068612	-80.938654
C18	35.089862	-80.918642	C72	35.065339	-80.935406	C126	35.068619	-80.938703
C19	35.089227	-80.918045	C73	35.065504	-80.935037	C127	35.068918	-80.938605
C20	35.089006	-80.920447	C74	35.065263	-80.934877	C128	35.068902	-80.938553
C21	35.088627	-80.922421	C75	35.065108	-80.935224	C129	35.069300	-80.938286
C22	35.086630	-80.923904	C76	35.064942	-80.935093	C130	35.069897	-80.937222
C23	35.087010	-80.924509	C77	35.064332	-80.936238	C131	35.069923	-80.936217
C24	35.087283	-80.924209	C78	35.063401	-80.936381	C132	35.070409	-80.936144
C25	35.087989	-80.924202	C79	35.063216	-80.936142	C133	35.070420	-80.936250
C26	35.088102	-80.924334	C80	35.063011	-80.936441	C134	35.071064	-80.936154
C27	35.087791	-80.925514	C81	35.062347	-80.936544	C135	35.071053	-80.936048
C28	35.087541	-80.925343	C82	35.062308	-80.936365	C136	35.072461	-80.935838
C29	35.087469	-80.925598	C83	35.062035	-80.936345	C137	35.072462	-80.935851
C30	35.087820	-80.925945	C84	35.062038	-80.936591	C138	35.072535	-80.935841
C31	35.087515	-80.927239	C85	35.061539	-80.936668	C139	35.072534	-80.935827
C32	35.087132	-80.929573	C86	35.061537	-80.936623	C140	35.072924	-80.935769
C33	35.086214	-80.930886	C87	35.061318	-80.936656	C141	35.072976	-80.935856
C34	35.082295	-80.933276	C88	35.061318	-80.936702	C142	35.073040	-80.935845
C35	35.082023	-80.931918	C89	35.060135	-80.936843	C143	35.073192	-80.936098
C36	35.081985	-80.931795	C90	35.059907	-80.936877	C144	35.073309	-80.936011
C37	35.081807	-80.931806	C91	35.059911	-80.936919	C145	35.073212	-80.935726
C38	35.081818	-80.931934	C92	35.060142	-80.936881	C146	35.074842	-80.935484
C39	35.081601	-80.931951	C93	35.056778	-80.937403	C147	35.074898	-80.935569
C40	35.081677	-80.933063	C94	35.056900	-80.936357	C148	35.075162	-80.935511
C41	35.081484	-80.933094	C95	35.056206	-80.936226	C149	35.075169	-80.935435
C42	35.081499	-80.933226	C96	35.056031	-80.937485	C150	35.081747	-80.934471
C43	35.081686	-80.933196	C97	35.055222	-80.937609	C151	35.082413	-80.934317
C44	35.081698	-80.933640	C98	35.055298	-80.938371	C152	35.082757	-80.934238
C45	35.080098	-80.933941	C99	35.055950	-80.938286	C153	35.083083	-80.934546
C46	35.079961	-80.933618	C100	35.055772	-80.939694	C154	35.083308	-80.934456
C47	35.079858	-80.933634	C101	35.056467	-80.939845	C155	35.083271	-80.934119
C48	35.079966	-80.933961	C102	35.056667	-80.938175	C156	35.086438	-80.933295
C49	35.079003	-80.934103	C103	35.057964	-80.937982	C157	35.086501	-80.934124
C50	35.078961	-80.933861	C104	35.057984	-80.938071	C158	35.086210	-80.934628
C51	35.078641	-80.933954	C105	35.059020	-80.937917	C159	35.086439	-80.934562
C52	35.078668	-80.934153	C106	35.059010	-80.937826	C160	35.086666	-80.934165
C53	35.077308	-80.934354	C107	35.060908	-80.937544	C161	35.086597	-80.933250
C54	35.076596	-80.932256	C108	35.060868	-80.938739	C162	35.088641	-80.932666



Legend

- Project Study Area - Area 1 (~ 183 acres)
- Project Study Area - Area 2 (~ 2 acres)
- Overlap With Project SAC-2019-01398
- Non-wetlands waters (Tributary)
- Wetland
- Data Point
- Photograph Location
- Study Area Corner

N, W, E, S

STV 100 Years

Client:

SCDOT South Carolina Department of Transportation

In Cooperation With

York County south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332

YORK COUNTY PFP3 PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Notes:

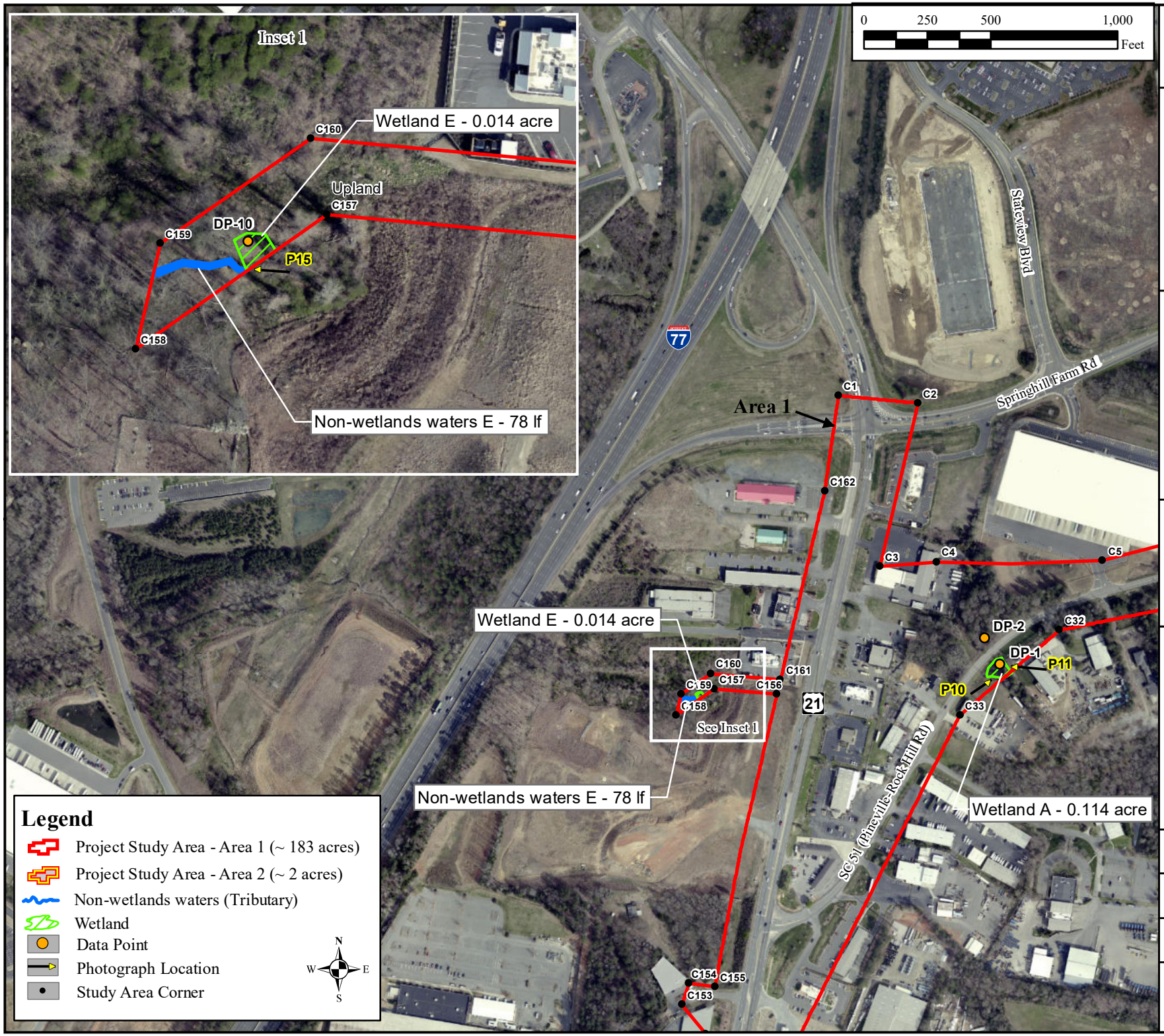
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No. 2515776

AREA - 1
FIGURE 5
OVERVIEW



STV 100 Years

Client:

SCDOT
South Carolina Department of Transportation

In Cooperation With

York County
south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332
YORK COUNTY PFP3
PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Sources: ESRI - Aerial Imagery (2019)

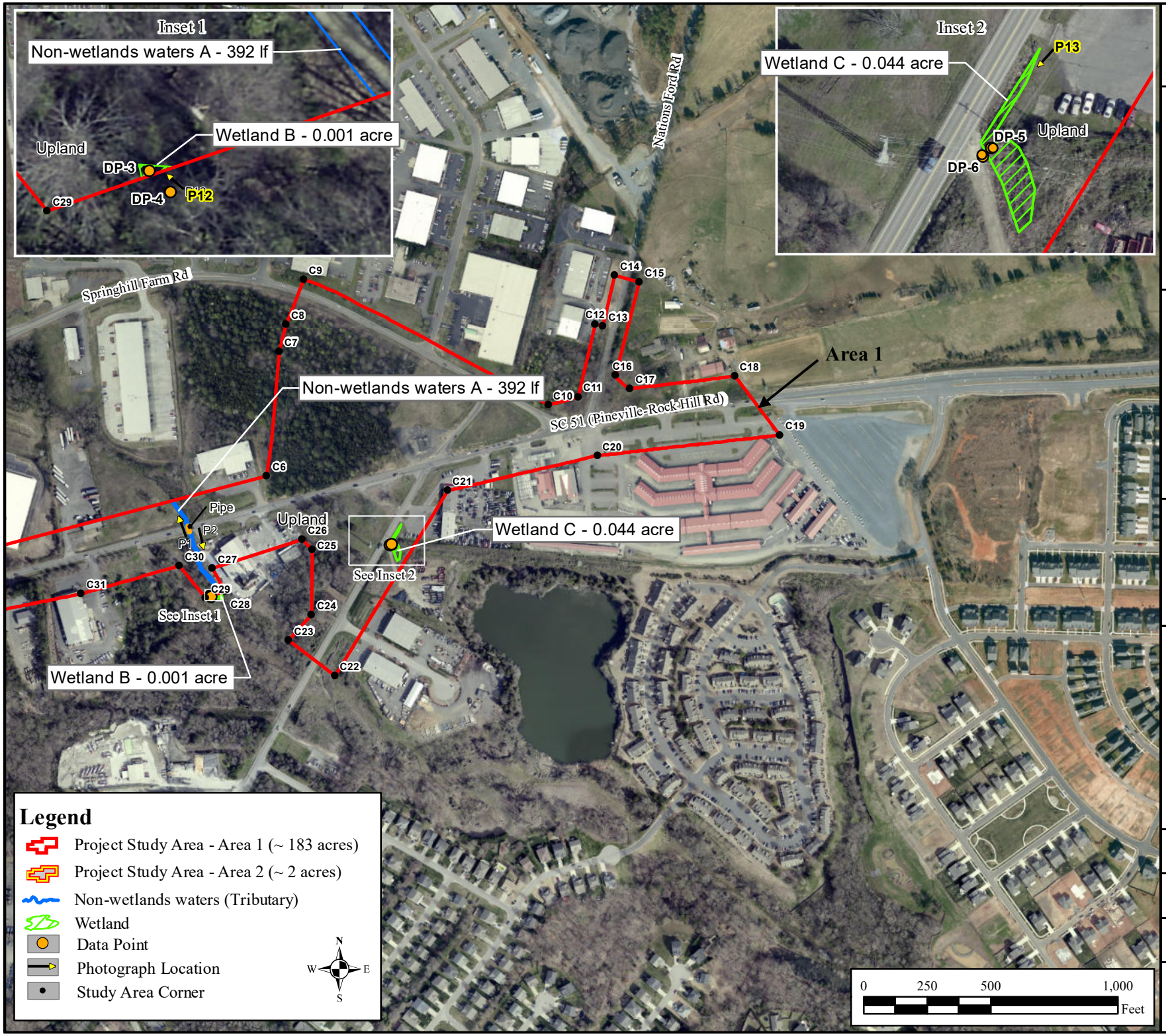
Notes:
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.
2515776

AREA - 1
FIGURE 5A



STV 100 Years

Client:

SCDOT
South Carolina Department of Transportation

In Cooperation With

York County
south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332
YORK COUNTY PFP3
PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Sources: ESRI - Aerial Imagery (2019)

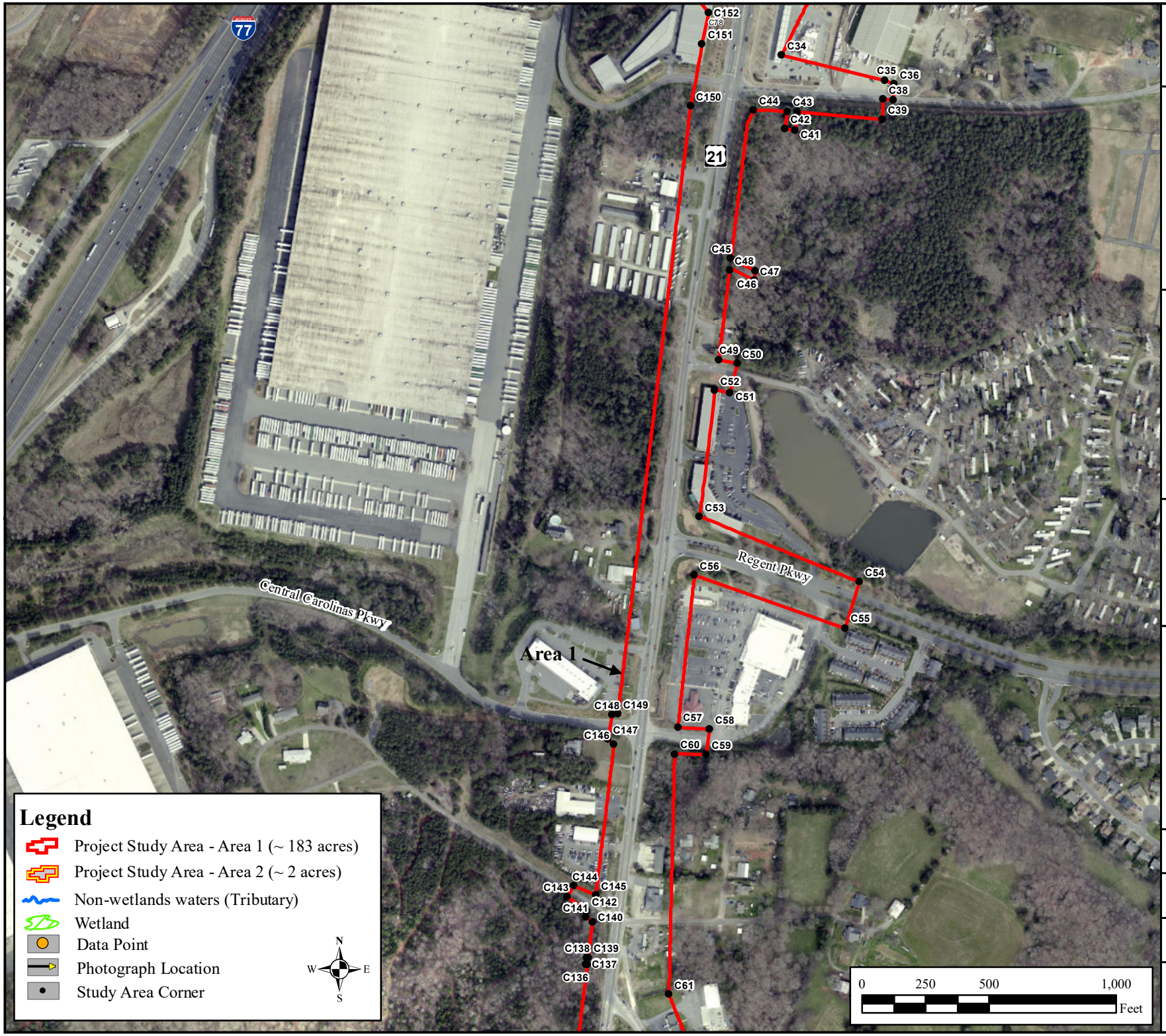
Notes:
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.
2515776

AREA - 1
FIGURE 5B



STV 100 Years

Client:

SCDOT
South Carolina Department of Transportation

In Cooperation With

York County
south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332
YORK COUNTY PFP3
PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Sources: ESRI - Aerial Imagery (2019)

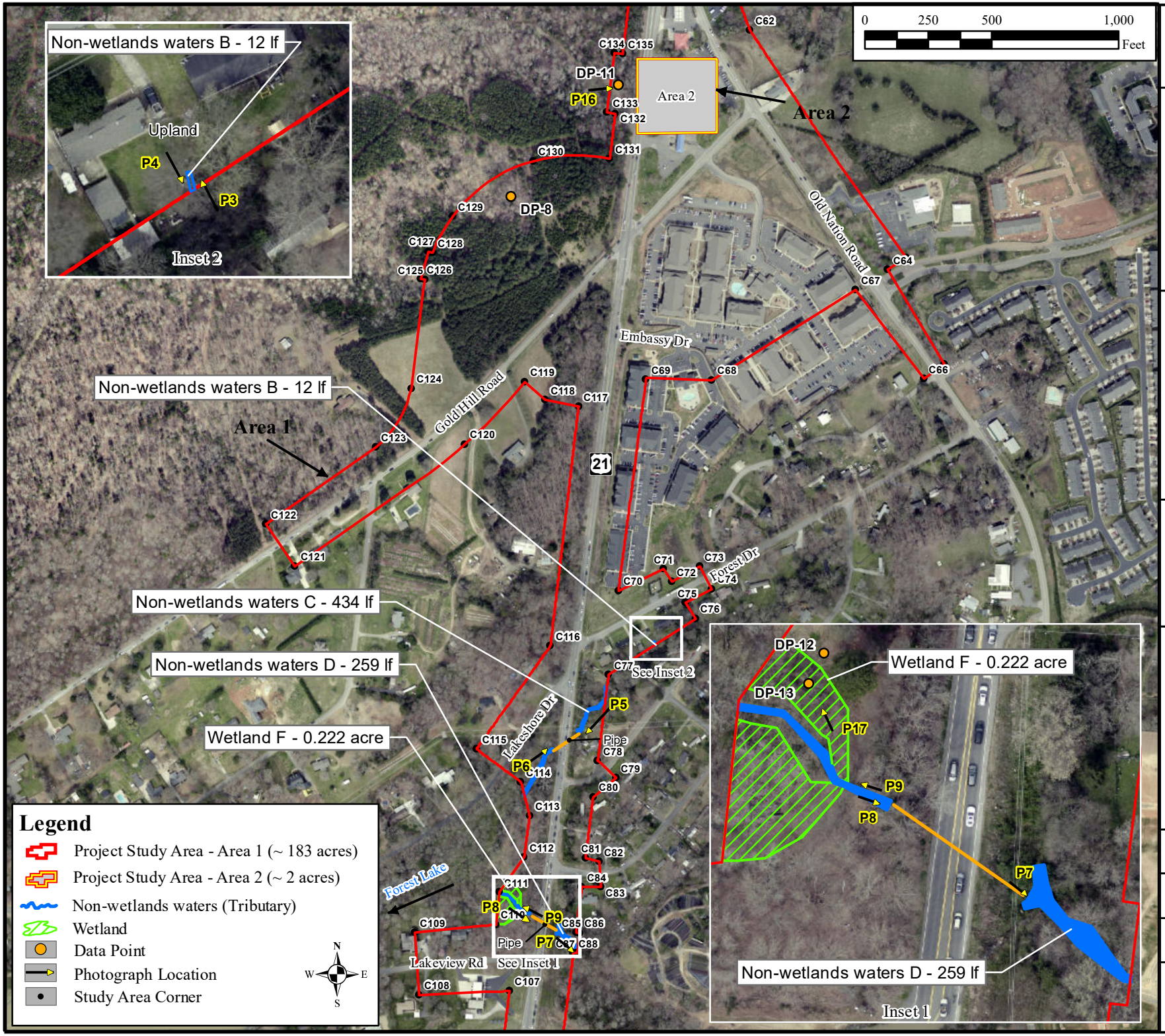
Notes:
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.
2515776

AREA - 1
FIGURE 5C



STV 100 Years

Client:

SCDOT South Carolina Department of Transportation

In Cooperation With

York County south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332

YORK COUNTY PFP3 PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Sources: ESRI - Aerial Imagery (2019)

Notes:

1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

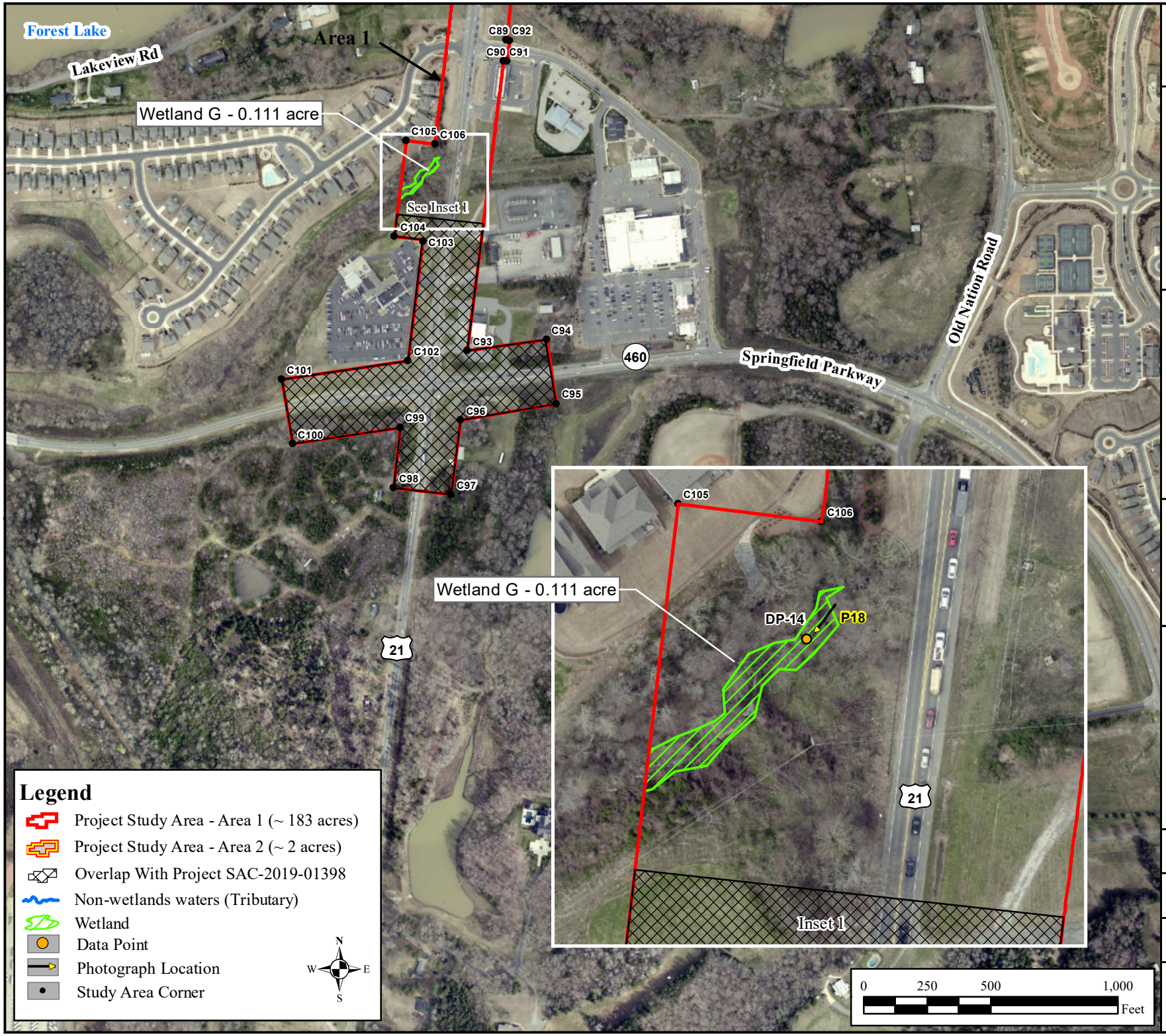
2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.

2515776

AREA - 1
FIGURE 5D



STV 100 Years

Client:

SCDOT
South Carolina Department of Transportation

In Cooperation With

York County
south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332
YORK COUNTY PFP3
PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Sources: ESRI - Aerial Imagery (2019)

Notes:
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.

2515776

AREA - 1
FIGURE 5E

Waters_Name	State	Cowardin_Code	HGM_Code	Meas_Type	Amount	Units	Waters_Type	Latitude	Longitude	Local_Waterway
Non-wetlands waters A (non-tidal)	SOUTH CAROLINA	R3		Linear	392	FOOT		35.08795900	-80.92570600	
Non-wetlands waters B (non-tidal)	SOUTH CAROLINA	R4		Linear	12	FOOT		35.06467400	-80.93563200	
Non-wetlands waters C (non-tidal)	SOUTH CAROLINA	R3		Linear	434	FOOT		35.06372800	-80.93661900	
Non-wetlands waters D (non-tidal)	SOUTH CAROLINA	R3		Linear	259	FOOT		35.06155600	-80.93688000	
Non-wetlands waters E (non-tidal)	SOUTH CAROLINA	R3		Linear	78	FOOT		35.08639200	-80.93444500	
Wetland A	SOUTH CAROLINA	PFO		Area	0.114	ACRE		35.08670900	-80.93037700	
Wetland B	SOUTH CAROLINA	PFO		Area	0.001	ACRE		35.08748800	-80.92553900	
Wetland C	SOUTH CAROLINA	PEM		Area	0.044	ACRE		35.08801000	-80.92309700	
Wetland E	SOUTH CAROLINA	PFO		Area	0.014	ACRE		35.08643600	-80.93431100	
Wetland F	SOUTH CAROLINA	PFO		Area	0.222	ACRE		35.06181000	-80.93757600	
Wetland G	SOUTH CAROLINA	PEM		Area	0.111	ACRE		35.05875100	-80.93786900	
Non-jurisdictional Water D (Area 2)	SOUTH CAROLINA			Area	0.017	ACRE		35.07058200	-80.93556100	

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant:	File Number:	Date:
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the Division Engineer, South Atlantic Division, 60 Forsyth St, SW, Atlanta, GA 30308-8801. This form must be received by the Division Engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD **is not appealable**. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact the Corps biologist who signed the letter to which this notification is attached. The name and telephone number of this person is given at the end of the letter.	If you only have questions regarding the appeal process you may also contact: Mr. Philip A. Shannin Administrative Appeals Review Officer CESAD-PDS-O 60 Forsyth St, SW, Floor M9 Atlanta, GA 30308-8803 (404) 562-5136

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, CHARLESTON DISTRICT
69A HAGOOD AVENUE
CHARLESTON, SC 29403-5107

November 23, 2021

Regulatory Division

Mr. Sean Connolly
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29202
ConnollyMS@scdot.org

Dear Mr. Connolly:

This is in response to your request for an Approved Jurisdictional Determination (AJD) (SAC-2015-00812) received in our office on June 9, 2021 and revised on October 18, 2021, for a 2-acre site known as SCDOT US 21& SC 51 Intersection Improvements in York County (SCDOT PIN 42332), **Area #2** which is located east of US 21 approximately 575 feet northeast of the intersection of US 21 and S-98 (Gold Hill Road) in Fort Mill, York County, South Carolina (Latitude: 35.076988°, Longitude: -80.932637°). An AJD is used to indicate the Corps has identified the presence or absence of wetlands and/or other aquatic resources on a site, including their accurate location(s) and boundaries, as well as their jurisdictional status pursuant to Section 404 of the Clean Water Act (CWA) (33 U.S.C. § 1344) and/or navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA) (33 U.S.C. § 403).

The site is shown on the attached depictions Area-2 Figure 5 and 5A, titled "US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 Approximated Waters of the U.S. and Wetlands Boundary Map" dated October 11, 2021 prepared by STV. Based on an on-site inspection, a review of aerial photography, topographic maps, National Wetlands Inventory maps, soil survey information, and Wetland Determination Data Forms, we conclude the site, as shown on the referenced depictions, do not contain any aquatic resources subject to regulatory jurisdiction under Section 404 of the CWA or Section 10 of the RHA.

Attached is a form describing the basis of jurisdiction for the delineated area(s). Note that some or all of these areas may be regulated by other state or local government entities and you should contact the South Carolina Department of Health and Environmental Control, Bureau of Water, to determine the limits of their jurisdiction.

Attached is a form describing the basis of jurisdiction for the delineated area(s). Note that some or all of these areas may be regulated by other state or local government entities and you should contact the South Carolina Department of Health and Environmental Control, Bureau of Water, or Department of Ocean and Coastal Resource Management, to determine the limits of their jurisdiction.

Attached is a form describing the basis of jurisdiction for the delineated area(s). Note that a Department of the Army (DA) permit may be required for certain activities in the areas subject to regulatory jurisdiction of the Corps of Engineers, and these areas may be further subject to restrictions or requirements of other state or local government entities.

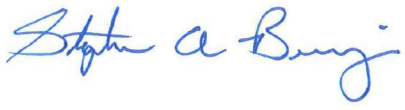
If you submit a permit application as a result of this AJD, include a copy of this letter and the depictions as part of the application. Not submitting the letter and depiction will cause a delay while we confirm an AJD was performed for the proposed permit project area. Note that some or all of these areas may be regulated by other state or local government entities, and you should contact the South Carolina Department of Health and Environmental Control, Bureau of Water, to determine the limits of their jurisdiction.

This AJD is valid for five (5) years from the date of this letter unless new information warrants revision before the expiration date. This AJD is an appealable action under the Corps of Engineers administrative appeal procedures defined at 33 CFR Part 331. The administrative appeal options, process and appeals request form is attached for your convenience and use.

This AJD was conducted pursuant to Corps of Engineers' regulatory authority to identify the limits of Corps of Engineers' jurisdiction for the particular site identified in this request. This AJD may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

In all future correspondence, please refer to file number SAC-2015-00812, US 21& SC 51 Intersection Improvements in York County (SCDOT PIN 42332), **Area #2**. A copy of this letter is forwarded to State and/or Federal agencies for their information. If you have any questions, please contact me at (803) 253-3445, or by email at Stephen.A.Brumagin@usace.army.mil.

Sincerely,



Stephen A. Brumagin
Project Manager

Attachments:
Approved Jurisdictional Determination Form
Notification of Appeal Options

Area-2 Figure 5 and 5A, titled “US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 Approximated Waters of the U.S. and Wetlands Boundary Map”

Copies Furnished:

Ms. Jackie Galloway
South Carolina Department of Transportation
955 Park Street
Columbia, SC 29202
GallowayJA@scdot.org

Mr. Joshua Kotheimer, PWS
STV Incorporated
900 West Trade St., Suite 715
Charlotte, NC 28202
joshua.kotheimer@stvinc.com

SCDHEC – Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201
WQCWetlands@dhec.sc.gov

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): November 23, 2021

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: JD Form 1 of 1; SAC-2015-00812 SCDOT US 21& SC 51 Intersection Improvements Project Area #2 in York County (SCDOT PIN 42332)

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: South Carolina County: York County City: Fort Mill

Center coordinates of site (lat/long in degree decimal format): Lat. 35.0769887699411 °, Long. -80.9326378928917 °.

Universal Transverse Mercator:

Name of nearest waterbody: Sugar creek and Steele Creek

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Catawba River

Name of watershed or Hydrologic Unit Code (HUC): 030501030103 Upper Sugar Creek & 030501030108 Steele Creek

☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.

☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☒ Office (Desk) Determination. Date: November 23, 2021

☒ Field Determination. Date(s): August 2, 2021

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

☐ Waters subject to the ebb and flow of the tide.

☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are no** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: linear feet: width (ft) and/or acres.
      Wetlands: 0.017 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Pick List**
      Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain: **As was previously identified and confirmed by the Corps in the July 1, 2016 Approved Jurisdictional Determination (AJD) for this project, there is a feature identified as "Non-jurisdictional Water D 0.017 acre" within Area #2 of the SCDOT US 21 & SC 51 Phase I project in York County South Carolina. This feature is located east of**

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

US 21 approximately 575 feet northeast of the intersection of US 21 and S-98 (Gold Hill Road) in Fort Mill, York County, S.C.

In the previous AJD the consultant had identified this feature as an unmaintained stormwater feature that may have some hydrophytic vegetation and saturated soils. However, on further investigation by the Corps with a field view on November 17, 2015, the Corps confirmed the presence of a concrete block wall that is located on the north site of the feature with the presence of sediment deposits and debris within the feature. At that time, it was observed there were limited hydrophytic plants present with areas of unvegetated sediment deposits and the substrate was saturated.

On August 2, 2021, the situation is very similar to the previous field view, however the accumulated sediments were moist in some location within the feature and other areas were quite dry. A sample of the accumulated sediments had some stratification of soil with matrix color of 10 YR 4/3 with s few remnant faint redox concentration only in a few select areas that had the most soil moisture. There may be more hydrophytic vegetation present than during the previous field view, but these were predominantly plants one would expect to move into a disturbed area such as Sweet Gum, Poison Ivy and Green Ash. Also, the condition of the concrete wall has not changed dramatically since the previous field view, other than some deterioration from age. As was previously determined by the Corps, this wall may have been constructed in the past as some type of low retaining wall with the idea of keeping storm water flows away from the placed fill. Due to development within the immediate area and within the drainage area above this feature, it appears, due to limited soil moisture, that some of the flows that formerly went through this feature have been diverted or intercepted and this area did not exhibit characteristics of tributaries beyond what would be expected for areas that receive stormwater directly related to precipitation events.

Based upon this field view, the feature identified in this delineation as Non-Jurisdictional Water D 0.017 acre, may be some type of un-maintained stormwater conveyance feature that does not meet the criteria for consideration as a wetland, nor does it have flow characteristics that meet the definition of a tributary. Therefore, the Corps has determined that this feature is not subject to jurisdiction under the Clean Water Act.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW
Identify TNW: .

Summarize rationale supporting determination: .

2. Wetland adjacent to TNW
Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: **Pick List**
Drainage area: **Pick List**
Average annual rainfall: inches
Average annual snowfall: inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☐ Tributary flows through **Pick List** tributaries before entering TNW.

Project waters are **Pick List** river miles from TNW.
Project waters are **Pick List** river miles from RPW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Project waters are **Pick List** aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain: .

Identify flow route to TNW[5]: .
Tributary stream order, if known: .

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain: .
☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):

☐ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☐ Muck
☐ Bedrock	☐ Vegetation. Type/% cover:	
☐ Other. Explain: .		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: .
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Pick List.** Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☐ the presence of litter and debris
☐ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☐ sediment deposition	☐ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community
☐ other (list):	

☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.
☐ tidal gauges	
☐ other (list):	

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: .
Identify specific pollutants, if known: .

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

- ☐ Riparian corridor. Characteristics (type, average width): .
- ☐ Wetland fringe. Characteristics: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: acres

Wetland type. Explain: .

Wetland quality. Explain: .

Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain: .

Surface flow is**: Pick List**

Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .

- ☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

- ☐ Directly abutting
- ☐ Not directly abutting
  - ☐ Discrete wetland hydrologic connection. Explain: .
  - ☐ Ecological connection. Explain: .
  - ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List.**

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .

Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

- ☐ Riparian buffer. Characteristics (type, average width): .
- ☐ Vegetation type/percent cover. Explain: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed: .

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: .
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

---

[8] See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.*

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
☒ Other: (explain, if not covered above): **As was described above in Section B.2, the identified feature, Non-Jurisdictional Water D 0.017 acre, has been determined by the Corps to be a linear storm water conveyance features that does not meet the criteria of wetlands nor does it exhibit characteristics of tributary. Therefore, this feature is not subject to jurisdiction under the Clean Water Act.**

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: depictions Area-2 Figure 5 and 5A, titled "US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 Approximated Waters of the U.S. and Wetlands Boundary Map" dated October 11, 2021 prepared by STV.
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
☒ Office concurs with data sheets/delineation report. The Corps agrees with the boundaries features represented in the drawings and based on the information provided
☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☒ Corps navigable waters' study: Charleston District Navigability Study, 1977.
☒ U.S. Geological Survey Hydrologic Atlas: HA 730-G, 1990.
☐ USGS NHD data.
☒ USGS 8 and 12 digit HUC maps. 030501030103 Upper Sugar Creek, 030501030108 Steele Creek and 03050103 Lower Catawba River.
☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24,000 Fort Mill, SC quadrangle.
☒ USDA Natural Resources Conservation Service Soil Survey. Citation: As provided by the Consultant in depictions, US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004, NRCS Soil Series Map Figures 3, 3B: Cecil, Mecklenburg-Wynott, Pacolet & Wynott-Winnsboro series.
☒ National wetlands inventory map(s). Cite name: As provided by Consultant in depiction US 21 North Phase I and SC 51 York County, SC SCDOT PIN 42332 York County PFP3 Project # 11149-004 National Wetland Inventory Map Figure 4 and the Corps Reg Viewer: Uplands.
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date): As provided by the consultant in the JD request.

or ☒ Other (Name & Date): As provided by the consultant in the JD request.

☒ Previous determination(s). File no. and date of response letter: SAC 2015-00812 AJD dated July 1, 2016.

☐ Applicable/supporting case law: .

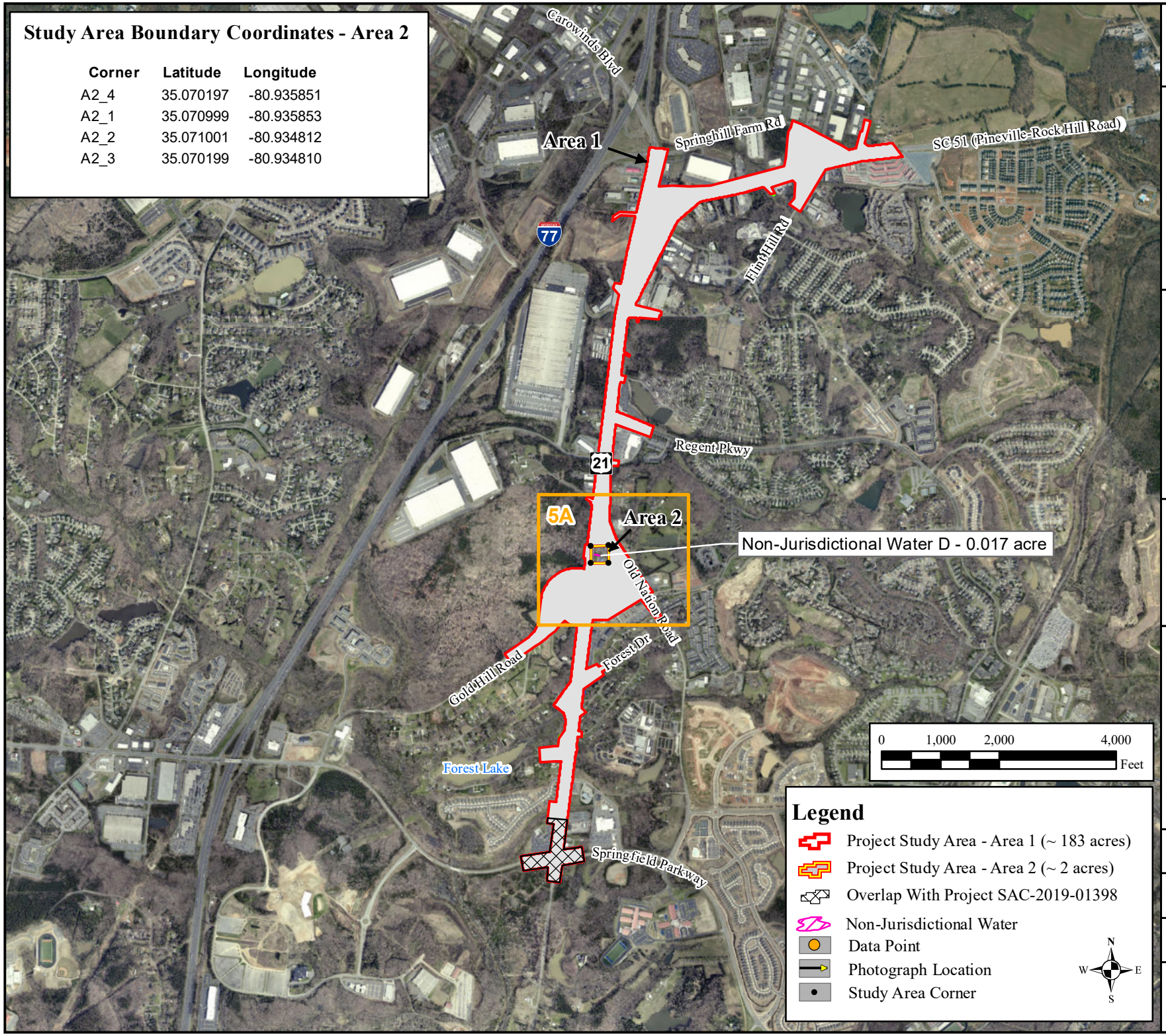
☐ Applicable/supporting scientific literature: .

☒ Other information (please specify): field view on August 2, 2021.

B. ADDITIONAL COMMENTS TO SUPPORT JD: As was described above in Section B.2, the identified feature, Non-Jurisdictional Water D 0.017 acre, has been determined by the Corps to be a linear storm water conveyance features that does not meet the criteria of wetlands nor does it exhibit characteristics of tributary. Therefore, this feature is not subject to jurisdiction under the Clean Water Act.

Study Area Boundary Coordinates - Area 2

Corner	Latitude	Longitude
A2_4	35.070197	-80.935851
A2_1	35.070999	-80.935853
A2_2	35.071001	-80.934812
A2_3	35.070199	-80.934810



STV 100 Years

Client:

SCDOT South Carolina Department of Transportation

In Cooperation With

York County south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332
YORK COUNTY PFP3 PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Notes:
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

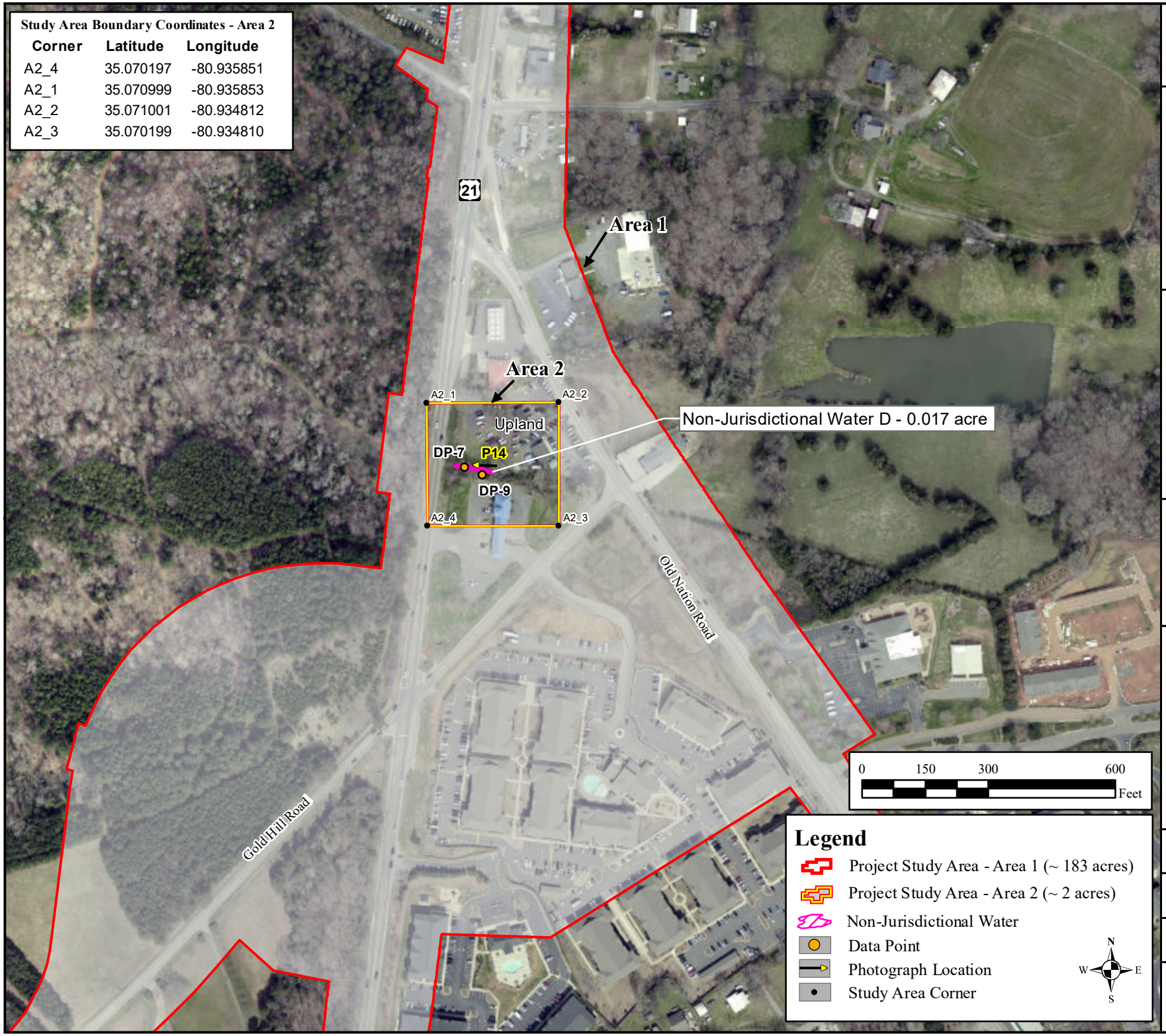
2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.

2515776

AREA - 2
FIGURE 5
OVERVIEW



STV 100 Years

Client:

SCDOT
South Carolina Department of Transportation

In Cooperation With

York County
south carolina

Project:

US 21 NORTH PHASE I AND SC 51

YORK COUNTY, SC

SCDOT PIN 42332
YORK COUNTY PFP3
PROJECT # 11149-004

Title:

APPROXIMATE WATERS OF THE U.S. AND WETLANDS BOUNDARY MAP

Notes:
1. Jurisdictional waters of the U.S. were delineated by STV, Inc. during field reviews conducted on November 27-28, 2012, June 3-4, 2014, March 31, 2016, February 10 2017, June 12, 2020, May 24, 2021, and August 13, 2021. Jurisdictional boundaries have been marked in the field with blue and white striped tape and surveyed by a professional licensed surveyor.

2. Jurisdictional boundaries of the waters of the U.S. have not been verified by the U.S. Army Corps of Engineers and are subject to change following verification.

Drawn By:	Checked By:
JLK	TPO
Approved By:	**Date:**
MAI	10/11/2021

STV Project No.
2515776

AREA - 2
FIGURE 5A

Waters_Name	State	Cowardin_Code	HGM_Code	Meas_Type	Amount	Units	Waters_Type	Latitude	Longitude	Local_Waterway
Non-wetlands waters A (non-tidal)	SOUTH CAROLINA	R3		Linear	392	FOOT		35.08795900	-80.92570600	
Non-wetlands waters B (non-tidal)	SOUTH CAROLINA	R4		Linear	12	FOOT		35.06467400	-80.93563200	
Non-wetlands waters C (non-tidal)	SOUTH CAROLINA	R3		Linear	434	FOOT		35.06372800	-80.93661900	
Non-wetlands waters D (non-tidal)	SOUTH CAROLINA	R3		Linear	259	FOOT		35.06155600	-80.93688000	
Non-wetlands waters E (non-tidal)	SOUTH CAROLINA	R3		Linear	78	FOOT		35.08639200	-80.93444500	
Wetland A	SOUTH CAROLINA	PFO		Area	0.114	ACRE		35.08670900	-80.93037700	
Wetland B	SOUTH CAROLINA	PFO		Area	0.001	ACRE		35.08748800	-80.92553900	
Wetland C	SOUTH CAROLINA	PEM		Area	0.044	ACRE		35.08801000	-80.92309700	
Wetland E	SOUTH CAROLINA	PFO		Area	0.014	ACRE		35.08643600	-80.93431100	
Wetland F	SOUTH CAROLINA	PFO		Area	0.222	ACRE		35.06181000	-80.93757600	
Wetland G	SOUTH CAROLINA	PEM		Area	0.111	ACRE		35.05875100	-80.93786900	
Non-jurisdictional Water D (Area 2)	SOUTH CAROLINA			Area	0.017	ACRE		35.07058200	-80.93556100	

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant:	File Number:	Date:
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the Division Engineer, South Atlantic Division, 60 Forsyth St, SW, Atlanta, GA 30308-8801. This form must be received by the Division Engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD **is not appealable**. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact the Corps biologist who signed the letter to which this notification is attached. The name and telephone number of this person is given at the end of the letter.	If you only have questions regarding the appeal process you may also contact: Mr. Philip A. Shannin Administrative Appeals Review Officer CESAD-PDS-O 60 Forsyth St, SW, Floor M9 Atlanta, GA 30308-8803 (404) 562-5136

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, CHARLESTON DISTRICT
69A HAGOOD AVENUE
CHARLESTON, SOUTH CAROLINA 29403-5107

March 22, 2023

Regulatory Division

Ms. Jackie Galloway
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29202
galloway.ja@dot.state.sc.us

Dear Ms. Galloway:

Enclosed is your Department of the Army Permit SAC-2015-00812 for the project known as SCDOT US 21& SC 51 Intersection in York County (SCDOT PIN 42332). It authorizes you to perform the work specified in the attached drawings. This permit is issued under provision of Federal laws for the protection and preservation of waters of the United States.

Please notify this office promptly, in writing or via email to Jeremy M. Kinney, Project Manager, when you start and complete work. Be aware a special condition is included in this permit requiring a copy of the permit and drawings be available at the work site during the entire time of construction.

FOR THE CHIEF, REGULATORY DIVISION Sincerely,

Ronnie Smith

Ronnie D. Smith
Chief, Northeast Branch

Attachments
DA Permit SAC-2015-00812
Notice of Commencement or Completion

DEPARTMENT OF THE ARMY PERMIT

Permittee: **SC Department of Transportation** **955 Park Street**
C/O Mr. Sean Connolly **Columbia, South Carolina 29201**

Permit No: **SAC-2015-00812**

Issuing Office: **CHARLESTON DISTRICT**

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:
The authorized work consists of widening of approximately 5.7 miles of roadway including US 21 from the intersection of US 21 and SC 160/North White Street to the intersection of US 21 and SC 51 and approximately one mile of SC 51 to the state boundary to improve traffic safety, traffic efficiency to meet current design criteria and to improve stormwater drainage. This project will include impacts to a total of 1,378 linear feet of tributaries and 0.984 acres of wetland areas. Specifically, this project will include placement of fill and piping in 1,019 linear feet of tributaries, placement of rock armor rip rap in 359 linear feet of tributaries, placement of fill (including cut/fill) in 0.832 acres of wetlands and mechanical clearing of 0.152 acre of wetlands.

All work is to be completed in accordance with attached drawings entitled: “US 21 North Phase I and SC 51 & US 21 North Phase II" sheets 1 through 21, and dated December 6, 2021.

Project Location:
The project is located along a 5.7-mile-long segment of roadway including US 21 from the intersection of US 21 and SC 160/North White Street to the intersection of US 21 and SC 51 and approximately one mile of SC 51 to the state boundary near Fort Mill in York County, South Carolina (Latitude: 35.056328 °, Longitude: -80.937939 °)

General Permit Conditions:

1. The time limit for completing the work authorized ends on **March 31, 2028**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you

desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Permit Conditions:

See Appendix A, pages 5 and 6.

Further information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

☐ Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403)

☒ Section 404 of the Clean Water Act (33 USC 1344)

☐ Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 USC 1413)

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, State or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume liability for:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data. The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. The Corps may reevaluate its decision on this permit any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to:

a. Failure to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which the Corps did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by the Corps, and if you fail to comply with such directive, the Corps may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Jackie Galloway — 3/22/2023

(PERMITTEE) **(DATE)**

For **SC Department of Transportation**
C/O Mr. Sean Connolly

Jackie Galloway

PRINT NAME

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Ronnie Smith — 3/24/2023

(DISTRICT ENGINEER) **(DATE)**
Andrew C. Johannes, PhD PE PMP
or their Designee
Ronnie Smith
Chief, Northeast Branch

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) (PRINT NAME) **(DATE)**

APPENDIX A
SPECIAL CONDITIONS FOR PERMIT SAC-2015-00812

a. The permittee agrees to provide all contractors associated with construction of the authorized activity a copy of the permit and drawings.

b. A copy of the permit must be available at the construction site at all times.

c. The permittee shall submit a signed compliance certification to the Corps within 60 days following completion of the authorized work and any required mitigation. The certification will include:

1. A copy of this permit.

2. A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions.

3. A statement that any required mitigation was completed in accordance with the permit conditions.

4. The signature of the permittee certifying the completion of the work and mitigation.

d. That as compensatory mitigation for impacts to aquatic resources, the permittee agrees to purchase a total of 7,175.5 stream mitigation credits from the following mitigation banks: Eagle House Mitigation Bank, Sandy Fork Mitigation Bank, and Turner's Branch Mitigation Bank. Specifically, the permittee will purchase 3,267.6 stream restoration credits and 253.37 stream preservation credits from Eagle House Mitigation Bank, 320.15 stream restoration credits and 283.15 stream preservation credits from Sandy Fork Mitigation Bank, and 3,051.23 stream preservation credits from Turner's Branch Mitigation Bank. In addition, the permittee agrees to purchase a total of 3.18 compensatory wetland credits from Eagle House Mitigation Bank and Rocky Creek Mitigation Bank. Specifically, the permittee will purchase 1.26 wetland restoration credits and 0.62 wetland preservation credits from Eagle House Mitigation Bank and 0.7 wetland restoration credits and 0.6 wetland preservation credits from Rocky Creek Mitigation Bank. Also, the permittee will debit a total of 1.905 acres from the Black River Mitigation Bank.

e. In order to fulfill your responsibility to complete the required compensatory mitigation as set forth in Special Condition d, the permittee must submit evidence of the purchase of required mitigation credits to both the Corps of Engineers and SCDHEC prior to commencement of the authorized work.

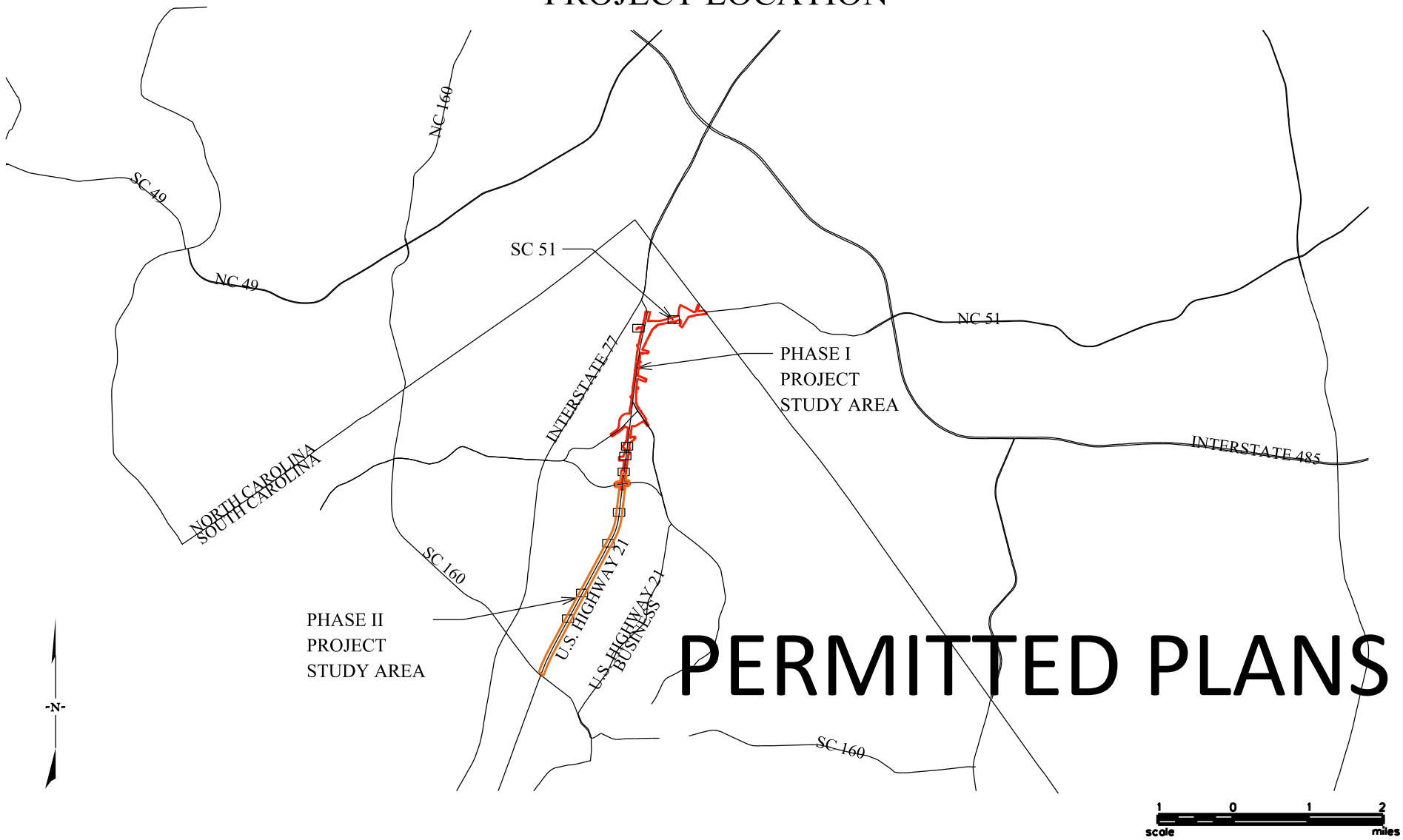
f. **That the permittee shall utilize clean fill materials for the construction of the US 21 and SC 51 Roadway Widening project that are free of potential sources of pollution to protect the water quality of the tributaries to Blankmanship Branch, tributaries to Jackson Branch or Steele Creek.**

g. **The permittee must implement appropriate best management practices that will minimize erosion and migration of sediments on and off the project site during and after construction. These practices should include the use of appropriate grading and sloping techniques, mulches, silt fences, or other devices capable of preventing erosion, migration of sediments, and bank failure. All disturbed land surfaces and sloped areas affected by the project must be stabilized upon project completion. This will include all requirements of the Water Quality Certification as approved by SCDHEC on January 5, 2023.**

h. **Prior to beginning the authorized work, the permittee must coordinate with the local NFIP flood plain manager and comply with FEMA requirements. A list of NFIP floodplain managers may be found at: https://www.dnr.sc.gov/water/flood/index.html.**

i. **The permittee shall clearly plot the Steele Creek ARP Church Cemetery/Blackstock Cemetery (SHPO Site No. 3799) on all construction plans and the permittee shall agree to place a 40-meter buffer area around this site with an exception being along Tributary E within the proposed right-of-way which will have the fencing placed along the north side of the channel. This buffer zone would be clearly marked in the field using orange fencing during construction and all ground disturbance, construction, and staging activities shall be conducted outside of this buffer area. If activities associated with the construction of this project enter into this site or the area within the protective fencing, the permittee will immediately cease these activities and directly contact the Corps to determine why this occurred. The Corps will initiate the Federal, Tribal, and state coordination required and will determine what actions would be required to mitigate these impacts**

US 21 NORTH PHASE I AND US 21 NORTH PHASE II
PROJECT LOCATION



PERMITTED PLANS

US 21 NORTH PHASE I PROJECT STUDY AREA

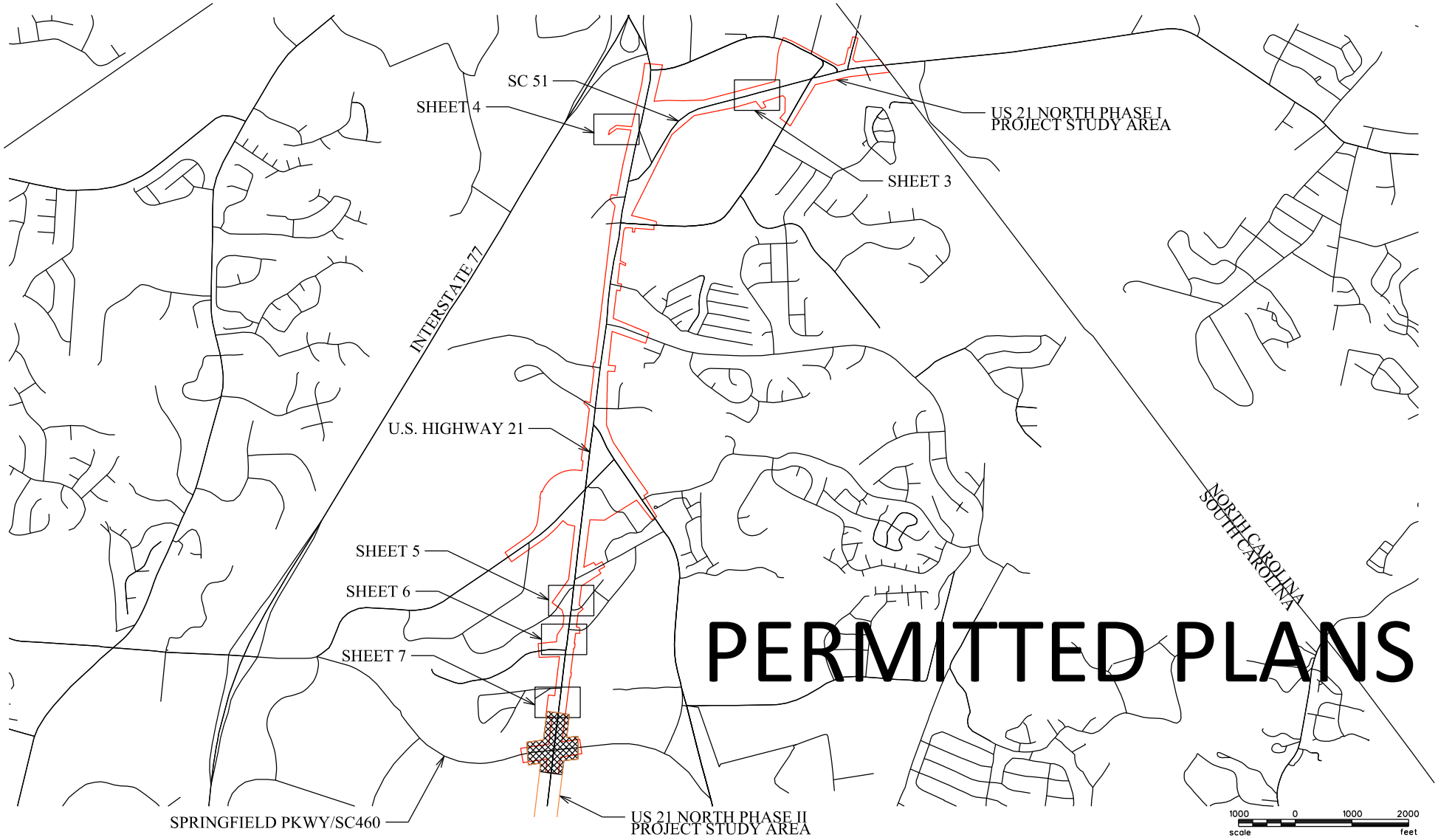
US 21 NORTH PHASE II PROJECT STUDY AREA

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 1 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
PROJECT OVERVIEW



PERMITTED PLANS

US 21 NORTH PHASE I PROJECT STUDY AREA

US 21 NORTH PHASE II PROCECT STUDY AREA

OVERLAP BETWEEN PHASE I & II

PHASE I IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	166	0.024
PERMANANT TRIBUTARY PIPE IMPACT	469	0.074
PERMANANT WETLAND FILL IMPACT		0.054
TEMPORARY WETLAND CLEARING IMPACT		0.045
TOTAL PERMANENT TRIBUTARY IMPACTS	635	0.098
TOTAL TEMPORARY WETLAND IMPACTS		0.045
TOTAL PERMANENT WETLAND IMPACTS		0.054

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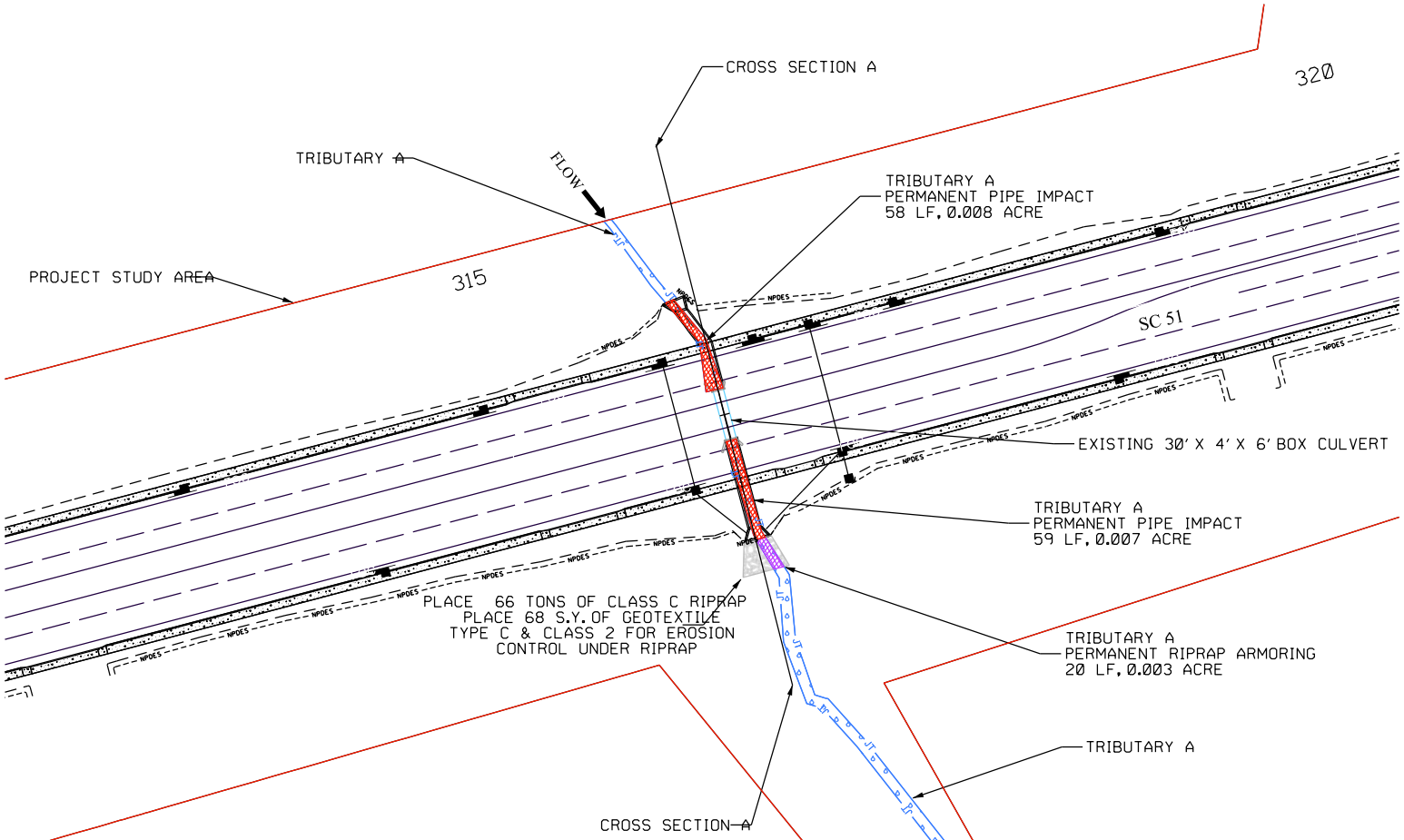
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 2 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



PERMITTED PLANS

WETLAND
JURISDICTIONAL TRIBUTARY
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT
TEMPORARY IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	20	0.003
PERMANANT TRIBUTARY PIPE IMPACT	117	0.015
TOTAL PERMANENT TRIBUTARY IMPACTS	137	0.018

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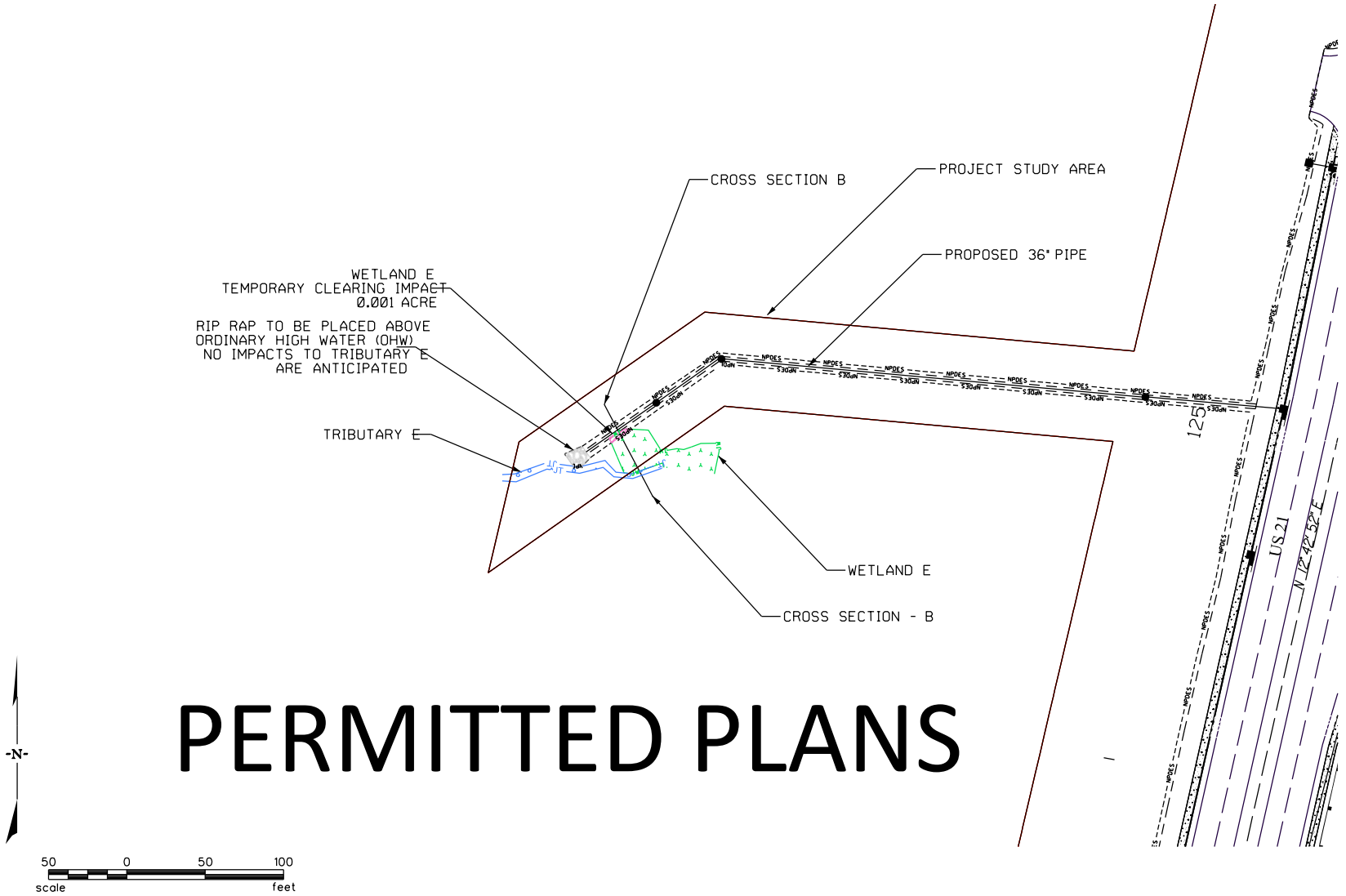
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 3 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



PERMITTED PLANS

WETLAND	
JURISDICTIONAL TRIBUTARY	
RIPRAP	
PERMANENT RIPRAP ARMORING IMPACT	
PERMANENT PIPE/CULVERT IMPACT	
PERMANENT FILL IMPACT	
TEMPORARY IMPACT	

SHEET IMPACT TOTALS	LF	ACRE
TEMPORARY WETLAND CLEARING IMPACT		0.001

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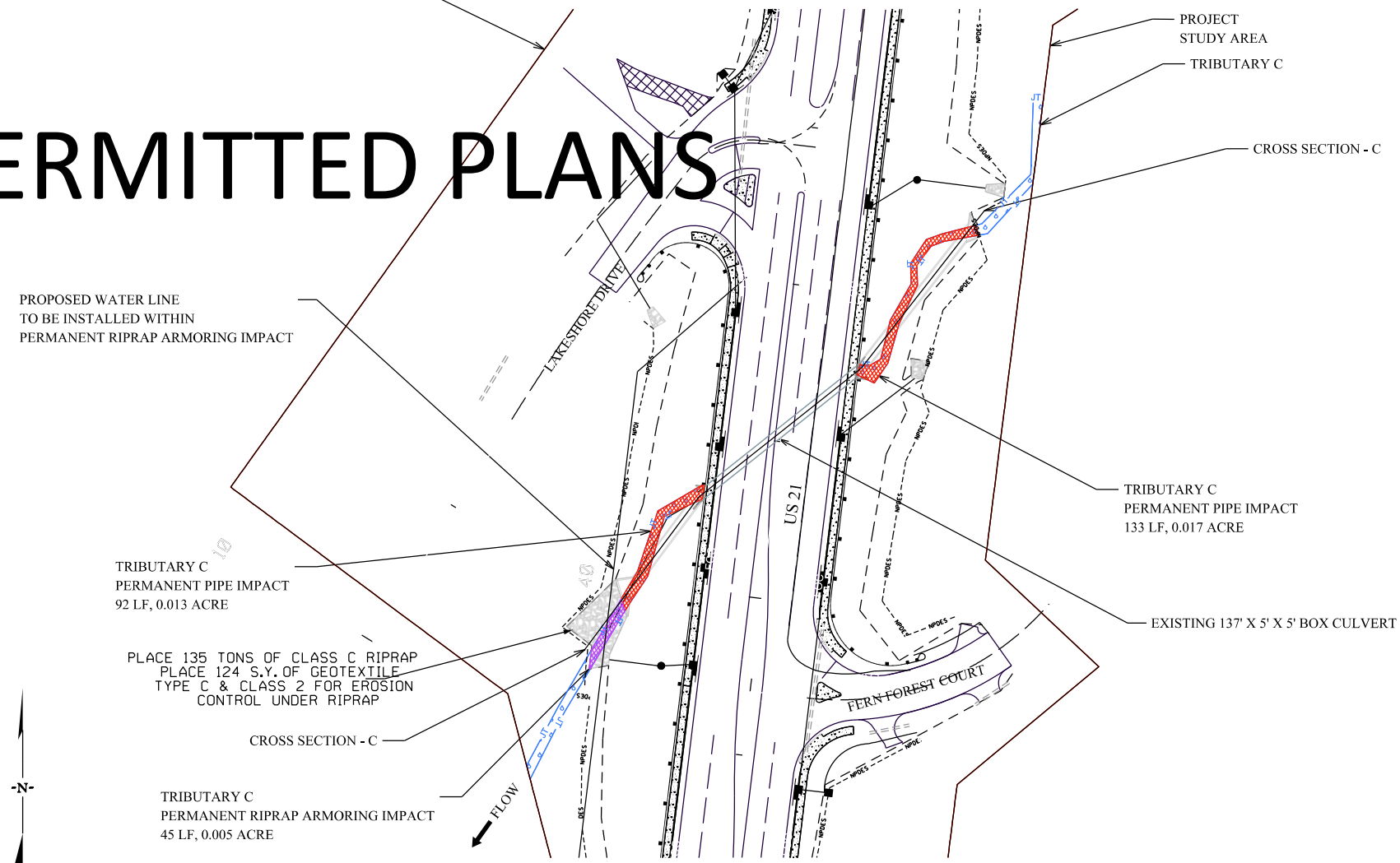
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 4 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW

PERMITTED PLANS



WETLAND	
JURISDICTIONAL TRIBUTARY	
RIPRAP	
PERMANENT RIPRAP ARMORING IMPACT	
PERMANENT PIPE/CULVERT IMPACT	
PERMANENT FILL IMPACT	
TEMPORARY IMPACT	

SHEET IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	45	0.005
PERMANANT TRIBUTARY PIPE IMPACT	225	0.030
TOTAL PERMANENT TRIBUTARY IMPACTS	270	0.035

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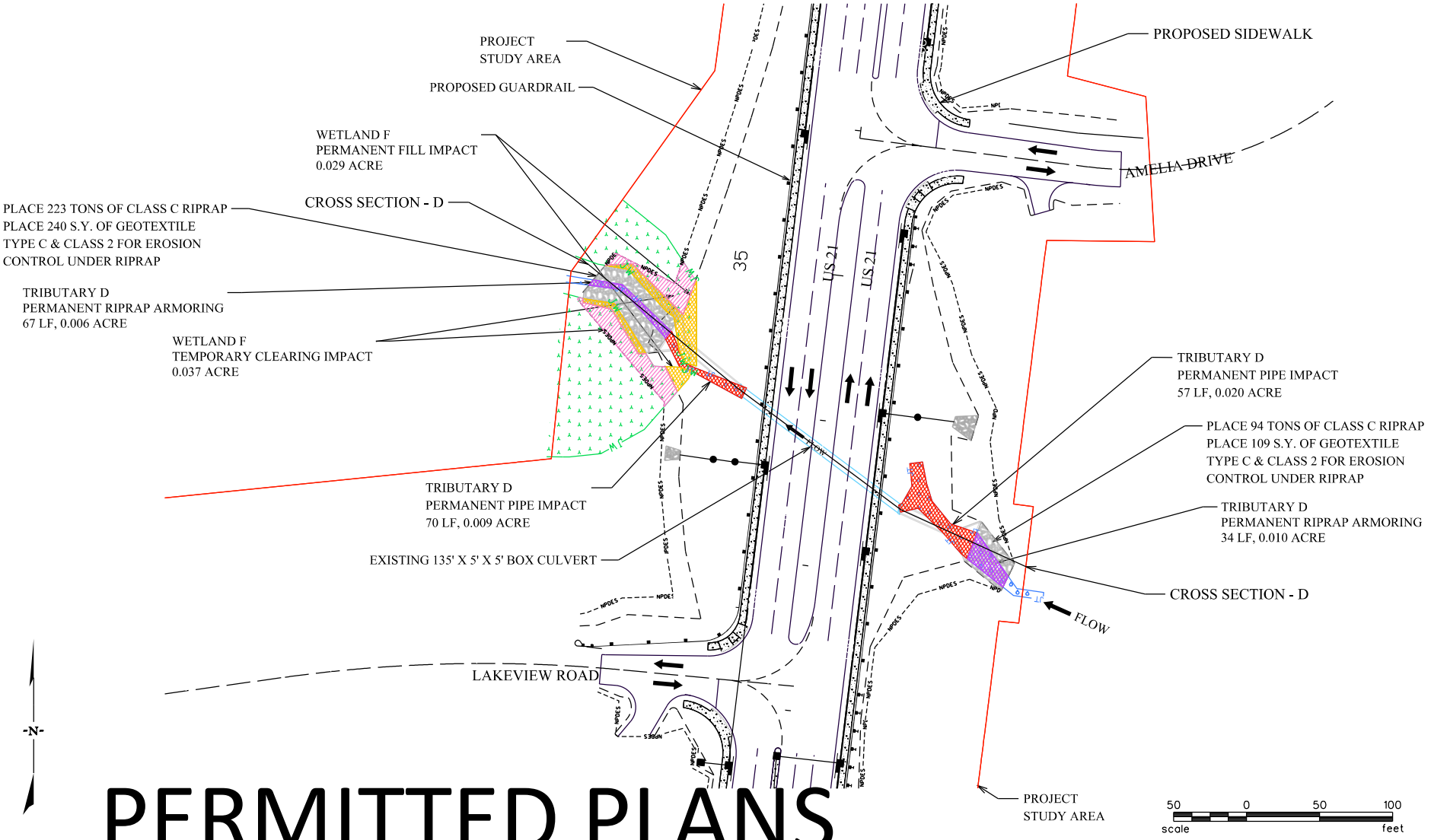
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 5 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



PERMITTED PLANS

WETLAND	
JURISDICTIONAL TRIBUTARY	
RIPRAP	
PERMANENT RIPRAP ARMORING IMPACT	
PERMANENT PIPE/CULVERT IMPACT	
PERMANENT FILL IMPACT	
TEMPORARY IMPACT	

SHEET IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	101	0.016
PERMANANT TRIBUTARY PIPE IMPACT	127	0.029
PERMANANT WETLAND FILL IMPACT		0.029
TEMPORARY WETLAND CLEARING IMPACT		0.037
TOTAL PERMANENT TRIBUTARY IMPACTS	228	0.045
TOTAL PERMANANT WETLAND IMPACTS		0.029
TOTAL TEMPORARY WETLAND IMPACTS		0.037

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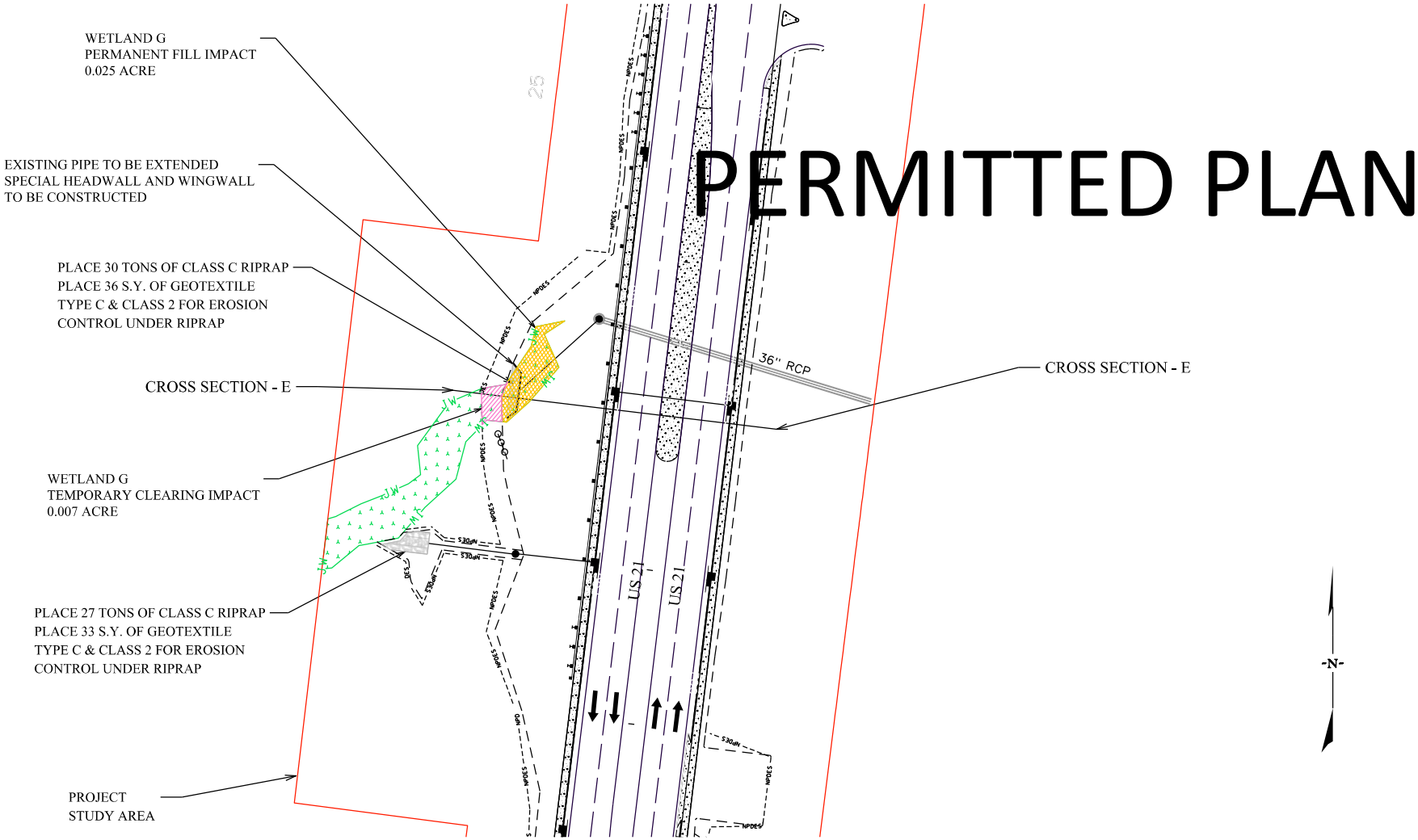
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 6 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW

PERMITTED PLANS



WETLAND	
JURISDICTIONAL TRIBUTARY	
RIPRAP	
PERMANENT RIPRAP ARMORING IMPACT	
PERMANENT PIPE/CULVERT IMPACT	
PERMANENT FILL IMPACT	
TEMPORARY IMPACT	

SHEET IMPACT TOTALS	LF	ACRE
PERMANANT WETLAND FILL IMPACT		0.025
TEMPORARY WETLAND CLEARING IMPACT		0.007
TOTAL PERMANENT WETLAND IMPACTS		0.025
TOTAL TEMPORARY WETLAND IMPACTS		0.007

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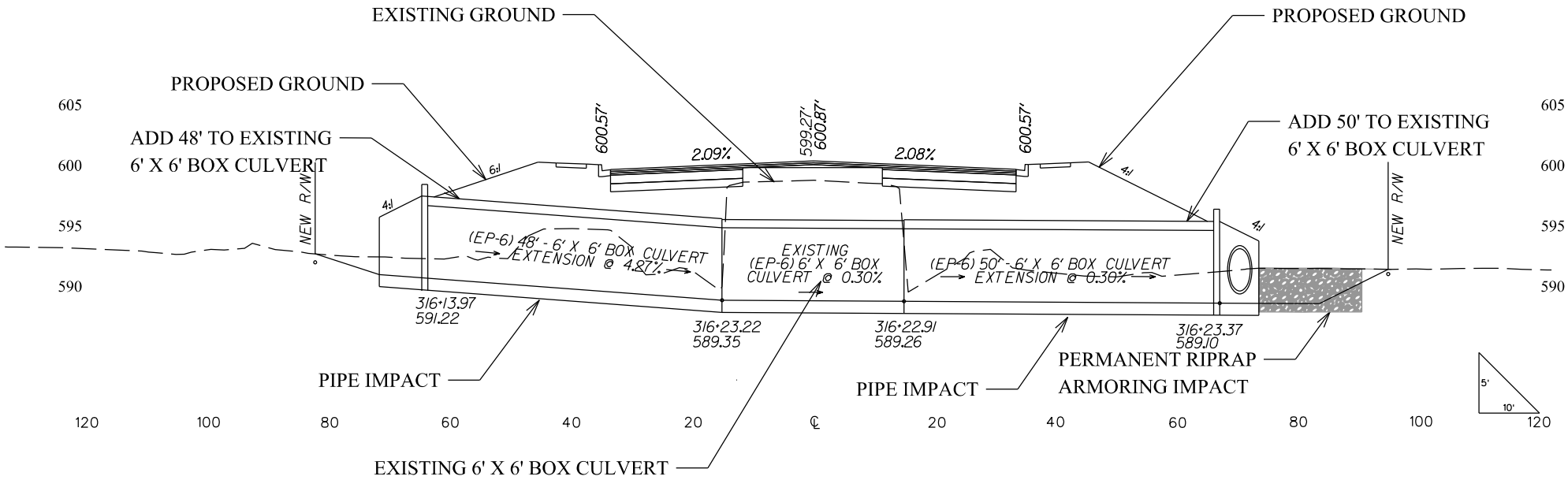
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 7 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION A - STA 316+23.05

PERMITTED PLANS



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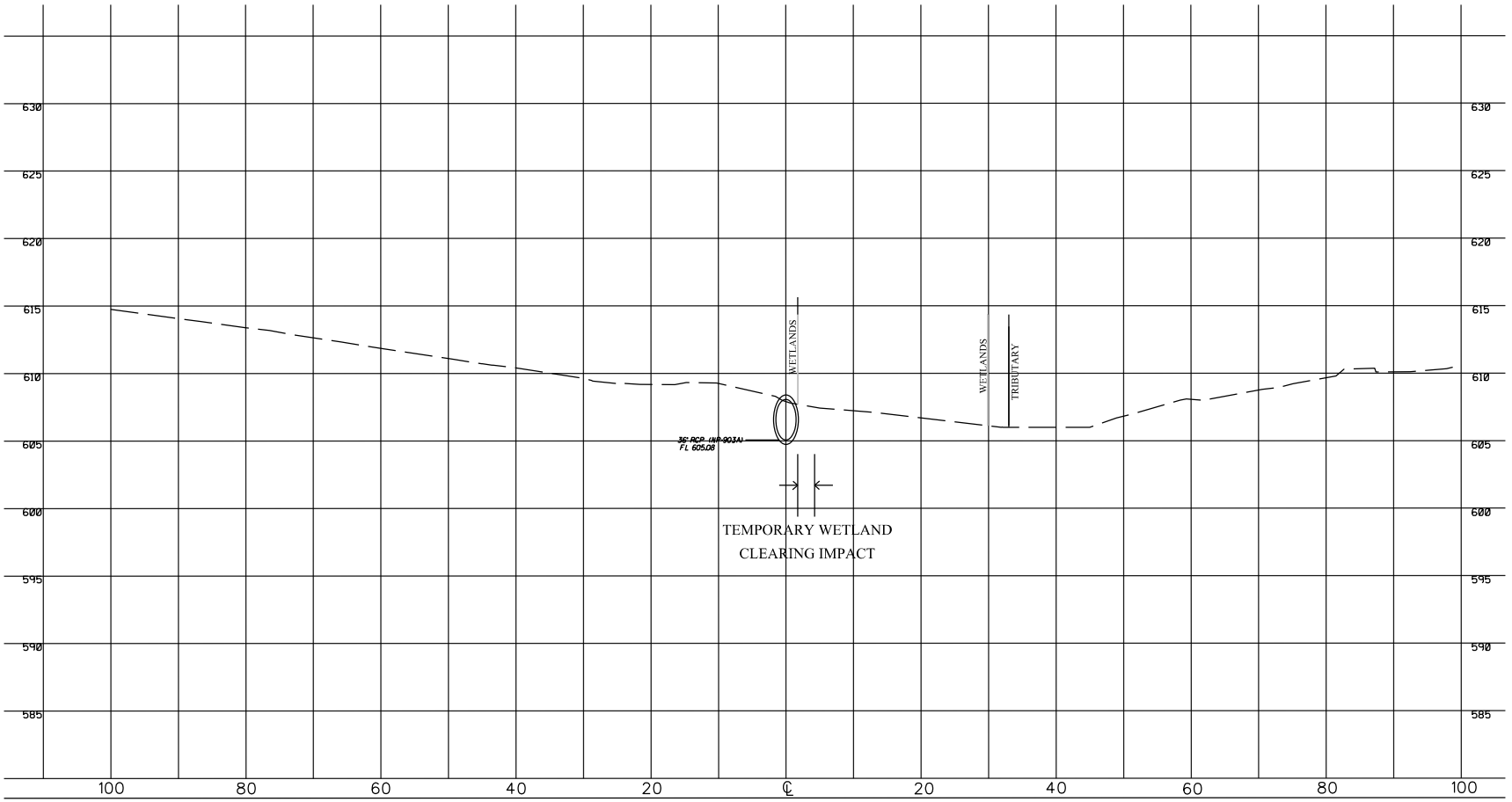
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 8 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION B - STA 124+7.00



PERMITTED PLANS

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LOCATION:	YORK COUNTY, SOUTH CAROLINA
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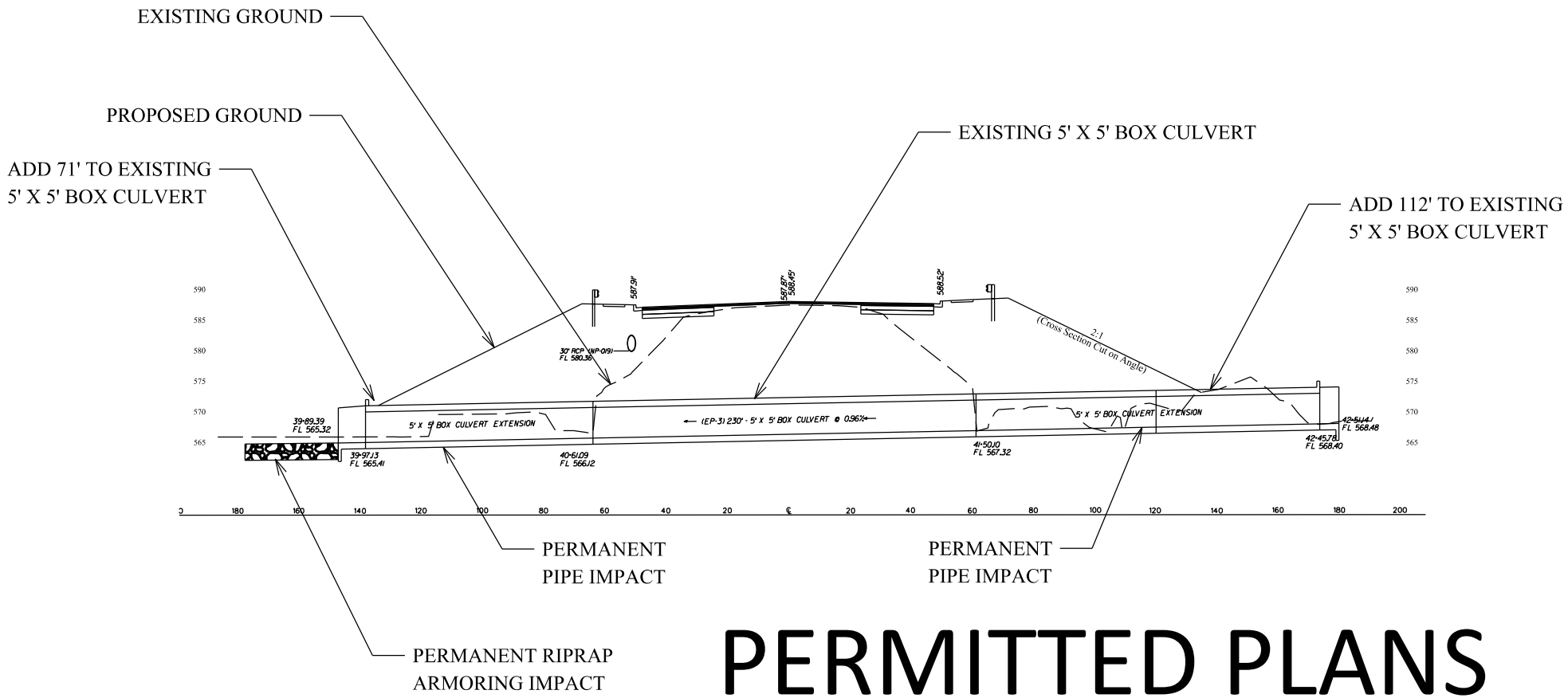
SCDOT PROJECT ID 42332 & 39235	
SHEET: 9 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION C - STA 41+06.45



PERMITTED PLANS

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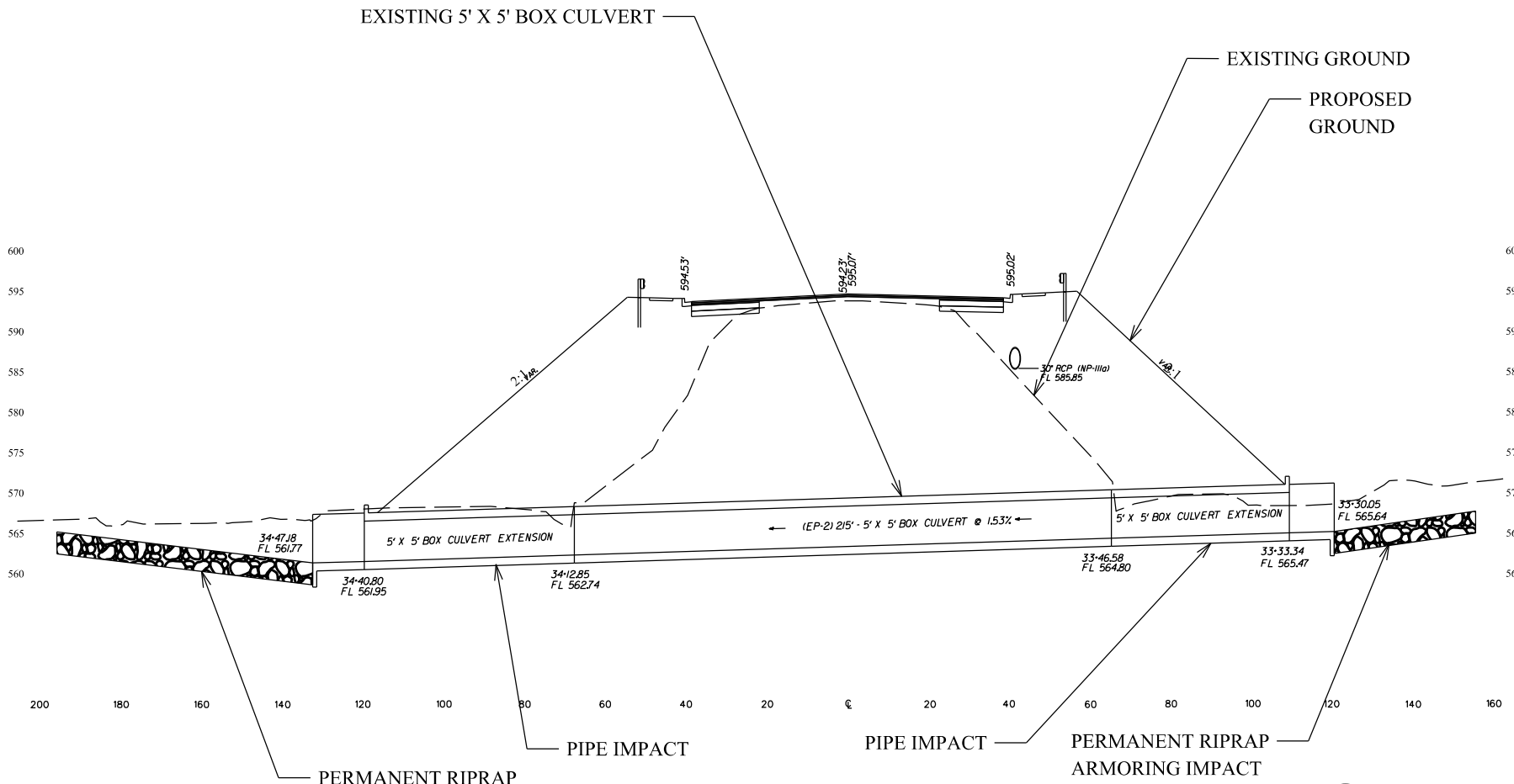
APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 10 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION D - STA 33+79.00



PERMITTED PLANS

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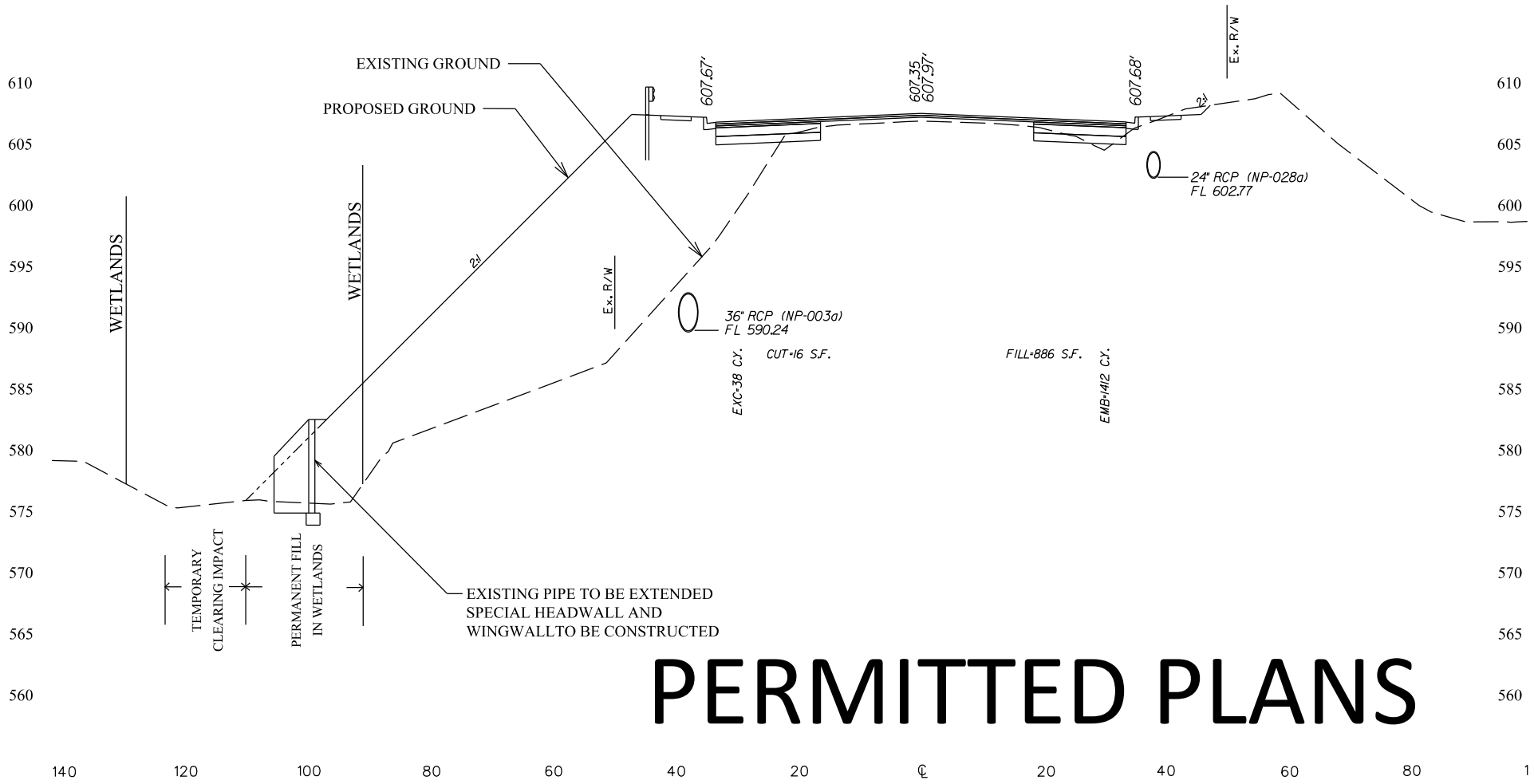
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 11 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION E - STA 23+00.00



PERMITTED PLANS

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YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 12 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
PROJECT SEGMENT OVERVIEW



PERMITTED PLANS

US 21 NORTH PHASE I PROJECT STUDY AREA

US 21 NORTH PHASE II PROCECT STUDY AREA

OVERLAP BETWEEN PHASE I & II

PHASE II IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	193	0.028
PERMANANT TRIBUTARY PIPE IMPACT	559	0.082
PERMANANT WETLAND FILL IMPACT		0.882
TOTAL PERMANENT TRIBUTARY IMPACTS	752	0.110
TOTAL PERMANENT WETLAND IMPACTS		0.882

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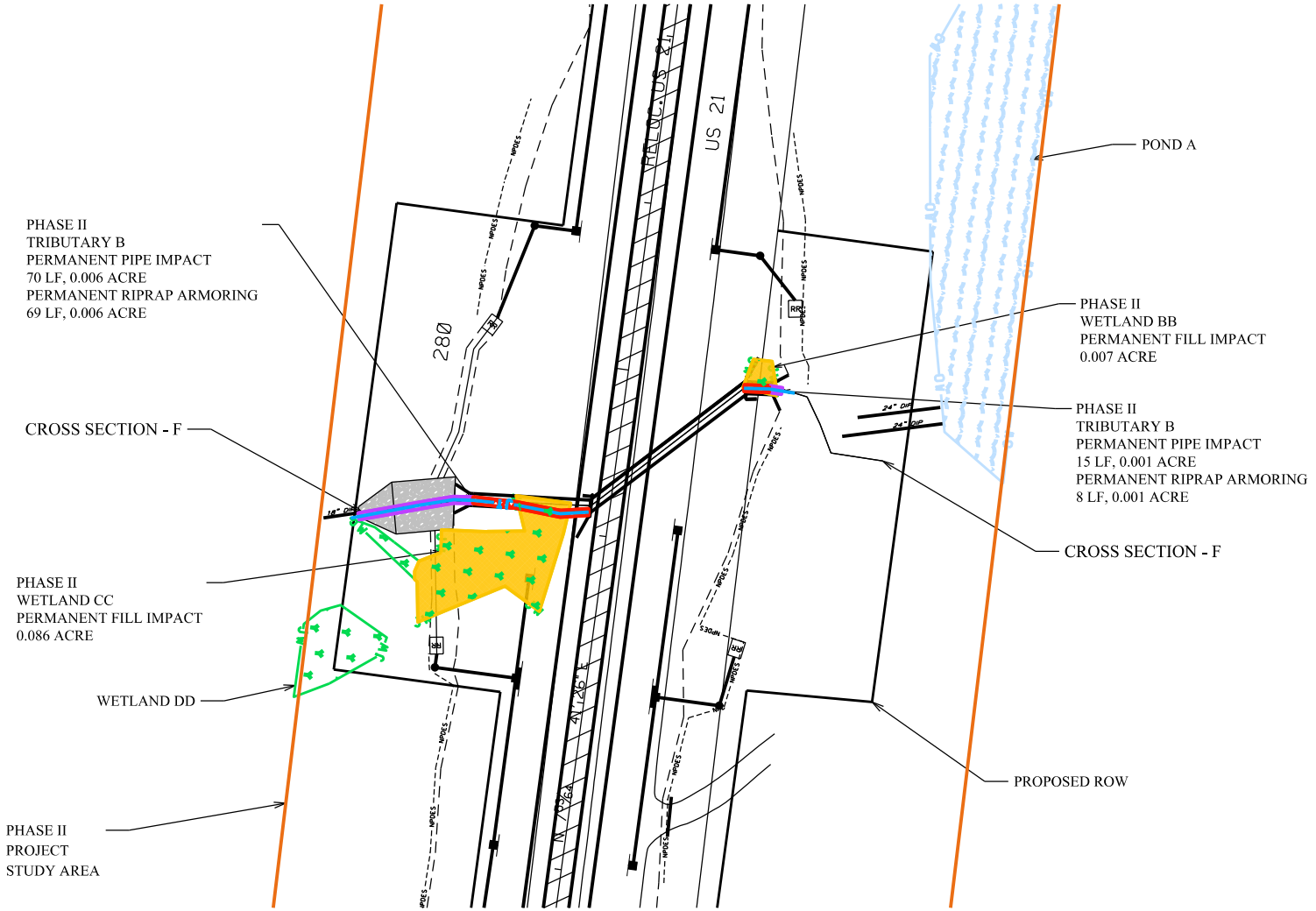
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 13 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
PLAN VIEW



PERMITTED PLANS

50 0 50 100
scale feet

WETLAND	SHEET IMPACT TOTALS	LF	ACRE
JURISDICTIONAL TRIBUTARY	PERMANANT TRIBUTARY ARMORING IMPACT	77	0.007
JURISDICTIONAL OPEN WATER	PERMANANT TRIBUTARY PIPE IMPACT	85	0.007
RIPRAP	PERMANANT WETLAND FILL IMPACT		0.093
PERMANENT RIPRAP ARMORING IMPACT			
PERMANENT PIPE/CULVERT IMPACT	TOTAL PERMANENT TRIBUTARY IMPACTS	162	0.014
PERMANENT FILL IMPACT	TOTAL PERMANANT WETLAND IMPACTS		0.093

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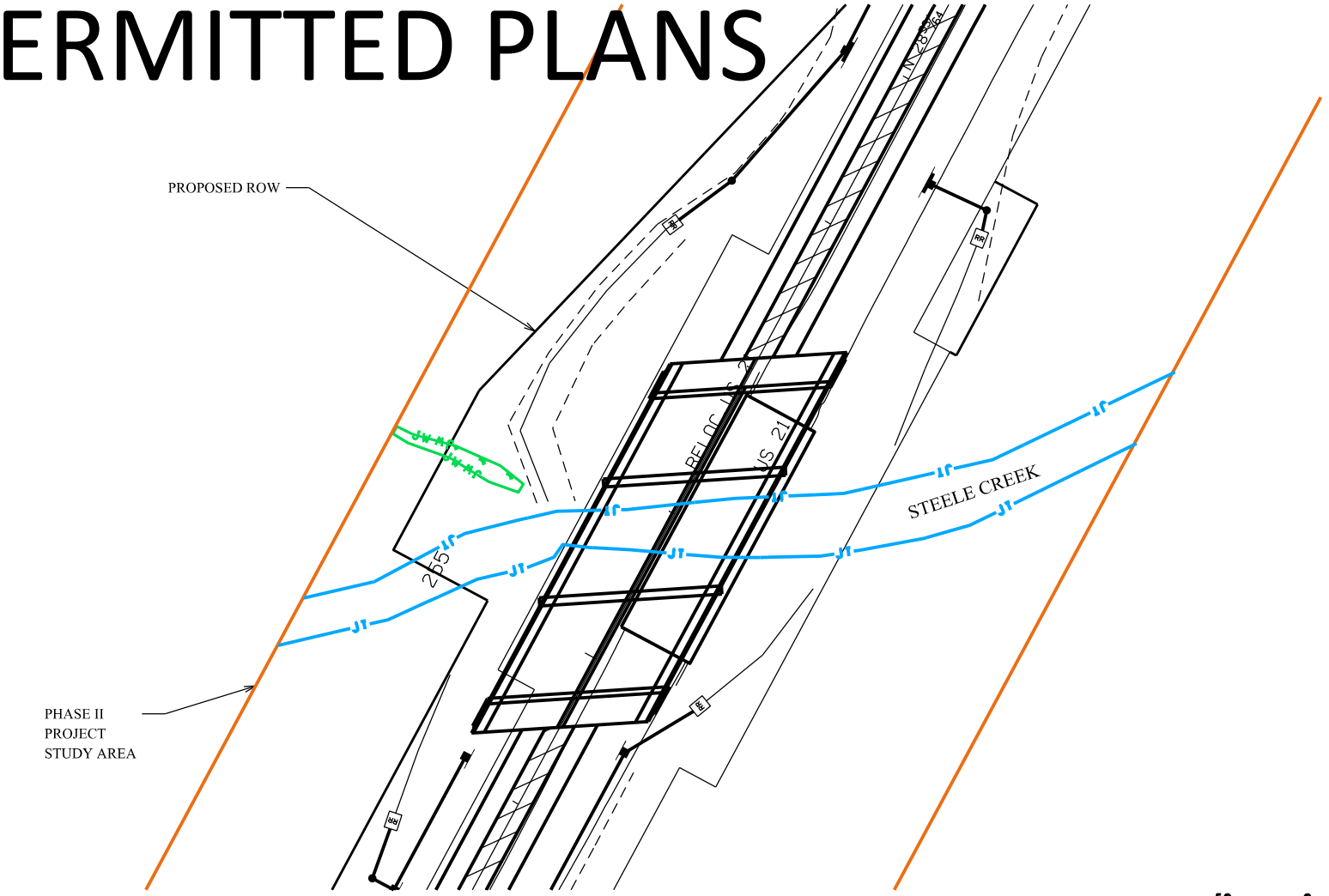
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 14 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
PLAN VIEW

PERMITTED PLANS



WETLAND

JURISDICTIONAL TRIBUTARY

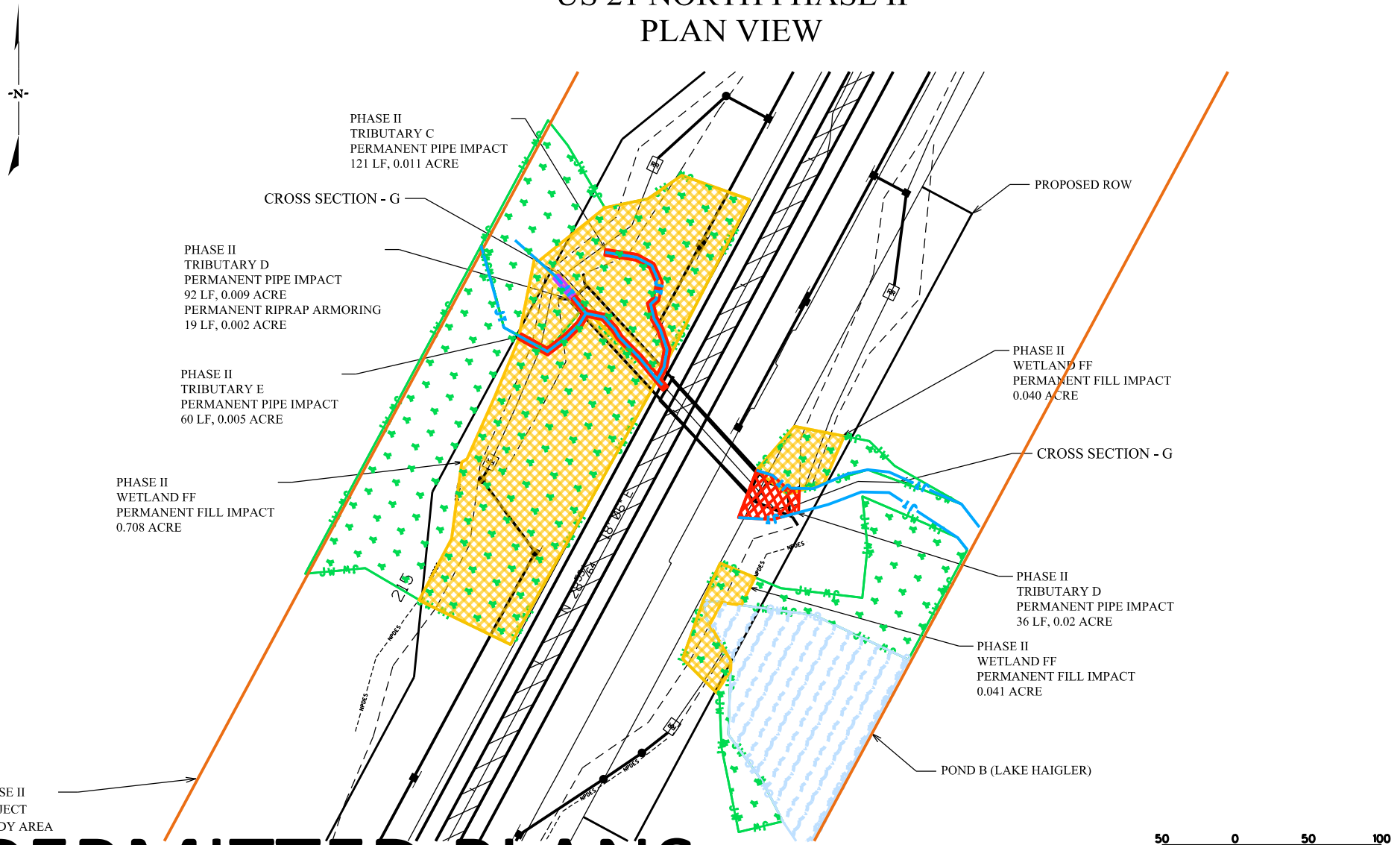
SHEET IMPACT TOTALS	LF	ACRE
NO IMPACTS		

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 15 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
PLAN VIEW



PERMITTED PLANS

WETLAND
JURISDICTIONAL TRIBUTARY
JURISDICTIONAL OPEN WATER
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	19	0.002
PERMANANT TRIBUTARY PIPE IMPACT	309	0.045
PERMANANT WETLAND FILL IMPACT		0.789
TOTAL PERMANENT TRIBUTARY IMPACTS	328	0.047
TOTAL PERMANANT WETLAND IMPACTS		0.789

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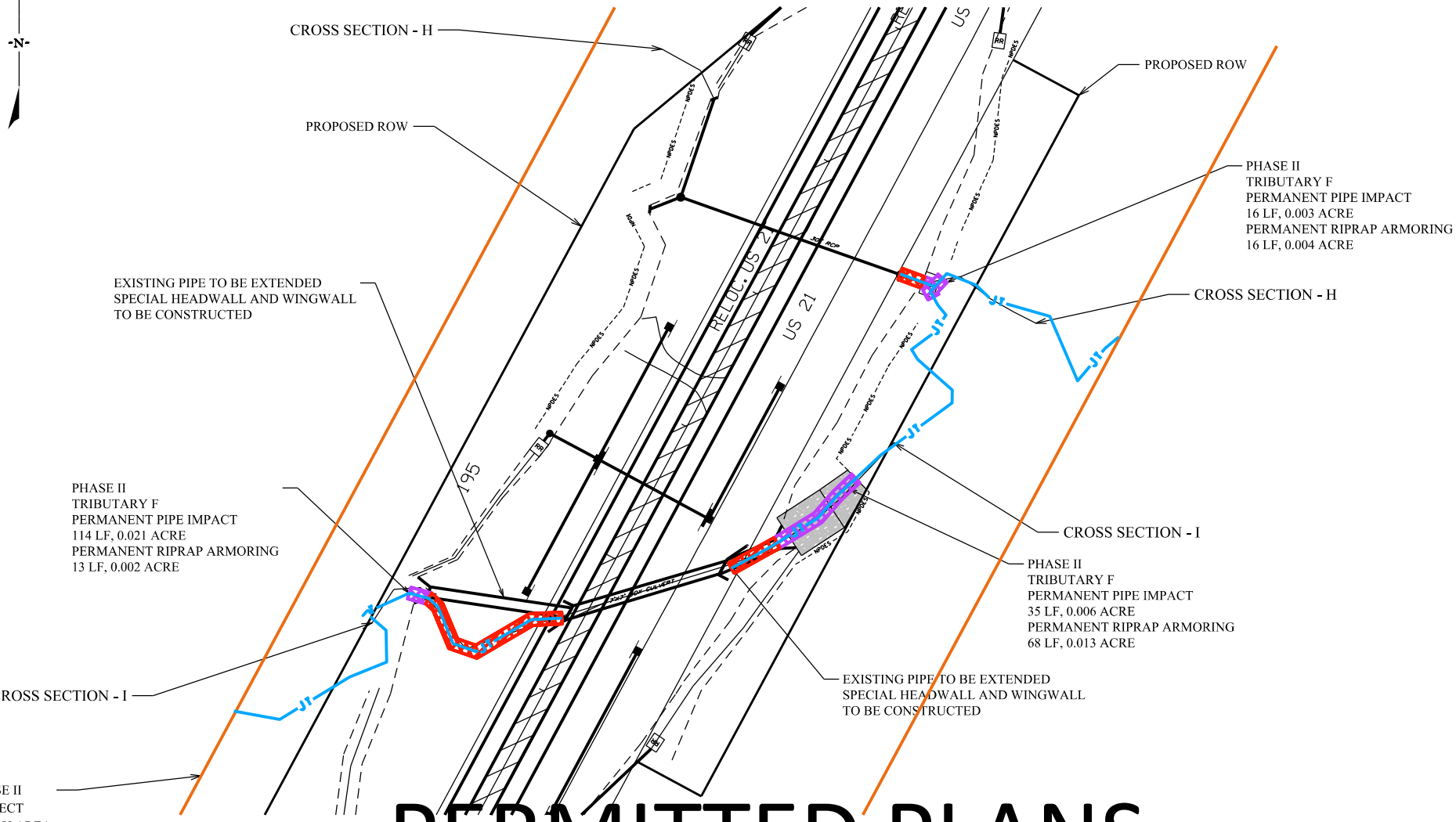
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 16 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
PLAN VIEW



PERMITTED PLANS

JURISDICTIONAL TRIBUTARY
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT

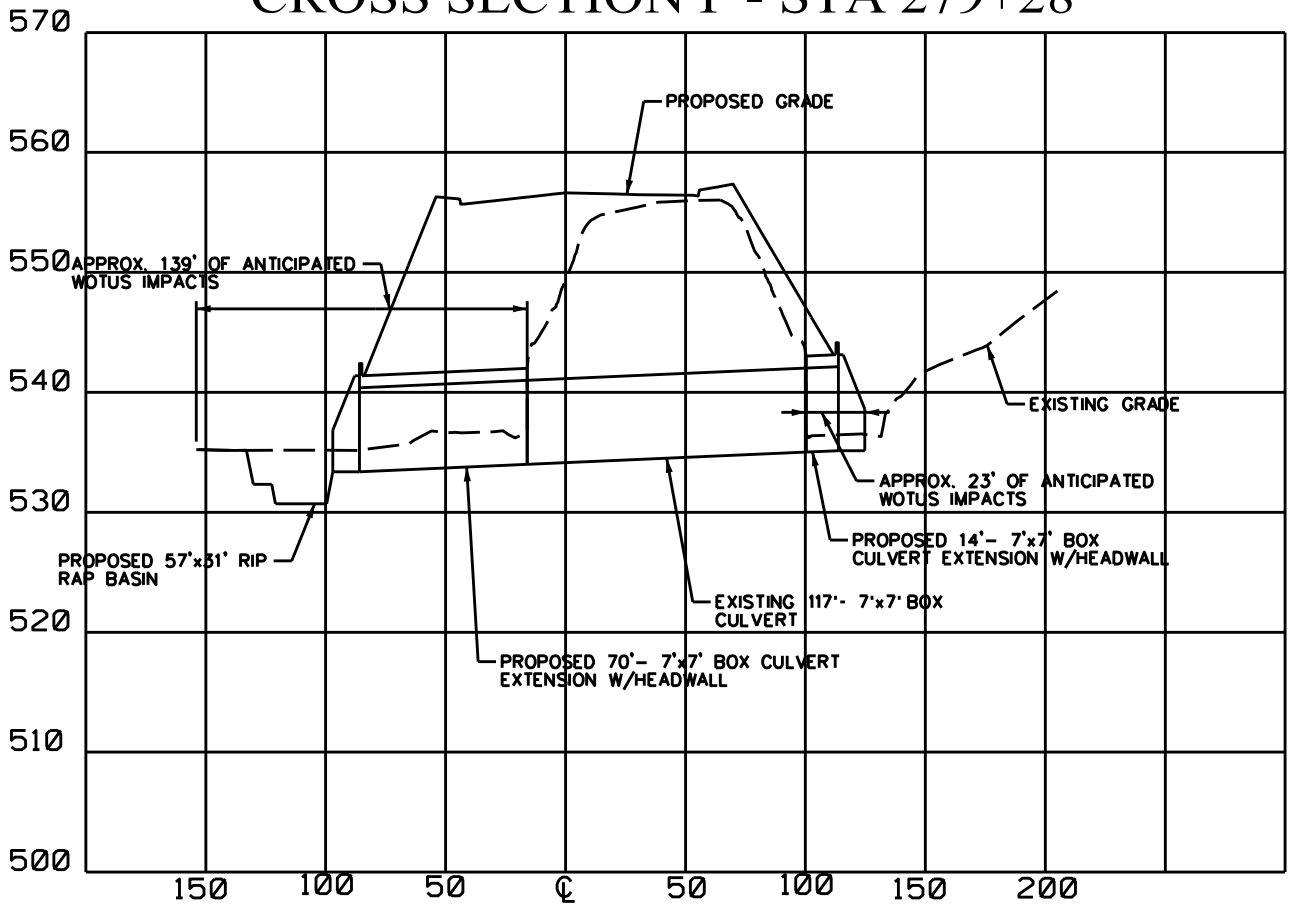
SHEET IMPACT TOTALS	LF	ACRE
PERMANANT TRIBUTARY ARMORING IMPACT	97	0.019
PERMANANT TRIBUTARY PIPE IMPACT	165	0.030
TOTAL PERMANENT TRIBUTARY IMPACTS	262	0.049

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 17 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
CROSS SECTION F - STA 279+28



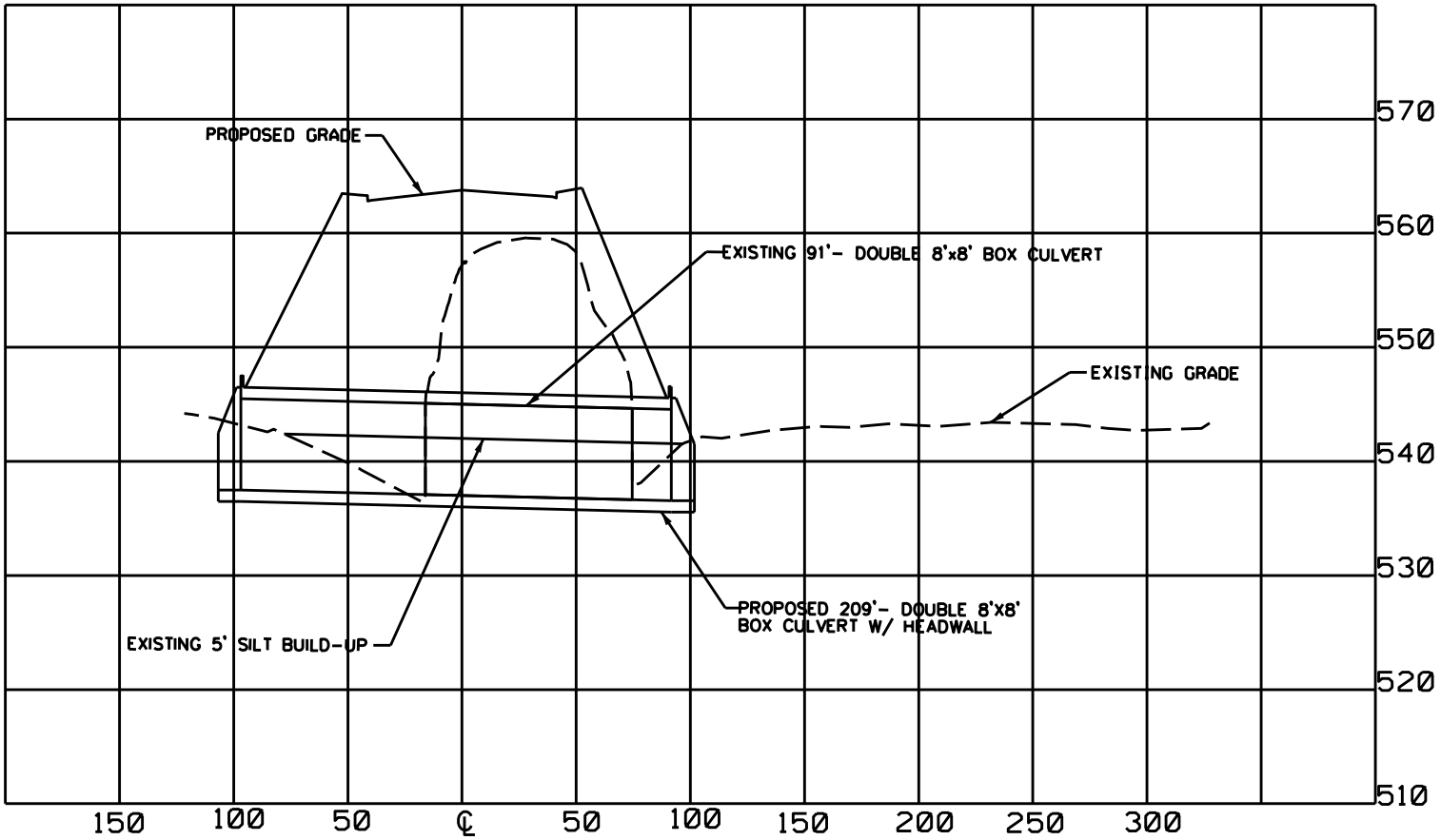
PERMITTED PLANS

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 18 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
CROSS SECTION G - STA 217+06



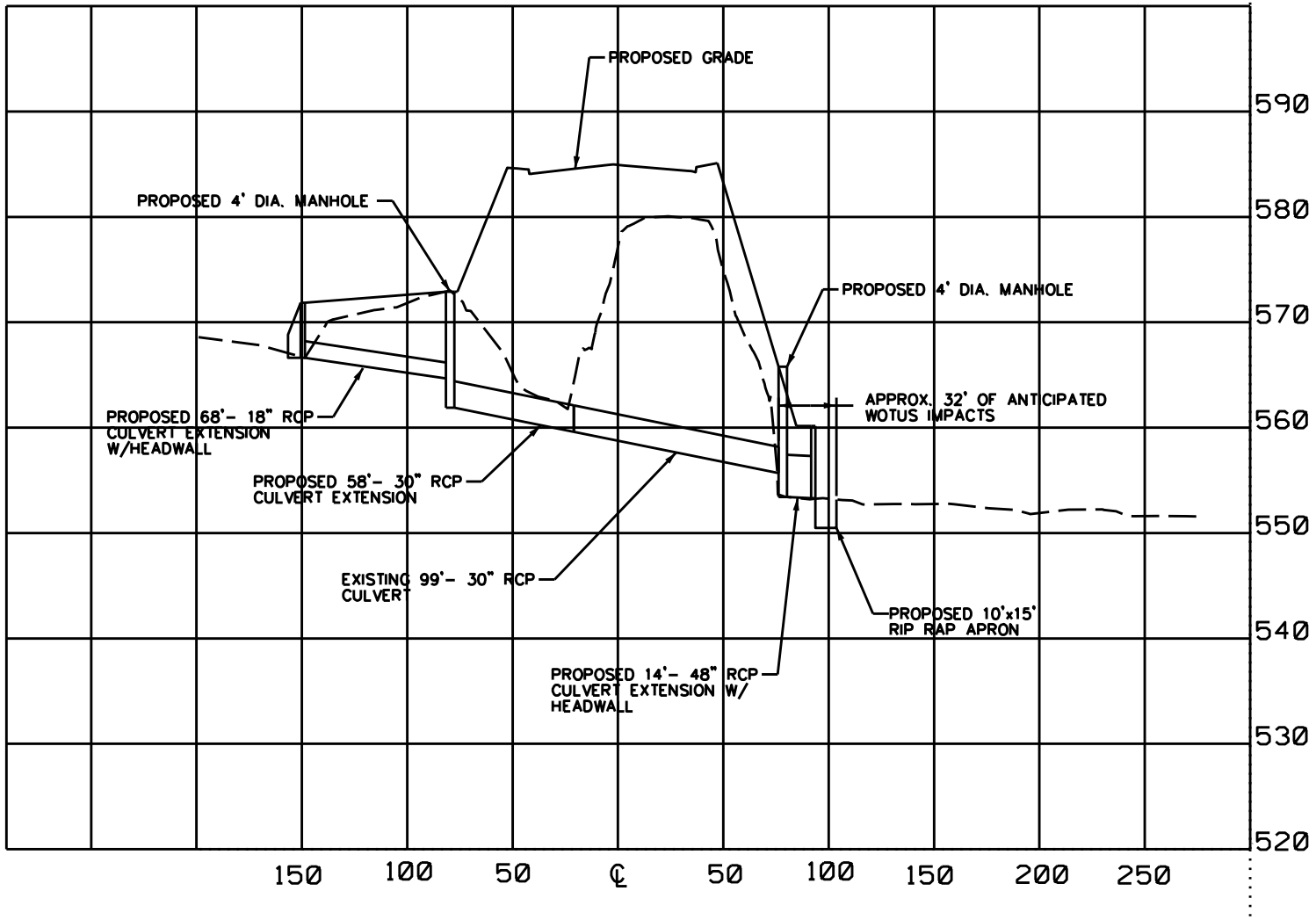
PERMITTED PLANS

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 19 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
CROSS SECTION H - STA 197+46



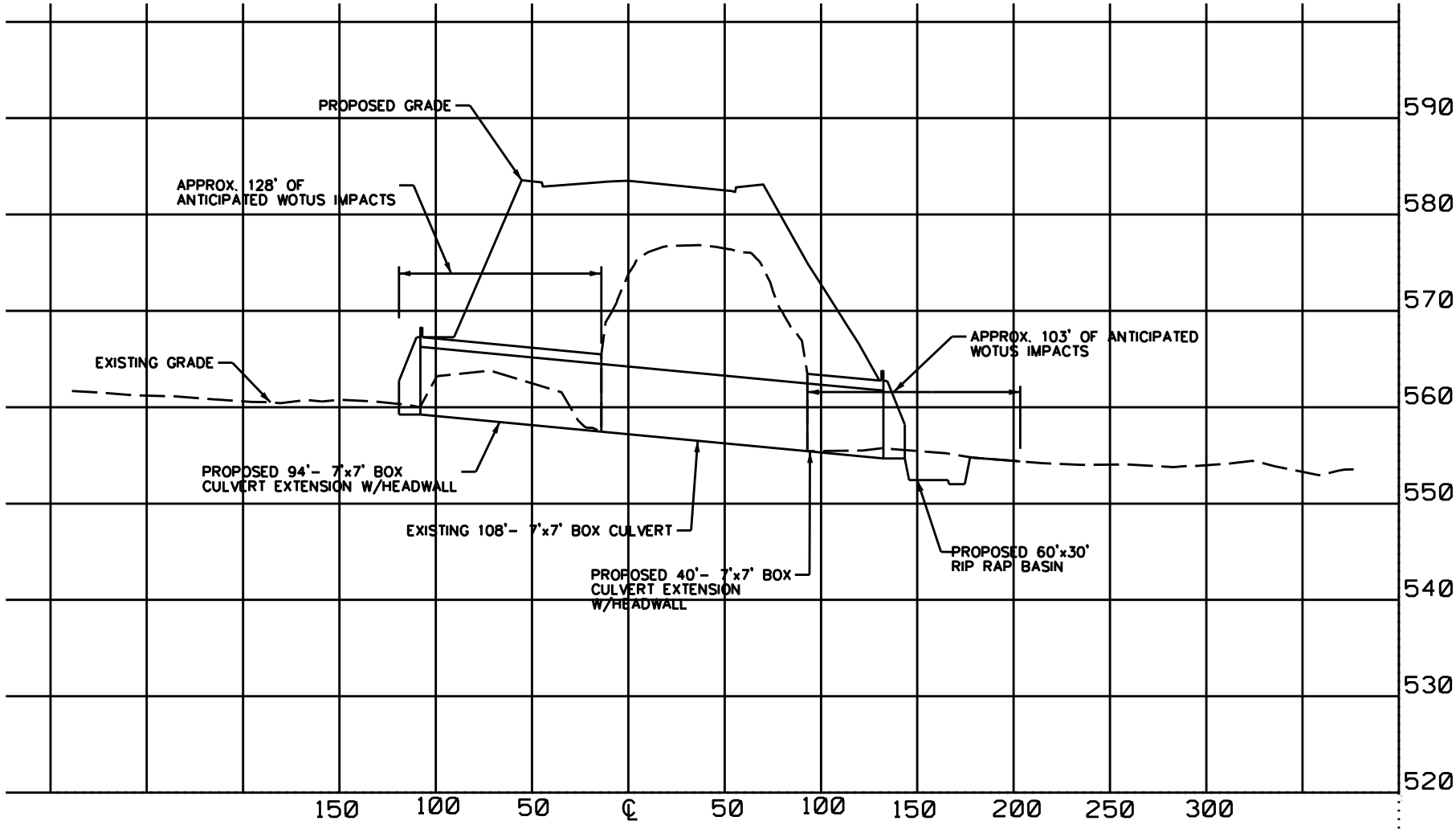
PERMITTED PLANS

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 20 OF 21	DATE: 12-6-2021

US 21 NORTH PHASE II
CROSS SECTION L - STA 194+87



PERMITTED PLANS

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 21 OF 21	DATE: 12-6-2021

dhec
Healthy People. Healthy Communities.

January 5, 2023

Jackie Galloway, SCDOT
PO BOX 191
COLUMBIA, SC 29202

Re: Certification in Accordance with Section 401 of the Clean Water Act, as amended.

SC DOT
Jackie Galloway, SCDOT
US 21 & SC 51 Interchange
Steele Creek
York County
P/N: SAC-2015-00812 Revised

Dear Sir or Madam:

South Carolina Department of Health and Environmental Control (DHEC) staff have reviewed plans for this project and determined there is a reasonable assurance that the proposed project will be conducted in a manner consistent with the Certification requirements of Section 401 of the Federal Clean Water Act, as amended. In accordance with the provisions of Section 401, we certify that this project, subject to the indicated conditions, is consistent with applicable provisions of Section 303 of the Federal Clean Water Act, as amended. We also hereby certify that there are no applicable effluent limitations under Sections 301(b) and 302, and that there are no applicable standards under Sections 306 and 307.

This certification is subject to the following conditions:

401 Water Quality Certification Conditions:

1. The applicant must implement appropriate best management practices that will minimize erosion and migration of sediments on and off the project site during and after construction. These practices should include the use of appropriate grading and sloping techniques, mulches, silt fences, or other devices capable of preventing erosion, migration of sediments, and bank failure. All disturbed land surfaces and sloped areas affected by the project must be stabilized. Customize Text

2. Prior to beginning any land disturbing activity, appropriate erosion and siltation control measures (i.e., silt fences or barriers) must be in place and maintained in a functioning capacity until the area is permanently stabilized.

3. Materials used for erosion control (e.g., hay bales or straw mulch) will be certified as weed free by the supplier.

4. All necessary measures must be taken to prevent petroleum products, tar, trash, construction debris, and other pollutants from entering the adjacent offsite areas/wetlands/waters.

5. Once the project is initiated, it must be carried to completion in an expeditious manner to minimize the period of disturbance to the environment.

6. Upon project completion, all disturbed areas must be permanently stabilized with vegetative cover (preferable), riprap or other erosion control methods as appropriate.

7. The project must comply with any applicable floodplain, stormwater, land disturbance, or riparian buffer ordinances.

8. As compensatory mitigation for unavoidable impacts, the applicant must purchase 7,175.5 stream mitigation credits and 3.18 freshwater wetland credits from the USACE-approved mitigation banks as described in the November 9, 2022 revised mitigation plan in the quantities and types specified (restoration and preservation) in the revised mitigation plan. The applicant must also purchase 1.905 acres of freshwater wetland mitigation (representing a 3:1 ratio of compensatory mitigation to impacts due to watershed location) from the SCDOT Black River Mitigation Bank as specified in the same plan.

9. The applicant must submit evidence to the USACE and to the SCDHEC that the number and type of stream and wetland mitigation credits and wetland acres have been purchased from the specified approved banks as referenced above in condition number eight and in the revised mitigation plan dated November 9, 2022, within 60 days of permit issuance or prior to beginning work authorized by the Department of the Army permit.

DHEC reserves the right to impose additional conditions on the Certification to respond to unforeseen, specific problems that might arise and to take any enforcement action to ensure compliance with State water quality standards.

Sincerely,

Nathan Haber, Director
Division of Water Quality
Bureau of Water

cc: US Army Corps of Engineers
Charleston District Office
Midlands-York County-Environmental Affairs District Office

NOTICE OF COMMENCEMENT OR COMPLETION
OF WORK AUTHORIZED BY PERMIT

_____ _____
DATE

*WORK AUTHORIZED BY DEPARTMENT OF THE ARMY PERMIT*_____

*DATED*__ _____

TO PERFORM WORK IN _____ _____
(WATERBODY NAME)

WAS COMMENCED
*ON*_____
WAS COMPLETED *(DATE)*
(circle appropriate response)

_____
(SIGNATURE)

FL 130
5 MAR 79

- - - -

dhec
Healthy People. Healthy Communities.

January 5, 2023

Jackie Galloway, SCDOT
PO BOX 191
COLUMBIA, SC 29202

Re: Certification in Accordance with Section 401 of the Clean Water Act, as amended.

SC DOT
Jackie Galloway, SCDOT
US 21 & SC 51 Interchange
Steele Creek
York County
P/N: SAC-2015-00812 Revised

Dear Sir or Madam:

South Carolina Department of Health and Environmental Control (DHEC) staff have reviewed plans for this project and determined there is a reasonable assurance that the proposed project will be conducted in a manner consistent with the Certification requirements of Section 401 of the Federal Clean Water Act, as amended. In accordance with the provisions of Section 401, we certify that this project, subject to the indicated conditions, is consistent with applicable provisions of Section 303 of the Federal Clean Water Act, as amended. We also hereby certify that there are no applicable effluent limitations under Sections 301(b) and 302, and that there are no applicable standards under Sections 306 and 307.

This certification is subject to the following conditions:

401 Water Quality Certification Conditions:

1. The applicant must implement appropriate best management practices that will minimize erosion and migration of sediments on and off the project site during and after construction. These practices should include the use of appropriate grading and sloping techniques, mulches, silt fences, or other devices capable of preventing erosion, migration of sediments, and bank failure. All disturbed land surfaces and sloped areas affected by the project must be stabilized. Customize Text

2. Prior to beginning any land disturbing activity, appropriate erosion and siltation control measures (i.e., silt fences or barriers) must be in place and maintained in a functioning capacity until the area is permanently stabilized.

3. Materials used for erosion control (e.g., hay bales or straw mulch) will be certified as weed free by the supplier.

4. All necessary measures must be taken to prevent petroleum products, tar, trash, construction debris, and other pollutants from entering the adjacent offsite areas/wetlands/waters.

5. Once the project is initiated, it must be carried to completion in an expeditious manner to minimize the period of disturbance to the environment.

6. Upon project completion, all disturbed areas must be permanently stabilized with vegetative cover (preferable), riprap or other erosion control methods as appropriate.

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DHEC reserves the right to impose additional conditions on the Certification to respond to unforeseen, specific problems that might arise and to take any enforcement action to ensure compliance with State water quality standards.

Sincerely,



Nathan Haber, Director
Division of Water Quality
Bureau of Water

cc: US Army Corps of Engineers
Charleston District Office
Midlands-York County-Environmental Affairs District Office

September 13, 2024

Steven Moss
Sr. Construction Manager - Engineering
York County Government
6 S Congress Street1
York, SC 2975

RE: Project No. P0042332/11149-004 – US21/SC51
York Co: Relocation Package – AT&T Transmission

Dear Mr. Moss –

Below you will find a brief description of the proposed work and submittal explanation. Please refer to AT&T Transmission's individual plans for details, or this document for plan status.

Scope of Work and Package Contents

Relocation Package

- Utility Agreement
- Detailed Cost Estimate
- Encroachment Permit Application
- Relocation Plans and associated U-sheets

Scope of Work Summary

Location	Utility Type	Scope of Work	Cost*
Springfield Farm	Underground Communication	Install new manhole, remove existing manhole in conflict and reconnect cables/conduits.	York County

It is STV's recommendation that this relocation package be approved and proceed to the formal agreement.

Should you have any additional questions or comments, please feel free to call me (843-207-2031) or email me at natalie.roumillat@stvinc.com.

Sincerely,

N. Oriana Roumillat

N. Oriana Roumillat, P.E.
Utility Coordinator

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US 21 NORTH AND SC 51

This Agreement made this _____ day of _____, 20_____ by and between

York County, hereinafter called "County" and the utility company

AT&T Enterprises, LLC.

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

AT&T Enterprises, LLC. will need to engineer and inspect a contractor relocate a manhole at the

intersection of Hwy. 21 and Andrew Tucker Road.

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $29,550.00

County Share $29,550.00 Company Share $0.00

(a) The Company ☐ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☑ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately 10 years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: Katrina Ivey
Phone Number: 678-641-5522
Email: ki2863@att.com

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

( ) BY COMPANY'S REGULAR FORCES

(●) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

AT&T does not have the work force for engineering / inspection or construction, therefore contract companies are used.

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

☑ Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

☐ Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company's delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Company agree participate in pre-litigation mediation and agree to diligently work in good faith to resolve any disputes associated with the costs charged to the Company for extreme delays. The parties shall select a mediator approved by both parties and set forth any resolutions in writing signed by both parties.

Should the parties fail to reach an agreement through pre-litigation mediation, the parties may seek a resolution for the dispute through the Court of Common Pleas located in York County, South Carolina, or the United States District Court for the State of South Carolina. This agreement shall be governed exclusively by the laws of the State of South Carolina without giving effect to its conflicts of law provisions.

12. The County shall have the right to inspect all recovered materials from the permanent facility prior to disposal by sale or scrap. This requirement will be satisfied by the Company giving notice to the County of the time and place the materials will be available for inspection. This notice is the responsibility of the Company and it may be held accountable for full value of materials disposed of without notice. The Company shall furnish a listing on final billings of major items not eligible for salvage credit and reasons therefore.

13. The Company will abide by the contract cost principles as set forth in FAPG 23 CFR 645A.

14. The Company will not participate directly or indirectly in any practice that subjects persons to discrimination because of their race, color, religion, sex, or national origin.

COMPANY: AT&T Enterprises, LLC

ADDRESS: 5450 Riverwood Parkway Atlanta, GA 30339

BY: _____

NAME: Christopher Joch

TITLE: Principal

YORK COUNTY

BY: _____

Joshua S. Edwards
County Manager

INSTRUCTIONS: Submit three original copies of this agreement form and three prints of drawings showing present location and proposed location of poles or lines with reference to highway survey stations and centerline.

Mike Cappello
AT&T OSWF

Manhole Relocation for Hwy. 21 Bypass Project in Fort Mill, SC

Trina Ivey
OSP Engineer

DESCRIPTION	*SECTION*	*QTY*	*PRICE*	*TOTAL*
Mobilization (Construction)	L105-4	1	$ 3,000.00	$ 3,000.00
4'x4'x4' Split Manhole Placement	L603-20	1	$ 8,000.00	$ 8,000.00
4'x4'x4' Manhole Removal	L904-6	1	$ 4,000.00	$ 4,000.00
Traffic Control	MISC	1	$ 2,000.00	$ 2,000.00
			CONSTRUCTION TOTAL	**$ 17,000.00**
Operation Tech - Inspection hours		-	$ 110.00	$ -
Cutover Crew (# of cutovers)		-	$ 20,000.00	$ -
			TELCO LABOR TOTAL	**$ -**

DESCRIPTION	*QTY*	*PRICE*	*TOTAL*	
HLB00A - Design/Project Engineer (Danny and Levi)	50	$ 86.00	$ 4,300.00	*$ 12,550.00*
HLB02A - Field Engineer (Matthew, Ron, Kanon, etc.)	75	$ 81.00	$ 6,075.00	
HLB20A - Senior ROW Agent (Lee Wren)	-	$ 75.00	$ -	
EMISC - Per Diem	5	$ 175.00	$ 875.00	
EMISC - Vehicle Mileage (Or IRS Rate)	2,000	$ 0.650	$ 1,300.00	
EMISC - Forkert Digitization (Includes 10% Markup)	-	$ 1,000.00	$ -	
DETAIL ENG., AGREEMENTS, MEETINGS AND AS-BUILT TOTAL			**$ 12,550.00**	
Telco Engineering - Trina Ivey		$ 2,000.00	$ -	
		TELCO ENGINEERING TOTAL	**$ -**	
Lightguide Cable - Core 48 Fiber	-	$ 3.00	$ -	
Splicing Materials	-	$ 1,300.00	$ -	
		CABLE	**$ -**	

TOTAL CONSTRUCTION COST	***$***	***29,550.00***

Application for Encroachment Permit

S.C. Department of Transportation

Form 637 (Rev 09/2015)

Contact Information

Applicant: AT&T Corp

Street: 3450 Riverwood Parkway

Room 162

City: Atlanta

State: GA **Zip Code:** 30339

Phone: (803)606-6700 **Fax:**

Email: makins223@gmail.com

Contact: Matthew Akins

Project Location

Primary County: York

County	Road Name
York	Highway 51 (SC 51)

1. Type of Encroachment: COMMUNICATIONS (Cable TV, Telephone & Other)

AT&T will be removing an existing communications manhole at the intersection of SC 51 and Andrew L Tucker Rd and installing a new 4'x4'x4' concrete communications manhole on the ROW of Springhill Farm Road to eliminate the conflict with SC DOT Proj. No. 11149-004(CONTINUED ON ADDENDUM)

2. Description of Location:

AT&T will be removing at Manhole for SC DOT Proj. No. 11149-004 at STA. 332+17.00 on SC 51 (Pineville - Rock Hill Rd.) and installing a new manhole at STA. 24+25.00 on Springhill Farm Rd(CONTINUED ON ADDENDUM)

(Attach sketch indicating roadway features such as: pavement width, shoulder width, sidewalk and curb and gutter location, significant drainage structure, north arrow, right of way width, and location of the proposed encroachment with respect to the roadway centerline and the nearest intersecting road on the State system.)

Customer Agreement

3. **The undersigned applicant hereby requests the SCDOT to permit encroachment on the SCDOT right of way as described herein. It is expressly understood that the encroachment, if and when constructed, shall be installed in accordance with the sketch attached hereto and made a part hereof. The applicant agrees to comply with and be bound by the SCDOT's "A Policy for Accommodating Utilities on Highways Rights of way", "Standard Specifications for Highway Construction", the "General Provisions" and "Special Provisions", attached hereto or made a part hereof by reference, during the installation, operation and maintenance of said encroachment within the SCDOT's Right of Way. DISCHARGES OF STORM WATER AND NON-STORM WATER: Work within State Highway right-of-way shall be conducted in compliance with all applicable requirements of the National Pollutant Discharge Elimination System (NPDES) permit(s) issued to the Department of Transportation (Department), to govern the discharge of storm water and non-storm water from its properties. Work shall also be in compliance with all other applicable Federal, State and Local laws and regulations, and with the Department's Encroachment Permits Manual and encroachment permit. The encroachment permit will not be issued until the applicant has received an NPDES construction permit from SC Department of Health and Environmental Control.**

The applicant agrees to comply with all current SCDOT Standards Specifications for Highway Construction including all Supplemental Technical Specifications. The applicant hereby further agrees, and binds his/her/its heirs, personal representatives, successors, assigns, to assume any and all liability for accidents or injuries to persons, or damage to property, including the highway, that may be caused by the construction, maintenance, use, moving or removing of the physical appurtenances contemplated herein, and the applicant agrees to indemnify and hold SCDOT harmless from and against any and all claims for personal injury and/or property damage, including attorney fees and costs, which may be sustained by reason of the construction, maintenance or existence of said encroachment on the SCDOT's right of way.

Applicant's Name: Lana Scarlett-Rowell (Please print or type) **Date:** July 19, 2022

Applicant's Sig: Lana Scarlett Rowell **Title:** Prin. Tech Proj/Program Mgmt

For Office Use Only

For Office Use Only

In accordance with your request and subject to all the provisions, terms, conditions, and restrictions stated in the application and the general and special provisions attached hereto, the SCDOT hereby approves your application for an encroachment permit. This permit shall become null and void unless the work contemplated herein shall have been completed prior to:

☐ **See Attached Special Provision and/or Permit Requirements**

NPDES Permit Nbr:

(Date received by res. Maint. Engr.) **(SCDOT Approval)** **(Date)**

General Provisions

Application for Encroachment Permit
General Provisions

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	SC 51	U17

FOR INFORMATION ONLY

AT&T to relocate the manhole along the existing conduit

AT&T will connect the conduits through the manhole and remove the manhole

Dashed line indicated edge of proposed fill line

Existing AT&T Manhole located inside proposed fill area.

MATCH LINE STA. 01+50.00 ANDREW L. TUCKER SHT. SHEET NO. U23

MATCH LINE STA. 328+50.00 SEE SHEET NO. U16

MATCH LINE STA. 22+80.00 S-48 SPRINGHILL FARM ROAD CUL-DE-SAC SEE SHEET NO. U16

POT=0+00.00

PT=335+62.41

PINEVILLE-ROCK HILL RD

WEST CAROLINA COUNTY YORK COUNTY

SOUTH CAROLINA / NORTH CAROLINA

HORIZONTAL 50 0 50 100 feet

VERTICAL 10 0 10 20 feet

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

VPI = 331+50.00
Elev. = 619.77
K = 185
350' V.C.
DS > 45 MPH

(+75) 620.32 VPC

(+85) 620.60 VPT

LOW POINT
STA. 330+32.96
ELEV. = 620.23

(-) 0.31%

(+) 1.58%

(+25) 622.53 VPT

(+35) 622.69 VPC

(+) 1.58%

(-) 1.30%

FINISHED GRADE

HIGH POINT
STA. 335+81.55
ELEV. = 624.63

VPI = 335+60.00
Elev. = 626.24
SSD = 600'
K = 156
450' V.C.
DS > 45 MPH

(+85) 623.31 VPT

EXISTING GRADE

SURVEY STA. 340+10.00
END PROJECT ID 0042332
SC 51 (HWY 51)
MATCH EXISTING PAVEMENT
ELEV = 620.38'

660 650 640 630 620 610 600 590 580 570

620.00 620.68 | 619.94 620.55 | 619.86 620.40 | 619.80 620.26 | 619.83 620.24 | 619.91 620.35 | 620.11 620.60 | 620.47 620.98 | 620.96 621.50 | 621.64 622.15 | 622.44 622.92 | 623.08 623.58 | 623.57 624.08 | 623.92 624.42 | 624.09 624.60 | 624.09 624.62 | 623.92 624.48 | 623.68 624.18 | 623.32 623.72 | 622.80 623.11 | 622.20 622.46 | 621.60 621.81 | 621.00 621.16 | 620.48 620.51 | 619.98 | 619.35 | 618.68 | 617.95

329+00 330+00 331+00 332+00 333+00 334+00 335+00 336+00 337+00 338+00 339+00 340+00 341+00 342+00

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U1

US 21 NORTH PHASE 1 AND SC 51 FROM SC 460 TO THE SC/NC STATE LINE ROAD WIDENING PID 0042332 YORK COUNTY, SC

UTILITY RELOCATION PLANS

COMPANY	CONTACT	PHONE NO.
POWER - E1 York Electric Corporation	Wes Dover PO Box 150 1385 A. Alexander Love Hwy York, SC 29745 Wes.Dover@yorkelectric.net	803-628-5564 803-627-0824
POWER - E2 (TRANS) Duke Energy	Stephen Lord 526 South Church St. Charlotte, NC 28202 Stephen.Lord@duke-energy.com	704-812-2316
POWER - E2 (Distribution) Duke Energy **NO CONFLICT**	Stephen Lord 526 South Church St. Charlotte, NC 28202 Stephen.Lord@duke-energy.com	704-812-2316
POWER - E3 (Distribution) Central Electric Power Cooperative **NO CONFLICT**	Jimmy Tindal 20 Cooperative Way Columbia, SC 29210 jtindal@cepci.org	803-255-8810 803-606-4581
TELECOM - T1 Comporium	Eric Kirkland 471-A Lakeshore Pkwy Rock Hill, SC 29730 eric.kirkland@comporium.com	803-326-6109
TELECOM - T2 Duke Net Legacy (Charter)	Matt McClain 3140 West Arrowood Road Charlotte, NC 28273 matt.mcclain@charter.com	704-378-2194 980-428-5092
TELECOM - T3 AT&T **No Conflict for Distribution**	Jamie Riggins 100 Belton Drive Spartanburg, SC 29301	864-574-8608
TELECOM - T4 Level 3 Communications (Lumen)	Wanita Brenes 227 Robeson Street Fayetteville NC 28301 wanita.brenes@lumen.com	910-551-8838
TELECOM - T5 Zayo Fiber	Brandon Carter 125 North Myers Street Charlotte, NC 28202 Brandon.Carter@zayo.com	704-779-9322
TELECOM - T6 MCI Communications (Verizon)	Corey Thomas corey.thomas@verizon.com	501-297-9085
TELECOM - T7 Windstream Commuications	Daniel Honeycutt Daniel.Honeycutt@windstream.com	704-849-1358 704-579-7897

COMPANY	CONTACT	PHONE NO.
TELECOM - TV1 Comporium	Eric Kirkland 471-A Lakeshore Pkwy Rock Hill, SC 29730 eric.kirkland@comporium.com	803-326-6109
TELECOM - TV2 Time Warner Communications	Matt McClain 3140 West Arrowood Road Charlotte, NC 28273 matt.mcclain@charter.com	704-378-2194 980-428-5092
GAS - G1 York County Natural Gas	Eric Cellucci 979 W. Main st. Rock Hill, SC 29731 eric.cellucci@ycnga.com	803-323-5392 803-627-4410
WATER - W1 York County Water and Sewer	David Hughes (Bert Becton STV Designer) 6 South Congress St. York, SC 29745	803-628-3211
Sewer - S1 York County Water and Sewer	David Hughes (Bert Becton STV Designer) 6 South Congress St. York, SC 29745	803-628-3211
Water - W2 Fern Forest Water Company	Dottie Carter (Bert Becton STV Designer)	(803) 548-0398
TRAFFIC CONTROL - TF1 SCDOT	John Huskins 338 Robertsion Rd. West Rock Hill, SC 29730	803-324-3545 Ext. 25

INDEX OF SHEETS

DESCRIPTION	SUBTOTAL OF SHEETS
UTILITY REFERENCE SHEET	U1
UTILITY LEGEND SHEET	U2
UTILITY DATA SHEET	U3
UTILITY POLE DATA SHEET	U4A - U4D
UTILITY GENERAL NOTES	U5
UTILITY PLAN SHEETS	U6 - U30 (U26-U29 Omitted)
TOTAL	29

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

500 0 500 1000
scale feet

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY REFERENCE SHEET

SCALE N/A RTE. US 21 DWG. NO. U1

SUE LEGEND AND NOTES

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21 SC 51	U2

ELECTRIC SYMBOLS

SYM	ABV	DESCRIPTION
	ETM	ELECTRICAL TRANSFORMER
	EMH	ELECTRICAL MAN HOLE
	EHH	ELECTRICAL HAND HOLE
	EPP	ELECTRIC PEDESTAL
	EBX	ELECTRIC BOX
	ESG	ELECTRIC SWITCH GEAR BOX
	EVT	ELECTRIC VAULT
	EGL	GROUND / LANDSCAPE LIGHT
	EAB	ELECTRIC AIR BRAKE
	ERO	ELECTRIC RESIDENTAL OUTLET

POLE SYMBOLS

SYM	ABV	DESCRIPTION
	PSP	SIGNIFICANT POLE (STEEL, CONCRETE, ETC)
	PP	ELECTRIC, COMBINATION POLE
	PMP	METER POLE
	PLT	TRANSMISSION LINE POLE
	PLP	AREA LIGHT POLE
	PTF	TRAFFIC SIGNAL POLE
	POP	OTHER USE POLE
	PCT	CELL PHONE TOWER
	PTP	TELEPHONE POLE
	PGP	GUY POLE

TRAFFIC CONTROL SYMBOLS

	TFV	TRAFFIC SIGNAL CONTROL VAULT
	TFHH	TRAFFIC CONTROL HAND HOLE
	TFJ	TRAFFIC SIGNAL JUNCTION BOX

GAS SYMBOLS

SYM	ABV	DESCRIPTION
	GM	GAS METER
	GVC	GAS VALVE CAP
	GMH	GAS MAN HOLE
GVT	GVT	GAS VENT
GR	GR	GAS PRESSURE REGULATOR
GTP	GTP	GAS LINE TEST POINT
GTF	GTF	GAS LINE TAP FARM

MISC SYMBOLS

	MWP	UTILITY WITNESS POST
EOI	MOI	END OF INFORMATION
	MUC	MISC / UNKNOWN VALVE CAP OR COVER
	MPB	PAVED OR BURIED MANHOLE / CAP
	MUE	UTILITY TERMINI / ENDS
	MTH	TEST HOLE

TELECOMMUNICATION SYMBOLS

SYM	ABV	DESCRIPTION
	TB	TELEPHONE BOOTH
	TVP	CABLE TV PEDESTAL
	TLC	SUBSCRIBER LOOP CARRIER (aka SLICK)
	TPP	TELEPHONE PEDESTAL
	TMH	TELEPHONE MAN HOLE
	TFOH	FIBER OPTIC HAND HOLE
	THH	TELEPHONE HAND HOLE
	TVHH	CABLE TV HAND HOLE
	TBX	TELEPHONE BOX
	TXB	UG / SPLICE - AG SPLICE BOX
	TRP	TELEPHONE REPEATER
	TVB	CABLE TV BOX
	TUV	UNDERGROUND TELEPHONE VAULT
	UTP	UNDERGROUND TELEPHONE PEDESTAL
	UTV	UNDERGROUND CABLE TV PEDESTAL

WATER SYMBOLS

	WM	WATER METER
	WV	WATER VALVE
	WMW	WATER MONITORING WELL
	WFH	FIRE HYDRANT
	WMH	WATER MAN HOLE
	WAR	WATER AIR RELEASE VALVE
	WVB	WATER VALVE BOX
	WFC	FIRE DEPARTMENT CONNECTION
	WBP	WATER BACKFLOW PREVENTER
	WBO	WATER BLOW OFF VALVE
	WWH	WELL HOUSE
	WPV	POST INDICATOR VALVE

SEWER SYMBOLS

SYM	ABV	DESCRIPTION
	SCO	SEWER CLEAN OUT
	SMH	SEWER MAN HOLE
	SAR	SEWER AIR RELEASE VALVE
	SST	SEWER STEP TANK
	SCV	SEWER CHECK VALVE BOX
	SGP	SEWER GRINDER / PUMP STATION
	SSV	SEWER VALVE
	SLS	SEWER LIFT STATION

NONPOTTABLE WATER SYMBOLS

	ICV	IRRIGATION CONTROL VALVE
	ICB	IRRIGATION CONTROL BOX
	IRH	IRRIGATION / SPRINKLER HEAD

COMBINATION LINE DEPICTION CODES

SHOW COMBINED LEVEL C & D SUE WILL INCLUDE THE FOLLOWING LEVEL QUALITY CODES:

LINE SHOWN DEPICTS QUALITY LEVEL C <C>

<C> T1

LINE SHOWN DEPICTS QUALITY LEVEL D <D>

<D> T1

MULTIPLE SUE OWNERS CAN BE DEPICTED OWNERSHIP WITH THE FOLLOWING CODES:

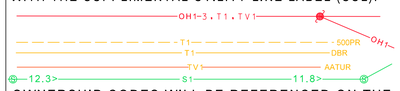
(A) UTILITY OWNER "X"

<C> (A) T1

(B) UTILITY OWNER "Y"

<D> T1 (B)

UTILITY LINES THAT REQUIRE MORE DETAILED INFORMATION ON THE PLAN SHEET CAN BE LABELED WITH THE SUPPLIMENTAL UTILITY LINE LABEL (SUL):



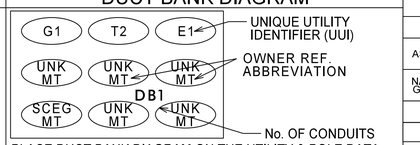
OWNERSHIP CODES WILL BE REFERENCED ON THE TITLE/OWNER SHEET AND THE UTILITY & POLE DATA SHEET.

SEWER MANHOLE NUMBERS (SMN)

S001 (S) SANITARY SEWER MANHOLE

DESIGNATE EACH SANITARY SEWER MANHOLE WITH A SEWER MANHOLE NUMBER (SMN). REFERENCE THIS SMN ON THE UTILITY DATA SHEET AND LIST ELEVATIONS.

DUCT BANK DIAGRAM



PLACE DUCT BANK DIAGRAM ON THE UTILITY & POLE DATA SHEET BELOW THE UTILITY & POLE DATA CHART. NOTE THE UUI OF THE DUCT BANK ON THE DIAGRAM. DEPICT THE CORRECT NUMBER OF CONDUITS IN THE DUCT AND THE USAGE OF EACH. MARK EMPTIES (IF KNOWN) WITH OWNER REFERENCE ABBREVIATION AND "MT".

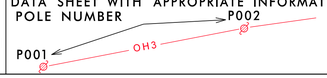
UTILITY INFORMATION TAGS (UIT)

WHEN UTILITY APPURTENANCES NEED DESCRIBING, PLACE A UIT NEXT TO THE CELL OR OUTLINED AREA. PLACE THE INFORMATION ON THE UTILITY DATA SHEET. DESIGNATE THE UTILITY BY THE OWNER NUMBER AND "T001" CODE IN THE "UTILITY" COLUMN. (IE - T2 T001).

(X) T001

UTILITY POLE ID NUMBER (UPIN)

TAG EACH UTILITY POLE WITH A UTILITY POLE ID NUMBER (UPIN) STARTING AT THE BEGINNING STATION. REFERENCE UPIN ON THE UTILITY & POLE DATA SHEET WITH APPROPRIATE INFORMATION.



UTILITY INFORMATION ABBERVIATIONS

EOI	END OF INFORMATION
EORI	END OF RECORDED INFORMATION
AATUR	UTILITY ABANDONED ACCORDING TO UTILITY RECORDS
AATFI	UTILITY ABANDONED ACCORDING TO FIELD INSPECTION
EATUR	EMPTY ACCORDING TO UTILITY RECORDS
NAP	NO ASSOCIATED PIPING FOUND FROM STRUCTURE
NAC	NO ASSOCIATED CABLES FOUND FROM STRUCTURE
DBR	DIRECT BURIED
DATFI	DEPICTED ACCORDING TO FIELD INSPECTION
EATFI	EMPTY ACCORDING TO FIELD INSPECTION
PR	PAIR
MT	EMPTY
CAP	CAPACITY
GR	GROUND

MATERIAL ABBREVIATIONS

C	COPPER
DI	DUCTILE IRON
S	STEEL
P	PLASTIC
FO	FIBER OPTIC
CI	CAST IRON
S	STEEL
CO	CONCRETE
PV	PVC
VY	VYLON
TC	TERRA COTTA
SWC	STEEL WRAPPED COATED
AC	ASBESTOS CEMENT
TF	TRAFFIC SIGNAL CABLE
GW	GUY WIRE
CNT	CONDUIT

GENERAL ABBREVIATIONS

E	ELECTRIC (POWER)
W	UNDERGROUND WATER
G	UNDERGROUND GAS
PUPS	PALMETTO UTILIY PROTECTION SERVICES
T	TELEPHONE, TELECOMMUNICATION
TV, C	CABLE TELEVISION
FO	FIBER OPTIC
S	SANITARY SEWER
FS	FORCED SANITARY SEWER, FORCE MAIN
DB	DUCT BANK
TF	TRAFFIC CONTROL UTILITY
UNK	UNKNOWN UTILITY
HP	HYDROGEN PEROXIDE
ST	STEAM LINE
F	FUEL / PETROLEUM LINE
R	RECLAIMED WATER / SLURRY LINE
I	IRRIGATION LINE
DB	DUCT BANK
TNL	TUNNEL
CA	GASES MATERIAL
OSL	OUTSIDE LIMITS
N/A	NOT AVAILABLE
N/S	NOT SURVEYED (REFERENCE)
PH	PHASE (POWER)
CIR	CIRCUIT (TRANSMISSION)
SVC	SERVICE
LPR	LOW PRESSURE
HPR	HIGH PRESSURE
UG	UNDERGROUND
AG	ABOVE GROUND

SOIL COMBINATION CHART

SANDY LOAM	SL	SILTY LOAM	ZL	SILT	Z
CLAY LOAM	CL	SILT CLAY LOAM	ZCL	SAND CLAY LOAM	SCL
SANDY CLAY	SC	SILTY CLAY	ZC	CLAY	C

SURFACE DESCRIPTION LEGEND KEY

ASPHALT	A	INTER-LOCKING BRICK	I	CONC-RETE	C
NATURAL GROUND	N				

SOIL DESCRIPTION LEGEND KEY

COMPACTION		WATER LEVEL		SOIL TYPE	
LOOSE	L	DRY	D	CLAY	C
SOFT	D	MOIST	M	LOAM	L
HARD	H	WET	E	SAND	S
SOLID	HH	STANDING WATER	WW	SILT	Z

UTILITY UNIQUE IDENTIFIER LINE-STYLES

ELECTRIC RECORDED	E1 THRU E10
ELECTRIC DESIGNATED	E1 THRU E10
TRAFFIC CONTROL RECORDED	TF1 THRU TF5
TRAFFIC CONTROL DESIGNATED	TF1 THRU TF5
TELEPHONE RECORDED	T1 THRU T10
TELEPHONE DESIGNATED	T1 THRU T10
CABLE TV RECORDED	TV1 THRU TV10
CABLE TV DESIGNATED	TV1 THRU TV10
IRRIGATION RECORDED	I1 THRU I5
IRRIGATION DESIGNATED	I1 THRU I5
SLURRY RECORDED	R1 THRU R5
SLURRY DESIGNATED	R1 THRU R5
GAS RECORDED	G1 THRU G10
GAS DESIGNATED	G1 THRU G10
FUEL/PETROL RECORDED	F1 THRU F5
FUEL/PETROL DESIGNATED	F1 THRU F5
STEAM RECORDED	ST1 THRU ST5
STEAM DESIGNATED	ST1 THRU ST5
COMPRESSED GASES RECORDED	CA1 THRU CA5
COMPRESSED GASES DESIGNATED	CA1 THRU CA5
WATER RECORDED	W1 THRU W10
WATER DESIGNATED	W1 THRU W10
GRAVITY SEWER	S1 THRU S10
FORCED SEWER RECORDED	FS1 THRU FS10
FORCED SEWER DESIGNATED	FS1 THRU FS10
AERIAL SIGNAL LINE	SIG
AERIAL UTILITY LINE	OH1 THRU OH20
AERIAL GUY WIRE	GW
MISCELLANEOUS RECORDED	M1 THRU M5
MISCELLANEOUS DESIGNATED	M1 THRU M5
DUCT BANK RECORDED	DB1 THRU DB5
DUCT BANK DESIGNATED	DB1 THRU DB5
UTILITY TUNNEL	TNL
UNKOWN DESIGNATED	UNK
SWEEP LIMIT	SUE
AERIAL COMMUNICATIONS	T1

QUALITY LEVEL DEFINITIONS

Level D. This level information comes solely from existing utility records. It may provide an overall "feel" for the congestion of utilities, but it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should be confined to project planning and route selection activities.

Level C. This level involves surveying visible aboveground utility facilities (e.g., manholes, valve boxes, posts) and correlating this information with existing utility records. When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, should be confined to rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.

Level B. This level involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities. This activity is called "designating." Two-dimensional mapping information is obtained. This information is usually sufficient to accomplish preliminary engineering goals. Decisions can be made on where to place storm drainage systems, footers, foundations and other design features in order to avoid conflicts with existing utilities. Slight adjustments in the design can produce substantial cost savings by eliminating utility relocations.

Level A. This level involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material and other characteristics. This activity is called "locating." It is the highest level presently available. When surveyed and mapped, precise plan and profile information are available for use in making final design decisions. By knowing exactly where a utility is positioned in three dimensions, the designer can often make small adjustments in elevations or horizontal locations and avoid the need to relocate utilities. Additional information (e.g., utility materials, condition, size, soil contamination, paving thickness) also assists the designer and Utility Company in their decisions.

U SHEET - UTILITY COORDINATION LEGEND

SYM	ABV	DESCRIPTION
	UCP	NEW / RELOCATED UTILITY POLE
	URP	REMOVE UTILITY POLE
W	UCW	NEW / RELOCATE WATER STRUCTURE
T	UCT	NEW / RELOCATE TELECOMMUNICATION PEDESTAL
G	UCG	NEW / RELOCATE GAS STRUTURE
E	UCE	NEW / RELOCATE ELECTRIC STRUCTURE
S	UCS	NEW / RELOCATE SEWER STRUCTURE
S	UCF	NEW / RELOCATE TRAFFIC STRUCTURE
U	UCU	NEW / RELOCATE MISC STRUCTURE

PROPOSED UTILITY LINES

T1 THRU T10	TELEPHONE
TV1 THRU TV10	CABLE TV
E1 THRU E10	ELECTRIC
TF1 THRU TF5	TRAFFIC CONTROL
W1 THRU W10	WATER
G1 THRU G10	GAS
FS1 THRU FS10	FORCED SEWER
F1 THRU F5	FUEL / PETROLEUM
OH1 THRU OH20	AERIAL UTILITIES
DB1 THRU DB5	DUCT BANK
M1 THRU M5	MISCELLANEOUS

U SHEET PLAN NOTES

U-SHEET LINEWORK WILL BE USED WHEN UTILITY RELCOATION PLANS ARE INCLUDED IN THE PLAN SET.

ALL U-SHEET UUI LINES WILL BE DETAILED ON THE U-SHEET DATA SHEET.

"MISCELLANEOUS" UUI U-SHEET LINEWORK CAN BE USED FOR ANY UTILITY NOT REPRESENTED WITH A RELOCATION UUI.

ON U-SHEETS, EXISTING UTILITIES ARE DEPICTED ON A GREYSCALE.

REMOVED UTILITIES

ABANDONED/REMOVED	
X X X X	TELEPHONE
X X X X	CABLE TV
X X X X	ELECTRIC
X X X X	TRAFFIC CONTROL
X X X X	WATER
X X X X	GAS
X X X X	FORCED SEWER
X X X X	FUEL / PETROLEUM
X X X X	AERIAL UTILITIES
X X X X	DUCT BANK
X X X X	MISCELANEOUS

PROJECT SPECIFIC NOTES

1. SUE WAS PERFORMED BY SAM FOR SCDOT.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
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PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY LEGEND SHEET

SCALE: N/A RTE. US 21 DWG. NO. U2

UTILITY DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U3

FOR INFORMATION ONLY

UTILITY	ALIGNMENT / ROUTE / RD	STATION RANGE	OFFSET RANGE	ITEM IN PLACE	OWNERSHIP	REMARKS / MISC NOTES
E1	US21, SC51			UNDERGROUND POWER	YORK ELECTRIC CORP.	
E1-1	US21, SC51			AERIAL SINGLE PHASE POWER	YORK ELECTRIC CORP.	
E1-2	US21, SC51			AERIAL TWO PHASE POWER	YORK ELECTRIC CORP.	
E1-3	US21, SC51			AERIAL THREE PHASE POWER	YORK ELECTRIC CORP.	
E2-TRANS	US21, SC51, SC641			AERIAL TRANSMISSION POWER	DUKE POWER	44kV & 100kV OVERHEAD TRANSMISSION
E3-3 TRANS	US21			AERIAL TRANSMISSION POWER	SANTEE COOPER POWER	3-PHASE OVERHEAD TRANSMISSION
T1	US21, SC51, SC641			UNDERGROUND TELEPHONE	COMPORIUM	
T1-C	US21, SC51, SC641			AERIAL TELEPHONE COPPER	COMPORIUM	COPPER
T1-F	SC51, SC641			AERIAL TELEPHONE FO	COMPORIUM	FIBER OPTIC
T2	US21, SC51, SC641			UNDERGROUND TELEPHONE FO	DUKE NET	
T2-F	US21, US21 BUS, SC98			AERIAL TELEPHONE FO	DUKE NET	FIBER OPTIC
T3	US21, US21 BUS			UNDERGROUND TELEPHONE FO	AT&T	
TV1	US21, US21 BUS, SC51			AERIAL & UNDERGROUND CATV	COMPORIUM	
TV2	US21, SC51, SC641			UNDERGROUND FO	TWC	
G1	US21, US21 BUS, SC51			UNDERGROUND GAS	YORK CO. NATURAL GAS	
W1	US21, US21 BUS, SC51, SC98			UNDERGROUND WATER	YORK CO. WATER & SEWER	
W2	AMELIA, FERN FOREST, FOREST			UNGROUND WATER	FERN FOREST MHP	
S1	US21, US21 BUS, SC51, SC98			UNDERGROUND SAN. SEWER	YORK CO. WATER & SEWER	
TF1	US21, US21 BUS, SC51, SC98			AERIAL & UNDERGROUND SIGNAL	SC DOT	
OH1	US21, SC51, SC641, SC98			OVERHEAD POWER	YORK ELECTRIC CORP.	ALSO CARRIES AT VARIOUS LOCATIONS T1, TV1, T2, TF1
OH2	US21, SC51			OVERHEAD TRAFFIC SIGNAL	SC DOT	
OH3	US21			OVERHEAD POWER	SANTEE COOPER POWER	OVERHEAD TRANSMISSION
OH4	US21, SC51, SC98			OVERHEAD TELEPHONE & CATV	COMPORIUM	
OH5	SC51, SC641			OVERHEAD POWER	DUKE POWER	DOUBLE CIRCUIT 44kV OVERHEAD TRANSMISSION
OH5	US21			OVERHEAD POWER	DUKE POWER	DOUBLE CIRCUIT 100kV OVERHEAD TRANSMISSION

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U3

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4A

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
1				York Electric	40 N	33'	9"	Wood	Pwr
2				York Electric		39'	11"	Wood	Pwr
3				York Electric		24'	7"	Wood	Pwr
4				York Electric	OSN	42'	11"	Wood	Pwr
5				York Electric	OSN	43'	12"	Wood	Pwr
6				York Electric		24'	7"	Wood	Pwr
7				SCDOT	5133A/350-N-6497A	27'	15"	Concrete	Signal
8				York Electric		42'	11"	Wood	Pwr
9				York Electric		43'	11"	Wood	Pwr
10				York Electric		42'	11"	Wood	Pwr
11				SCDOT	8-150/350-5767A	27'	15"	Wood	Signal
12				York Electric		43'	11"	Concrete	Pwr
13				York Electric		12'	4x6	Wood	Pwr
14				York Electric		34'	10"	Wood	Pwr
15				York Electric		35'	10"	Wood	Pwr
16				York Electric		12'	4x6	Wood	Pwr
17				SCDOT	1-188/350N-6022A	27'	15"	Concrete	Signal
18				SCDOT	7-133A/350-N-6497A	27'	15"	Concrete	Signal, Pwr, Tel
19				York Electric	40N	42'	11"	Wood	Pwr
20				York Electric		34'	11"	Wood	Pwr
21				York Electric		38'	11"	Wood	Pwr
22				York Electric		29'	9"	Wood	Pwr
23				York Electric		38'	11"	Wood	Pwr
24				York Electric		33'	10"	Wood	Pwr
25				York Electric	20N	42'	11"	Wood	Pwr
26				York Electric		38'	11"	Wood	Pwr
27				York Electric		34'	10"	Wood	Pwr
28				York Electric		37'	11"	Wood	Pwr
29				Santee Cooper	16# 156475	60'	14"	Wood	Pwr
30				Santee Cooper	15# 165474	77'	14"	Wood	Pwr
31				Santee Cooper	14# 165473	68'	14"	Wood	Pwr
32				York Electric		36'	12"	Wood	Pwr
33				York Electric		40'	12"	Wood	Pwr
34				York Electric		40'	12"	Wood	Pwr
35				York Electric	30N 3CACA1	37'	11"	Wood	Pwr
36				York Electric		49'	14"	Wood	Pwr
37				York Electric		39'	11"	Wood	Pwr
38				York Electric		35'	10"	Wood	Pwr
39				York Electric		34'	10"	Wood	Pwr
40				York Electric	2ST	34'	10"	Wood	Pwr
41				York Electric		38'	10"	Wood	Pwr, Tel, Ctv
42				York Electric	10N	28'	10"	Wood	Pwr
43				York Electric		52'	12"	Wood	Pwr
44				York Electric	30N	42'	12"	Wood	Pwr
45				York Electric		34'	10"	Wood	Guy
46				York Electric	2 12	34'	10"	Wood	Pwr, Tel, Ctv
47				York Electric		24'	9"	Wood	Pwr
48				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
49				York Electric	11	33'	9"	Wood	Pwr, Tel, Ctv
50				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
51				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
52				York Electric		32'	8"	Wood	Pwr, Tel, Ctv
53				York Electric		28'	8"	Wood	Pwr, Tel, Ctv
54				York Electric		44'	12"	Wood	Pwr
55				York Electric	30N	42'	12"	Wood	Pwr
56				York Electric		38'	11"	Wood	Guy
57				Comporium	3CAB1	24'	11"	Wood	Tel, Ctv
58				York Electric		22'	8"	Wood	Pwr
59				York Electric	22	32'	9"	Wood	Pwr, Tel, Ctv
60				York Electric		24'	9"	Wood	Pwr, Tel, Ctv
61				York Electric	3	33'	10"	Wood	Pwr, Tel, Ctv
62				York Electric		26'	7"	Wood	Pwr, Tel, Ctv
63				York Electric	4	34'	10"	Wood	Pwr, Tel, Ctv
64				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
65				York Electric		11'	8"	Wood	Pwr, Tel, Ctv
66				York Electric		28'	8"	Wood	Pwr, Tel, Ctv
67				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
68				York Electric		25'	7"	Wood	Pwr, Tel, Ctv
69				York Electric		29'	7"	Wood	Pwr, Tel, Ctv
70				York Electric	5	34'	9"	Wood	Pwr, Tel, Ctv
71				York Electric	AB6	34'	9"	Wood	Pwr, Tel, Ctv
72				Duke Power		93'		Metal	Pwr
73				Duke Power		90'		Metal	Pwr
74				York Electric		41'	12"	Wood	Pwr
75				York Electric		30'	9"	Wood	Pwr, Tel, Ctv
76				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
77				York Electric		48'	14"	Wood	Pwr
78				York Electric		28'	9"	Wood	Guy
79				York Electric		25'	8"	Wood	Guy
80				York Electric		29'	9"	Wood	Guy
81				York Electric	11	43'	12"	Wood	Pwr, Tel, Ctv
82				York Electric		25'	8"	Wood	Pwr, Tel, Ctv
83				York Electric	3AAA 10	43'	12"	Wood	Pwr, Tel, Ctv
84				York Electric		25'	7"	Wood	Pwr, Tel, Ctv
85				York Electric		33'	10"	Wood	Pwr
86				York Electric		33'	10"	Wood	Pwr
87				York Electric		43'	12"	Wood	Pwr
88				York Electric		44'	12"	Wood	Pwr

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4A

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4B

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
89				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
90				York Electric	7	43'	11"	Wood	Pwr, Tel, Ctv
91				York Electric	6.5	43'	11"	Wood	Pwr, Tel, Ctv
92				York Electric	3C6	48'	13"	Wood	Pwr, Tel, Ctv
93				York Electric	20N	48'	12"	Wood	Pwr, Tel, Ctv
94				SCDOT	350-5698A	27'	15"	Concrete	Signal
95				SCDOT	350-698A	26'	15"	Concrete	Signal
96				SCDOT	350N-5698A	27'	15"	Concrete	Signal
97				SCDOT	350N-5614A	27'	15"	Concrete	Signal
98				York Electric		43'	12"	Wood	Pwr
99				York Electric		37'	12"	Wood	Pwr
100				York Electric		43'	12"	Wood	Pwr, Tel
101				York Electric		33'	10"	Wood	Pwr, Tel
102				York Electric		42'	11"	Wood	Pwr
103				York Electric		41'	11"	Wood	Pwr, Tel
104				York Electric	10N	32'	10"	Wood	Pwr
105				York Electric		33'	10"	Wood	Pwr
106				York Electric		33'	10"	Wood	Pwr
107				York Electric		24'	8"	Wood	Pwr
108				York Electric		33'	11"	Wood	Pwr
109				York Electric		42'	12"	Wood	Pwr
110				York Electric		43'	12"	Wood	Pwr
111				York Electric		24'	8"	Wood	Pwr
112				York Electric	40N	42'	12"	Wood	Pwr
113				York Electric		48'	12"	Wood	Pwr
114				York Electric	60N 40N	34'	12"	Wood	Pwr
115				York Electric		24'	8"	Wood	Pwr
116				York Electric		52'	12"	Wood	Pwr, Tel, Ctv
117				York Electric	3B4	43'	12"	Wood	Pwr, Tel, Ctv
118				York Electric		43'	12"	Wood	Pwr
119				York Electric		33'	10"	Wood	Pwr
120				York Electric		35'	10"	Wood	Pwr
121				York Electric		38'	11"	Wood	Pwr
122				York Electric	20N 4A	36'	10"	Wood	Pwr
123				York Electric		24'	7"	Wood	Pwr
124				York Electric		44'	11"	Wood	Pwr
125				York Electric	3BS	43'	11"	Wood	Pwr, Tel, Ctv
126				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
127				York Electric		29'	8"	Wood	Pwr
128				York Electric		34'	10"	Wood	Pwr
129				York Electric		25'	8"	Wood	Pwr, Tel
130				York Electric		42'	12"	Wood	Pwr, Tel, Ctv
131				York Electric		42'	12"	Wood	Pwr
132				York Electric		44'	13"	Wood	Pwr
133				York Electric		44'	12"	Wood	Pwr, Tel, Ctv
134				York Electric		33'	10"	Wood	Pwr, Tel, Ctv
135				York Electric		29'	10"	Wood	Pwr, Tel, Ctv
136				York Electric		44'	11"	Wood	Pwr, Tel, Ctv
137				York Electric		38'	11"	Wood	Pwr, Tel, Ctv
138				York Electric	1ST	34'	10"	Wood	Pwr, Tel, Ctv
139				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
140				York Electric		29'	9"	Wood	Pwr
141				York Electric		30'	8"	Wood	Pwr, Tel, Ctv
142				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
143				York Electric		34'	11"	Wood	Pwr, Tel, Ctv
144				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
145				York Electric		29'	9"	Wood	Tel, Ctv
146				York Electric		29'	9"	Wood	Tel, Ctv
147				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
148				York Electric	3BAIC 5N 30N	37'	12"	Wood	Pwr, Tel
149				York Electric	30N	42'	12"	Wood	Pwr, Tel, Ctv
150				York Electric		43'	13"	Wood	Pwr, Tel, Ctv
151				York Electric	10N	33'	12"	Wood	Pwr, Tel, Ctv
152				York Electric		42'	13"	Wood	Pwr, Tel, Ctv
153				York Electric		28'	9"	Wood	Pwr
154				Comporium		30'	7"	Wood	Tel, Ctv
155				York Electric	30N	42'	11"	Wood	Pwr, Tel, Ctv
156				SCDOT		29'	13"	Wood	Signal
157				York Electric	40N	36'	11"	Wood	Pwr
158				York Electric	60N	38'	11"	Wood	Pwr
159				SCDOT		33'	11"	Wood	Signal
160				York Electric		13'	4x6	Wood	Pwr
161				York Electric		25'	8"	Wood	Pwr
162				SCDOT		30'	11"	Wood	Signal
163				York Electric		44'	12"	Wood	Pwr
164				York Electric		43'	12"	Wood	Pwr
165				York Electric	40N	44'	12"	Wood	Pwr, Tel, Ctv
166				York Electric		28'	8"	Wood	Pwr
167				York Electric		28'	10"	Wood	Pwr
168				York Electric		42'	12"	Wood	Pwr, Tel, Ctv
169				York Electric		20'	9"	Wood	Pwr
170				York Electric	5N	38'	12"	Wood	Pwr, Tel, Ctv
171				York Electric		28'	8"	Wood	Pwr
172				SCDOT	400N-5767B	30'	15"	Concrete	Signal
173				York Electric		24'	8"	Wood	Pwr
174				York Electric		25'	8"	Wood	Pwr, Ctv
175				York Electric	5A	28'	9"	Wood	Pwr, Tel, Ctv
176				York Electric		24'	8"	Wood	Pwr, Tel, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
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ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4B

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4C

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
177				York Electric		24'	7"	Wood	Pwr
178				SCDOT	400-4558B	30'	15"	Concrete	Signal
179				York Electric		42'	11"	Wood	Pwr, Tel, Ctv
180				SCDOT	400M-5767B	29'	15"	Concrete	Signal
181				SCDOT	400M-4400A	29'	15"	Concrete	Signal
182				York Electric	30N	42'	13"	Wood	Pwr, Tel, Ctv
183				York Electric		41'	9"	Wood	Pwr, Tel, Ctv
184				York Electric		43'	12"	Wood	Pwr, Ctv
185				York Electric	50N	33'	11"	Wood	Pwr
186				York Electric		43'	11"	Wood	Pwr, Ctv
187				York Electric		42'	12"	Wood	Pwr, Ctv
188				York Electric		43'	11"	Wood	Pwr, Tel, Ctv
189				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
190				York Electric		24'	8"	Wood	Pwr
191				York Electric		43'	10"	Wood	Pwr, Tel, Ctv
192				York Electric		42'	10"	Wood	Pwr, Tel, Ctv
193				York Electric		53'	13"	Wood	Pwr, Ctv
194				York Electric		25'	9"	Wood	Pwr
195				York Electric		52'	13"	Wood	Pwr
196				York Electric		43'	13"	Wood	Pwr
197				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
198				York Electric		33'	9"	Wood	Pwr, Tel, Ctv
199				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
200				Fort Mill Telephone		27'	10"	Wood	Tel, Ctv
201				York Electric		43'	12"	Wood	Pwr
202				York Electric		42'	12"	Wood	Pwr
203				York Electric		34'	9"	Wood	Pwr
204				York Electric		47'	13"	Wood	Pwr, Tel, Ctv
205				SCDOT		28'	15"	Wood	Signal
206				SCDOT		28'	12"	Wood	Signal
207				York Electric		29'	9"	Wood	Guy
208				SCDOT		29'	11"	Wood	Signal
209				SCDOT		29'	11"	Wood	Signal
210				York Electric		23'	11"	Wood	Tel, Ctv
211				York Electric		43'	7"	Wood	Pwr, Tel, Ctv
212				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
213				York Electric		33'	12"	Wood	Pwr
214				York Electric		39'	10"	Wood	Pwr
215				York Electric		29'	9"	Wood	
216				York Electric		43'	12"	Wood	Pwr, Ctv
217				York Electric		36'	11"	Wood	Pwr, Tel
218				York Electric	30N	38'	11"	Wood	Pwr, Tel
219				York Electric		29'	8"	Wood	Pwr, Tel
220				York Electric		24'	8"	Wood	Pwr
221				SCDOT		32'	15"	Concrete	Signal
222				SCDOT		31'	15"	Concrete	Signal
223				SCDOT		32'	15"	Concrete	Signal
224				York Electric	20	34'	9"	Wood	Pwr
225				SCDOT		31'	15"	Concrete	Signal
226				York Electric		39'	11"	Wood	Pwr
227				York Electric		21'	9"	Wood	Pwr
228				York Electric		34'	10"	Wood	Pwr, Tel
229				York Electric		33'	10"	Wood	Pwr, Tel
230				York Electric	15N	44'	11"	Wood	Pwr, Tel
231				York Electric	30N	33'	9"	Wood	Pwr, Tel
232				York Electric		34'	10"	Wood	Pwr, Tel
233				Comporium		25'	8"	Wood	Tel
234				York Electric		36'	10"	Wood	Pwr
235				Comporium		30'	8"	Wood	Tel, Ctv
236				York Electric	BN1	40'	10"	Wood	Pwr, Tel, Ctv
237				York Electric		39'	10"	Wood	Pwr, Tel, Ctv
238				York Electric		23'	8"	Wood	Pwr
239				York Electric		37'	11"	Wood	Pwr
240				York Electric		38'	11"	Wood	Pwr, Tel
241				York Electric		36'	11"	Wood	Pwr, Tel
242				York Electric		42'	13"	Wood	Pwr, Tel
243				York Electric		34'	10"	Wood	Pwr
244				York Electric		36'	10"	Wood	Pwr
245				York Electric		34'	10"	Wood	Pwr
246				York Electric		38'	11"	Wood	Pwr, Tel
247				York Electric		30'	9"	Wood	Pwr
248				York Electric		34'	11"	Wood	Pwr, Tel
249				York Electric		38'	11"	Wood	Pwr, Tel
250				York Electric		32'	10"	Wood	Pwr, Tel
251				York Electric	3BP5	42'	13"	Wood	Pwr, Tel
252				York Electric		38'	11"	Wood	Pwr
253				York Electric		32'	9"	Wood	Pwr
254				York Electric		33'	11"	Wood	Pwr
255				York Electric		36'	11"	Wood	Pwr, Tel, Ctv
256				York Electric		33'	11"	Wood	Pwr, Tel, Ctv
257				York Electric		37'	10"	Wood	Pwr, Tel, Ctv
258				York Electric	3BP912 15N	35'	11"	Wood	Pwr, Tel, Ctv
259				York Electric	5N	37'	11"	Wood	Pwr, Tel, Ctv
260				York Electric		38'	11"	Wood	Pwr, Tel, Ctv
261				Comporium		34'	10"	Wood	Pwr, Tel, Ctv
262				York Electric		35'	10"	Wood	Pwr
263				York Electric		34'	11"	Wood	Pwr
264				York Electric		33'	8"	Wood	Pwr, Tel, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4C

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4D

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
265				York Electric		24'	10"	Wood	Pwr
266				York Electric	4.5	36'	11"	Wood	Pwr, Tel, Ctv
267				Comporium		33'	8"	Wood	Pwr, Tel, Ctv
268				York Electric		24'	9"	Wood	Pwr, Tel
269				Comporium		25'	10"	Wood	Tel
270				York Electric		30'	10"	Wood	Pwr
271				York Electric		26'	9"	Wood	Pwr
272				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
273				Duke Power		92'		Metal	Pwr
274				York Electric		33'	10"	Wood	Pwr
275				York Electric		32'	10"	Wood	Pwr, Tel, Ctv
276				York Electric		34'	11"	Wood	Pwr, Tel, Ctv
277				Comporium		34'	10"	Wood	Pwr, Tel, Ctv
278				York Electric	3B16	43'	12"	Wood	Pwr, Tel, Ctv
279				SCDOT	350N-5299B	28'	15"	Concrete	Signal
280				York Electric		25'	8"	Wood	Pwr, Tel
281				SCDOT		28'	15"	Concrete	Signal
282				SCDOT	E-350N-5299B	28'	15"	Concrete	Signal
283				SCDOT	350N-5299B	28'	15"	Concrete	Signal
284				York Electric	3B17	43'	13"	Wood	Pwr, Tel, Ctv
285				York Electric	3BE20	30'	10"	Wood	Pwr, Tel, Ctv
286				York Electric		29'	10"	Wood	Pwr
287				York Electric		33'	10"	Wood	Pwr, Tel, Ctv
288				York Electric		28'	9"	Wood	Pwr
289				Duke Power	5	43'	11"	Wood	Pwr
290				Duke Power		105'		Metal	Pwr
291				York Electric	30N	31'	10"	Wood	Pwr, Tel, Ctv
292				Duke Power	1	42'	13"	Wood	Pwr, Tel
293				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
294				Duke Power	2	51'	13"	Wood	Pwr
295				York Electric	99	35'	12"	Wood	Pwr, Tel
296				York Electric		34'	9"	Wood	Pwr
297				York Electric	3BEC1	34'	10"	Wood	Pwr, Tel, Ctv
298				York Electric		33'	9"	Wood	Pwr
299				York Electric		34'	11"	Wood	Pwr
300				York Electric		35'	10"	Wood	Pwr, Tel, Ctv
301				York Electric		39'	11"	Wood	Pwr, Tel, Ctv
302				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
303				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
304				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
305				York Electric		38'	10"	Wood	Pwr, Tel, Ctv
306				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
307				York Electric		39'	11"	Wood	Pwr
308				York Electric		38'	11"	Wood	Pwr
309				York Electric	30N	33'	12"	Wood	Pwr
310				York Electric		39'	12"	Wood	Pwr
311				York Electric	20N	39'	12"	Wood	Pwr
312				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
313				York Electric		30'	9"	Wood	Pwr, Tel
314				York Electric	23	37'	10"	Wood	Pwr, Tel
315				York Electric		38'	11"	Wood	Pwr
316				Duke Power		90'		Metal	Pwr
317				York Electric		38'	10"	Wood	Pwr, Tel, Ctv, Signal
318				York Electric		38'	12"	Wood	Pwr, Tel, Ctv
319				York Electric		38'	12"	Wood	Pwr, Tel, Ctv, Signal
320				York Electric		38'	12"	Wood	Pwr, Tel, Ctv, Signal
321				York Electric	30N	38'	10"	Wood	Pwr, Tel, Ctv, Signal
322				York Electric		29'	9"	Wood	Pwr
323				York Electric		29'	9"	Wood	Pwr
324				York Electric		28'	9"	Wood	Pwr
325				York Electric		26'	9"	Wood	Pwr
326				York Electric		29'	9"	Wood	Pwr
327				York Electric		24'	9"	Wood	Pwr
328				York Electric	30N	33'	10"	Wood	Pwr
329				York Electric	12N	34'	9"	Wood	Pwr
330				York Electric		33'	12"	Wood	Pwr
331				York Electric		33'	10"	Wood	Pwr
332				York Electric		35'	10"	Wood	Pwr
333				York Electric		33'	11"	Wood	Pwr
334				York Electric		33'	10"	Wood	Pwr
335				York Electric		34'	12"	Wood	Pwr
336				York Electric		34'	10"	Wood	Pwr
337				York Electric		24'	9"	Wood	Pwr
338				York Electric		34'	10"	Wood	Pwr
339				York Electric			11"	Wood	Pwr
340				SCDOT			11"	Wood	Signal
341				York Electric			11"	Wood	Pwr, Tel
342				SCDOT			11"	Wood	Signal
343				York Electric			11"	Wood	Pwr
344				York Electric			11"	Wood	Pwr
345				York Electric			11"	Wood	Pwr, Ctv
346				Duke Power			13"	Wood	Pwr
347				York Electric	30N		11"	Wood	Pwr, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05
POLE	Reference the Utility Pole ID Number	P001, P25
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC

COLUMN	DESCRIPTION	EXAMPLE
STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23
OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L
ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH

COLUMN	DESCRIPTION	EXAMPLE
OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
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NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4D

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U5

GENERAL NOTES

THESE PLANS ARE TO BE USED ONLY AS REFERENCE FOR UTILITY RELOCATIONS.

ALL RELOCATIONS ARE APPROXIMATE BASED ON INFORMATION PROVIDED BY THE INDIVIDUAL UTILITY OWNERS.

ALL PROPOSED RELOCATIONS ARE CONSIDERED INCOMPLETE AND THE INDIVIDUAL UTILITY OWNERS MAY REQUIRE ADDITIONAL RELOCATIONS.

ACTUAL FIELD CONDITIONS WILL DICTATE THE PRECISE LOCATION OF THE RELOCATED UTILITY THROUGH COORDINATION BETWEEN THE CONTRACTOR AND THE UTILITY OWNER.

THE CONTRACTOR IS REQUIRED TO CONTACT 811 AS WELL AS THE NON-811 MEMBER UTILITIES THREE DAYS PRIOR TO EXCAVATING ACTIVITIES.
1-888-721-7877

SPECIAL PROVISIONS

UTILITY STAKING:

CONTRACTOR SHALL BE AWARE ON AS NEEDED BASIS, UTILITIES MAY REQUEST STAKING OF CONSTRUCTION ITEMS AND RIGHT-OF-WAY TO HELP FACILITATE RELOCATIONS AND TO AVOID POTENTIAL CONFLICT WITH ROADWAY CONSTRUCTION AND OTHER UTILITIES.

UTILITY RELOCATION CLEARING SEQUENCE:

UTILITY RELOCATION APPROACH:

IT IS THE INTENTION OF THE UTILITIES TO RELOCATE ACCORDING TO THE FOLLOWING CONSTRUCTION SEQUENCE. THE CLEARING CONTRACTOR SHALL CLEAR AND GRUB ACCORDING TO THE PRIORITY SHOWN IN CHART.

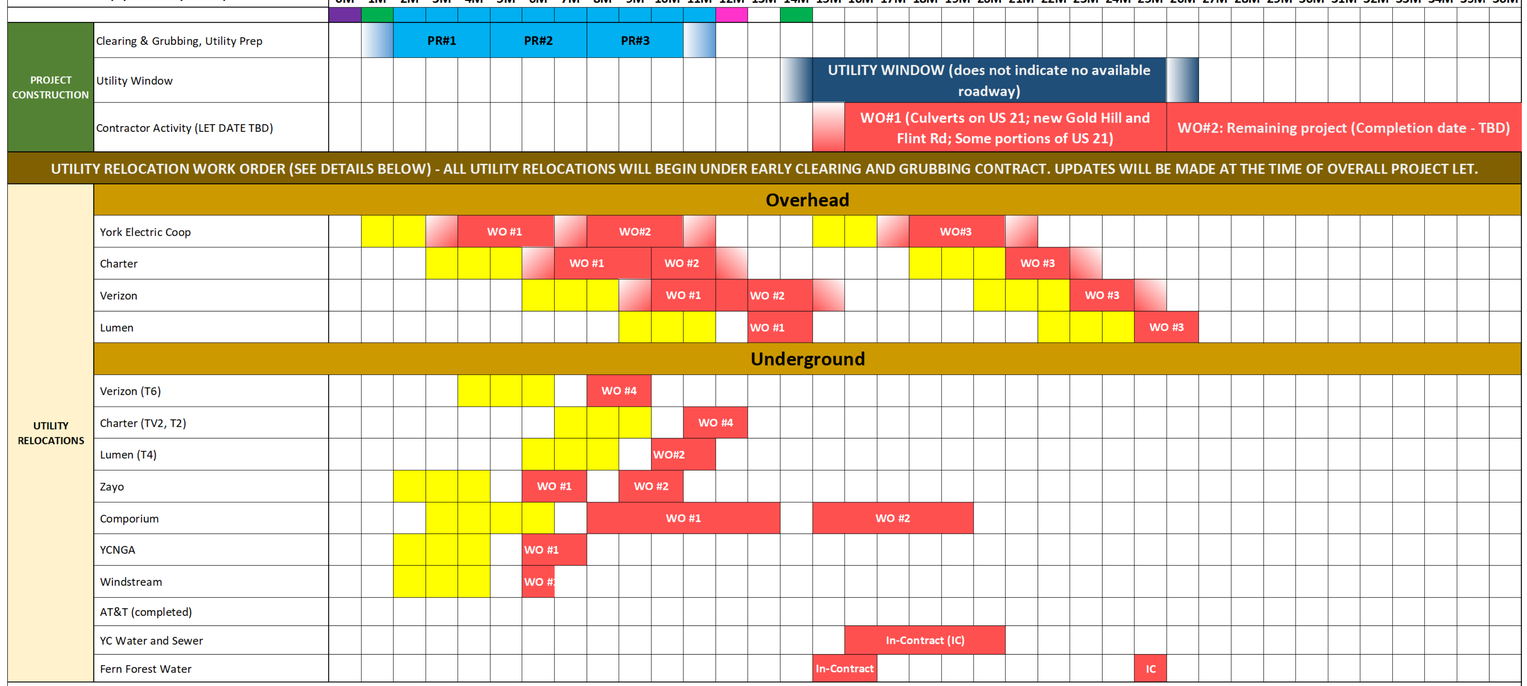
IT IS THE INTENT THAT UTILITIES WILL START WORKING IN ALL AVAILABLE LOCATIONS, WHERE AND WHEN POSSIBLE. EXISTING UTILITIES WILL REMAIN ACTIVE UNTIL ALL NEW FACILITIES ARE INSTALLED AND CUT OVER.

KEY

- notifications (permitting, procurement, scheduling)
- active relocation/ construction activity
- some activity
- no activity
- Project Bid (Early C&G only)
- NTP
- Contractor on-site for C&G operations
- Utility Window
- Project Bid (TBD - For visual purpose only)

**THIS BAR CHART IS FOR INFORMATION ONLY. THE PURPOSE IS TO VISUALLY SHOW THE ORDER OF UTILITY RELOCATIONS IN RELATION TO OTHER CONSTRUCTION ACTIVITY AND NEEDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY UTILITY RELOCATION STATUS. CONTRACTOR ACTIVITY FOR THE PROJECT WILL EXTEND FURTHER THAN WHAT IS SHOWN.

US 21/ SC 51 Widening
(Updated Sept 2023)



WORK AREAS, CONTRACTOR ACTIVITY, AND PRECEDING RELOCATION REQUIRED FOR UTILITY RELOCATION

York Electric Cooperative (E1):
WO #1: SC 51 (need clearing and new alignment graded)
WO #2: Old Nations to SC 51
WO#3: Remaining US 21 (require fill efforts from prime)

Charter (TV2, T2):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 72+00

Verizon (T6):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 61+00

Zayo (T5):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

Comporium (T1):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

AT&T (T3):
Work is complete for Encrochment #A029Y30

Windstream:
WO #1: Adjust as needed; 1 month notification

Lumen (T4):
WO #1: Old Nations to end of SC 51 (OH) (need YEC & Tele OH
WO #2: Gold Hill to Old Nations (UG only) (need C&G)
WO #3: All remaining OH (need YEC OH & Other OH Telecoms

YCNGA (G1):
WO #1: SC 51 (need clearing & grubbing)
WO#2: All remaining relocations

York County Water/Sewer (W1/SS1):
In-contract

Fern Forest Water (T2):
In-contract (2 parts)

Clearing Priorities:
PR#1:
C&G SC51 and Flint Hill Road (new and existing); Includes rough grading new alignments of existing ground
PR#2:
C&G RT/LT Side from Gold Hill to SC 43 and cut from Sta 44+00 to 54+00 LT on US 21; Includes rough grading for new alignment for Gold Hill of existing ground
PR#3:
Remaining project

STV Incorporated
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

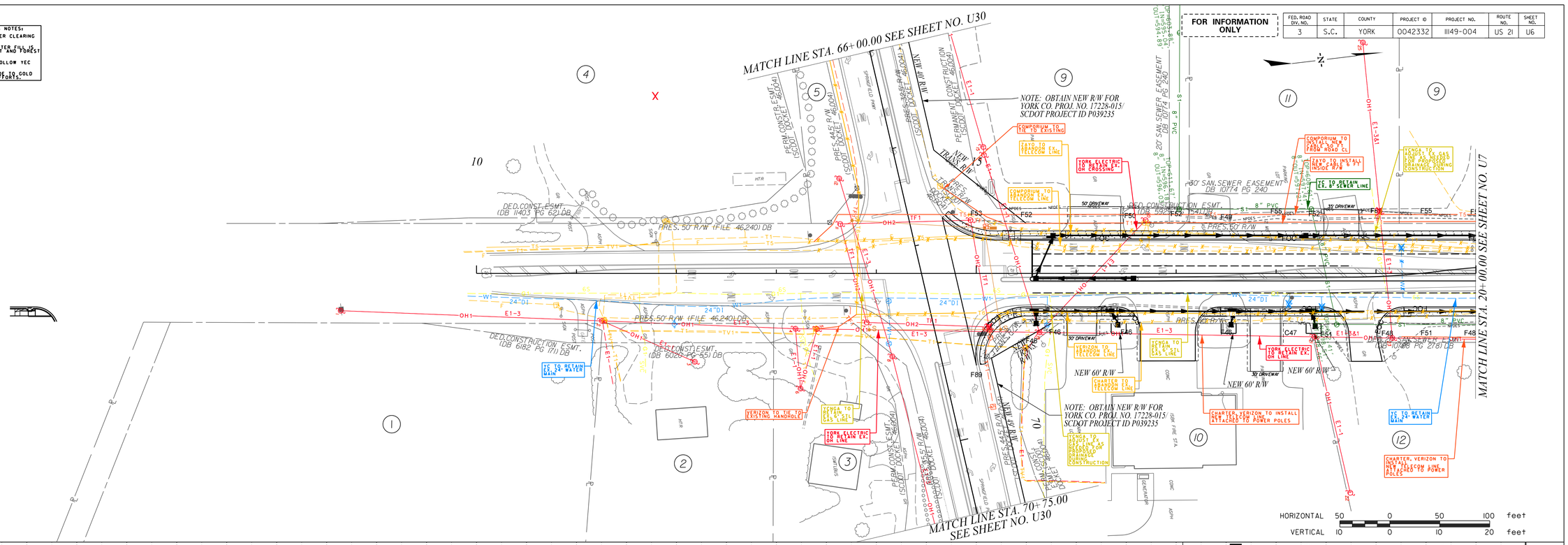
UTILITY GENERAL NOTES SHEET

SCALE: N/A RTE. US 21 DWG. NO. U5

PHASE 3 UTILITY RELOCATIONS NOTES:
COMPORIUM TO RELOCATE AFTER CLEARING EFFORTS.
YEC TO RELOCATE OH LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE
CHARTER AND VERIZON WILL FOLLOW YEC RELOCATIONS.
ZAYO TO RELOCATE ON L.T. SIDE TO GOLD HILL ROAD AFTER CLEARING EFFORTS.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U6



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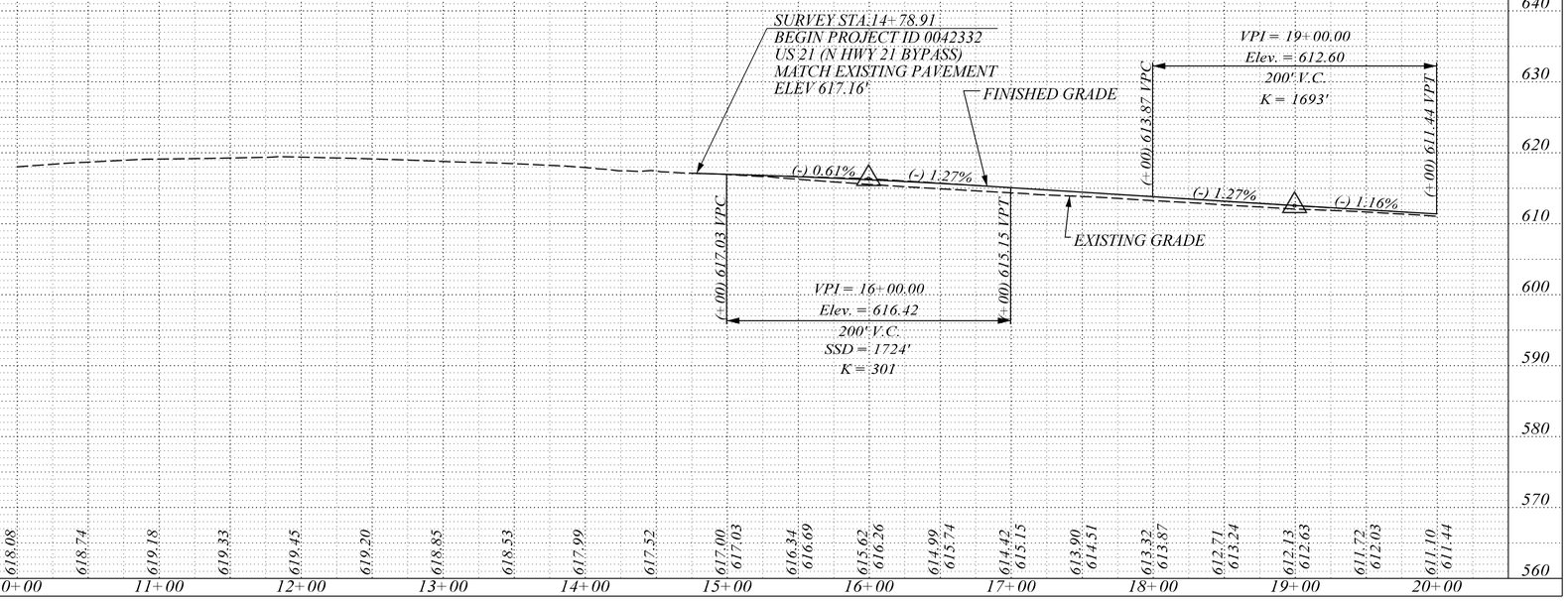
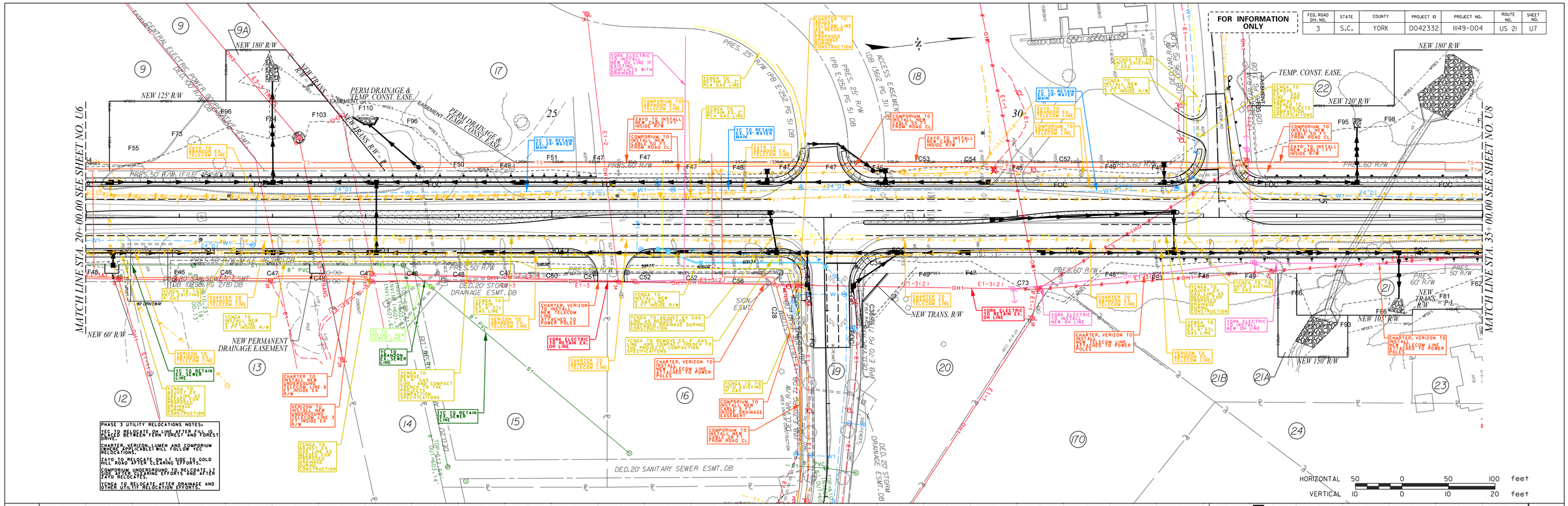
US 21 (N HWY 21 BYPASS)



PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	U7

FOR INFORMATION ONLY



PHASE 3 UTILITY RELOCATIONS NOTES:

YEC TO RELOCATE ON LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE.

CHARTER, VERIZON, LUMEN AND COMPORIUM (WHERE APPLICABLE) WILL FOLLOW YEC RELOCATIONS.

ZAYO TO RELOCATE ON LT SIDE TO GOLD HILL ROAD AFTER CLEARING EFFORTS.

COMPORIUM UNDERGROUND TO RELOCATE LT SIDE AFTER CLEARING EFFORTS AND AFTER ZAYO RELOCATES.

YCNGA TO RELOCATE AFTER DRAINAGE AND OTHER UTILITY RELOCATION EFFORTS.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
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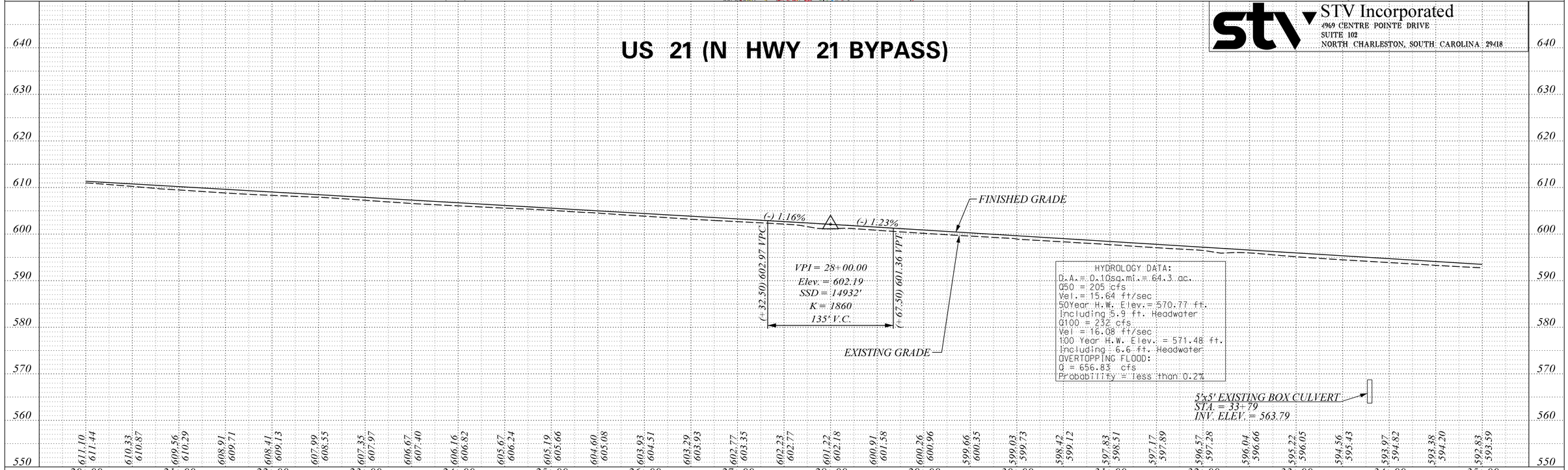
US 21 (N HWY 21 BYPASS)



PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:
COLD HILL TO SR 38 AND CUT SIDE FROM SR 38 TO SR 38 AND CUT SIDE FROM CARTER TO LAKESHORE DR. INCLUDES ROUGH GRADING FOR NEW ALIGNMENT FOR COLD HILL

VERIZON TO RELOCATE SCSI TO ELSIE IN LATER CLEARING/GRADING IS COMPLETE.

VERIZON TO RELOCATE FROM COMPORIUM MH TO COLD HILL PRIOR TO COMPORIUM MH. VERIZON HAS TO INCLUDE THEIR MH FROM CARTER TO COLD HILL. VERIZON MH MUST BE RELOCATED BEFORE COMPORIUM MH OR ELSE IT WILL HOLD UP COMPORIUM.

VERIZON HAS TO BE 9' FEET AT STATION 40+00 FROM RIGHT ROW, DRAINAGE DEPTH AND COMPORIUM.

PHASE 3 UTILITY RELOCATIONS NOTES:
COMPORIUM UNDERGROUND TO RELOCATE AFTER GRADING ESTIMATE COMPORIUM TO BEGIN AT LAKESHORE DR. SIDE AND PROCEEDING TO COLD HILL. NEED GRADING CLEARING IN GOOD SHAPE AND FUTURE GRADING IF ANY SIDE CUTS ARE NEEDED DUE TO ZATO AND/OR CLEARING EFFORTS.

FEC TO RELOCATE POLE JUST AFTER FILL IS COMPLETE BETWEEN CRN, PONDS AND FOREST DRIVE.

CHARTER, VERIZON AND LUMEN TO FOLLOW FEC RELOCATIONS.

ZATO TO RELOCATE ON LT SIDE TO COLD. COMPORIUM TO BE ON RT SIDE FROM BEGINNING TO COLD HILL AND CUT ARE BETWEEN LAKESHORE AND COLD HILL

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	U8

MATCH LINE STA. 35+00.00 SEE SHEET NO. U7

MATCH LINE STA. 50+00.00 SEE SHEET NO. U9

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
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US 21 (N HWY 21 BYPASS)

HYDROLOGY DATA:
D.A.= 0.142sq.mi.= 90.9 ac.
Q50 = 249 cfs
Vel.= 14.65 ft/sec
50Year H.W. Elev.= 574.56 ft.
Including 7.1 ft. Headwater
Q100 = 281 cfs
Vel = 15.06 ft/sec
100 Year H.W. Elev. = 575.56 ft.
Including 8.1 ft. Headwater
OVERTOPPING FLOOD:
Q = 539.95 cfs
Probability = less than 0.2%

VPI = 41+00.00
Elev. = 586.22
K = 106
430' V.C.

(+ 85) 588.86 VPC

(+ 15) 592.31 VPT

LOW POINT
40+15.01
ELEV. = 588.06

(-) 1.23%

(+) 2.84%

FINISHED GRADE

EXISTING GRADE

5'x5' EXISTING BOX CULVERT
STA. = 41+06
INV. ELEV. = 566.73

	35+00	36+00	37+00	38+00	39+00	40+00	41+00	42+00	43+00	44+00	45+00	46+00	47+00	48+00	49+00	50+00
	592.83	592.29	591.64	590.92	590.32	589.66	589.01	588.46	587.95	587.49	587.28	587.42	587.81	588.40	589.13	590.02
	593.59	592.98	592.36	591.75	591.13	590.52	589.90	589.29	588.68	588.26	588.07	588.12	588.40	588.92	589.68	590.67
	591.00	592.31	593.79	595.32	596.83	598.30	599.74	601.18	602.58	604.01	605.45	606.87	608.29	609.74	611.20	
	591.90	593.31	594.72	596.14	597.56	598.98	600.39	601.81	603.23	604.65	606.07	607.48	608.90	610.32	611.74	

640 630 620 610 600 590 580 570 560 550

PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL TO SC 49 AND CUT FROM STA. 28+00 TO 29+65 ON DOUBLEMOCKS ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL

ZATO TO RELOCATE TO SCSI TO BE TIE IN AFTER CLEARING/GRADING IS COMPLETE.

RT SIDE UNDERGROUND TELECOM RELOCATION SEQUENCE: VERIZON > COMPORIUM > LUMEN > CHARTER

PHASE 3 UTILITY RELOCATIONS NOTES:

COMPORIUM TO RELOCATE BOTH SIDES AFTER CLEARING EFFORTS.

YEC TO RELOCATE ON LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE.

CHARTER AND VERIZON WILL FOLLOW YEC RELOCATIONS.

ZATO TO RELOCATE ON LT SIDE TO GOLD HILL AFTER CLEARING EFFORTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U9

MATCH LINE STA. 31+00.00 S-1726 (GOLD HILL ROAD) SEE SHEET NO. U19

MATCH LINE STA. 50+00.00 SEE SHEET NO. U8

MATCH LINE STA. 65+00.00 SEE SHEET NO. U10

MATCH LINE STA. 12+50.00 US 21 BUSINESS SEE SHEET NO. U20

HORIZ 50 0 50 100 feet
VERT 10 0 10 20 feet

US 21 (N HWY 21 BYPASS)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

HIGH POINT
STA. 62+65.06
ELEV. = 642.15

(+) 2.84% (-) 1.29%

FINISHED GRADE

EXISTING GRADE

(+80) 636.69 VPC

(+40) 641.03 VPT

VPI = 61+60.00
Elev. = 644.63
SSD = 541'
K = 136
560' V.C.

670	660	650	640	630	620	610	600	590	580

50+00	51+00	52+00	53+00	54+00	55+00	56+00	57+00	58+00	59+00	60+00	61+00	62+00	63+00	64+00	65+00
611.20 611.74	612.54 613.16	613.95 614.57	615.41 615.99	616.86 617.41	618.28 618.83	619.67 620.25	621.05 621.66	622.41 623.08	623.84 624.50	625.26 625.92	626.71 627.34	628.19 628.75	629.63 630.17	631.06 631.59	632.48 633.01	633.92 634.42	635.32 635.84	636.68 637.25	637.91 638.50	638.98 639.57	639.79 640.45	640.45 641.15	640.96 641.67	641.32 642.00	641.32 642.14	641.50 642.11	641.31 641.89	640.92 641.48	640.39 640.90	639.71 640.25

PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM STATION 12+00 SB AND UNDERLINE ROUGH GRADING FOR NEW ALIGNMENT FOR COLD HILL

FEC WILL NEED FILL OPERATIONS TO BE COMPLETED PRIOR TO RELOCATIONS TO AND BATTER TO BEGIN RELOCATIONS

ZAYO TO INSTALL UG LINE ON LT SIDE FROM STA. 65+00 TO STA. 80+00 TO EXISTING TIE POINT ON EXISTING SCSC

RT SIDE UNDERGROUND TELECOM RELOCATION SEQUENCE COMPORIUM > LUMEN > CHARTER

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U10

MATCH LINE STA. 65+00.00 SEE SHEET NO. U9

MATCH LINE STA. 80+00.00 SEE SHEET NO. U11

MATCH LINE STA. 17+00.00 OLD NATION ROAD SEE SHEET NO. 20

HORIZONTAL 50 0 50 100 feet

VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

VPI = 69+00.00
Elev. = 635.10
K = 180
550' V.C.

(+ 25) 638.64 VPC

(+ 75) 639.95 VPT

LOW POINT
STA. 68+57.13
ELEV. = 637.15

(-) 1.29%

(+) 1.76%

FINISHED GRADE

EXISTING GRADE

(+) 1.76%

1.22%

(+ 10) 649.39 VPC

VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.

	65+00	66+00	67+00	68+00	69+00	70+00	71+00	72+00	73+00	74+00	75+00	76+00	77+00	78+00	79+00	80+00
EXISTING	639.71	639.00	638.29	637.61	637.07	636.68	636.53	636.50	636.59	636.91	637.36	637.92	638.49	639.08	639.69	640.40
FINISHED	640.25	639.61	638.96	638.34	637.83	637.47	637.24	637.15	637.20	637.39	637.71	638.18	638.78	639.53	640.39	641.27

	641.12	641.84	642.61	643.37	644.30	645.42	646.54	647.62	648.65	649.50	650.23	650.72	651.07	651.33	651.42
EXISTING	642.16	643.04	643.92	644.80	645.68	646.57	647.45	648.33	649.21	650.05	650.74	651.27	651.66	651.91	652.00
FINISHED															

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PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM GOLD MILL TO ZZ+78 AND CUT FROM 37+ 22+50 TO 24+66 OR USED INCLUDES ROUGH GRADING FOR NEW ALIGNENT FOR COLD HILL

ZAYO TO INSTALL UNDERGROUND 12- FEET DEEP TO AVOID PROPOSED DRAINAGE ACTIVITIES AND CUT OF EXISTING AT STATION 85+00 AND 7- FEET DEEP UNTIL STATION 98+00 WHERE THERE IS BETTER SEPARATION.

COMPORIUM TO INSTALL UNDERGROUND 12- FEET DEEP TO AVOID PROPOSED DRAINAGE ACTIVITIES AND CUT OF EXISTING AT STATION 85+00 AND 7- FEET DEEP UNTIL STATION 98+00 WHERE THERE IS BETTER SEPARATION.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	U11

MATCH LINE STA. 80+00.00 SEE SHEET NO. U10

MATCH LINE STA. 95+00.00 SEE SHEET NO. U12

MATCH LINE STA. 12+00.00
J3-107 (REGENT PARKWAY)
SEE SHEET NO. U25

NEW TEMPORARY CONSTRUCTION EASEMENT

CONTROL OF ACCESS EASEMENT DB

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

HIGH POINT
STA. 80+05.77
ELEV. = 652.00

(-) 1.22%

(+10) 650.75 VPT

VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.

VPI = 87+85.00
Elev. = 643.75
K = 82
280' V.C.

(+45) 645.46 VPC

LOW POINT
STA. 87+45.14
ELEV. = 644.85

(-) 1.22%

(+) 2.19%

(+25) 646.81 VPT

FINISHED GRADE

EXISTING GRADE

	80+00	81+00	82+00	83+00	84+00	85+00	86+00	87+00	88+00	89+00	90+00	91+00	92+00	93+00	94+00	95+00
EXISTING	652.00	651.94	651.73	651.38	650.87	650.27	649.66	649.05	648.44	647.83	647.22	646.61	646.00	645.40	644.97	644.85
FINISHED	652.00	651.45	651.29	650.96	650.46	648.92	648.41	648.56	647.91	647.30	646.67	646.02	645.38	644.81	644.42	644.34
EXISTING	644.85	644.97	645.03	645.51	646.30	647.36	648.45	649.55	650.64	651.74	652.83	653.92	655.02	656.11	657.21	658.30	659.39
FINISHED	644.34	644.51	644.93	645.74	646.69	647.60	648.87	650.15	651.19	652.26	653.24	654.38	655.54	656.70	657.83	658.88	

700 690 680 670 660 650 640 630 620 610

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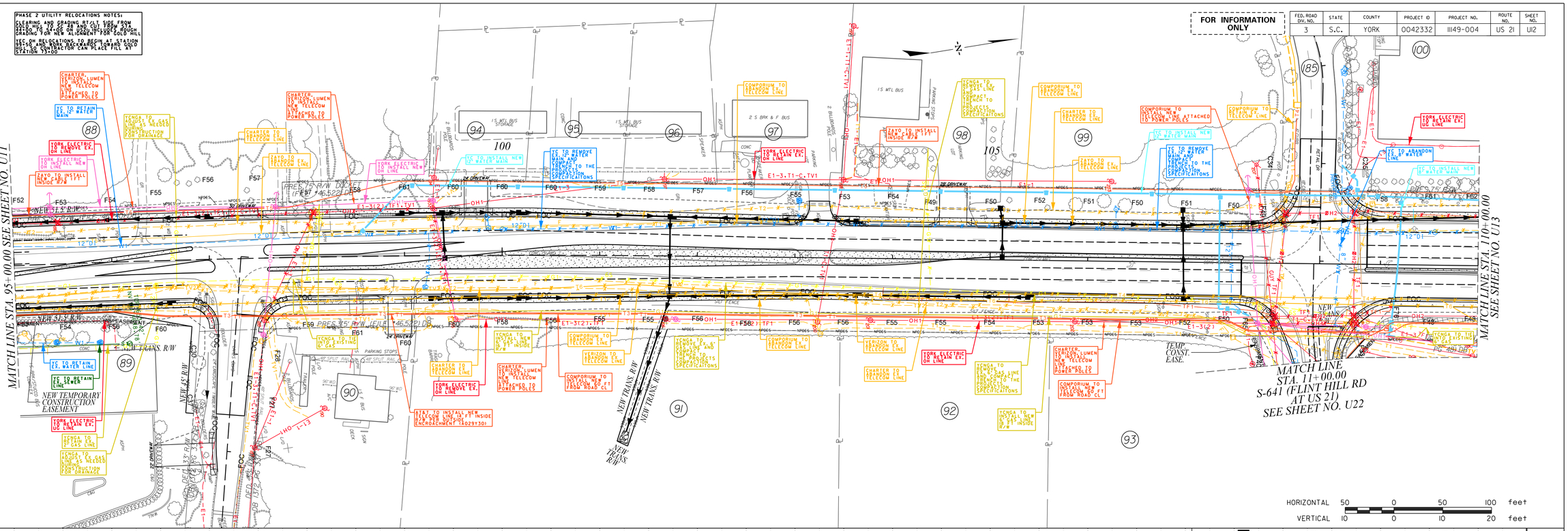
PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL ST. TO 30' NW AND CUT FROM STA. 102+00 TO STA. 97+00 OR DEPENDING ON ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL

TEC-DH RELOCATIONS TO BEGIN AT STATION 99+50 AND WORK BACKWARDS TOWARD GOLD HILL. TO CONTRACTOR CAN PLACE FILL BY STATION 73+00

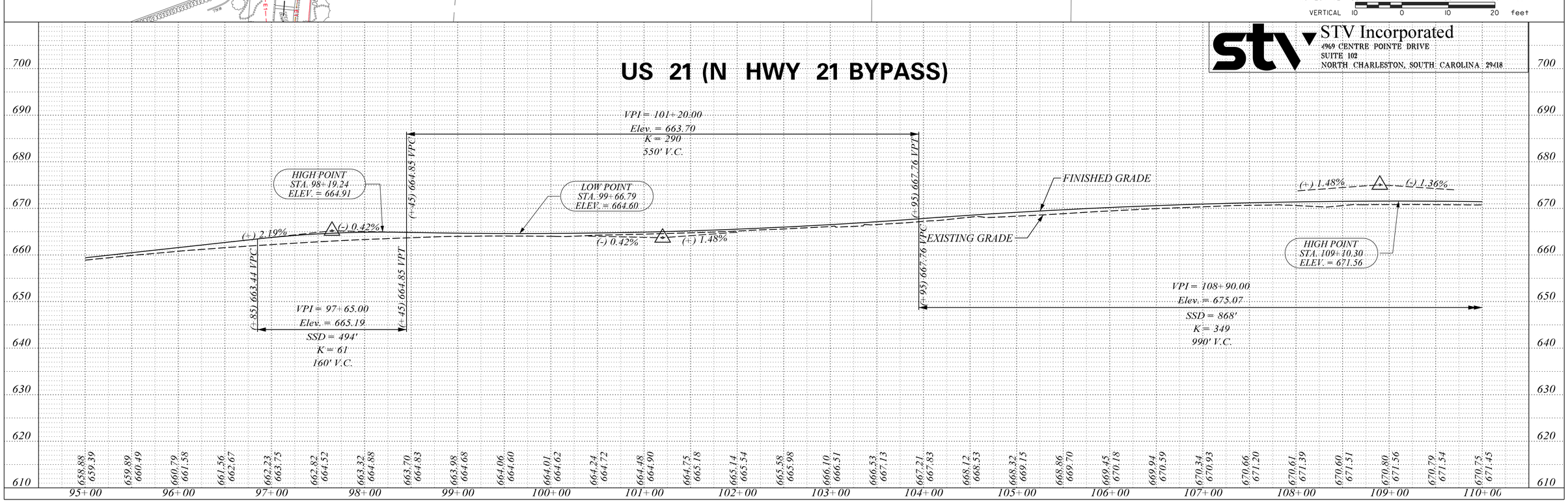
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U12



STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

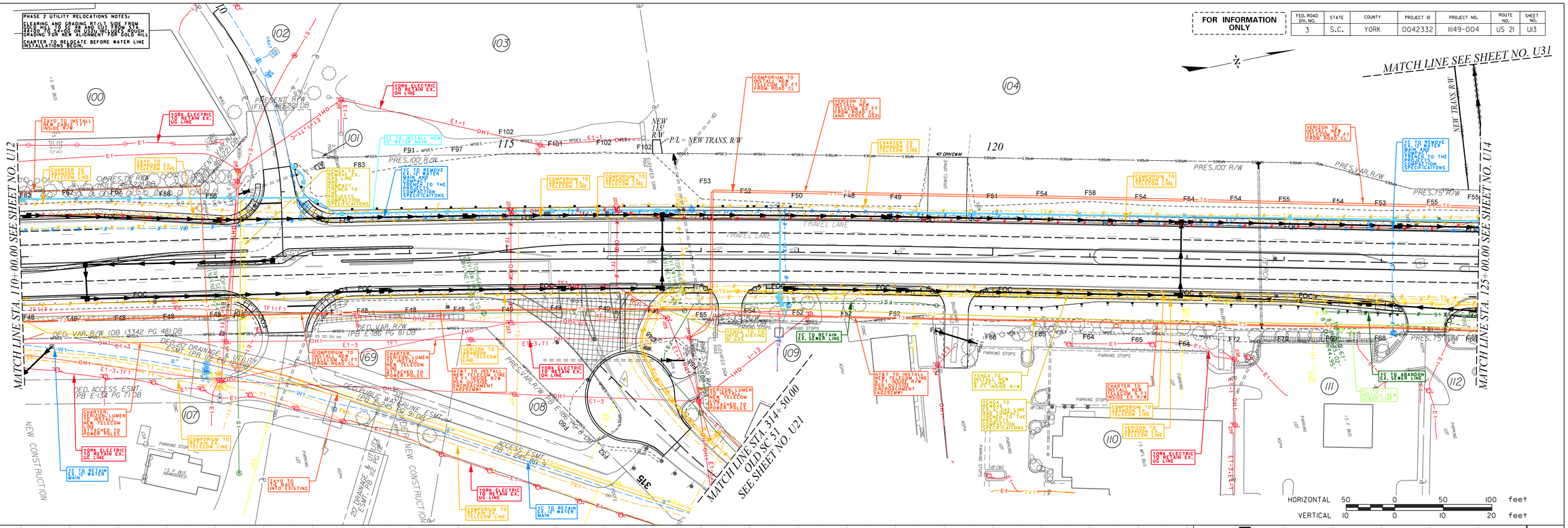


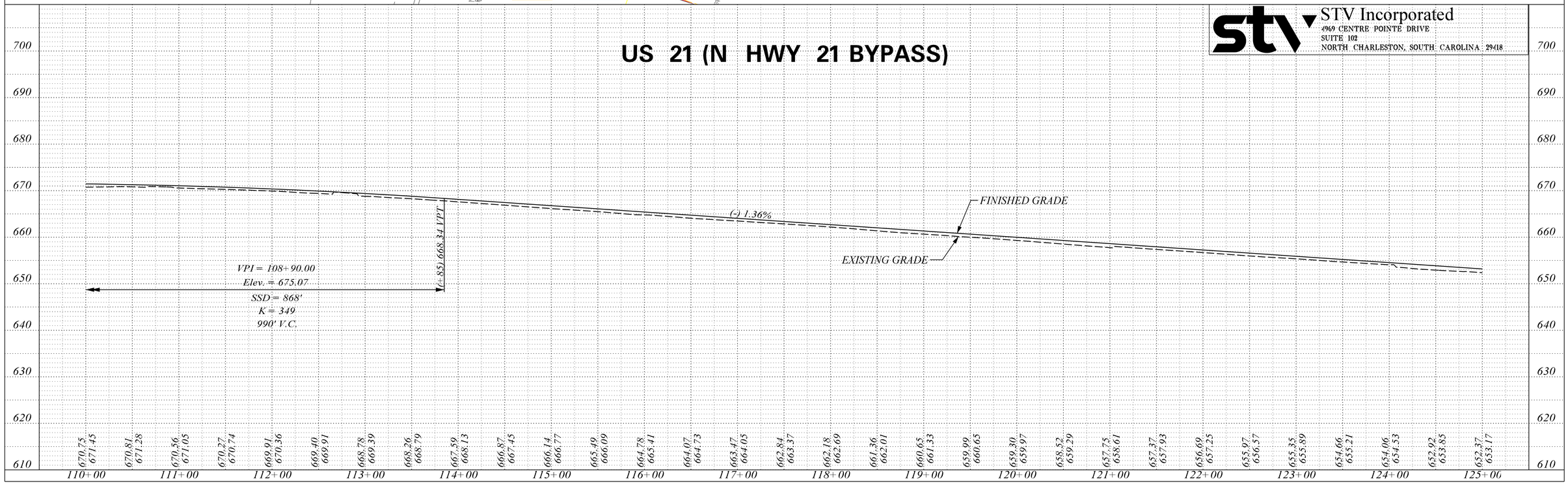
PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING AT/LT SIDE FROM STA. 110+00 TO STA. 120+00 (OLD STORY SW) GRADING FOR NEW ALIGNMENT FOR ZOLO HILL

CHARTER TO RELOCATE BEFORE WATER LINE INSTALLATIONS BEGIN.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U13





STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

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FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U14

PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING AT/AT SIDE FROM 200'RT @ STA 125+00 TO 300'LT @ STA 134+00 TO BE DONE WITH MAIN GRADING FOR NEW ALIGNMENT FOR SOLD ROW.

CHARTER TO RELOCATE BEFORE WATER LINE INSTALLATIONS BEGIN.

MATCH LINE SEE SHEET NO. U31

MATCH LINE STA. 125+ 00.00 SEE SHEET NO. U13

MATCH LINE STA. 298+ 50.00 SEE SHEET NO. U15

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

VPI = 128+30.00
Elev. = 648.68
K = 92.1
135' V.C.
(+ 62.5) 649.60 VPC
(+ 97.5) 647.86 VPT
(-) 1.36%
(-) 1.21%
EXISTING GRADE
FINISHED GRADE
SURVEY STA.134+33.25
END PROJECT ID 0042332
US 21 (N HWY 21 BYPASS)
MATCH EXISTING PAVEMENT
ELEV = 641.36'

652.37 653.17
651.97 652.49
650.96 651.81
650.26 651.13
649.61 650.45
649.03 649.77
648.38 649.10
647.84 648.45
647.27 647.83
646.69 647.23
646.17 646.62
645.66 646.01
645.09 645.41
644.60 644.80
643.95 644.19
643.03 643.59
643.49 642.98
642.91 642.37
642.32 641.77
641.71

125+00 126+00 127+00 128+00 129+00 130+00 131+00 132+00 133+00 134+00

SC 51

EXISTING GRADE
(-) 0.44%
FINISHED GRADE
SURVEY STA.296+15.72
BEGIN PROJECT ID 0042332
RELOC. SC 51 (HWY 51)
MATCH PROPOSED US21 PAVEMENT
ELEV. = 646.66'

647.96 650.68 646.51 651.42 646.29 651.45 646.07 651.36 645.85 651.42 645.63

296+00 297+00 298+00

690 680 670 660 650 640 630 620 610 600

PROLINE.DGN

PHASE 1 UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCSI AND FLINT HILL ROAD (NEW & EXISTING) INCLUDE ROUGH GRADING NEW ALIGNMENTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U15

MATCH LINE STA. 298+50.00 SEE SHEET NO. U14

MATCH LINE STA. 303+00.00 OLD SC 51 SEE SHEET NO. U21

MATCH LINE STA. 313+50.00 SEE SHEET NO. U16

-N-

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

SC 51

(+60) 644.71 VPC

(+60) 639.06 VPT

VPI = 302+10.00
Elev. = 644.05
SSD = 524'
K = 104
300' V.C.
DS > 45 MPH

T(-)0.44%

(-)3.33%

FINISHED GRADE

EXISTING GRADE

660 650 640 630 620 610 600 590 580 570

651.42 645.63 | 650.88 645.41 | 649.95 645.19 | 648.19 644.97 | 647.07 644.75 | 646.46 644.46 | 645.33 643.93 | 643.35 643.15 | 642.10 642.14 | 639.64 640.89 | 637.65 639.39 | 635.32 637.73 | 635.52 636.07 | 633.90 634.41 | 632.20 632.75 | 630.65 631.08 | 629.04 629.42 | 627.39 627.76 | 625.63 626.10 | 623.81 624.43 | 622.08 622.77 | 620.46 621.11 | 618.80 619.45 | 617.13 617.78 | 615.50 616.12 | 613.85 614.46 | 612.28 612.80 | 610.70 611.13 | 609.00 609.47 | 607.34 607.81 | 605.69 606.15

299+00 300+00 301+00 302+00 303+00 304+00 305+00 306+00 307+00 308+00 309+00 310+00 311+00 312+00 313+00

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

PHASE I UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCS1 AND FLINT HILL ROAD NEW & EXISTING INCLUDE ROUGH GRADING NEW ALIGNMENTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U16

MATCH LINE STA. 313+50.00 SEE SHEET NO. U15

MATCH LINE STA. 29+00.00
S-48 (SPRINGHILL FARM ROAD RELOC.)
SEE SHEET NO. U23

MATCH LINE STA. 17+00.00
S-641 (FLINT HILL AT SC 51)
SEE SHEET NO. U22

MATCH LINE STA. 328+50.00 SEE SHEET NO. U17

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

VPI = 316+15.00
Elev. = 597.33
K = 84
490' V.C.
DS = 45 MPH

(+ 70) 605.48 VPC

(- 60) 603.45 VPT

LOW POINT
STA. 316+49.93
ELEV. = 600.83

(-) 3.33%

(+) 2.50%

EXISTING GRADE

FINISHED GRADE

6'x6' EXISTING BOX CULVERT
(EP-6) STA. = 316+23
INV. ELEV. = 589.30

HYDROLOGY DATA:
D.A.= 0.06sq.mi.= 38.5 ac.
Q50 = 53 cfs
Vel.= 8.53 ft/sec
50Year H.W. Elev.= 595.22 ft.
Including 4.0 ft. Headwater
Q100 = 59 cfs
Vel = 8.99 ft/sec
100 Year H.W. Elev. = 595.37 ft.
Including 4.2 ft. Headwater
OVERTOPPING FLOOD:
Q = 271.31 cfs
Probability = less than 0.2%

(+ 85) 614.05 VPC

(+) 2.50%

(-) 0.31%

HIGH POINT
STA. 328+18.13
ELEV. = 620.70

VPI = 325+85.00
Elev. = 621.54
SSD = 684'
K = 214
600' V.C.
DS > 45 MPH

650 640 630 620 610 600 590 580 570 560

605.69 606.15 | 604.05 604.54 | 602.44 603.20 | 600.99 602.16 | 599.92 601.42 | 599.34 600.98 | 599.20 600.83 | 599.59 600.98 | 600.40 601.42 | 601.55 602.16 | 602.76 603.20 | 603.98 604.45 | 605.22 605.69 | 606.46 606.94 | 607.76 608.19 | 609.02 609.44 | 610.26 610.68 | 611.55 611.93 | 612.84 613.18 | 614.04 614.42 | 615.18 615.58 | 616.20 616.61 | 617.09 617.53 | 617.83 618.34 | 618.52 619.02 | 619.05 619.59 | 619.50 620.04 | 619.80 620.38 | 620.00 620.60 | 620.05 620.70 | 620.00 620.68

314+00 315+00 316+00 317+00 318+00 319+00 320+00 321+00 322+00 323+00 324+00 325+00 326+00 327+00 328+00

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U17

FOR INFORMATION ONLY

PHASE I UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCSL AND FLINT HILL ROAD NEW & EXISTING INCLUDE ROUGH GRADING NEW ALIGNMENTS

MATCH LINE STA. 322+50.00 SEE SHEET NO. U16

MATCH LINE STA. 328+50.00 SEE SHEET NO. U16

MATCH LINE STA. 01+50.00 ANDREW L. TUCKER SEE SHEET NO. U23

S-48 (SPRINGHILL FARM ROAD) CULDE-SAC SEE SHEET NO. U24

NEW TRANS. R/W & OFFSET OF EOP

TEMP. CONST. EASE.

NEW TRANS. R/W 8' OFFSET OF EOP

NEW 55' R/W

NEW 45' R/W

PRES. 33' R/W

PRES. 40' R/W

PRES. 60' R/W

PRES. 80' R/W

PRES. 100' R/W

PINEVILLE-ROCK HILL RD

MCCLELLANVILLE COURT

YORK ELECTRIC TO INSTALL NEW DH LINE

WINDSTREAM TO ADJUST EXISTING FACILITIES DURING CONSTRUCTION AS NEEDED.

ZAYO TO INSTALL NEW TELECOM 1" FT INSIDE R/W

YC TO RETAIN EX. W WATER LINE

VERIZON TO INSTALL NEW TELECOM 2" FT ATTACHED TO POWER POLES

COMPORIUM TO INSTALL NEW TELECOM 1" FT INSIDE R/W

LUMEN TO ABANDON EX. TELECOM LINE

VERIZON TO ABANDON EX. TELECOM LINE

YORK ELECTRIC TO REMOVE EX. OH LINE

CHARTER TO ADJUST EXISTING LINE TO ACCOMMODATE CONFLICT WITH PROPOSED DRAINAGE

ZAYO TO INSTALL NEW TELECOM HANDHOLE

ZAYO TO TIE BACK TO EXISTING

VERIZON LUMEN, CHARTER TO INSTALL NEW TELECOM LINE ATTACHED TO POWER POLES

VERIZON CHARTER, LUMEN TO INSTALL NEW TELECOM LINE ATTACHED TO POWER POLES

VERIZON TO INSTALL NEW TELECOM 2" FT INSIDE R/W

CHARTER TO ABANDON EX. TELECOM LINE

YC TO RETAIN EX. SEWER LINE

YC TO ABANDON EX. W WATER LINE

YC TO RETAIN EX. W WATER LINE

YC TO ABANDON EX. W WATER LINE

YORK ELECTRIC TO INSTALL NEW DH LINE

FEND UNKNOWN

330

335

340

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

VPI = 331+50.00
Elev. = 619.77
K = 185
350' V.C.
DS > 45 MPH

(+75) 620.32 VPC

(+85) 620.60 VPT

LOW POINT
STA. 330+32.96
ELEV. = 620.23

(-) 0.31%

(+) 1.58%

(+35) 622.53 VPT

(+) 1.58%

(-) 1.30%

FINISHED GRADE

HIGH POINT
STA. 335+81.55
ELEV. = 624.63

(+35) 622.69 VPC

VPI = 335+60.00
Elev. = 626.24
SSD = 600'
K = 156
450' V.C.
DS > 45 MPH

(+85) 623.31 VPT

EXISTING GRADE

SURVEY STA.340+10.00
END PROJECT ID 0042332
SC 51 (HWY 51)
MATCH EXISTING PAVEMENT
ELEV = 620.38'

660 650 640 630 620 610 600 590 580 570

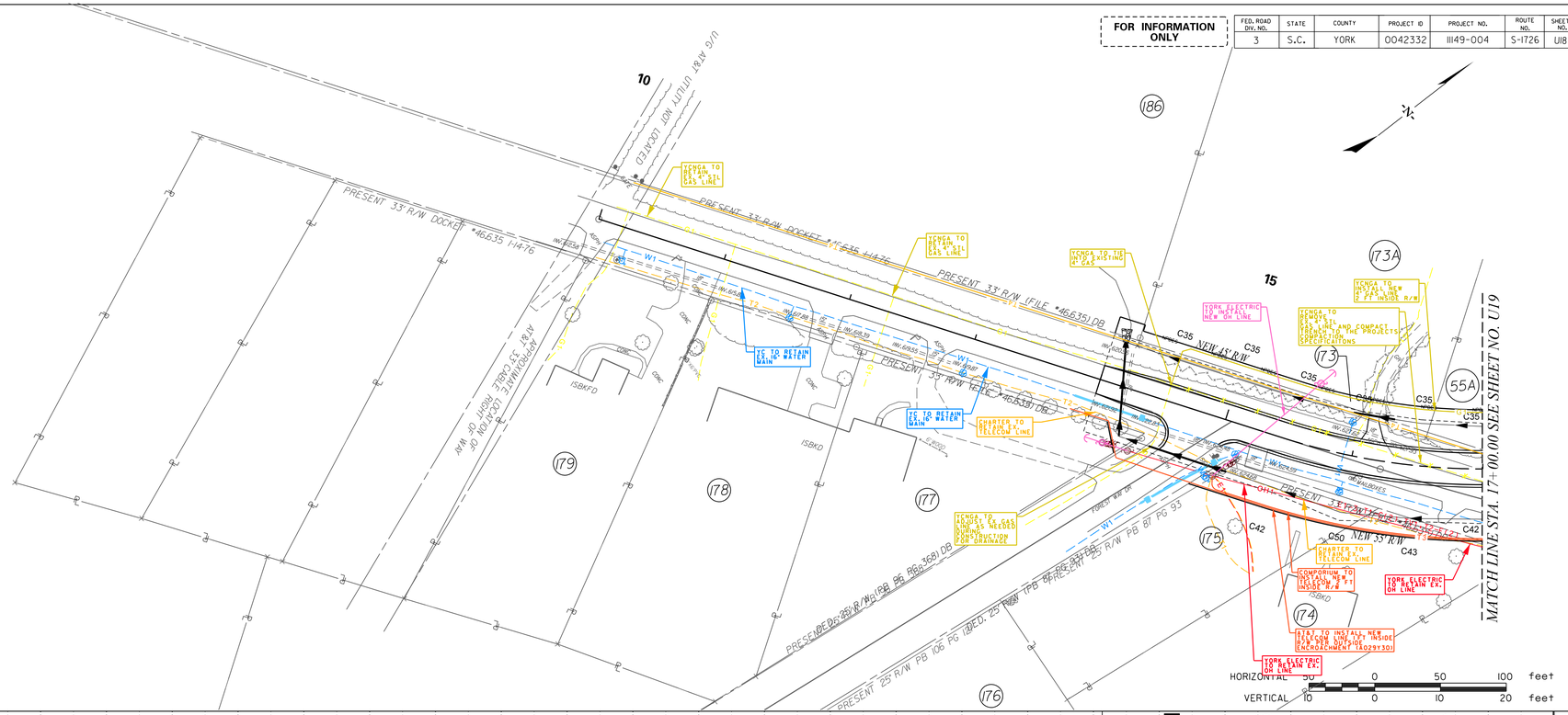
620.00 620.68 | 619.94 620.55 | 619.86 620.40 | 619.80 620.26 | 619.83 620.24 | 619.91 620.35 | 620.11 620.60 | 620.47 620.98 | 620.96 621.50 | 621.64 622.15 | 622.44 622.92 | 623.08 623.58 | 623.57 624.08 | 623.92 624.42 | 624.09 624.60 | 624.09 624.62 | 623.92 624.48 | 623.68 624.18 | 623.32 623.72 | 622.80 623.11 | 622.20 622.46 | 621.60 621.81 | 621.00 621.16 | 620.48 620.51 | 619.98 | 619.35 | 618.68 | 617.95

329+00 330+00 331+00 332+00 333+00 334+00 335+00 336+00 337+00 338+00 339+00 340+00 341+00 342+00

PROLINE.DGN

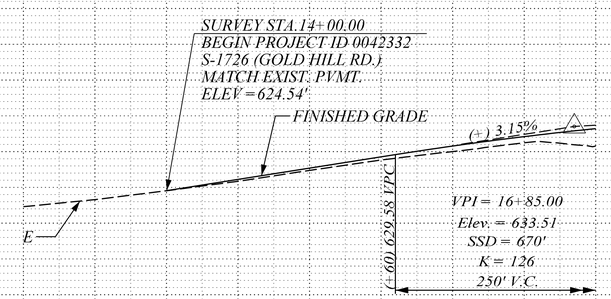
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	S-1726	U18



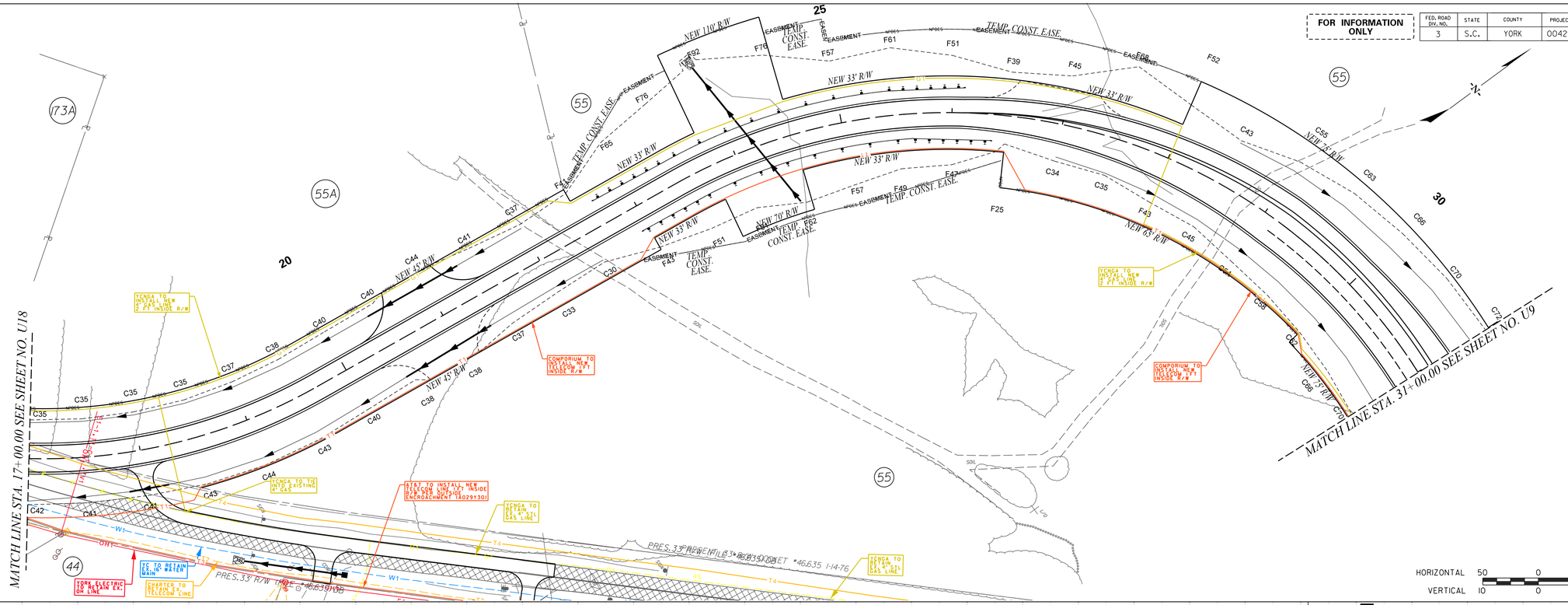
S–1726 (GOLD HILL RD.)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



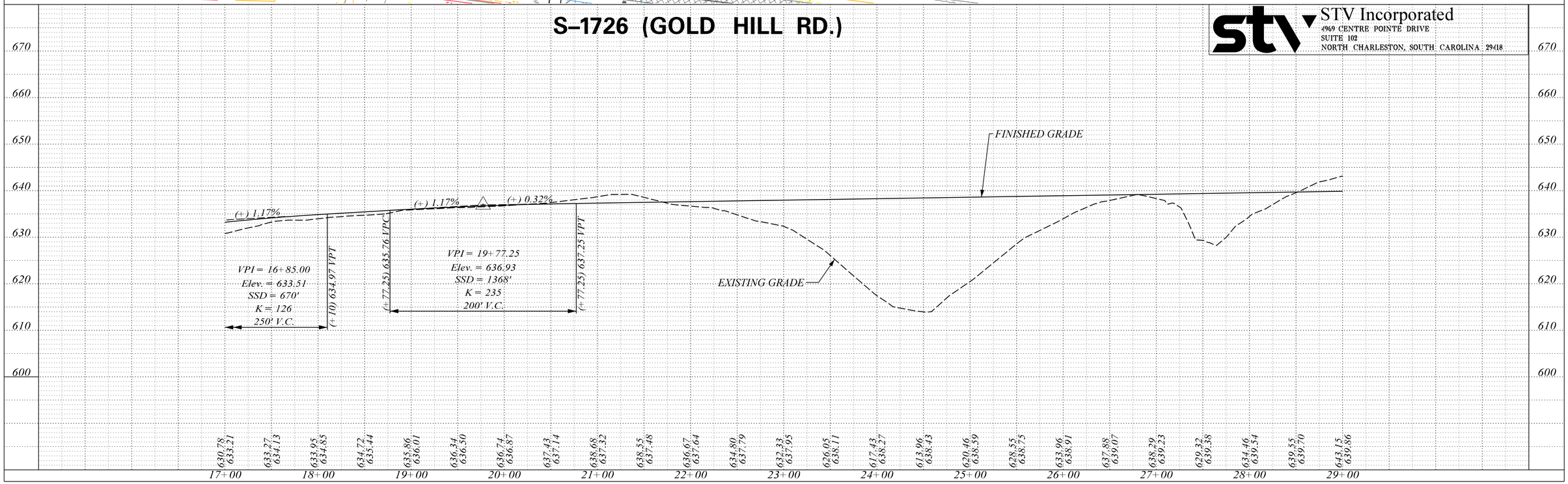
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-1726	U19

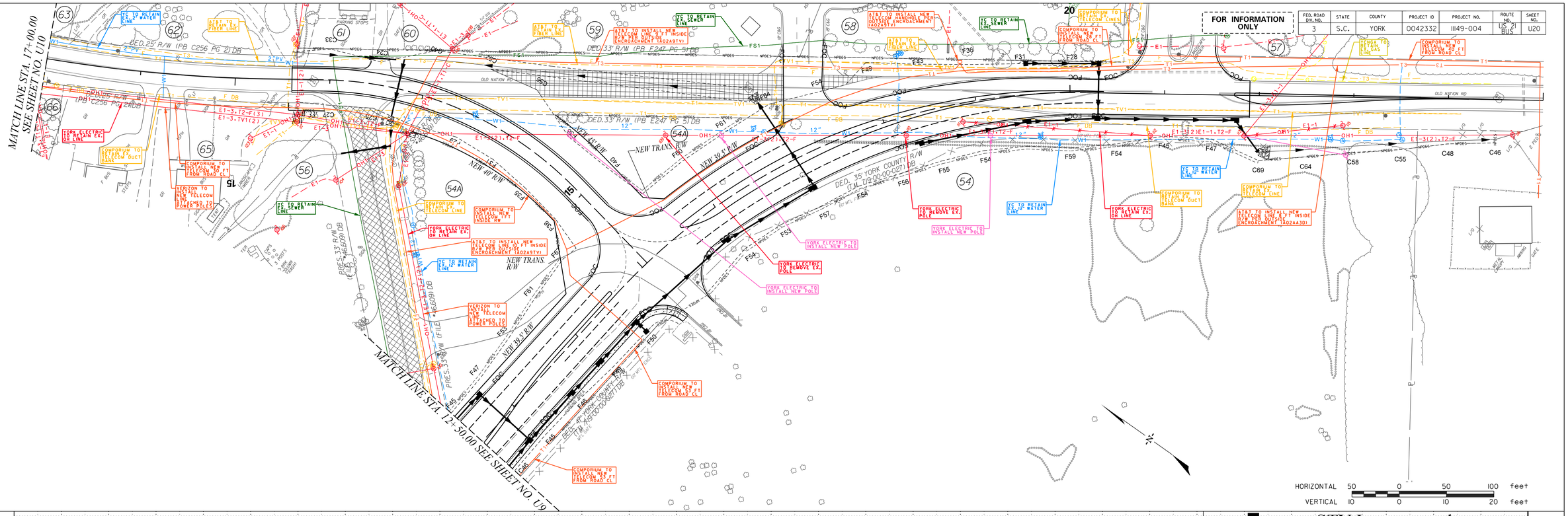


S-1726 (GOLD HILL RD.)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

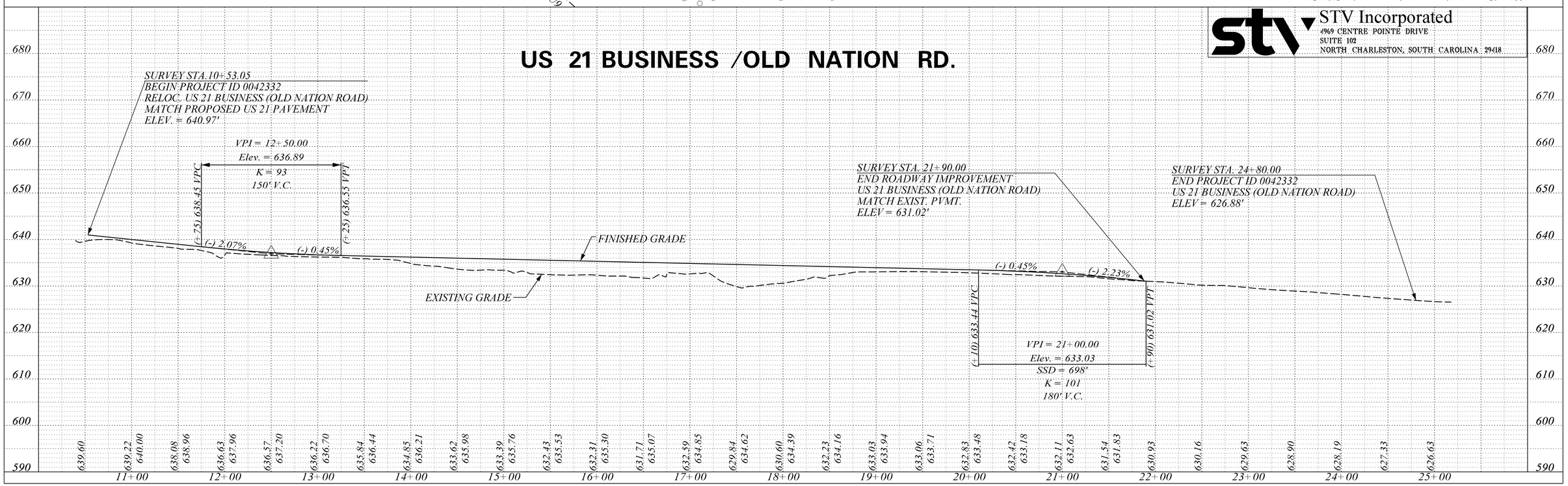


PROLINE.DGN



US 21 BUSINESS /OLD NATION RD.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



PROLINE.DGN

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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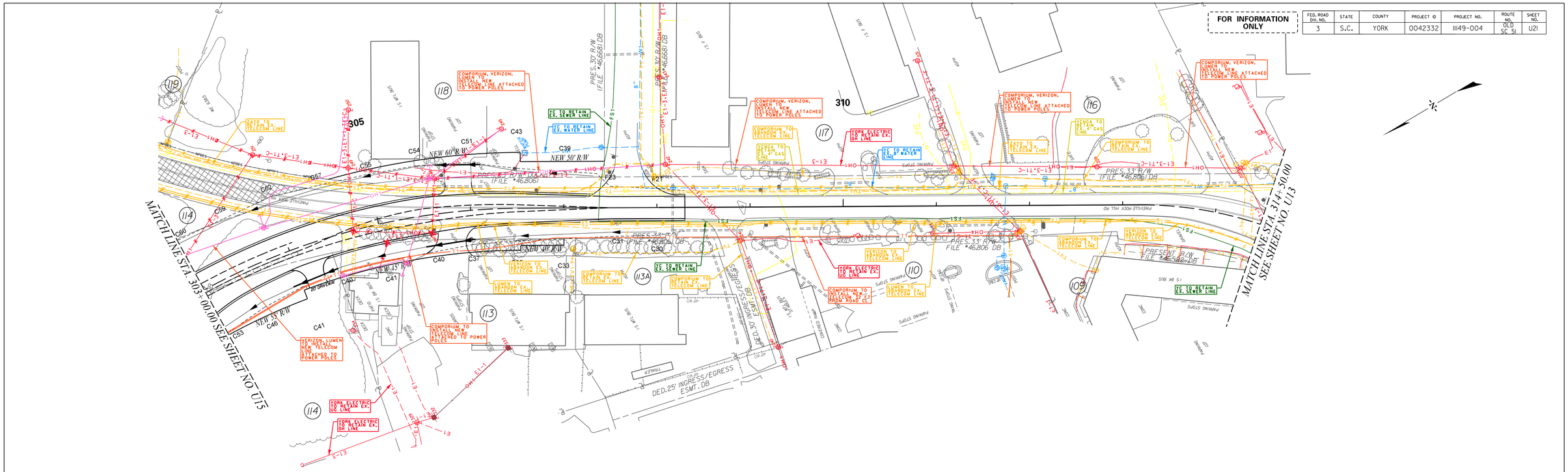
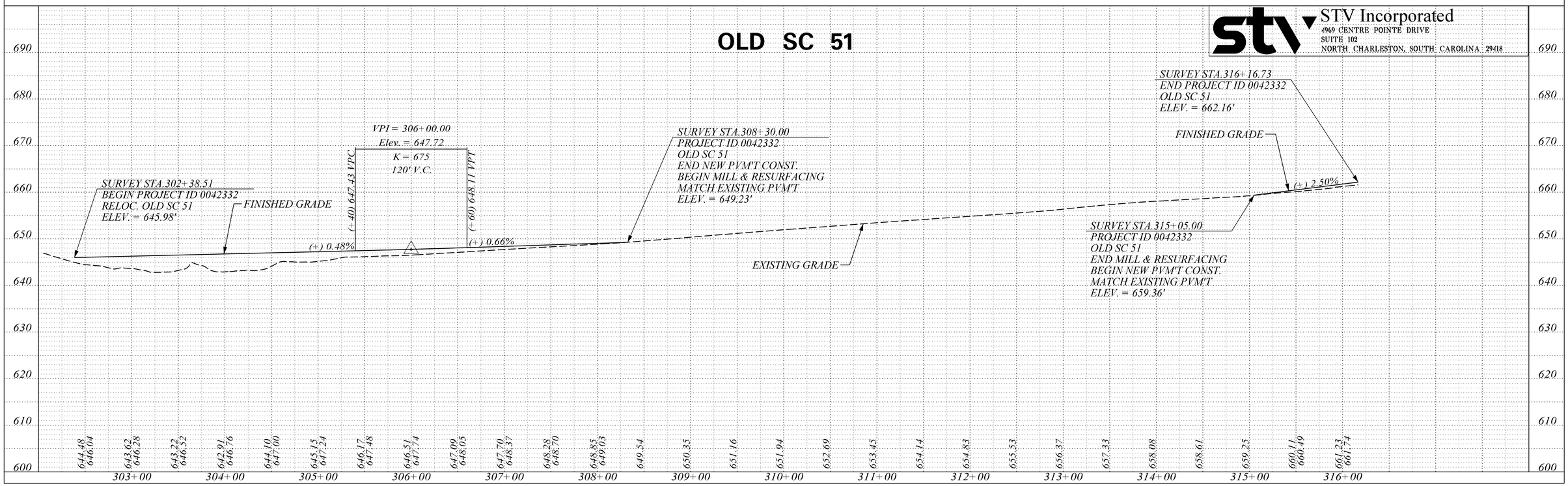


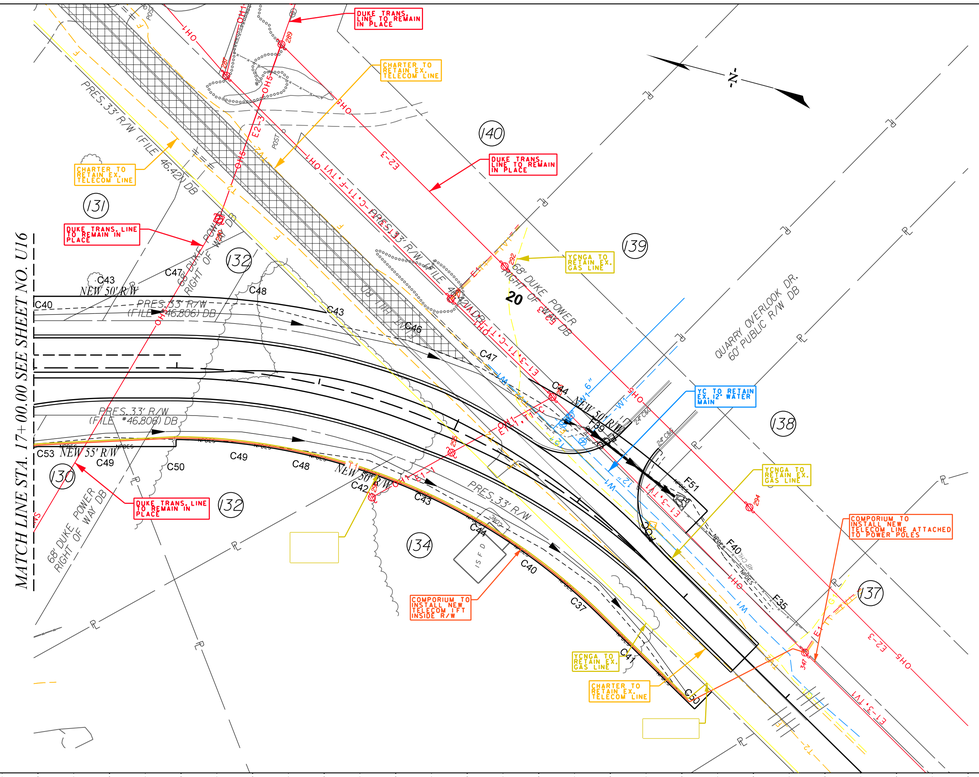


STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

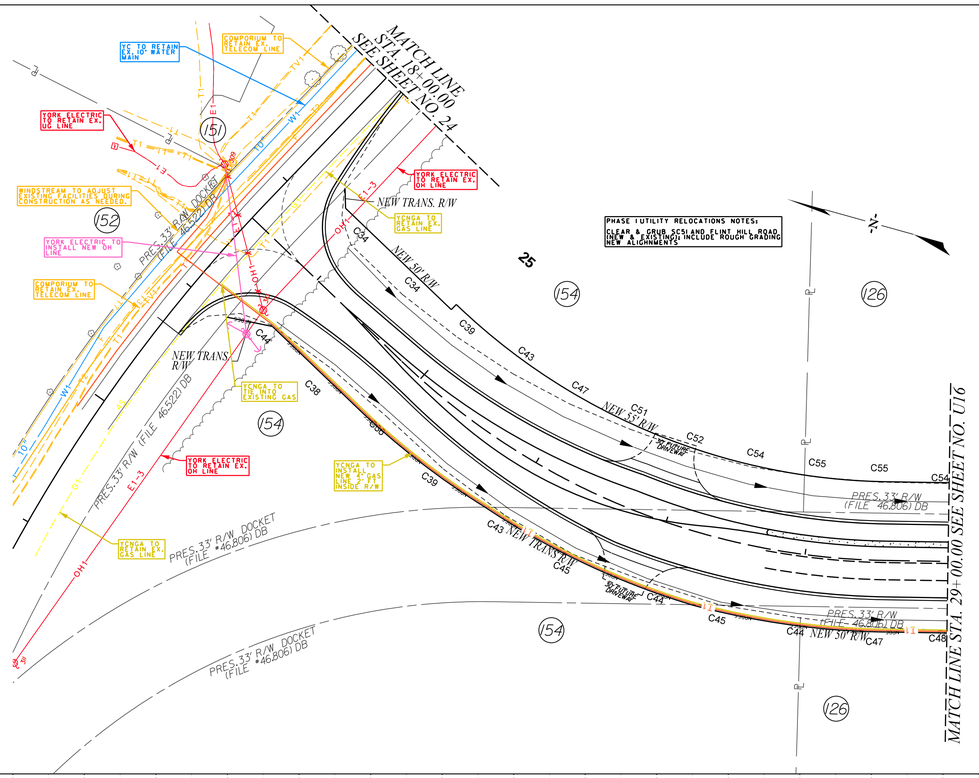
FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-641	U22

FOR INFORMATION ONLY

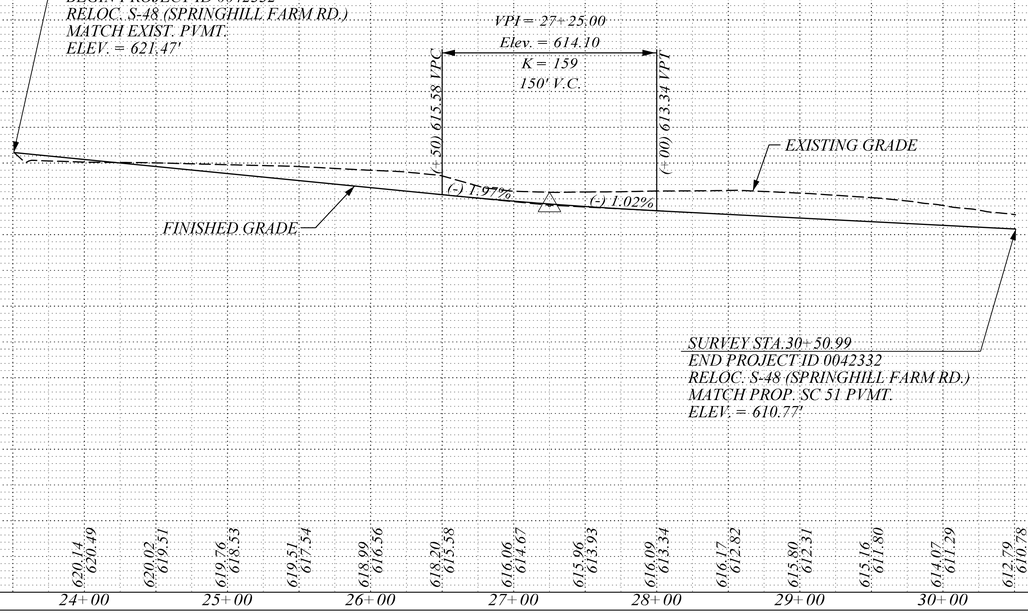


FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-48 S-328	U23

FOR INFORMATION ONLY



S–48 (SPRINGHILL FARM RD. RELOC.)



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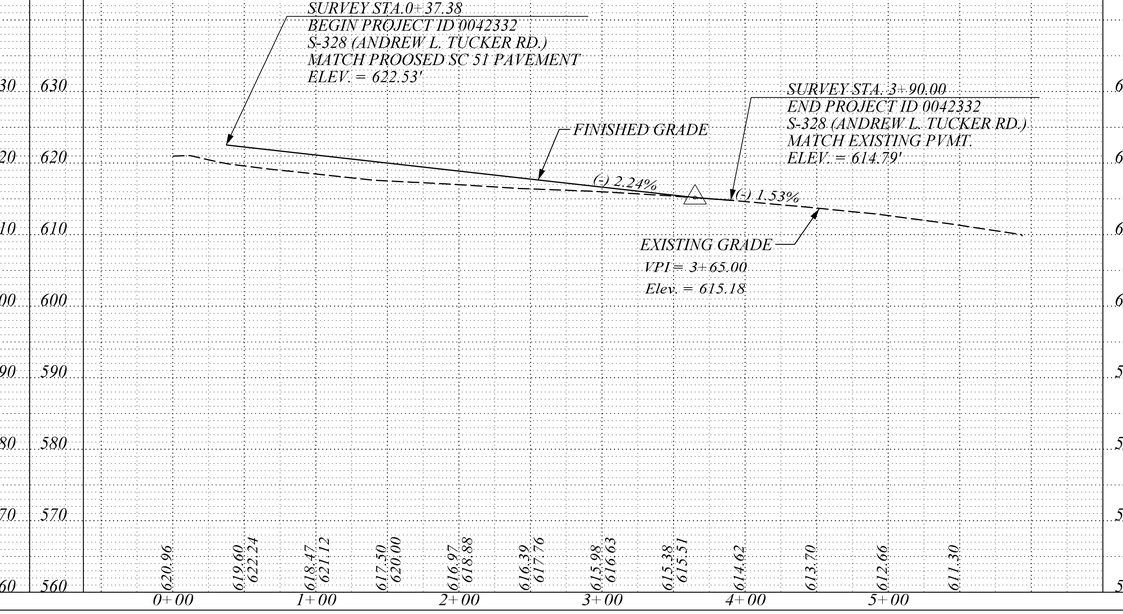

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

FOR INFORMATION ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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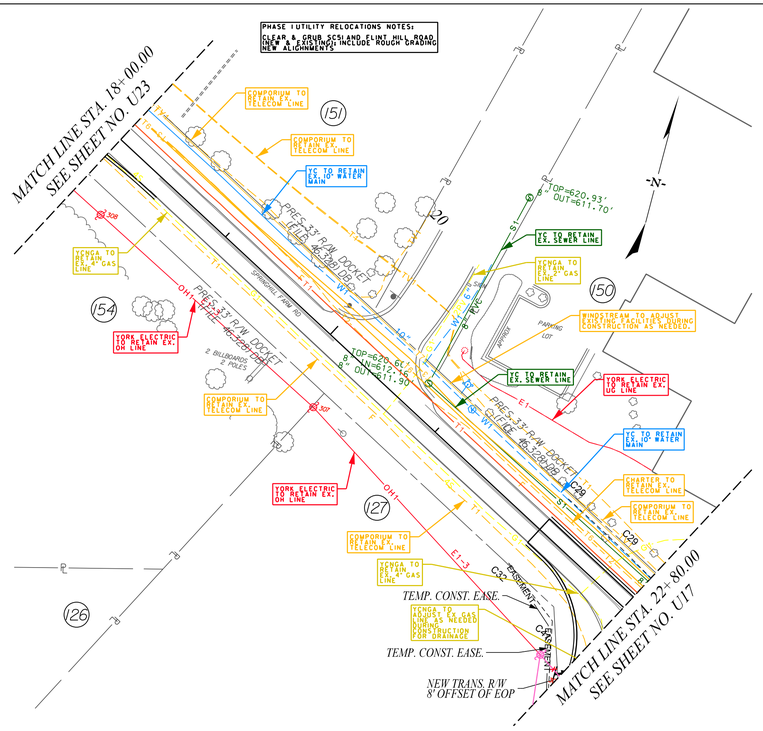
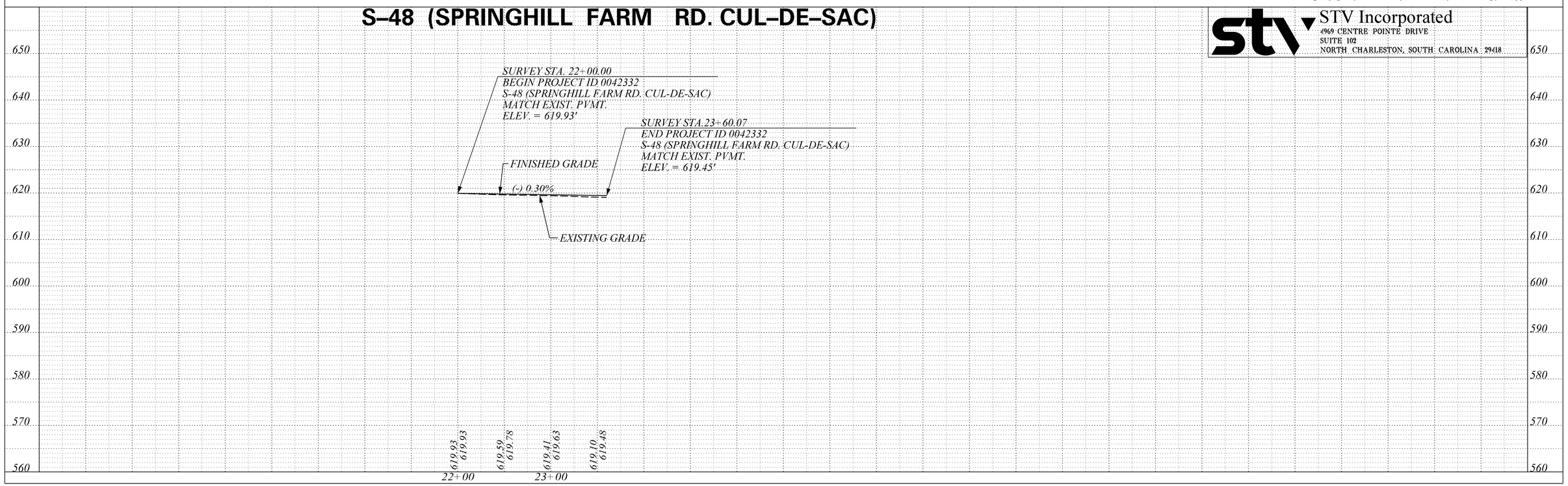


HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S–48 (SPRINGHILL FARM RD. CUL–DE–SAC)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



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FOR INFORMATION ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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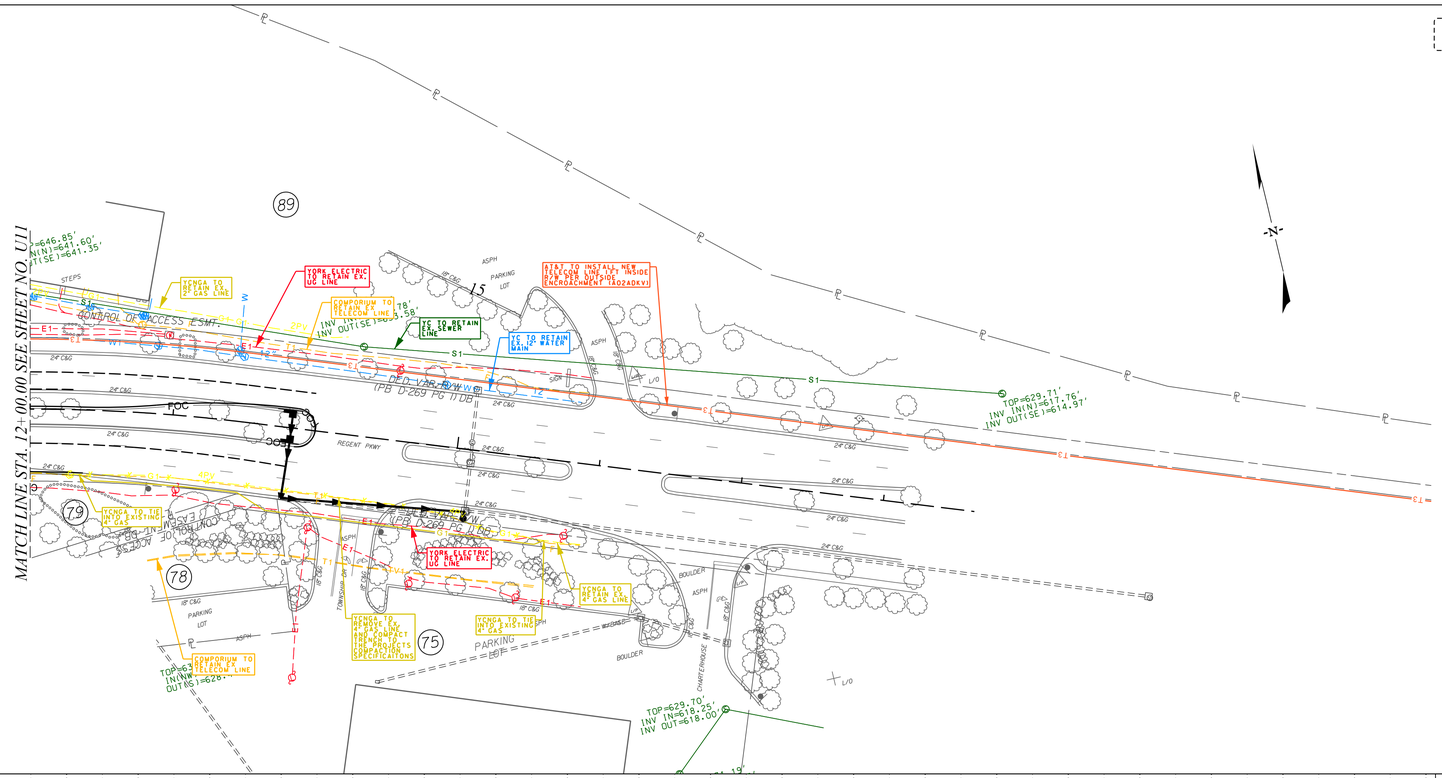
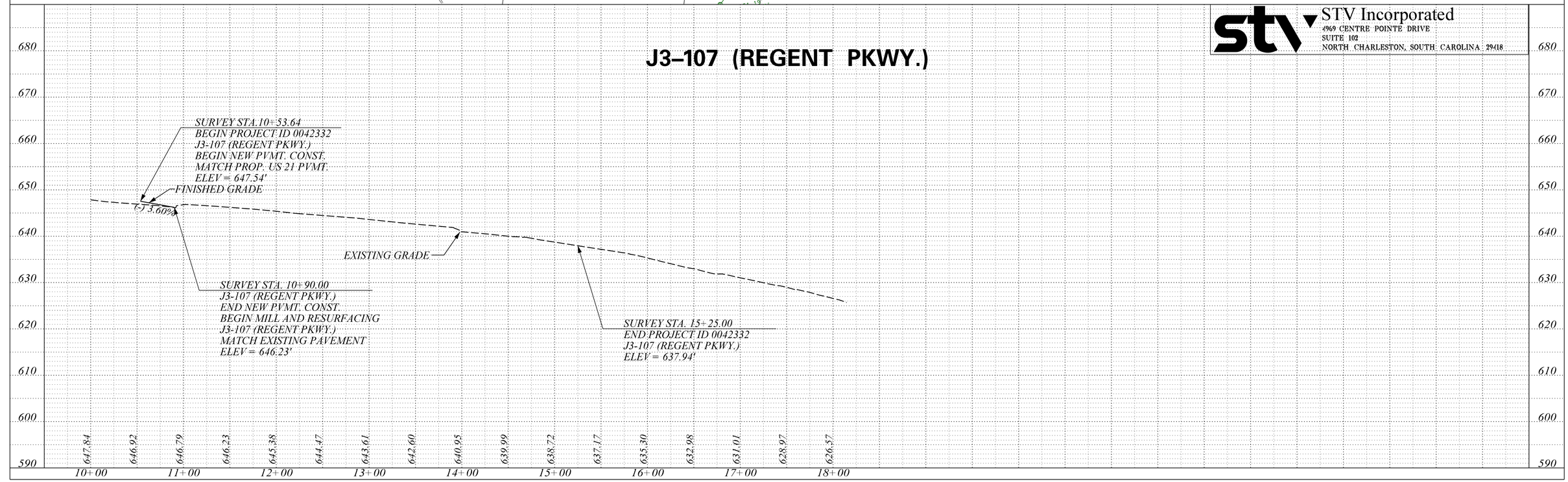


HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

J3–107 (REGENT PKWY.)



PROLINE.DGN

FOR INFORMATION ONLY

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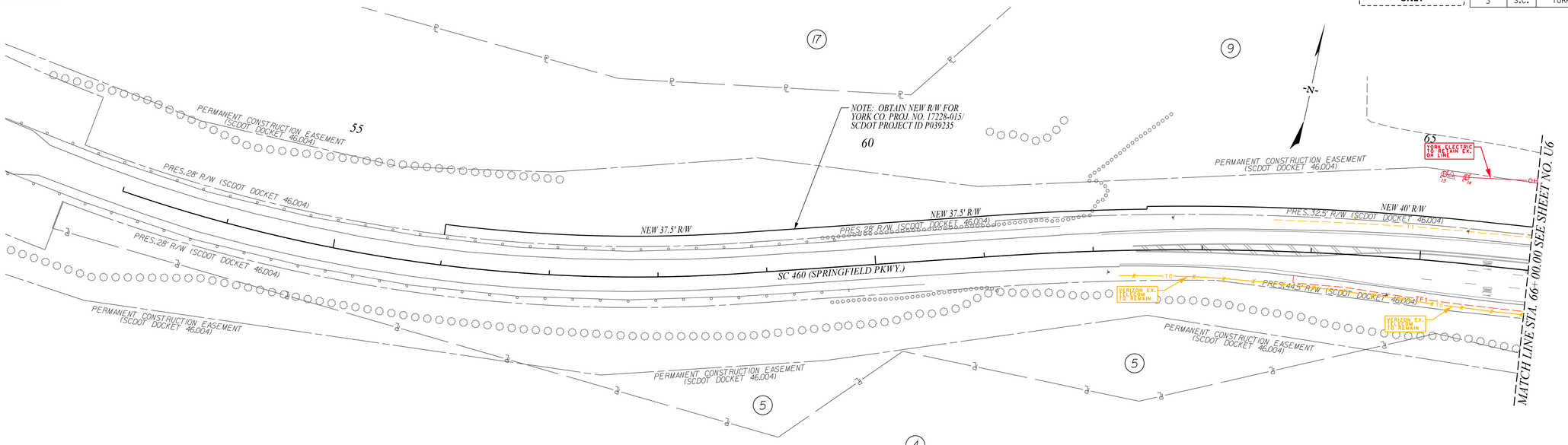
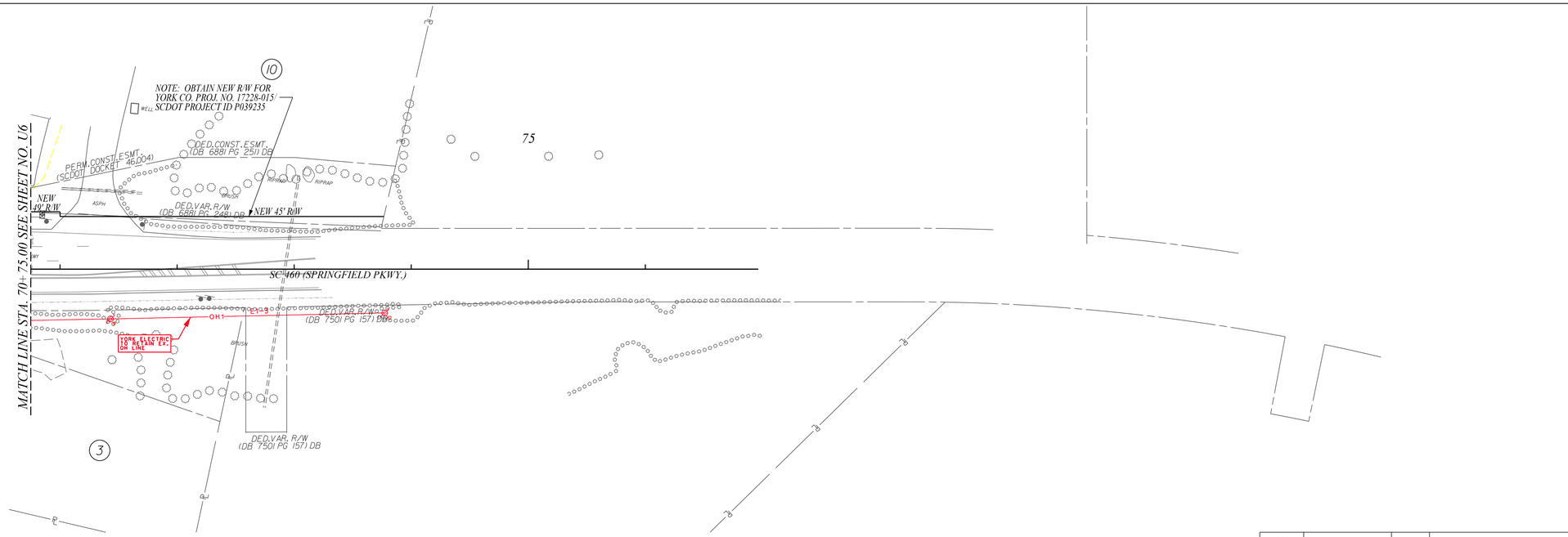




STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

SCALE 1" = 50' RTE. DWG. NO. U30

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3			
2			
1			

SmithA2
S:\Projects\255776\2516776.000\90_CAD Models and Sheets\04_CT_Transportation\Utilities\Utility Plan Sheets & PDFs\UTL_2516776 PLN SHT30.dgn
9/13/2024

October 23, 2024

Steven Moss
Sr. Construction Project Manager - Engineering
York County Government
6 S Congress Street1
York, SC 2975

RE: Project No. P0042332/11149-004 – US21/SC51
York Co: Relocation Package – Comporium

Dear Mr. Moss –

Below you will find a brief description of the proposed work and submittal explanation. Please refer to Comporium's individual plans for details, or this document for plan status.

Scope of Work and Package Contents

Relocation Package

- Utility Agreement
- Detailed Cost Estimate
- Encroachment Permit Application (Applied but not included)
- Relocation Plans and associated U-sheets

Scope of Work Summary

Location	Utility Type	Scope of Work	Cost*
US21	Underground communication	Install new underground communication cables from Sta 14+00 to 135+00	York County
US21	Overhead communication attached to York Electric	Install new overhead cables attached to York Electric poles from Sta 79+00 to 90+00	York County
SC51	Underground communication	Install new underground communication cables from Sta 298+00 to 340+00	York County
SC51	Overhead communication attached to York Electric	Install new overhead cables attached to York Electric poles from Sta 333+00 to 339+00	York County
Gold Hill	Underground communication	Install new underground communication cables from Sta 15+00 to 32+00	York County
Old Nation	Underground communication	Install new underground communication cables from Sta 10+00 to 17+00	York County

US21 Business	Underground communication	Install new underground communication cables from Sta 10+00 to 23+00	York County
Old SC51	Underground communication	Install new underground communication cables from Sta 303+00 to 312+00	York County
Flint Hill	Underground communication	Install new underground communication cables from Sta 17+00 to 22+00	York County
Spring Hill Farm	Underground communication	Install new underground communication cables from Sta 24+00 to 30+00	York County

It is STV's recommendation that this relocation package be approved and proceed to the formal agreement.

Should you have any additional questions or comments, please feel free to call me (843-207-2031) or email me at natalie.roumillat@stvinc.com.

Sincerely,

N. Oriana Roumillat

N. Oriana Roumillat, P.E
Utility Coordinator
STV Incorporated

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US 21, RT 51, RT-48, J3-140

This Agreement made this _____ day of _____, 20_____ by and between

York County, hereinafter called "County" and the utility company _

Comporium Communications

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

Relocate buried communication facilities in conjunction with York County Project 11149-004.

Roads impacted include US 21, Old Nation Rd, Gold Hill Rd, Hwy 51 & Springhill Farm Rd.

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $ 3,545,000

County Share $ 3,545,000 Company Share $_____

(a) The Company ☒ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☐ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately 36 years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: Eric Kirkland
Phone Number: 803-326-6109
Email: eric.kirkland@comporium.com

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

(X) BY COMPANY'S REGULAR FORCES

( ) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

_____

_____

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

[X] Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

[ ] Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company's delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Company agree participate in pre-litigation mediation and agree to diligently work in good faith to resolve any disputes associated with the costs charged to the Company for extreme delays. The parties shall select a mediator approved by both parties and set forth any resolutions in writing signed by both parties.

Should the parties fail to reach an agreement through pre-litigation mediation, the parties may seek a resolution for the dispute through the Court of Common Pleas located in York County, South Carolina, or the United States District Court for the State of South Carolina. This agreement shall be governed exclusively by the laws of the State of South Carolina without giving effect to its conflicts of law provisions.

12. The County shall have the right to inspect all recovered materials from the permanent facility prior to disposal by sale or scrap. This requirement will be satisfied by the Company giving notice to the County of the time and place the materials will be available for inspection. This notice is the responsibility of the Company and it may be held accountable for full value of materials disposed of without notice. The Company shall furnish a listing on final billings of major items not eligible for salvage credit and reasons therefore.

13. The Company will abide by the contract cost principles as set forth in FAPG 23 CFR 645A.

14. The Company will not participate directly or indirectly in any practice that subjects persons to discrimination because of their race, color, religion, sex, or national origin.

COMPANY: Comporium Communications

ADDRESS: 471 Lakeshore Parkway
Rock Hill, SC 29730

BY: _____

NAME: J Mark Whitfield

TITLE: Director - Plant Facilities Eng.

YORK COUNTY

BY: _____
Joshua S. Edwards
County Manager

INSTRUCTIONS: Submit three original copies of this agreement form and three prints of drawings showing present location and proposed location of poles or lines with reference to highway survey stations and centerline.

Pennies for Progress

US 21 & SC 51 Relocation

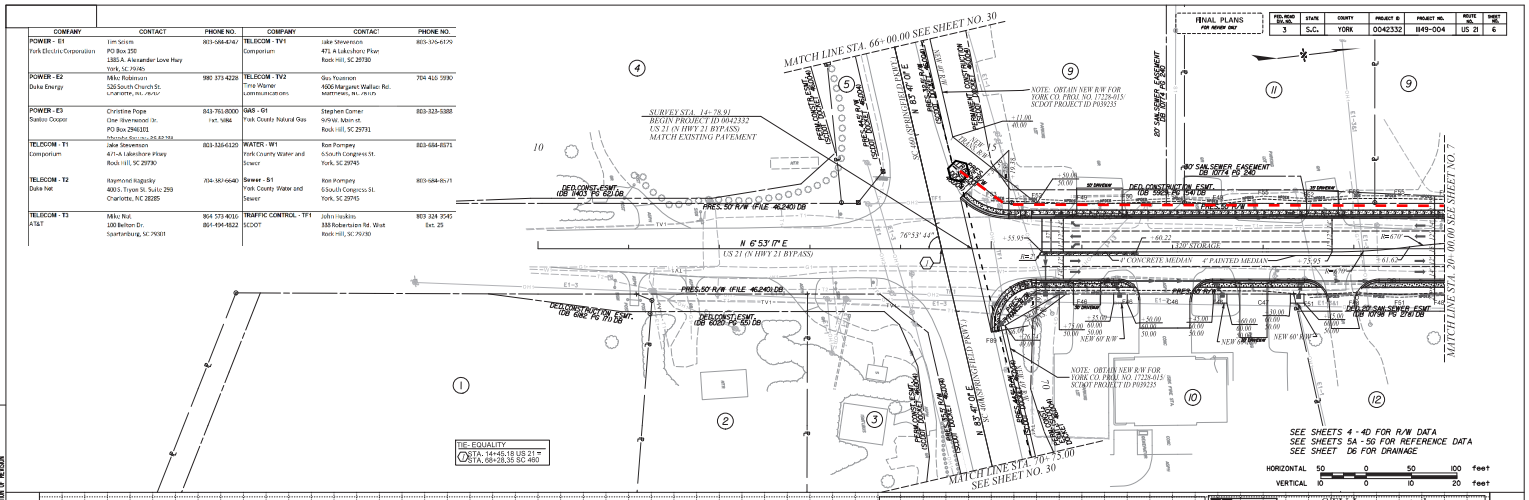
York County ID: 11149-004

Project ID: 0042332

Comporium Communications Cost Breakdown

Material:	**$1,311,650**
Labor:	**$2,233,350**
Total:	**$3,545,000**

COMPORIUM PROPOSED RELOCATION PLAN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SURVEY STA. 14+78.91
BEGIN PROJECT ID 0042332
US 21 (N HWY 21 BYPASS)
MATCH EXISTING PAVEMENT
N 63°48'47" W
N 63°48'47" W
N 6°53'17" E
US 21 (N HWY 21 BYPASS)
76°53'44"
DEFL CONST. ESMT. DB 1403 PG 0208
PRES. 50' R/W (FILE 46-240)DB
DEFL CONST. ESMT. DB 1403 PG 0208
DEFL CONST. ESMT. DB 6080 PG 0208
DEFL CONST. ESMT. DB 1008 PG 0178
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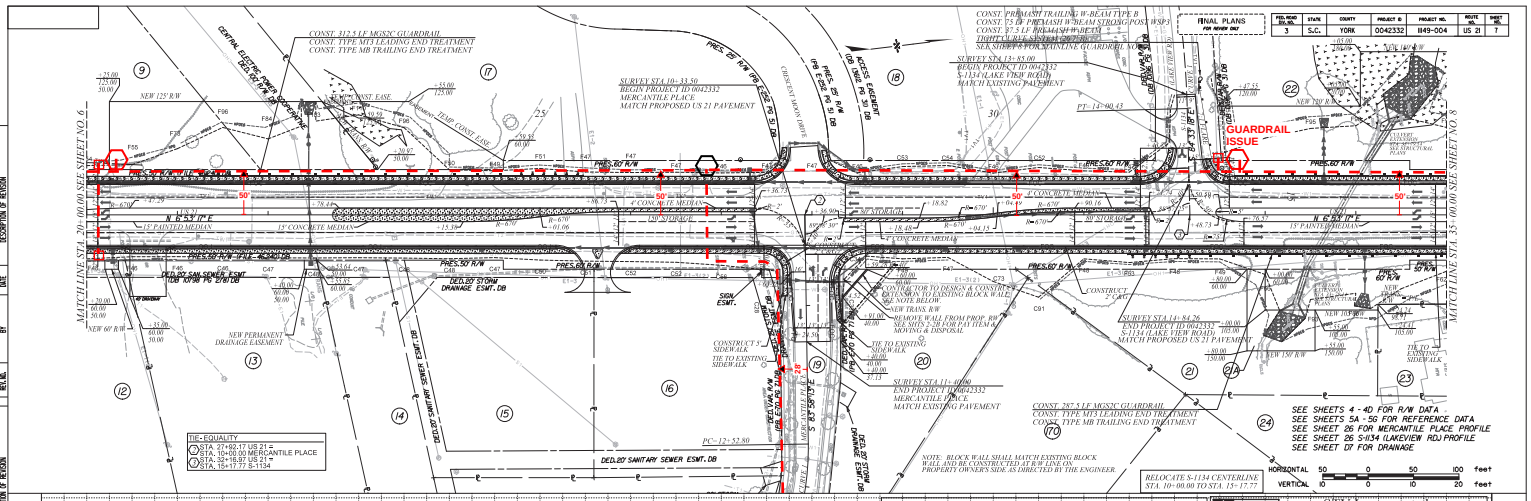
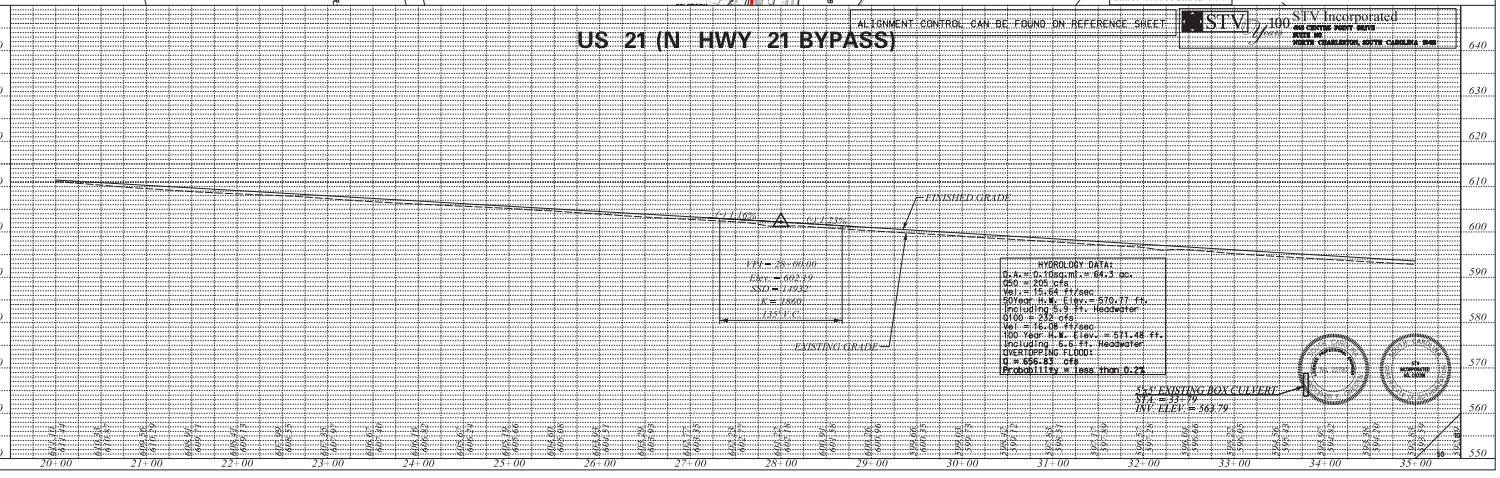


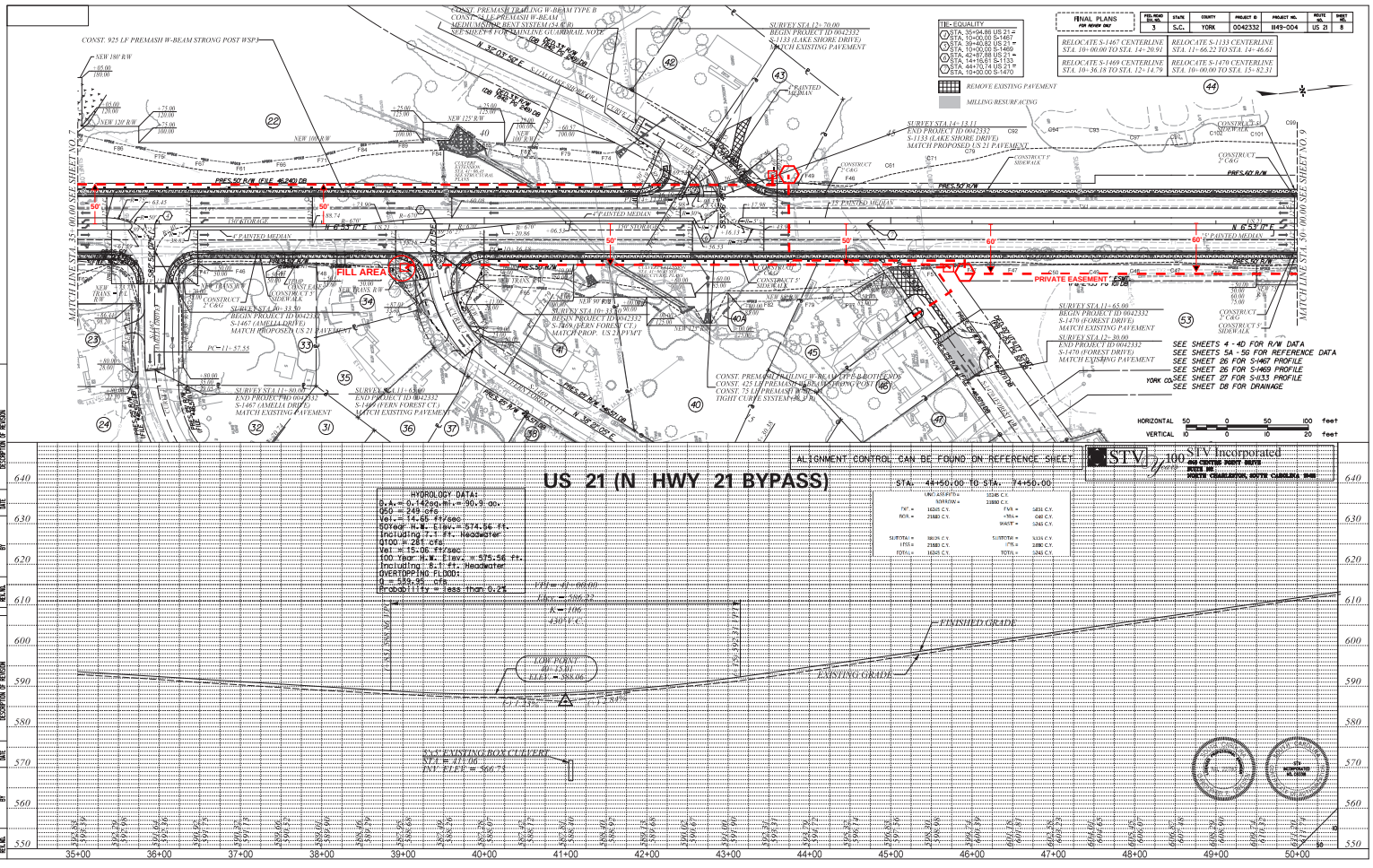


REV.NO.	BY	DATE	DESCRIPTION OF REVISION
3	MJC	12/4/09	REMOVED DETAIL FROM TH 14
2	MJC	09/03/09	REVISED TYPICAL AND DR ALONG TRs 9+7
1	JES	08/04/09	THACT 7b REMOVED DETAIL AREA

REV.NO.	BY	DATE	DESCRIPTION OF REVISION
7			
6	JES	2/6/2009	REVISED SUPERSTORES ON TRs 2 & 8
5	JES	2/6/2009	REMOVED/REVISED DETAIL ON TR 8 & 20
4	MJC	2/5/2009	REVISED DETAIL ON TR 17
3	JES	2/4/2009	REVISED NOTE FOR RETAINING WALL TO TR 20

REV.NO.	BY	DATE	DESCRIPTION OF REVISION
11			
10	TSM	1/6/2009	REVISED R/W & PT # ADDED TR NO.'s
9	JES	2/4/2009	CONVERTED MES R/W TO TCE - TR 17
8	JES	1/22/2009	TR.'s CHANGED R/W TO PERM.DRAINAGE EASEMENT
7	JES	2/4/2009	ADDED WALL EXCAVATION LIMITS ON TRACT 20

Last Saved By: mjc
Full Name: C:\25776\125776.2009 WC.CAD Models and Sheets\WC4_T1.rvt
Date/Time: 4/30/2020



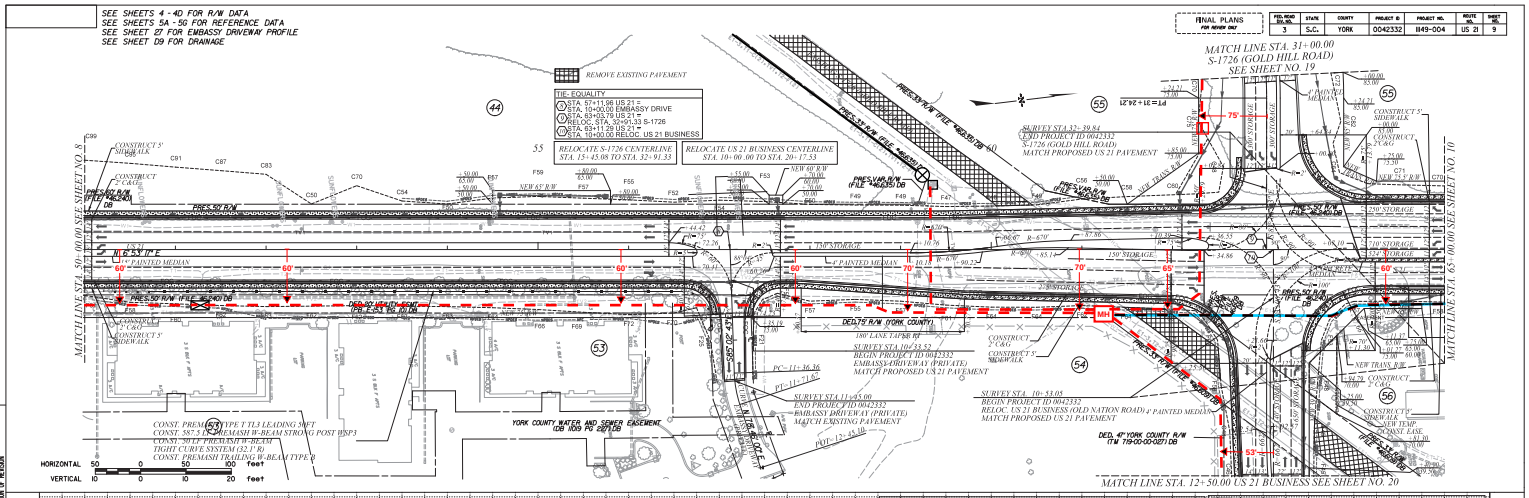
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
1	JBS	05/07/20	REVISED PER R/W & UTILITY COMMENTS
2	MAC	08/07/20	TRACT 5A REVISED TIES
3	JBS	09/07/20	TRACT 5A ADDED TIE TO COVER PERMISSIONS
4			
5			
6			

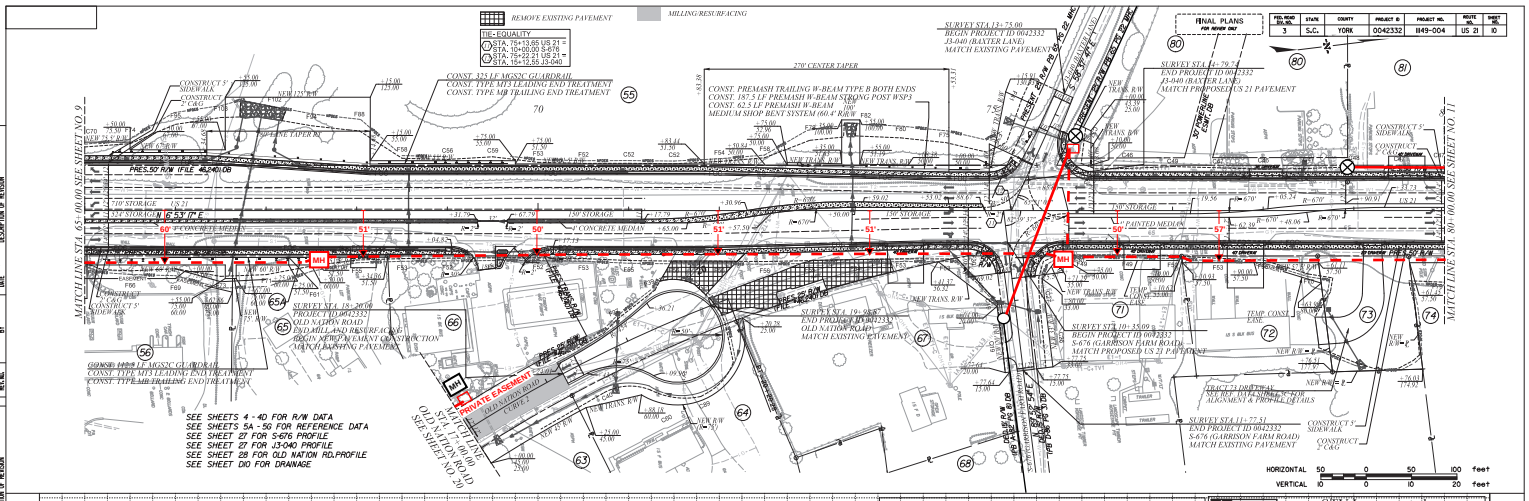
Plotted By: Plot Date/Time: 4/30/2020

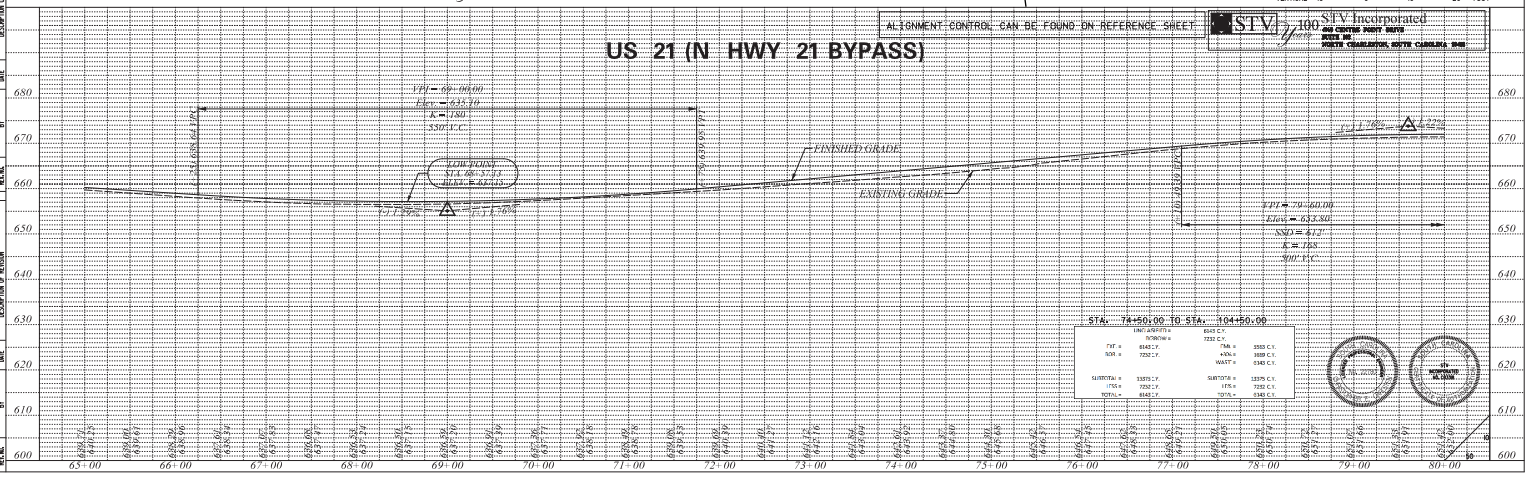
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 27 FOR EMBASSY DRIVEWAY PROFILE
SEE SHEET D9 FOR DRAINAGE

FINAL PLANS
FOR REVIEW ONLY

FED. ROAD SYS. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	9


MATCH LINE STA. 31+00.00
S-1726 (GOLD HILL ROAD)
SEE SHEET NO. 19
MATCH LINE STA. 50+00.00 SEE SHEET NO. 8
MATCH LINE STA. 65+00.00 SEE SHEET NO. 10
MATCH LINE STA. 12+50.00 US 21 BUSINESS SEE SHEET NO. 20
REMOVE EXISTING PAVEMENT
TIE- EQUALITY
A STA. 57+11.96 US 21 =
STA. 10+00.00 EMBASSY DRIVE
B STA. 83+33.79 US 21 =
RELOC. STA. 32+91.33 S-1726
C STA. 63+11.26 US 21 =
STA. 10+00.00 RELOC. US 21 BUSINESS
RELOCATE S-1726 CENTERLINE STA. 15+45.08 TO STA. 32+91.33
RELOCATE US 21 BUSINESS CENTERLINE STA. 10+00.00 TO STA. 20+17.53
PRES.50' R/W (FILE 4-6240) DB
PRES.60' R/W
PRES.VAR.R/W (FILE 4-6240) DB
PRES.VAR.R/W (FILE 4-6240) DB
PRES.VAR.R/W (FILE 4-6240) DB
PRES.50' R/W (FILE 4-6240) DB
PRES.50' R/W (FILE 4-6240) DB
PRES.50'





REV. NO.	BY	DATE	DESCRIPTION OF REVISION
11	TSM	3/14/19	REVISED R/W PER MARK & ADD TR - TR 63, 64
10	TSM	2/8/19	REVISED DRIVEWAY TR. 66 AND CONC. MEDIAN
9	TSM	9/1/20	REVISED R/W PER & ADDED DRIVEWAY TR TR. 73
8	JJS	7/23/19	REMOVED THRU VALLEY GR TR. 66

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
7	MMC	9/6/19	REVISED DETAILS & DRAINAGE ON TRS. 63 & 65
6	MMC	9/5/19	REMOVED TURN LANE AND REVISED R/W ON TR 74
5	MMC	9/5/19	REVISED R/W AROUND TR 66
4	MMC	5/9/19	REVISED DETAIL ON TRACT #3

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	MMC	5/8/19	REVISED DETAIL & DETAIL ON TRACTS 55 & 60
2	JJS	6/7/19	TR. 72,73,74 REVISED SLOPES/RAMPS
1	JJS	8/5/19	TR. 72,73,74 REVISED GUARDRAIL/REVISED SLOPES

workflow
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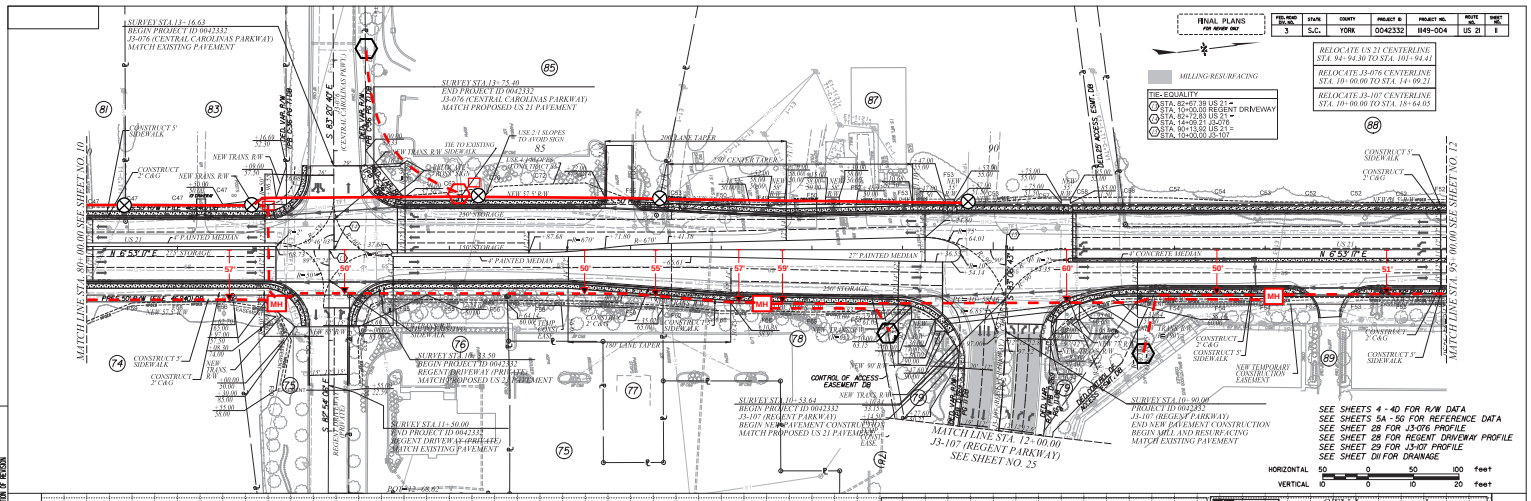
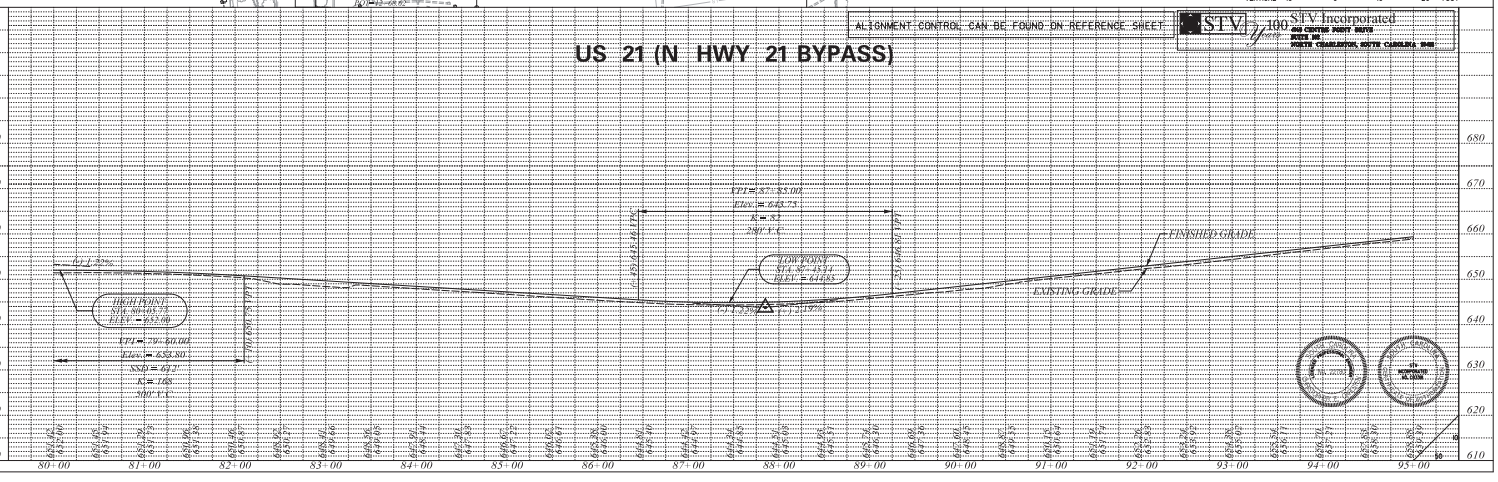
4/30/2020





REVISIONS					
NO.	BY	DATE	DESCRIPTION OF REVISION		
1	JES	10/6/18	TIE TO EXISTING SIDEWALK & ADDITIONAL CROSS SLOPES		
2	JES	10/6/18	ON/MOVE NOTES TO TIE IN TO EXISTING SIDEWALK		
3	MJC	10/6/18	REVISED NOTES TO TIE IN TO EXISTING SIDEWALK & ADDITIONAL CROSS SLOPES		
4	MJC	1/25/19	REVISED FROM TO TIE ON TO		
5	MJC	1/25/19	ON/MOVE NOTES TO TIE IN TO EXISTING SIDEWALK & R/W		
6					

Plotted: Jan 25, 2019 - 10:57am
Xrefs: ...\25571A\25571A_ROW_MAP.dwg
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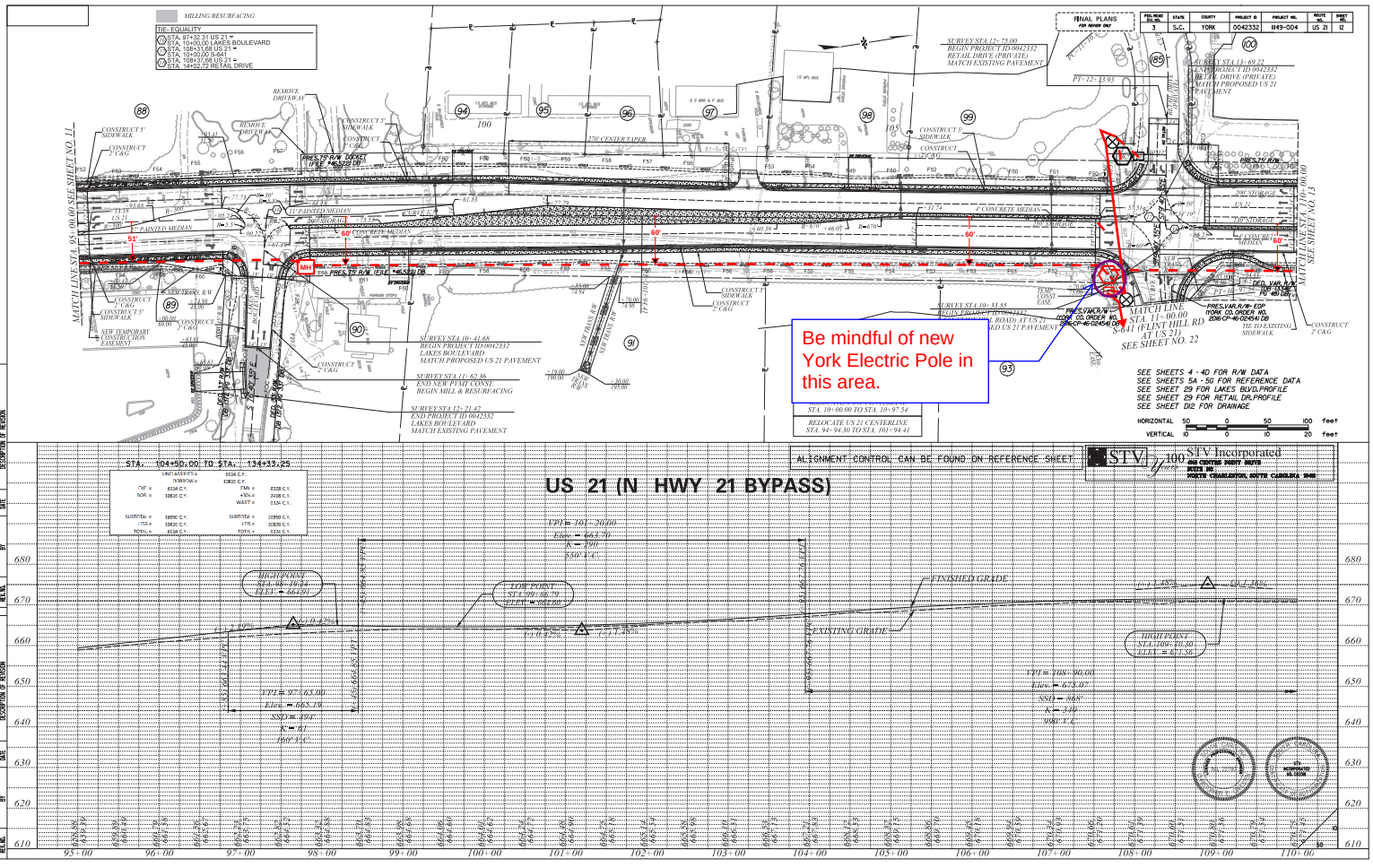
4/30/2020



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6	TDM	5/8/2020	REMOVED NEW R/W ADDED PERMISSION - TR 95
5	JES	05/07/2020	ADDED DRIVEWAY TO TR 97
4	MAC	04/06/2020	ADDED TIE TO TR 97
3	MAC	01/09/2020	ADDED TEMP. CONST. ESMT. TO TR 93
2	MAC	04/04/2019	REVISED EX. R/W ON TRACT 88
1	JES	3/29/2018	TRACT 89A REVISED EX. R/W R/W ON FLINT HILL

Plotted: Mar 25, 2020 - 4:25:27pm
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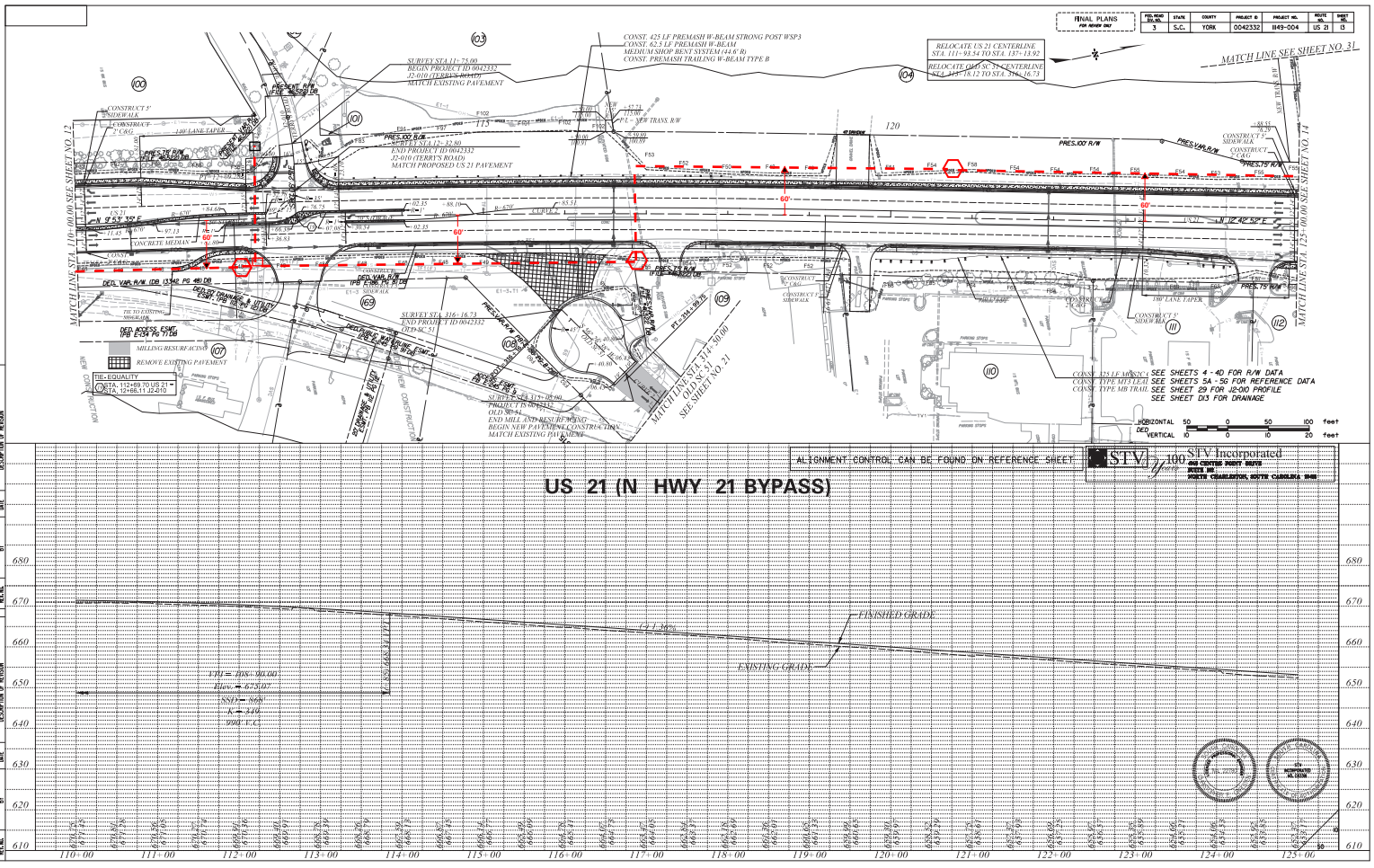
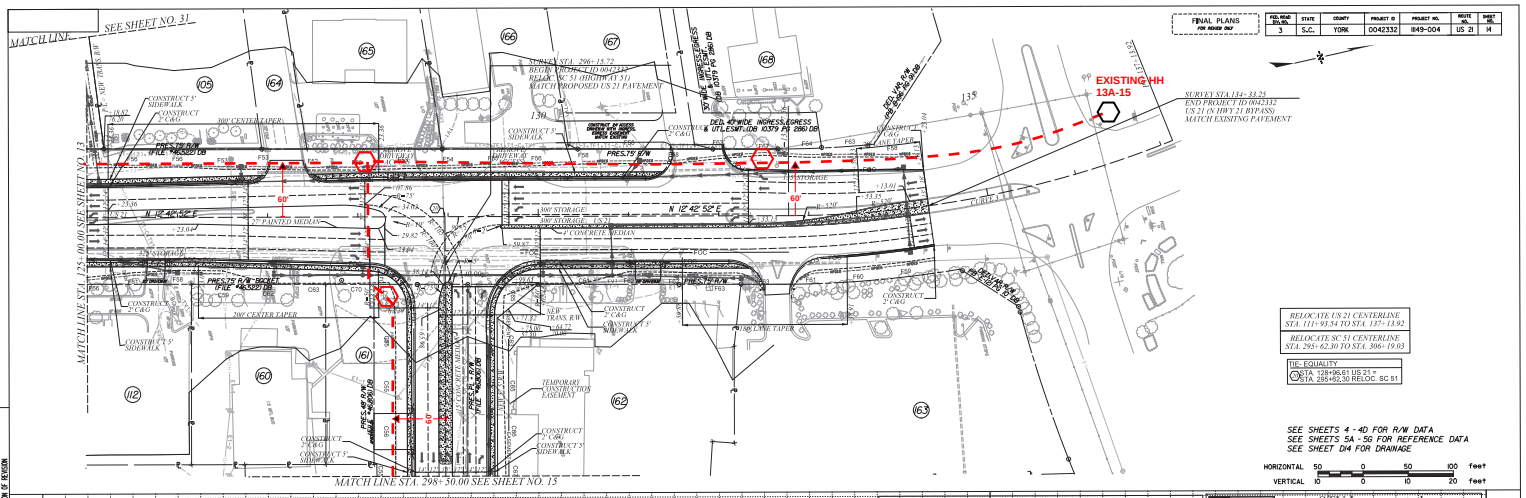
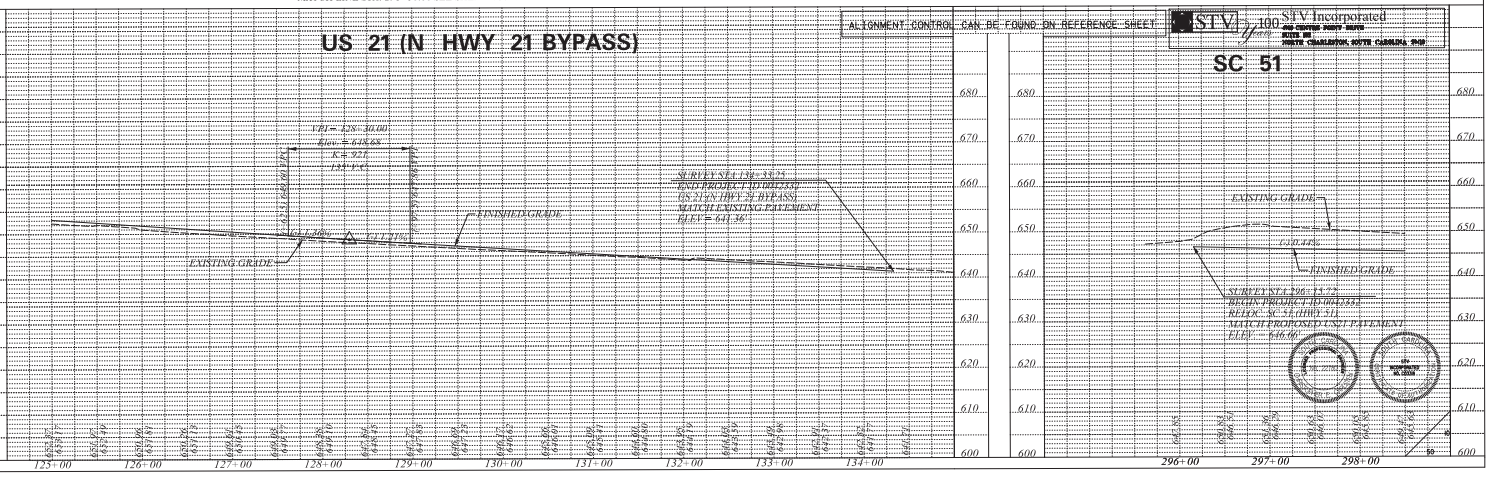

FINAL PLANS
FOR REVIEW ONLY
FED. ROAD SYS. NO. 3
STATE S.C.
COUNTY YORK
PROJECT ID 0042332
PROJECT NO. 11149-004
ROUTE NO. US 21
SHEET NO. 13
RELOCATE US 21 CENTERLINE STA. 111+ 93.54 TO STA. 137+13.92
RELOCATE OLD SC 51 CENTERLINE STA. 145+78.12 TO STA. 316+16.73
CONST. 425 LF PREMASH W-BEAM STRONG POST WSP3
CONST. 62.5 LF PREMASH W-BEAM MEDIUM SHOP BENT SYSTEM (44.6' ft)
CONST. PREMASH TRAILING W-BEAM TYPE B
MATCH LINE SEE SHEET NO. 3L
MATCH LINE STA. 110+00.00 SEE SHEET NO. 12
MATCH LINE STA. 125+00.00 SEE SHEET NO. 14
SURVEY STA 111+75.00
BEGIN PROJECT ID 0042333
J2-010 (TERRY'S ROAD)
MATCH EXISTING PAVEMENT
SURVEY STA 123+22.80
END PROJECT ID 0042332
J2-010 (TERRY'S ROAD)
MATCH PROPOSED US 21 PAVEMENT
SURVEY STA 316+16.73
END PROJECT ID 0042332
OLD SC 51
PROJECT ID 0042333
OLD SC 51
END MILL AND RESURFACING
BEGIN NEW PAVEMENT CONSTRUCTION
MATCH EXISTING PAVEMENT
MATCH LINE STA. 314+30.00
OLD SC 51
SEE SHEET NO. 21
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 29 FOR J2-010 PROFILE
SEE SHEET D3 FOR DRAINAGE
HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet
ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET
STV Incorporated
400 CENTRE POINT DRIVE
ROUTE 160
MIDDLETOWN, SOUTH CAROLINA 29566
US 21 (N HWY 21 BYPASS)
EXISTING GRADE
FINISHED GRADE
PRES.100 R/W
PRES.VAR.R/W
PRES.75 R/W
CONSTRUCT 5' SIDEWALK
CONSTRUCT 2' CRG
MILLING/RESURFACING
REMOVE EXISTING PAVEMENT
TIE-EQUALITY
STA. 112+69.70 US 21 =
STA. 12+66.11 J2-010
CONCRETE MEDIAN
DED. ACCESS. CAMP
TAB E-534 PG 71 DB
DEED VAR. R/W (DB 13142 PG 48) DB
DEED R/W (DB 13142 PG 48) DB
PRES.VAR.R/W (DB 13142 PG 48) DB
PRES.100 R/W (DB 13142 PG 48) DB
PRES.75 R/W (DB 13142 PG 48) DB
PRES.VAR.





NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3	JBS	1/6/2020	TRACT 10A, UPDATED SURVEY, REVISED DRAINAGE
2	JBS	5/5/2020	TRACT 6,5, REMOVED NEW R/W
1			
REV. NO.	BY	DATE	DESCRIPTION OF REVISION

FED. ROAD DIV.NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	I849-004	US 21	14

mastmg
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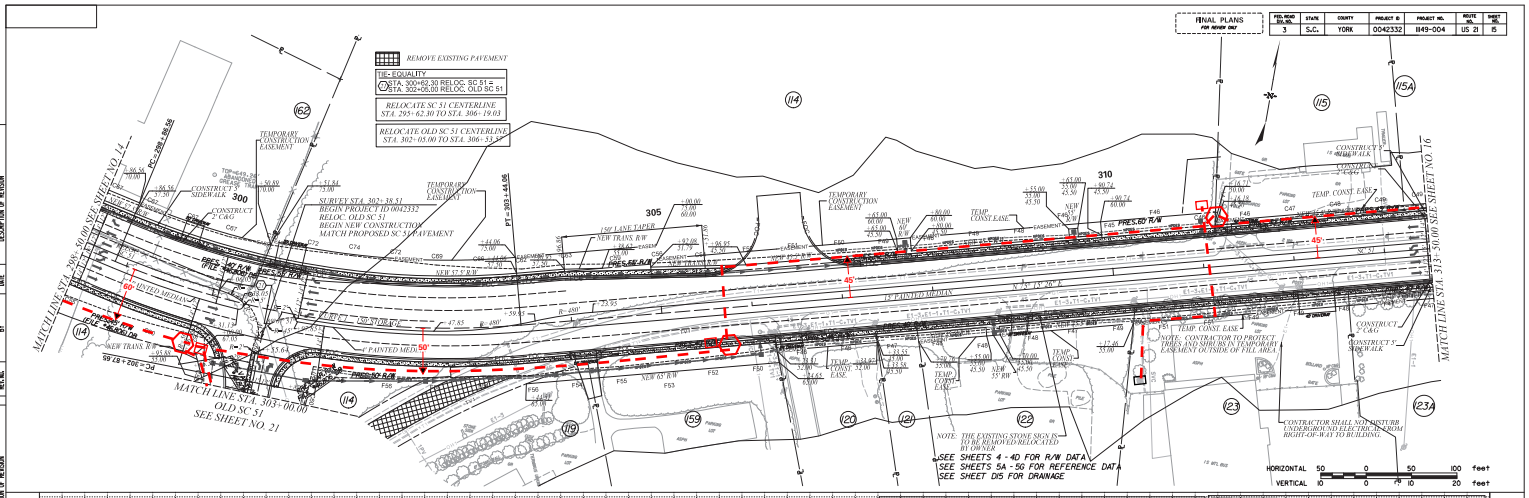
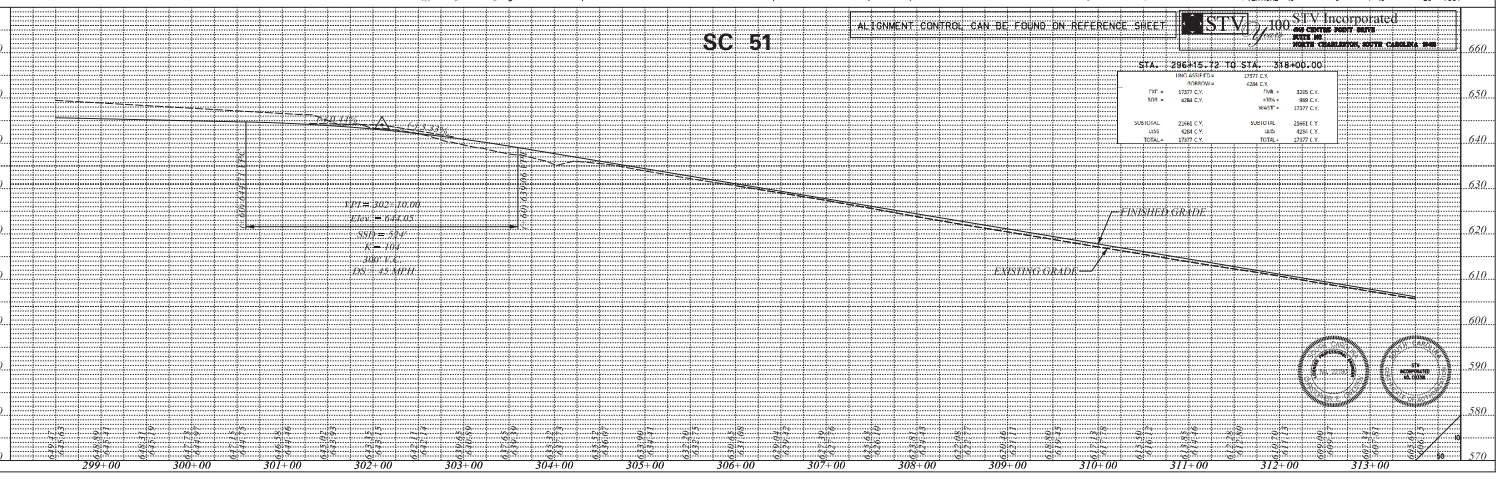
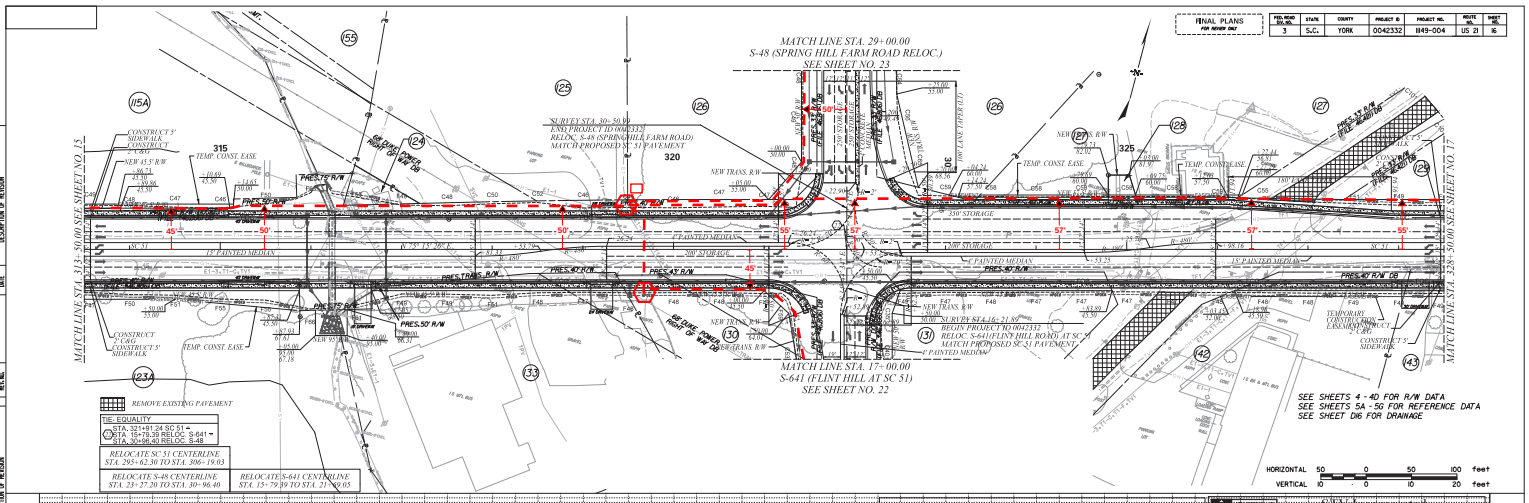
4/30/2020


FINAL PLANS
FOR REVIEW ONLY
FED. ROAD DIV. NO. 3
STATE S.C.
COUNTY YORK
PROJECT ID 0042332
PROJECT NO. 11149-004
ROUTE NO. US 21
SHEET NO. 15
REMOVE EXISTING PAVEMENT
TIE-EQUALITY
STA. 300+62.30 RELOC. SC 51 =
STA. 302+00.00 RELOC. OLD SC 51
RELOCATE SC 51 CENTERLINE
STA. 295+62.30 TO STA. 306+19.03
RELOCATE OLD SC 51 CENTERLINE
STA. 302+05.00 TO STA. 306+33.76
MATCH LINE STA. 303+00.00
OLD SC 51
SEE SHEET NO. 21
MATCH LINE STA. 313+50.00 SEE SHEET NO. 16
NOTE: THE EXISTING STONE SIGN IS TO BE REMOVED/RELOCATED BY OWNER.
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D15 FOR DRAINAGE
NOTE: CONTRACTOR TO PROTECT TREES AND SHRUBS IN TEMPORARY EASEMENT OUTSIDE OF FILL AREA.
CONTRACTOR SHALL NOT DISTURB UNDERGROUND ELECTRIC CUSTOM RIGHT-OF-WAY TO BUILDING.
HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet


SC 51
ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET
STV Incorporated
STA. 296+15.72 TO STA. 318+00.00
EXCAVATION
TWF = 37377 C.Y.
SUB = 4286 C.Y.
EMBANKMENT
TWF = 3295 C.Y.
+15% = 899 C.Y.
WASTE = 37377 C.Y.
SUBTOTAL 23981 C.Y.
LESS 4286 C.Y.
TOTAL = 37377 C.Y.
SUBTOTAL 23981 C.Y.
LESS 4286 C.Y.
TOTAL = 37377 C.Y.
VPI = 307+10.00
EVPI = 644.05
SSD = 334'
K = 100
300' V.C.
DS = 45 MPH
EXISTING GRADE
FINISHED GRADE
299+00
300+00
301+00
302+00
303+00
304+00
305+00
306+00
307+00
308+00
309+00
310+00
311+00
312+00
313+00



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	MJC	6/2/20	ADDED CONC. MEDIAN TO SPRING HILL FARM
2	JDS	12/4/09	ADDED TCE & REMOVED RW FROM TR 16 & 16A
1	JDS	12/4/09	ADDED TCE & REMOVED RW FROM TR 07
	BY	DATE	DESCRIPTION OF REVISION
6	JDS	12/7/18	ADDED TCE & REMOVED RW FROM TR 16 & 16A
5	MJC	9/4/09	ADDED TCE & REMOVED RW FROM TR 16 & 16A
4	MJC	9/4/09	ADDED TCE & REMOVED RW FROM TR 06 & 07
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
9			
8	TSM	9/9/09	ADDED 45' RDWY CURB OVERLAY - TR 16A & 123A
7	TSM	9/9/09	SHROUDED 8 & 10, ADDED 16A & 123A
REV. NO.	BY	DATE	DESCRIPTION OF REVISION

Xrefs:
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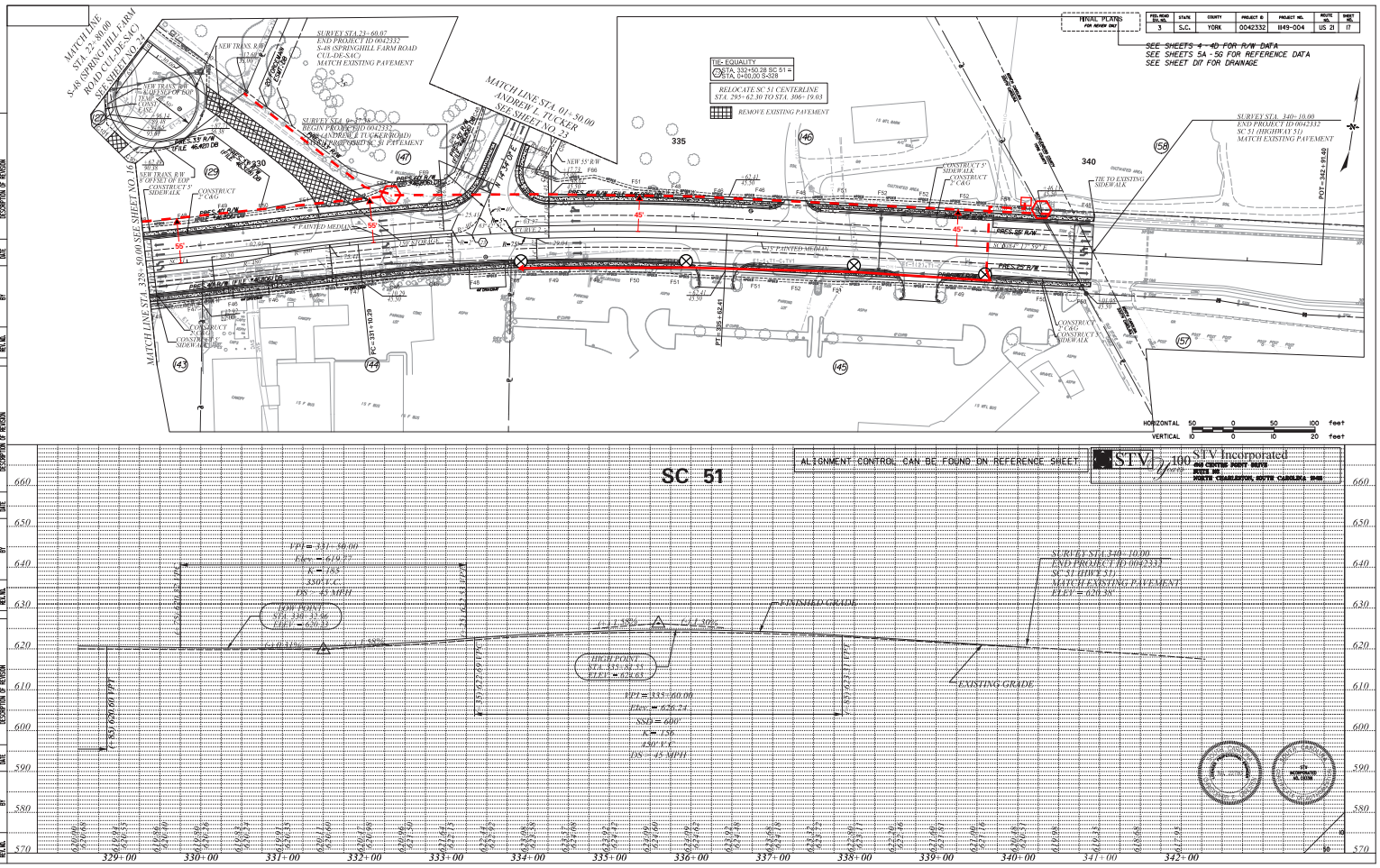
4/30/2020
PRELIMINARY

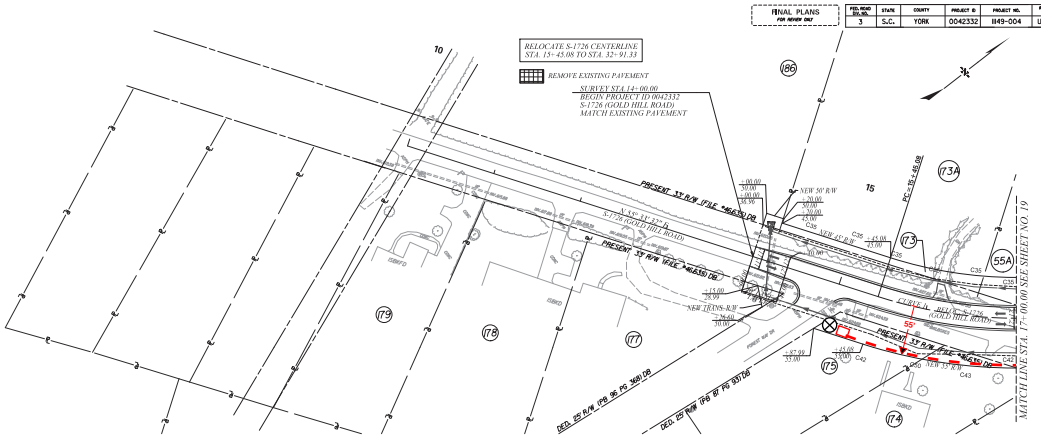


NO.	BY	DATE	DESCRIPTION OF REVISION
1	AJS	5/5/2020	MOVED SPECS LINE OFF OF TRACT 09
2	AJS	6/23/2020	ADDED RW LINE ACROSS TRACT 07
3	MAC	09/09/20	ADDED RW LINE ACROSS CL/SW FOR TRACTS 07 & 08
4	MAC	10/06/20	REVISED RW TIE TO NEW STATE LINE
5	MAC	10/20/20	ADDED TIE & REMOVED RW FROM FOR TRACT H3
6	MAC	12/08/20	REVISED RW TIE TO NEW STATE LINE
7	MAC	04/07/21	ADDED TIE & REMOVED RW FROM FOR TRACT 07
8			
9			

Plotted: Mar 25, 2021 - 11:25:17 AM
Xref Name: c:\25171\c25171s_2020-06_CAD Models and Sheets\04_CT_Transportation\Roadway\Plan Sheets\c25171s_PLAN_SHT17.dgn

FINAL PLANS
FOR REVIEW ONLY

FED. ROAD SYS. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	18



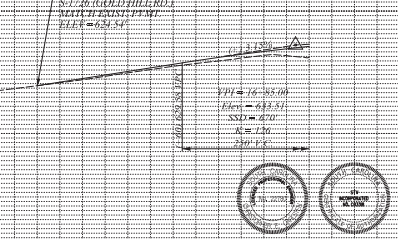
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D18 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S-1726 (GOLD HILL RD.)

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

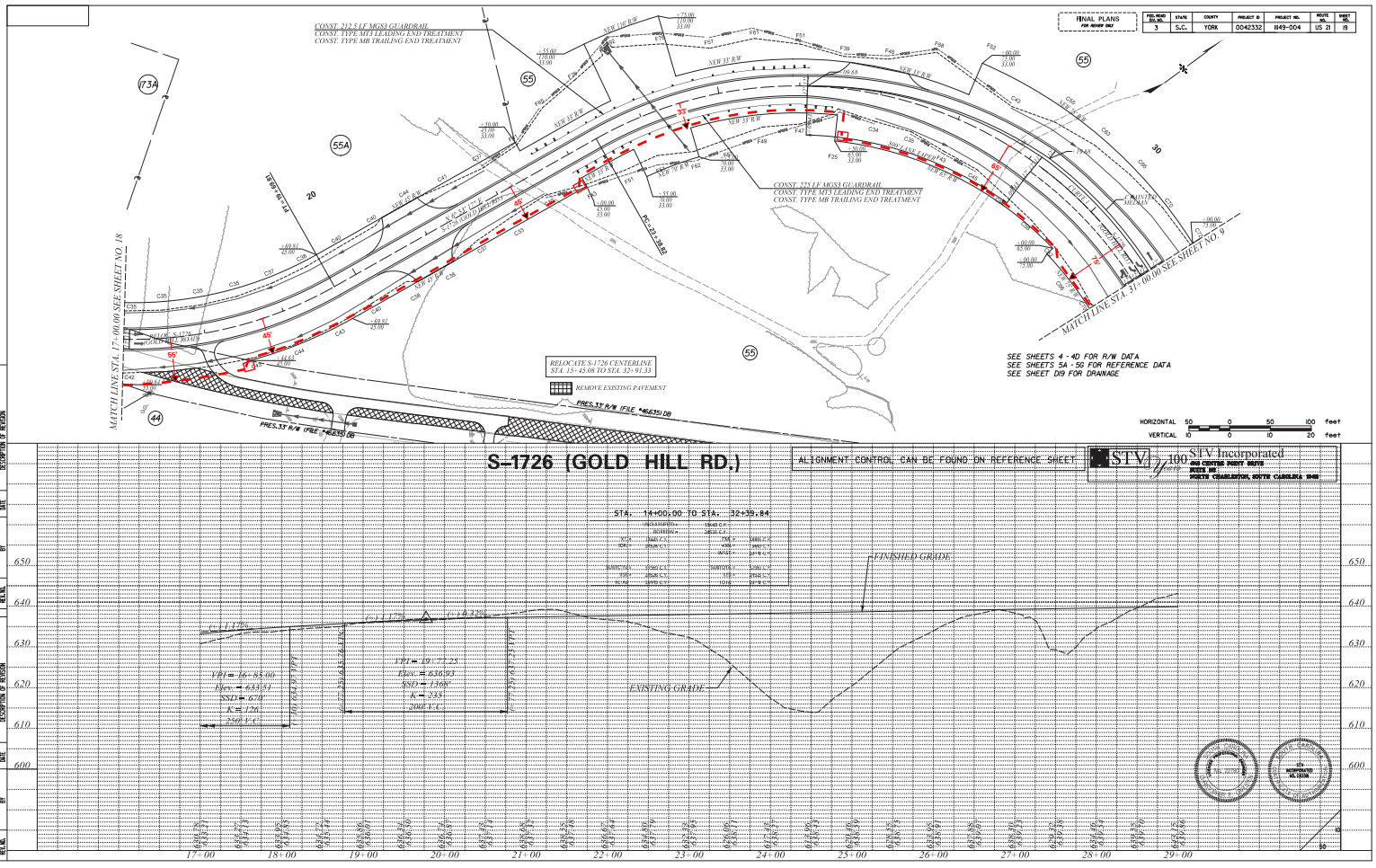
STV Incorporated
400 CENTRE POINT DRIVE
SUITE 140
MIDDLETON, SOUTH CAROLINA 29649



NO.	BY	DATE	DESCRIPTION OF REVISION
1	JBS	10/04/21	ADDED IN STA. REVISED IN ST. THAT 15% ADDED PER PLAT
2	TDM	6/4/20	
3			
4			REVISIONS
5			
6			

Plotted: Jun 04, 2020 - 4:30:20pm
User: tmcmillan
File: C:\25778\125778.2020.06_CAD Models and Sheets\04_CT_Transportation\Roadway\Plan Sheets\125778_PLAT SHTS.dgn

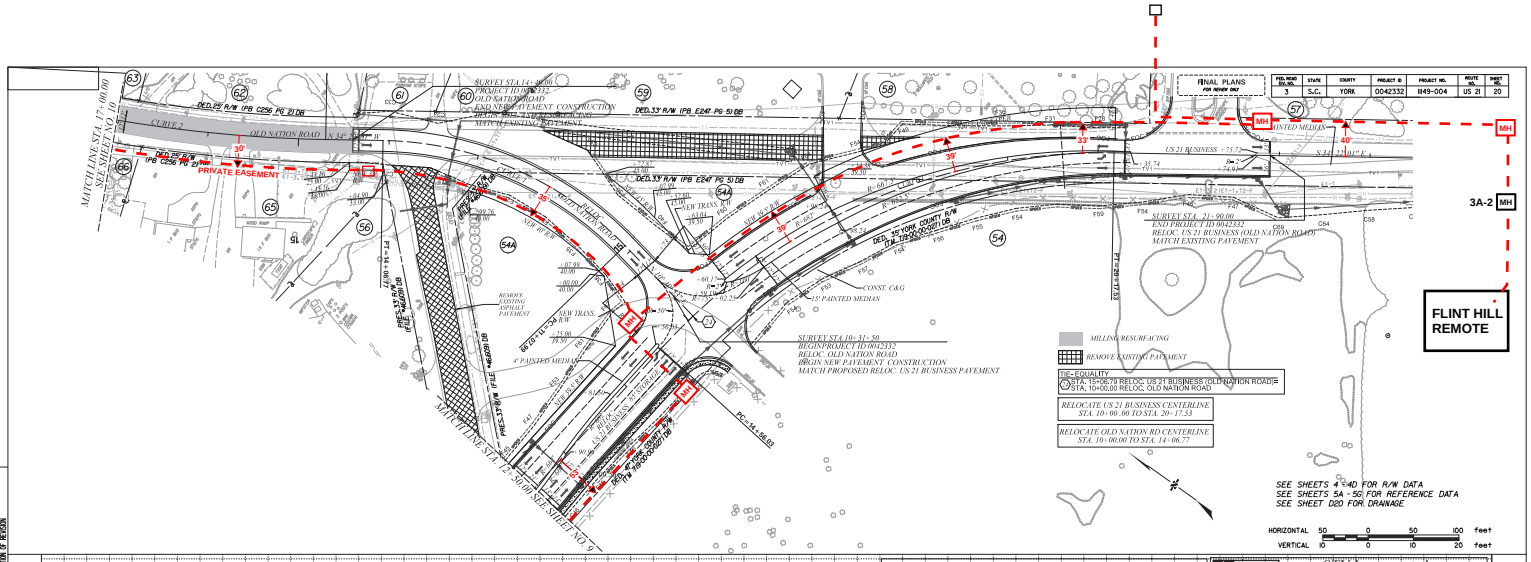
PROJ.NUM



NO.	BY	DATE	DESCRIPTION OF REVISION
1	MAC	10/17/19	TRACT 35 R/W REVISION
2	TGM	6/4/20	
3	TGM	9/7/20	
4			
5			
6			

HWY. PROJECT FOR FUTURE DEVELOPMENT
FED. ROAD SYS. NO. 3 | STATE S.C. | COUNTY YORK | PROJECT # 0042332 | PROJECT NO. 11149-004 | ROUTE NO. US 21 | SHEET NO. 19

Plotted By: Thomas Mcmillan on 4/30/2020
Drawing Name: C:\25776\025776.2020.06_CAD Models and Sheets\04_CT_Transportation\Roadway\Plan Sheets\025776_Plot Settings.dgn



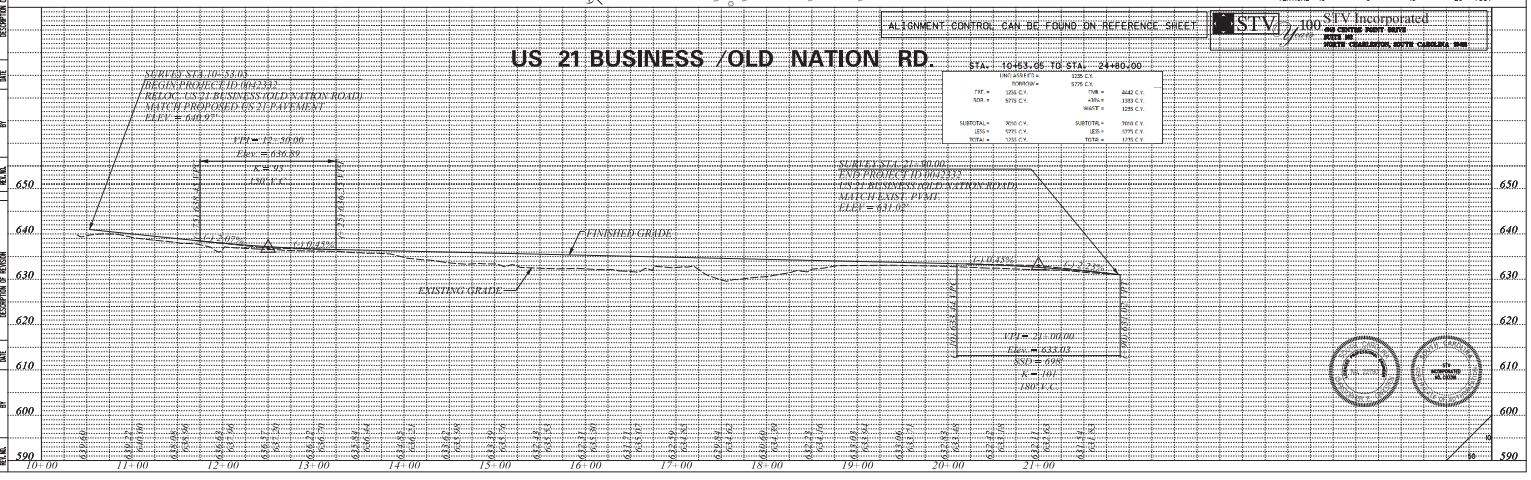
ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV Incorporated
100 STV Group
400 CENTRE POINT DRIVE
SUITE 340
MOUNT PLEASANT, SOUTH CAROLINA 29464

US 21 BUSINESS /OLD NATION RD.

STA. 10+53.05 TO STA. 24+80.00

LINE ASSEFTS =	1235 C.Y.		
TOPSOIL =	5775 C.Y.		
FAT =	1256 C.Y.	TMB =	4642 C.Y.
SUB =	5975 C.Y.	+35%=	1593 C.Y.
		WASTE =	1255 C.Y.
SUBTOTAL =	7010 C.Y.	SUBTOTAL =	7490 C.Y.
LESS =	5975 C.Y.	LESS =	5775 C.Y.
TOTAL =	1255 C.Y.	TOTAL =	1775 C.Y.

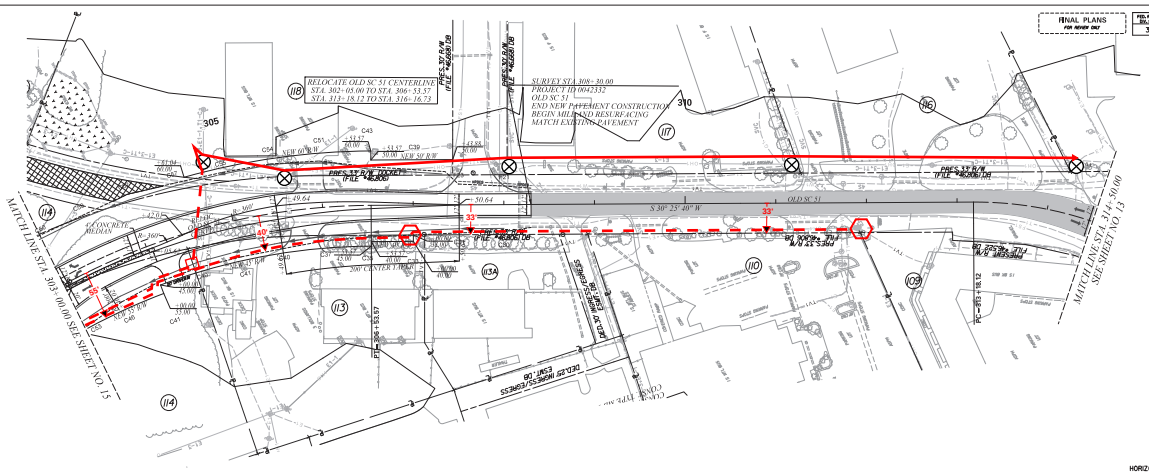


NO.	BY	DATE	DESCRIPTION OF REVISION
1	JAS	1/25/2018	EXTENDED SIDEWALK ALONG TRACT 54 ON US 21BUS
2	TGM	6/14/2018	REVISED R&R TIMES - TR 544
3			
4			
5			
6			

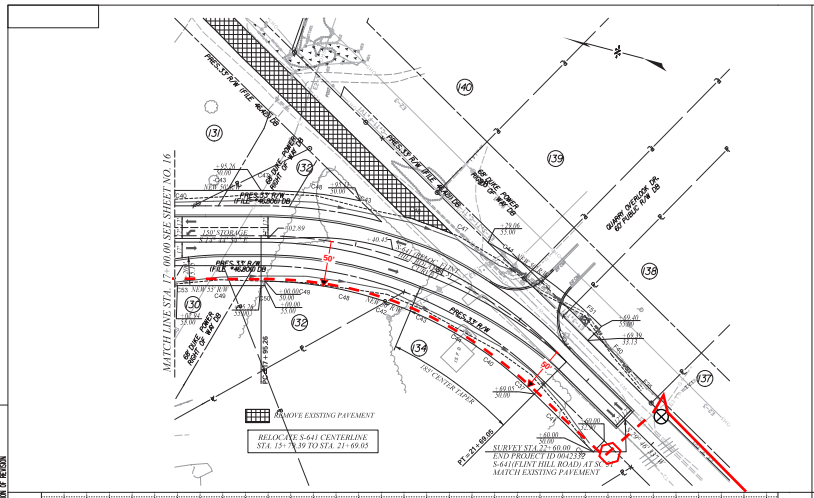
Plotted: 4/30/2020
W:\Projects\0042332\H149_0004\Roadway\Plan Sheets\042332_PLS_SHT20.dgn

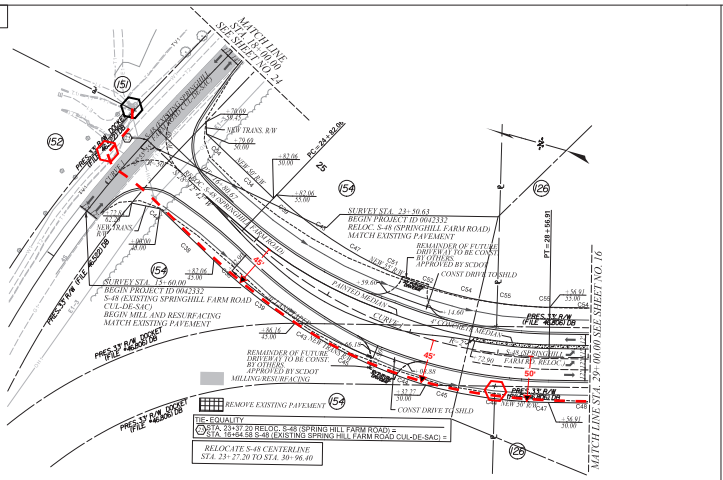
FINAL PLANS
FOR REVIEW ONLY

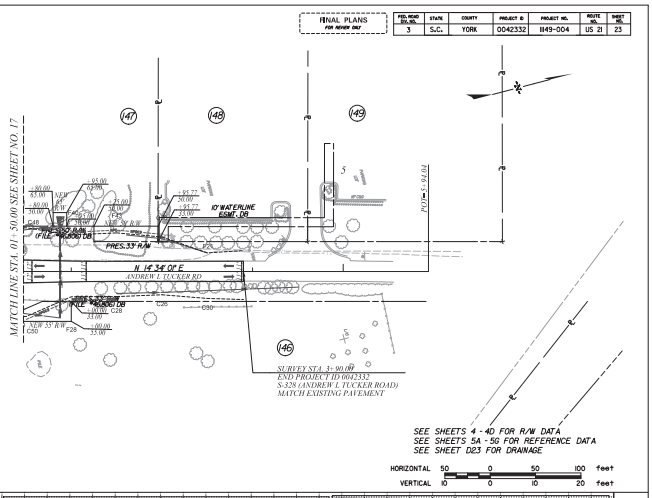
FED. ROAD SYS. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	21

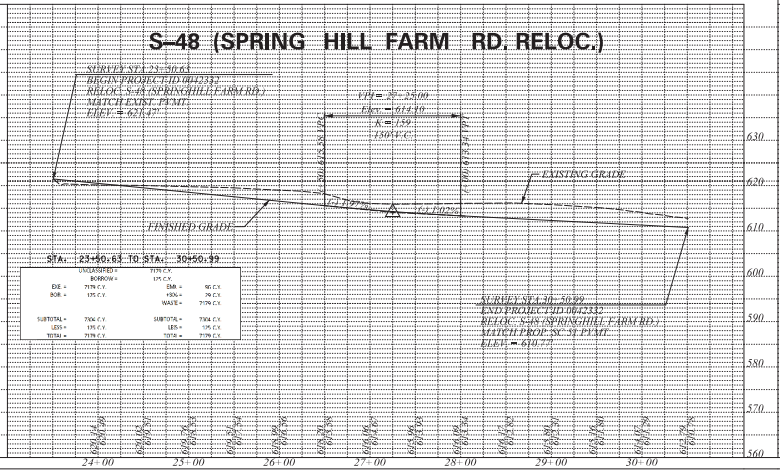

RELOCATE OLD SC 51 CENTERLINE
STA. 302+05.00 TO STA. 306+53.57
STA. 313+18.12 TO STA. 316+16.73
SURVEY STA. 108+30.00
PROJECT ID 0042332
OLD SC 51
END NEW PAVEMENT CONSTRUCTION
BEGIN MILL AND RESURFACING
MATCH EXISTING PAVEMENT
PRES. ST R/W
PRES. ST R/W
OLD SC 51
S 30° 25' 20" W
MATCH LINE STA. 303+00.00 SEE SHEET NO. 15
MATCH LINE STA. 315+00.00 SEE SHEET NO. 13
PC=313+18.12
PT=316+16.73
C.C. CONCRETE HEADWALL
CONCRETE HEADWALL
CONCRETE HEADWALL
CONCRETE HEADWALL
DRIVE
DRIVE
DRIVE

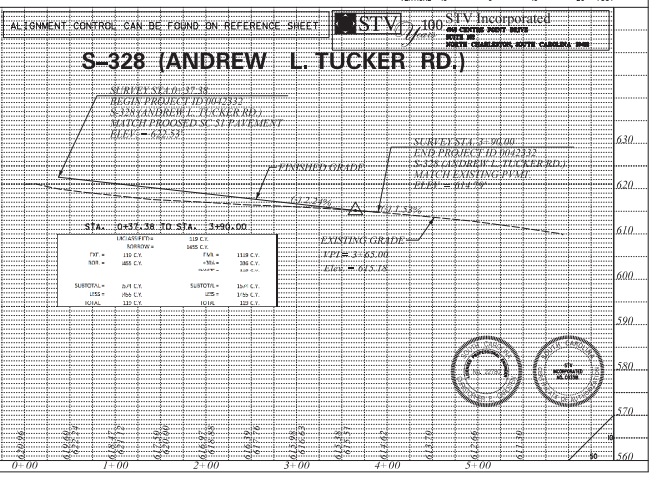
FINAL PLANS FOR REVIEW ONLY	FED. ROAD SYS. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	1149-004	US 21	22


MATCH LINE STA. 17+00.00 SEE SHEET NO. 16
PRES. ST R/W (TITLE 40.00 DB)
PRES. ST R/W (TITLE 40.00 DB)
PRES. ST R/W (TITLE 40.00 DB)
PRES. ST R/W (TITLE 40.00 DB)
PRES. ST R/W
750' STORAGE
50'
50'
50'









STV Incorporated
100 CENTRE POINT SUITE 400
MOUNT PLEASANT, SOUTH CAROLINA 29464

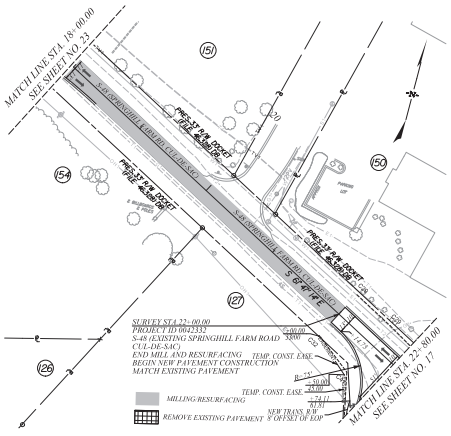
NO.	DESCRIPTION OF REVISION	BY	DATE
1	ADDED BREAKLINES TO TIE IN AND REVISED VERSION	BTS	04/02/2020
2	REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS AND REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS	TSM	04/07/2020
3	REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS AND REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS	TSM	04/09/2020
4	REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS AND REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS	TSM	04/09/2020
5	REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS AND REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS	TSM	04/09/2020
6	REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS AND REVISED TYPICAL SECTION TO SHOW 1' CURB AND GUTTER AT CURB RETURNS	TSM	04/09/2020

"I HEREBY CERTIFY THAT THE DESIGN SHOWN ON THESE PLANS IS IN ACCORDANCE WITH THE REQUIREMENTS OF THE SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION'S STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AND ANY SUPPLEMENTS THERETO."

xrefs: ...\25577A\25577A_ROW-MC.DWG Models and Sheets\XsA_C1_Transportation\Roadway\Plan Sheets\25577A_P-S1_SHT23.dgn
4/30/2020

FINAL PLANS
FOR REVIEW ONLY

FED. ROAD SYS. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	24



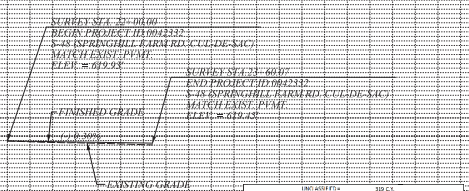
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D24 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S-48 (SPRING HILL FARM RD. CUL-DE-SAC)

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV Incorporated
400 CENTRE POINT DRIVE
SUITE 200
MOUNT PLEASANT, SOUTH CAROLINA 29464



UNCLASSIFIED			
BORROW =	325 C.Y.		
		CUT =	338 C.Y.
CUT =	338 C.Y.	TOPS =	130 C.Y.
SUB =	134 C.Y.	+15% =	32 C.Y.
		WASTE =	309 C.Y.
SUBTOTAL =	472 C.Y.	SUBTOTAL =	472 C.Y.
LESS =	134 C.Y.	LESS =	134 C.Y.
TOTAL =	338 C.Y.	TOTAL =	338 C.Y.



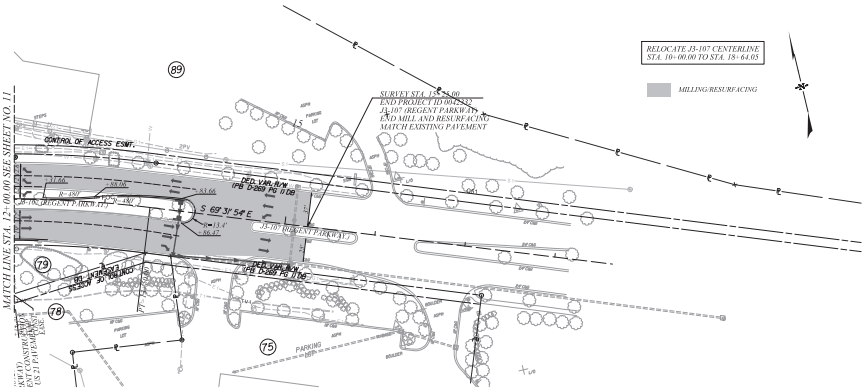
NO.	BY	DATE	DESCRIPTION OF REVISION
1	MHC	04/09/2020	ADDED TCE & REMOVED RW PERM FOR TRACT 127
2			
3			
4			
5			
6			

xrefs: C:\25778\125778_2020-06_CAD Models and Sheets\04_CT_Transportation\Roadway\Plan Sheets\125778_PLH_SHT24.dgn
4/30/2020

PROJ.NEJOH

FINAL PLANS
FOR REVIEW ONLY

FED. ROAD DIV.NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	25



SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5I FOR REFERENCE DATA
SEE SHEET D25 FOR DRAINAGE DATA

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV Incorporated
400 CENTRE POINT DRIVE
SUITE 340
MOUNT PLEASANT, SOUTH CAROLINA 29464

J3-107 (REGENT PKWY.)

STA: 10+53.64 TO STA: 13+50.00

LINE ASPHALT =	212 C.Y.		
SIDEWALK =	26 C.Y.		
CMP =	212 C.	FMS =	30 C.Y.
SOR =	30 C.	MES =	8 C.Y.
		SWAST =	212 C.Y.
SUBTOTAL =	256 C.	SUBTOTAL =	256 C.Y.
17% =	30 C.	17% =	36 C.Y.
TOTAL =	212 C.	TOTAL =	212 C.Y.

SURVEY STA. 10+53.64
BEGIN PROJECT ID 0042332
J3-107 (REGENT PKWY.)
BEGIN NEW PVMT. CONST.
MATCH PROP. US 21 PVMT.
ELEV. = 647.54'
FINISHED GRADE

EXISTING GRADE

SURVEY STA. 10+90.00
END PROJECT ID 0042332
J3-107 (REGENT PKWY.)
END NEW PVMT. CONST.
BEGIN MILL AND RESURFACING
MATCH EXISTING PAVEMENT
ELEV. = 646.20'

10+00	11+00	12+00	13+00	14+00	15+00	16+00	17+00	18+00
646.14	646.62	646.70	646.63	646.18	644.47	643.66	640.00	640.85	639.00	637.65	635.30	632.98	631.16	628.92	626.58

REVISIONS				
NO.	BY	DATE	DESCRIPTION OF REVISION	
1				
2				
3				
4				
5				
6				

PROFESSIONAL ENGINEER
STATE OF SOUTH CAROLINA
JOHN D. WILSON
NUMBER 31,329
REGISTERED

PROFESSIONAL LANDSCAPE ARCHITECT
STATE OF SOUTH CAROLINA
REGISTERED

PROJ.NO.2104

Modified: Thursday, April 30, 2020 10:40:00 AM
Plotted: Thursday, April 30, 2020 10:40:00 AM
By: Jeffrey Hall
Xrefs: ...\25\TIA\25TIA_Xsect_Template.dgn
...\25\TIA\25TIA_Xsect_Template.dgn
...\25\TIA\25TIA_Xsect_Template.dgn

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U1

US 21 NORTH PHASE 1 AND SC 51 FROM SC 460 TO THE SC/NC STATE LINE ROAD WIDENING PID 0042332 YORK COUNTY, SC

UTILITY RELOCATION PLANS

COMPANY	CONTACT	PHONE NO.
POWER - E1 York Electric Corporation	Wes Dover PO Box 150 1385 A. Alexander Love Hwy York, SC 29745 Wes.Dover@yorkelectric.net	803-628-5564 803-627-0824
POWER - E2 (TRANS) Duke Energy	Stephen Lord 526 South Church St. Charlotte, NC 28202 Stephen.Lord@duke-energy.com	704-812-2316
POWER - E2 (Distribution) Duke Energy **NO CONFLICT**	Stephen Lord 526 South Church St. Charlotte, NC 28202 Stephen.Lord@duke-energy.com	704-812-2316
POWER - E3 (Distribution) Central Electric Power Cooperative **NO CONFLICT**	Jimmy Tindal 20 Cooperative Way Columbia, SC 29210 jtindal@cepci.org	803-255-8810 803-606-4581
TELECOM - T1 Comporium	Eric Kirkland 471-A Lakeshore Pkwy Rock Hill, SC 29730 eric.kirkland@comporium.com	803-326-6109
TELECOM - T2 Duke Net Legacy (Charter)	Matt McClain 3140 West Arrowood Road Charlotte, NC 28273 matt.mcclain@charter.com	704-378-2194 980-428-5092
TELECOM - T3 AT&T **No Conflict for Distribution**	Jamie Riggins 100 Belton Drive Spartanburg, SC 29301	864-574-8608
TELECOM - T4 Level 3 Communications (Lumen)	Wanita Brenes 227 Robeson Street Fayetteville NC 28301 wanita.brenes@lumen.com	910-551-8838
TELECOM - T5 Zayo Fiber	Brandon Carter 125 North Myers Street Charlotte, NC 28202 Brandon.Carter@zayo.com	704-779-9322
TELECOM - T6 MCI Communications (Verizon)	Corey Thomas corey.thomas@verizon.com	501-297-9085
TELECOM - T7 Windstream Commuications	Daniel Honeycutt Daniel.Honeycutt@windstream.com	704-849-1358 704-579-7897

COMPANY	CONTACT	PHONE NO.
TELECOM - TV1 Comporium	Eric Kirkland 471-A Lakeshore Pkwy Rock Hill, SC 29730 eric.kirkland@comporium.com	803-326-6109
TELECOM - TV2 Time Warner Communications	Matt McClain 3140 West Arrowood Road Charlotte, NC 28273 matt.mcclain@charter.com	704-378-2194 980-428-5092
GAS - G1 York County Natural Gas	Eric Cellucci 979 W. Main st. Rock Hill, SC 29731 eric.cellucci@ycnga.com	803-323-5392 803-627-4410
WATER - W1 York County Water and Sewer	David Hughes (Bert Becton STV Designer) 6 South Congress St. York, SC 29745	803-628-3211
Sewer - S1 York County Water and Sewer	David Hughes (Bert Becton STV Designer) 6 South Congress St. York, SC 29745	803-628-3211
Water - W2 Fern Forest Water Company	Dottie Carter (Bert Becton STV Designer)	(803) 548-0398
TRAFFIC CONTROL - TF1 SCDOT	John Huskins 338 Robertsion Rd. West Rock Hill, SC 29730	803-324-3545 Ext. 25

INDEX OF SHEETS

DESCRIPTION	SUBTOTAL OF SHEETS
UTILITY REFERENCE SHEET	U1
UTILITY LEGEND SHEET	U2
UTILITY DATA SHEET	U3
UTILITY POLE DATA SHEET	U4A - U4D
UTILITY GENERAL NOTES	U5
UTILITY PLAN SHEETS	U6 - U30 (U26-U29 Omitted)
TOTAL	29

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

500 0 500 1000
scale feet

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY REFERENCE SHEET

SCALE N/A RTE. US 21 DWG. NO. U1

SUE LEGEND AND NOTES

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21 SC 51	U2

ELECTRIC SYMBOLS

SYM	ABV	DESCRIPTION
	ETM	ELECTRICAL TRANSFORMER
	EMH	ELECTRICAL MAN HOLE
	EHH	ELECTRICAL HAND HOLE
	EPP	ELECTRIC PEDESTAL
	EBX	ELECTRIC BOX
	ESG	ELECTRIC SWITCH GEAR BOX
	EVT	ELECTRIC VAULT
	EGL	GROUND / LANDSCAPE LIGHT
	EAB	ELECTRIC AIR BRAKE
	ERO	ELECTRIC RESIDENTAL OUTLET

POLE SYMBOLS

SYM	ABV	DESCRIPTION
	PSP	SIGNIFICANT POLE (STEEL, CONCRETE, ETC)
	PP	ELECTRIC, COMBINATION POLE
	PMP	METER POLE
	PLT	TRANSMISSION LINE POLE
	PLP	AREA LIGHT POLE
	PTF	TRAFFIC SIGNAL POLE
	POP	OTHER USE POLE
	PCT	CELL PHONE TOWER
	PTP	TELEPHONE POLE
	PGP	GUY POLE

TRAFFIC CONTROL SYMBOLS

	TFV	TRAFFIC SIGNAL CONTROL VAULT
	TFHH	TRAFFIC CONTROL HAND HOLE
	TFJ	TRAFFIC SIGNAL JUNCTION BOX

GAS SYMBOLS

SYM	ABV	DESCRIPTION
	GM	GAS METER
	GVC	GAS VALVE CAP
	GMH	GAS MAN HOLE
GVT	GVT	GAS VENT
GR	GR	GAS PRESSURE REGULATOR
GTP	GTP	GAS LINE TEST POINT
GTF	GTF	GAS LINE TAP FARM

MISC SYMBOLS

	MWP	UTILITY WITNESS POST
EOI	MOI	END OF INFORMATION
	MUC	MISC / UNKNOWN VALVE CAP OR COVER
	MPB	PAVED OR BURIED MANHOLE / CAP
	MUE	UTILITY TERMINI / ENDS
	MTH	TEST HOLE

TELECOMMUNICATION SYMBOLS

SYM	ABV	DESCRIPTION
	TB	TELEPHONE BOOTH
	TVP	CABLE TV PEDESTAL
	TLC	SUBSCRIBER LOOP CARRIER (aka SLICK)
	TPP	TELEPHONE PEDESTAL
	TMH	TELEPHONE MAN HOLE
	TFOH	FIBER OPTIC HAND HOLE
	THH	TELEPHONE HAND HOLE
	TVHH	CABLE TV HAND HOLE
	TBX	TELEPHONE BOX
	TXB	UG / SPLICE - AG SPLICE BOX
	TRP	TELEPHONE REPEATER
	TVB	CABLE TV BOX
	TUV	UNDERGROUND TELEPHONE VAULT
	UTP	UNDERGROUND TELEPHONE PEDESTAL
	UTV	UNDERGROUND CABLE TV PEDESTAL

WATER SYMBOLS

	WM	WATER METER
	WV	WATER VALVE
	WMW	WATER MONITORING WELL
	WFH	FIRE HYDRANT
	WMH	WATER MAN HOLE
	WAR	WATER AIR RELEASE VALVE
	WVB	WATER VALVE BOX
	WFC	FIRE DEPARTMENT CONNECTION
	WBP	WATER BACKFLOW PREVENTER
	WBO	WATER BLOW OFF VALVE
	WWH	WELL HOUSE
	WPV	POST INDICATOR VALVE

SEWER SYMBOLS

SYM	ABV	DESCRIPTION
	SCO	SEWER CLEAN OUT
	SMH	SEWER MAN HOLE
	SAR	SEWER AIR RELEASE VALVE
	SST	SEWER STEP TANK
	SCV	SEWER CHECK VALVE BOX
	SGP	SEWER GRINDER / PUMP STATION
	SSV	SEWER VALVE
	SLS	SEWER LIFT STATION

NONPOTTABLE WATER SYMBOLS

	ICV	IRRIGATION CONTROL VALVE
	ICB	IRRIGATION CONTROL BOX
	IRH	IRRIGATION / SPRINKLER HEAD

COMBINATION LINE DEPICTION CODES

SHOW COMBINED LEVEL C & D SUE WILL INCLUDE THE FOLLOWING LEVEL QUALITY CODES:

LINE SHOWN DEPICTS QUALITY LEVEL C <C>

<C> T1

LINE SHOWN DEPICTS QUALITY LEVEL D <D>

<D> T1

MULTIPLE SUE OWNERS CAN BE DEPICTED OWNERSHIP WITH THE FOLLOWING CODES:

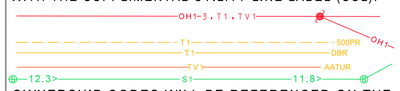
(A) UTILITY OWNER "X"

<C> (A) T1

(B) UTILITY OWNER "Y"

<D> T1 (B)

UTILITY LINES THAT REQUIRE MORE DETAILED INFORMATION ON THE PLAN SHEET CAN BE LABELED WITH THE SUPPLIMENTAL UTILITY LINE LABEL (SUL):



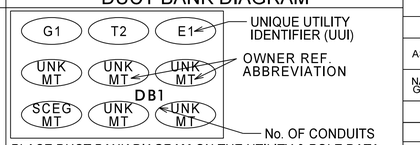
OWNERSHIP CODES WILL BE REFERENCED ON THE TITLE/OWNER SHEET AND THE UTILITY & POLE DATA SHEET.

SEWER MANHOLE NUMBERS (SMN)

S001 (S) SANITARY SEWER MANHOLE

DESIGNATE EACH SANITARY SEWER MANHOLE WITH A SEWER MANHOLE NUMBER (SMN). REFERENCE THIS SMN ON THE UTILITY DATA SHEET AND LIST ELEVATIONS.

DUCT BANK DIAGRAM



PLACE DUCT BANK DIAGRAM ON THE UTILITY & POLE DATA SHEET BELOW THE UTILITY & POLE DATA CHART. NOTE THE UUI OF THE DUCT BANK ON THE DIAGRAM. DEPICT THE CORRECT NUMBER OF CONDUITS IN THE DUCT AND THE USAGE OF EACH. MARK EMPTIES (IF KNOWN) WITH OWNER REFERENCE ABBREVIATION AND "MT".

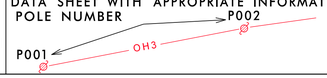
UTILITY INFORMATION TAGS (UIT)

WHEN UTILITY APPURTENANCES NEED DESCRIBING, PLACE A UIT NEXT TO THE CELL OR OUTLINED AREA. PLACE THE INFORMATION ON THE UTILITY DATA SHEET. DESIGNATE THE UTILITY BY THE OWNER NUMBER AND "T001" CODE IN THE "UTILITY" COLUMN. (IE - T2 T001).

(X) T001

UTILITY POLE ID NUMBER (UPIN)

TAG EACH UTILITY POLE WITH A UTILITY POLE ID NUMBER (UPIN) STARTING AT THE BEGINNING STATION. REFERENCE UPIN ON THE UTILITY & POLE DATA SHEET WITH APPROPRIATE INFORMATION.



UTILITY INFORMATION ABBERVIATIONS

EOI	END OF INFORMATION
EORI	END OF RECORDED INFORMATION
AATUR	UTILITY ABANDONED ACCORDING TO UTILITY RECORDS
AATFI	UTILITY ABANDONED ACCORDING TO FIELD INSPECTION
EATUR	EMPTY ACCORDING TO UTILITY RECORDS
NAP	NO ASSOCIATED PIPING FOUND FROM STRUCTURE
NAC	NO ASSOCIATED CABLES FOUND FROM STRUCTURE
DBR	DIRECT BURIED
DATFI	DEPICTED ACCORDING TO FIELD INSPECTION
EATFI	EMPTY ACCORDING TO FIELD INSPECTION
PR	PAIR
MT	EMPTY
CAP	CAPACITY
GR	GROUND

MATERIAL ABBREVIATIONS

C	COPPER
DI	DUCTILE IRON
S	STEEL
P	PLASTIC
FO	FIBER OPTIC
CI	CAST IRON
S	STEEL
CO	CONCRETE
PV	PVC
VY	VYLON
TC	TERRA COTTA
SWC	STEEL WRAPPED COATED
AC	ASBESTOS CEMENT
TF	TRAFFIC SIGNAL CABLE
GW	GUY WIRE
CNT	CONDUIT

GENERAL ABBREVIATIONS

E	ELECTRIC (POWER)
W	UNDERGROUND WATER
G	UNDERGROUND GAS
PUPS	PALMETTO UTILIY PROTECTION SERVICES
T	TELEPHONE, TELECOMMUNICATION
TV, C	CABLE TELEVISION
FO	FIBER OPTIC
S	SANITARY SEWER
FS	FORCED SANITARY SEWER, FORCE MAIN
DB	DUCT BANK
TF	TRAFFIC CONTROL UTILITY
UNK	UNKNOWN UTILITY
HP	HYDROGEN PEROXIDE
ST	STEAM LINE
F	FUEL / PETROLEUM LINE
R	RECLAIMED WATER / SLURRY LINE
I	IRRIGATION LINE
DB	DUCT BANK
TNL	TUNNEL
CA	GASES MATERIAL
OSL	OUTSIDE LIMITS
N/A	NOT AVAILABLE
N/S	NOT SURVEYED (REFERENCE)
PH	PHASE (POWER)
CIR	CIRCUIT (TRANSMISSION)
SVC	SERVICE
LPR	LOW PRESSURE
HPR	HIGH PRESSURE
UG	UNDERGROUND
AG	ABOVE GROUND

SOIL COMBINATION CHART

SANDY LOAM	SL	SILTY LOAM	ZL	SILT	Z
CLAY LOAM	CL	SILT CLAY LOAM	ZCL	SAND CLAY LOAM	SCL
SANDY CLAY	SC	SILTY CLAY	ZC	CLAY	C

SURFACE DESCRIPTION LEGEND KEY

ASPHALT	A	INTER-LOCKING BRICK	I	CONC-RETE	C
NATURAL GROUND	N				

SOIL DESCRIPTION LEGEND KEY

COMPACTION		WATER LEVEL		SOIL TYPE	
LOOSE	L	DRY	D	CLAY	C
SOFT	D	MOIST	M	LOAM	L
HARD	H	WET	E	SAND	S
SOLID	HH	STANDING WATER	WW	SILT	Z

UTILITY UNIQUE IDENTIFIER LINE-STYLES

ELECTRIC RECORDED	E1 THRU E10
ELECTRIC DESIGNATED	E1 THRU E10
TRAFFIC CONTROL RECORDED	TF1 THRU TF5
TRAFFIC CONTROL DESIGNATED	TF1 THRU TF5
TELEPHONE RECORDED	T1 THRU T10
TELEPHONE DESIGNATED	T1 THRU T10
CABLE TV RECORDED	TV1 THRU TV10
CABLE TV DESIGNATED	TV1 THRU TV10
IRRIGATION RECORDED	I1 THRU I5
IRRIGATION DESIGNATED	I1 THRU I5
SLURRY RECORDED	R1 THRU R5
SLURRY DESIGNATED	R1 THRU R5
GAS RECORDED	G1 THRU G10
GAS DESIGNATED	G1 THRU G10
FUEL/PETROL RECORDED	F1 THRU F5
FUEL/PETROL DESIGNATED	F1 THRU F5
STEAM RECORDED	ST1 THRU ST5
STEAM DESIGNATED	ST1 THRU ST5
COMPRESSED GASES RECORDED	CA1 THRU CA5
COMPRESSED GASES DESIGNATED	CA1 THRU CA5
WATER RECORDED	W1 THRU W10
WATER DESIGNATED	W1 THRU W10
GRAVITY SEWER	S1 THRU S10
FORCED SEWER RECORDED	FS1 THRU FS10
FORCED SEWER DESIGNATED	FS1 THRU FS10
AERIAL SIGNAL LINE	SIG
AERIAL UTILITY LINE	OH1 THRU OH20
AERIAL GUY WIRE	GW
MISCELLANEOUS RECORDED	M1 THRU M5
MISCELLANEOUS DESIGNATED	M1 THRU M5
DUCT BANK RECORDED	DB1 THRU DB5
DUCT BANK DESIGNATED	DB1 THRU DB5
UTILITY TUNNEL	TNL
UNKOWN DESIGNATED	UNK
SWEEP LIMIT	SUE
AERIAL COMMUNICATIONS	T1

QUALITY LEVEL DEFINITIONS

Level D. This level information comes solely from existing utility records. It may provide an overall "feel" for the congestion of utilities, but it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should be confined to project planning and route selection activities.

Level C. This level involves surveying visible aboveground utility facilities (e.g., manholes, valve boxes, posts) and correlating this information with existing utility records. When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, should be confined to rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.

Level B. This level involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities. This activity is called "designating." Two-dimensional mapping information is obtained. This information is usually sufficient to accomplish preliminary engineering goals. Decisions can be made on where to place storm drainage systems, footers, foundations and other design features in order to avoid conflicts with existing utilities. Slight adjustments in the design can produce substantial cost savings by eliminating utility relocations.

Level A. This level involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material and other characteristics. This activity is called "locating." It is the highest level presently available. When surveyed and mapped, precise plan and profile information are available for use in making final design decisions. By knowing exactly where a utility is positioned in three dimensions, the designer can often make small adjustments in elevations or horizontal locations and avoid the need to relocate utilities. Additional information (e.g., utility materials, condition, size, soil contamination, paving thickness) also assists the designer and Utility Company in their decisions.

U SHEET - UTILITY COORDINATION LEGEND

SYM	ABV	DESCRIPTION
	UCP	NEW / RELOCATED UTILITY POLE
	URP	REMOVE UTILITY POLE
W	UCW	NEW / RELOCATE WATER STRUCTURE
T	UCT	NEW / RELOCATE TELECOMMUNICATION PEDESTAL
G	UCG	NEW / RELOCATE GAS STRUTURE
E	UCE	NEW / RELOCATE ELECTRIC STRUCTURE
S	UCS	NEW / RELOCATE SEWER STRUCTURE
S	UCF	NEW / RELOCATE TRAFFIC STRUCTURE
U	UCU	NEW / RELOCATE MISC STRUCTURE

PROPOSED UTILITY LINES

T1 THRU T10	TELEPHONE
TV1 THRU TV10	CABLE TV
E1 THRU E10	ELECTRIC
TF1 THRU TF5	TRAFFIC CONTROL
W1 THRU W10	WATER
G1 THRU G10	GAS
FS1 THRU FS10	FORCED SEWER
F1 THRU F5	FUEL / PETROLEUM
OH1 THRU OH20	AERIAL UTILITIES
DB1 THRU DB5	DUCT BANK
M1 THRU M5	MISCELLANEOUS

U SHEET PLAN NOTES

U-SHEET LINEWORK WILL BE USED WHEN UTILITY RELCOATION PLANS ARE INCLUDED IN THE PLAN SET.

ALL U-SHEET UUI LINES WILL BE DETAILED ON THE U-SHEET DATA SHEET.

"MISCELLANEOUS" UUI U-SHEET LINEWORK CAN BE USED FOR ANY UTILITY NOT REPRESENTED WITH A RELOCATION UUI.

ON U-SHEETS, EXISTING UTILITIES ARE DEPICTED ON A GREYSCALE.

REMOVED UTILITIES

ABANDONED/REMOVED	
X X X X	TELEPHONE
X X X X	CABLE TV
X X X X	ELECTRIC
X X X X	TRAFFIC CONTROL
X X X X	WATER
X X X X	GAS
X X X X	FORCED SEWER
X X X X	FUEL / PETROLEUM
X X X X	AERIAL UTILITIES
X X X X	DUCT BANK
X X X X	MISCELANEOUS

PROJECT SPECIFIC NOTES

1. SUE WAS PERFORMED BY SAM FOR SCDOT.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY LEGEND SHEET

SCALE: N/A RTE. US 21 DWG. NO. U2

UTILITY DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U3

FOR INFORMATION ONLY

UTILITY	ALIGNMENT / ROUTE / RD	STATION RANGE	OFFSET RANGE	ITEM IN PLACE	OWNERSHIP	REMARKS / MISC NOTES
E1	US21, SC51			UNDERGROUND POWER	YORK ELECTRIC CORP.	
E1-1	US21, SC51			AERIAL SINGLE PHASE POWER	YORK ELECTRIC CORP.	
E1-2	US21, SC51			AERIAL TWO PHASE POWER	YORK ELECTRIC CORP.	
E1-3	US21, SC51			AERIAL THREE PHASE POWER	YORK ELECTRIC CORP.	
E2-TRANS	US21, SC51, SC641			AERIAL TRANSMISSION POWER	DUKE POWER	44kV & 100kV OVERHEAD TRANSMISSION
E3-3 TRANS	US21			AERIAL TRANSMISSION POWER	SANTEE COOPER POWER	3-PHASE OVERHEAD TRANSMISSION
T1	US21, SC51, SC641			UNDERGROUND TELEPHONE	COMPORIUM	
T1-C	US21, SC51, SC641			AERIAL TELEPHONE COPPER	COMPORIUM	COPPER
T1-F	SC51, SC641			AERIAL TELEPHONE FO	COMPORIUM	FIBER OPTIC
T2	US21, SC51, SC641			UNDERGROUND TELEPHONE FO	DUKE NET	
T2-F	US21, US21 BUS, SC98			AERIAL TELEPHONE FO	DUKE NET	FIBER OPTIC
T3	US21, US21 BUS			UNDERGROUND TELEPHONE FO	AT&T	
TV1	US21, US21 BUS, SC51			AERIAL & UNDERGROUND CATV	COMPORIUM	
TV2	US21, SC51, SC641			UNDERGROUND FO	TWC	
G1	US21, US21 BUS, SC51			UNDERGROUND GAS	YORK CO. NATURAL GAS	
W1	US21, US21 BUS, SC51, SC98			UNDERGROUND WATER	YORK CO. WATER & SEWER	
W2	AMELIA, FERN FOREST, FOREST			UNGROUND WATER	FERN FOREST MHP	
S1	US21, US21 BUS, SC51, SC98			UNDERGROUND SAN. SEWER	YORK CO. WATER & SEWER	
TF1	US21, US21 BUS, SC51, SC98			AERIAL & UNDERGROUND SIGNAL	SC DOT	
OH1	US21, SC51, SC641, SC98			OVERHEAD POWER	YORK ELECTRIC CORP.	ALSO CARRIES AT VARIOUS LOCATIONS T1, TV1, T2, TF1
OH2	US21, SC51			OVERHEAD TRAFFIC SIGNAL	SC DOT	
OH3	US21			OVERHEAD POWER	SANTEE COOPER POWER	OVERHEAD TRANSMISSION
OH4	US21, SC51, SC98			OVERHEAD TELEPHONE & CATV	COMPORIUM	
OH5	SC51, SC641			OVERHEAD POWER	DUKE POWER	DOUBLE CIRCUIT 44kV OVERHEAD TRANSMISSION
OH5	US21			OVERHEAD POWER	DUKE POWER	DOUBLE CIRCUIT 100kV OVERHEAD TRANSMISSION

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U3

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4A

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
1				York Electric	40 N	33'	9"	Wood	Pwr
2				York Electric		39'	11"	Wood	Pwr
3				York Electric		24'	7"	Wood	Pwr
4				York Electric	OSN	42'	11"	Wood	Pwr
5				York Electric	OSN	43'	12"	Wood	Pwr
6				York Electric		24'	7"	Wood	Pwr
7				SCDOT	5133A/350-N-6497A	27'	15"	Concrete	Signal
8				York Electric		42'	11"	Wood	Pwr
9				York Electric		43'	11"	Wood	Pwr
10				York Electric		42'	11"	Wood	Pwr
11				SCDOT	8-150/350-5767A	27'	15"	Wood	Signal
12				York Electric		43'	11"	Concrete	Pwr
13				York Electric		12'	4x6	Wood	Pwr
14				York Electric		34'	10"	Wood	Pwr
15				York Electric		35'	10"	Wood	Pwr
16				York Electric		12'	4x6	Wood	Pwr
17				SCDOT	1-188/350N-6022A	27'	15"	Concrete	Signal
18				SCDOT	7-133A/350-N-6497A	27'	15"	Concrete	Signal, Pwr, Tel
19				York Electric	40N	42'	11"	Wood	Pwr
20				York Electric		34'	11"	Wood	Pwr
21				York Electric		38'	11"	Wood	Pwr
22				York Electric		29'	9"	Wood	Pwr
23				York Electric		38'	11"	Wood	Pwr
24				York Electric		33'	10"	Wood	Pwr
25				York Electric	20N	42'	11"	Wood	Pwr
26				York Electric		38'	11"	Wood	Pwr
27				York Electric		34'	10"	Wood	Pwr
28				York Electric		37'	11"	Wood	Pwr
29				Santee Cooper	16# 156475	60'	14"	Wood	Pwr
30				Santee Cooper	15# 165474	77'	14"	Wood	Pwr
31				Santee Cooper	14# 165473	68'	14"	Wood	Pwr
32				York Electric		36'	12"	Wood	Pwr
33				York Electric		40'	12"	Wood	Pwr
34				York Electric		40'	12"	Wood	Pwr
35				York Electric	30N 3CACA1	37'	11"	Wood	Pwr
36				York Electric		49'	14"	Wood	Pwr
37				York Electric		39'	11"	Wood	Pwr
38				York Electric		35'	10"	Wood	Pwr
39				York Electric		34'	10"	Wood	Pwr
40				York Electric	2ST	34'	10"	Wood	Pwr
41				York Electric		38'	10"	Wood	Pwr, Tel, Ctv
42				York Electric	10N	28'	10"	Wood	Pwr
43				York Electric		52'	12"	Wood	Pwr
44				York Electric	30N	42'	12"	Wood	Pwr
45				York Electric		34'	10"	Wood	Guy
46				York Electric	2 12	34'	10"	Wood	Pwr, Tel, Ctv
47				York Electric		24'	9"	Wood	Pwr
48				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
49				York Electric	11	33'	9"	Wood	Pwr, Tel, Ctv
50				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
51				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
52				York Electric		32'	8"	Wood	Pwr, Tel, Ctv
53				York Electric		28'	8"	Wood	Pwr, Tel, Ctv
54				York Electric		44'	12"	Wood	Pwr
55				York Electric	30N	42'	12"	Wood	Pwr
56				York Electric		38'	11"	Wood	Guy
57				Comporium	3CAB1	24'	11"	Wood	Tel, Ctv
58				York Electric		22'	8"	Wood	Pwr
59				York Electric	22	32'	9"	Wood	Pwr, Tel, Ctv
60				York Electric		24'	9"	Wood	Pwr, Tel, Ctv
61				York Electric	3	33'	10"	Wood	Pwr, Tel, Ctv
62				York Electric		26'	7"	Wood	Pwr, Tel, Ctv
63				York Electric	4	34'	10"	Wood	Pwr, Tel, Ctv
64				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
65				York Electric		11'	8"	Wood	Pwr, Tel, Ctv
66				York Electric		28'	8"	Wood	Pwr, Tel, Ctv
67				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
68				York Electric		25'	7"	Wood	Pwr, Tel, Ctv
69				York Electric		29'	7"	Wood	Pwr, Tel, Ctv
70				York Electric	5	34'	9"	Wood	Pwr, Tel, Ctv
71				York Electric	AB6	34'	9"	Wood	Pwr, Tel, Ctv
72				Duke Power		93'		Metal	Pwr
73				Duke Power		90'		Metal	Pwr
74				York Electric		41'	12"	Wood	Pwr
75				York Electric		30'	9"	Wood	Pwr, Tel, Ctv
76				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
77				York Electric		48'	14"	Wood	Pwr
78				York Electric		28'	9"	Wood	Guy
79				York Electric		25'	8"	Wood	Guy
80				York Electric		29'	9"	Wood	Guy
81				York Electric	11	43'	12"	Wood	Pwr, Tel, Ctv
82				York Electric		25'	8"	Wood	Pwr, Tel, Ctv
83				York Electric	3AAA 10	43'	12"	Wood	Pwr, Tel, Ctv
84				York Electric		25'	7"	Wood	Pwr, Tel, Ctv
85				York Electric		33'	10"	Wood	Pwr
86				York Electric		33'	10"	Wood	Pwr
87				York Electric		43'	12"	Wood	Pwr
88				York Electric		44'	12"	Wood	Pwr

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4A

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4B

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
89				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
90				York Electric	7	43'	11"	Wood	Pwr, Tel, Ctv
91				York Electric	6.5	43'	11"	Wood	Pwr, Tel, Ctv
92				York Electric	3C6	48'	13"	Wood	Pwr, Tel, Ctv
93				York Electric	20N	48'	12"	Wood	Pwr, Tel, Ctv
94				SCDOT	350-5698A	27'	15"	Concrete	Signal
95				SCDOT	350-698A	26'	15"	Concrete	Signal
96				SCDOT	350N-5698A	27'	15"	Concrete	Signal
97				SCDOT	350N-5614A	27'	15"	Concrete	Signal
98				York Electric		43'	12"	Wood	Pwr
99				York Electric		37'	12"	Wood	Pwr
100				York Electric		43'	12"	Wood	Pwr, Tel
101				York Electric		33'	10"	Wood	Pwr, Tel
102				York Electric		42'	11"	Wood	Pwr
103				York Electric		41'	11"	Wood	Pwr, Tel
104				York Electric	10N	32'	10"	Wood	Pwr
105				York Electric		33'	10"	Wood	Pwr
106				York Electric		33'	10"	Wood	Pwr
107				York Electric		24'	8"	Wood	Pwr
108				York Electric		33'	11"	Wood	Pwr
109				York Electric		42'	12"	Wood	Pwr
110				York Electric		43'	12"	Wood	Pwr
111				York Electric		24'	8"	Wood	Pwr
112				York Electric	40N	42'	12"	Wood	Pwr
113				York Electric		48'	12"	Wood	Pwr
114				York Electric	60N 40N	34'	12"	Wood	Pwr
115				York Electric		24'	8"	Wood	Pwr
116				York Electric		52'	12"	Wood	Pwr, Tel, Ctv
117				York Electric	3B4	43'	12"	Wood	Pwr, Tel, Ctv
118				York Electric		43'	12"	Wood	Pwr
119				York Electric		33'	10"	Wood	Pwr
120				York Electric		35'	10"	Wood	Pwr
121				York Electric		38'	11"	Wood	Pwr
122				York Electric	20N 4A	36'	10"	Wood	Pwr
123				York Electric		24'	7"	Wood	Pwr
124				York Electric		44'	11"	Wood	Pwr
125				York Electric	3BS	43'	11"	Wood	Pwr, Tel, Ctv
126				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
127				York Electric		29'	8"	Wood	Pwr
128				York Electric		34'	10"	Wood	Pwr
129				York Electric		25'	8"	Wood	Pwr, Tel
130				York Electric		42'	12"	Wood	Pwr, Tel, Ctv
131				York Electric		42'	12"	Wood	Pwr
132				York Electric		44'	13"	Wood	Pwr
133				York Electric		44'	12"	Wood	Pwr, Tel, Ctv
134				York Electric		33'	10"	Wood	Pwr, Tel, Ctv
135				York Electric		29'	10"	Wood	Pwr, Tel, Ctv
136				York Electric		44'	11"	Wood	Pwr, Tel, Ctv
137				York Electric		38'	11"	Wood	Pwr, Tel, Ctv
138				York Electric	1ST	34'	10"	Wood	Pwr, Tel, Ctv
139				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
140				York Electric		29'	9"	Wood	Pwr
141				York Electric		30'	8"	Wood	Pwr, Tel, Ctv
142				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
143				York Electric		34'	11"	Wood	Pwr, Tel, Ctv
144				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
145				York Electric		29'	9"	Wood	Tel, Ctv
146				York Electric		29'	9"	Wood	Tel, Ctv
147				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
148				York Electric	3BAIC 5N 30N	37'	12"	Wood	Pwr, Tel
149				York Electric	30N	42'	12"	Wood	Pwr, Tel, Ctv
150				York Electric		43'	13"	Wood	Pwr, Tel, Ctv
151				York Electric	10N	33'	12"	Wood	Pwr, Tel, Ctv
152				York Electric		42'	13"	Wood	Pwr, Tel, Ctv
153				York Electric		28'	9"	Wood	Pwr
154				Comporium		30'	7"	Wood	Tel, Ctv
155				York Electric	30N	42'	11"	Wood	Pwr, Tel, Ctv
156				SCDOT		29'	13"	Wood	Signal
157				York Electric	40N	36'	11"	Wood	Pwr
158				York Electric	60N	38'	11"	Wood	Pwr
159				SCDOT		33'	11"	Wood	Signal
160				York Electric		13'	4x6	Wood	Pwr
161				York Electric		25'	8"	Wood	Pwr
162				SCDOT		30'	11"	Wood	Signal
163				York Electric		44'	12"	Wood	Pwr
164				York Electric		43'	12"	Wood	Pwr
165				York Electric	40N	44'	12"	Wood	Pwr, Tel, Ctv
166				York Electric		28'	8"	Wood	Pwr
167				York Electric		28'	10"	Wood	Pwr
168				York Electric		42'	12"	Wood	Pwr, Tel, Ctv
169				York Electric		20'	9"	Wood	Pwr
170				York Electric	5N	38'	12"	Wood	Pwr, Tel, Ctv
171				York Electric		28'	8"	Wood	Pwr
172				SCDOT	400N-5767B	30'	15"	Concrete	Signal
173				York Electric		24'	8"	Wood	Pwr
174				York Electric		25'	8"	Wood	Pwr, Ctv
175				York Electric	5A	28'	9"	Wood	Pwr, Tel, Ctv
176				York Electric		24'	8"	Wood	Pwr, Tel, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4B

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4C

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
177				York Electric		24'	7"	Wood	Pwr
178				SCDOT	400-4558B	30'	15"	Concrete	Signal
179				York Electric		42'	11"	Wood	Pwr, Tel, Ctv
180				SCDOT	400M-5767B	29'	15"	Concrete	Signal
181				SCDOT	400M-4400A	29'	15"	Concrete	Signal
182				York Electric	30N	42'	13"	Wood	Pwr, Tel, Ctv
183				York Electric		41'	9"	Wood	Pwr, Tel, Ctv
184				York Electric		43'	12"	Wood	Pwr, Ctv
185				York Electric	50N	33'	11"	Wood	Pwr
186				York Electric		43'	11"	Wood	Pwr, Ctv
187				York Electric		42'	12"	Wood	Pwr, Ctv
188				York Electric		43'	11"	Wood	Pwr, Tel, Ctv
189				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
190				York Electric		24'	8"	Wood	Pwr
191				York Electric		43'	10"	Wood	Pwr, Tel, Ctv
192				York Electric		42'	10"	Wood	Pwr, Tel, Ctv
193				York Electric		53'	13"	Wood	Pwr, Ctv
194				York Electric		25'	9"	Wood	Pwr
195				York Electric		52'	13"	Wood	Pwr
196				York Electric		43'	13"	Wood	Pwr
197				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
198				York Electric		33'	9"	Wood	Pwr, Tel, Ctv
199				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
200				Fort Mill Telephone		27'	10"	Wood	Tel, Ctv
201				York Electric		43'	12"	Wood	Pwr
202				York Electric		42'	12"	Wood	Pwr
203				York Electric		34'	9"	Wood	Pwr
204				York Electric		47'	13"	Wood	Pwr, Tel, Ctv
205				SCDOT		28'	15"	Wood	Signal
206				SCDOT		28'	12"	Wood	Signal
207				York Electric		29'	9"	Wood	Guy
208				SCDOT		29'	11"	Wood	Signal
209				SCDOT		29'	11"	Wood	Signal
210				York Electric		23'	11"	Wood	Tel, Ctv
211				York Electric		43'	7"	Wood	Pwr, Tel, Ctv
212				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
213				York Electric		33'	12"	Wood	Pwr
214				York Electric		39'	10"	Wood	Pwr
215				York Electric		29'	9"	Wood	
216				York Electric		43'	12"	Wood	Pwr, Ctv
217				York Electric		36'	11"	Wood	Pwr, Tel
218				York Electric	30N	38'	11"	Wood	Pwr, Tel
219				York Electric		29'	8"	Wood	Pwr, Tel
220				York Electric		24'	8"	Wood	Pwr
221				SCDOT		32'	15"	Concrete	Signal
222				SCDOT		31'	15"	Concrete	Signal
223				SCDOT		32'	15"	Concrete	Signal
224				York Electric	20	34'	9"	Wood	Pwr
225				SCDOT		31'	15"	Concrete	Signal
226				York Electric		39'	11"	Wood	Pwr
227				York Electric		21'	9"	Wood	Pwr
228				York Electric		34'	10"	Wood	Pwr, Tel
229				York Electric		33'	10"	Wood	Pwr, Tel
230				York Electric	15N	44'	11"	Wood	Pwr, Tel
231				York Electric	30N	33'	9"	Wood	Pwr, Tel
232				York Electric		34'	10"	Wood	Pwr, Tel
233				Comporium		25'	8"	Wood	Tel
234				York Electric		36'	10"	Wood	Pwr
235				Comporium		30'	8"	Wood	Tel, Ctv
236				York Electric	BN1	40'	10"	Wood	Pwr, Tel, Ctv
237				York Electric		39'	10"	Wood	Pwr, Tel, Ctv
238				York Electric		23'	8"	Wood	Pwr
239				York Electric		37'	11"	Wood	Pwr
240				York Electric		38'	11"	Wood	Pwr, Tel
241				York Electric		36'	11"	Wood	Pwr, Tel
242				York Electric		42'	13"	Wood	Pwr, Tel
243				York Electric		34'	10"	Wood	Pwr
244				York Electric		36'	10"	Wood	Pwr
245				York Electric		34'	10"	Wood	Pwr
246				York Electric		38'	11"	Wood	Pwr, Tel
247				York Electric		30'	9"	Wood	Pwr
248				York Electric		34'	11"	Wood	Pwr, Tel
249				York Electric		38'	11"	Wood	Pwr, Tel
250				York Electric		32'	10"	Wood	Pwr, Tel
251				York Electric	3BP5	42'	13"	Wood	Pwr, Tel
252				York Electric		38'	11"	Wood	Pwr
253				York Electric		32'	9"	Wood	Pwr
254				York Electric		33'	11"	Wood	Pwr
255				York Electric		36'	11"	Wood	Pwr, Tel, Ctv
256				York Electric		33'	11"	Wood	Pwr, Tel, Ctv
257				York Electric		37'	10"	Wood	Pwr, Tel, Ctv
258				York Electric	3BP912 15N	35'	11"	Wood	Pwr, Tel, Ctv
259				York Electric	5N	37'	11"	Wood	Pwr, Tel, Ctv
260				York Electric		38'	11"	Wood	Pwr, Tel, Ctv
261				Comporium		34'	10"	Wood	Pwr, Tel, Ctv
262				York Electric		35'	10"	Wood	Pwr
263				York Electric		34'	11"	Wood	Pwr
264				York Electric		33'	8"	Wood	Pwr, Tel, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4C

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4D

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
265				York Electric		24'	10"	Wood	Pwr
266				York Electric	4.5	36'	11"	Wood	Pwr, Tel, Ctv
267				Comporium		33'	8"	Wood	Pwr, Tel, Ctv
268				York Electric		24'	9"	Wood	Pwr, Tel
269				Comporium		25'	10"	Wood	Tel
270				York Electric		30'	10"	Wood	Pwr
271				York Electric		26'	9"	Wood	Pwr
272				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
273				Duke Power		92'		Metal	Pwr
274				York Electric		33'	10"	Wood	Pwr
275				York Electric		32'	10"	Wood	Pwr, Tel, Ctv
276				York Electric		34'	11"	Wood	Pwr, Tel, Ctv
277				Comporium		34'	10"	Wood	Pwr, Tel, Ctv
278				York Electric	3B16	43'	12"	Wood	Pwr, Tel, Ctv
279				SCDOT	350N-5299B	28'	15"	Concrete	Signal
280				York Electric		25'	8"	Wood	Pwr, Tel
281				SCDOT		28'	15"	Concrete	Signal
282				SCDOT	E-350N-5299B	28'	15"	Concrete	Signal
283				SCDOT	350N-5299B	28'	15"	Concrete	Signal
284				York Electric	3B17	43'	13"	Wood	Pwr, Tel, Ctv
285				York Electric	3BE20	30'	10"	Wood	Pwr, Tel, Ctv
286				York Electric		29'	10"	Wood	Pwr
287				York Electric		33'	10"	Wood	Pwr, Tel, Ctv
288				York Electric		28'	9"	Wood	Pwr
289				Duke Power	5	43'	11"	Wood	Pwr
290				Duke Power		105'		Metal	Pwr
291				York Electric	30N	31'	10"	Wood	Pwr, Tel, Ctv
292				Duke Power	1	42'	13"	Wood	Pwr, Tel
293				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
294				Duke Power	2	51'	13"	Wood	Pwr
295				York Electric	99	35'	12"	Wood	Pwr, Tel
296				York Electric		34'	9"	Wood	Pwr
297				York Electric	3BEC1	34'	10"	Wood	Pwr, Tel, Ctv
298				York Electric		33'	9"	Wood	Pwr
299				York Electric		34'	11"	Wood	Pwr
300				York Electric		35'	10"	Wood	Pwr, Tel, Ctv
301				York Electric		39'	11"	Wood	Pwr, Tel, Ctv
302				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
303				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
304				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
305				York Electric		38'	10"	Wood	Pwr, Tel, Ctv
306				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
307				York Electric		39'	11"	Wood	Pwr
308				York Electric		38'	11"	Wood	Pwr
309				York Electric	30N	33'	12"	Wood	Pwr
310				York Electric		39'	12"	Wood	Pwr
311				York Electric	20N	39'	12"	Wood	Pwr
312				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
313				York Electric		30'	9"	Wood	Pwr, Tel
314				York Electric	23	37'	10"	Wood	Pwr, Tel
315				York Electric		38'	11"	Wood	Pwr
316				Duke Power		90'		Metal	Pwr
317				York Electric		38'	10"	Wood	Pwr, Tel, Ctv, Signal
318				York Electric		38'	12"	Wood	Pwr, Tel, Ctv
319				York Electric		38'	12"	Wood	Pwr, Tel, Ctv, Signal
320				York Electric		38'	12"	Wood	Pwr, Tel, Ctv, Signal
321				York Electric	30N	38'	10"	Wood	Pwr, Tel, Ctv, Signal
322				York Electric		29'	9"	Wood	Pwr
323				York Electric		29'	9"	Wood	Pwr
324				York Electric		28'	9"	Wood	Pwr
325				York Electric		26'	9"	Wood	Pwr
326				York Electric		29'	9"	Wood	Pwr
327				York Electric		24'	9"	Wood	Pwr
328				York Electric	30N	33'	10"	Wood	Pwr
329				York Electric	12N	34'	9"	Wood	Pwr
330				York Electric		33'	12"	Wood	Pwr
331				York Electric		33'	10"	Wood	Pwr
332				York Electric		35'	10"	Wood	Pwr
333				York Electric		33'	11"	Wood	Pwr
334				York Electric		33'	10"	Wood	Pwr
335				York Electric		34'	12"	Wood	Pwr
336				York Electric		34'	10"	Wood	Pwr
337				York Electric		24'	9"	Wood	Pwr
338				York Electric		34'	10"	Wood	Pwr
339				York Electric			11"	Wood	Pwr
340				SCDOT			11"	Wood	Signal
341				York Electric			11"	Wood	Pwr, Tel
342				SCDOT			11"	Wood	Signal
343				York Electric			11"	Wood	Pwr
344				York Electric			11"	Wood	Pwr
345				York Electric			11"	Wood	Pwr, Ctv
346				Duke Power			13"	Wood	Pwr
347				York Electric	30N		11"	Wood	Pwr, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05
POLE	Reference the Utility Pole ID Number	P001, P25
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC

COLUMN	DESCRIPTION	EXAMPLE
STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23
OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L
ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH

COLUMN	DESCRIPTION	EXAMPLE
OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
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NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4D

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U5

GENERAL NOTES

THESE PLANS ARE TO BE USED ONLY AS REFERENCE FOR UTILITY RELOCATIONS.

ALL RELOCATIONS ARE APPROXIMATE BASED ON INFORMATION PROVIDED BY THE INDIVIDUAL UTILITY OWNERS.

ALL PROPOSED RELOCATIONS ARE CONSIDERED INCOMPLETE AND THE INDIVIDUAL UTILITY OWNERS MAY REQUIRE ADDITIONAL RELOCATIONS.

ACTUAL FIELD CONDITIONS WILL DICTATE THE PRECISE LOCATION OF THE RELOCATED UTILITY THROUGH COORDINATION BETWEEN THE CONTRACTOR AND THE UTILITY OWNER.

THE CONTRACTOR IS REQUIRED TO CONTACT 811 AS WELL AS THE NON-811 MEMBER UTILITIES THREE DAYS PRIOR TO EXCAVATING ACTIVITIES.
1-888-721-7877

SPECIAL PROVISIONS

UTILITY STAKING:

CONTRACTOR SHALL BE AWARE ON AS NEEDED BASIS, UTILITIES MAY REQUEST STAKING OF CONSTRUCTION ITEMS AND RIGHT-OF-WAY TO HELP FACILITATE RELOCATIONS AND TO AVOID POTENTIAL CONFLICT WITH ROADWAY CONSTRUCTION AND OTHER UTILITIES.

UTILITY RELOCATION CLEARING SEQUENCE:

UTILITY RELOCATION APPROACH:

IT IS THE INTENTION OF THE UTILITIES TO RELOCATE ACCORDING TO THE FOLLOWING CONSTRUCTION SEQUENCE. THE CLEARING CONTRACTOR SHALL CLEAR AND GRUB ACCORDING TO THE PRIORITY SHOWN IN CHART.

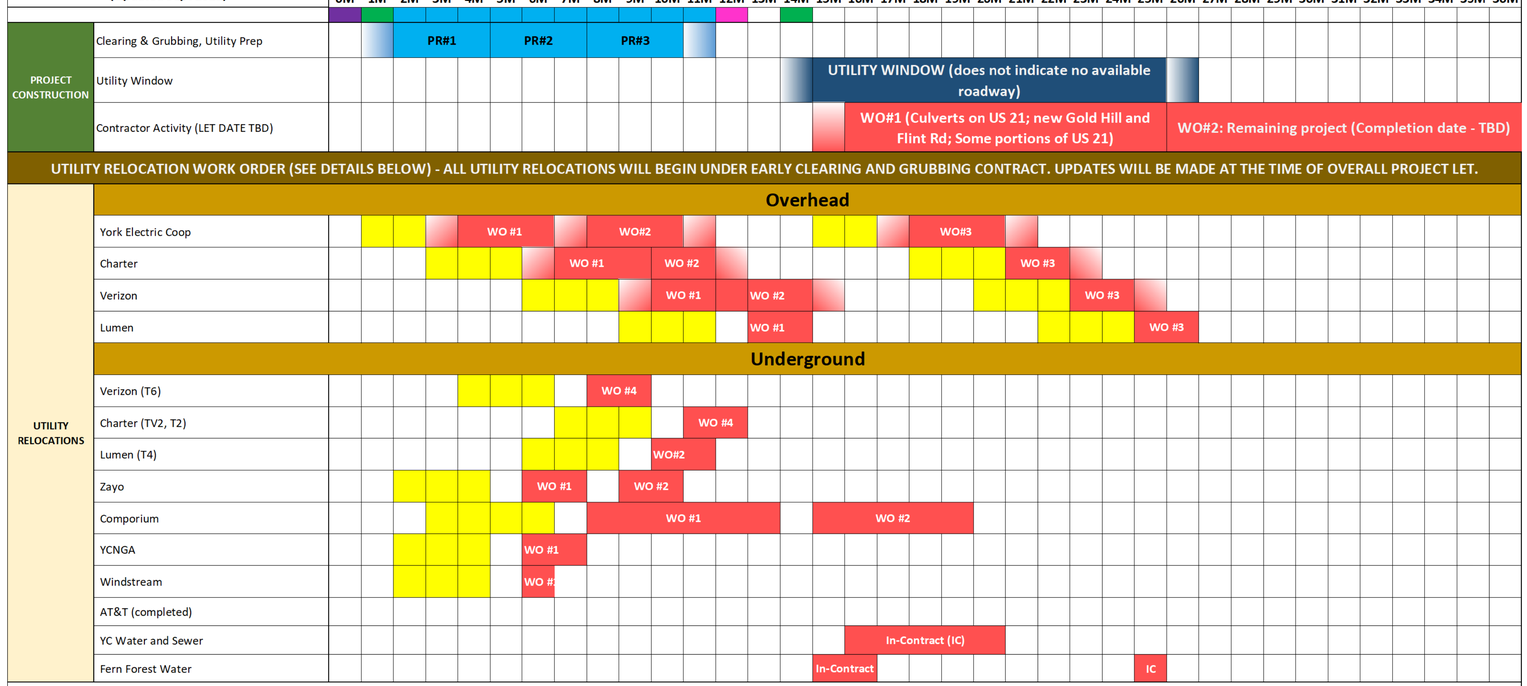
IT IS THE INTENT THAT UTILITIES WILL START WORKING IN ALL AVAILABLE LOCATIONS, WHERE AND WHEN POSSIBLE. EXISTING UTILITIES WILL REMAIN ACTIVE UNTIL ALL NEW FACILITIES ARE INSTALLED AND CUT OVER.

KEY

- notifications (permitting, procurement, scheduling)
- active relocation/ construction activity
- some activity
- no activity
- Project Bid (Early C&G only)
- NTP
- Contractor on-site for C&G operations
- Utility Window
- Project Bid (TBD - For visual purpose only)

**THIS BAR CHART IS FOR INFORMATION ONLY. THE PURPOSE IS TO VISUALLY SHOW THE ORDER OF UTILITY RELOCATIONS IN RELATION TO OTHER CONSTRUCTION ACTIVITY AND NEEDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY UTILITY RELOCATION STATUS. CONTRACTOR ACTIVITY FOR THE PROJECT WILL EXTEND FURTHER THAN WHAT IS SHOWN.

US 21/ SC 51 Widening
(Updated Sept 2023)



WORK AREAS, CONTRACTOR ACTIVITY, AND PRECEDING RELOCATION REQUIRED FOR UTILITY RELOCATION

York Electric Cooperative (E1):
WO #1: SC 51 (need clearing and new alignment graded)
WO #2: Old Nations to SC 51
WO#3: Remaining US 21 (require fill efforts from prime)

Charter (TV2, T2):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 72+00

Verizon (T6):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 61+00

Zayo (T5):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

Comporium (T1):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

AT&T (T3):
Work is complete for Encrochment #A029Y30

Windstream:
WO #1: Adjust as needed; 1 month notification

Lumen (T4):
WO #1: Old Nations to end of SC 51 (OH) (need YEC & Tele OH
WO #2: Gold Hill to Old Nations (UG only) (need C&G)
WO #3: All remaining OH (need YEC OH & Other OH Telecoms

YCNGA (G1):
WO #1: SC 51 (need clearing & grubbing)
WO#2: All remaining relocations

York County Water/Sewer (W1/SS1):
In-contract

Fern Forest Water (T2):
In-contract (2 parts)

Clearing Priorities:
PR#1:
C&G SC51 and Flint Hill Road (new and existing); Includes rough grading new alignments of existing ground
PR#2:
C&G RT/LT Side from Gold Hill to SC 43 and cut from Sta 44+00 to 54+00 LT on US 21; Includes rough grading for new alignment for Gold Hill of existing ground
PR#3:
Remaining project

STV Incorporated
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

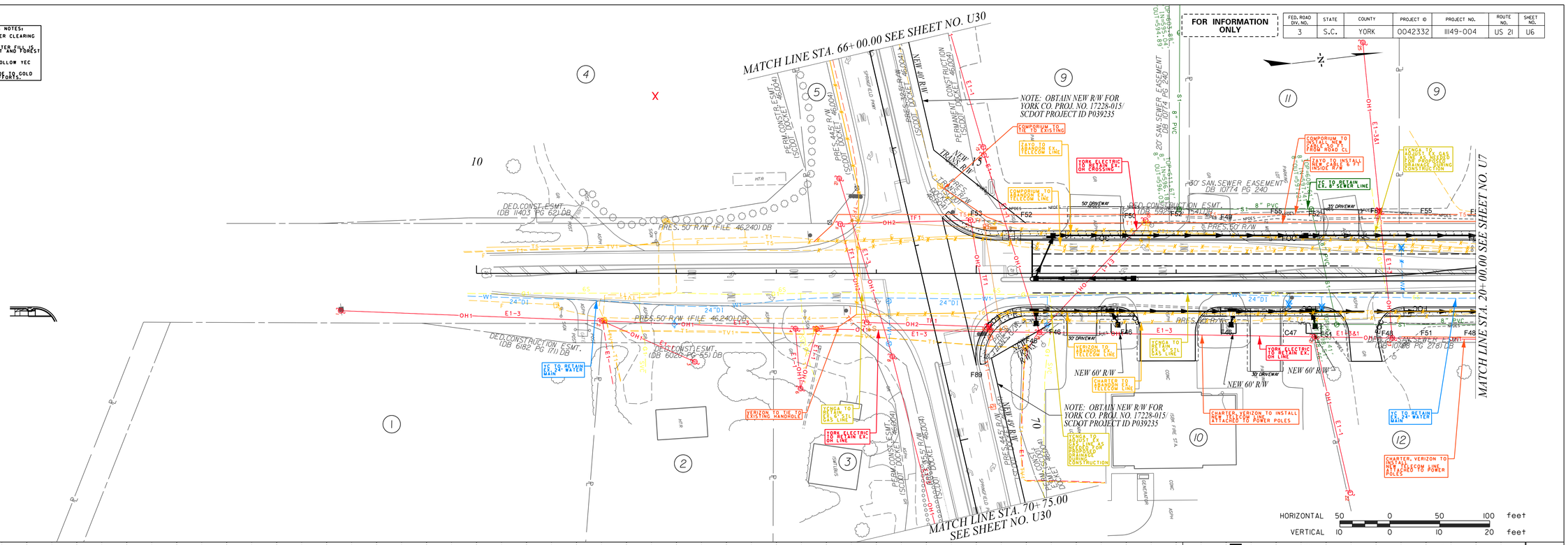
UTILITY GENERAL NOTES SHEET

SCALE: N/A RTE. US 21 DWG. NO. U5

PHASE 3 UTILITY RELOCATIONS NOTES:
COMPORIUM TO RELOCATE AFTER CLEARING EFFORTS.
YEC TO RELOCATE OH LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE
CHARTER AND VERIZON WILL FOLLOW YEC RELOCATIONS.
ZAYO TO RELOCATE ON L.T. SIDE TO GOLD HILL ROAD AFTER CLEARING EFFORTS.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U6



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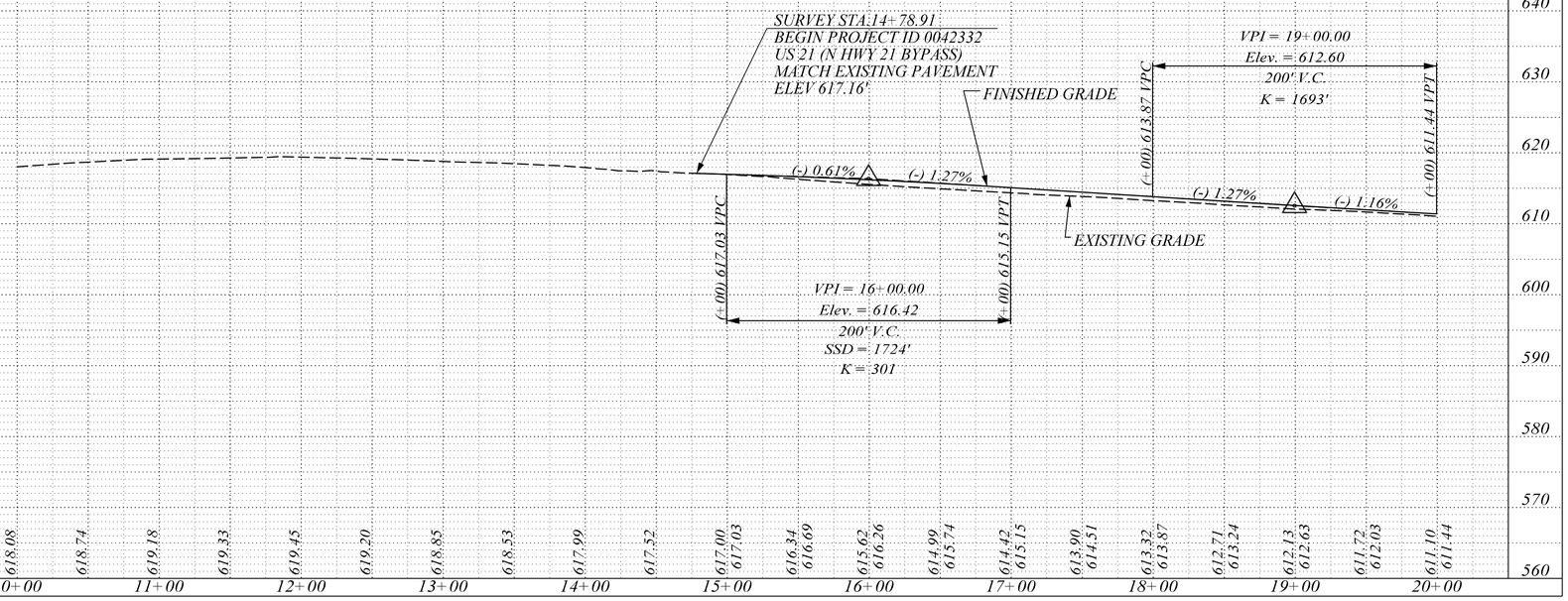
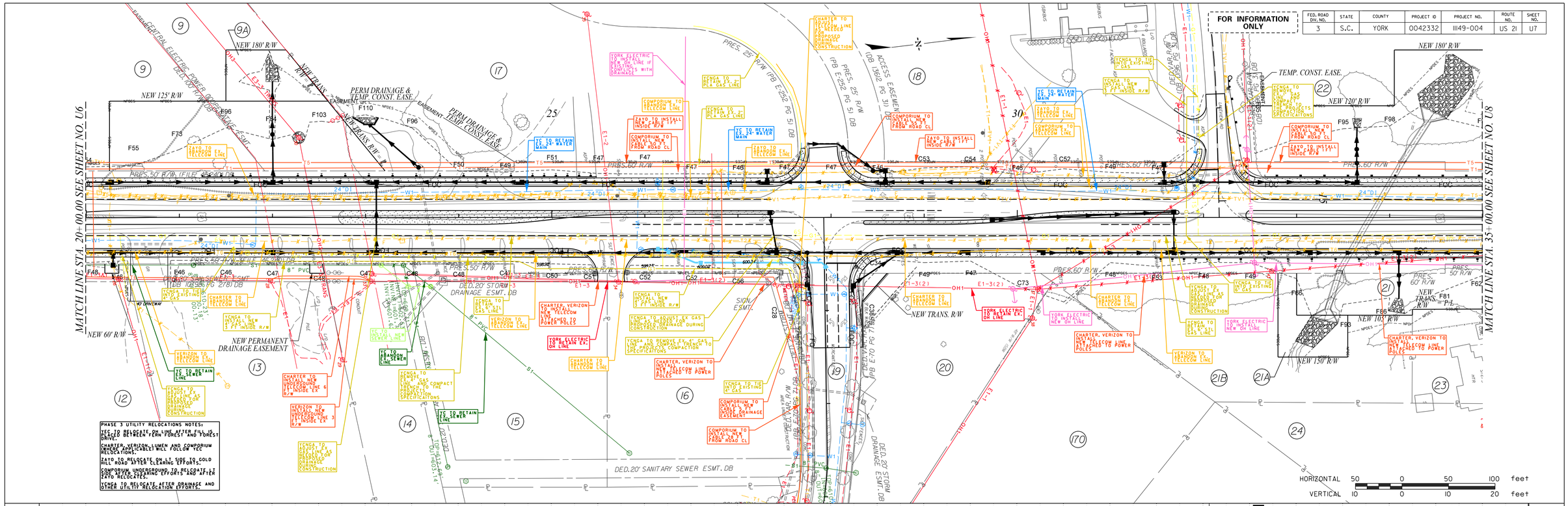
US 21 (N HWY 21 BYPASS)



PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	U7

FOR INFORMATION ONLY



PHASE 3 UTILITY RELOCATIONS NOTES:

YEC TO RELOCATE ON LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE.

CHARTER, VERIZON, LUMEN AND COMPORIUM (WHERE APPLICABLE) WILL FOLLOW YEC RELOCATIONS.

ZAYO TO RELOCATE ON LT SIDE TO GOLD HILL ROAD AFTER CLEARING EFFORTS.

COMPORIUM UNDERGROUND TO RELOCATE LT SIDE AFTER CLEARING EFFORTS AND AFTER ZAYO RELOCATES.

YCNGA TO RELOCATE AFTER DRAINAGE AND OTHER UTILITY RELOCATION EFFORTS.

STV Incorporated
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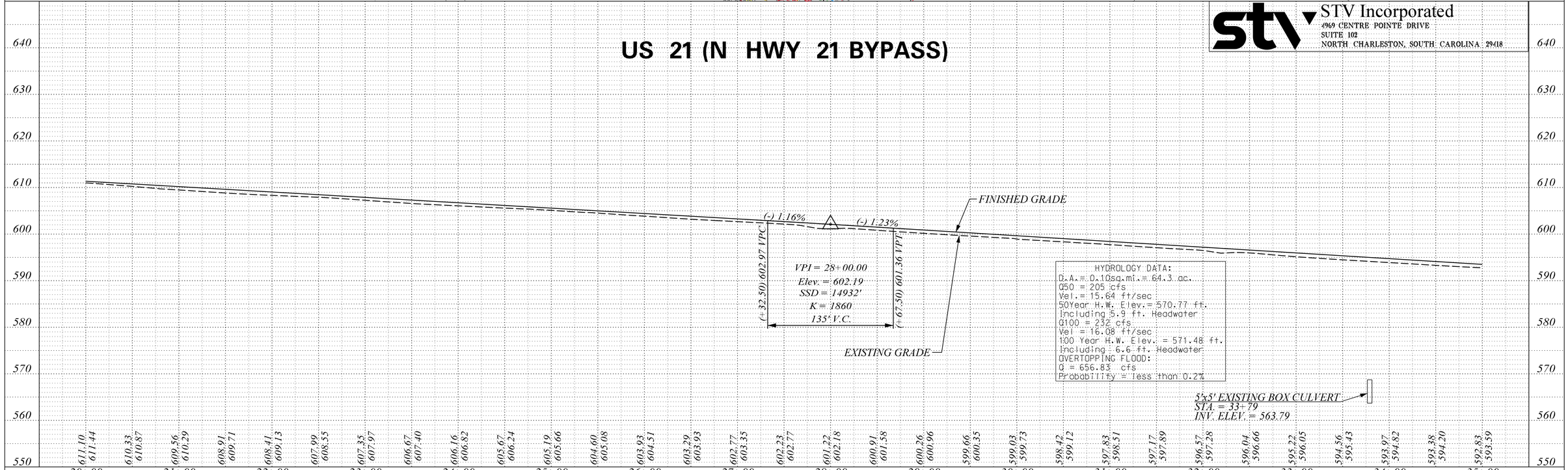
US 21 (N HWY 21 BYPASS)



PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:
COLD HILL TO SR 38 AND CUT SIDE FROM SR 38 TO SR 38 AND CUT SIDE FROM CARTER TO LAKESHORE DR. INCLUDES ROUGH GRADING FOR NEW ALIGNMENT FOR COLD HILL

VERIZON TO RELOCATE SCSI TO ELSIE IN LATER CLEARING/GRADING IS COMPLETE.

VERIZON TO RELOCATE FROM COMPORIUM MH TO COLD HILL PRIOR TO COMPORIUM MH. VERIZON HAS TO INCLUDE THEIR MH FROM CARTER TO COLD HILL. VERIZON MH MUST BE RELOCATED BEFORE COMPORIUM MH OR ELSE IT WILL HOLD UP COMPORIUM.

VERIZON HAS TO BE 9' FEET AT STATION 40+00 FROM RIGHT ROW, DRAINAGE DEPTH AND COMPORIUM.

PHASE 3 UTILITY RELOCATIONS NOTES:
COMPORIUM UNDERGROUND TO RELOCATE AFTER GRADING ESTIMATE COMPORIUM TO BEGIN AT LAKESHORE DR. SIDE AND PROCEEDING TO COLD HILL. NEED GRADING CLEARING IN GOOD SHAPE AND FUTURE GRADING IF ANY SIDE CUTS ARE NEEDED DUE TO ZATO AND/OR CLEARING EFFORTS.

FEC TO RELOCATE POLE JUST AFTER FILL IS COMPLETE BETWEEN CRN, PONDS AND FOREST DRIVE.

CHARTER, VERIZON AND LUMEN TO FOLLOW FEC RELOCATIONS.

ZATO TO RELOCATE ON LT SIDE TO COLD. COMPORIUM TO BE ON RT SIDE FROM BEGINNING TO COLD HILL AND CUT ARE BETWEEN LAKESHORE AND COLD HILL

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	U8

MATCH LINE STA. 35+00.00 SEE SHEET NO. U7

MATCH LINE STA. 50+00.00 SEE SHEET NO. U9

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
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US 21 (N HWY 21 BYPASS)

HYDROLOGY DATA:
D.A.= 0.142sq.mi.= 90.9 ac.
Q50 = 249 cfs
Vel.= 14.65 ft/sec
50Year H.W. Elev.= 574.56 ft.
Including 7.1 ft. Headwater
Q100 = 281 cfs
Vel = 15.06 ft/sec
100 Year H.W. Elev. = 575.56 ft.
Including 8.1 ft. Headwater
OVERTOPPING FLOOD:
Q = 539.95 cfs
Probability = less than 0.2%

VPI = 41+00.00
Elev. = 586.22
K = 106
430' V.C.

(+ 85) 588.86 VPC

(+ 15) 592.31 VPT

LOW POINT
40+15.01
ELEV. = 588.06

(-) 1.23%

(+) 2.84%

FINISHED GRADE

EXISTING GRADE

5'x5' EXISTING BOX CULVERT
STA. = 41+06
INV. ELEV. = 566.73

	35+00	36+00	37+00	38+00	39+00	40+00	41+00	42+00	43+00	44+00	45+00	46+00	47+00	48+00	49+00	50+00
	592.83	592.29	591.64	590.92	590.32	589.66	589.01	588.46	587.95	587.49	587.28	587.42	587.81	588.40	589.13	590.02
	593.59	592.98	592.36	591.75	591.13	590.52	589.90	589.29	588.68	588.26	588.07	588.12	588.40	588.92	589.68	590.67
	591.00	592.31	593.79	595.32	596.83	598.30	599.74	601.18	602.58	604.01	605.45	606.87	608.29	609.74	611.20	
	591.90	593.31	594.72	596.14	597.56	598.98	600.39	601.81	603.23	604.65	606.07	607.48	608.90	610.32	611.74	

640 630 620 610 600 590 580 570 560 550

PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL TO SC 49 AND CUT FROM STA. 28+00 TO 29+65 ON DOUBLEMOCKS ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL

ZATO TO RELOCATE TO SCSI TO BE TIE IN AFTER CLEARING/GRADING IS COMPLETE.

RT SIDE UNDERGROUND TELECOM RELOCATION SEQUENCE: VERIZON > COMPORIUM > LUMEN > CHARTER

PHASE 3 UTILITY RELOCATIONS NOTES:

COMPORIUM TO RELOCATE BOTH SIDES AFTER CLEARING EFFORTS.

YEC TO RELOCATE ON LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE.

CHARTER AND VERIZON WILL FOLLOW YEC RELOCATIONS.

ZATO TO RELOCATE ON LT SIDE TO GOLD HILL AFTER CLEARING EFFORTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U9

MATCH LINE STA. 31+00.00 S-1726 (GOLD HILL ROAD) SEE SHEET NO. U19

MATCH LINE STA. 50+00.00 SEE SHEET NO. U8

MATCH LINE STA. 65+00.00 SEE SHEET NO. U10

MATCH LINE STA. 12+50.00 US 21 BUSINESS SEE SHEET NO. U20

HORIZ 50 0 50 100 feet
VERT 10 0 10 20 feet

US 21 (N HWY 21 BYPASS)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

HIGH POINT
STA. 62+65.06
ELEV. = 642.15

(+) 2.84% (-) 1.29%

FINISHED GRADE

EXISTING GRADE

(+80) 636.69 VPC

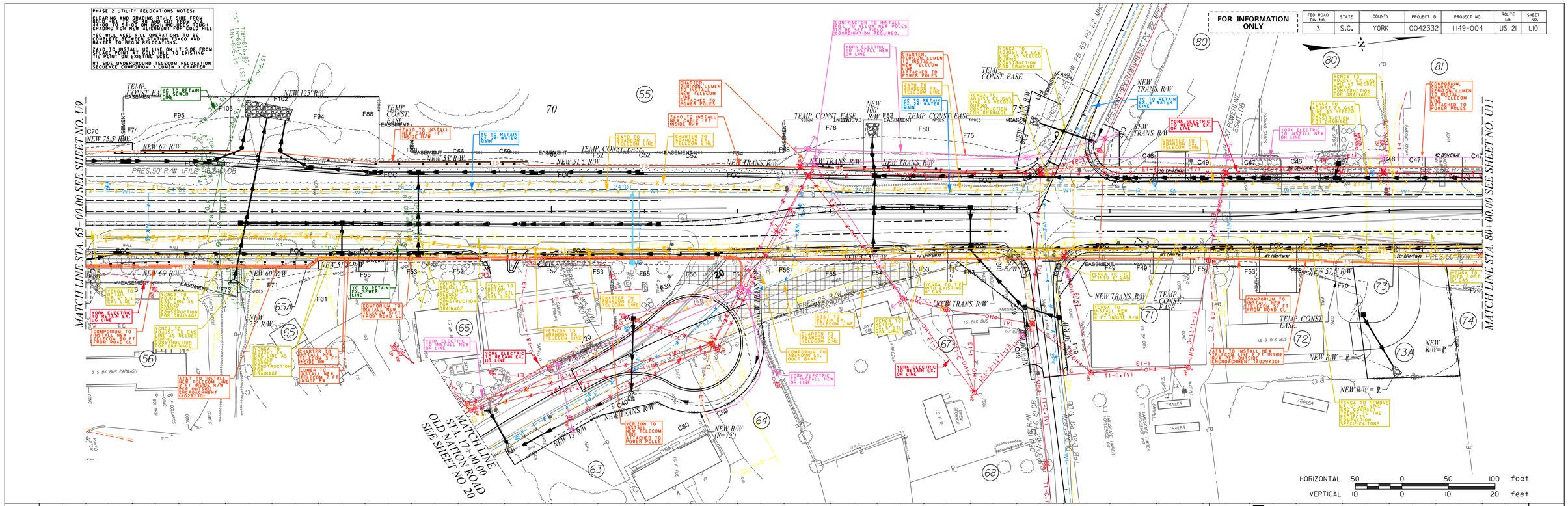
(+40) 641.03 VPT

VPI = 61+60.00
Elev. = 644.63
SSD = 541'
K = 136
560' V.C.

670	660	650	640	630	620	610	600	590	580

50+00	51+00	52+00	53+00	54+00	55+00	56+00	57+00	58+00	59+00	60+00	61+00	62+00	63+00	64+00	65+00
611.20 611.74	612.54 613.16	613.95 614.57	615.41 615.99	616.86 617.41	618.28 618.83	619.67 620.25	621.05 621.66	622.41 623.08	623.84 624.50	625.26 625.92	626.71 627.34	628.19 628.75	629.63 630.17	631.06 631.59	632.48 633.01	633.92 634.42	635.32 635.84	636.68 637.25	637.91 638.50	638.98 639.57	639.79 640.45	640.45 641.15	640.96 641.67	641.32 642.00	641.32 642.14	641.50 642.11	641.31 641.89	640.92 641.48	640.39 640.90	639.71 640.25

PROLINE.DGN


FOR INFORMATION ONLY
FED. ROAD DIV. NO. 3
STATE S.C.
COUNTY YORK
PROJECT ID 0042332
PROJECT NO. 11149-004
ROUTE NO. US 21
SHEET NO. U10
MATCH LINE STA. 65+00.00 SEE SHEET NO. U9
MATCH LINE STA. 80+00.00 SEE SHEET NO. U11
MATCH LINE STA. 17+00.00 OLD NATION ROAD SEE SHEET NO. 20
HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418
US 21 (N HWY 21 BYPASS)
VPI = 69+00.00
Elev. = 635.10
K = 180
550' V.C.
(+25) 638.64 VPC
(+75) 639.95 VPT
LOW POINT
STA. 68+57.13
ELEV. = 637.15
(-) 1.29%
(+) 1.76%
FINISHED GRADE
EXISTING GRADE
(+10) 649.39 VPC
(+) 1.76%
(-) 1.22%
VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.
670
660
650
640
630
620
610
600
590
580
65+00
66+00
67+00
68+00
69+00
70+00
71+00
72+00
73+00
74+00
75+00
76+00
77+00
78+00
79+00
80+00

PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM GOLD MILL TO ZZ+78 AND CUT FROM 37+ 22+50 TO 24+66 OR USED INCLUDES ROUGH GRADING FOR NEW ALIGNENT FOR COLD HILL

ZAYO TO INSTALL UNDERGROUND 12- FEET DEEP TO AVOID PROPOSED DRAINAGE ACTIVITIES AND CUT OF EXISTING AT STATION 85+00 AND 7- FEET DEEP UNTIL STATION 98+00 WHERE THERE IS BETTER SEPARATION.

COMPORIUM TO INSTALL UNDERGROUND 12- FEET DEEP TO AVOID PROPOSED DRAINAGE ACTIVITIES AND CUT OF EXISTING AT STATION 85+00 AND 7- FEET DEEP UNTIL STATION 98+00 WHERE THERE IS BETTER SEPARATION.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	U11

MATCH LINE STA. 80+00.00 SEE SHEET NO. U10

MATCH LINE STA. 95+00.00 SEE SHEET NO. U12

MATCH LINE STA. 12+00.00
J3-107 (REGENT PARKWAY)
SEE SHEET NO. U25

NEW TEMPORARY CONSTRUCTION EASEMENT

CONTROL OF ACCESS EASEMENT DB

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

HIGH POINT
STA. 80+05.77
ELEV. = 652.00

(-) 1.22%

(+10) 650.75 VPT

VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.

VPI = 87+85.00
Elev. = 643.75
K = 82
280' V.C.

(+45) 645.46 VPC

LOW POINT
STA. 87+45.14
ELEV. = 644.85

(-) 1.22%

(+) 2.19%

(+25) 646.81 VPT

FINISHED GRADE

EXISTING GRADE

	80+00	81+00	82+00	83+00	84+00	85+00	86+00	87+00	88+00	89+00	90+00	91+00	92+00	93+00	94+00	95+00
EXISTING	652.00	651.94	651.73	651.38	650.87	650.27	649.66	649.05	648.44	647.83	647.22	646.61	646.00	645.40	644.97	644.85
FINISHED	652.00	651.45	651.29	650.96	650.46	648.92	648.41	648.56	647.91	647.30	646.67	646.02	645.38	644.81	644.42	644.34
EXISTING	644.85	644.97	645.03	645.51	646.30	647.36	648.45	649.55	650.64	651.74	652.83	653.92	655.02	656.11	657.21	658.30	659.39
FINISHED	644.34	644.51	644.93	645.74	646.69	647.60	648.87	650.15	651.19	652.26	653.24	654.38	655.54	656.70	657.83	658.88	

700 690 680 670 660 650 640 630 620 610

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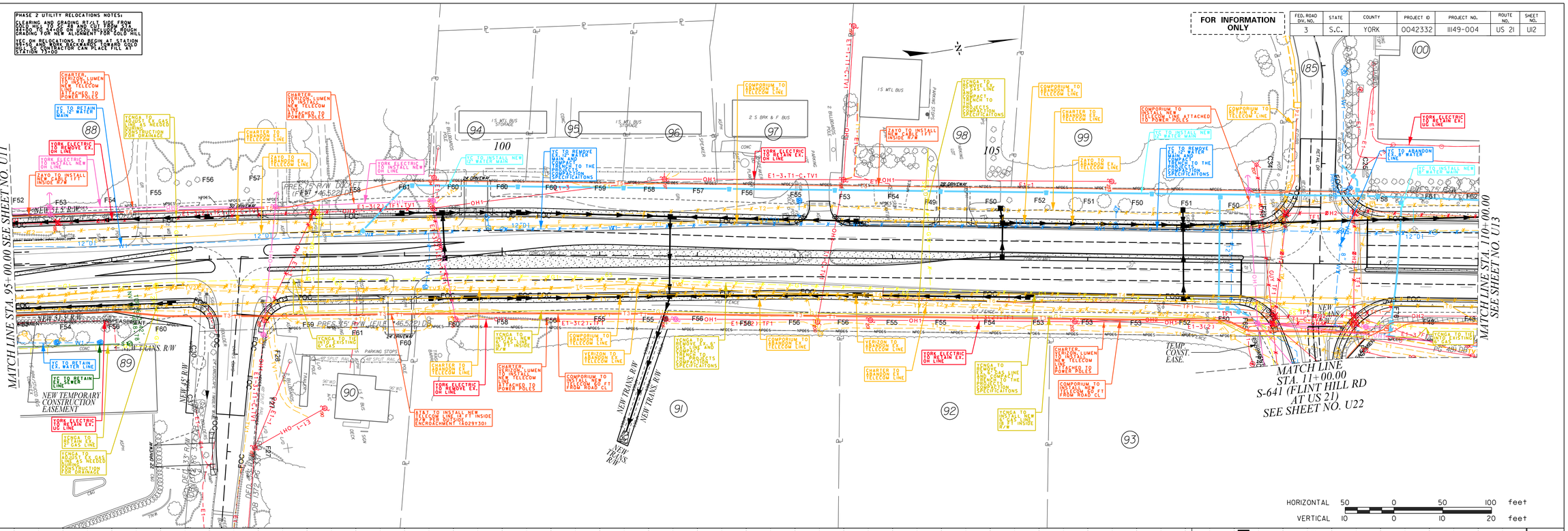
PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL ST. TO 30' NW AND CUT FROM STA. 102+00 TO STA. 97+00 OR DEPENDING ON ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL

TEC-DH RELOCATIONS TO BEGIN AT STATION 99+50 AND WORK BACKWARDS TOWARD GOLD HILL. TO CONTRACTOR CAN PLACE FILL BY STATION 73+00

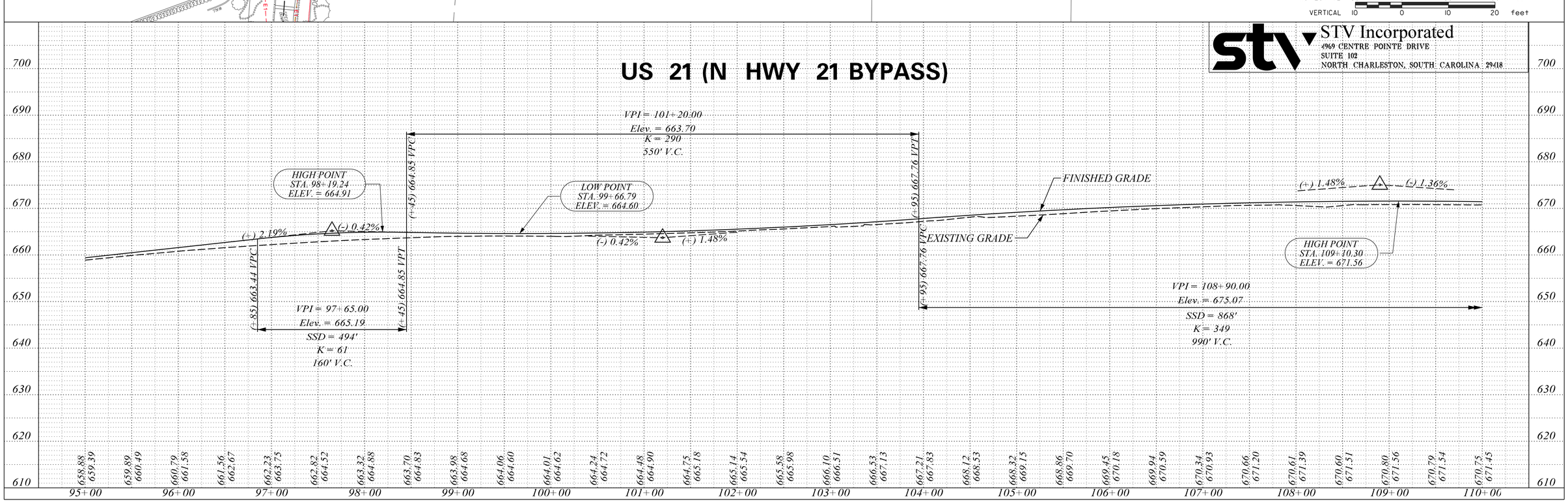
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U12



STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

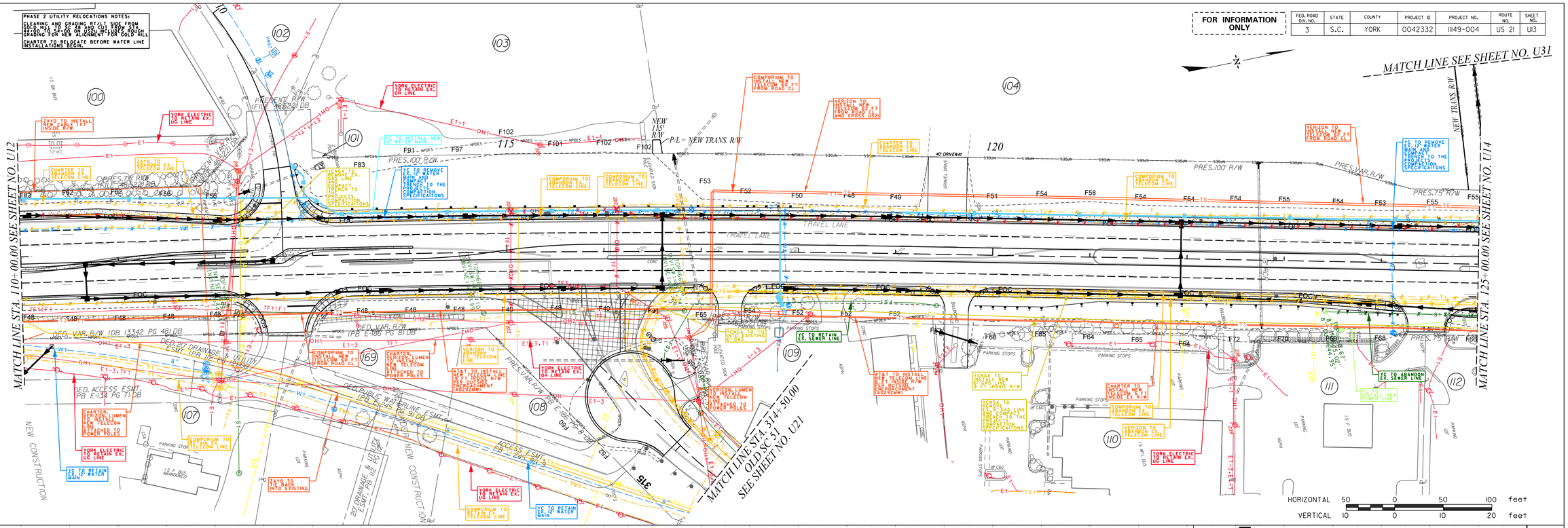


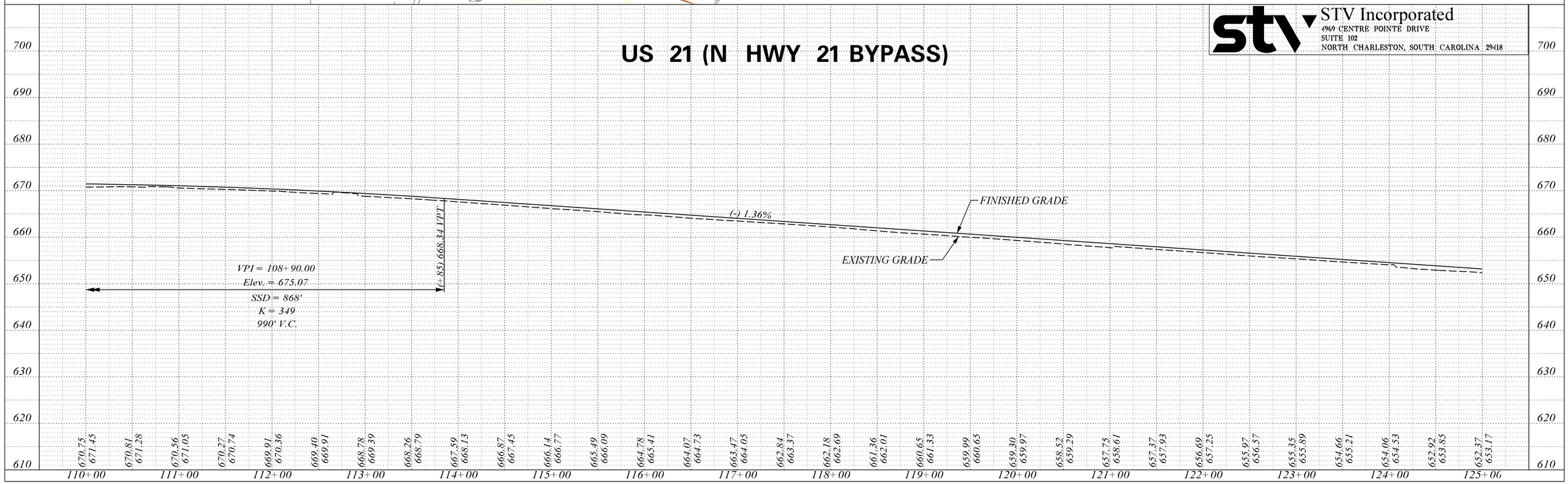
PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING AT/LT SIDE FROM STA. 110+00 TO STA. 120+00 (OLD STORY SW) GRADING FOR NEW ALIGNMENT FOR ZOLO HILL

CHARTER TO RELOCATE BEFORE WATER LINE INSTALLATIONS BEGIN.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U13





STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

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FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U14

PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING AT/AT SIDE FROM 200'RT @ STA 125+00 TO 300'LT @ STA 134+00 TO BE DONE WITH MAIN GRADING FOR NEW ALIGNMENT FOR SOLD ROW.

CHARTER TO RELOCATE BEFORE WATER LINE INSTALLATIONS BEGIN.

MATCH LINE SEE SHEET NO. U31

MATCH LINE STA. 125+ 00.00 SEE SHEET NO. U13

MATCH LINE STA. 298+ 50.00 SEE SHEET NO. U15

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

VPI = 128+30.00
Elev. = 648.68
K = 92.1
135' V.C.
(+ 62.5) 649.60 VPC
(+ 97.5) 647.86 VPT
(-) 1.36%
(-) 1.21%
EXISTING GRADE
FINISHED GRADE
SURVEY STA.134+33.25
END PROJECT ID 0042332
US 21 (N HWY 21 BYPASS)
MATCH EXISTING PAVEMENT
ELEV = 641.36'

652.37 653.17
651.97 652.49
650.96 651.81
650.26 651.13
649.61 650.45
649.03 649.77
648.38 649.10
647.84 648.45
647.27 647.83
646.69 647.23
646.17 646.62
645.66 646.01
645.09 645.41
644.60 644.80
643.95 644.19
643.03 643.59
643.49 642.98
642.91 642.37
642.32 641.77
641.71

125+00 126+00 127+00 128+00 129+00 130+00 131+00 132+00 133+00 134+00

SC 51

EXISTING GRADE
(-) 0.44%
FINISHED GRADE
SURVEY STA.296+15.72
BEGIN PROJECT ID 0042332
RELOC. SC 51 (HWY 51)
MATCH PROPOSED US21 PAVEMENT
ELEV. = 646.66'

647.96 650.68 646.51 651.42 646.29 651.45 646.07 651.36 645.85 651.42 645.63

296+00 297+00 298+00

690 680 670 660 650 640 630 620 610 600

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PHASE 1 UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCSI AND FLINT HILL ROAD (NEW & EXISTING) INCLUDE ROUGH GRADING NEW ALIGNMENTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U15

MATCH LINE STA. 298+50.00 SEE SHEET NO. U14

MATCH LINE STA. 303+00.00 OLD SC 51 SEE SHEET NO. U21

MATCH LINE STA. 313+50.00 SEE SHEET NO. U16

-N-

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

SC 51

(+60) 644.71 VPC

(+60) 639.06 VPT

VPI = 302+10.00
Elev. = 644.05
SSD = 524'
K = 104
300' V.C.
DS > 45 MPH

T(-)0.44%

(-)3.33%

FINISHED GRADE

EXISTING GRADE

660 650 640 630 620 610 600 590 580 570

651.42 645.63 | 650.88 645.41 | 649.95 645.19 | 648.19 644.97 | 647.07 644.75 | 646.46 644.46 | 645.33 643.93 | 643.35 643.15 | 642.10 642.14 | 639.64 640.89 | 637.65 639.39 | 635.32 637.73 | 635.52 636.07 | 633.90 634.41 | 632.20 632.75 | 630.65 631.08 | 629.04 629.42 | 627.39 627.76 | 625.63 626.10 | 623.81 624.43 | 622.08 622.77 | 620.46 621.11 | 618.80 619.45 | 617.13 617.78 | 615.50 616.12 | 613.85 614.46 | 612.28 612.80 | 610.70 611.13 | 609.00 609.47 | 607.34 607.81 | 605.69 606.15

299+00 300+00 301+00 302+00 303+00 304+00 305+00 306+00 307+00 308+00 309+00 310+00 311+00 312+00 313+00

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

PHASE 1 UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCS1 AND FLINT HILL ROAD NEW & EXISTING INCLUDE ROUGH GRADING NEW ALIGNMENTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U16

MATCH LINE STA. 313+ 50.00 SEE SHEET NO. U15

MATCH LINE STA. 29+ 00.00
S-48 (SPRINGHILL FARM ROAD RELOC.)
SEE SHEET NO. U23

MATCH LINE STA. 17+ 00.00
S-641 (FLINT HILL AT SC 51)
SEE SHEET NO. U22

MATCH LINE STA. 328+ 50.00 SEE SHEET NO. U17

315
TEMP. CONST. EASE
NEW 45.5' R/W
320
NEW TRANS. R/W
325
TEMP. CONST. EASE.
NEW 95' R/W
NEW PERM DRAINAGE EASE
TEMP. CONST. EASE
TEMPORARY CONSTRUCTION EASEMENT END UNKNOWN

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

VPI = 316+15.00
Elev. = 597.33
K = 84
490' V.C.
DS = 45 MPH
(+ 70) 605.48 VPC
(- 60) 603.45 VPT
LOW POINT
STA. 316+49.93
ELEV. = 600.83
(-) 3.33%
(+) 2.50%
EXISTING GRADE
FINISHED GRADE
(+) 2.50%
(-) 0.31%
HIGH POINT
STA. 328+18.13
ELEV. = 620.70
(+ 85) 614.05 VPC
VPI = 325+85.00
Elev. = 621.54
SSD = 684'
K = 214
600' V.C.
DS > 45 MPH
6'x6' EXISTING BOX CULVERT
(EP-6) STA. = 316+23
INV. ELEV. = 589.30

HYDROLOGY DATA:
D.A.= 0.06sq.mi.= 38.5 ac.
Q50 = 53 cfs
Vel.= 8.53 ft/sec
50Year H.W. Elev.= 595.22 ft.
Including 4.0 ft. Headwater
Q100 = 59 cfs
Vel = 8.99 ft/sec
100 Year H.W. Elev. = 595.37 ft.
Including 4.2 ft. Headwater
OVERTOPPING FLOOD:
Q = 271.31 cfs
Probability = less than 0.2%

650 640 630 620 610 600 590 580 570 560

605.69 606.15 | 604.05 604.54 | 602.44 603.20 | 600.99 602.16 | 599.92 601.42 | 599.34 600.98 | 599.20 600.83 | 599.59 600.98 | 600.40 601.42 | 601.55 602.16 | 602.76 603.20 | 603.98 604.45 | 605.22 605.69 | 606.46 606.94 | 607.76 608.19 | 609.02 609.44 | 610.26 610.68 | 611.55 611.93 | 612.84 613.18 | 614.04 614.42 | 615.18 615.58 | 616.20 616.61 | 617.09 617.53 | 617.83 618.34 | 618.52 619.02 | 619.05 619.59 | 619.50 620.04 | 619.80 620.38 | 620.00 620.60 | 620.05 620.70 | 620.00 620.68

314+00 315+00 316+00 317+00 318+00 319+00 320+00 321+00 322+00 323+00 324+00 325+00 326+00 327+00 328+00

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FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U17

FOR INFORMATION ONLY

PHASE I UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCSL AND FLINT HILL ROAD NEW & EXISTING INCLUDE ROUGH GRADING NEW ALIGNMENTS

MATCH LINE STA. 322+50.00 SEE SHEET NO. U16

MATCH LINE STA. 328+50.00 SEE SHEET NO. U16

MATCH LINE STA. 01+50.00 ANDREW L. TUCKER SEE SHEET NO. U23

S-48 (SPRINGHILL FARM ROAD) CULDE-SAC SEE SHEET NO. U24

NEW TRANS. R/W & OFFSET OF EOP

TEMP. CONST. EASE.

NEW TRANS. R/W 8' OFFSET OF EOP

NEW 55' R/W

NEW 45' R/W

PRES. 33' R/W

PRES. 40' R/W

PRES. 60' R/W

PRES. 80' R/W

PRES. 100' R/W

PINEVILLE-ROCK HILL RD

MCCLELLANVILLE COURT

YORK ELECTRIC TO INSTALL NEW DH LINE

WINDSTREAM TO ADJUST EXISTING FACILITIES DURING CONSTRUCTION AS NEEDED.

ZAYO TO INSTALL NEW TELECOM 1" FT INSIDE R/W

YC TO RETAIN EX. W WATER LINE

VERIZON TO INSTALL NEW TELECOM 2" FT ATTACHED TO POWER POLES

COMPORIUM TO INSTALL NEW TELECOM 1" FT INSIDE R/W

LUMEN TO ABANDON EX. TELECOM LINE

VERIZON TO ABANDON EX. TELECOM LINE

YORK ELECTRIC TO REMOVE EX. OH LINE

CHARTER TO ADJUST EXISTING LINE TO ACCOMMODATE CONFLICT WITH PROPOSED DRAINAGE

ZAYO TO INSTALL NEW TELECOM HANDHOLE

ZAYO TO TIE BACK TO EXISTING

VERIZON LUMEN, CHARTER TO INSTALL NEW TELECOM LINE ATTACHED TO POWER POLES

VERIZON CHARTER, LUMEN TO INSTALL NEW TELECOM LINE ATTACHED TO POWER POLES

VERIZON TO INSTALL NEW TELECOM 2" FT INSIDE R/W

CHARTER TO ABANDON EX. TELECOM LINE

YC TO RETAIN EX. SEWER LINE

YC TO ABANDON EX. W WATER LINE

YC TO RETAIN EX. W WATER LINE

YC TO ABANDON EX. W WATER LINE

YORK ELECTRIC TO INSTALL NEW DH LINE

FEND UNKNOWN

330

335

340

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

VPI = 331+50.00
Elev. = 619.77
K = 185
350' V.C.
DS > 45 MPH

(+75) 620.32 VPC

(+85) 620.60 VPT

LOW POINT
STA. 330+32.96
ELEV. = 620.23

(-) 0.31%

(+) 1.58%

(+35) 622.53 VPT

(+) 1.58%

(-) 1.30%

FINISHED GRADE

HIGH POINT
STA. 335+81.55
ELEV. = 624.63

(+35) 622.69 VPC

VPI = 335+60.00
Elev. = 626.24
SSD = 600'
K = 156
450' V.C.
DS > 45 MPH

(+85) 623.31 VPT

EXISTING GRADE

SURVEY STA.340+10.00
END PROJECT ID 0042332
SC 51 (HWY 51)
MATCH EXISTING PAVEMENT
ELEV = 620.38'

660 650 640 630 620 610 600 590 580 570

620.00 620.68 | 619.94 620.55 | 619.86 620.40 | 619.80 620.26 | 619.83 620.24 | 619.91 620.35 | 620.11 620.60 | 620.47 620.98 | 620.96 621.50 | 621.64 622.15 | 622.44 622.92 | 623.08 623.58 | 623.57 624.08 | 623.92 624.42 | 624.09 624.60 | 624.09 624.62 | 623.92 624.48 | 623.68 624.18 | 623.32 623.72 | 622.80 623.11 | 622.20 622.46 | 621.60 621.81 | 621.00 621.16 | 620.48 620.51 | 619.98 | 619.35 | 618.68 | 617.95

329+00 330+00 331+00 332+00 333+00 334+00 335+00 336+00 337+00 338+00 339+00 340+00 341+00 342+00

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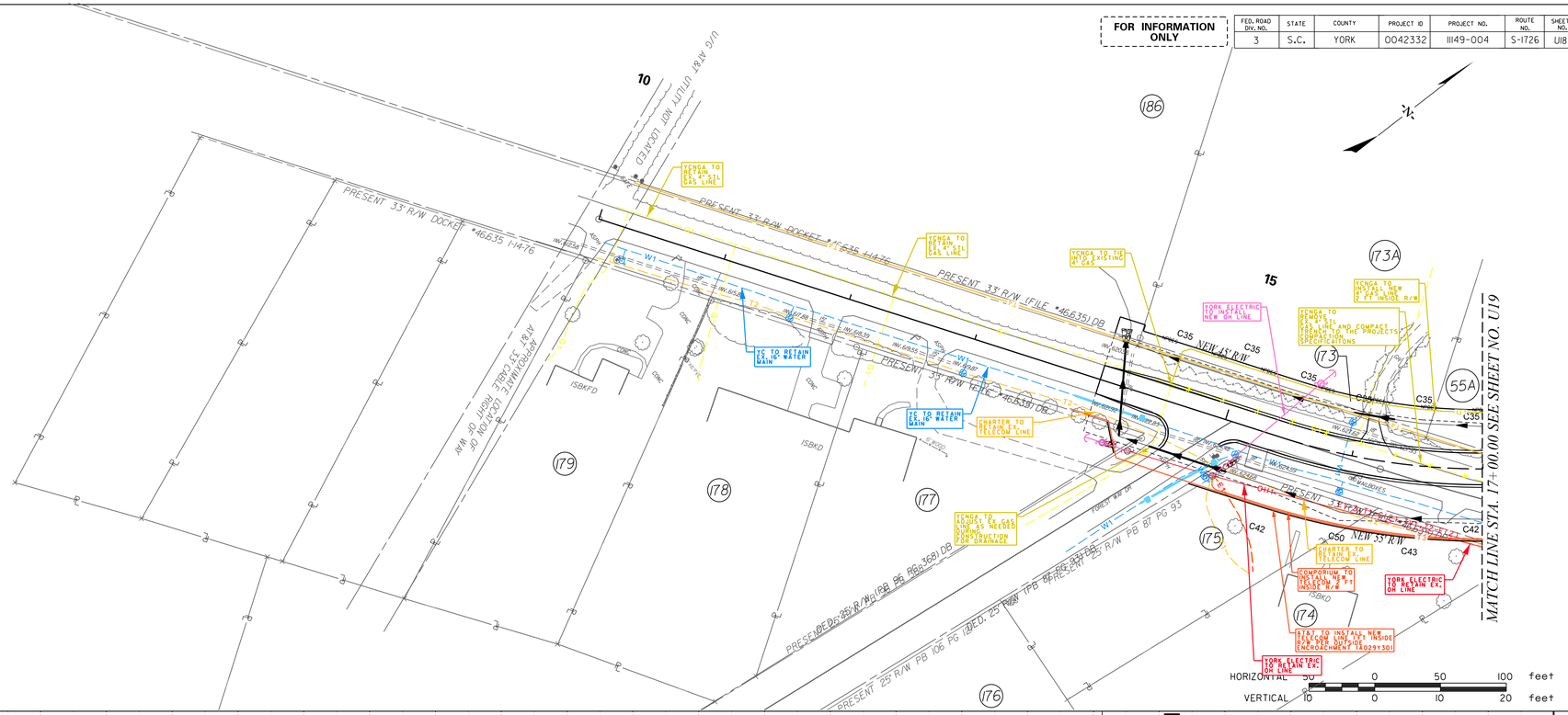
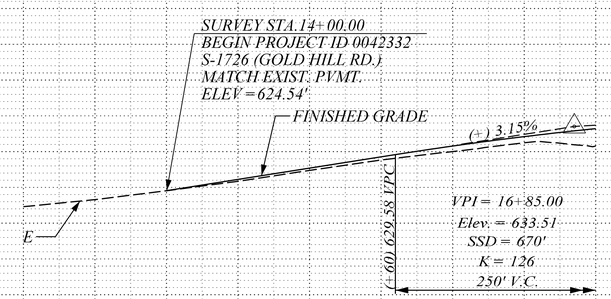
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	S-1726	U18



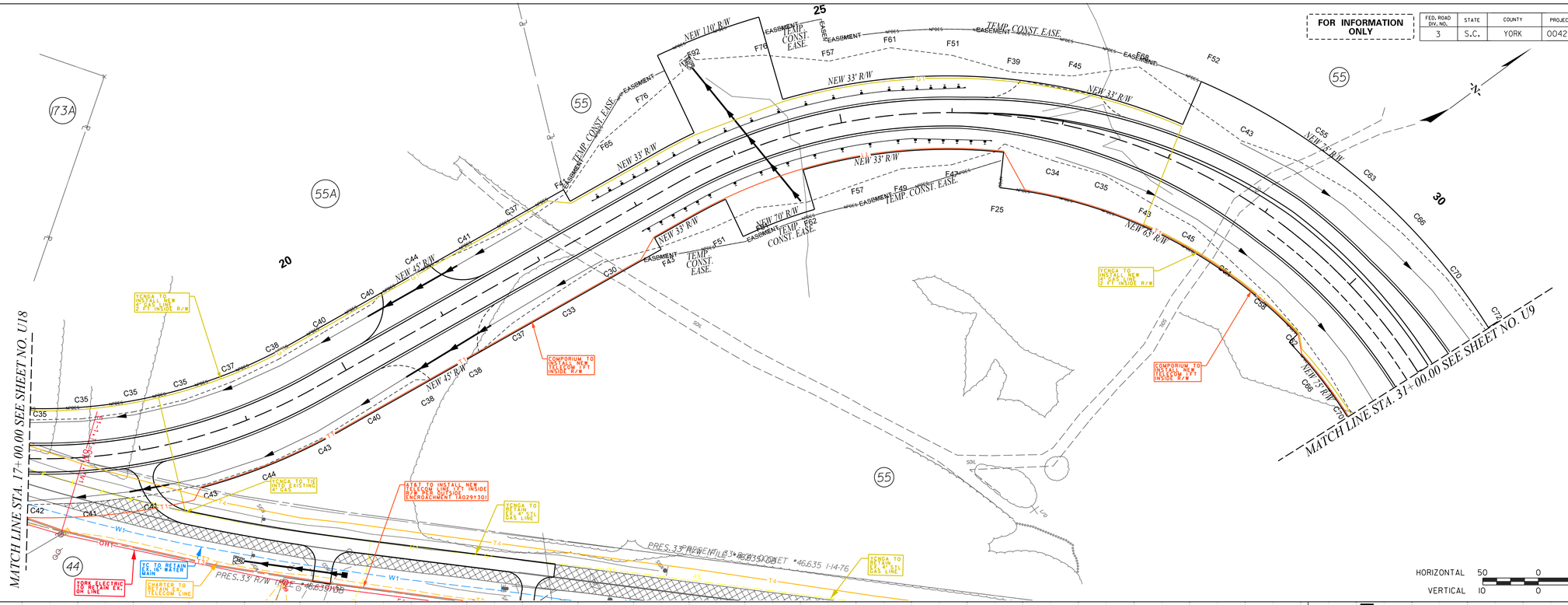
S–1726 (GOLD HILL RD.)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



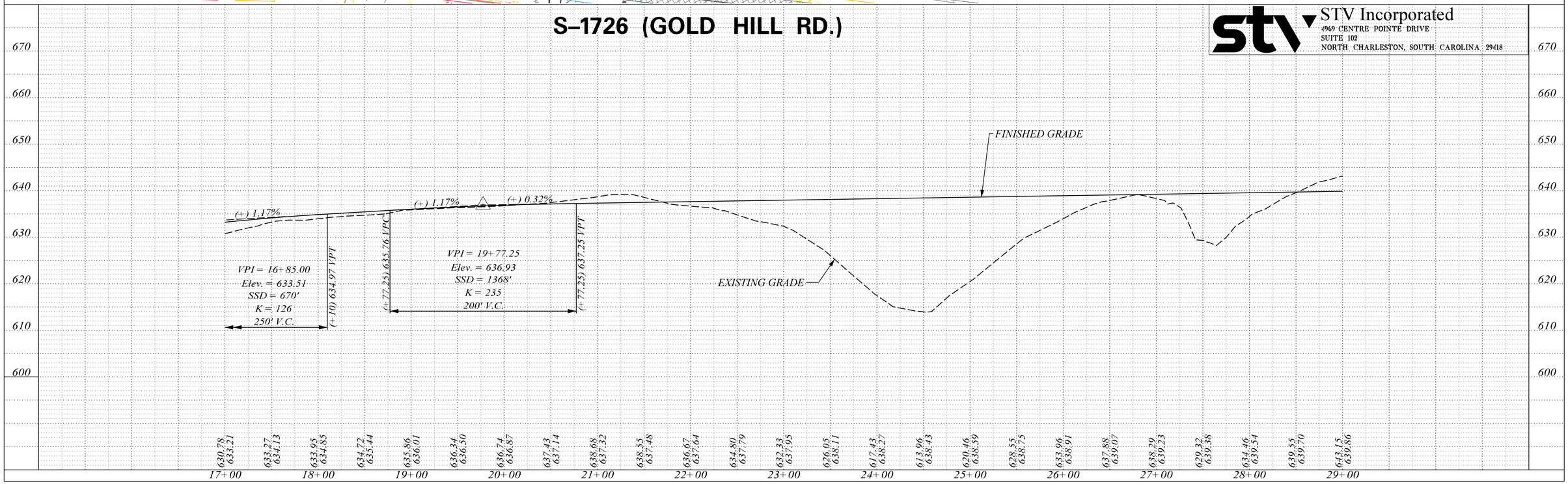
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-1726	U19

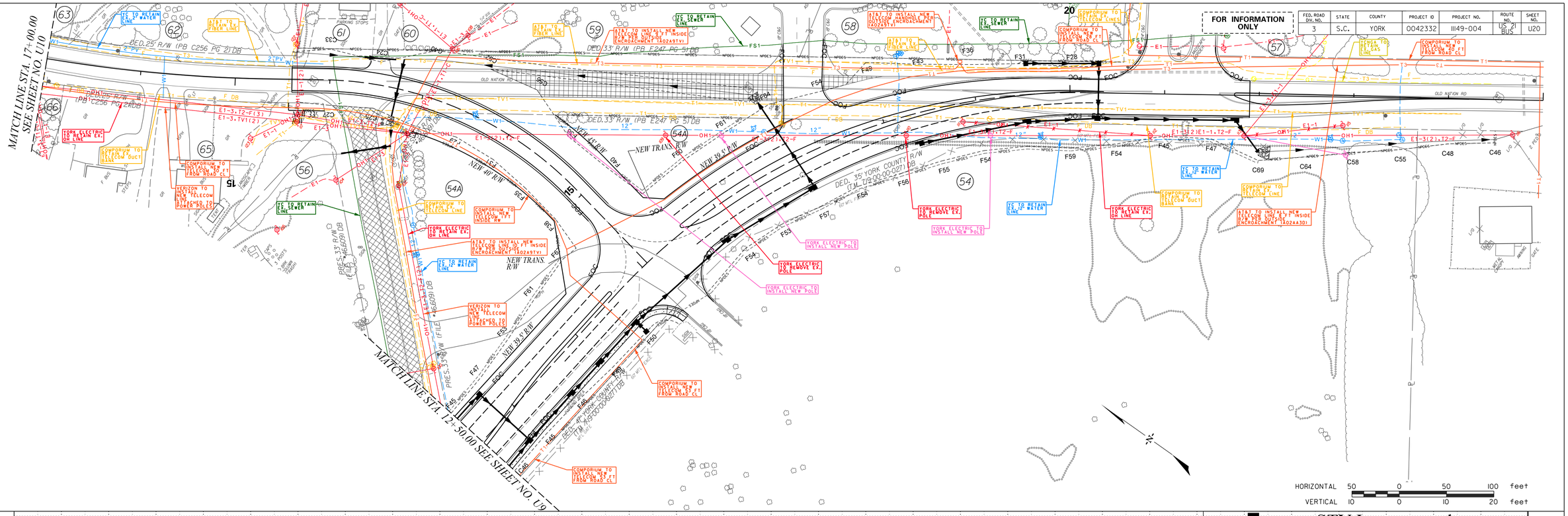


S-1726 (GOLD HILL RD.)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

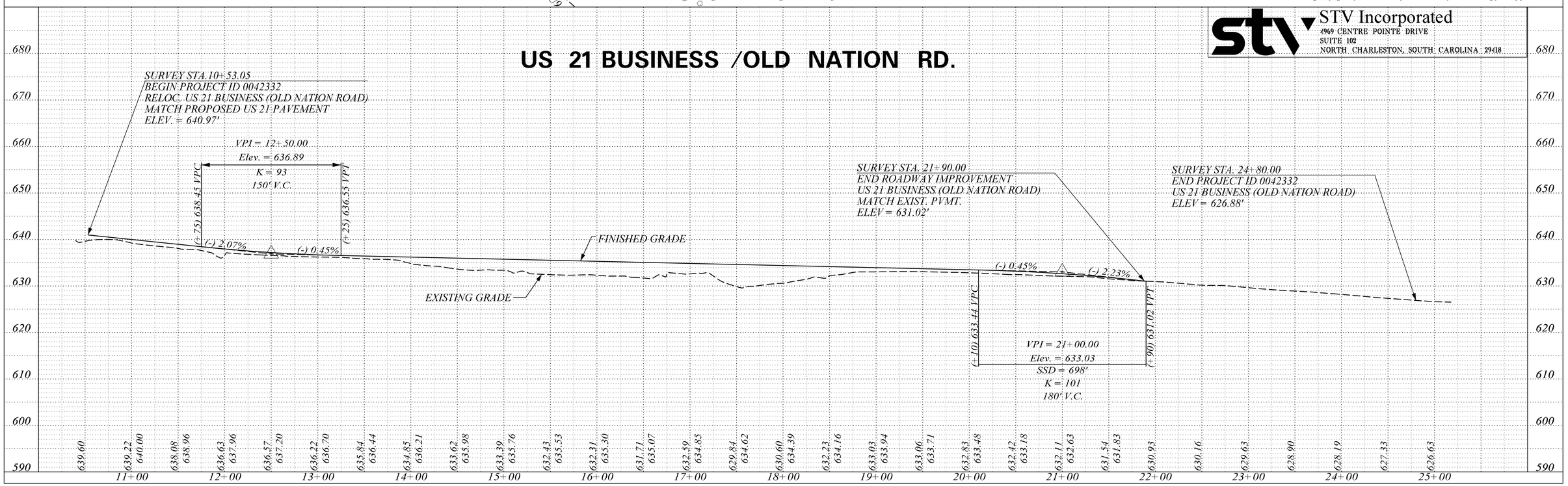


PROLINE.DGN



US 21 BUSINESS /OLD NATION RD.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



PROLINE.DGN

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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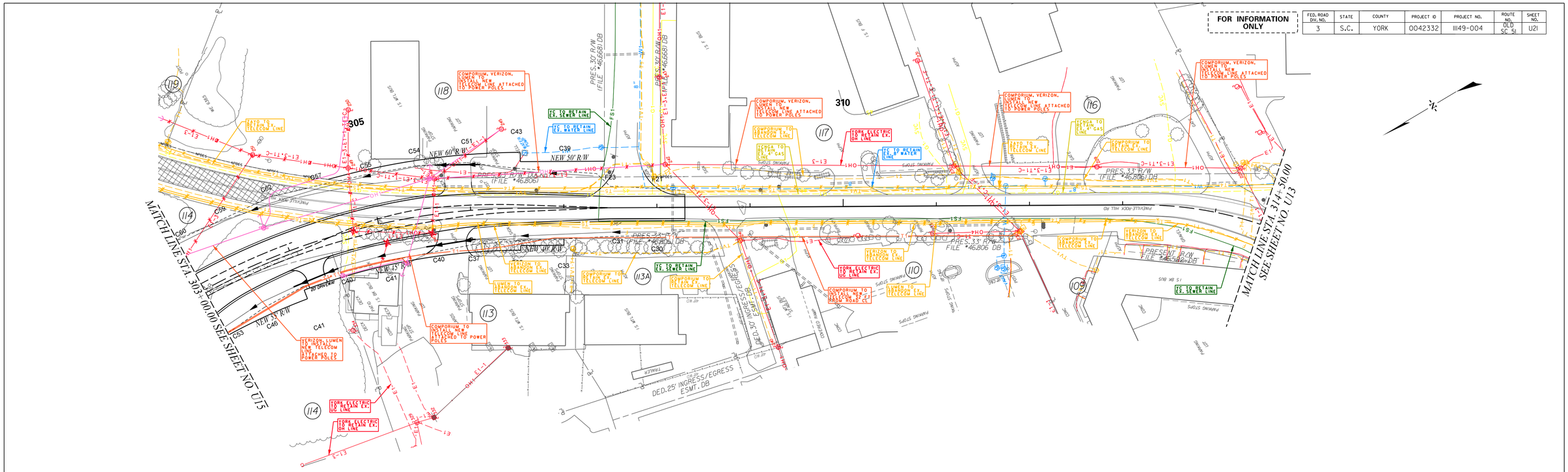
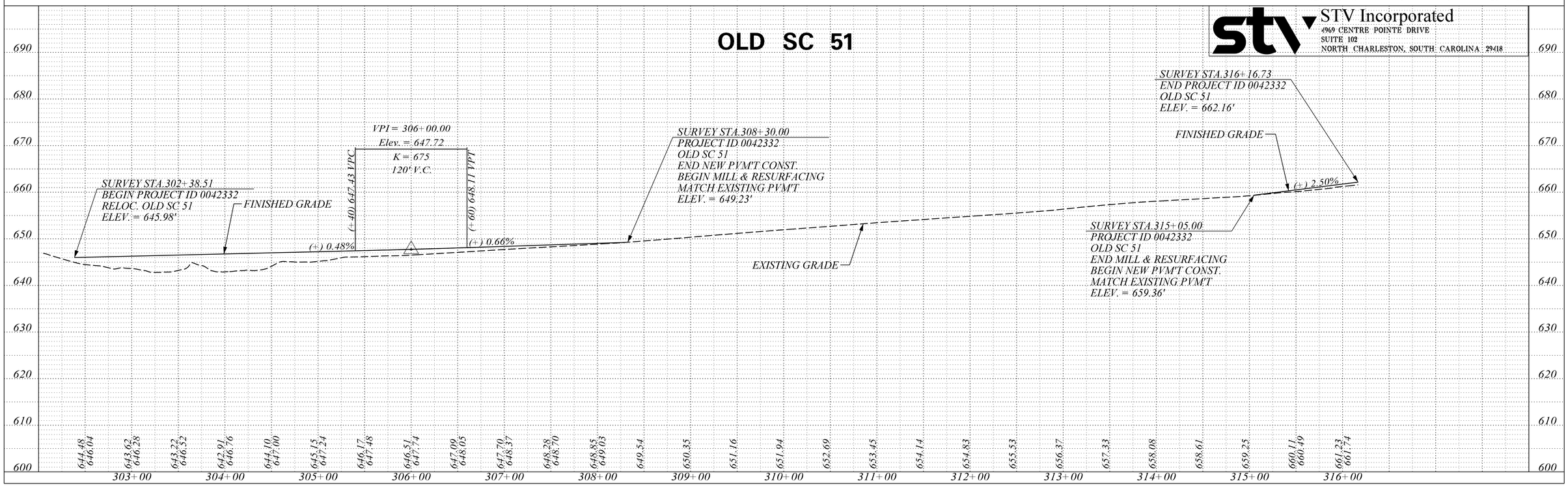


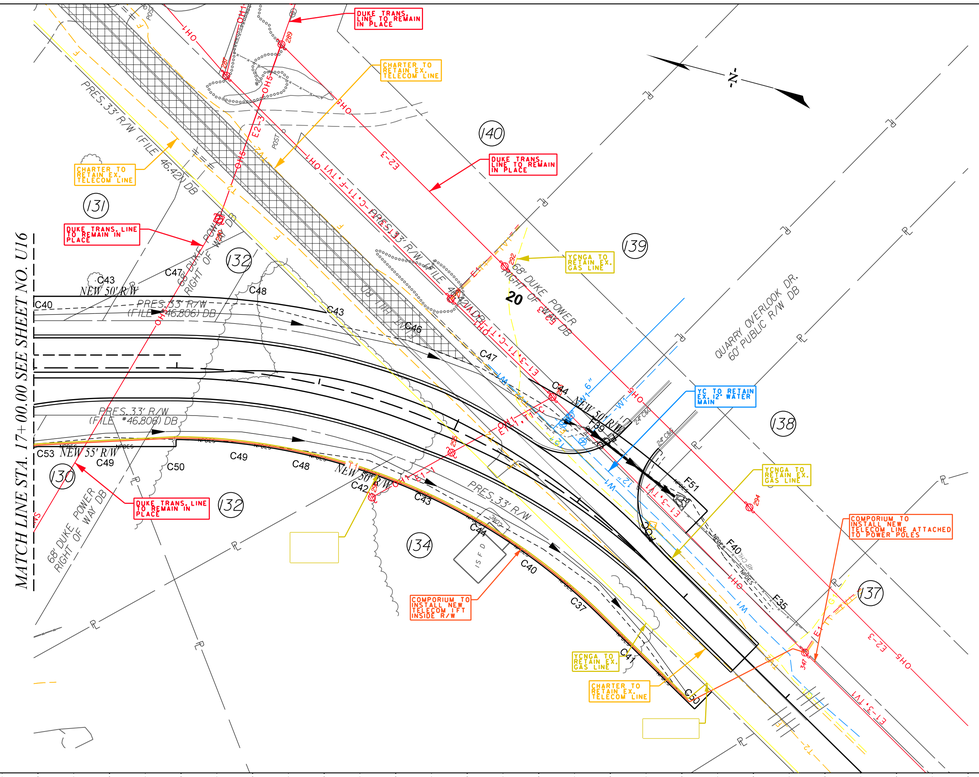


STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-641	U22

FOR INFORMATION ONLY



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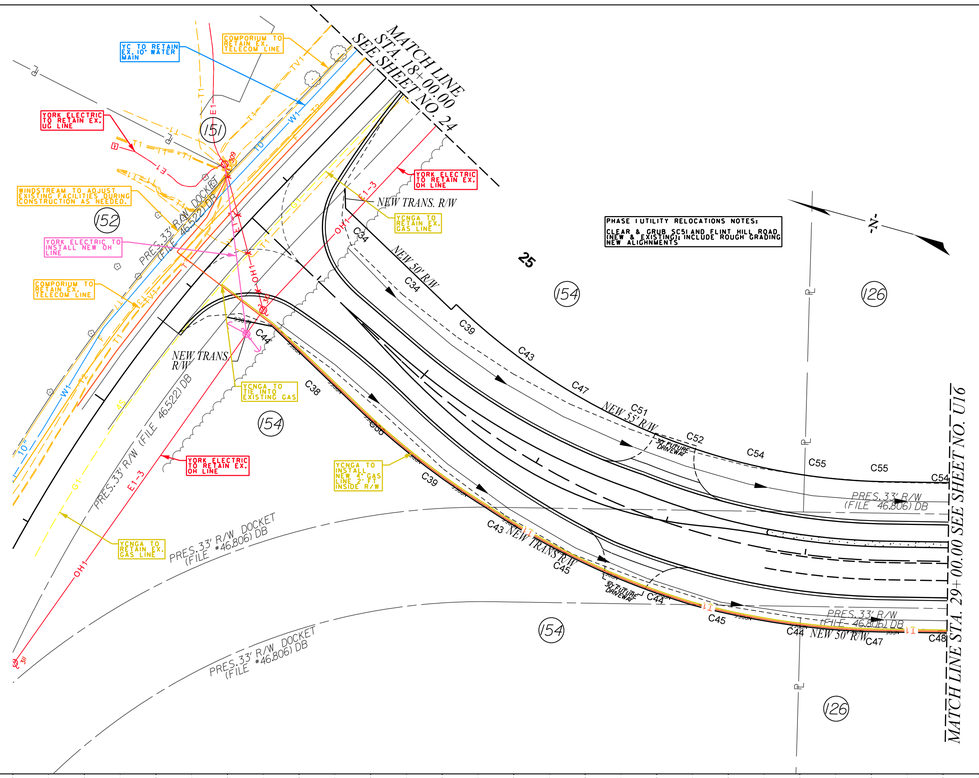
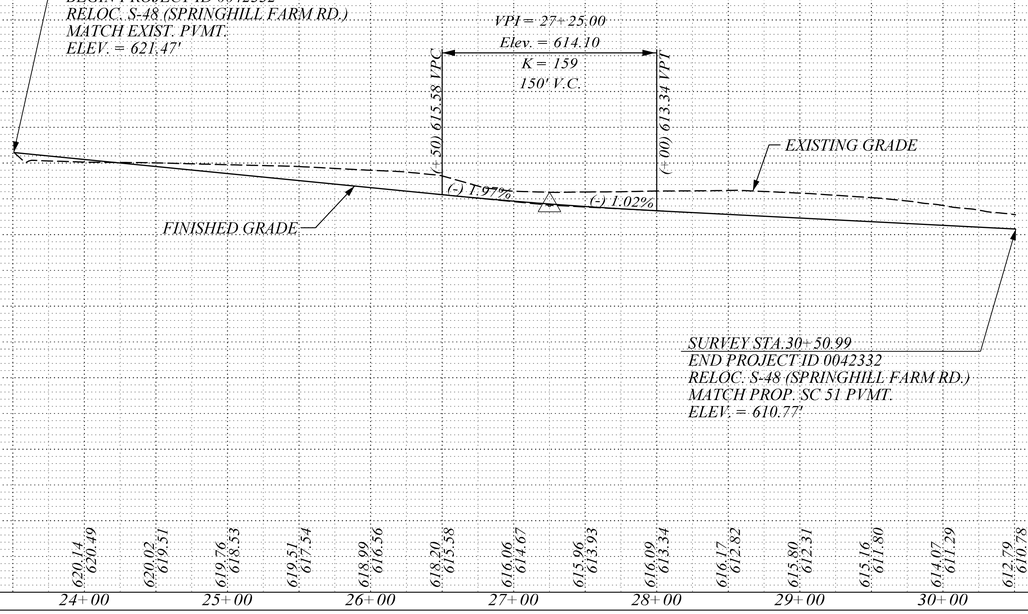
3	S.C.	YORK	0042332	1149-004	S-48 S-328	U23

FOR INFORMATION ONLY



S–48 (SPRINGHILL FARM RD. RELOC.)



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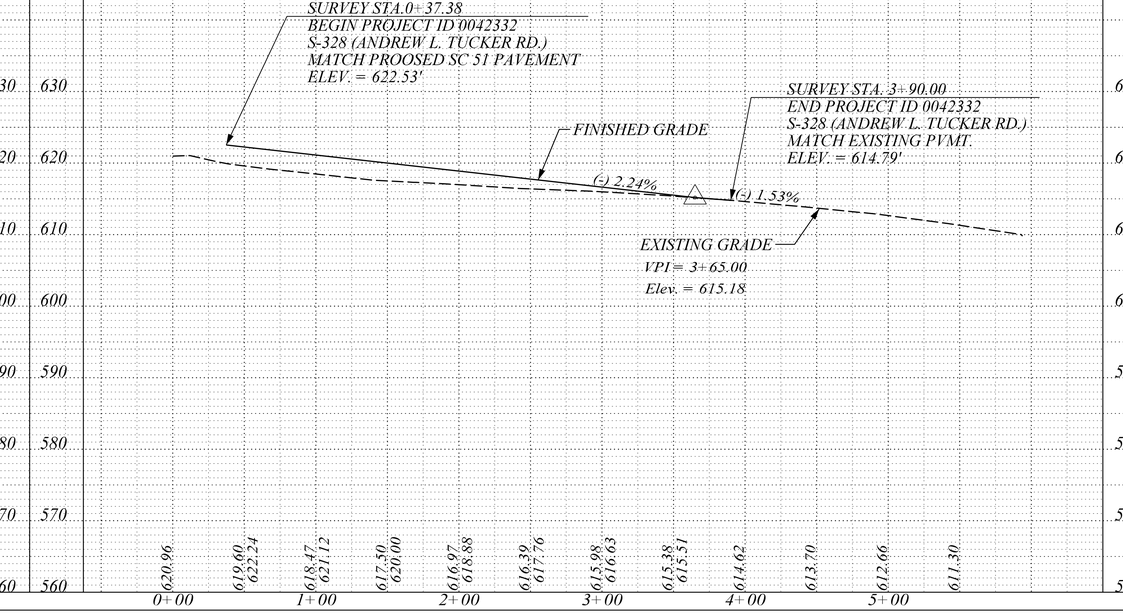

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

FOR INFORMATION ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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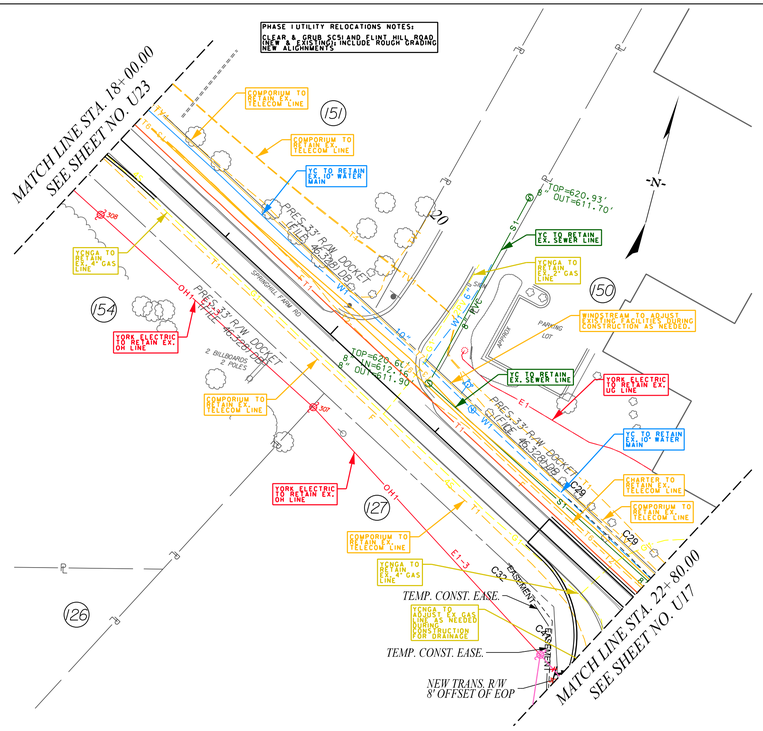
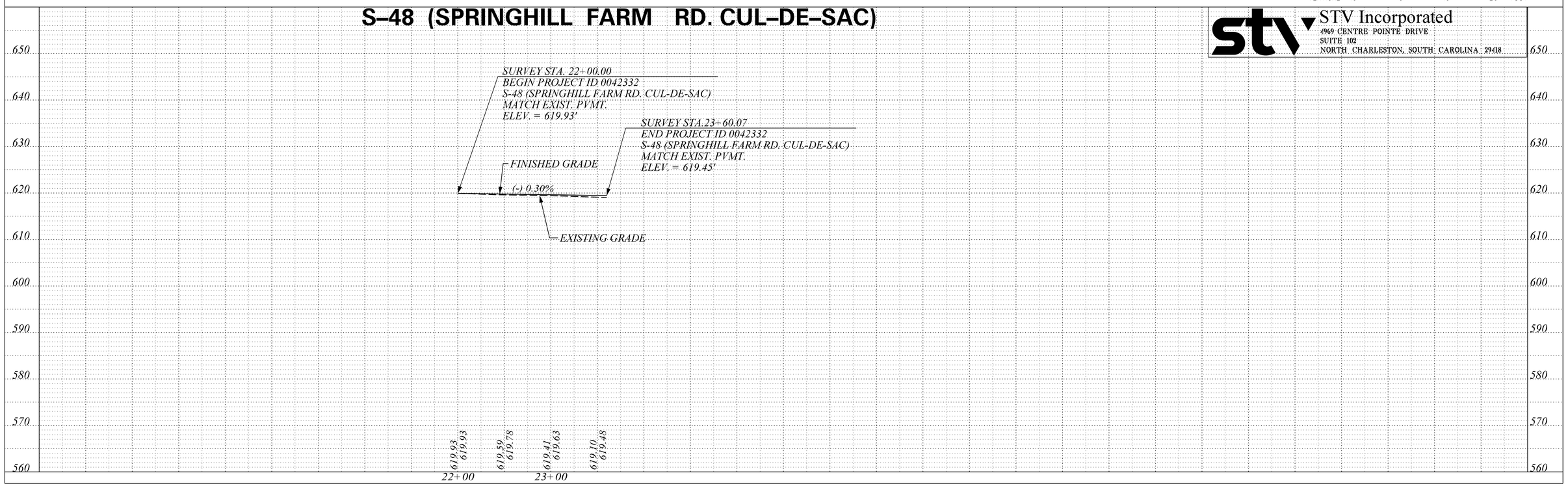


HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S–48 (SPRINGHILL FARM RD. CUL–DE–SAC)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



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FOR INFORMATION ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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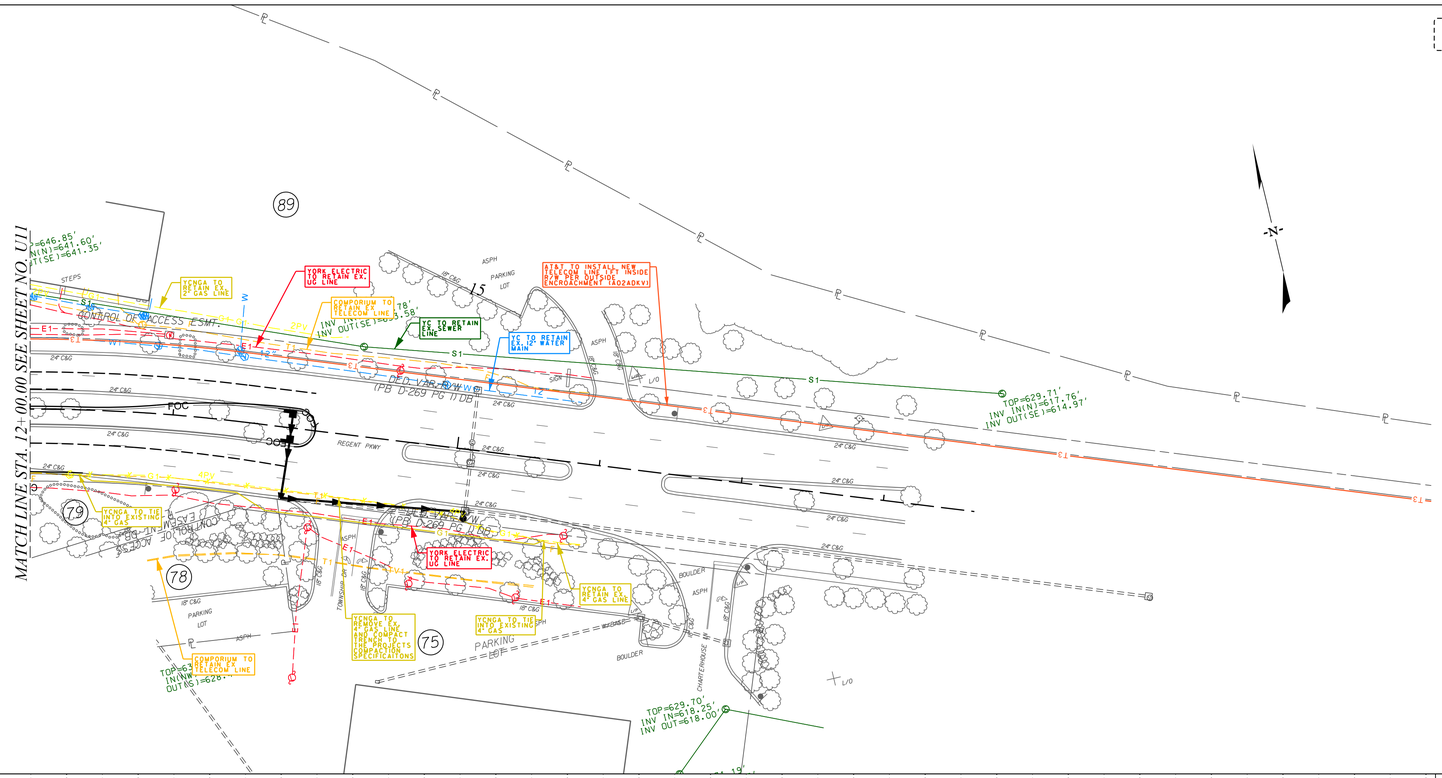
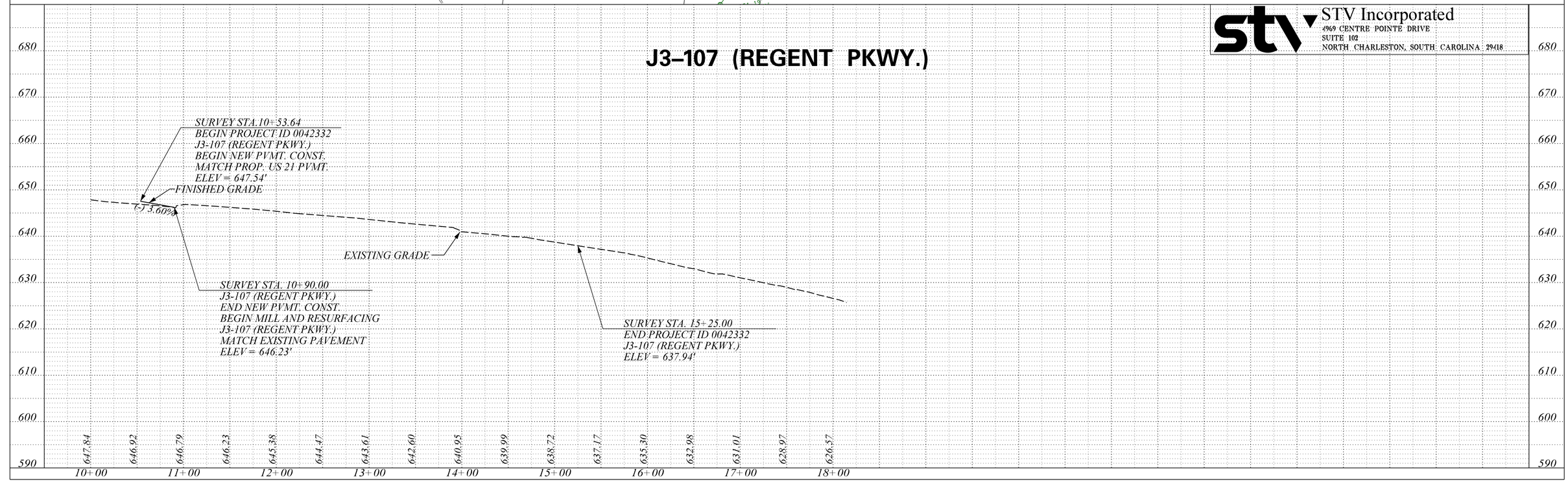


HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

J3–107 (REGENT PKWY.)



PROLINE.DGN

FOR INFORMATION ONLY

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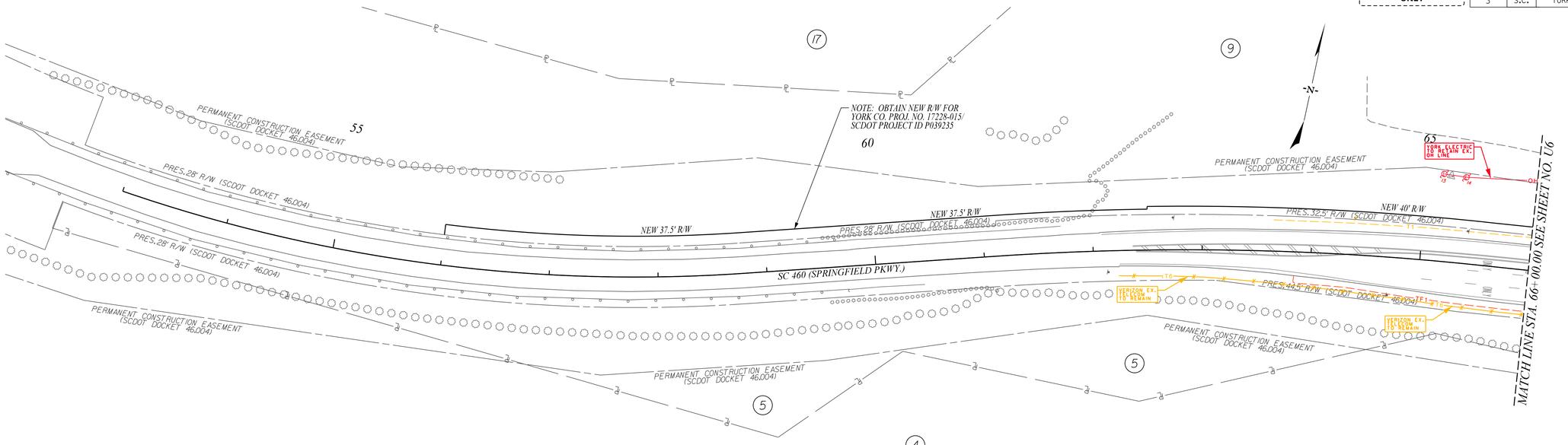

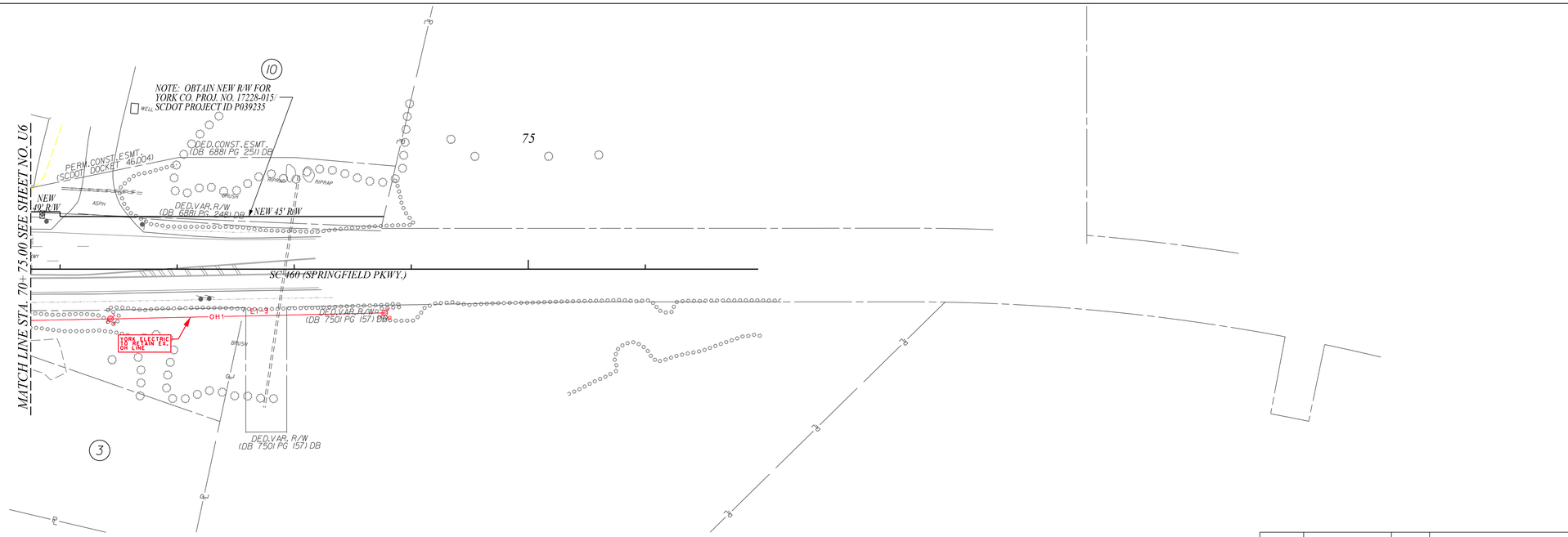

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

SCALE 1" = 50' RTE. DWG. NO. U30

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3			
2			
1			

SmithA2
S:\Projects\255776\2516776.000\90_CAD Models and Sheets\04_CT_Transportation\Utilities\Utility Plan Sheets & PDFs\UTL_2516776 PLN SHT30.dgn
9/13/2024

August 20, 2024

Steven Moss
Sr. Construction Manager - Engineering
York County Government
6 S Congress Street1
York, SC 2975

RE: Project No. P0042332/11149-004 – US21/SC51
York Co: Relocation Package – Lumen

Dear Mr. Moss –

Below you will find a brief description of the proposed work and submittal explanation. Please refer to Lumen's individual plans for details, or this document for plan status.

Scope of Work and Package Contents

Relocation Package

- Utility Agreement
- Detailed Cost Estimate
- Encroachment Permit Application
- Relocation Plans and associated U-sheets

Scope of Work Summary

Location	Utility Type	Scope of Work	Cost*
US21	Underground communication	Install new underground communication cables from 62+00 to 68+00	York County
US21	Overhead communication attached to York Electric	Install new overhead cables attached to existing York Electric poles from Sta 72+00 to 116+00	York County
SC51	Overhead communication attached to York Electric	Install new overhead cables attached to existing York Electric poles from Sta 306+00 to 339+00	York County

It is STV's recommendation that this relocation package be approved and proceed to the formal agreement.

Should you have any additional questions or comments, please feel free to call me (843-207-2031) or email me at natalie.roumillat@stvinc.com.

Sincerely,

N. Oriana Roumillat
N. Oriana Roumillat, P.E.
Utility Coordinator

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US 21 NORTH AND SC 51

This Agreement made this _____ day of _____, 20_____ by and between

York County, hereinafter called "County" and the utility company

Level 3 Communications, LLC

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

UG & Aerial 144ct &12ct FOC in conflict with road widening project taking place along HWY 21 and HWY 51 in Rock Hill SC.
New Capex required to support this reimbursable project, nod ark fiber. This project is being driven by York County SC as part of the Pennis for Progress program part of the Road widening project. Requesting Lumen to relocate our UG cable to the new poles.

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $ 127,015.11 MC

County Share $ 127,015.11 Company Share $ 0

(a) The Company ☑ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☐ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately Six years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: Wanita Brenes
Phone Number: 910-551-8838
Email: Wanita.Brenes@lumen.com

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

( ) BY COMPANY'S REGULAR FORCES

(ı) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

Level 3 Communications, LLC conducts all construction work and road move projects in this manner, as the company does not own or maintain construction related equipment.

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

☑ Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

☐ Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company’s delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Company agree participate in pre-litigation mediation and agree to diligently work in good faith to resolve any disputes associated with the costs charged to the Company for extreme delays. The parties shall select a mediator approved by both parties and set forth any resolutions in writing signed by both parties.

Should the parties fail to reach an agreement through pre-litigation mediation, the parties may seek a resolution for the dispute through the Court of Common Pleas located in York County, South Carolina, or the United States District Court for the State of South Carolina. This agreement shall be governed exclusively by the laws of the State of South Carolina without giving effect to its conflicts of law provisions.

12. The County shall have the right to inspect all recovered materials from the permanent facility prior to disposal by sale or scrap. This requirement will be satisfied by the Company giving notice to the County of the time and place the materials will be available for inspection. This notice is the responsibility of the Company and it may be held accountable for full value of materials disposed of without notice. The Company shall furnish a listing on final billings of major items not eligible for salvage credit and reasons therefore.

13. The Company will abide by the contract cost principles as set forth in FAPG 23 CFR 645A.

14. The Company will not participate directly or indirectly in any practice that subjects persons to discrimination because of their race, color, religion, sex, or national origin.

COMPANY: Level3 Communications, LLC

ADDRESS: 1025 El Dorado Bl Broomfield, Colorado, 80021

BY: Randolph Cloud
Randolph Cloud (Apr 21, 2023 15:10 MDT)

NAME: Randolph Cloud

TITLE: Director Network Implementation

YORK COUNTY

BY: _____
Joshua S. Edwards
County Manager

INSTRUCTIONS: Submit three original copies of this agreement form and three prints of drawings showing present location and proposed location of poles or lines with reference to highway survey stations and centerline.

Signature: Michael Casey
Michael Casey (Apr 21, 2023 17:07 EDT)

Email: michael.e.casey@lumen.com

P-407791 LVL3_Lumen York County Utility Reimburse Relo Agmt-Approved 4.21.23

Final Audit Report 2023-04-21

Created:	2023-04-21
By:	Russell Wheat (russ.wheat@centurylink.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAA7mYoGYudAG2WanoeacDbp1g0tHLOQ1Vc

"P-407791 LVL3_Lumen York County Utility Reimburse Relo Agmt-Approved 4.21.23" History

Document created by Russell Wheat (russ.wheat@centurylink.com)
2023-04-21 - 8:57:40 PM GMT- IP address: 155.70.52.168

Document emailed to Michael Casey (michael.e.casey@lumen.com) for signature
2023-04-21 - 9:03:11 PM GMT

Email viewed by Michael Casey (michael.e.casey@lumen.com)
2023-04-21 - 9:06:02 PM GMT- IP address: 47.135.194.72

Document e-signed by Michael Casey (michael.e.casey@lumen.com)
Signature Date: 2023-04-21 - 9:07:10 PM GMT - Time Source: server- IP address: 47.135.194.72

Document emailed to randolph.cloud@lumen.com for signature
2023-04-21 - 9:07:12 PM GMT

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2023-04-21 - 9:08:57 PM GMT- IP address: 104.47.70.126

Signer randolph.cloud@lumen.com entered name at signing as Randolph Cloud
2023-04-21 - 9:10:06 PM GMT- IP address: 75.166.218.180

Document e-signed by Randolph Cloud (randolph.cloud@lumen.com)
Signature Date: 2023-04-21 - 9:10:08 PM GMT - Time Source: server- IP address: 75.166.218.180

Agreement completed.
2023-04-21 - 9:10:08 PM GMT

Names and email addresses are entered into the Acrobat Sign service by Acrobat Sign users and are unverified unless otherwise noted.

LUMEN | Powered by Adobe Acrobat Sign

Pennies for Progress

US 21 & SC 51 Relocation

York County ID: 11149-004

Project ID: 0042332

****Utility Level3 Communications, LLC / Lumen****
Cost Estimate Breakdown
P-407791

Material:	**$29,597.81**
Labor:	**$97,417.30**
Total:	**$127,015.11**

Application for Encroachment Permit

S.C. Department of Transportation
Form 637 (Rev 09/2015)

Contact Information

Applicant: SourceOneCorp
Street: 100 Corporate Dr

City: Spartanburg
State: SC **Zip Code:** 29303

Phone: (864)630-6601 **Fax:**
Email: bmcbrearty@sourceonecorp.com
Contact: Bryan McBrearty

Project Location

Primary County: York

County	Road Name
York	Highway 21 Byp N (US 21)
York	Springhill Farm Rd (S-48)
York	Gold Hill Rd (S-98)

1. Type of Encroachment: COMMUNICATIONS (Cable TV, Telephone & Other)

COMMUNICATIONS RELOCATIONS IN LIEU OF SCDOT PROJECT SC51/US21. LUMEN WILL RELOCATE EXISTING BURIED CABLE, CONDUIT AND HH'S BASED OFF OF NEW ROADWAY RIGHT OF WAY.

2. Description of Location:

ALONG US21 FROM SPRINGDALE TO US 51, FORT MILL SC.

(Attach sketch indicating roadway features such as: pavement width, shoulder width, sidewalk and curb and gutter location, significant drainage structure, north arrow, right of way width, and location of the proposed encroachment with respect to the roadway centerline and the nearest intersecting road on the State system.)

Customer Agreement

3. The undersigned Applicant hereby requests SCDOT to permit encroachment on SCDOT right of way as described herein. It is expressly understood that every encroachment, if and when constructed, shall be installed in accordance with the sketch attached hereto and made a part hereof. Applicant agrees to comply with and be bound by SCDOT's 'A Policy for Accommodating Utilities on Highways Rights of way', 'Standard Specifications for Highway Construction', the 'General Provisions' and 'Special Provisions', attached hereto or made a part hereof by reference, during the installation, operation and maintenance of said encroachment within SCDOT's right of way.

DISCHARGES OF STORM WATER AND NON-STORM WATER: Work within State Highway right of way shall be conducted in compliance with all applicable requirements of the National Pollutant Discharge Elimination System (NPDES) permit(s) issued to SCDOT, to govern the discharge of storm water and non-storm water from SCDOT properties. Work shall also be in compliance with all other applicable Federal, State and Local laws and regulations, and with SCDOT's Encroachment Permits Manual and the encroachment permit. The encroachment permit will not be issued until Applicant has received an NPDES construction permit from SC Department of Health and Environmental Control.

Applicant and Permittee agrees to comply with all current SCDOT Standards Specifications for Highway Construction including all Supplemental Technical Specifications. Applicant and Permittee hereby further agrees, and binds his/her/its heirs, personal representatives, successors and assigns, to assume any and all liability for accidents or injuries to persons, or damage to property, including the highway and all SCDOT facilities in the right of way, that may be caused by the construction, maintenance, use, moving or removing of the physical appurtenances contemplated herein, and the applicant agrees to indemnify and hold SCDOT harmless from and against any and all claims for personal injury and/or property damage, including attorney fees and costs, which may be sustained by reason of the construction,

maintenance or existence of said encroachment on the SCDOT's right of way.

Applicant's Name: **Date:**

(Please print or type)

Applicant's Sig: _____ **Title:**

For Office Use Only

For Office Use Only

In accordance with your request and subject to all the provisions, terms, conditions, and restrictions stated in the application and the general and special provisions attached hereto, the SCDOT hereby approves your application for an encroachment permit. This permit shall become null and void unless the work contemplated herein shall have been completed prior to:

☐ See Attached Special Provision and/or Permit Requirements

NPDES Permit Nbr: _____

_____ _____ _____

(Date received by res. Maint. Engr.) **(SCDOT Approval)** **(Date)**

General Provisions

Application for Encroachment Permit
General Provisions

1. **DEFINITIONS: The word "Permittee" used herein shall mean the name of the person, firm, or corporation to whom this permit is addressed, his, her, its, heirs, personal representatives, successors and assigns. The word "DEPARTMENT" shall mean the South Carolina Department of Transportation.**
2. **NOTICE PRIOR TO STARTING WORK: Before starting the work contemplated herein within the limits of the highway right of way, the Department's Resident Maintenance Engineer in the county in which the proposed work is located shall be notified 24 hours in advance so that he may be present while the work is under way.**
3. **PERMIT SUBJECT TO INSPECTION: This permit shall be kept at the site of the work at all times while said work is under way and must be shown to any representative of the Department or law enforcement officer on demand.**
4. **PROTECTION OF HIGHWAY TRAFFIC: The applicant shall be responsible for the protection of the highway traffic at all times during the construction, maintenance, removing or moving of the encroachment permitted herein. Detours, barricades, warning signs and flagmen, as necessary, shall be provided by and at the expense of the Permittee and shall be in accordance with the "Manual on Uniform Traffic Control Devices" (MUTCD). The work shall be planned and carried out so that there will be the least possible inconvenience to the motoring public. The Permittee agrees to observe all rules and regulations of the Department while carrying on the work contemplated herein and take all other precautions that circumstances warrant.**
5. **STANDARDS OF CONSTRUCTION: All work shall conform to the Department?s standards of construction and shall be performed in a workman-like manner. The applicant shall make adequate provisions for maintaining the proper drainage of the highway as it may be affected by the encroachment permitted herein. All work shall be subject to the supervision and satisfaction of the Department.**
6. **FUTURE MOVING OF PHYSICAL APPURTENANCES: If, in the opinion of the State Highway Engineer, it should ever become necessary to move or remove the physical appurtenances, or any part thereof contemplated herein, on account of change in location of the highway, widening of the highway, or for any other sufficient reason, such moving shall be done on demand of the Department at the expense of the Permittee.**
7. **RESTORATION OF HIGHWAY FACILITIES UPON MOVING OR REMOVING OF PHYSICAL APPURTENANCES: If, and when, the physical appurtenances contemplated herein shall be moved or removed, either on the demand of the Department or at the option of the Permittee, the highway and facilities shall immediately be restored to their original condition at the expense of the Permittee.**
8. **COSTS: All work in connection with the construction, maintenance, moving or removing of the physical appurtenances contemplated herein shall be done by and at the expense of the Permittee.**
9. **ADDITIONAL PERMISSIONS:**
   (a) It is distinctly understood that this permit does not in any way grant or release any rights lawfully possessed by the abutting property owners. The Permittee shall secure any such rights, as necessary, from said abutting property owners.

(b) The Permittee shall be responsible for obtaining all other approvals or permits necessary for installation of the encroachment from other government entities.

(c) There shall be no excavation of soil nearer than two feet to any public utility line or appurtenant facility except with the consent of the owner thereof, or except upon special permission of this Department after an opportunity to be heard is given the owner of such line or appurtenant facility.

10. **ADDITIONAL WORK PERFORMANCE:**

(a) All crossings over the highway shall be constructed in accordance with "Specifications for Overhead Crossings of Light and Power Transmission Lines and Telegraph Lines over each other and over Highway Rights of Way in South Carolina," as approved by the Public Service Commission of South Carolina and effective as of date of this permit.

(b) All tunneling, boring, or jacking shall be done in such a way as not to disturb the highway surfacing.

(c) No pavement shall be cut unless specifically authorized herein.

(d) No excavation shall be nearer than three feet to the edge of pavement unless specifically authorized herein.

(e) Underground facilities will be located at minimum depths as defined in the "Utility Accommodations Manual" for the transmittant, generally as follows: 4 feet minimum for hazardous or dangerous transmittant, 3 feet minimum for other lines. The Department may approve shallower depths if adequate protection is provided. Such approval must be obtained in writing.

(f) Service and other small diameter pipes shall be jacked, driven, or otherwise forced underneath the pavements on any surfaced road without disturbing the pavement. The section under the highway pavement and within a distance of three (3) feet on either side shall be continuous without joints.

11. **ACCESS:**

(a) Permittee is responsible for maintaining reasonable access to private driveways during construction.

(b) It is expressly provided that, with respect to any limited access highway, the Permittee shall not have or gain access from the main traveled way of the highway, or the on or off ramps to such facility, except upon approval by the Department.

12. **DRIVEWAYS:**

(a) The existing crown of the highway shall be continued to the outside shoulder line of the highway.

(b) If the driveway or approach is concrete pavement, the pavement shall be constructed at least 6 inches thick and with a minimum of class 2500 concrete. There shall be a bituminous expansion joint, not less than 3/4 inches in thickness, placed between the highway paving and the paving of the approach for the full width of the approach.

13. **BEAUTIFICATION:**

(a) All trees, plants, flowers, etc. shall be placed in accordance with the provisions specifically stipulated herein.

(b) All trees, plants, flowers, etc. shall be maintained by, and at the expense of, the Permittee and the provisions of this permit shall become null and void, if and when said Permittee ceases to maintain aid trees, plants, flowers, etc.

14. **AS-BUILT PLANS:**

(a) The applicant shall provide the Department with survey-quality as-built plans in accordance with the requirements set forth in the Department's "A Policy for Accommodating Utilities on Highway Rights of Way".

15. **COMPLETE STREETS:**

Reference Departmental Directive 28, "Complete Streets". For encroachment permit types that require a Traffic Impact Study (TIS), the applicant shall consider the inclusion of walking, bicycling, and transit accommodations within the scope of the encroachment. The applicant shall review walking, bicycling, and transit plans from Metropolitan Planning Organizations (MPOs), Councils of Government (COGs), and regional transit providers to determine the scope of accommodations for complete streets. Coordination with the District Permit Engineer is required to determine if the inclusion of walking, bicycling, and transit accommodations are conducive for implementation based on the scope of the encroachment.

ADDRESS: US-21 FORT MILL, SC
PROJECT NAME: US-21/ SC-51

P-407791



SITE LOCATION
FW #: P.093180

CONTACTS

SOURCEONE CORPORATION

ENGINEERIN CONTACT:
100 CORPORATE DRIVE (SUITE 1)
SPARTANBURG, SC 29303
BRIANNE GILHAM
bgilham@sourceonecorp.com

Wanita Brenes
SR NETWORK IMPLEMENTATION
PROGRAM MANAGER
OSP ENGINEER
(910) 551-8838
wanita.brenes@lumen.com

SITE INDEX

1- COVER SHEET/SITE LOCATION
2- LEGEND
3- NOTES
4- SPLICE POINT
5 - 22-- PLAN DRAWINGS
23 - RATE CARD

MATERIAL LIST

48 CT ARMORED = 887'
96 CT AROURED = 6,634'
144 CT AROURED = 5,113'
1.50" HDPE CONDUITS =2,292'
24"x36"x36" HANDHOLES = 5
GROUND RODS = 4
MARKER POST = 1
MARKER POST W/ TEST STATION = 4

SCOPE OF WORK:

THIS PROJECT PROPOSES PLACING (3) 1.5" HDPE CONDUIT WITH 48 CT AND 144 CT FIBER CABLES, STARTING AT SE CORNER OF SPRINGFIELD PKWY (SC-460) AND TRAVELING NORTH ON EAST SIDE OF US-21. ABANDON EXISTING FIBERS AND CONDUIT IN PLACE.

(#) SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY

LEGEND

LINETYPES

- UG FIBER – EXISTING
- UG FIBER – PROPOSED
- AERIAL FIBER – EXISTING
- AERIAL FIBER – PROPOSED
- STRAND – EXISTING
- STRAND – PROPOSED
- CONDUIT – EXISTING
- CONDUIT – PROPOSED
- INNERDUCT – EXISTING
- INNERDUCT – PROPOSED
- GAS
- WATER
- TELEPHONE
- ELECTRIC
- SANITARY SEWER (SEW)
- STORM DRAIN
- FENCE
- CABLE TV
- STEAM
- OIL
- UNKNOWN UTILITY
- RIGHT OF WAY
- EDGE OF PAVEMENT

SYMBOL	DESCRIPTION
ASW	ASPHALT SIDEWALK
BIP	BLACK IRON PIPE
BSP	BLACK STEEL PIPE
CSW	CONCRETE SIDEWALK
EOP	EDGE OF PAVEMENT
EOTW	EDGE OF TRAVEL WAY
FOC	FACE OF CURB
HDPE	HIGH DENSITY POLYETHYLENE
HH	HANDHOLE
JB	JUNCTION BOX
MH	MANHOLE
MP	MILE POST
O/S	OFFSET
PVC	POLY VINYL CHLORIDE
RGS	RIGID GALVANIZED STEEL CONDUIT
ROW	RIGHT OF WAY
STA.	STATION

- RISER
- TELEPHONE
- POWER VAULT
- CATCH BASIN/INLET
- FIRE HYDRANT
- GROUND/BOND
- STREET LIGHT
- TREE
- CULVERT
- WING WALL
- BRIDGE
- MISC. UTILITY
- UTILITY POLE – EXISTING
  OWNER ID
- POLE – PROPOSED
  LEVEL 3 ID
- HANDHOLE – EXISTING
  HH– / HH / HANDHOLE OWNER
- HANDHOLE – PROPOSED
  HH- / HH / HANDHOLE LEVEL 3
- MANHOLE – EXISTING
- MANHOLE – PROPOSED
  MH- / MH / MANHOLE LEVEL 3
- PULLBOX – EXISTING
  PB– / PB / PULLBOX OWNER
- PULBOX – PROPOSED
  PB- / PB / PULLBOX LEVEL 3

- VAULT – EXISTING
  VAULT– / V / VAULT OWNER
- VAULT – PROPOSED
  VAULT- / V / VAULT LEVEL 3
- AERIAL STORAGE – EXISTING
  0'
- AERIAL STORAGE – PROPOSED
  0'
- VAULT/BUILDING STORAGE – EXISTING
  0'
- VAULT/BUILDING STORAGE – PROPOSED
  0'
- POLE ANCHOR/DOWN GUY – EXISTING
- POLE ANCHOR/DOWN GUY – PROPOSED
- PROPOSED DOWN GUY ON EXISTING ANCHOR
- TERMINATION – EXISTING
  FDP / NAME / SIZE / LOCATION
- TERMINATION – PROPOSED
  FDP / NAME / SIZE / LOCATION
- BUILDING CALLOUT – PROPOSED
  BUILDING / NAME / STREET
- SPLICE POINT – EXISTING
- SPLICE POINT – PROPOSED
  MANUFACTURER NAME
- SEQUENTIAL CALLOUT
  #F | IN: 0 | OUT: 0
- SEQUENTIAL IN TAIL CALLOUT
  #F | IN: 0 | TAIL: 0
- SEQUENTIAL TAIL OUT CALLOUT
  #F | TAIL: 0 | OUT: 0

- POLE ATTACHMENT CALLOUT – EXISTING
  USE DYNAMIC PULL DOWN TO SELECT FROM 1 TO 6 ATTACHMENTS
  POLE NO N/A | UTILITY1 0'–0"
- POLE ATTACHMENT CALLOUT – PROPOSED
  USE DYNAMIC PULL DOWN TO SELECT FROM 1 TO 6 ATTACHMENTS
  POLE NO N/A | UTILITY1 0'–0"
- CABLE SPAN CALLOUT – EXISTING
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
  1 CABLE FIBERS: FIBERS
  CABLE OWNER: LEVEL 3
  CABLE LENGTH: LENGTH
  NOTES:
- CABLE SPAN CALLOUT – PROPOSED
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
  1 CABLE FIBERS: FIBERS
  CABLE OWNER: LEVEL 3
  CABLE LENGTH: LENGTH
  NOTES:
- CONDUIT CALLOUT – EXISTING
  FOR USE ON PAPER SPACE (SHOWN AT 50X) WITH OR WITHOUT INNER DUCT INFO
  1 CONDUIT OWNER: LEVEL 3
  CONDUIT LENGTH: LENGTH
  CONDUIT QTY: CONDUITS
  CONDUIT SIZE: SIZE
  CONDUIT TYPE: TYPE
  INNER DUCT QTY: INNERDUCTS
  INNER DUCT SIZE: SIZE
  INNER DUCT TYPE: TYPE
  NOTES:
- CONDUIT CALLOUT – PROPOSED
  FOR USE ON PAPER SPACE (SHOWN AT 50X) WITH OR WITHOUT INNER DUCT INFO
  1 CONDUIT OWNER: LEVEL 3
  CONDUIT LENGTH: LENGTH
  CONDUIT QTY: CONDUITS
  CONDUIT SIZE: SIZE
  CONDUIT TYPE: TYPE
  INNER DUCT QTY: INNERDUCTS
  INNER DUCT SIZE: SIZE
  INNER DUCT TYPE: TYPE
  NOTES:
- STRAND CALLOUT – EXISTING
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
  1 STRAND TYPE: TYPE
  STRAND LENGTH: LENGTH
  NOTES:
- STRAND CALLOUT – PROPOSED
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
  1 STRAND TYPE: TYPE
  STRAND LENGTH: LENGTH
  NOTES:

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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2				REVISION # 1
1				ORIGINAL

Level(3) COMMUNICATIONS IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21, FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY

GENERAL NOTES

1.Contractor must obtain locates prior to disturbing the ground.

2.Contractor must have a copy of the approved permit from the appropriate agency on the jobsite at all times.

3.All cable will be placed at standard minimum depth. (Level 3 standard is 36" deep unless otherwise directed by a Level 3 representative.)

4. Any landscaping will be replaced to equal or better than that which existed prior to work.

5.Project site will be properly secured prior to the end of each day.

6.All work is to be in accordance with all authorities having jurisdiction in the work zone.

7.Contractors are advised to contact Level 3 for any additional information or clarification concerning scope of work or the requirements necessary for project completion.

8.Contractor is responsible to field verify all dimensions, quantities and existing conditions prior to construction. If a significant change to the running line is needed, please contact your Level 3 representative before proceeding.

9.Before construction begins, contractor shall take appropriate precautions to avoid any potential obstructions prior to proceeding with work.

10.No construction on private property will commence until approval is given by the appropriate Level 3 employee.

11.Contractor shall not proceed with work until they have received a Purchase Order and have been directed to do so by an authorized Level 3 representative.

12.Contractor shall not exceed the Purchase Order value without authorization in writing from the appropriate Level 3 representative.

13.As-Builts will be required for each project including cable footage sequentials at every access point, slack loop, splice location, pole and termination point. Contractor should also provide notes of all changes in depths, running lines, mh/hh locations, and any other applicable notes to depict the work that took place. NOTE: All major changes need to be pre-approved by an authorized Level 3 employee prior to starting the work.

CAUTION: GRADE CUTS RANGE FROM 0'–18' AND FILLS RANGE FROM 0'–14' GRADE CUTS AND FILLS NEED TO BE STAKED IN FIELD TO OBTAIN 48" MIN DEPTH FROM FINAL GRADE

CAUTION: RETAINER WALLS ARE BEING BUILT IN SEVERAL SECTIONS VERIFY THAT FIBER/CONDUIT DEPTHS WILL NOT BE A CONFLICT WITH CONSTRUCTION OF WALL. DEPTHS ARE NOTED FOR THESE SECTIONS WITH STATION REFERENCES ON PRINTS. DEPTH BASED AT 3' BELOW WALL DEPTHS.

General Construction Notes

The following construction notes are to be placed on a plan sheet for all construction plans submitted.

1. Contractor is responsible for locating all existing utilities prior to start of construction.
2. All erosion control devices shall be constructed and maintained in accordance with the most current standards of the Land Quality Section of the NCDENR.
3. As a minimum requirement, all graded areas not under pavement and within the right-of-way and/or easements shall be prepared, fertilized and limed, seeded, and mulched immediately upon completion of construction.
4. All work must carry a one-year warranty to cover all defects in materials and workmanship.
5. The most current editions of The North Carolina Department of Transportation Standard Specifications for Roads and Structures and The North Carolina Department of Transportation Roadway Standard Drawings will govern all roadway repair unless otherwise specified herein.
6. All subgrade under paved areas, curb and gutter, sidewalk, and roadway shoulders shall be compacted to at least 95% of the maximum dry density as determined by AASHTO T99 and the NCDOT. The final 12" of subgrade under paved areas and under curb and gutter shall be compacted to 100%.
7. All expansion joints for concrete to be sealed with silicone or polyurethane per NCDOT specifications. Hot applied joint sealer shall not be used. Color must be gray or a color that matches the concrete (not black).
8. Sidewalks shall be installed in the thicknesses as follows:
   a. Residential: 4" thick
      6" thick from PC to PT at intersections including HCR.
      6" thick across all driveways
   b. Commercial: 6" thick
   c. Industrial: 6" thick
      8" thick across all driveways
9. All concrete shall be a minimum of Class A (3000 psi). Class B (2500 psi) shall not be used.

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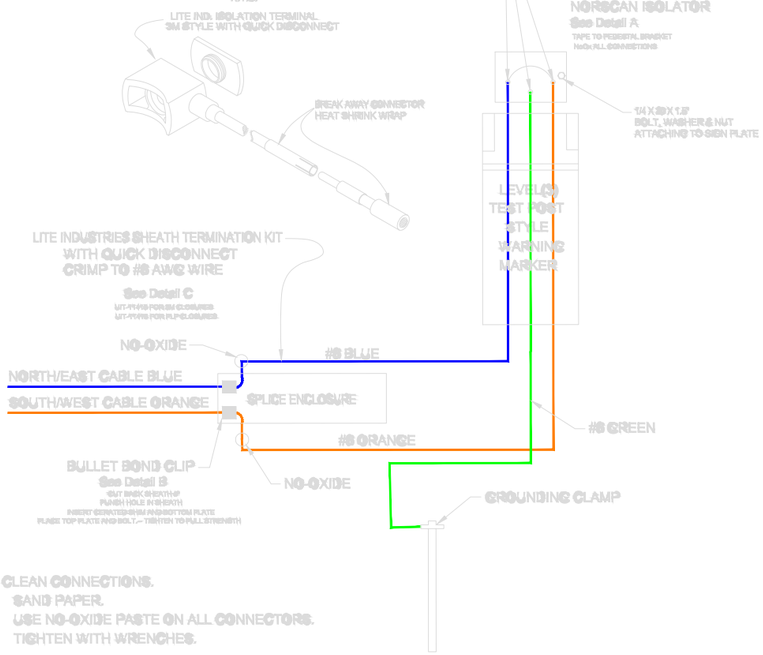
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY

SPLICE POINT

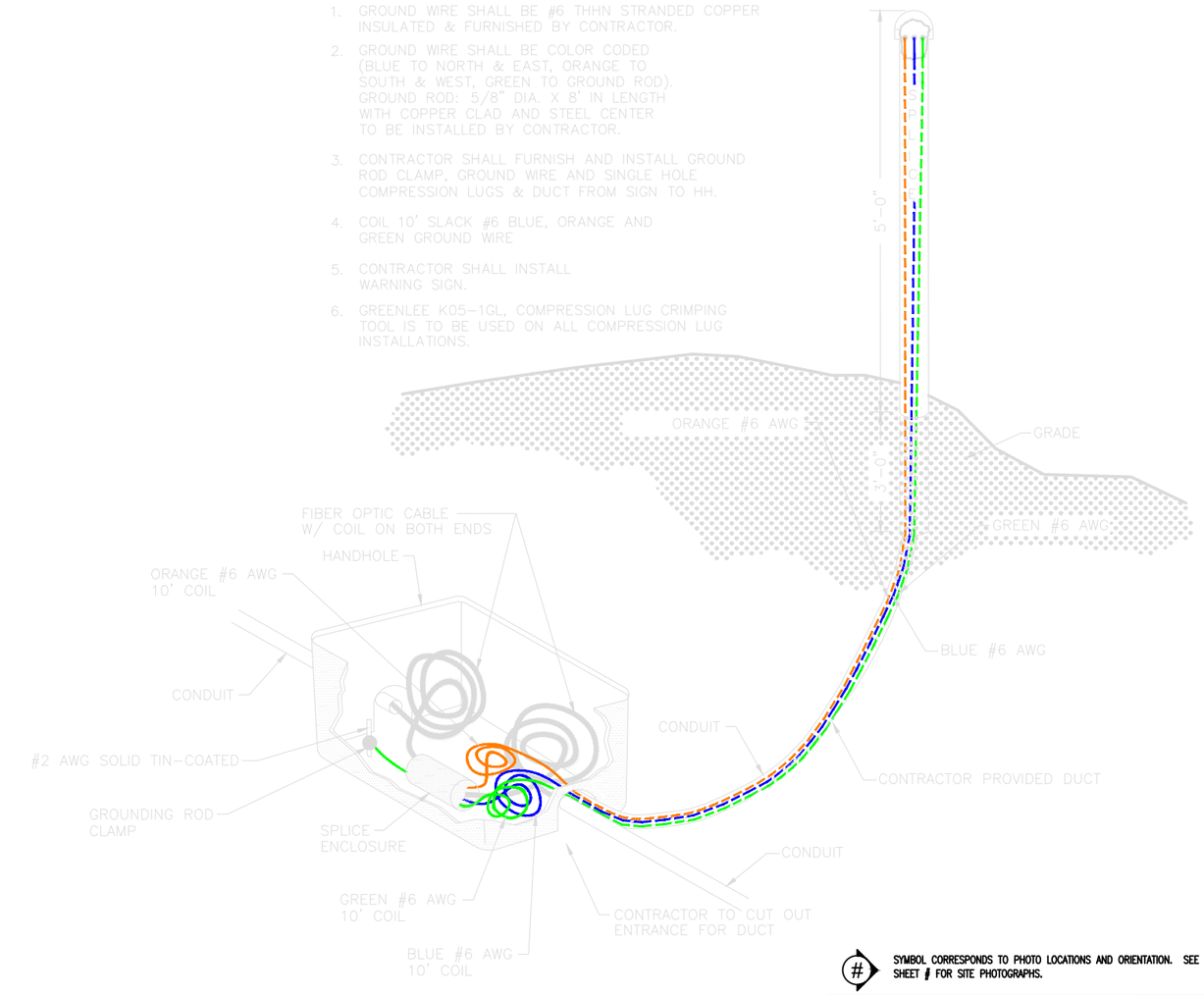
1. INSTALL SPLICE CLOSURE PER DIRECTIONS.
2. USE BULLET BONDS AND METAL BRAID TO CONNECT CABLE SHEATHS TO INTERNAL LUG.
3. CONNECT SHEATH TERMINATION KIT(S) WITH QUICK DISCONNECT TO THE EXTERIOR LUG(S) AND #6 WIRE (MARKED WITH BLUE OR ORANGE HEAT SHRINK) PER KIT DIRECTIONS. USE PROPER CRIMP DISCONNECT TO WIRE. NoOx ALL CONNECTIONS.
4. PRESSURE TEST THE CLOSURE TO HOLD 10 PSI AIR.
5. INSTALL GROUND ROD INSIDE THE VAULT ASSEMBLY AWAY FROM THE FIBER CABLE.
6. CLAMP #6 GREEN WIRE TO THE GROUND ROD NoOx ALL CONNECTIONS.
7. RUN THE 3 (EAST, GROUND AND WEST) #6 WIRES THROUGH HDPE, INSIDE THE LEVEL(3) MARKER UP TO THE ACT ISOLATOR.
8. ATTACH THE SINGLE HOLE COMPRESSION LUGS TO #6 WIRES.
9. ATTACH THE #6 WIRES TO ACT ISOLATOR FOLLOWING THE DIRECTIONS INCLUDED WITH THE ISOLATOR. NoOx ALL CONNECTIONS.



SPLICE WARNING SIGN INSTALLATION

NOTES:

1. GROUND WIRE SHALL BE #6 THHN STRANDED COPPER INSULATED & FURNISHED BY CONTRACTOR.
2. GROUND WIRE SHALL BE COLOR CODED (BLUE TO NORTH & EAST, ORANGE TO SOUTH & WEST, GREEN TO GROUND ROD). GROUND ROD: 5/8" DIA. X 8' IN LENGTH WITH COPPER CLAD AND STEEL CENTER TO BE INSTALLED BY CONTRACTOR.
3. CONTRACTOR SHALL FURNISH AND INSTALL GROUND ROD CLAMP, GROUND WIRE AND SINGLE HOLE COMPRESSION LUGS & DUCT FROM SIGN TO HH.
4. COIL 10' SLACK #6 BLUE, ORANGE AND GREEN GROUND WIRE
5. CONTRACTOR SHALL INSTALL WARNING SIGN.
6. GREENLEE K05-1GL, COMPRESSION LUG CRIMPING TOOL IS TO BE USED ON ALL COMPRESSION LUG INSTALLATIONS.



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LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
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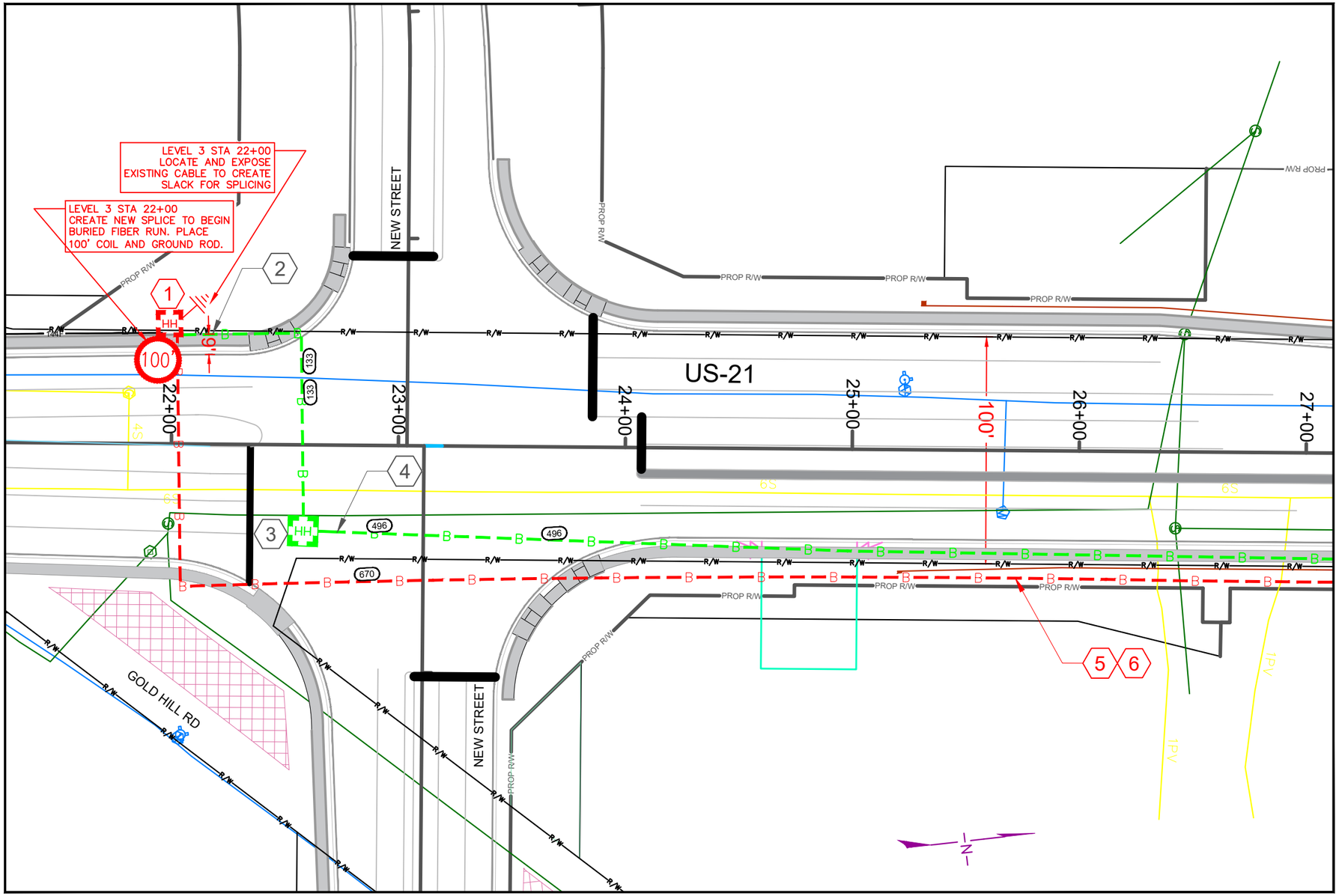
LOCATION: US-21, FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



CONSTRUCTION NOTES

1. LEVEL 3 PROPOSED 24"x36"x36" HANDHOLE
2. ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT
3. EXISTING HANDHOLE TO BE REMOVED IN PLACE
4. ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT
5. CONDUIT OWNER: LEVEL3
   CONDUIT LENGTH: 620'
   CONDUIT QTY: 1
   CONDUIT SIZE: 1.5"
   CONDUIT TYPE: 5
6. CABLE FIBERS: 144 CT ARMORED
   CABLE OWNER: LEVEL 3
   CABLE LENGTH: 720'

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	620'	
UGB - FIBER PL IN CONDUIT	FT	720'	
UGB - LOCATE WIRE IN CONDUIT	FT	620'	
UGB - HH 24x36x36	EA	1	
UGB - GROUND ROD 5/8" - 8FT	EA	1	
UGB - RMV HH	EA	1	
UGB - ABANDON FIBER & CONDUIT	FT	629'	
UGB - MARKER POST WITH TEST STATION	EA	1	
UGB - DIG & EXPOSE EXIST FACILITY	CU. YDS	6.5	

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0 10' 20' 30' 40' 50'
SCALE: 1"=50'

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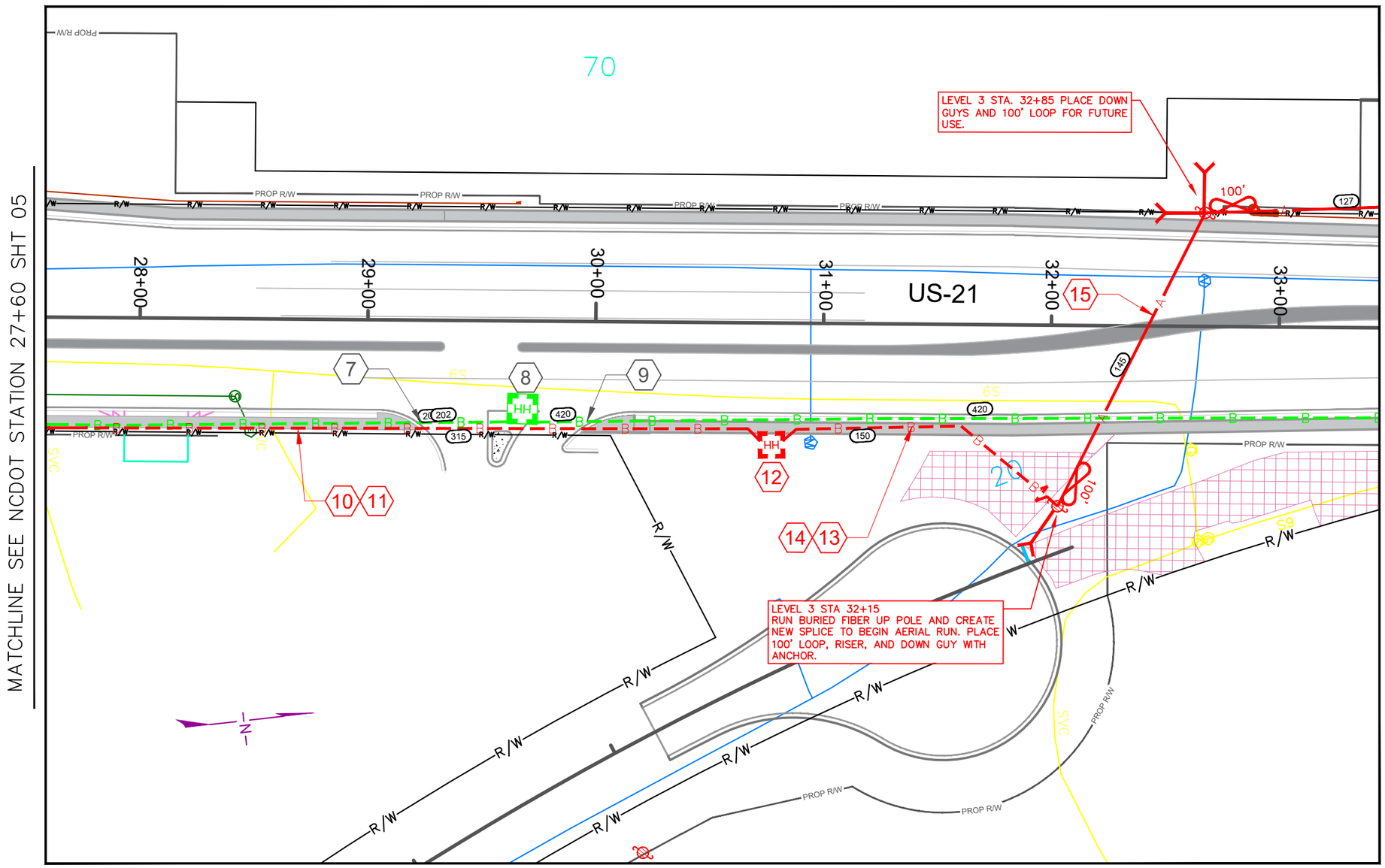

CONSTRUCTION NOTES

7. ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT
8. EXISTING HANDHOLE TO BE REMOVED IN PLACE
9. ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT
10. CONDUIT OWNER: LEVEL3
    CONDUIT LENGTH: 315
    CONDUIT QTY: 1
    CONDUIT SIZE: 1.5"
    CONDUIT TYPE: 10
11. CABLE FIBERS: 144 CT ARMORED
    CABLE OWNER: LEVEL 3
    CABLE LENGTH: 315
12. LEVEL 3 PROPOSED 24"x36"x36" HANDHOLE
13. CONDUIT OWNER: LEVEL3
    CONDUIT LENGTH: 160
    CONDUIT QTY: 1
    CONDUIT SIZE: 1.5"
    CONDUIT TYPE: 5
14. CABLE FIBERS: 144 CT ARMORED
    CABLE OWNER: LEVEL 3
    CABLE LENGTH: 160'
15. CABLE FIBERS: 144 CT ARMORED
    CABLE OWNER: LEVEL 3
    CABLE LENGTH: 321'

(#) SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	486'	
UGB - FIBER PL IN CONDUIT	FT	486'	
UGB - LOCATE WIRE IN CONDUIT	FT	486'	
UGB - HH 24x36x36	EA	1	
UGB - RMV HH	EA	1	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	622	

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	321'	
AER-STRAND 6M	FT	321'	
AER- AERIAL FIBER SNOWSHOE	EA	1	
MAT- POLE RISER 1.25" TYPE 11 UV BLACK	FT	10'	
MAT- RISER U-GAURD 2in PLASTIC	EA	1	
AER- DOWN GUY	EA	3	
AER- ANCHOR - SCREW	EA	3	

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SCALE: 1"=50'

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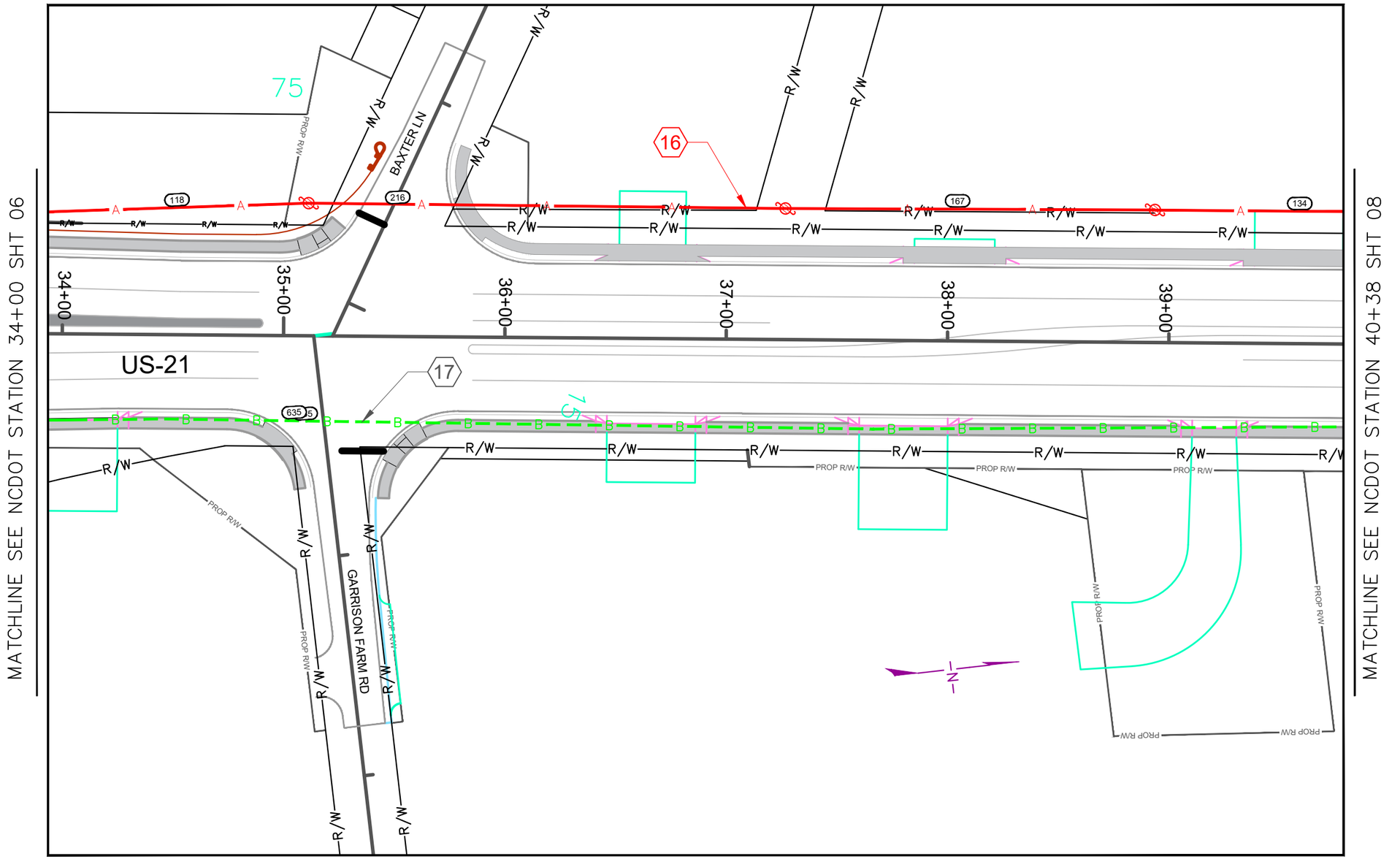

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	585'	
AER-STRAND 6M	FT	585'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	585'	

CONSTRUCTION NOTES

16 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 585'

17 ABANDON LEVEL 3 FIBER CABLE AND CONDUIT

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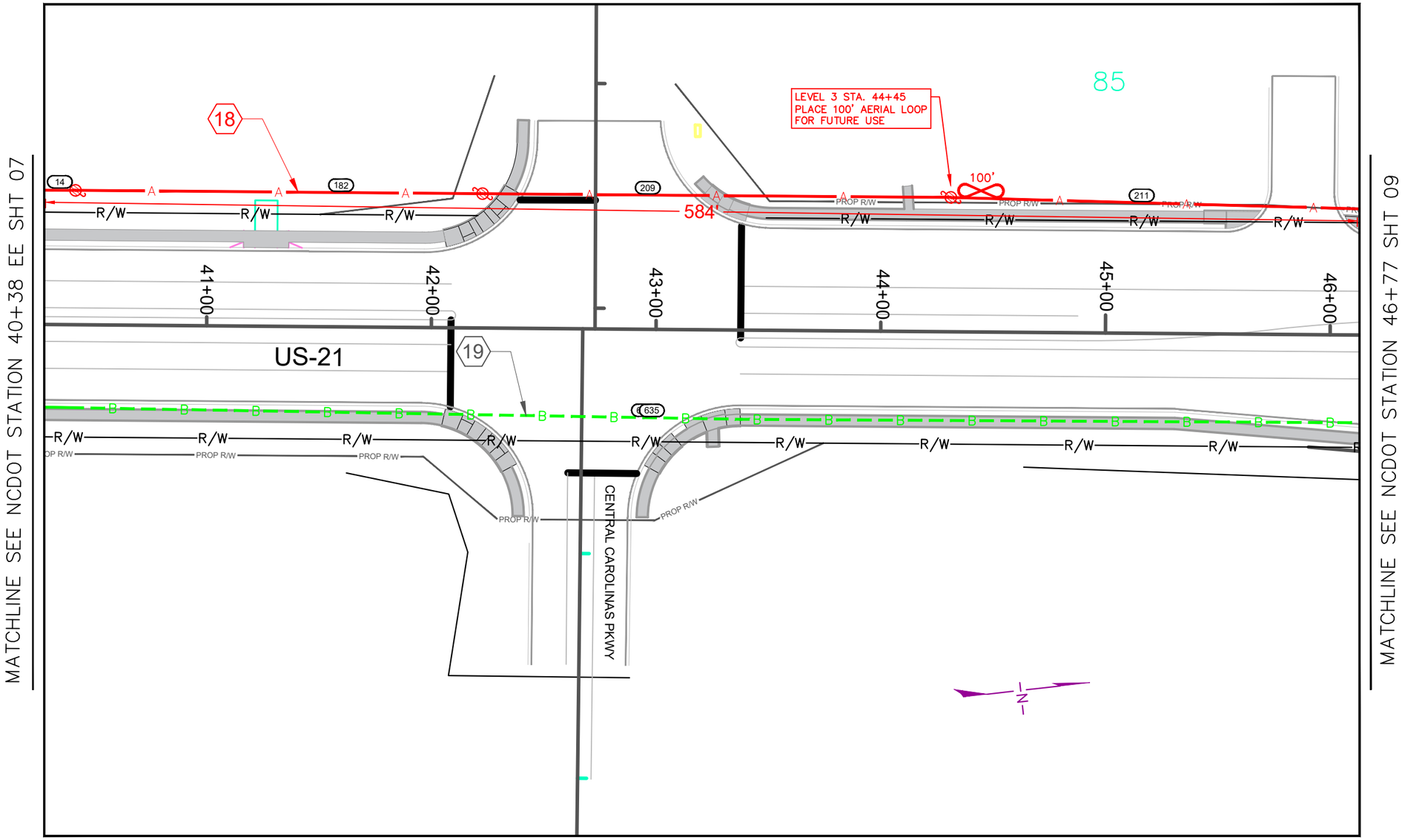
LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg



CONSTRUCTION NOTES

18 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 685'

19 ABANDON LEVEL 3 FIBER CABLE AND CONDUIT

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	685'	
AER-STRAND 6M	FT	585'	
AER- AERIAL FIBER SNOWSHOE	EA	1	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	585'	

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

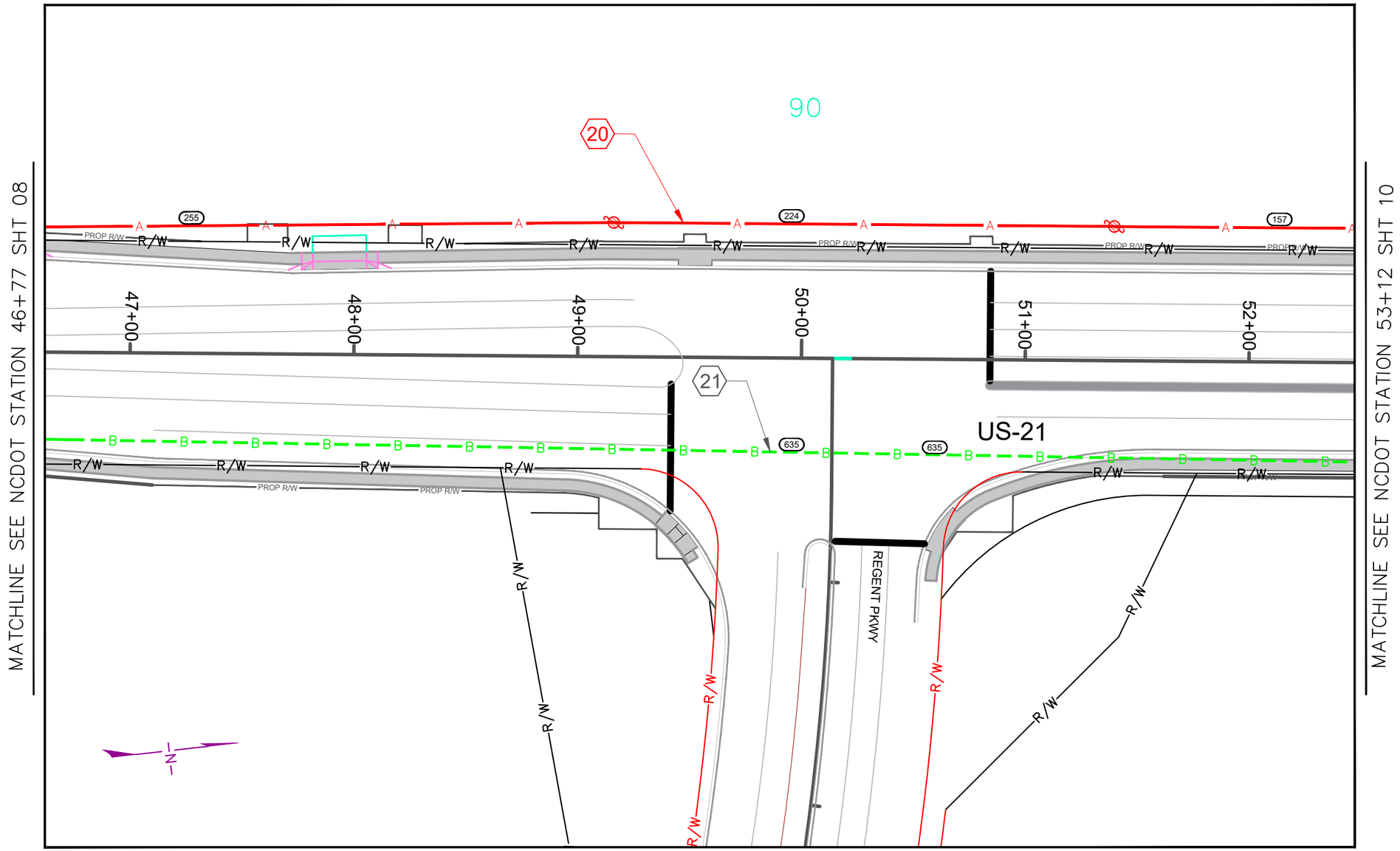
Know what's below. Call before you dig.

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) COMMUNICATIONS IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg



CONSTRUCTION NOTES

20 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 584'

21 ABANDON LEVEL 3 FIBER CABLE AND CONDUIT

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	584'	
AER-STRAND 6M	FT	584'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	584'	

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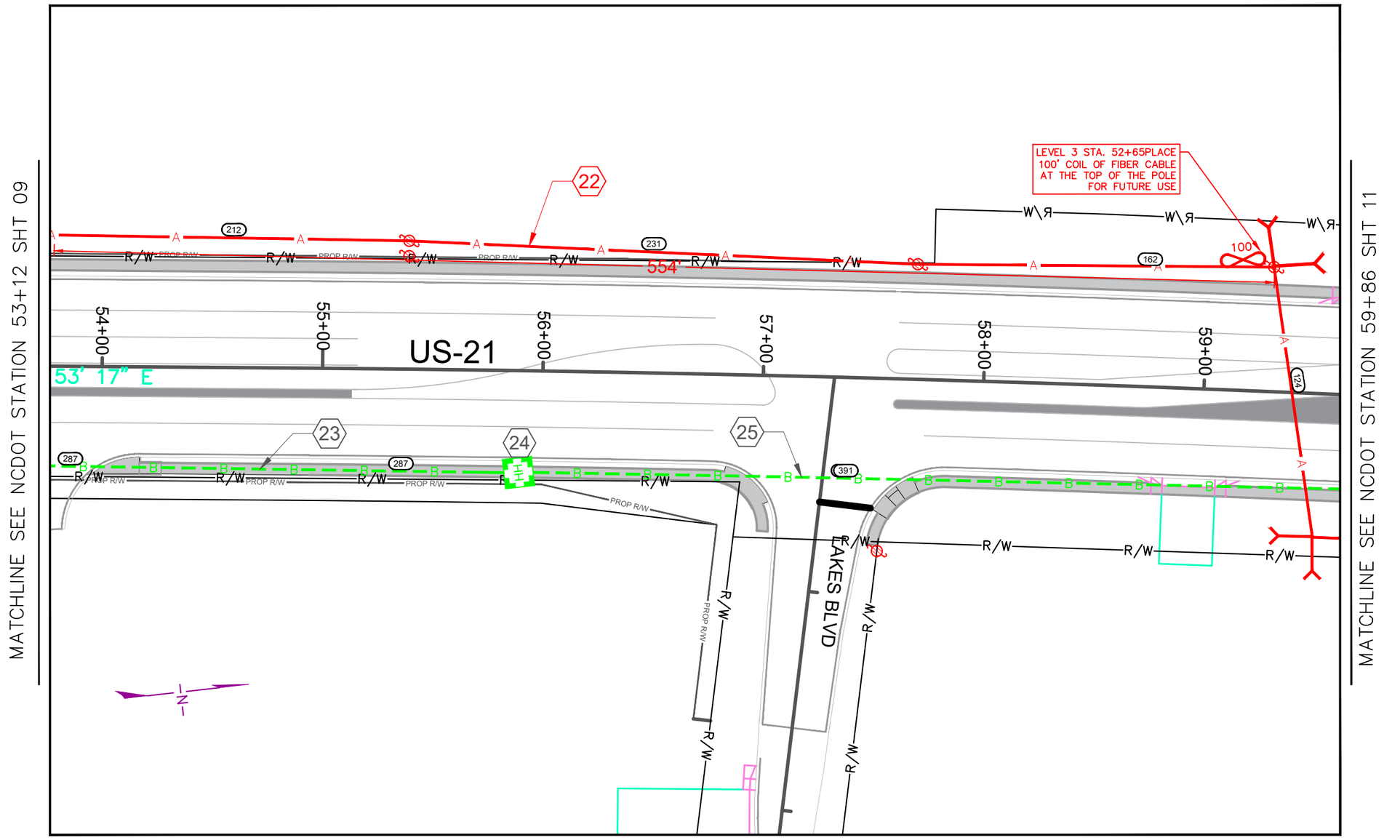
SCALE: 1"=50'

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) COMMUNICATIONS IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



CONSTRUCTION NOTES

22 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 789'

23 ABANDON LEVEL 3 FIBER CABLE AND CONDUIT

24 EXISTING HANDHOLE
TO BE REMOVED IN PLACE

25 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	789'	
AER-STRAND 6M	FT	689'	
AER-DOWN GUY	EA	4	
AER-ANCHOR - SCREW	EA	4	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	678	
AER- AERIAL FIBER SNOWSHOE	EA	1	

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2				REVISION # 1
1				ORIGINAL

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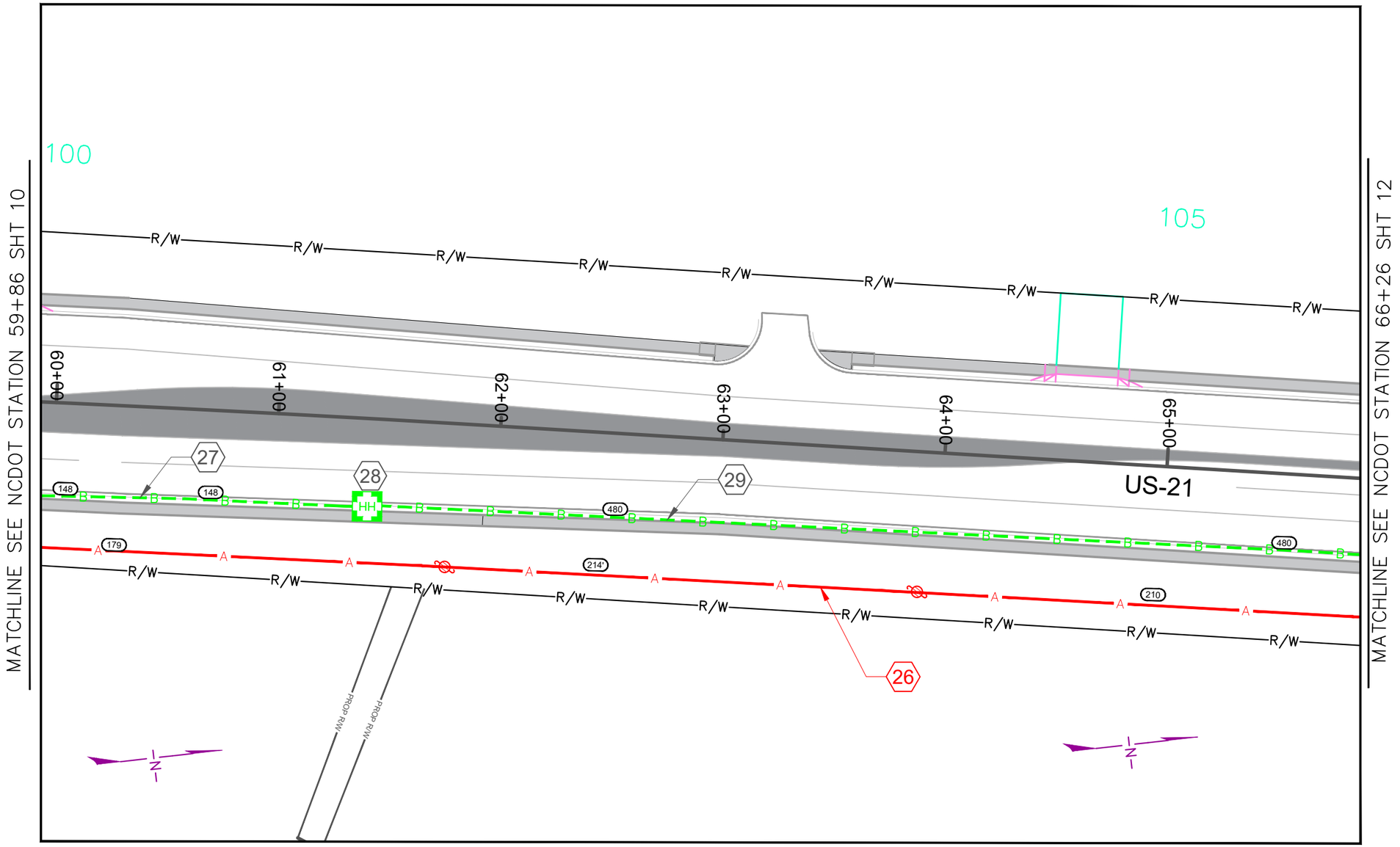
LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



CONSTRUCTION NOTES

26 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 585'

27 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

28 EXISTING HANDHOLE
TO BE REMOVED IN PLACE

29 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	585'	
AER-STRAND 6M	FT	585'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	579'	

811 Know what's **below.** **Call** before you dig.

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SCALE: 1"=50'

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NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
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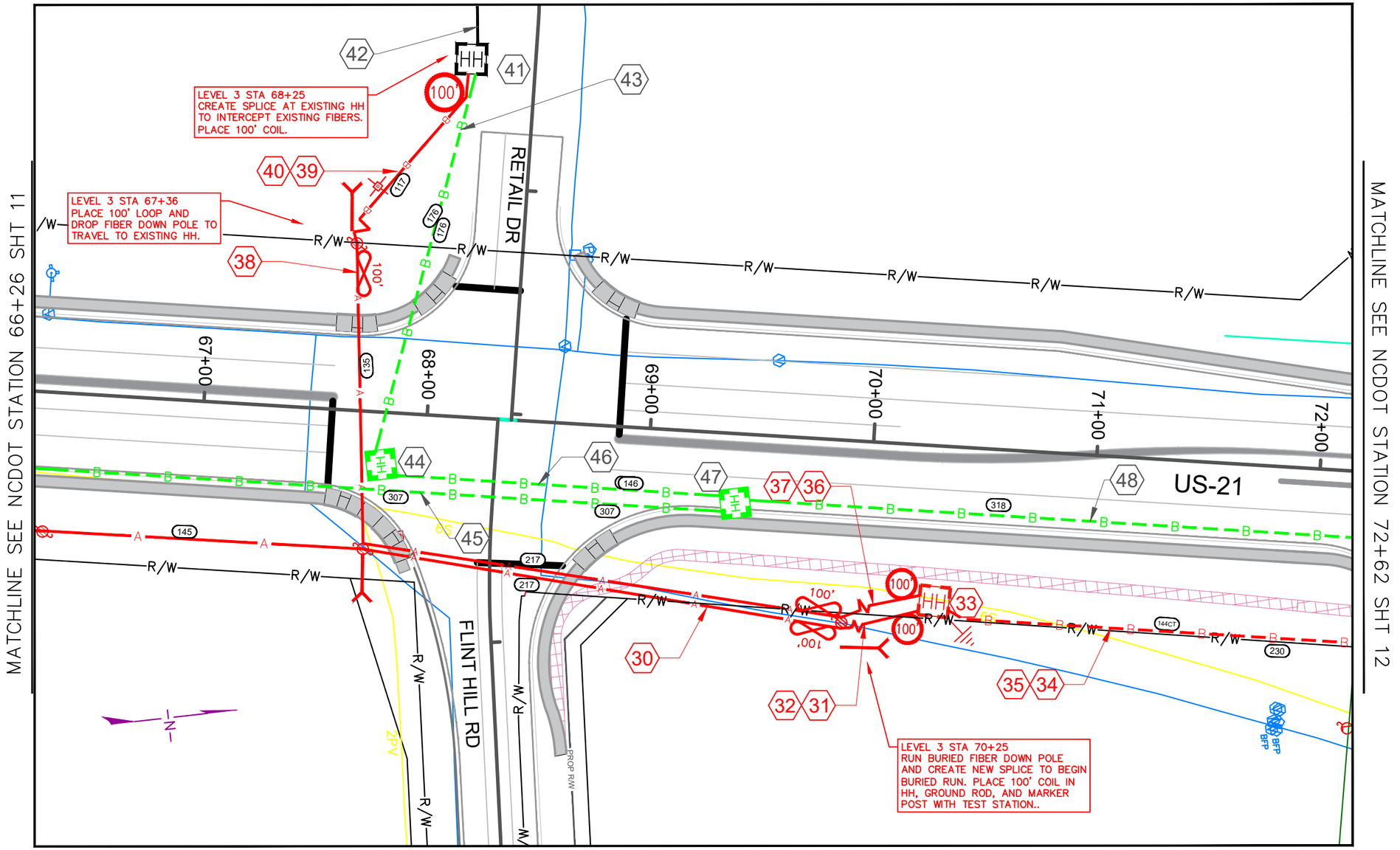
2				REVISION # 1
1				ORIGINAL

Level(3) IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg



Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	425'	
UGB - LOCATE WIRE IN CONDUIT	FT	425'	
UGB - FIBER PL IN CONDUIT	FT	625'	
UGB - HH 24x36x36	EA	1	
UGB - GROUND ROD 5/8" - 8FT	EA	1	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	947	
UGB - RMV HH	EA	2	
UGB - MARKER POST WITH TEST STATION	EA	1	

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	967'	
AER-STRAND 6M	FT	577'	
AER-DOWN GUY	EA	3	
AER-ANCHOR - SCREW	EA	3	
AER- AERIAL FIBER SNOWSHOE	EA	3	
MAT- POLE RISER 1.25" TYPE 11 UV BLACK	FT	30'	
MAT- RISER U-GAURD 2in PLASTIC	EA	3	

CONSTRUCTION NOTES

30 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 247'

31 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 22'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

32 CABLE FIBERS: 144 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 122'

33 LEVEL 3 PROPOSED
24"x36"x36" HANDHOLE

34 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 185'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

35 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 185'

36 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 22'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

37 CABLE FIBERS: 48 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 122'

38 CABLE FIBERS: 48 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 583'

39 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 82'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

40 CABLE FIBERS: 48 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 182'

41 EXISTING HANDHOLE
TO BE REMOVED IN PLACE

42 EXISTING LEVEL 3 UG FIBER CABLE & CONDUIT

43 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

44 EXISTING HANDHOLE
TO BE REMOVED IN PLACE

45 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

46 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

47 REMOVE EXISTING HANDHOLE
TO BE REMOVED IN PLACE

48 EXISTING LEVEL 3 UG FIBER CABLE & CONDUIT

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SCALE: 1"=50'

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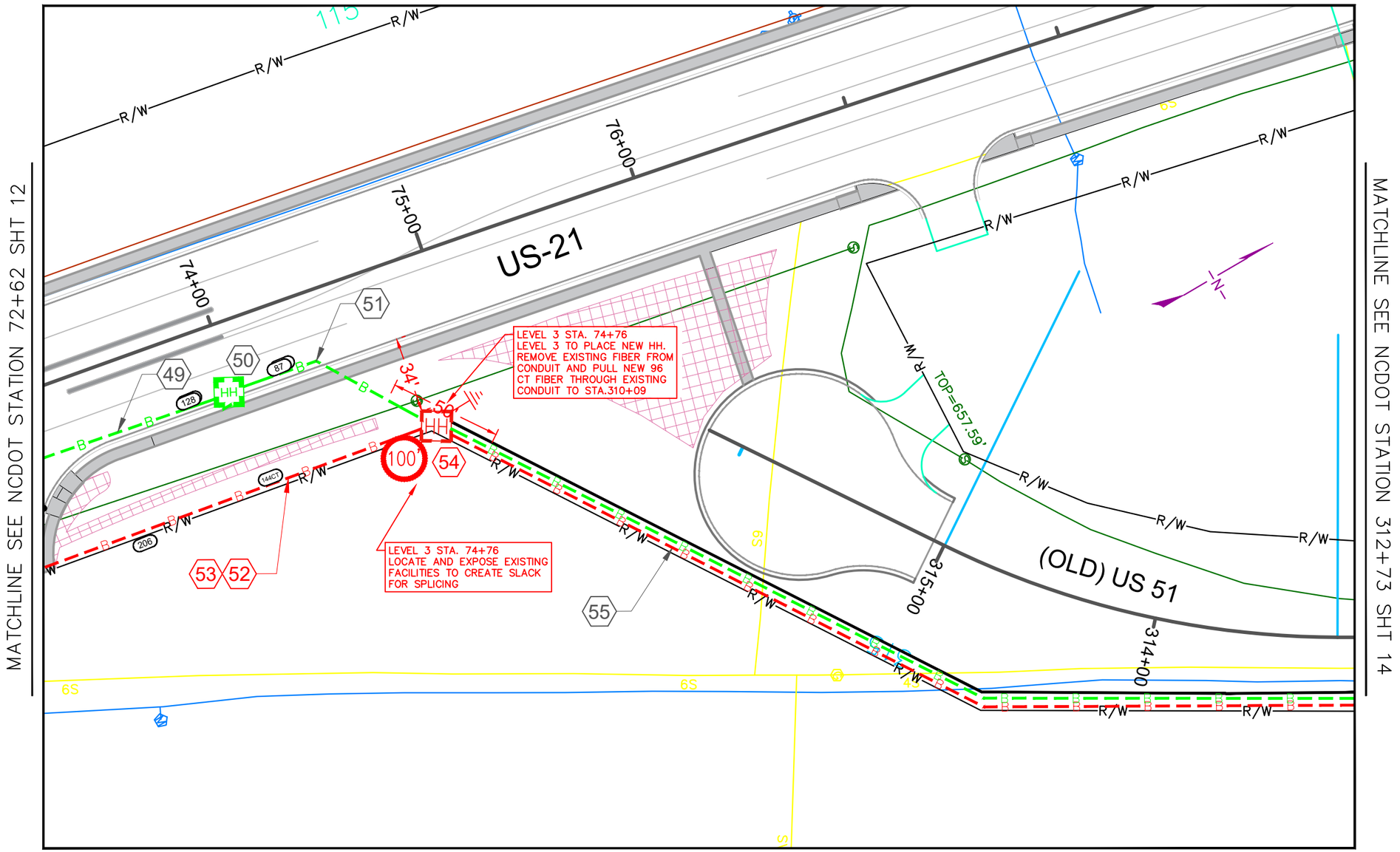
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



CONSTRUCTION NOTES

49 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

50 REMOVE EXISTING HANDHOLE TO BE REMOVED IN PLACE

51 ABANDON LEVEL 3 UG FIBER CABLE & CONDUIT

52 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 179'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 51

53 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 710'

54 LEVEL 3 PROPOSED
24"x36"x36" HANDHOLE

55 EXISTING LEVEL 3 UG FIBER CABLE & CONDUIT

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	179'	
UGB - FIBER PL IN CONDUIT	FT	710'	
UGB - LOCATE WIRE IN CONDUIT	FT	179'	
UGB - HH 24x36x36	EA	1	
UGB - GROUND ROD 5/8" - 8FT	EA	1	
UGB - RMV HH	EA	1	
UGB - RMV FIBER FORM CONDUIT	FT	700'	
UGB - DIG & EXPOSE EXISTING FACILITY	CU. YDS	6	
UGB - MARKER POST WITH TEST STATION	EA	1	

(#) SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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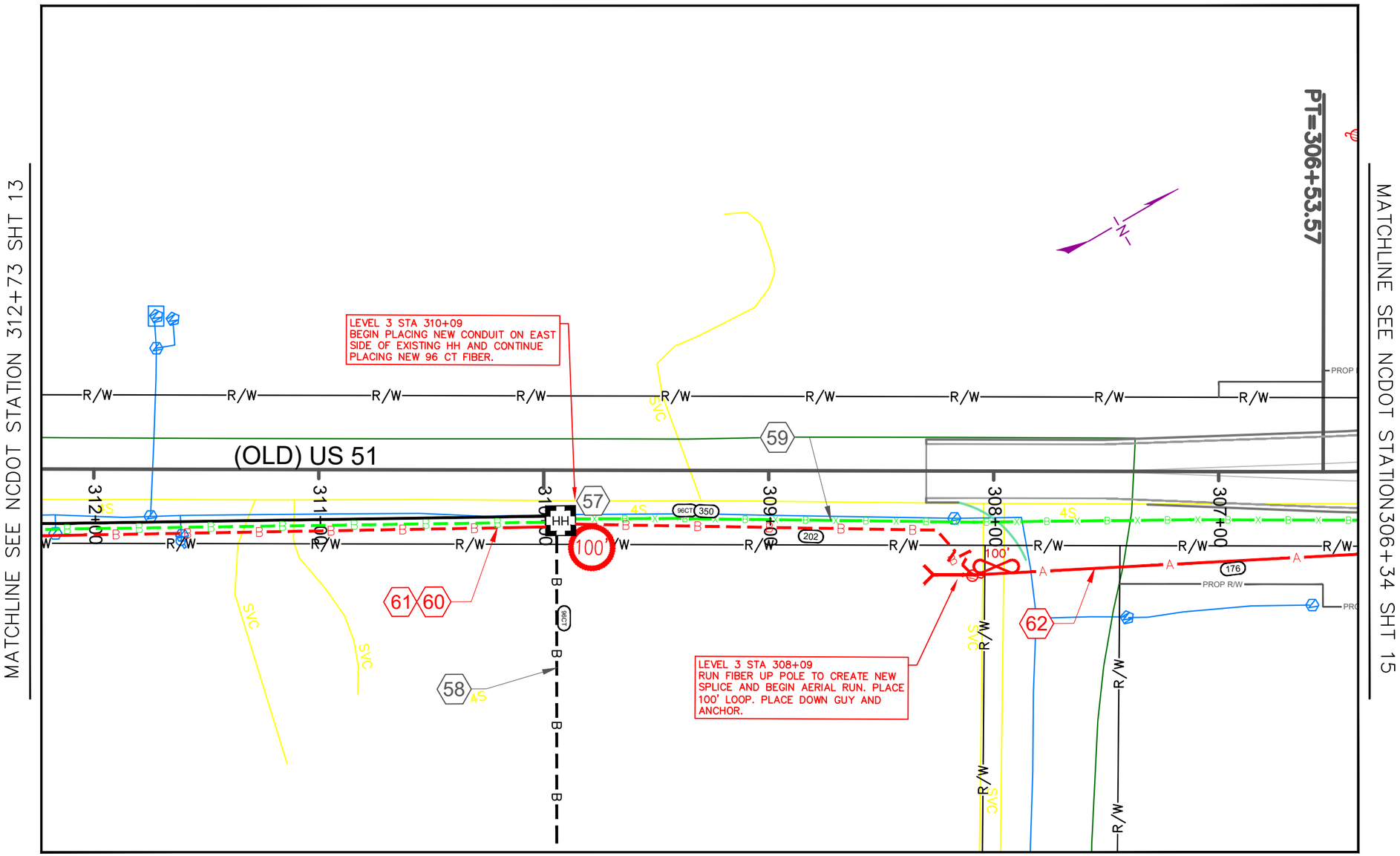
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



CONSTRUCTION NOTES

56 EXISTING LEVEL 3 UG FIBER CABLE & CONDUIT

57 EXISTING HANDHOLE

58 EXISTING LEVEL 3 UG FIBER CABLE & CONDUIT

59 EXISTING LEVEL 3 UG FIBER CABLE & CONDUIT

60 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 407'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

61 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 482'

62 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 301'

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	174'	
UGB - FIBER PL IN CONDUIT	FT	510'	
UGB - LOCATE WIRE IN CONDUIT	FT	174'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	560'	

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	301'	
AER-STRAND 6M	FT	171'	
AER-DOWN GUY	EA	1	
AER-ANCHOR - SCREW	EA	1	
AER- AERIAL FIBER SNOWSHOE	EA	1	

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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SCALE: 1"=50'

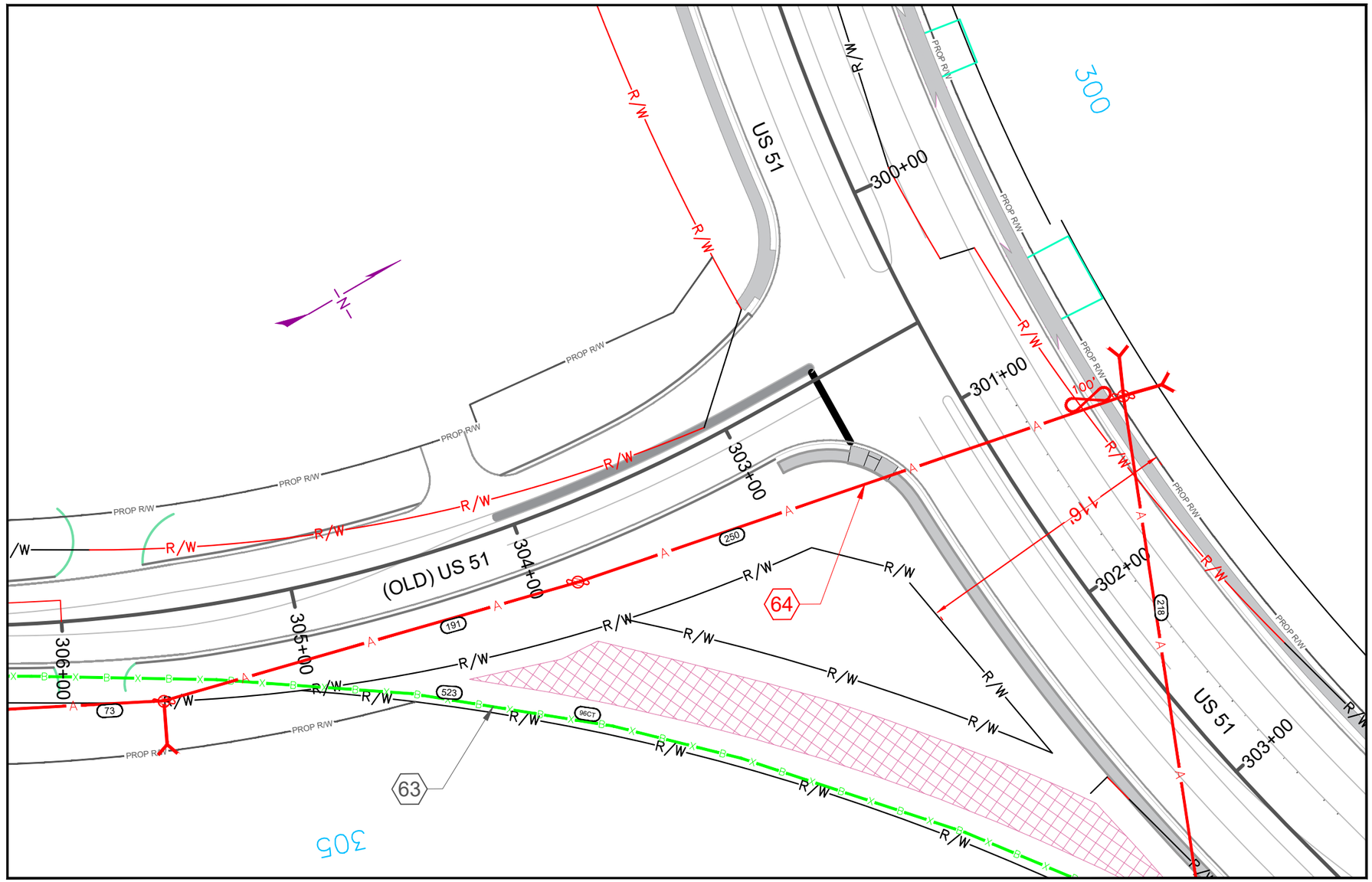
NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) COMMUNICATIONS IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY

MATCHLINE SEE NCDOT STATION 306+34 SHT 14



MATCHLINE SEE NCDOT STATION 303+26 SHT 16

CONSTRUCTION NOTES

63 EXISTING LEVEL 3
UG FIBER CABLE & CONDUIT

64 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 810'

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	810'	
AER-STRAND 6M	FT	710'	
AER-DOWN GUY	EA	3	
AER-ANCHOR - SCREW	EA	3	
AER- AERIAL FIBER SNOWSHOE	EA	1	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	523	

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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SCALE: 1"=50'

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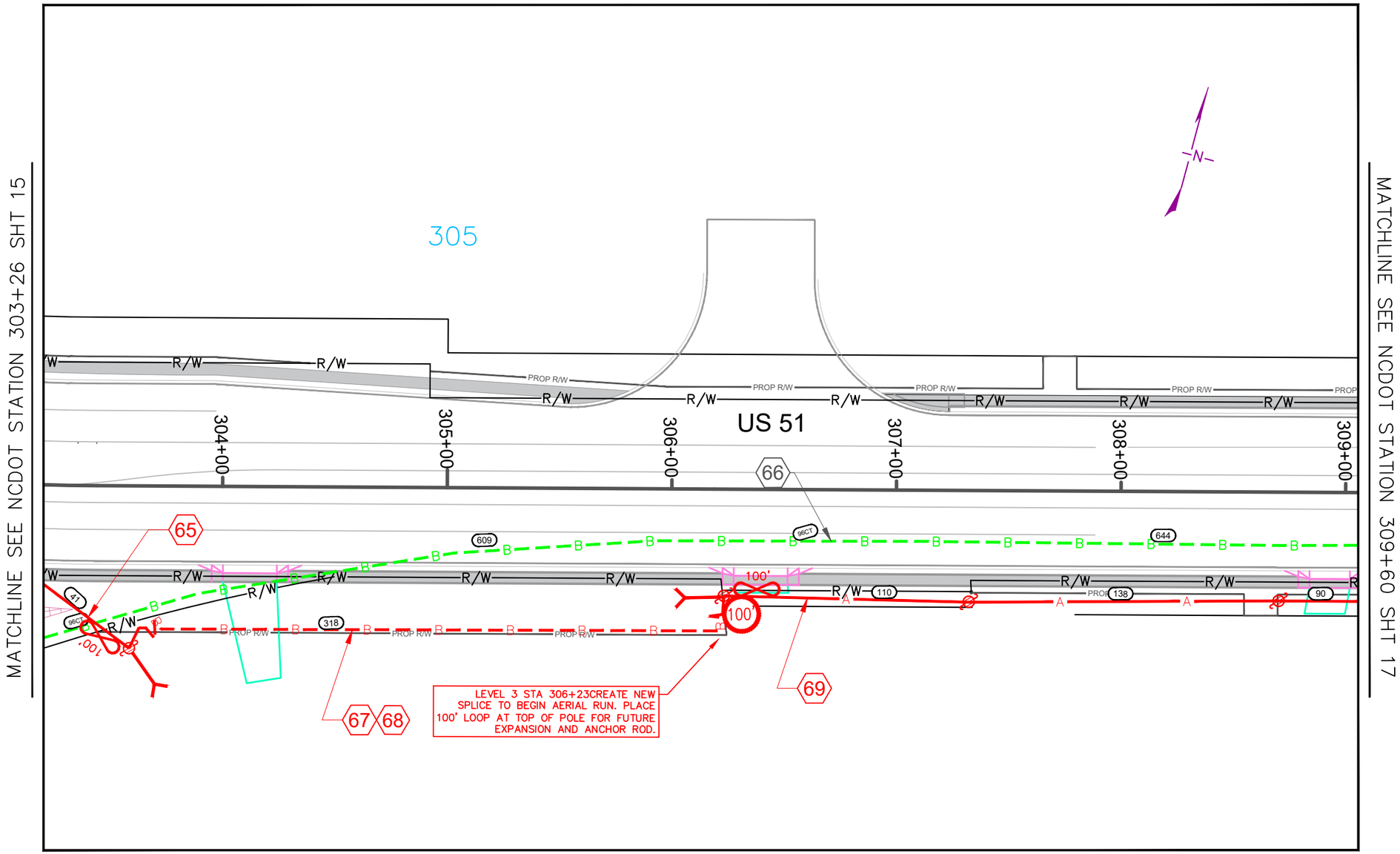
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY SHEET: 15 OF 23



CONSTRUCTION NOTES

65 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 46'

66 ABANDON LEVEL 3
UG FIBER CABLE & CONDUIT

67 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 258'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

68 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 358'

69 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 411'

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	588'	
AER-STRAND 6M	FT	328'	
AER-DOWN GUY	EA	2	
AER-ANCHOR - SCREW	EA	2	
AER- AERIAL FIBER SNOWSHOE	EA	2	
MAT- POLE RISER 1.25" TYPE 11 UV BLACK	FT	20'	
MAT- RISER U-GAURD 2in PLASTIC	EA	2	

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	248'	
UGB - FIBER PL IN CONDUIT	FT	348'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	644	

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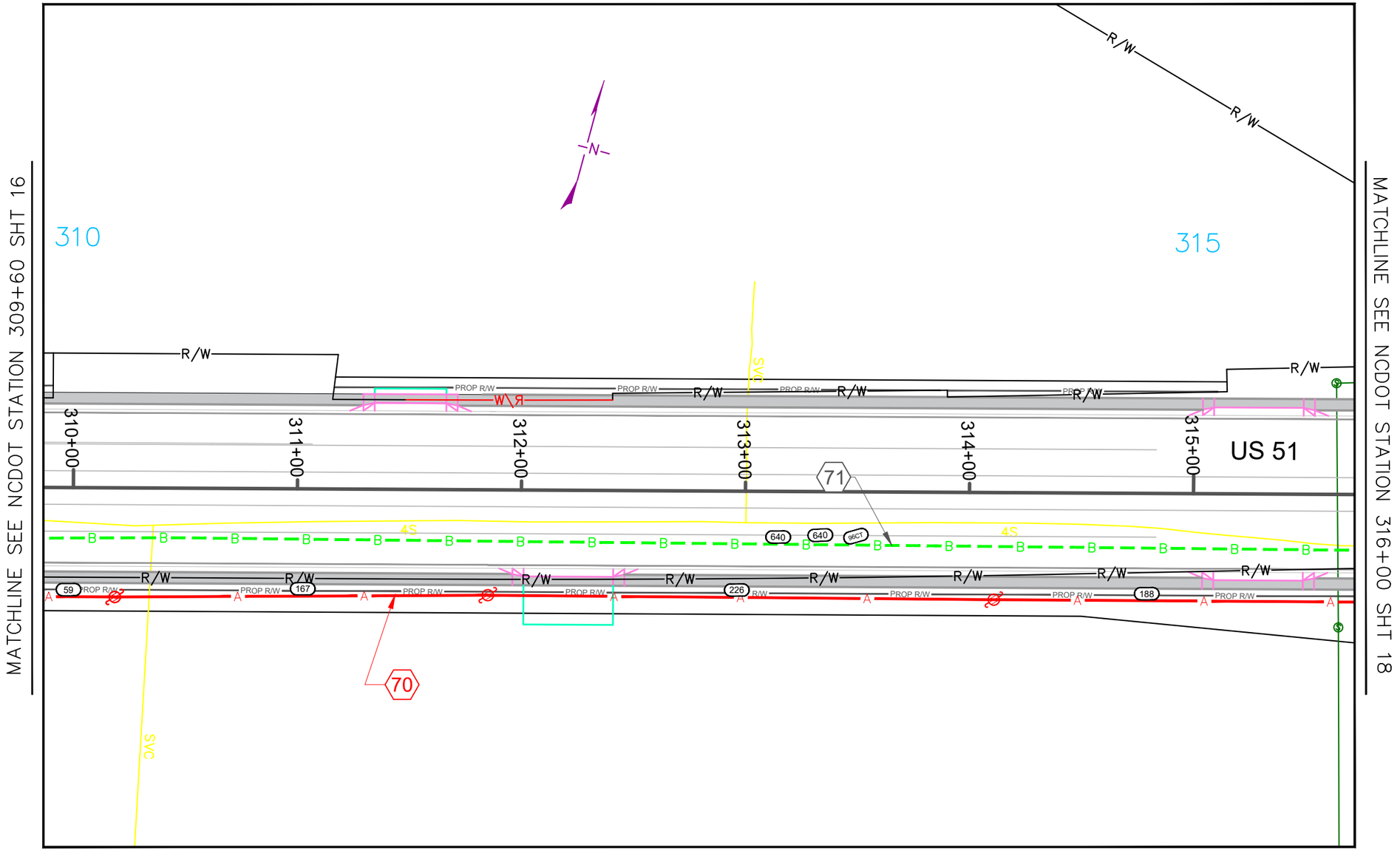
SCALE: 1"=50'

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21, FORT MILL, SC
DRAWING NAME: US-21.dwg



Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	582'	
AER-STRAND 6M	FT	582'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	585'	

CONSTRUCTION NOTES

70 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 582'

71 ABANDON LEVEL 3
UG FIBER CABLE & CONDUIT

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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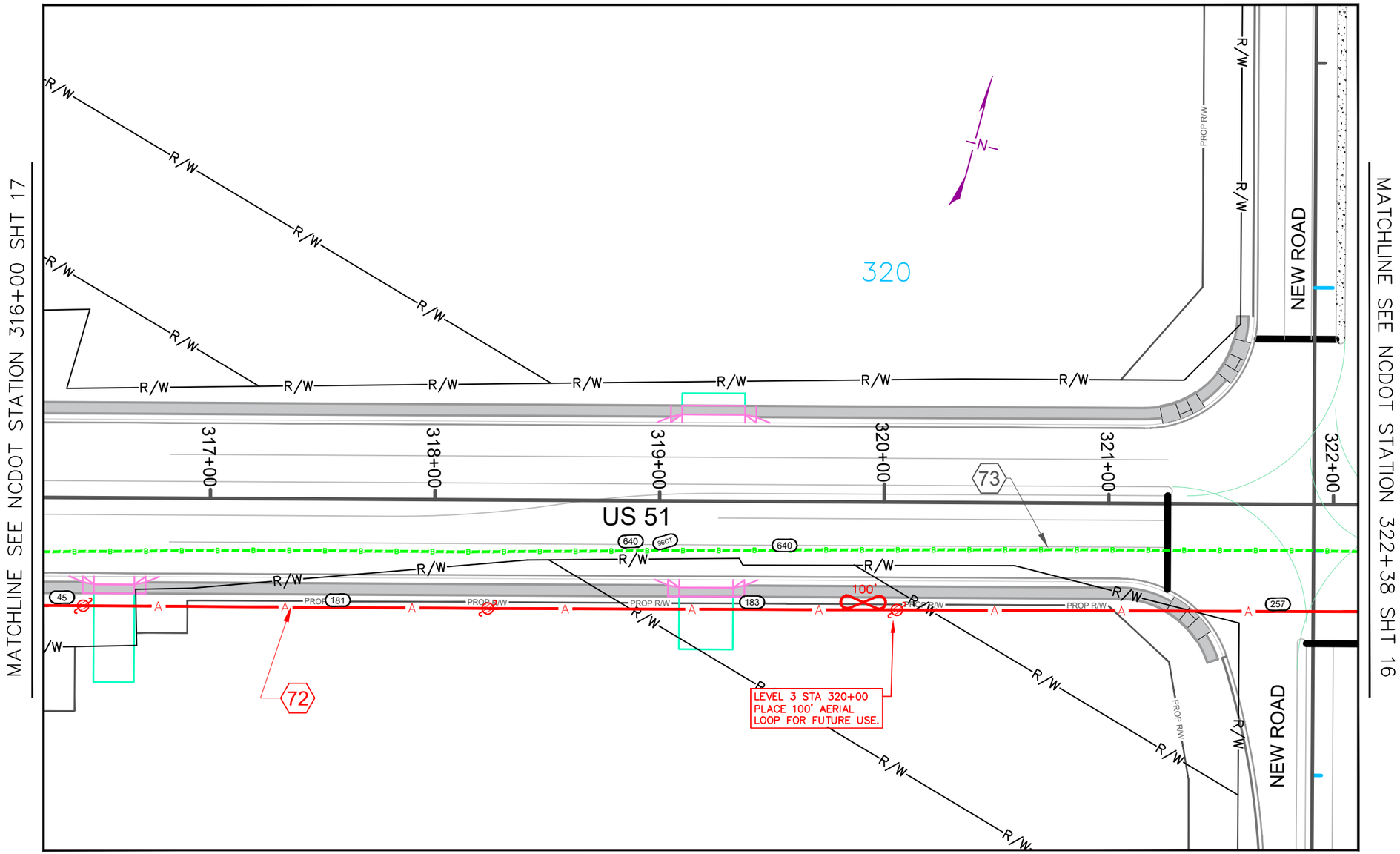
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	684'	
AER-STRAND 6M	FT	584'	
AER- AERIAL FIBER SNOWSHOE	EA	1	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	589'	

CONSTRUCTION NOTES

72 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 684'

73 ABANDON LEVEL 3
UG FIBER CABLE & CONDUIT

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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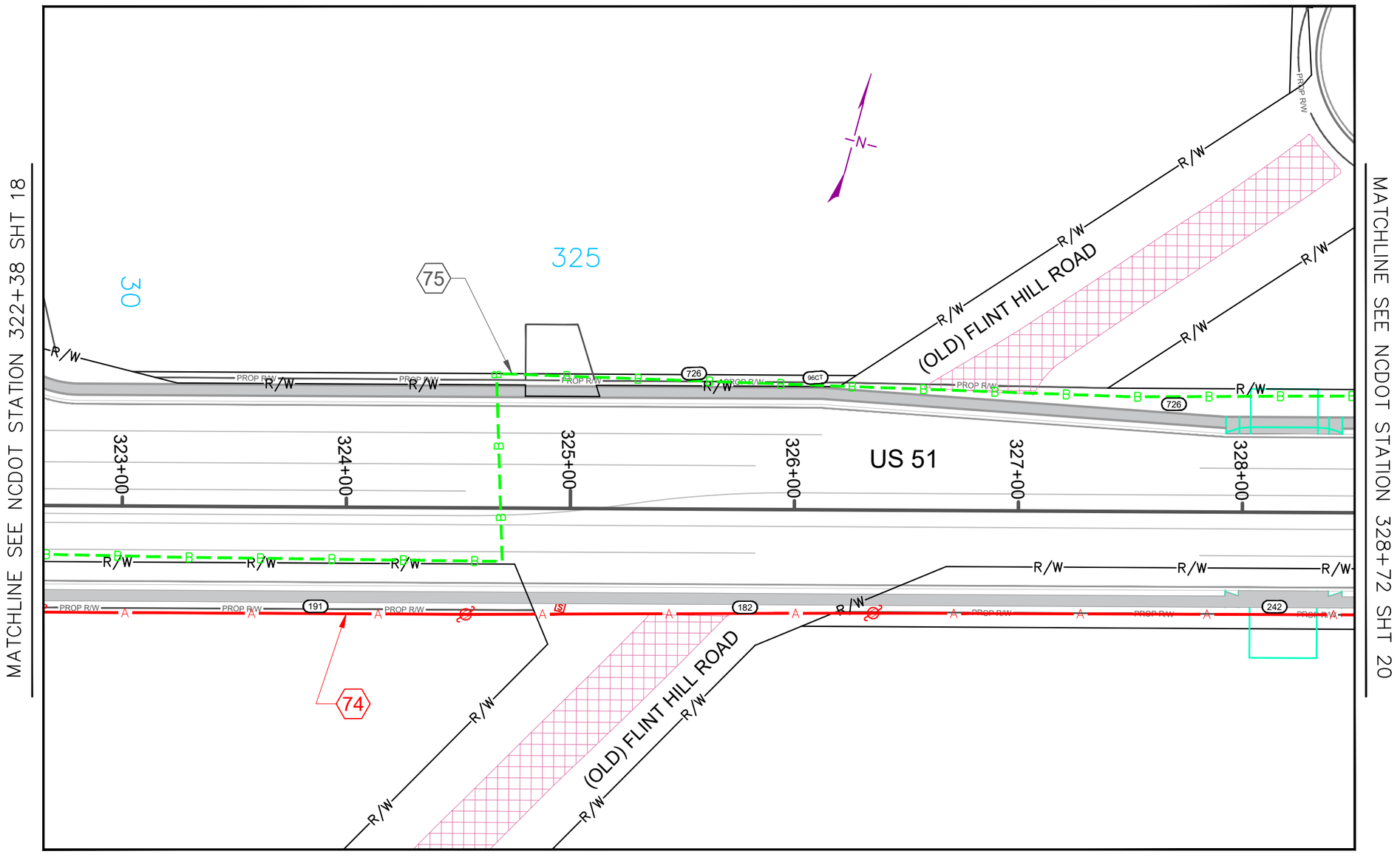
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	584'	
AER-STRAND 6M	FT	584'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	584'	

CONSTRUCTION NOTES

74 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 584'

75 ABANDON LEVEL 3 UG
FIBER CABLE & CONDUIT

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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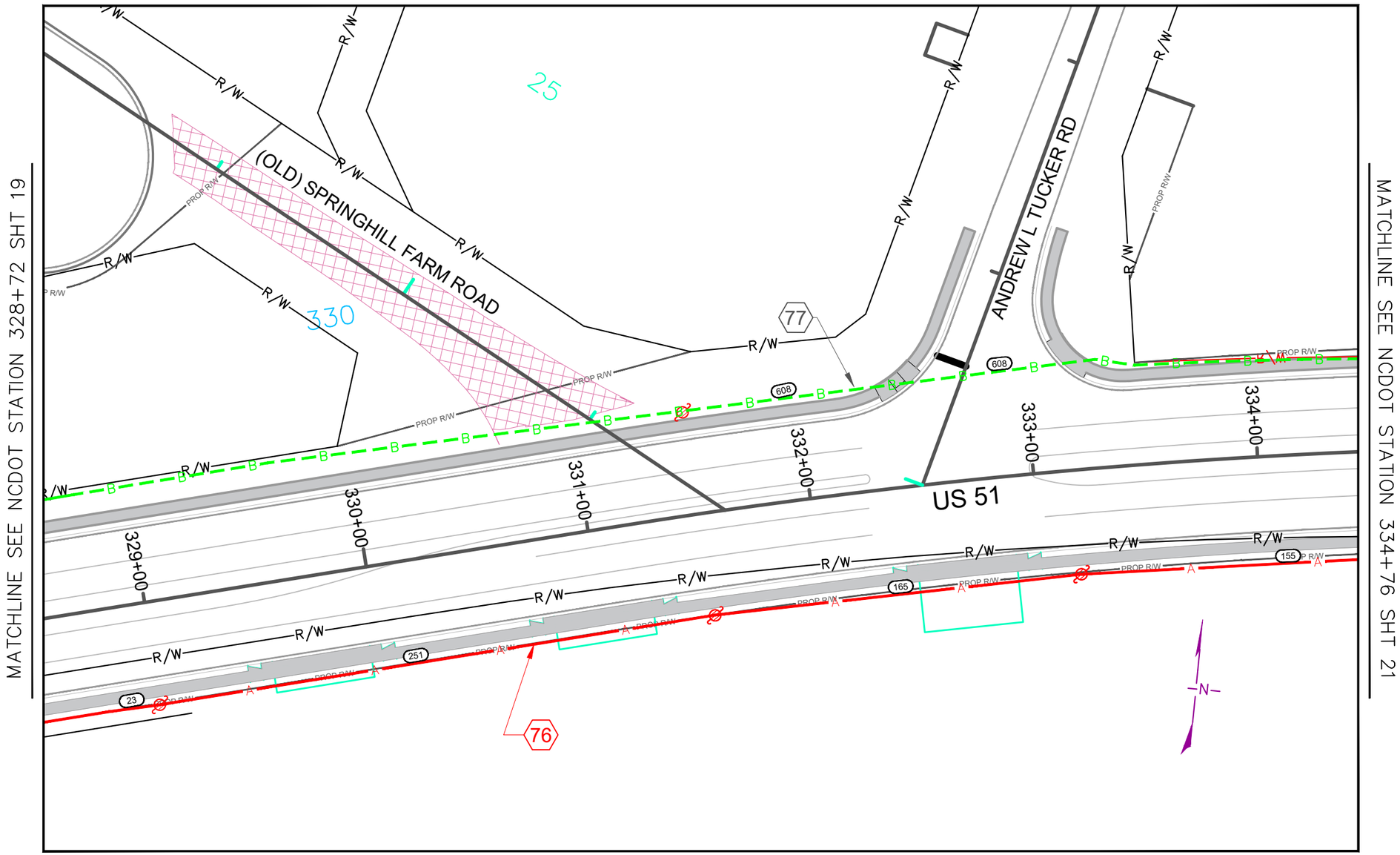
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	587'	
AER-STRAND 6M	FT	587'	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	580'	

CONSTRUCTION NOTES

76 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 587'

77 ABANDON LEVEL 3 UG
FIBER CABLE & CONDUIT

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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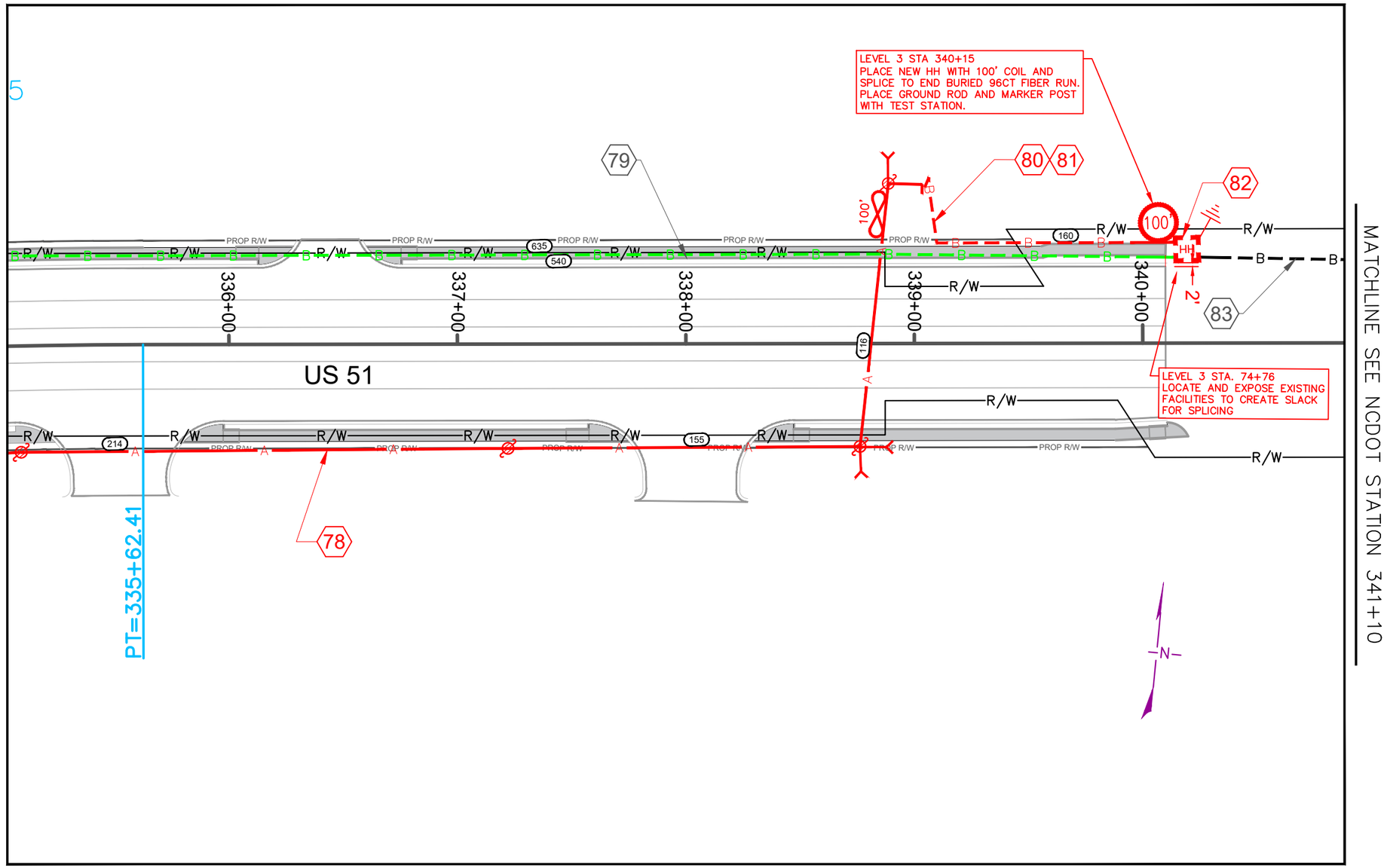
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY SHEET: 20 OF 23



CONSTRUCTION NOTES

78 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 634'

79 ABANDON LEVEL 3
UG FIBER CABLE & CONDUIT

80 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 160'
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

81 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 260'

82 LEVEL 3 PROPOSED
24"x36"x36" HANDHOLE

83 EXISTING LEVEL 3
UG FIBER CABLE & CONDUIT

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	634'	
AER-STRAND 6M	FT	588'	
AER-DOWN GUY	EA	3	
AER-ANCHOR - SCREW	EA	3	
AER- AERIAL FIBER SNOWSHOE	EA	1	
MAT- POLE RISER 1.25" TYPE 11 UV BLACK	FT	30'	
MAT- RISER U-GAURD 2in PLASTIC	EA	3	

Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	160'	
UGB - FIBER PL IN CONDUIT	FT	260'	
UGB - LOCATE WIRE IN CONDUIT	FT	160'	
UGB - HH 24x36x36	EA	1	
UGB - GROUND ROD 5/8" - 8FT	EA	1	
UGB - MARKER POST W/ TEST STATION	EA	1	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	540'	
UGB - DIG & EXPOSE EXISTING FACILITY	CU. YDS	6	

811 Know what's below. Call before you dig.

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

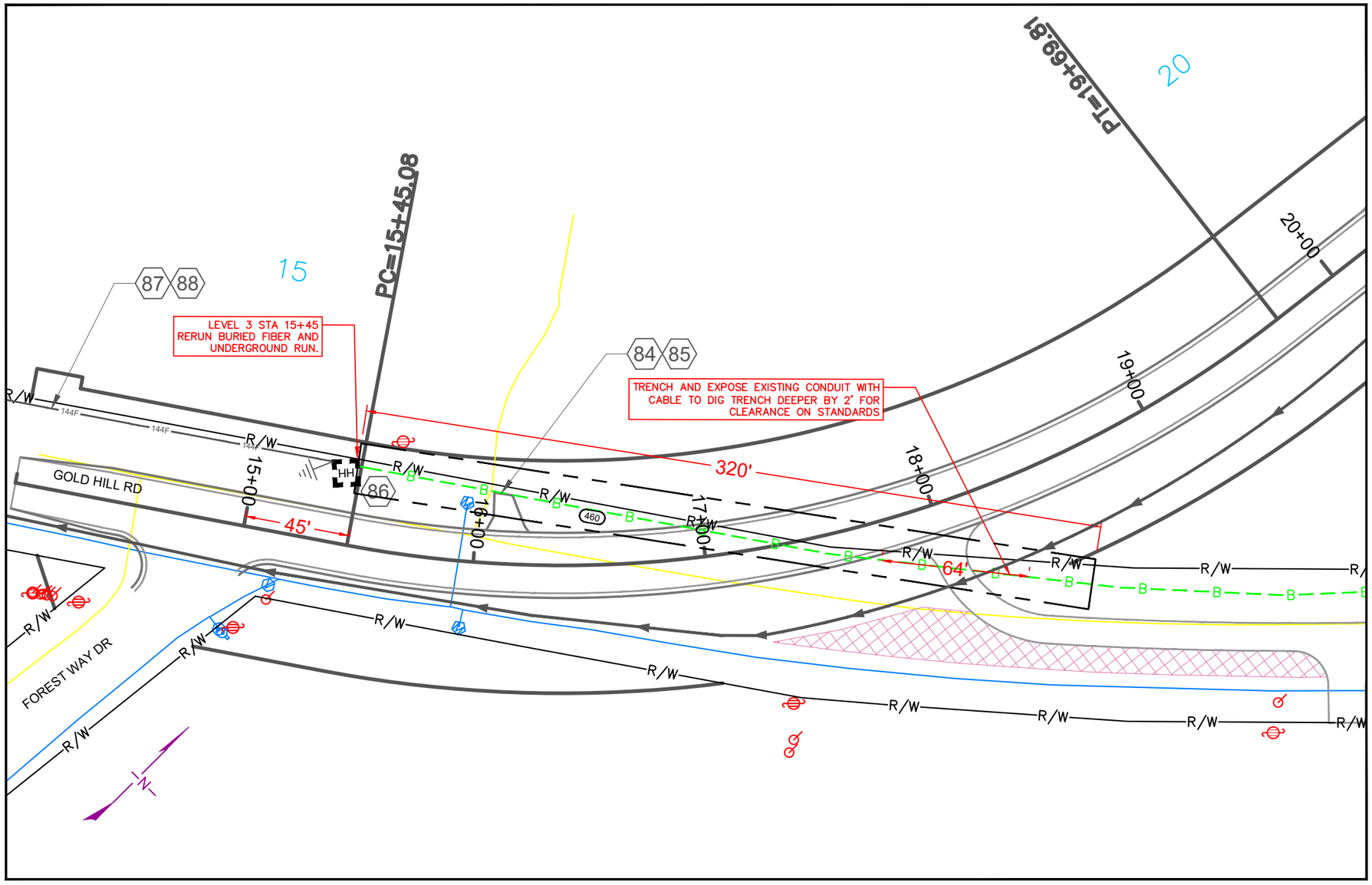
SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

Level(3) IS NOW CenturyLink

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY



Page Rate Card			
Unit Code & Description	Units	Estimated Quantity	Actual Quantity
UGB - DIG & EXPOSE EXISTING FACILITY	CU. YDS	8	

CONSTRUCTION NOTES

80 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 460
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 5

85 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 560

86 LEVEL 3 PROPOSED
24"x36"x36" HANDHOLE

80 CONDUIT OWNER: LEVEL3
CONDUIT LENGTH: 166
CONDUIT QTY: 1
CONDUIT SIZE: 1.5"
CONDUIT TYPE: 87

88 CABLE FIBERS: 96 CT ARMORED
CABLE OWNER: LEVEL 3
CABLE LENGTH: 166

(#) SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

811 Know what's **below.** **Call** before you dig.

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY

Labor Rate Card			
Unit Code and Description	Units	Estimated Quantity	Actual Quantity
UGB - BORE <= 2in 3 HDPE ON 1 REEL	FT	2,292'	
UGB - FIBER PL IN CONDUIT	FT	3,659'	
UGB - LOCATE WIRE IN CONDUIT	FT	2,292'	
UGB - HH 24x36x36	EA	5	
UGB - GROUND ROD 5/8" - 8FT	EA	4	
UGB - MARKER POST	EA	1	
UGB - MARKER POST W/ TEST STATION	EA	4	
UGB - RMV HH	EA	5	
UGB - ABANDON FIBER CABLE & CONDUIT	FT	10,604'	
UGB - DIG & EXPOSE EXIST FACILITY	CU. YDS	26.5	

Material Rate Card			
Unit Code and Description	Units	Estimated Quantity	Actual Quantity
MAT-1.5" HPDE 3-WAY REEL	FT	2,292'	
MAT - FIB 144 1JKT 1ARMOR LT	FT	5,113'	
MAT - FIB 96 1JKT 1ARMOR LT	FT	6,634'	
MAT - FIB 48 1JKT 1ARMOR LT	FT	887'	
MAT-STRAND 6M	FT	8,060'	
MAT-DOWN GUY	EA	19	
MAT-ANCHOR_SCREW	EA	19	
MAT-HH 24x36x36	EA	5	
MISC-GROUND ROD 5/8in x 8ft	EA	4	
MAT-MARKER POST MATERIAL	EA	1	
MAT-MARKER POST w/TEST STATION	EA	4	
MISC-TRAFFIC CONTROL - 3rd PARTY	EA	1	
MAT- POLE RISER 1.25" TYPE 11 UV BLACK	FT	90'	
MAT- RISER U-GAURD 2in PLASTIC	EA	9	

Labor Rate Card			
Unit Code and Description	Units	Estimated Quantity	Actual Quantity
AER-LASH FIBER	FT	8,260'	
AER-STRAND 6M	FT	8,060'	
AER-DOWN GUY	EA	19	
AER-ANCHOR - SCREW	EA	19	
AER- AERIAL FIBER SNOWSHOE	EA	11	

811
Know what's **below.**
Call before you dig.

NO.	DATE	ENG DESIGN	DRAFTING	COMMENT
3				AS-BUILT
2				REVISION # 1
1				ORIGINAL

LEVEL 3 ENGINEER: WANITA BRENES
ENGINEERING FIRM: SOC
PROJECT NUMBER: P-407791
LOCATION: US-21,
FORT MILL, SC
DRAWING NAME: US-21.dwg

CONFIDENTIAL/PROPRIETARY

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US 21 North and SC 51

This Agreement made this _____ day of _____, 20_____ by and between

York County, hereinafter called "County" and the utility company

MCIMETRO ACCESS TRANSMISSION SERVICES LLC

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

Relocation of existing Company (MCImetro) facilities along US21, between Springfield Pkwy and Springhill Farm Rd and along SC51, between US21 and Mecklenburg/York County line.

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $ 377,642.26

County Share $ 377,642.26 Company Share $ 0

(a) The Company ☐ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☒ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately 5 years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: Steven Ruiz
Phone Number: 704-692-3142
Email: steven.ruiz@verizon.com

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

( ) BY COMPANY'S REGULAR FORCES

(I) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

The underground portion of the Company's relocation will be completed by horizontal directional bore and its aerial relocation will be completed by placing 10m strand and over lashing our Fiber Optic Cable by its contractor TEP OPCO LLC

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

[x] Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

[ ] Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company’s delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Pennies for Progress

US 21 & SC 51 Relocation

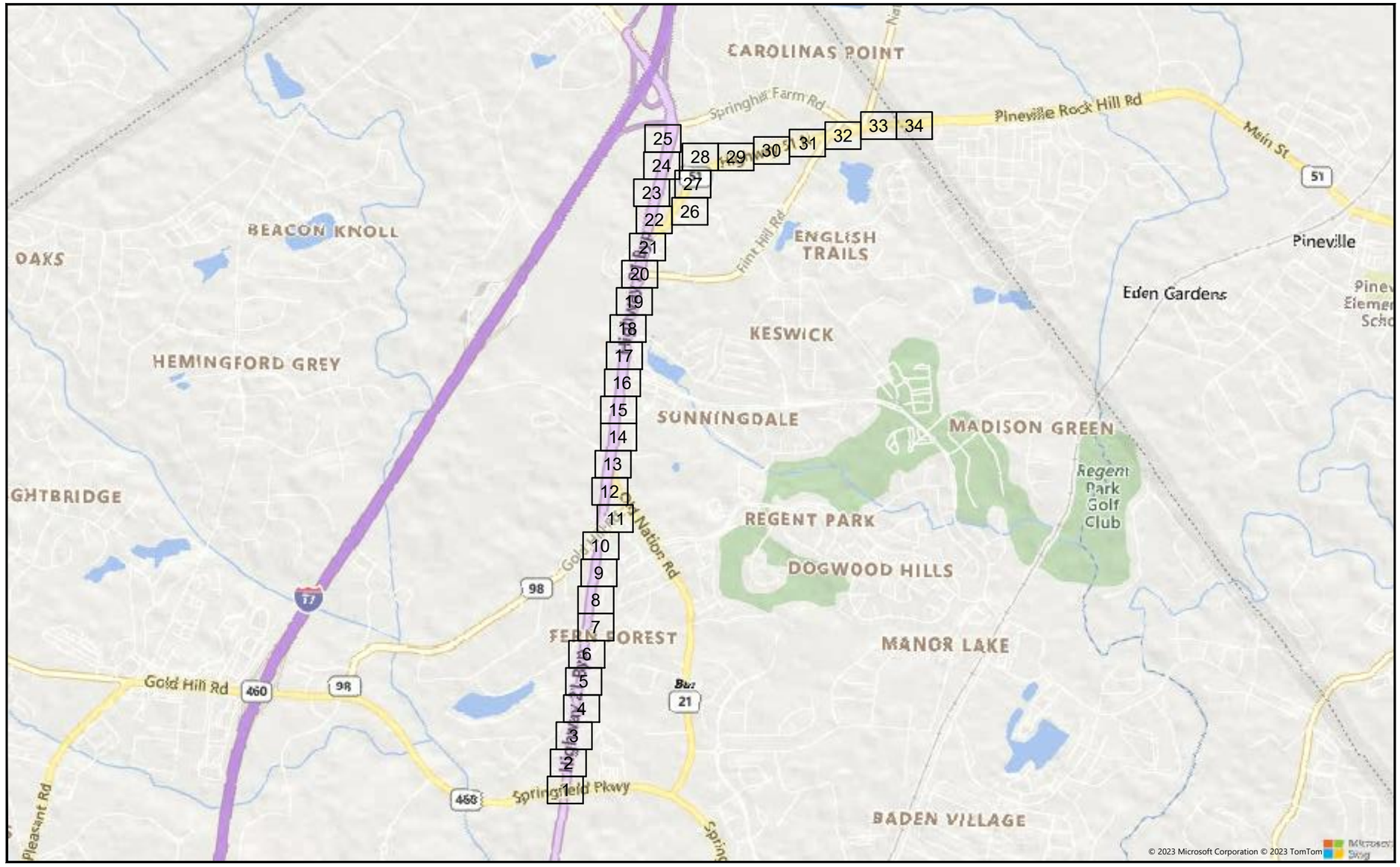
York County ID: 11149-004

Project ID: 0042332

MCImetro Access Transmission Services LLC
Cost Breakdown

Material:	$99,428.70
Labor:	$278,213.56
Total:	$377,642.26

Utility Owner: MCI Metro
Project Number: U721631
Project Name: US21 & SC51 RELO
Address: 1950 US-21, Fort Mill, SC 29715



Know what's below
Call before you dig.

N

PROJECT DESCRIPTION

PLACEMENT OF 4,896' OF (1) 2.0" HDPE SDR11 CONDUIT BY MEANS OF TRENCHING AND HORIZONTAL DIRECTIONAL BORING METHODS AND 13,219' OF ¼" EHS STRAND ATTACHED TO EXISTING POWER POLES.

SHEET INDEX

A - NFID/SITE NAME LIST
AA - COVER SHEET/SITE LOCATION
B - LEGEND
C - GENERAL NOTES
D - RAKE OFF TABLE
E - G - TYPICALS
1 - 34 - PROJECT SHEET

UTILITY OWNER:

MCI metro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

CONTACTS

Utility Owner: MCI Metro
400 International Pkwy. Richardson, TX 75081

Bill Bloom - Sr Engr Cslt-Tech Proj Mgmt
william.bloom@verizon.com
(252) 201-0326

Engineering Company: Tower Engineering Professionals
3201 Rotary Dr. Charlotte, NC 28269

Chris Barbee - Project Manager
cbarbee@tepgroup.net
(980) 404-2752

Gage Martin - Project Lead
gmartin@tepgroup.net

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

COVER SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

AA of 34

CONFIDENTIAL/PROPRIETARY

LEGEND

LINETYPES

- UG FIBER – EXISTING
- UG FIBER – PROPOSED
- AERIAL FIBER – EXISTING
- AERIAL FIBER – PROPOSED
- STRAND – EXISTING
- STRAND – PROPOSED
- CONDUIT – EXISTING
- CONDUIT – PROPOSED
- INNERDUCT – EXISTING
- INNERDUCT – PROPOSED
- G — GAS
- W — WATER
- T — TELEPHONE
- E — ELECTRIC
- SEW — SANITARY SEWER (SEW)
- SD — STORM DRAIN
- X — FENCE
- TV — CABLE TV
- STM — STEAM
- OIL — OIL
- UNK — UNKNOWN UTILITY
- R/W — RIGHT OF WAY
- EOP — EDGE OF PAVEMENT

SYMBOL	DESCRIPTION
ASW	ASPHALT SIDEWALK
BIP	BLACK IRON PIPE
BSP	BLACK STEEL PIPE
CSW	CONCRETE SIDEWALK
EOP	EDGE OF PAVEMENT
EOTW	EDGE OF TRAVEL WAY
FOC	FACE OF CURB
HDPE	HIGH DENSITY POLYETHYLENE
HH	HANDHOLE
JB	JUNCTION BOX
MH	MANHOLE
MP	MILE POST
O/S	OFFSET
PVC	POLY VINYL CHLORIDE
RGS	RIGID GALVANIZED STEEL CONDUIT
ROW	RIGHT OF WAY
STA.	STATION

- (R) — RISER
- (T) — TELEPHONE
- (P) — POWER VAULT
- CATCH BASIN/INLET
- FIRE HYDRANT
- GROUND/BOND
- STREET LIGHT
- TREE
- CULVERT
- WING WALL
- MKR — MARKER
- BORE PIT
- BRIDGE
- (U) — MISC. UTILITY
- (⊗) OWNER ID — UTILITY POLE – EXISTING
- OWNER ID — POLE – PROPOSED
- HH– [HH] HANDHOLE OWNER — HANDHOLE – EXISTING
- HH- [HH] HANDHOLE OWNER — HANDHOLE – PROPOSED
- MH– [MH] MANHOLE OWNER — MANHOLE – EXISTING
- MH- [MH] MANHOLE OWNER — MANHOLE – PROPOSED
- PB– [PB] PULLBOX OWNER — PULLBOX – EXISTING
- PB- [PB] PULLBOX OWNER — PULLBOX – PROPOSED

- VAULT– [V] VAULT OWNER — VAULT – EXISTING
- VAULT- [V] VAULT OWNER — VAULT – PROPOSED
- 0’ — AERIAL STORAGE – EXISTING
- 0’ — AERIAL STORAGE – PROPOSED
- 0’ — VAULT/BUILDING STORAGE – EXISTING
- 0’ — VAULT/BUILDING STORAGE – PROPOSED
- POLE ANCHOR/DOWN GUY – EXISTING
- POLE ANCHOR/DOWN GUY – PROPOSED
- PROPOSED DOWN GUY ON EXISTING ANCHOR
- [FDP] NAME SIZE LOCATION — TERMINATION – EXISTING
- [FDP] NAME SIZE LOCATION — TERMINATION – PROPOSED
- [BUILDING] NAME STREET — BUILDING CALLOUT – PROPOSED
- MANUFACTURER NAME — SPLICE POINT – EXISTING
- MANUFACTURER NAME — SPLICE POINT – PROPOSED

#F	IN:	0
	OUT:	0

SEQUENTIAL CALLOUT

#F	IN:	0
	TAIL:	0

SEQUENTIAL IN TAIL CALLOUT

#F	TAIL:	0
	OUT:	0

SEQUENTIAL TAIL OUT CALLOUT

POLE NO	N/A
UTILITY1	0’–0”

POLE ATTACHMENT CALLOUT – EXISTING
USE DYNAMIC PULL DOWN TO SELECT
FROM 1 TO 6 ATTACHMENTS

POLE NO	N/A
UTILITY1	0’–0”

POLE ATTACHMENT CALLOUT – PROPOSED
USE DYNAMIC PULL DOWN TO SELECT
FROM 1 TO 6 ATTACHMENTS

- (1) CABLE FIBERS: FIBERS
  CABLE OWNER: OWNER
  CABLE LENGTH: LENGTH
  NOTES:
  — CABLE SPAN CALLOUT – EXISTING
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
- (1) CABLE FIBERS: FIBERS
  CABLE OWNER: OWNER
  CABLE LENGTH: LENGTH
  NOTES:
  — CABLE SPAN CALLOUT – PROPOSED
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
- (1) CONDUIT OWNER: OWNER
  CONDUIT LENGTH: LENGTH
  CONDUIT QTY: CONDUITS
  CONDUIT SIZE: SIZE
  CONDUIT TYPE: TYPE
  INNER DUCT QTY: INNERDUCTS
  INNER DUCT SIZE: SIZE
  INNER DUCT TYPE: TYPE
  NOTES:
  — CONDUIT CALLOUT – EXISTING
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
  WITH OR WITHOUT INNER DUCT INFO
- (1) CONDUIT OWNER: OWNER
  CONDUIT LENGTH: LENGTH
  CONDUIT QTY: CONDUITS
  CONDUIT SIZE: SIZE
  CONDUIT TYPE: TYPE
  INNER DUCT QTY: INNERDUCTS
  INNER DUCT SIZE: SIZE
  INNER DUCT TYPE: TYPE
  NOTES:
  — CONDUIT CALLOUT – PROPOSED
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
  WITH OR WITHOUT INNER DUCT INFO
- (1) STRAND TYPE: TYPE
  STRAND LENGTH: LENGTH
  NOTES:
  — STRAND CALLOUT – EXISTING
  FOR USE ON PAPER SPACE (SHOWN AT 50X)
- (1) STRAND TYPE: TYPE
  STRAND LENGTH: LENGTH
  NOTES:
  — STRAND CALLOUT – PROPOSED
  FOR USE ON PAPER SPACE (SHOWN AT 50X)

ENGINEER:
TEP FIBER
2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SHEET TITLE:	LEGEND
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg
SHEET:	B of 34

CONFIDENTIAL/PROPRIETARY

GENERAL NOTES

GENERAL NOTES

CONTRACTOR MUST OBTAIN LOCATES PRIOR TO DISTURBING THE GROUND.

CONTRACTOR MUST HAVE A COPY OF THE APPROVED PERMIT FROM THE APPROPRIATE AGENCY ON THE JOBSITE AT ALL TIMES.

ALL CABLE WILL BE PLACED AT A MINIMUM DEPTH OF 36" DEEP UNLESS OTHERWISE DIRECTED BY A REPRESENTATIVE OF THE UTILITY OWNER.

ANY LANDSCAPING WILL BE REPLACED TO EQUAL OR BETTER THAN THAT WHICH EXISTED PRIOR TO WORK.

PROJECT SITE WILL BE PROPERLY SECURED PRIOR TO THE END OF EACH DAY.

ALL WORK IS TO BE IN ACCORDANCE WITH ALL AUTHORITIES HAVING JURISDICTION IN THE WORK ZONE.

CONTRACTORS ARE ADVISED TO CONTACT THE PROJECT MANAGER FOR ANY ADDITIONAL INFORMATION OR CLARIFICATION CONCERNING SCOPE OF WORK OR THE REQUIREMENTS NECESSARY FOR PROJECT COMPLETION.

CONTRACTOR IS RESPONSIBLE TO FIELD VERIFY ALL DIMENSIONS, QUANTITIES AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION. IF A SIGNIFICANT CHANGE TO THE RUNNING LINE IS NEEDED, PLEASE CONTACT THE PROJECT MANAGER BEFORE PROCEEDING.

BEFORE CONSTRUCTION BEGINS, CONTRACTOR SHALL TAKE APPROPRIATE PRECAUTIONS TO AVOID ANY POTENTIAL OBSTRUCTIONS PRIOR TO PROCEEDING WITH WORK.

NO CONSTRUCTION ON PRIVATE PROPERTY WILL COMMENCE UNTIL APPROVAL IS GIVEN BY A REPRESENTATIVE OF THE UTILITY OWNER.

CONTRACTOR SHALL NOT PROCEED WITH WORK UNTIL THEY HAVE RECEIVED A PURCHASE ORDER AND HAVE BEEN DIRECTED TO DO SO BY AN AUTHORIZED REPRESENTATIVE OF THE UTILITY OWNER.

CONTRACTOR SHALL NOT EXCEED THE PURCHASE ORDER VALUE WITHOUT AUTHORIZATION IN WRITING FROM THE APPROPRIATE REPRESENTATIVE OF THE UTILITY OWNER.

AS-BUILTS WILL BE REQUIRED FOR EACH PROJECT INCLUDING CABLE FOOTAGE SEQUENTIALS AT EVERY ACCESS POINT, SLACK LOOP, SPLICE LOCATION, POLE AND TERMINATION POINT. CONTRACTOR SHOULD ALSO PROVIDE NOTES OF ALL CHANGES IN DEPTHS, RUNNING LINES, MH/HH LOCATIONS, AND ANY OTHER APPLICABLE NOTES TO DEPICT THE WORK THAT TOOK PLACE. NOTE: ALL MAJOR CHANGES NEED TO BE PRE-APPROVED BY AN AUTHORIZED REPRESENTATIVE OF THE UTILITY COMPANY PRIOR TO STARTING THE WORK.

SITE CONDITIONS

THE ACTUAL LOCATION OF EXISTING CONDUIT AND CABLES MAY VARY FROM THE LOCATION SHOWN. REPAIR OF ANY DAMAGED CONDUIT CONTAINING CABLE SHALL BE MADE BY USE OF PVC SPLIT DUCT. THE CONTRACTOR SHALL ENCLOSE THE EXISTING CABLES IN PVC.

THE LOCATIONS OF EXISTING UTILITIES SHOWN IN THIS PLAN ARE APPROXIMATE. WHEN WORK IS TO BE CONDUCTED IN THE VICINITY OF KNOWN UTILITIES, THEIR ACTUAL LOCATION MUST BE FIELD VERIFIED TO AVOID CONFLICTS OR DAMAGE TO THOSE UTILITIES. VARIATION IN LOCATION BETWEEN "RECORDED POSITIONS" AND ACTUAL POSITIONS SHOULD BE ANTICIPATED.

IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES. BURIED UTILITIES MAY EXIST IN THE AREA IN ADDITION TO THOSE SHOWN ON THE PLAN. THE CONTRACTOR SHALL CONTACT PROPERTY OWNERS WHEN WORKING WITHIN PRIVATE EASEMENTS FOR LOCATION OF UNDERGROUND TANKS, PIPELINES, DRAIN TILES, OR OTHER BURIED IMPROVEMENTS. THE CONTRACTOR SHALL ALSO NOTIFY THE UTILITY NOTIFICATION CENTER PRIOR TO COMMENCING ANY CONSTRUCTION ACTIVITIES.

THE CONTRACTOR MUST ASSUME ALL BURIED UTILITIES ENCOUNTERED ARE ALIVE AND ACTIVE UNLESS SPECIFICALLY INSTRUCTED OTHERWISE BY OWNERS OR OPERATORS OF SAID UTILITIES.

DAMAGE TO SUB-SURFACE STRUCTURES IS THE SOLE RESPONSIBILITY OF THE PLACING CONTRACTOR.

THE CONTRACTOR SHALL PROTECT THE EXISTING TRAFFIC CONTROL LOOPS. IF EXISTING TRAFFIC CONTROL LOOPS ARE DAMAGED DURING CONSTRUCTION, THE ENTIRE LOOP WIRE FROM TERMINAL TO TERMINAL SHALL BE REPLACED IN ACCORDANCE WITH GOVERNING AGENCY STANDARDS AND REGULATIONS AT CONTRACTOR'S EXPENSE.

REMOVAL OF EXISTING ASPHALT PAVEMENT, CONCRETE CURBS, AND CONCRETE SIDEWALKS WILL BE "NEAT LINE" WITH SAW OR PAVEMENT CUTTER, PER REQUIREMENTS AND SPECIFICATIONS OF THE AGENCY OR DEPARTMENT RESPONSIBLE FOR EACH LOCATION. IF CONCRETE PAVEMENT IS ENCOUNTERED WHILE EXCAVATING CONDUIT TRENCHES, THE CONCRETE REMOVAL WILL BE "NEAT LINE" WITH A PAVEMENT SAW.

IF CONCRETE CURB RETURNS AND/OR SIDEWALKS ARE REPLACED DUE TO CONDUIT OR MANHOLE INSTALLATION, THE CONTRACTOR SHALL PLACE APPROVED HANDICAPPED SIDEWALK AND CURB ACCESS RAMPS IN CONFORMANCE WITH THE APPROPRIATE STATE STATUTES.

ALL MATERIALS NECESSARY FOR THE REPAIR OF STREETS, CURBS, SIDEWALKS, SANITARY SEWERS, STORM SEWERS, AND PUBLIC SERVICE UTILITIES, AND THE INSTALLATION OF SUCH MATERIALS SHALL BE IN CONFORMANCE WITH THE REQUIREMENTS AND SPECIFICATIONS OF THE AGENCY OR DEPARTMENT RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF THE REPAIRED FACILITY.

ALL WORK SHALL CONFORM TO THE SPECIFICATIONS OF THE JURISDICTIONAL PERMIT AGENCY.

ALL OPEN TRENCH WILL BE CLEARLY MARKED WITH BARRICADES OR CONES. STEEL PLATES OR OTHER TYPES OF BRIDGING SHALL BE PROVIDED TO COVER OPEN TRENCH IN THE TRAVEL PORTION OF THE STREETS. THESE PLATES OR BRIDGING SHALL BE ADEQUATE TO SUPPORT THE NORMAL VEHICLE LOADS ANTICIPATED IN THIS AREA AND SHALL BE IN PLACE DURING ALL NON-WORKING AREAS.

ALL SURFACES TO BE RESTORED TO ORIGINAL CONDITION, AND BACKFILL TO BE COMPACTED AS SPECIFIED. TRENCH EXCAVATION IN SURFACES WHICH INCLUDE CONCRETE TREATED BASE SHALL FOLLOW LOCAL AREA SPECIFICATIONS.

HAZARDOUS MATERIALS

THE CONTRACTOR SHALL NOTIFY THE JURISDICTIONAL PERMIT AGENCY IMMEDIATELY IF ANY MATERIALS ARE ENCOUNTERED THAT ARE CONSIDERED HAZARDOUS BY THE EPA, DEQ, OR OSHA. IF POTENTIALLY HAZARDOUS MATERIALS ARE ENCOUNTERED THE CONTRACTOR SHALL SECURE THE SITE AND PREVENT THE ACCIDENTAL EXPOSURE BY THE PUBLIC OR THE CONTRACTOR'S PERSONNEL.

THE CONTRACTOR MAY EXCAVATE UP TO, BUT SHALL NOT DISTURB KNOWN HAZARDOUS MATERIALS SUCH AS ASBESTOS, OILS, ACID, ETC. THE REMOVAL OF ALL HAZARDOUS MATERIALS MUST BE DONE BY AN APPROVED OR CERTIFIED HAZARDOUS MATERIALS CONTRACTOR LICENSED IN THE APPROPRIATE STATE.

A COPY OF ALL CORRESPONDENCE PERTINENT TO THE REMOVAL OF HAZARDOUS MATERIALS SHALL BE TRANSMITTED TO OWNER AND A COPY SHALL BE AVAILABLE AT THE PROJECT OFFICE AND THE JOB SITE.

AERIAL NOTES

- AERIAL CONSTRUCTION TO BE PERFORMED TO INDUSTRY ACCEPTABLE STANDARDS.
- ALL HEIGHTS OF CABLE PLACEMENT WILL BE RECORDED AT TIME OF CONSTRUCTION. DOCUMENT ALL POINTS OF ATTACHMENT.
- ALL EXTENSION ARMS TO BE PLACED WILL BE EPOXY ARMS UNLESS OTHERWISE NOTED OR APPROVED BY THE INSPECTOR.
- BOND STRAND TO POWER MGN WHERE APPLICABLE. ANCHORS TO BE USED WILL BE 3/4 SCREW IN TYPE.
- ALL STRAPS WILL BE PLACED 4" BEFORE AND AFTER EVERY SUPPORTING CLAMP AT A MINIMUM OF 21" APART.
- P.O.A. = POINT OF ATTACHMENT.
- ADD MISSING GROUNDS.
- REPAIR/REPLACE EXISTING LASHING WIRE IF DAMAGED.

CONSTRUCTION STAKING

IN AREAS WHERE THE CONDUIT ALIGNMENT IS NOT CLEARLY DEFINED BY CURB LINES, FENCE LINES, OR OTHER EVIDENCE OF THE RIGHT-OF-WAY, THE ENGINEER WILL PROVIDE CENTERLINE STAKES OR PAINT MARKS WHERE REQUIRED TO MAKE THE PROPOSED CONDUIT ALIGNMENT EVIDENT.

MANHOLE CENTERS WILL BE FIELD STAKED BY THE ENGINEER WHEN REQUESTED WITH OFFSET STAKES AT RIGHT ANGLES (90°) TO THE CONDUIT ALIGNMENT.

CLOSURES IDENTIFIED IN THE PLANS SHALL BE LOCATED BY THE CONTRACTOR. DEVIATION FROM PLAN LAYOUT SHALL BE APPROVED BY THE ENGINEER PRIOR TO CONDUIT AND/OR CLOSURE INSTALLATION.

IF ADDITIONAL, FIELD STAKING OR LOCATION OF CONDUITS, MANHOLES, PROPERTY LINES, ETC., BECOMES NECESSARY, THE CONTRACTOR IS TO NOTIFY THE INSPECTOR OR THE ENGINEER TWO WORKING DAYS PRIOR TO BEGINNING THE WORK.

PERMITS - FRANCHISES - EASEMENTS

PHYSICAL WORK SHALL NOT BE STARTED UNTIL THE GOVERNING AGENCY INSPECTOR AND THE CONTRACTOR ARE IN POSSESSION OF AND HAVE CAREFULLY REVIEWED AND FULLY UNDERSTAND ALL CONDITIONS AND SPECIFICATIONS SET FORTH IN THE REQUIRED PERMITS, FRANCHISES, AND/OR EASEMENTS.

PLACING FOREMAN TO HAVE A COPY OF THE PERMITS/EASEMENTS ON SITE AT ALL TIMES.

ANY CONFLICT BETWEEN WORK PRINT SPECIFICATIONS AND SPECIFICATIONS SET FORTH UNDER RELATED PERMITS, FRANCHISES, AND/OR EASEMENTS MUST BE CLEARED BY PROPER COMPANY AUTHORITY BEFORE PROGRESSING WITH WORK INVOLVED

TRAFFIC CONTROL

THIS PROJECT WILL INVOLVE WORKING ALONG A MAJOR ARTERIAL ROAD AND HEAVY TRAFFIC VOLUME SHOULD BE ANTICIPATED.

UNIFORM TRAFFIC FLOW SHALL BE MAINTAINED AT ALL TIMES. ONLY EQUIPMENT AND MATERIALS NECESSARY FOR IMMEDIATELY SCHEDULED OR IN PROGRESS WORK WILL BE MAINTAINED IN THE WORK AREA. ALL OTHER EQUIPMENT AND MATERIALS WILL BE "STORED OR STOCKPILED" IN SUCH A MANNER AS TO ELIMINATE HAZARDOUS CONDITIONS FOR TRAFFIC OR PEDESTRIANS DURING NON-WORKING OR SHUT DOWN PERIODS.

TRAFFIC WARNING DEVICES AND SIGNS SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (U.S. GOVERNMENT PRINTING OFFICE) AND TO THE STATE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION. HIGH LEVEL WARNING TYPE DEVICES ARE TO BE USED AT ALL TIMES AND SPECIAL WARNING DEVICES MAY BE STIPULATED BY THE JURISDICTIONAL PERMIT AGENCY AT ANY TIME THE USE WILL ADD TO THE SAFETY AND PROTECTION OF TRAFFIC OR PEDESTRIANS IN THE CONSTRUCTION AREA.

ALL CONDUIT TRENCHING IN PAVED AREAS SHALL BE BACKFILLED WITH CRUSHED GRAVEL OR COMPLETELY COVERED AT THE COMPLETION OF EACH WORKING DAY. ANY BACKFILLED TRENCH SHALL BE CAPPED WITH A MINIMUM LAYER OF ASPHALTIC CONCRETE COLD PATCH AT THE END OF EACH WORKING DAY.

THE CONTRACTOR SHALL MARK THE CONDUIT TRENCH AND DEFINE HIS CONSTRUCTION AREA CLEARLY WITH BARRICADES, CONES, AND/OR OTHER VISIBLE METHODS THAT ALERT THE PUBLIC OF THE CONSTRUCTION ACTIVITY.

A TRAFFIC CONTROL PLAN SHALL BE PREPARED BY THE CONTRACTOR AS REQUIRED AND SUBMITTED TO EACH PERMITTING AGENCY REQUESTING SUCH PLAN FOR REVIEW AND APPROVAL OR REVISION PRIOR TO COMMENCING ANY CONSTRUCTION ACTIVITY FOR THIS PROJECT. THE APPROVED PLAN SHALL BE SUBMITTED TO THE AGENCY AND A COPY OF THE PLAN SHALL BE KEPT AT THE CONSTRUCTION SITE AND MUST BE READILY AVAILABLE REVIEW BY THE AGENCY REPRESENTATIVES.

SPECIAL UTILITY CLEARANCES

ALL WORK CONDUCTED ADJACENT TO WATER MAINS SHALL CONFORM TO THE FOLLOWING CONDITIONS:

A. WHEREVER POSSIBLE CONDUIT SHALL MAINTAIN A HORIZONTAL SEPARATION OF 3.0 FEET, MEASURED SURFACE TO SURFACE (OUTSIDE EDGE TO OUTSIDE EDGE), FROM PARALLEL WATER MAINS.

B. WHEREVER POSSIBLE, CONDUIT SHALL PASS UNDER EXISTING WATER MAINS AND MUST MAINTAIN 12" VERTICAL CLEAR SEPARATION. CONDUITS PASSING OVER WATER MAINS MUST ALSO MAINTAIN THE 12" VERTICAL SEPARATION.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING THIS REQUIRED VERTICAL SEPARATION BY EITHER EXPOSING THE WATER MAIN EVERY 100 FEET IN THOSE AREAS WHERE HORIZONTAL SEPARATION IS LESS THAN 3.0 FEET OR BY UTILIZING THE DEPTHS OF ADJACENT WATER VALVES. IF THE CONTRACTOR UTILIZES THE ADJACENT WATER TO DETERMINE WATER MAIN DEPTH, HE SHALL CONTACT THE AGENCY AT EACH SUCH LOCATION AND THE AGENCY WILL DETERMINE THE NECESSARY DEPTH OF THE TOP OF THE CONDUIT AT THAT POINT.

D. THE VERTICAL AND HORIZONTAL SEPARATION SHALL BE MAINTAINED AT ALL TIMES UNLESS SPECIFICALLY REVISED BY AGREEMENT BETWEEN THE JURISDICTIONAL PERMIT AGENCY AND THE AGENCY ANY SPECIFIC DEVIATION IN VERTICAL AND HORIZONTAL SEPARATION FROM THOSE DESCRIBED SHALL BE REPORTED TO THE OWNER BY THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING VERTICAL AND HORIZONTAL SEPARATION AT ALL TIMES AND SHALL BE RESPONSIBLE FOR ANY AND ALL ENCROACHMENTS.

E. CLEARANCES TO STORM SEWERS AND SANITARY SEWERS SHALL BE EXACTLY THE SAME AS THOSE TO WATER MAINS.

STRUCTURE PROTECTION

MANHOLES AND CONDUIT TO BE PLACED ADJACENT TO EXISTING STRUCTURES SUCH AS BRIDGE BRIDGE FOOTINGS/PIERS, BUILDING FOUNDATIONS, WALLS, POWER AND TELEPHONE POLES, AND OTHER UTILITIES SHALL MAINTAIN A MINIMUM CLEARANCE AS SHOWN. THE CONTRACTOR SHALL NOT UNDERMINE ANY ADJACENT STRUCTURE WITHOUT SPECIFIC WRITTEN PERMISSION FROM THE OWNER/OPERATOR OF SUCH STRUCTURE.

SHORING USED AS FOUNDATION SUPPORT SHALL BE DESIGNED SPECIFICALLY FOR BOTH THE LIVE AND DEAD LOADS OF THE STRUCTURE, OR IF ONLY THE DEAD LOAD IS USED FOR DESIGN, THE CONTRACTOR SHALL PROVIDE A DETAILED LAYOUT AND PLAN OF THE METHOD OF ESTABLISHING AND MAINTAINING THE DESIGN LOAD CONDITIONS (I.E., ROAD DETOURS, TIEBACKS, ETC.).

SEE UTILITY CLEARANCE SECTION NOTES FOR CLEARANCE CRITERIA TO PARALLEL OR CROSS UTILITIES.

EXISTING UTILITIES EXPOSED DURING EXCAVATION SHALL BE 100% SUPPORTED BY EITHER TRENCH BRIDGING AND SUSPENSION OR BY THE USE OF LONGITUDINAL TRAYS OR PLATFORMS VERTICALLY SUPPORTED BY ADJUSTABLE BUILDING JACKS.

EXISTING SPLICE CASES AND CABLES SHALL BE SUPPORTED BY SUSPENSION FROM A CROSSING BEAM. SUPPORTS SHALL BE PLACED AT A MAXIMUM SPACING OF 4.0 FEET AND SHALL CONSIST OF A CANVAS SLING WITH NYLON BELTING OR ROPE. ALL CABLE SUPPORTS SHALL BE PLACED IN A MANNER THAN PREVENTS KINKS OR OTHER DAMAGE TO THE CABLE SHEATH.

AN ACCEPTABLE ALTERNATIVE TO CABLE SLINGS WOULD BE THE UTILIZATION OF A WIDE FLANGE "I" BEAM OR CHANNEL AS A "CABLE TRAY" WITH THE CABLES/CASES BANDED IN PLACE.

SHORING

THE CONTRACTOR SHALL PROVIDE SHORING FOR CONDUIT TRENCH EXCAVATION 42" OR MORE IN DEPTH AS MEASURED FROM THE HIGH SIDE OF THE TRENCH AND FOR ALL MANHOLE EXCAVATION.

MANHOLE SHORING SHALL BE TIGHT-SHEETED.

ALL SHORING SHALL CONFORM TO THE STANDARDS AND SPECIFICATIONS OF LOCAL COUNTY AND THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).

SHORING SHALL BE DESIGNED TO MEET H-20 HIGHWAY LOADING.

THE CONTRACTOR SHALL PROVIDE ALL SHORING AND DESIGN CALCULATIONS TO THE PERMIT ISSUING AGENCY PRIOR TO COMMENCING ANY CONSTRUCTION ACTIVITY.

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SHEET TITLE:

GENERAL NOTES

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

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BILL OF MATERIALS

Materials		
Description	**Unit**	**Engineered Quantity**
(1) 2.0" HDPE SDR 11 Conduit	FT	4,896
Tracer Wire	FT	5,330
864CT Fiber-Optic Cable (MMID: 10855006) - Buried	FT	5,775
864CT Fiber-Optic Cable (MMID: 10855006) - Aerial	FT	13,219
1/4" EHS Strand	FT	13,219
30X48X36 - Handhole	EA	8
Ground Rod - Copper Clad Steel - 5/8" X 8'	EA	8
Gravel Bag	EA	8
600D Splice Enclosure	EA	2
Seed & Straw	SQ FT	152

ENGINEER:
TEP FIBER
2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SHEET TITLE:
RAKE OFF TABLES

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

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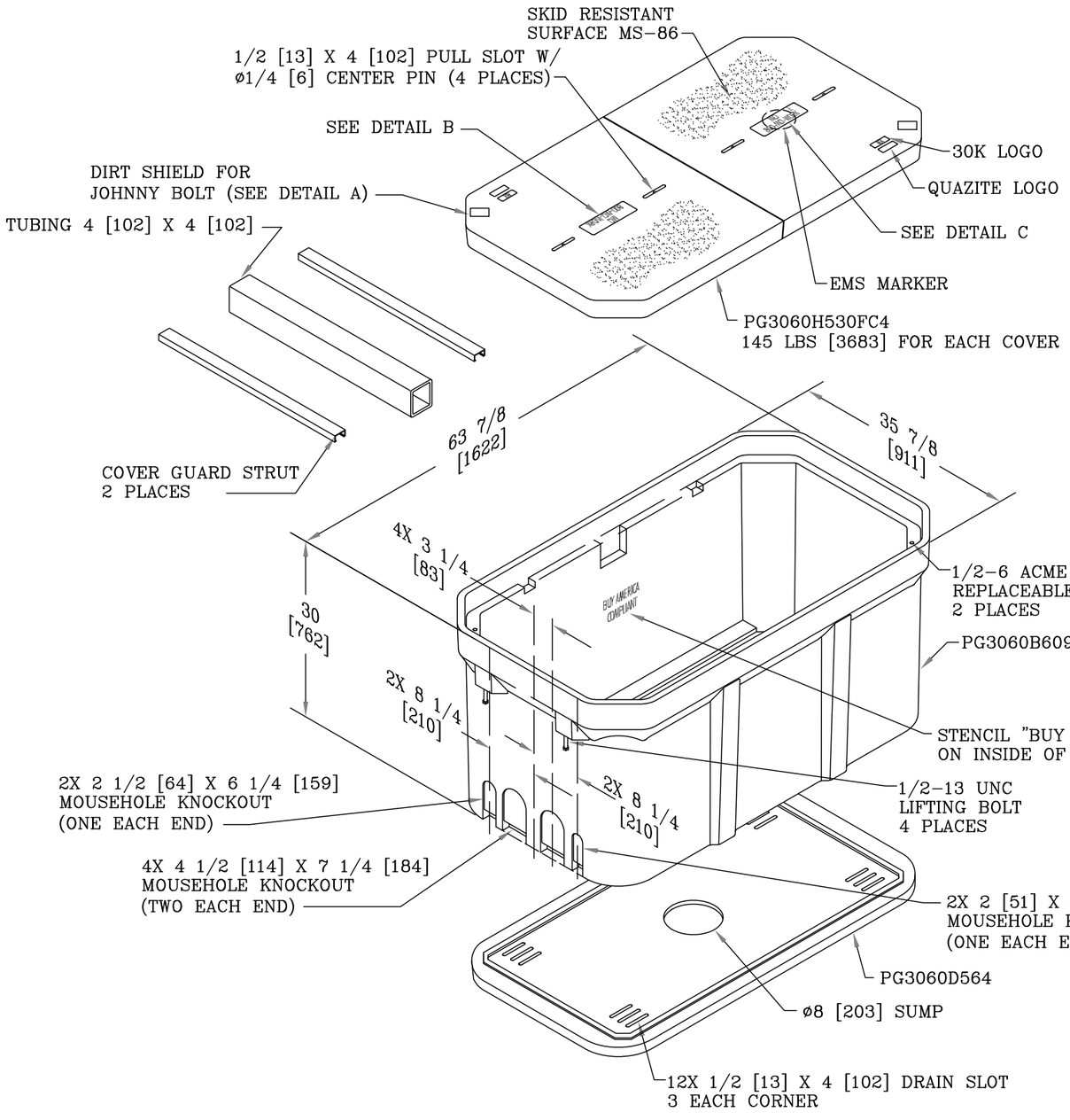
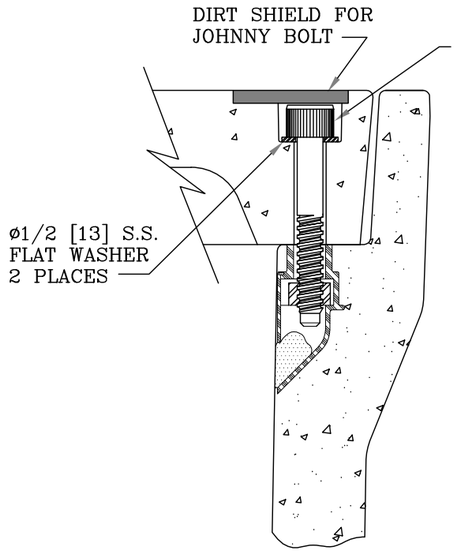
TYPICALS





DETAIL A
2 PLACES

MCI
800-MCI-WORK

DETAIL B

MCI E
800-MCI-WORK

DETAIL C

30K STANDARD HANDHOLE

MEETS SCTE/ANSI 77-TIER 22 LOADING CRITERIA
DESIGN LOAD: 30,000 LBS
MINIMUM FAILURE LOAD: 45,000 LBS
NP12-6281

ENGINEER:

TEP FIBER
2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SHEET TITLE: TYPICALS

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PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
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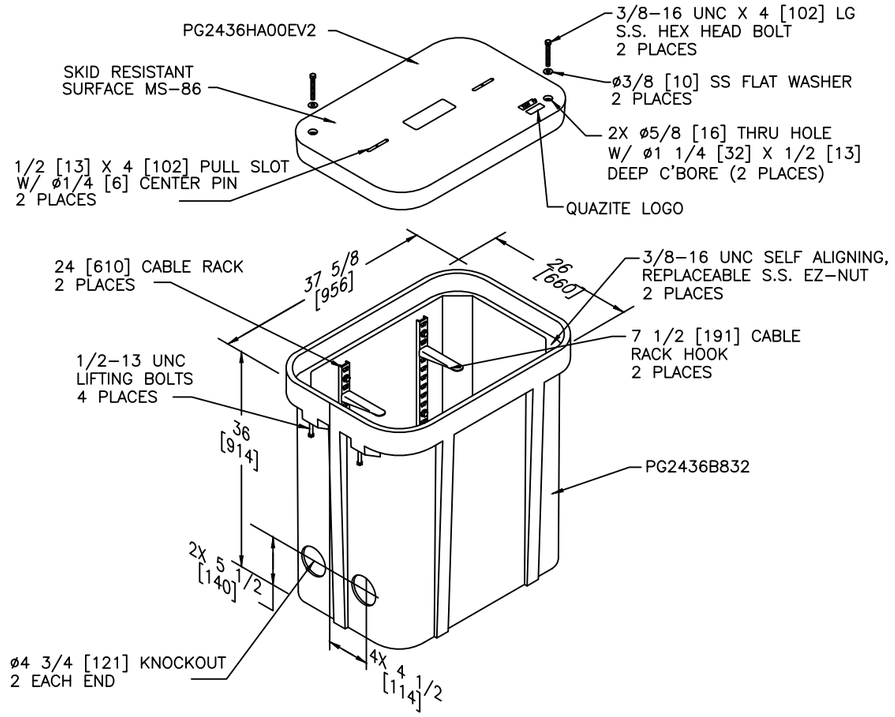
TYPICALS



TYPICAL DETAIL – #10

QUAZITE 24X36X36 BOX ASSEMBLY

W/(2) 24" CR, (2) 7 1/2" CR, HOOKS

& (4) ø4 3/4 KNOCKOUT

NP19-8464

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SHEET TITLE:	TYPICALS
PROJECT MANAGER:	CHRIS BARBEE
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PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg
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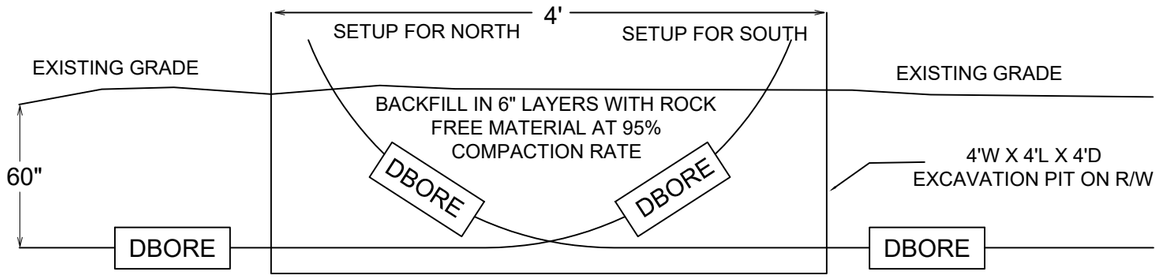
TYPICALS

DIRECTIONAL BORE TIE-IN DETAIL

NOT TO SCALE

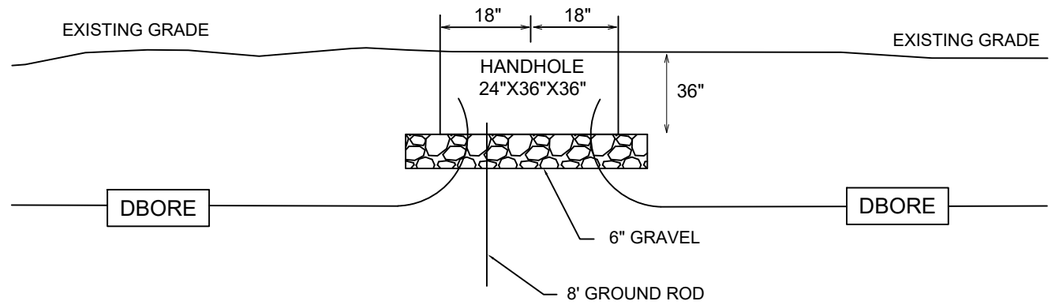


TIE-IN STATION

- BORE FROM EACH DIRECTION IS RUN AT DESIGN DEPTH TO 2 FEET PAST THE INTENDED TIE-IN. THEN TURNED UP TO DAYLIGHT.
- THE TIE-IN POINT IS EXCAVATED. THE CONDUITS CUT OFF WHERE THEY CROSS EACH OTHER AT DESIGN DEPTH, AND A COUPLER IS INSTALLED TO CONNECT THE TWO CONDUITS AT THE DESIGN DEPTH.
- ALL EXCAVATIONS OR TRENCHES 4 FEET OR GREATER IN DEPTH SHALL BE APPROPRIATELY BENCHED, SHORED, OR SLOPED IN OSHA'S EXCAVATION STANDARD, 29 CFR 1926.650, .651, AND .652

HANDHOLE CONSTRUCTION DETAILS, CONDUIT TO HANDHOLE PROFILE FOR R/W CONSTRUCTION

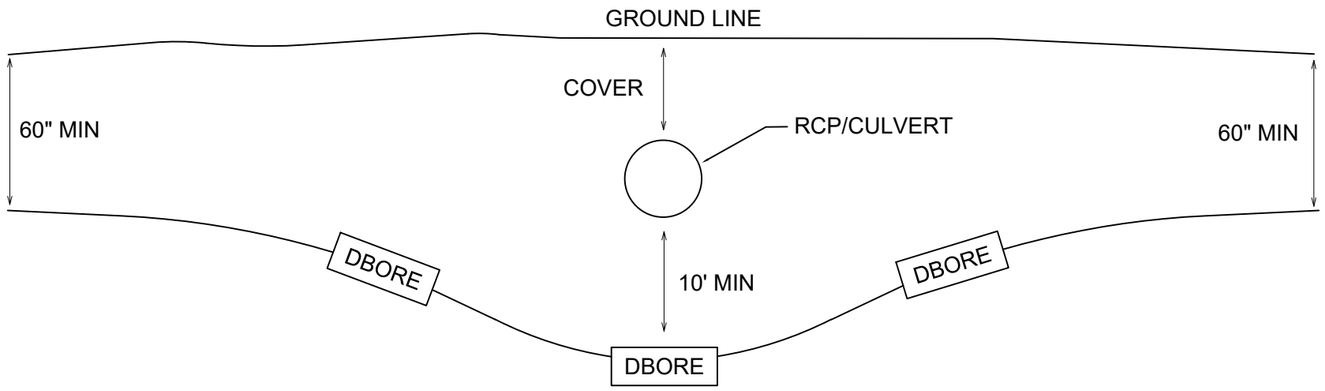
NOT TO SCALE



ALL EXCAVATIONS OR TRENCHES 4FEET OR GREATER IN DEPTH SHALL BE APPROPRIATELY BENCHED, SHORED, OR SLOPED ACCORDING TO THE PROCEDURES AND REQUIREMENTS SET FORTH IN OSHA'S EXCAVATION STANDARD, 29 CFR 1926.650, .651, AND .652.

CULVERT CROSSING DETAIL

NOT TO SCALE



ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SHEET TITLE: TYPICALS

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

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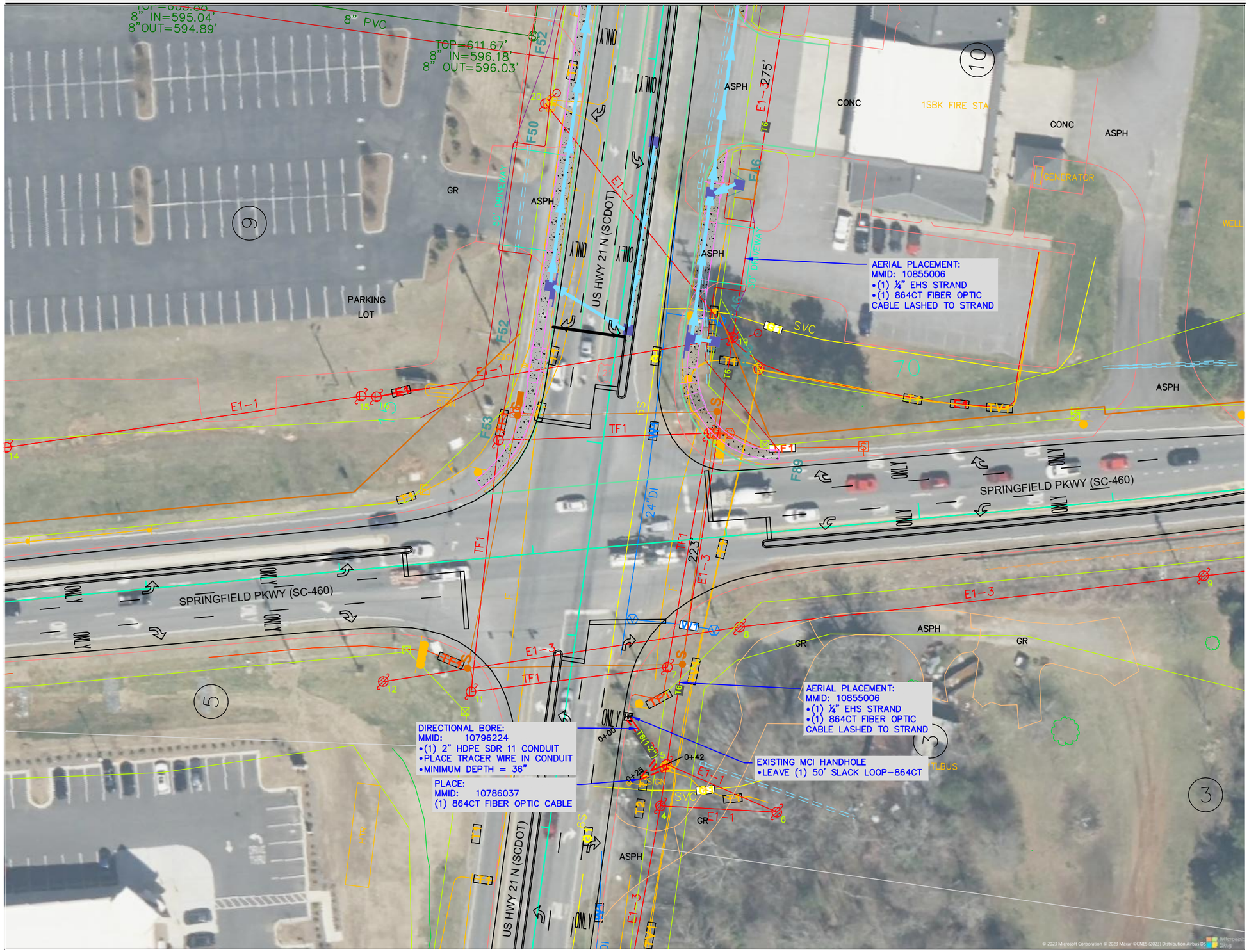
MATCH TO SHEET 2



UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

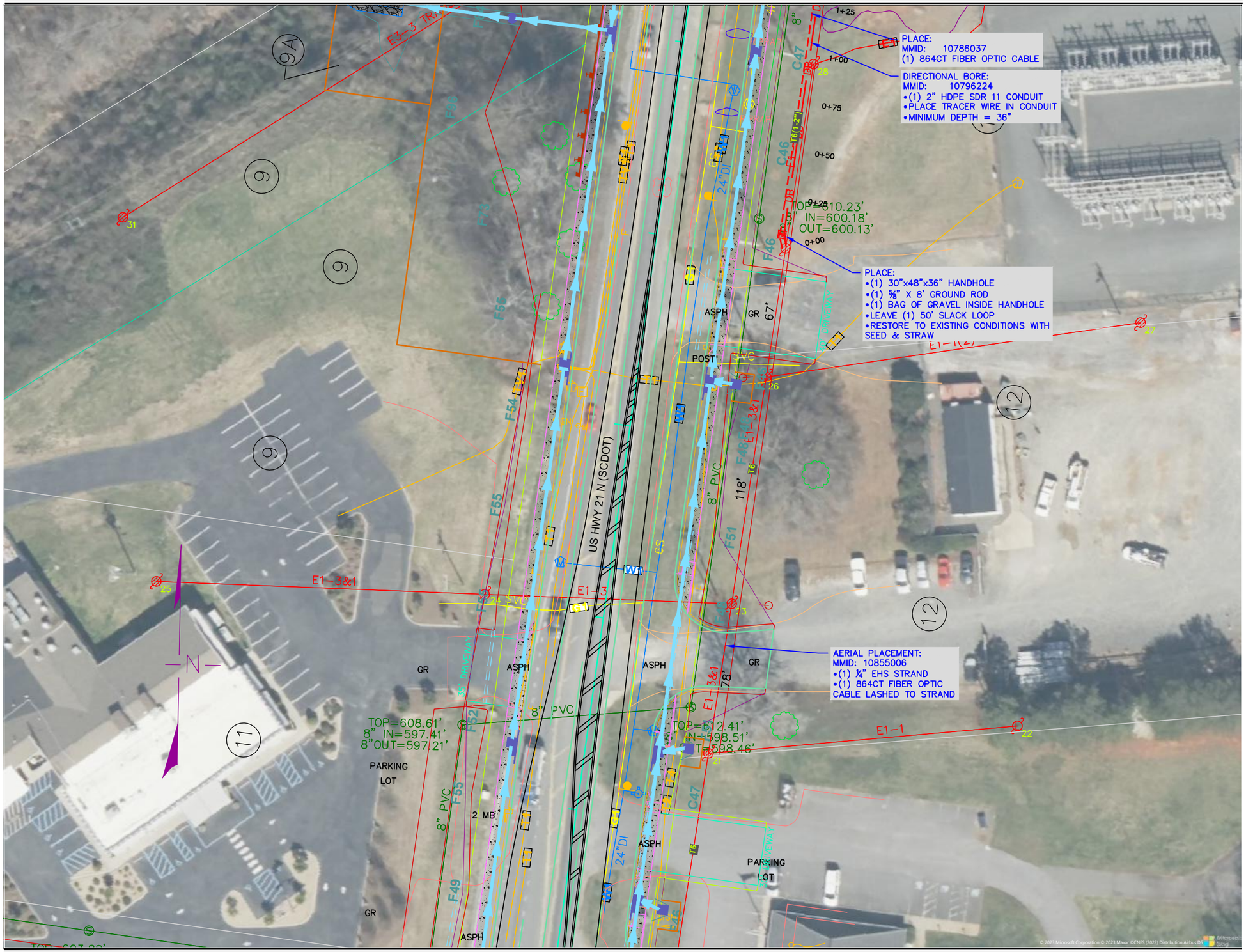
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

1 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 3



MATCH TO SHEET 1

SCALE: 1"=50'

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

Know what's below Call before you dig.

UTILITY OWNER:

MCImetro

ENGINEER:

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2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

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CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 4

AERIAL PLACEMENT:
MMID: 10855006
•(1) ¼" EHS STRAND
•(1) 864CT FIBER OPTIC CABLE LASHED TO STRAND

DIRECTIONAL BORE:
MMID: 10796224
•(1) 2" HDPE SDR 11 CONDUIT
•PLACE TRACER WIRE IN CONDUIT
•MINIMUM DEPTH = 36"

DIRECTIONAL BORE:
MMID: 10796224
•(1) 2" HDPE SDR 11 CONDUIT
•PLACE TRACER WIRE IN CONDUIT
•MINIMUM DEPTH = 36"

TOP=609.71'
INV(E)=602.53'
INV(E)=601.78'
INV(S)=601.62'

TOP=612.69'
8" OUT=603.14'

MATCH TO SHEET 2

UTILITY OWNER:
MCImetro

ENGINEER:
TEP FIBER
2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

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REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
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3	----	----
4	----	----

SHEET TITLE:
PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
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PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
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SHEET:
3 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 5



MATCH TO SHEET 3

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

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4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
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DESCRIPTION:	US21 & SC51 RELO
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SHEET:

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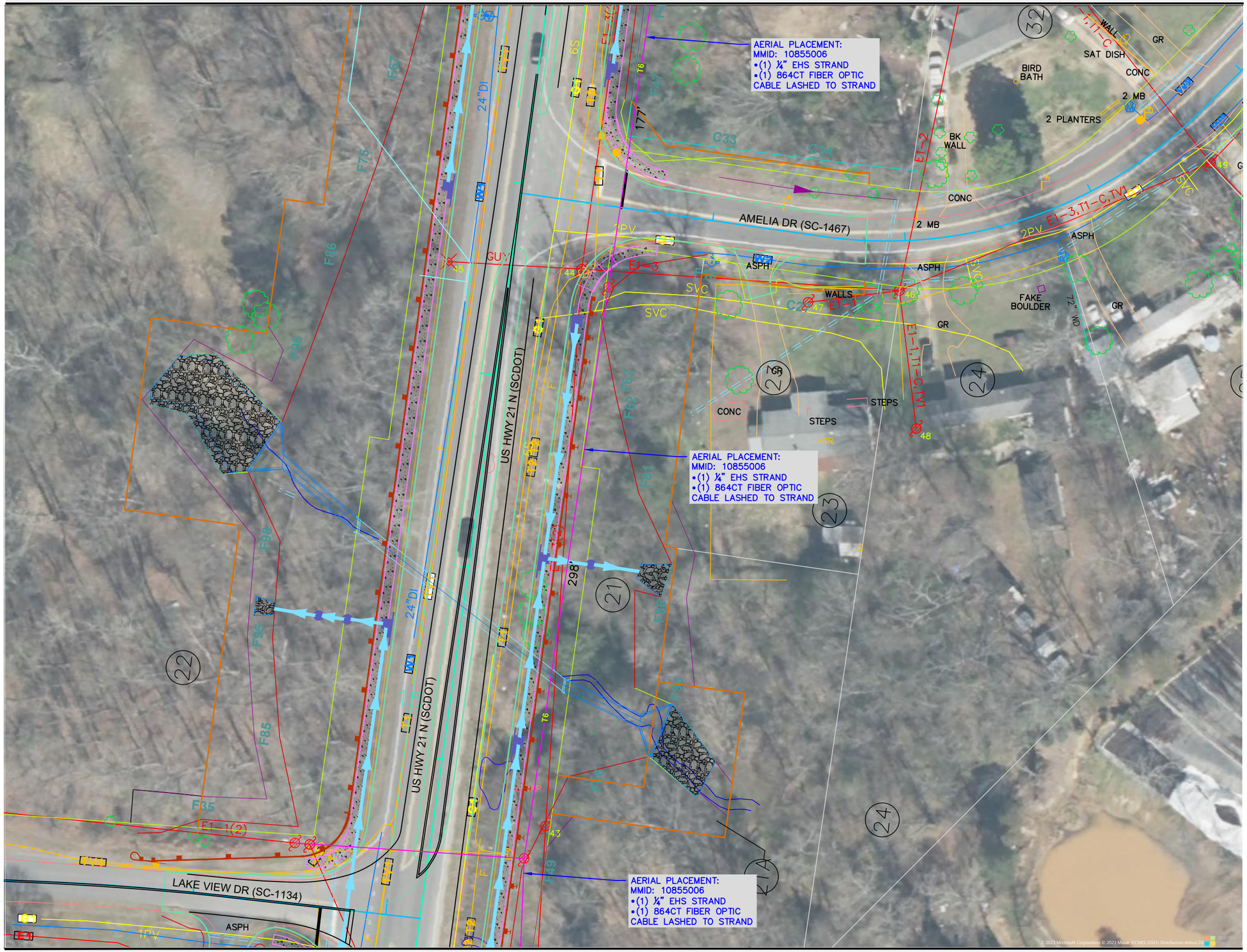
CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 6



MATCH TO SHEET 4

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

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REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
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4	----	----

SHEET TITLE:

PROJECT SHEET

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DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

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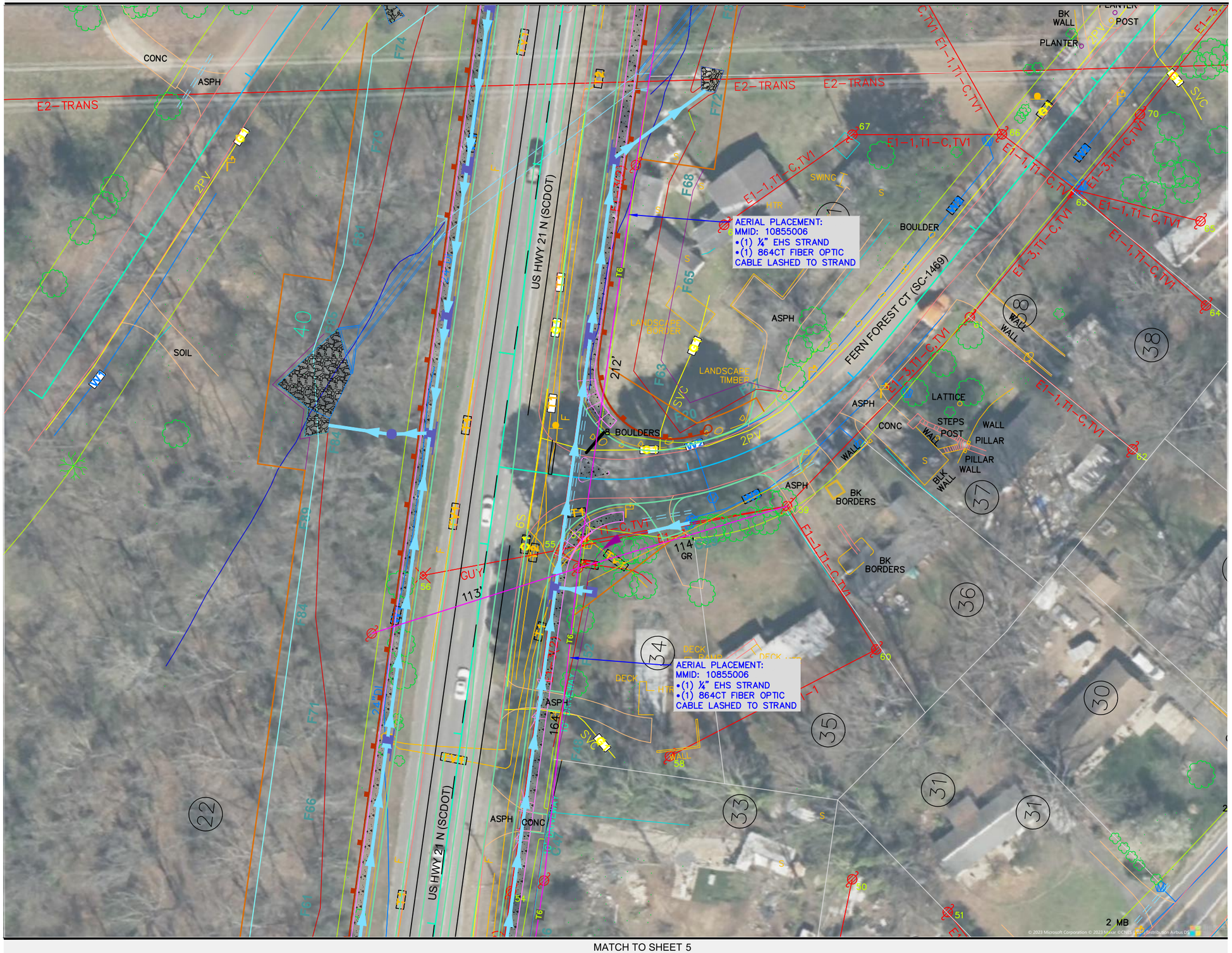
CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 7



MATCH TO SHEET 5

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

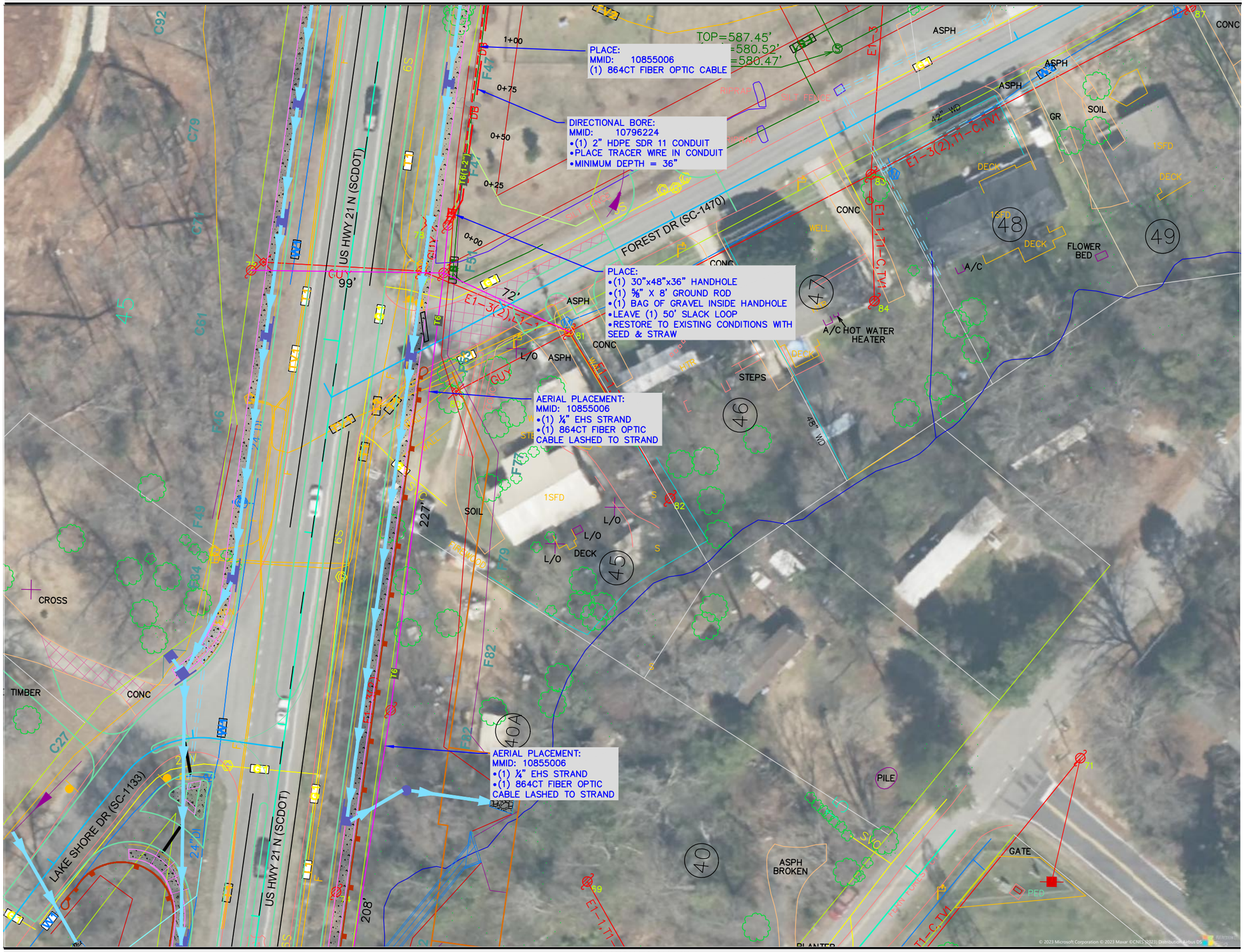
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

6 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 8



MATCH TO SHEET 6

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

7 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 9



MATCH TO SHEET 7

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

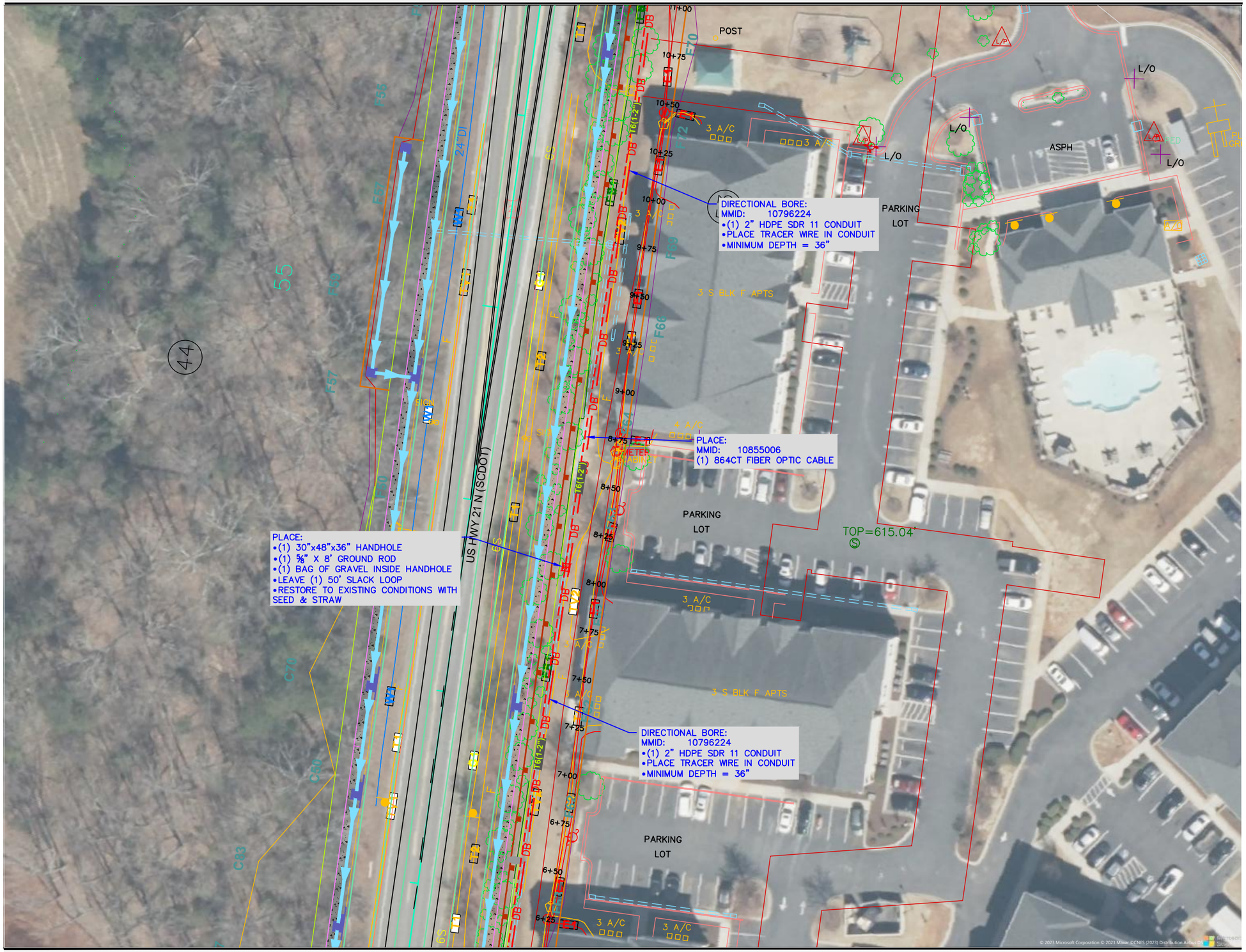
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

8 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 10



MATCH TO SHEET 8

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

9 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 11

AERIAL PLACEMENT:
MMID: 10855006
•(1) ¼" EHS STRAND
•(1) 864CT FIBER OPTIC CABLE LASHED TO STRAND

PLACE:
•(1) 30"x48"x36" HANDHOLE
•(1) ⅝" X 8' GROUND ROD
•(1) BAG OF GRAVEL INSIDE HANDHOLE
•LEAVE (1) 50' SLACK LOOP
•RESTORE TO EXISTING CONDITIONS WITH SEED & STRAW

DIRECTIONAL BORE:
MMID: 10796224
•(1) 2" HDPE SDR 11 CONDUIT
•PLACE TRACER WIRE IN CONDUIT
•MINIMUM DEPTH = 36"

PLACE:
MMID: 10855006
(1) 864CT FIBER OPTIC CABLE

DIRECTIONAL BORE:
MMID: 10796224
•(1) 2" HDPE SDR 11 CONDUIT
•PLACE TRACER WIRE IN CONDUIT
•MINIMUM DEPTH = 36"

GOLD HILL RD
US HWY 21 N (SCDOT)
EMBASSY DR
ASPH
GR
60" MTL FENCE
RIPRAP
A/C PIPE
TOP=631.54'
L/O
SIGN
24"DI
12"
16"
15+50
15+25
15+00
14+75
14+50
14+25
14+00
13+75
13+50
13+25
13+00
12+75
12+50
12+25
12+00
11+75
11+50
11+25

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MATCH TO SHEET 9

UTILITY OWNER:
MCImetro

ENGINEER:
TEP FIBER
2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811
Know what's below
Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
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3	----	----
4	----	----

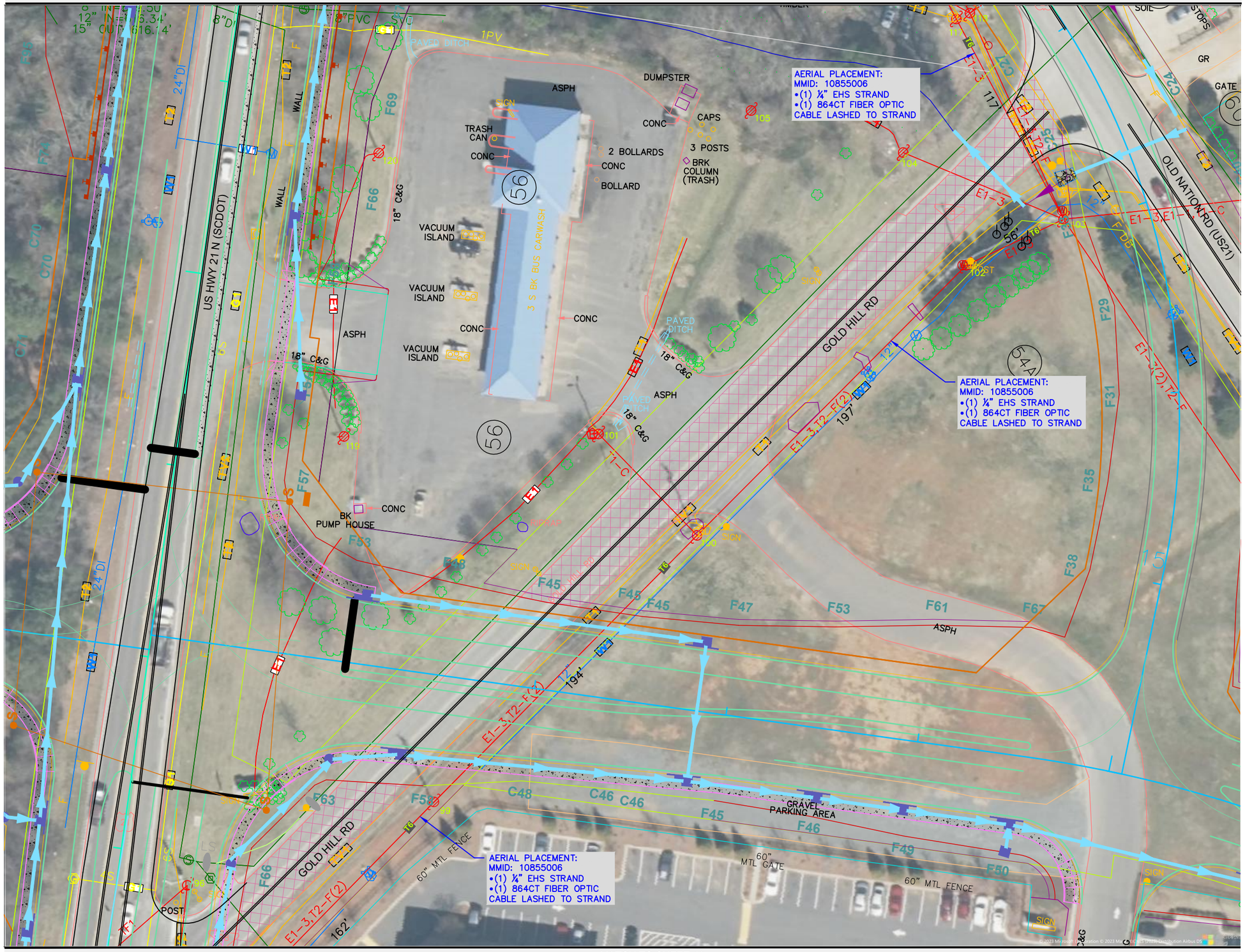
SHEET TITLE:
PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:
10 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 12



MATCH TO SHEET 10

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

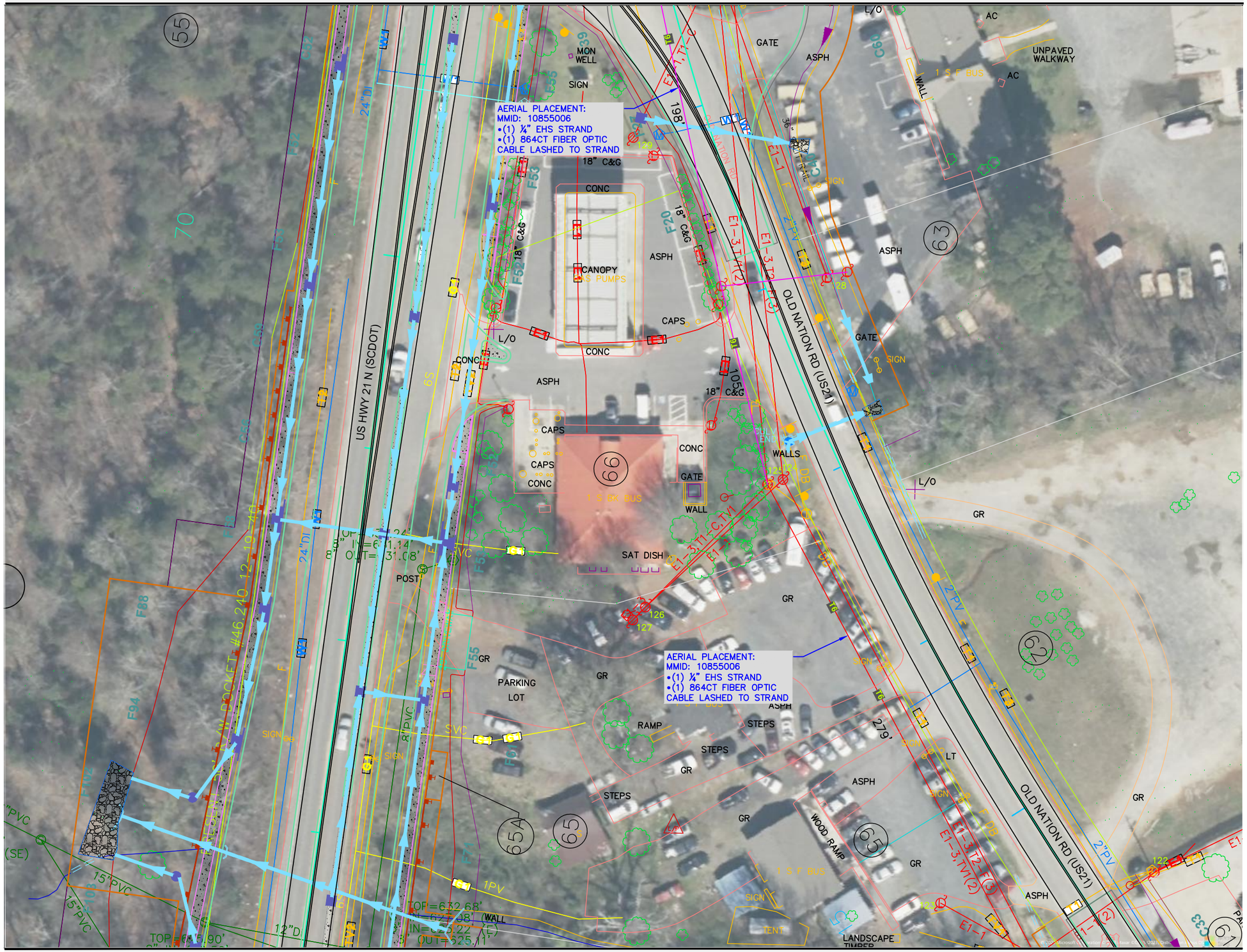
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

11 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 13



MATCH TO SHEET 11

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811
Know what's below
Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
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3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

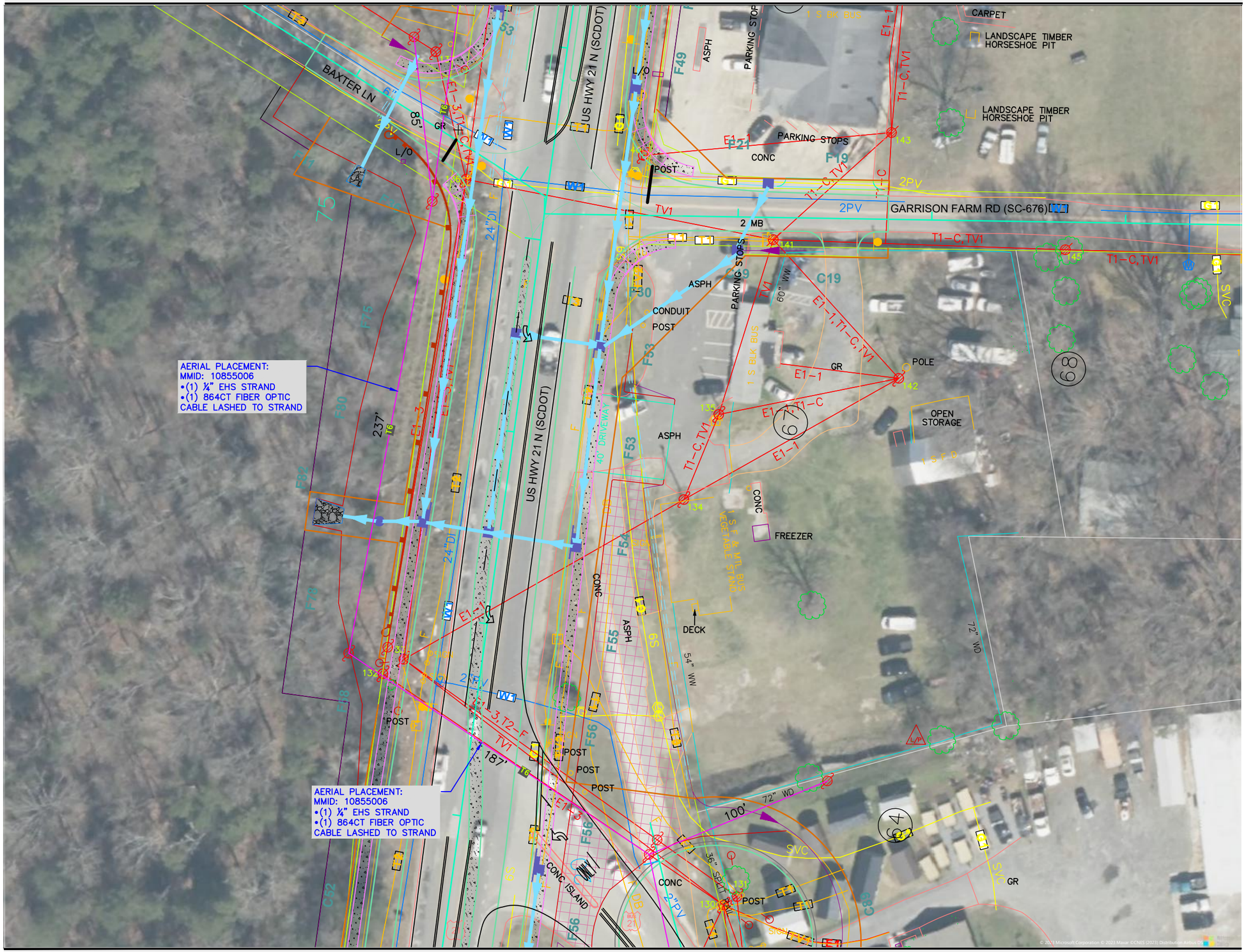
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

12 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 14



MATCH TO SHEET 12

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

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SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
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4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

13 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 15



MATCH TO SHEET 13

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
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3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

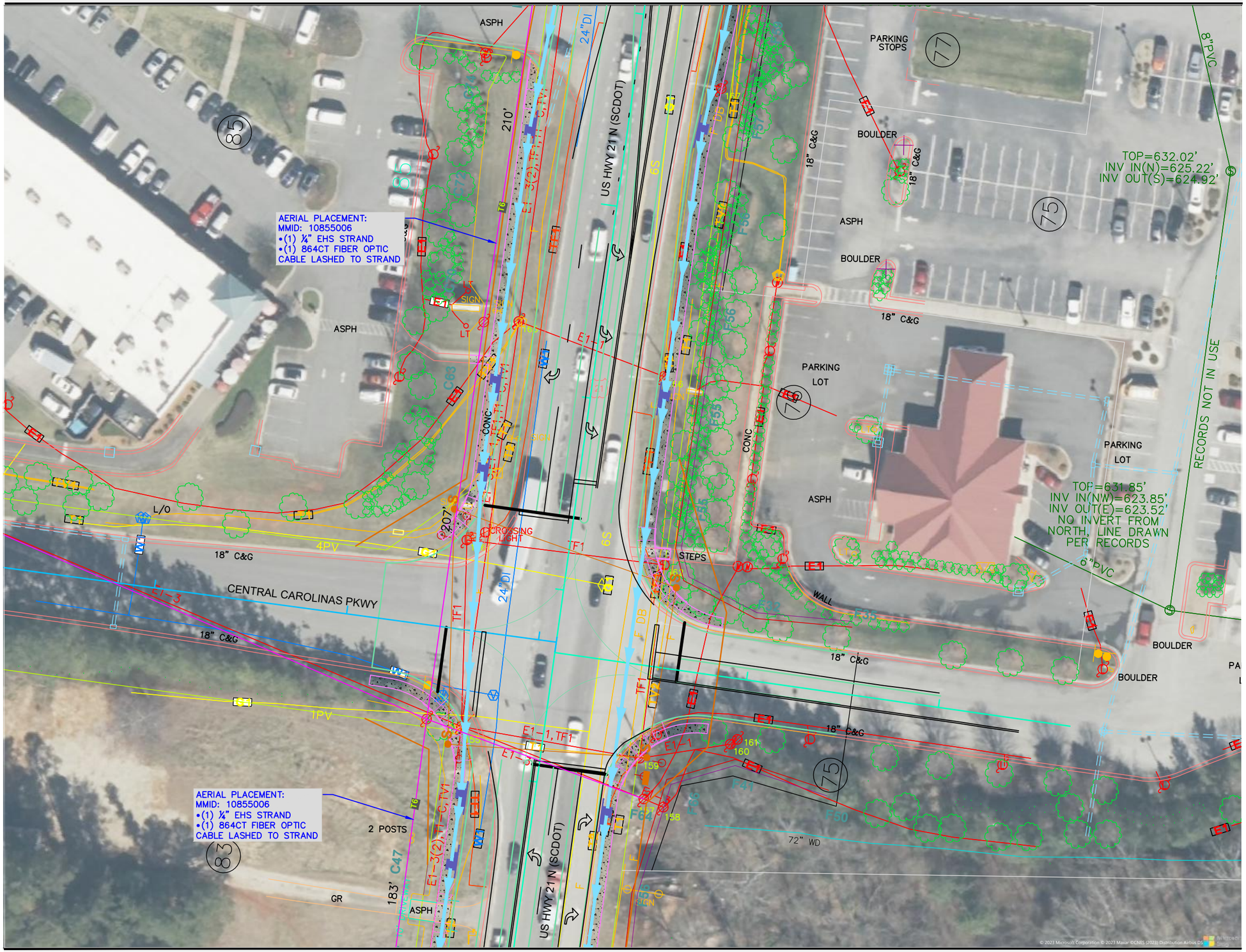
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

14 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 16



MATCH TO SHEET 14

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

15 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 17



MATCH TO SHEET 15

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

16 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 18



AERIAL PLACEMENT:
MMID: 10855006
•(1) ¼" EHS STRAND
•(1) 864CT FIBER OPTIC
CABLE LASHED TO STRAND

MATCH TO SHEET 16

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

17 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 19



MATCH TO SHEET 17

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

18 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 20



MATCH TO SHEET 18

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

19 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 21



MATCH TO SHEET 19

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811
Know what's below
Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
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SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

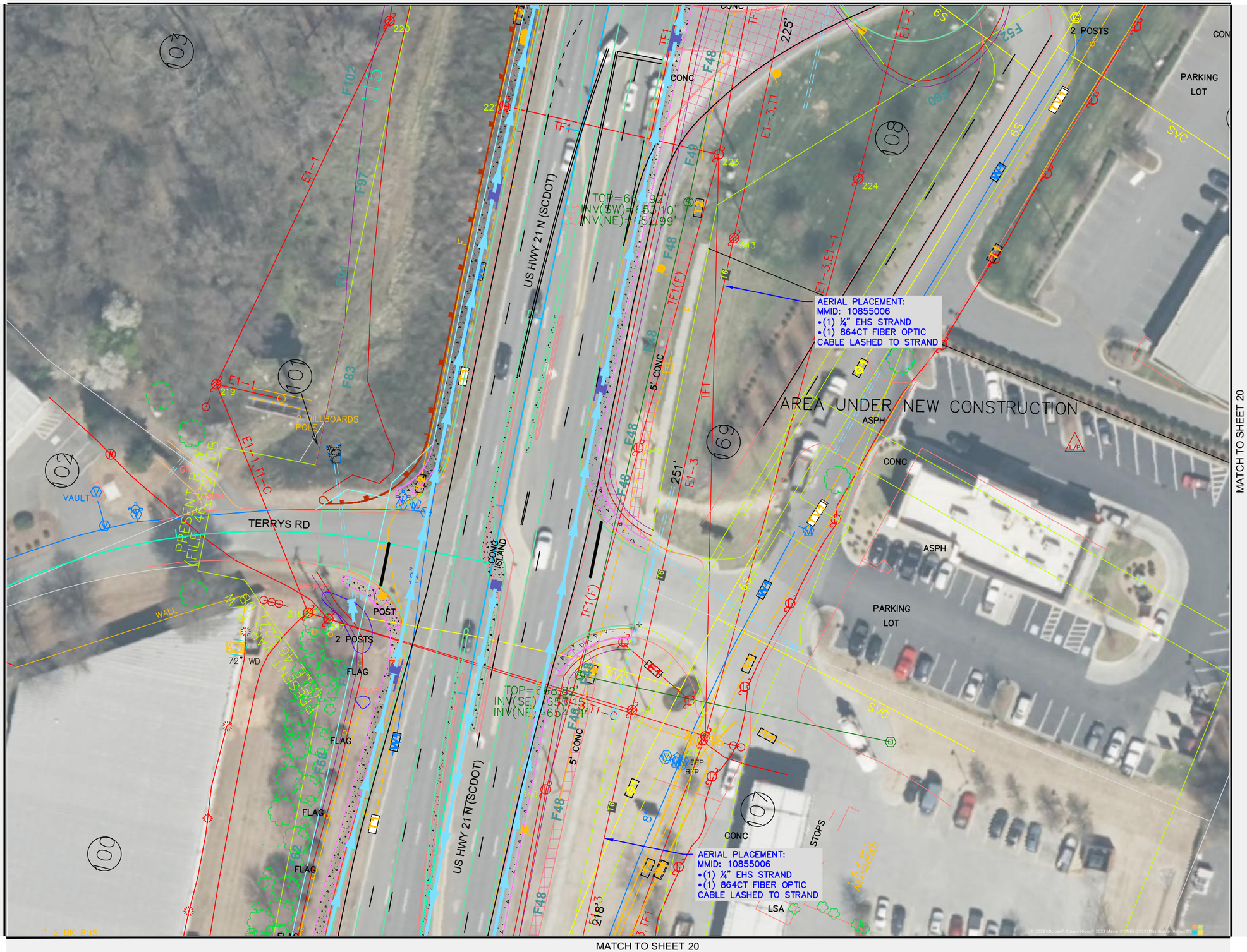
20 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 22

MATCH TO SHEET 20

MATCH TO SHEET 20



MATCH TO SHEET 20

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

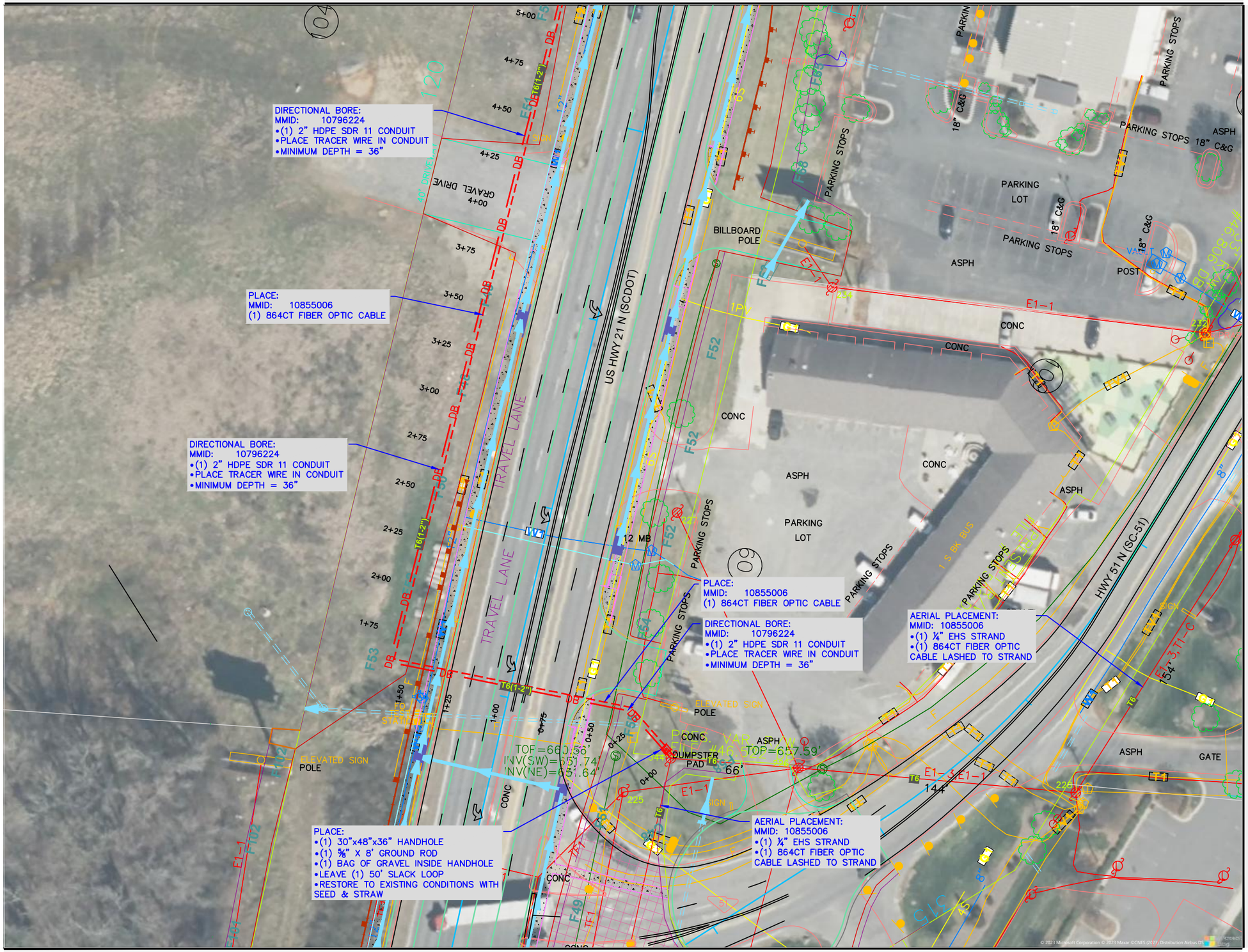
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

21 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 23



MATCH TO SHEET 26

MATCH TO SHEET 21

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
4	----	----

SHEET TITLE:

PROJECT SHEET

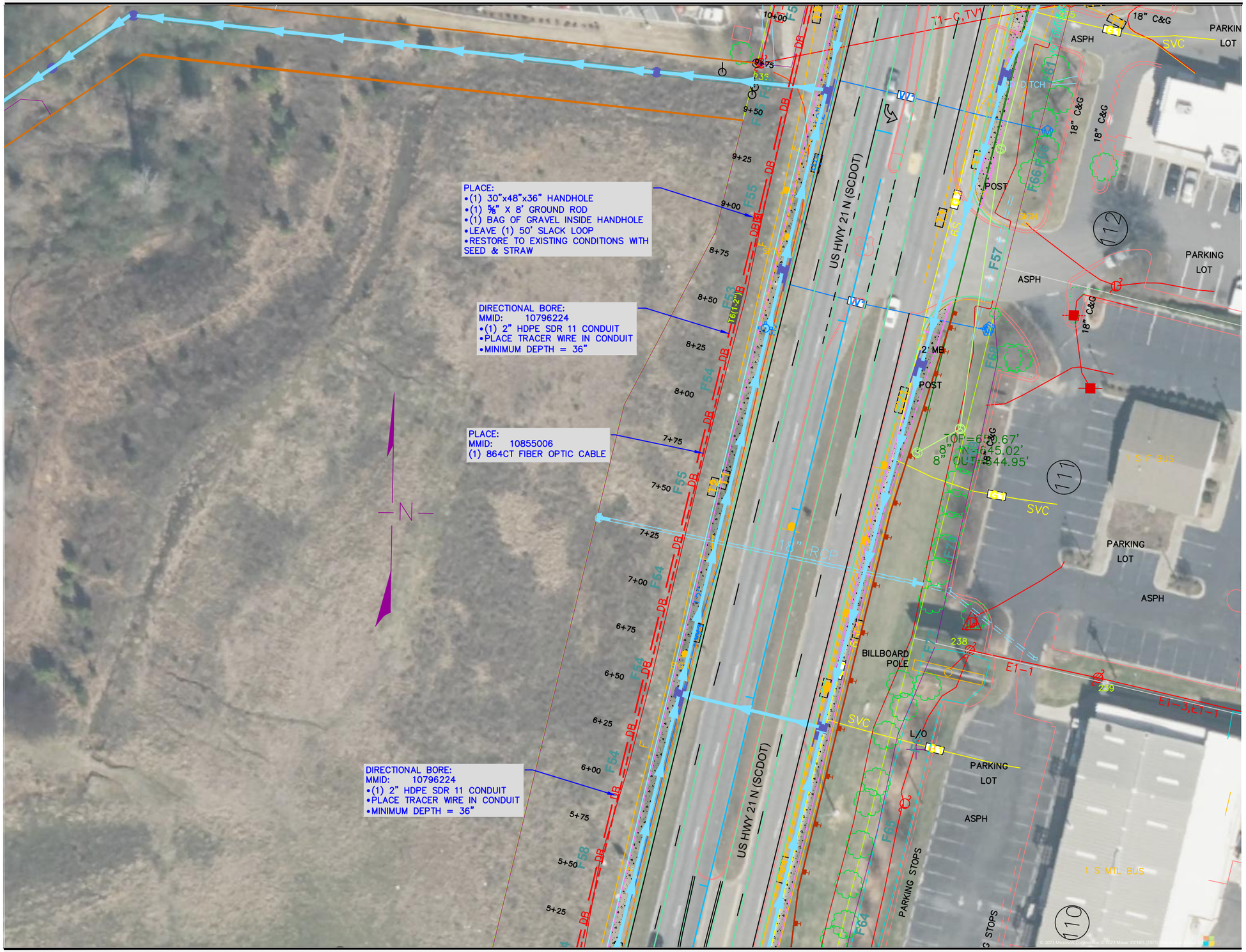
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

22 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 24



MATCH TO SHEET 22

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811 Know what's below Call before you dig.

(#) SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
2	----	----
3	----	----
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SHEET TITLE:

PROJECT SHEET

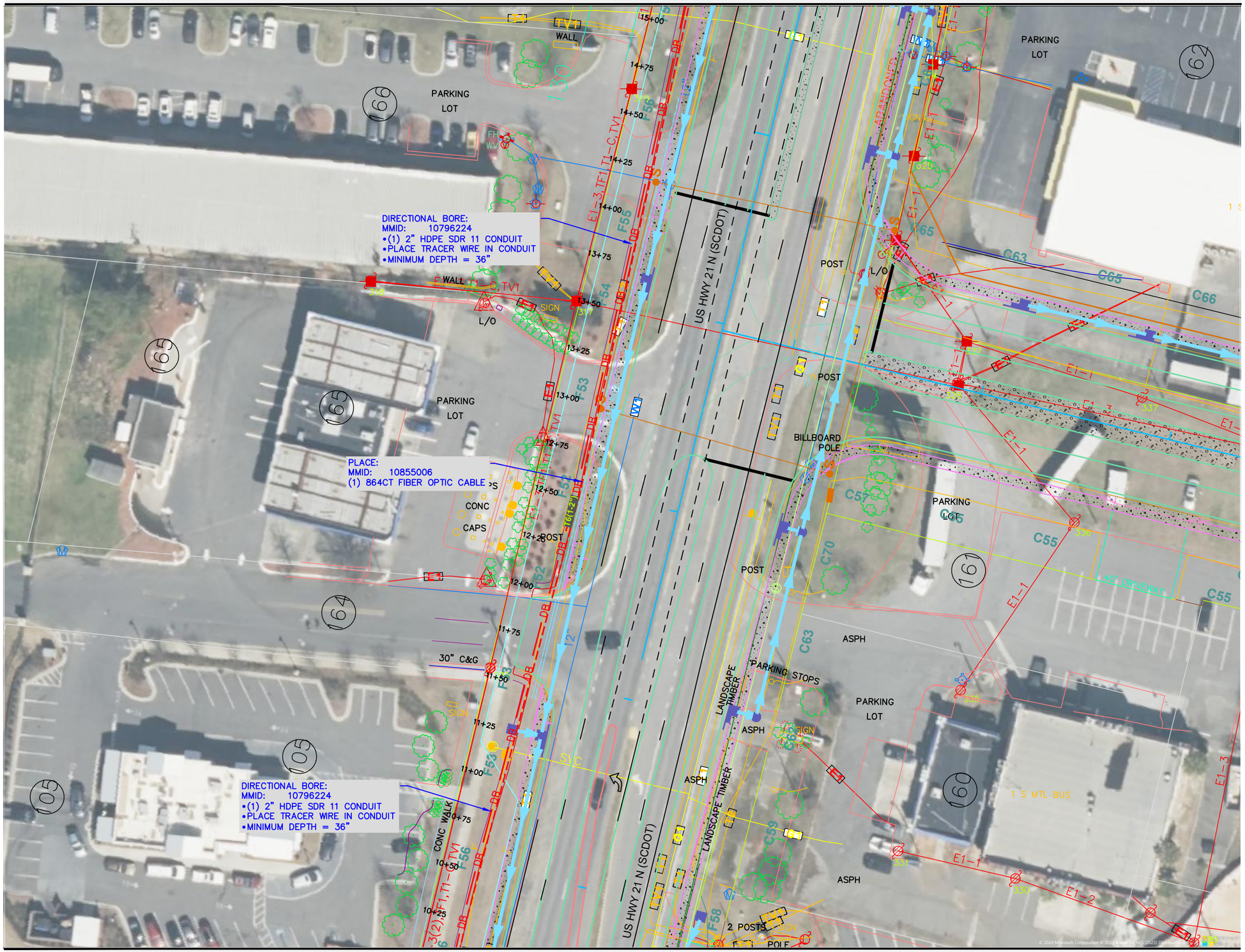
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

23 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 25



MATCH TO SHEET 23

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
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1	----	----
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SHEET TITLE:

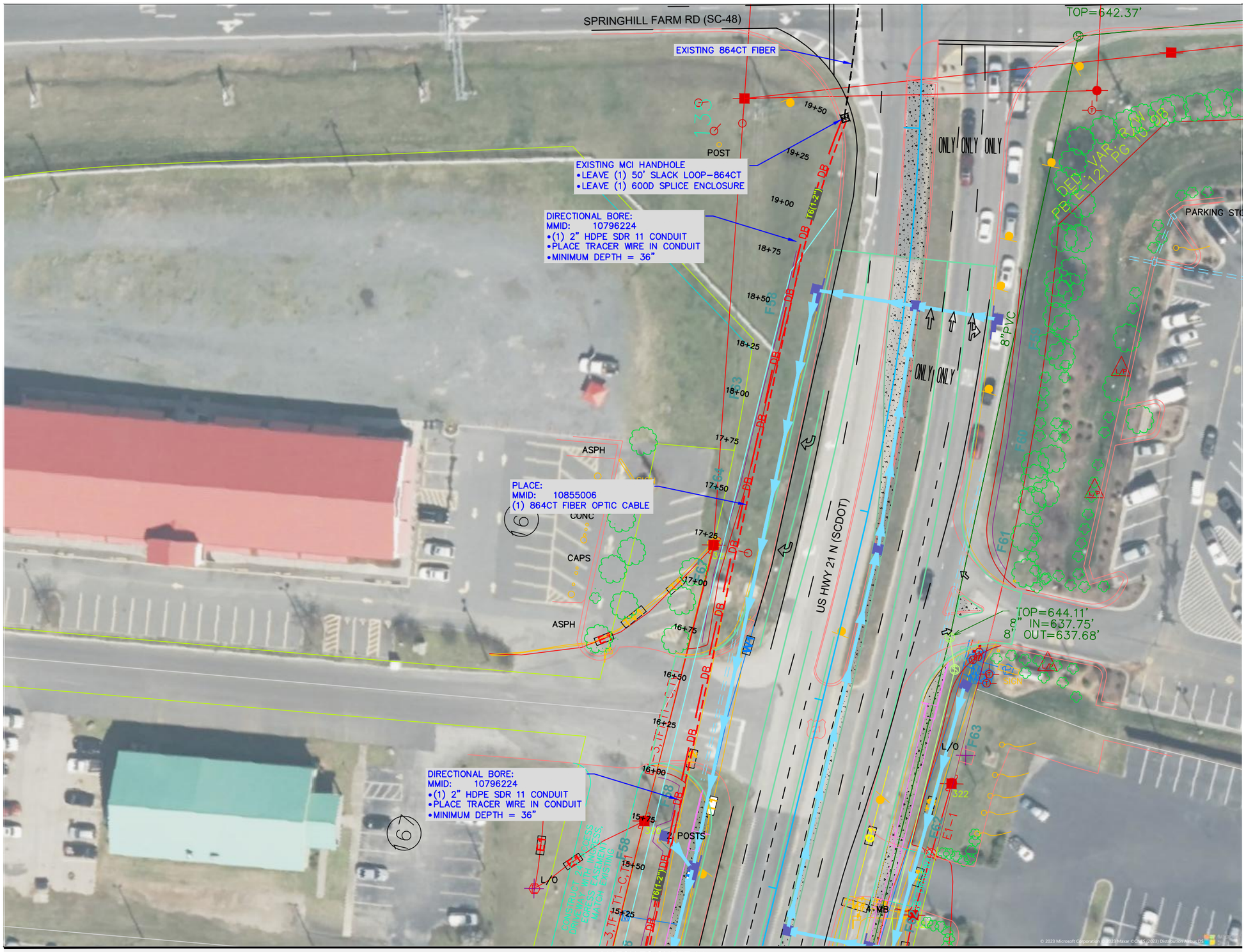
PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

24 of 34

CONFIDENTIAL/PROPRIETARY



MATCH TO SHEET 24

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

811 Know what's below Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
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3	----	----
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SHEET TITLE:

PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

25 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 27

MATCH TO SHEET 22

MATCH TO SHEET 20



MATCH TO SHEET 20

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811
Know what's below
Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

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SHEET TITLE:

PROJECT SHEET

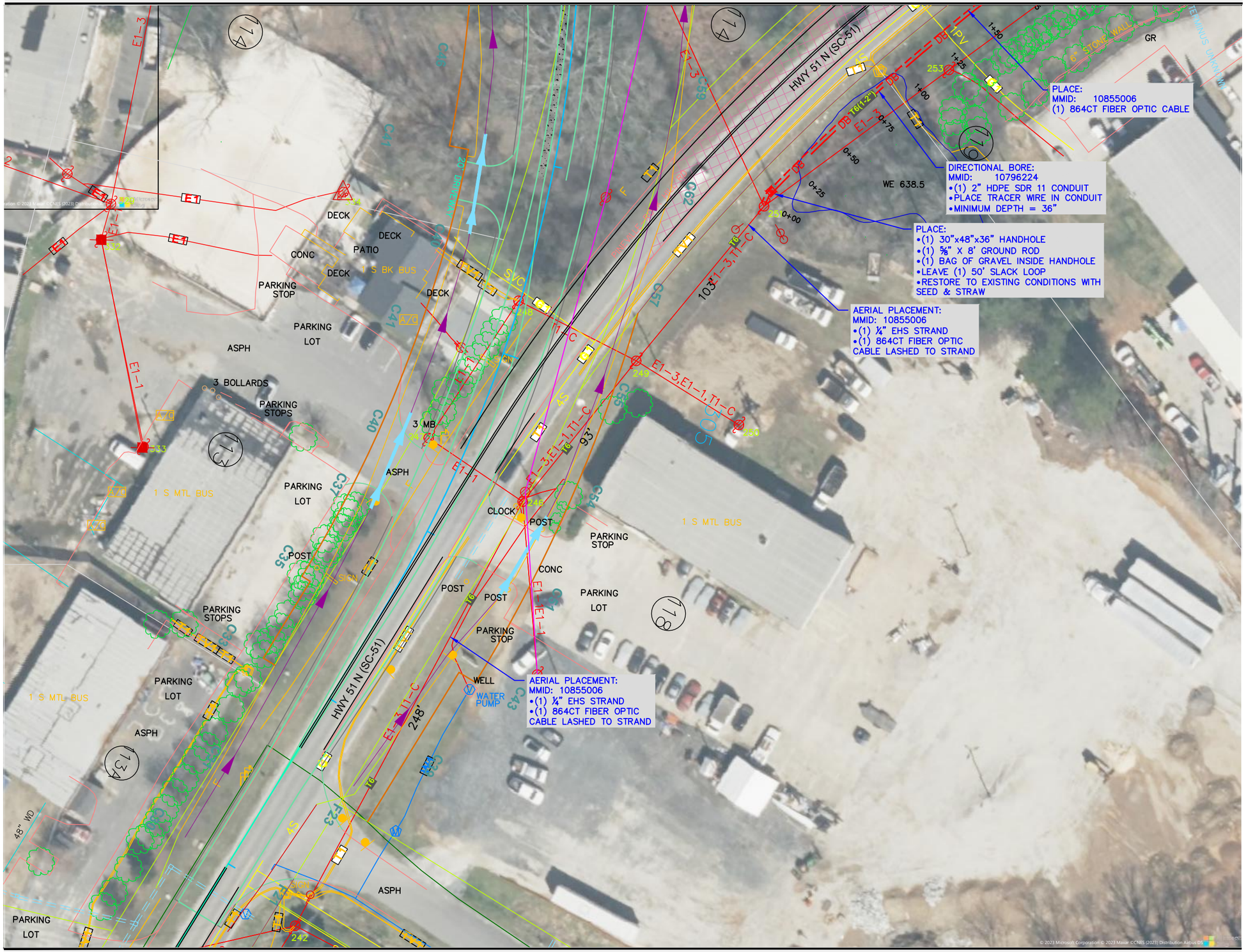
PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

26 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 28



MATCH TO SHEET 26

UTILITY OWNER:

MCImetro

ENGINEER:

TEP FIBER

2033 CROSS BEAM DR.
CHARLOTTE, NC 28217

0 10' 20' 30' 40' 50'
SCALE: 1"=50'

N

811
Know what's below
Call before you dig.

SYMBOL CORRESPONDS TO PHOTO LOCATIONS AND ORIENTATION. SEE SHEET # FOR SITE PHOTOGRAPHS.

REV	DESCRIPTION	DATE
0	ORIGINAL	07/11/2023
1	----	----
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3	----	----
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SHEET TITLE:

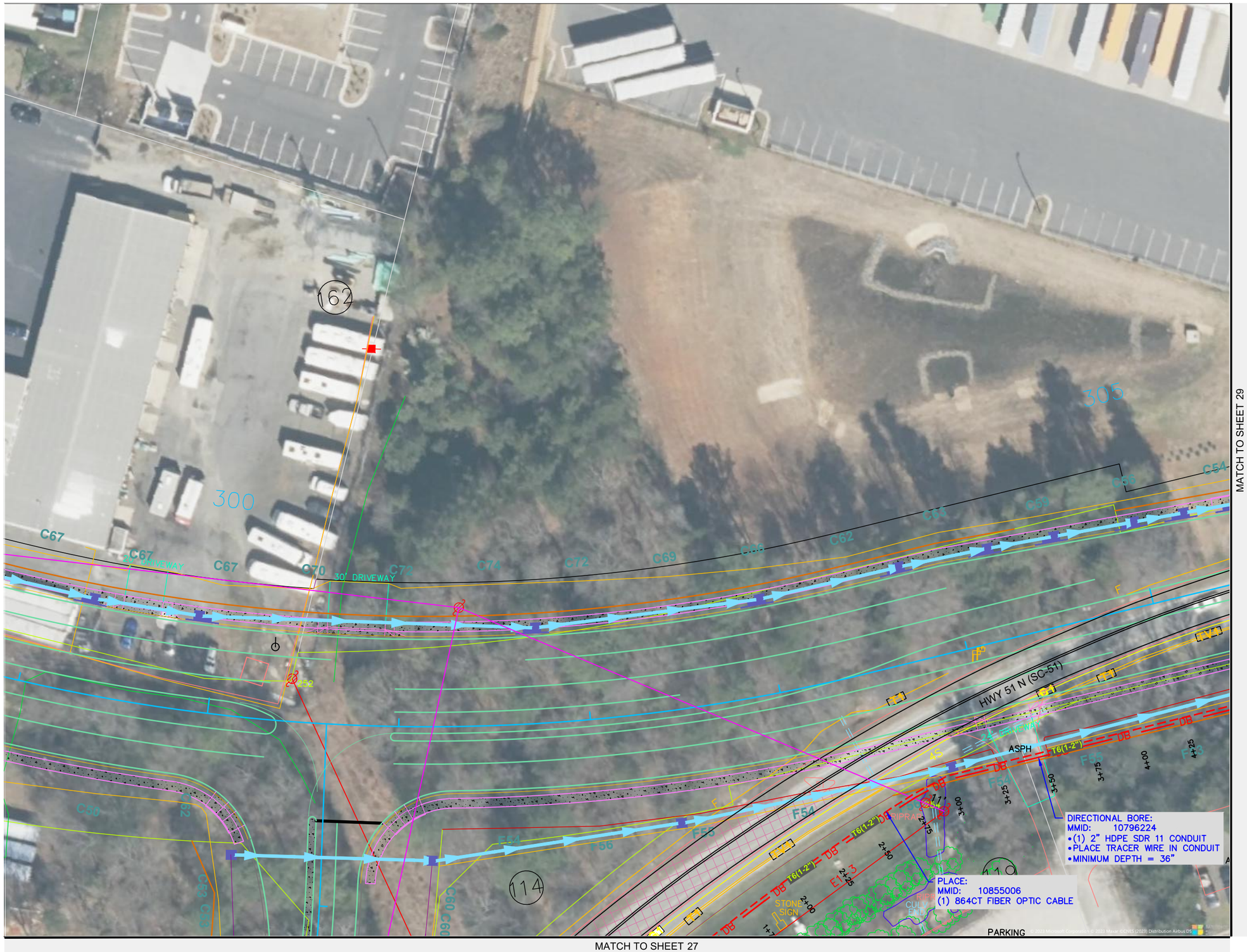
PROJECT SHEET

PROJECT MANAGER:	CHRIS BARBEE
PROJECT ENGINEER:	GAGE MARTIN
PROJECT NUMBER:	U721631
DESCRIPTION:	US21 & SC51 RELO
DRAWING NAME:	U721631 - US21 & SC51 RELO (7-11-23).dwg

SHEET:

27 of 34

CONFIDENTIAL/PROPRIETARY



MATCH TO SHEET 27

MATCH TO SHEET 29

UTILITY OWNER:

MCImetro

ENGINEER:

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CHARLOTTE, NC 28217

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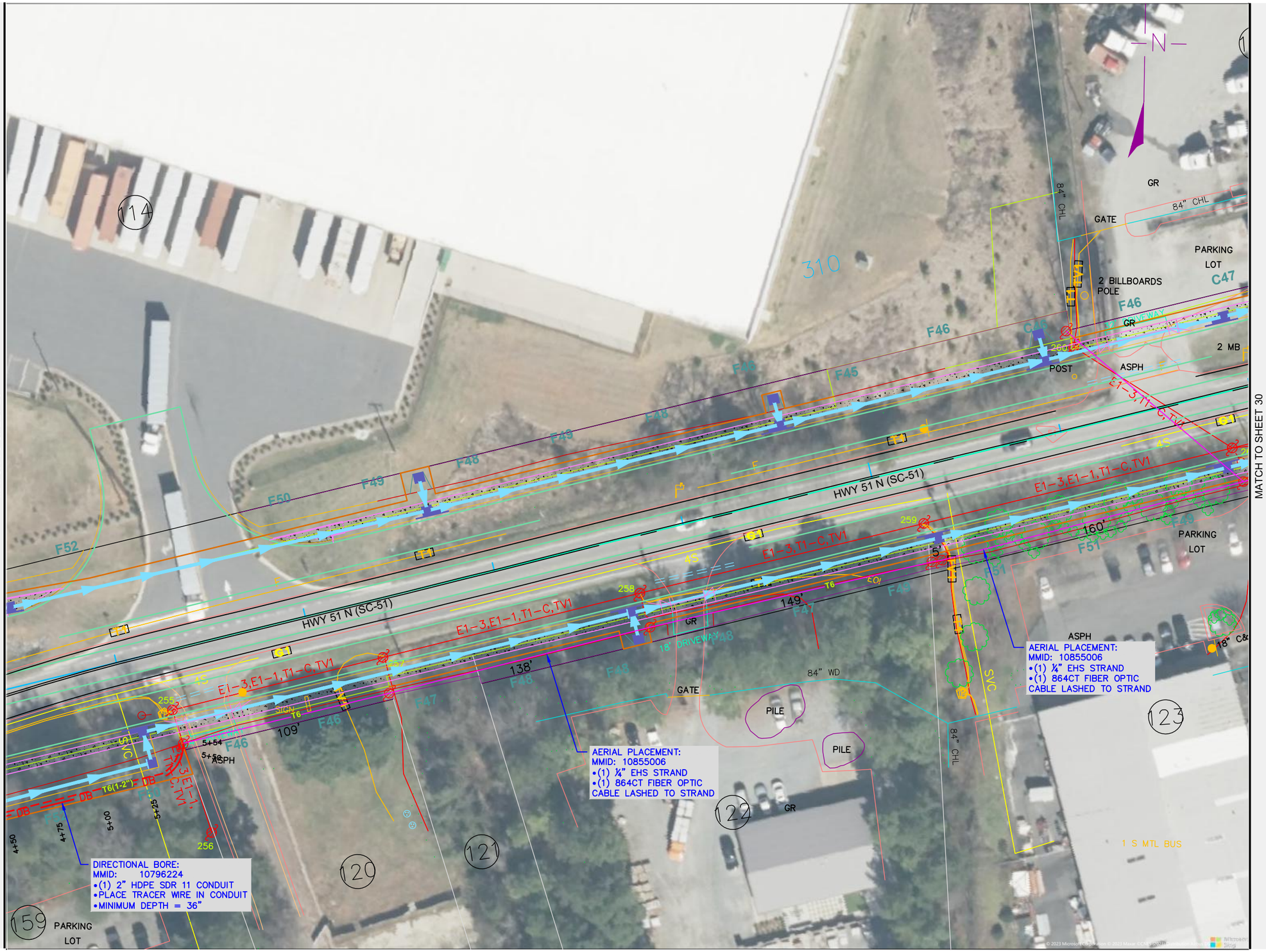
SHEET:

28 of 34

CONFIDENTIAL/PROPRIETARY

MATCH TO SHEET 28

MATCH TO SHEET 30



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CHARLOTTE, NC 28217

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SHEET:

29 of 34

CONFIDENTIAL/PROPRIETARY



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MCImetro

ENGINEER:

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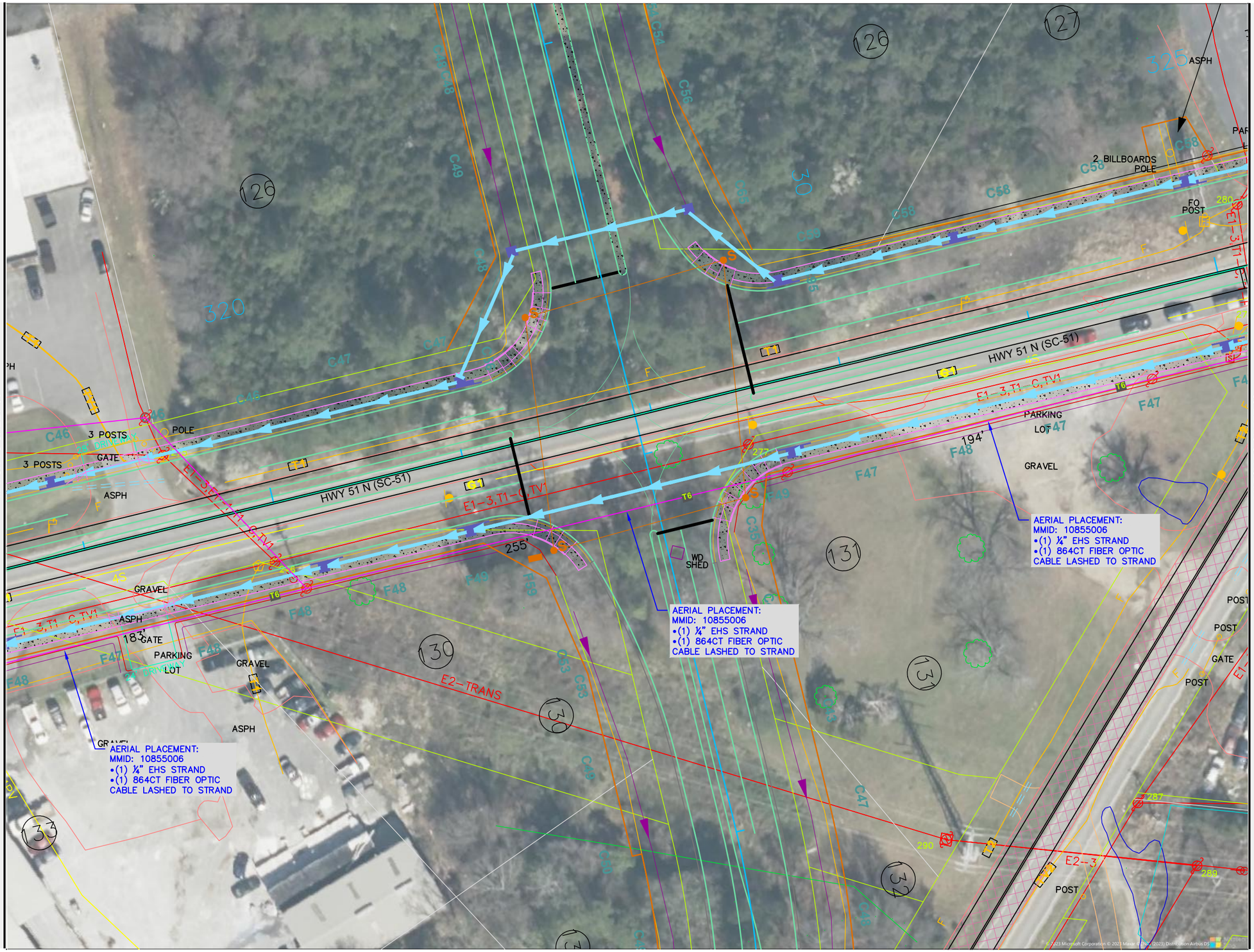
SHEET:

30 of 34

CONFIDENTIAL/PROPRIETARY



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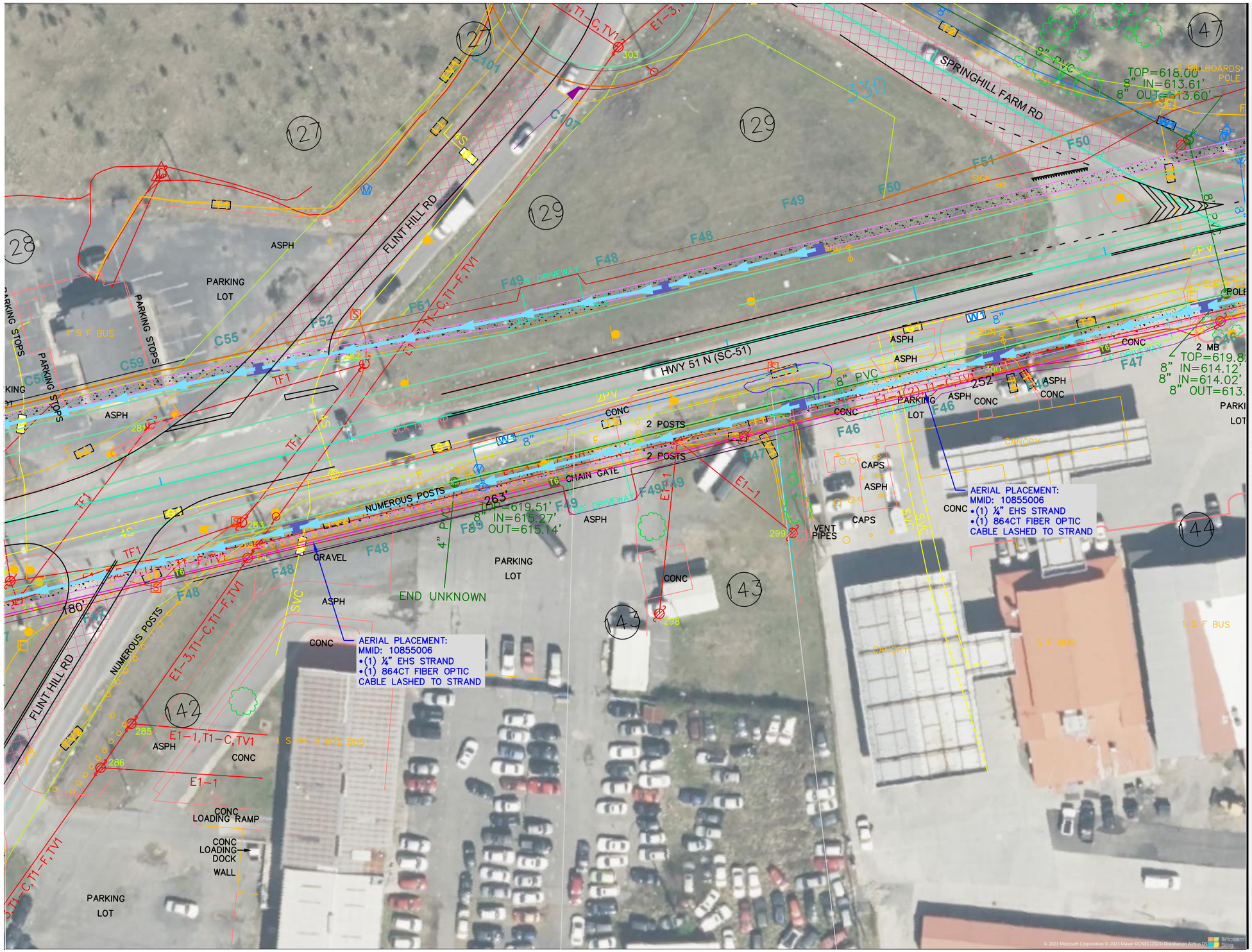
SHEET:

31 of 34

CONFIDENTIAL/PROPRIETARY



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32 of 34

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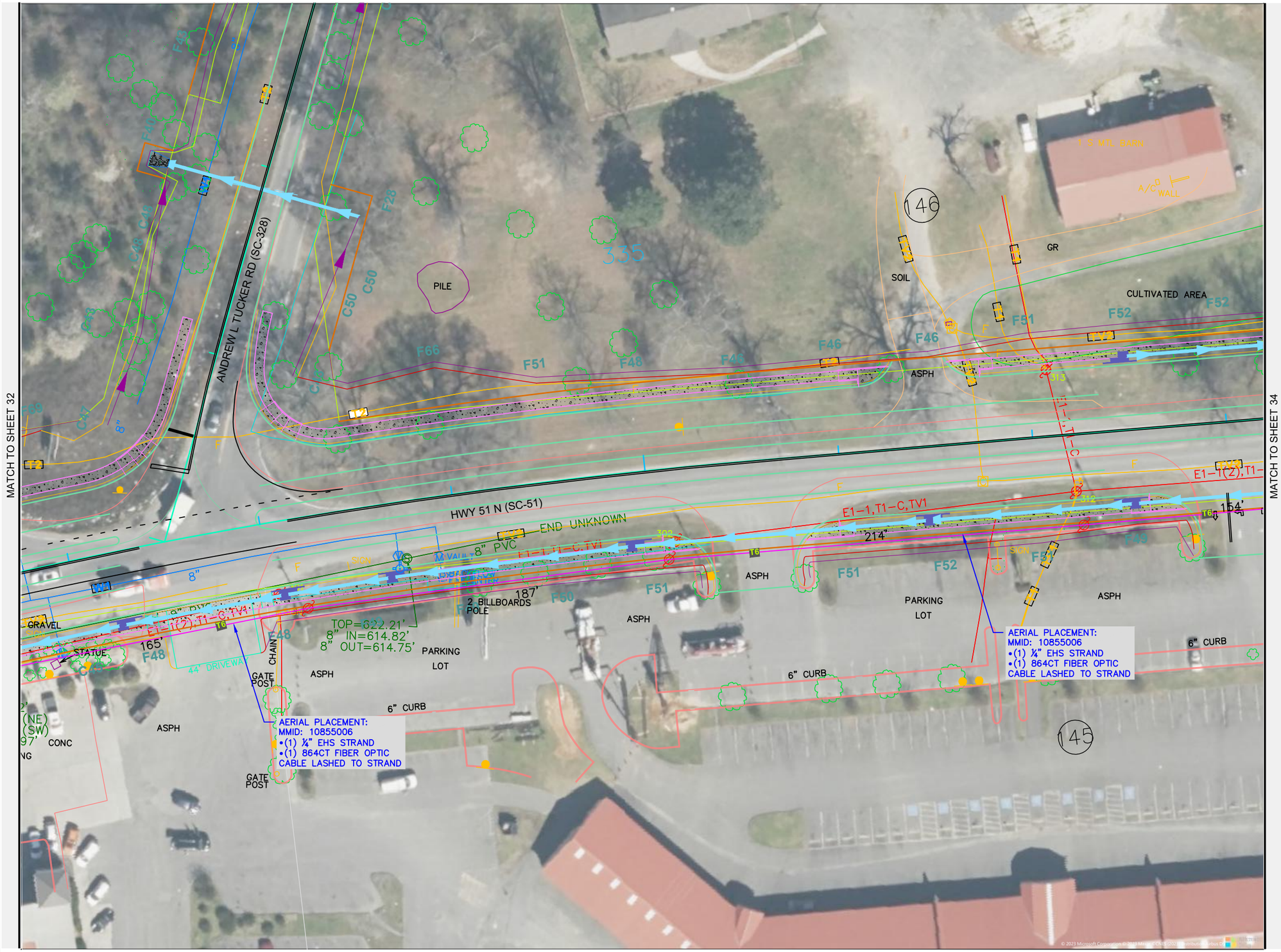

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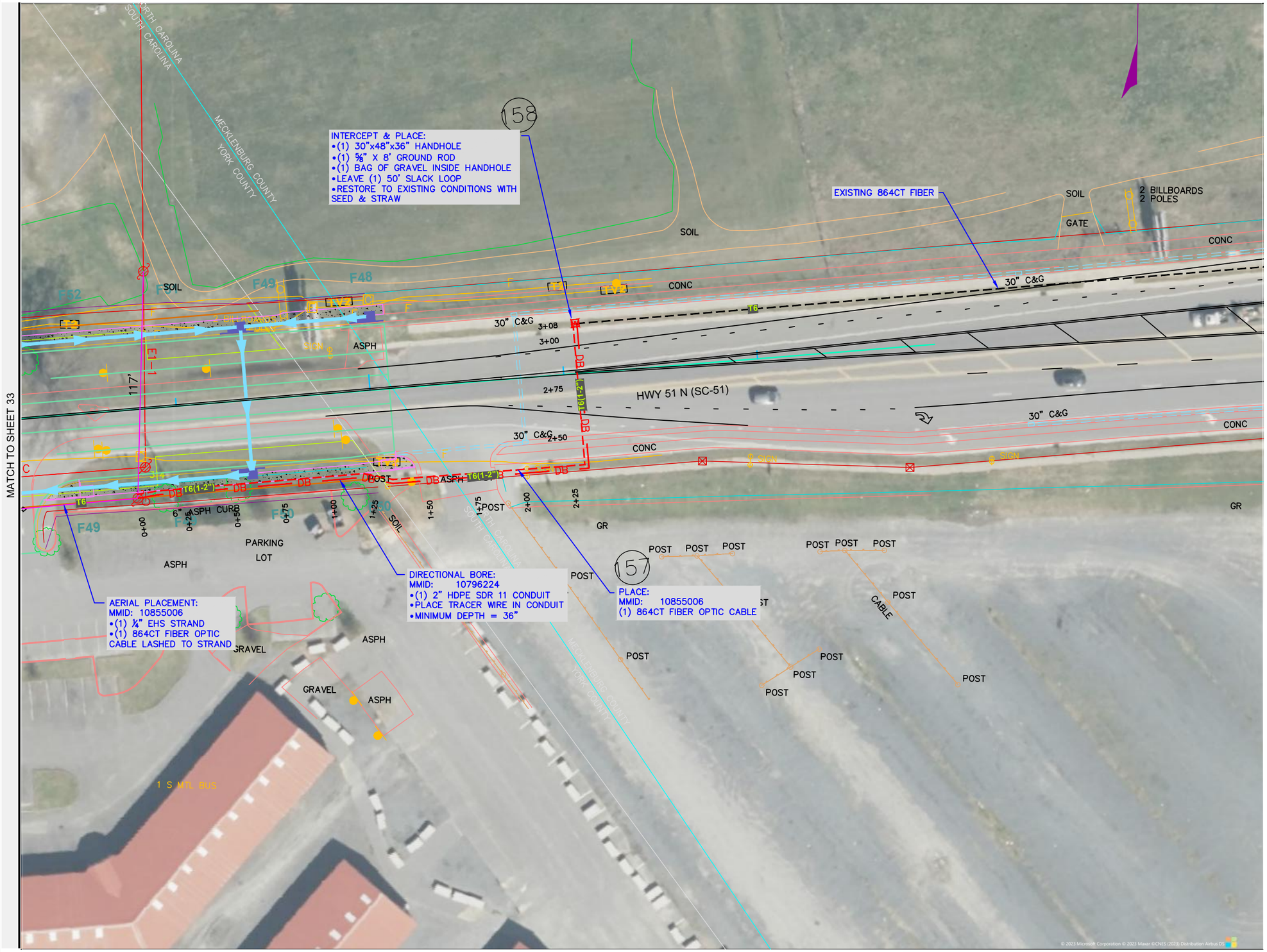

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SHEET:

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CONFIDENTIAL/PROPRIETARY

August 12, 2024

Project Description: US-21/51 Road Widening

PID # 0042332

County: York

I have reviewed Windstream's records for the above referenced project. Based on your construction plans, I certify that Windstream has "No Conflict" within the project limits as defined on your drawings.

Sincerely,

Patrick Ware

Patrick Ware
Construction Manager
704-472-6543
patrick.ware@Windstream.com

Sensitivity: Internal

August 20, 2024

Steven Moss
Sr. Construction Project Manager - Engineering
York County Government
6 S Congress Street1
York, SC 2975

RE: Project No. P0042332/11149-004 – US21/SC51
York Co: Relocation Package – York County Natural Gas

Dear Mr. Moss –

Below you will find a brief description of the proposed work and submittal explanation. Please refer to York County Natural Gas's individual plans for details, or this document for plan status.

This package assumes approval to remain in place by SCDOT. YCNGA is still trying to obtain this. The reimbursement agreement and scope of work reflects this assumption. Should SCDOT deny their request, then both will need to be updated and amended.

Scope of Work and Package Contents

Relocation Package

- Utility Agreement
- Detailed Cost Estimate
- Relocation Plans

Scope of Work Summary

Location	Utility Type	Scope of Work	Cost*
US21	4" Gas	Install new 4" gas line from Sta 21+00 to 28+00	York County
US21	6" Gas	Install new 6" gas line from Sta 73+00 to 79+00	York County
US21	6" Gas	Install new 6" gas line from Sta 98+00 to 109+00	York County
US21	6" Gas	Install new 6" gas line from Sta 116+00 to 128+00	York County
SC51	2" Gas	Install new 2" gas line from Sta 326+90 to 340+00	York County
Lake View	2" Gas	Install new 2" gas line	York County
Amelia	2" Gas	Install new 2" gas line	York County
Gold Hill	4" Gas	Install new 4" gas line from Sta 14+00 to 33+00	York County
Regent	4" Gas	Install new 4" gas line from Sta 12+00 to 16+00	York County

It is STV's recommendation that this relocation package be approved and proceed to the formal agreement.

Should you have any additional questions or comments, please feel free to call me (843-207-2031) or email me at natalie.roumillat@stvinc.com .

Sincerely,

N. Oriana Roumillat

N. Oriana Roumillat, P.E.
Utility Coordinator
STV Incorporated

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US-21 & SC-51

This Agreement made this _____ day of _____, 2024 by and between

York County, hereinafter called "County" and the utility company

York County Natural Gas Authority (YCNGA)

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

YCNGA will install/ relocate new 6" and 4" Steel Pipe, 4" and 2" Plastic Pipe, and associated valves in locations so as not to conflict with road grading, curb & gutter, ditches, stormwater culverts, and guardrail on US 21, SC 51, and roads which tie-in to the project corridor. When practical and not directly in-conflict, YCNGA will attempt to leave some of our facilities under pavement in order to reduce the costs associated with the relocations of this project.

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $1,246,188

County Share $1,246,188 Company Share $0

(a) The Company ☐ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☑ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately 25+ years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: Levi Hagerdon
Phone Number: (803) 323-5367
Email: levi.hagerdon@ycnga.com

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

( ) BY COMPANY'S REGULAR FORCES

(●) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

YCNGA does not own the equipment or have the personnel to install this quantity of gas main; for approved projects we contract construction forces with who we have an established relationship.

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

☑ Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

☐ Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company’s delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Company agree participate in pre-litigation mediation and agree to diligently work in good faith to resolve any disputes associated with the costs charged to the Company for extreme delays. The parties shall select a mediator approved by both parties and set forth any resolutions in writing signed by both parties.

Should the parties fail to reach an agreement through pre-litigation mediation, the parties may seek a resolution for the dispute through the Court of Common Pleas located in York County, South Carolina, or the United States District Court for the State of South Carolina. This agreement shall be governed exclusively by the laws of the State of South Carolina without giving effect to its conflicts of law provisions.

12. The County shall have the right to inspect all recovered materials from the permanent facility prior to disposal by sale or scrap. This requirement will be satisfied by the Company giving notice to the County of the time and place the materials will be available for inspection. This notice is the responsibility of the Company and it may be held accountable for full value of materials disposed of without notice. The Company shall furnish a listing on final billings of major items not eligible for salvage credit and reasons therefore.

13. The Company will abide by the contract cost principles as set forth in FAPG 23 CFR 645A.

14. The Company will not participate directly or indirectly in any practice that subjects persons to discrimination because of their race, color, religion, sex, or national origin.

COMPANY: York County Natural Gas Authority

ADDRESS: PO Box 11907 / Rock Hill, SC 29731

BY: _____

NAME: Stephen Comer, PE

TITLE: Director of Project Management

YORK COUNTY

BY: _____
Joshua S. Edwards
County Manager

INSTRUCTIONS: Submit three original copies of this agreement form and three prints of drawings showing present location and proposed location of poles or lines with reference to highway survey stations and centerline.

York County Natural Gas AUTHORITY

979 West Main Street
PO Box 11907
Rock Hill, SC 29731
www.ycnga.com

Cost Estimate for 11149-004 – US 21 & SC 51 Road Widening Project
June 14, 2024

Materials:

Item Description:	Estimated Cost
Pipe	
6 5/8" OD, 0.280” wt, API-5L, X-52, FBE 14 mils, PWC 40 mils, Steel Pipe	$47,502.84
6 5/8" OD, 0.188” wt, API-5L, X-52, FBE 14 mils, Steel Pipe	$46,047.87
4" IPS, SDR 11, 8300PE, Plastic Pipe	$33,636.24
2" IPS, SDR 11, 8300PE, Plastic Pipe	$770.44
Valves	
6" Balon, 150# ANSI Class, Weld x Weld, 6FUS33BW, Steel Valve	$14,754.27
4" Plastic PE Valve, SDR 11	$1,925.00
2" Plastic PE Valve, SDR 11	$924.00
Cathodic Protection	
1# Anodes	$108.90
MATERIAL TOTAL:	**$145,669.56**

Miscellaneous and Other 3rd Party Costs:

Miscellaneous:	EST. COST
Bell-Hole for mains under pavement	$156,000.00
2 lb, F-1, Joint Coating Epoxy Kits	$2,550.00
6”, 150#, TDW Spherical 3-Way Tee	$22,200.00
Pipe Removal Cost	$210,000.00
Traffic Control	$130,000.00
6” STL Lowering for storm water (as needed)	$144,000.00
TOTAL MISCELLANEOUS COST:	**$664,750.00**

Labor:

Item Description:	Estimated Cost
Install Price via Trenching, by pipe diameter & material	
6” Steel	$38,699.20
4” Plastic	$63,645.52
Install Price via HDD (Horizontal Directional Drilling), by pipe diameter & material	
6" Steel	$64,698.43
4” Plastic	$142,135.69
2” Plastic	$20,586.15
Tapping and Tying-in to Existing Gas Mains, by pipe diameter	
6-inch	$5,175.00
4-inch	$6,900.00
2-inch	$11,040.00
Valve Installation, by pipe diameter & material	
6” Steel	$3,105.00
4” Plastic	$1,006.25
2” Plastic	$805.00
Service Line Tie-Overs into Existing Gas Mains, by pipe diameter	
1” or less	$18,630.00
LABOR TOTAL:	**$376,426.24**

TOTALS:

MATERIAL COST:	**$145,669.56**
MISCELLANEOUS COST:	**$664,750.00**
LABOR COST:	**$376,426.24**
5% PROJECT CONTINGENCY	**$59,342.29**
TOTAL COST ESTIMATE:	**$1,246,188.09**

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U1

US 21 NORTH PHASE 1 AND SC 51 FROM SC 460 TO THE SC/NC STATE LINE ROAD WIDENING PID 0042332 YORK COUNTY, SC

UTILITY RELOCATION PLANS

COMPANY	CONTACT	PHONE NO.
POWER - E1 York Electric Corporation	Wes Dover PO Box 150 1385 A. Alexander Love Hwy York, SC 29745 Wes.Dover@yorkelectric.net	803-628-5564 803-627-0824
POWER - E2 (TRANS) Duke Energy	Stephen Lord 526 South Church St. Charlotte, NC 28202 Stephen.Lord@duke-energy.com	704-812-2316
POWER - E2 (Distribution) Duke Energy **NO CONFLICT**	Stephen Lord 526 South Church St. Charlotte, NC 28202 Stephen.Lord@duke-energy.com	704-812-2316
POWER - E3 (Distribution) Central Electric Power Cooperative **NO CONFLICT**	Jimmy Tindal 20 Cooperative Way Columbia, SC 29210 jtindal@cepci.org	803-255-8810 803-606-4581
TELECOM - T1 Comporium	Eric Kirkland 471-A Lakeshore Pkwy Rock Hill, SC 29730 eric.kirkland@comporium.com	803-326-6109
TELECOM - T2 Duke Net Legacy (Charter)	Matt McClain 3140 West Arrowood Road Charlotte, NC 28273 matt.mcclain@charter.com	704-378-2194 980-428-5092
TELECOM - T3 AT&T **No Conflict for Distribution**	Jamie Riggins 100 Belton Drive Spartanburg, SC 29301	864-574-8608
TELECOM - T4 Level 3 Communications (Lumen)	Wanita Brenes 227 Robeson Street Fayetteville NC 28301 wanita.brenes@lumen.com	910-551-8838
TELECOM - T5 Zayo Fiber	Brandon Carter 125 North Myers Street Charlotte, NC 28202 Brandon.Carter@zayo.com	704-779-9322
TELECOM - T6 MCI Communications (Verizon)	Corey Thomas corey.thomas@verizon.com	501-297-9085
TELECOM - T7 Windstream Commuications	Daniel Honeycutt Daniel.Honeycutt@windstream.com	704-849-1358 704-579-7897

COMPANY	CONTACT	PHONE NO.
TELECOM - TV1 Comporium	Eric Kirkland 471-A Lakeshore Pkwy Rock Hill, SC 29730 eric.kirkland@comporium.com	803-326-6109
TELECOM - TV2 Time Warner Communications	Matt McClain 3140 West Arrowood Road Charlotte, NC 28273 matt.mcclain@charter.com	704-378-2194 980-428-5092
GAS - G1 York County Natural Gas	Eric Cellucci 979 W. Main st. Rock Hill, SC 29731 eric.cellucci@ycnga.com	803-323-5392 803-627-4410
WATER - W1 York County Water and Sewer	David Hughes (Bert Becton STV Designer) 6 South Congress St. York, SC 29745	803-628-3211
Sewer - S1 York County Water and Sewer	David Hughes (Bert Becton STV Designer) 6 South Congress St. York, SC 29745	803-628-3211
Water - W2 Fern Forest Water Company	Dottie Carter (Bert Becton STV Designer)	(803) 548-0398
TRAFFIC CONTROL - TF1 SCDOT	John Huskins 338 Robertsion Rd. West Rock Hill, SC 29730	803-324-3545 Ext. 25

INDEX OF SHEETS

DESCRIPTION	SUBTOTAL OF SHEETS
UTILITY REFERENCE SHEET	U1
UTILITY LEGEND SHEET	U2
UTILITY DATA SHEET	U3
UTILITY POLE DATA SHEET	U4A - U4D
UTILITY GENERAL NOTES	U5
UTILITY PLAN SHEETS	U6 - U30 (U26-U29 Omitted)
TOTAL	29

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

500 0 500 1000
scale feet

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY REFERENCE SHEET

SCALE N/A RTE. US 21 DWG. NO. U1

SUE LEGEND AND NOTES

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21 SC 51	U2

ELECTRIC SYMBOLS

SYM	ABV	DESCRIPTION
	ETM	ELECTRICAL TRANSFORMER
	EMH	ELECTRICAL MAN HOLE
	EHH	ELECTRICAL HAND HOLE
	EPP	ELECTRIC PEDESTAL
	EBX	ELECTRIC BOX
	ESG	ELECTRIC SWITCH GEAR BOX
	EVT	ELECTRIC VAULT
	EGL	GROUND / LANDSCAPE LIGHT
	EAB	ELECTRIC AIR BRAKE
	ERO	ELECTRIC RESIDENTAL OUTLET

POLE SYMBOLS

SYM	ABV	DESCRIPTION
	PSP	SIGNIFICANT POLE (STEEL, CONCRETE, ETC)
	PP	ELECTRIC, COMBINATION POLE
	PMP	METER POLE
	PLT	TRANSMISSION LINE POLE
	PLP	AREA LIGHT POLE
	PTF	TRAFFIC SIGNAL POLE
	POP	OTHER USE POLE
	PCT	CELL PHONE TOWER
	PTP	TELEPHONE POLE
	PGP	GUY POLE

TRAFFIC CONTROL SYMBOLS

	TFV	TRAFFIC SIGNAL CONTROL VAULT
	TFHH	TRAFFIC CONTROL HAND HOLE
	TFJ	TRAFFIC SIGNAL JUNCTION BOX

GAS SYMBOLS

SYM	ABV	DESCRIPTION
	GM	GAS METER
	GVC	GAS VALVE CAP
	GMH	GAS MAN HOLE
GVT	GVT	GAS VENT
GR	GR	GAS PRESSURE REGULATOR
GTP	GTP	GAS LINE TEST POINT
GTF	GTF	GAS LINE TAP FARM

MISC SYMBOLS

	MWP	UTILITY WITNESS POST
EOI	MOI	END OF INFORMATION
	MUC	MISC / UNKNOWN VALVE CAP OR COVER
	MPB	PAVED OR BURIED MANHOLE / CAP
	MUE	UTILITY TERMINI / ENDS
	MTH	TEST HOLE

TELECOMMUNICATION SYMBOLS

SYM	ABV	DESCRIPTION
	TB	TELEPHONE BOOTH
	TVP	CABLE TV PEDESTAL
	TLC	SUBSCRIBER LOOP CARRIER (aka SLICK)
	TPP	TELEPHONE PEDESTAL
	TMH	TELEPHONE MAN HOLE
	TFOH	FIBER OPTIC HAND HOLE
	THH	TELEPHONE HAND HOLE
	TVHH	CABLE TV HAND HOLE
	TBX	TELEPHONE BOX
	TXB	UG / SPLICE - AG SPLICE BOX
	TRP	TELEPHONE REPEATER
	TVB	CABLE TV BOX
	TUV	UNDERGROUND TELEPHONE VAULT
	UTP	UNDERGROUND TELEPHONE PEDESTAL
	UTV	UNDERGROUND CABLE TV PEDESTAL

WATER SYMBOLS

	WM	WATER METER
	WV	WATER VALVE
	WMW	WATER MONITORING WELL
	WFH	FIRE HYDRANT
	WMH	WATER MAN HOLE
	WAR	WATER AIR RELEASE VALVE
	WVB	WATER VALVE BOX
	WFC	FIRE DEPARTMENT CONNECTION
	WBP	WATER BACKFLOW PREVENTER
	WBO	WATER BLOW OFF VALVE
	WWH	WELL HOUSE
	WPV	POST INDICATOR VALVE

SEWER SYMBOLS

SYM	ABV	DESCRIPTION
	SCO	SEWER CLEAN OUT
	SMH	SEWER MAN HOLE
	SAR	SEWER AIR RELEASE VALVE
	SST	SEWER STEP TANK
	SCV	SEWER CHECK VALVE BOX
	SGP	SEWER GRINDER / PUMP STATION
	SSV	SEWER VALVE
	SLS	SEWER LIFT STATION

NONPOTTABLE WATER SYMBOLS

	ICV	IRRIGATION CONTROL VALVE
	ICB	IRRIGATION CONTROL BOX
	IRH	IRRIGATION / SPRINKLER HEAD

COMBINATION LINE DEPICTION CODES

SHOW COMBINED LEVEL C & D SUE WILL INCLUDE THE FOLLOWING LEVEL QUALITY CODES:

LINE SHOWN DEPICTS QUALITY LEVEL C <C>

<C> T1

LINE SHOWN DEPICTS QUALITY LEVEL D <D>

<D> T1

MULTIPLE SUE OWNERS CAN BE DEPICTED OWNERSHIP WITH THE FOLLOWING CODES:

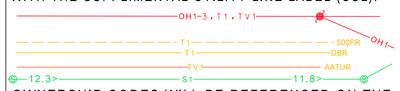
(A) UTILITY OWNER "X"

<C> (A) T1

(B) UTILITY OWNER "Y"

<D> T1 (B)

UTILITY LINES THAT REQUIRE MORE DETAILED INFORMATION ON THE PLAN SHEET CAN BE LABELED WITH THE SUPPLIMENTAL UTILITY LINE LABEL (SUL):



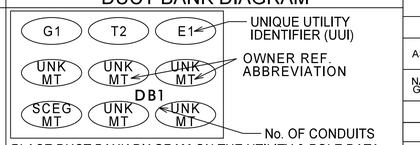
OWNERSHIP CODES WILL BE REFERENCED ON THE TITLE/OWNER SHEET AND THE UTILITY & POLE DATA SHEET.

SEWER MANHOLE NUMBERS (SMN)

S001 (S) SANITARY SEWER MANHOLE

DESIGNATE EACH SANITARY SEWER MANHOLE WITH A SEWER MANHOLE NUMBER (SMN). REFERENCE THIS SMN ON THE UTILITY DATA SHEET AND LIST ELEVATIONS.

DUCT BANK DIAGRAM



PLACE DUCT BANK DIAGRAM ON THE UTILITY & POLE DATA SHEET BELOW THE UTILITY & POLE DATA CHART. NOTE THE UUI OF THE DUCT BANK ON THE DIAGRAM. DEPICT THE CORRECT NUMBER OF CONDUITS IN THE DUCT AND THE USAGE OF EACH. MARK EMPTIES (IF KNOWN) WITH OWNER REFERENCE ABBREVIATION AND "MT".

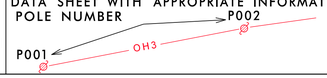
UTILITY INFORMATION TAGS (UIT)

WHEN UTILITY APPURTENANCES NEED DESCRIBING, PLACE A UIT NEXT TO THE CELL OR OUTLINED AREA. PLACE THE INFORMATION ON THE UTILITY DATA SHEET. DESIGNATE THE UTILITY BY THE OWNER NUMBER AND "T001" CODE IN THE "UTILITY" COLUMN. (IE - T2 T001).

(X) T001

UTILITY POLE ID NUMBER (UPIN)

TAG EACH UTILITY POLE WITH A UTILITY POLE ID NUMBER (UPIN) STARTING AT THE BEGINNING STATION. REFERENCE UPIN ON THE UTILITY & POLE DATA SHEET WITH APPROPRIATE INFORMATION.



UTILITY INFORMATION ABBERVIATIONS

EOI	END OF INFORMATION
EORI	END OF RECORDED INFORMATION
AATUR	UTILITY ABANDONED ACCORDING TO UTILITY RECORDS
AATFI	UTILITY ABANDONED ACCORDING TO FIELD INSPECTION
EATUR	EMPTY ACCORDING TO UTILITY RECORDS
NAP	NO ASSOCIATED PIPING FOUND FROM STRUCTURE
NAC	NO ASSOCIATED CABLES FOUND FROM STRUCTURE
DBR	DIRECT BURIED
DATFI	DEPICTED ACCORDING TO FIELD INSPECTION
EATFI	EMPTY ACCORDING TO FIELD INSPECTION
PR	PAIR
MT	EMPTY
CAP	CAPACITY
GR	GROUND

MATERIAL ABBREVIATIONS

C	COPPER
DI	DUCTILE IRON
S	STEEL
P	PLASTIC
FO	FIBER OPTIC
CI	CAST IRON
S	STEEL
CO	CONCRETE
PV	PVC
VY	VYLON
TC	TERRA COTTA
SWC	STEEL WRAPPED COATED
AC	ASBESTOS CEMENT
TF	TRAFFIC SIGNAL CABLE
GW	GUY WIRE
CNT	CONDUIT

GENERAL ABBREVIATIONS

E	ELECTRIC (POWER)
W	UNDERGROUND WATER
G	UNDERGROUND GAS
PUPS	PALMETTO UTILIY PROTECTION SERVICES
T	TELEPHONE, TELECOMMUNICATION
TV, C	CABLE TELEVISION
FO	FIBER OPTIC
S	SANITARY SEWER
FS	FORCED SANITARY SEWER, FORCE MAIN
DB	DUCT BANK
TF	TRAFFIC CONTROL UTILITY
UNK	UNKNOWN UTILITY
HP	HYDROGEN PEROXIDE
ST	STEAM LINE
F	FUEL / PETROLEUM LINE
R	RECLAIMED WATER / SLURRY LINE
I	IRRIGATION LINE
DB	DUCT BANK
TNL	TUNNEL
CA	GASES MATERIAL
OSL	OUTSIDE LIMITS
N/A	NOT AVAILABLE
N/S	NOT SURVEYED (REFERENCE)
PH	PHASE (POWER)
CIR	CIRCUIT (TRANSMISSION)
SVC	SERVICE
LPR	LOW PRESSURE
HPR	HIGH PRESSURE
UG	UNDERGROUND
AG	ABOVE GROUND

SOIL COMBINATION CHART

SANDY LOAM	SL	SILTY LOAM	ZL	SILT	Z
CLAY LOAM	CL	SILT CLAY LOAM	ZCL	SAND CLAY LOAM	SCL
SANDY CLAY	SC	SILTY CLAY	ZC	CLAY	C

SURFACE DESCRIPTION LEGEND KEY

ASPHALT	A	INTER-LOCKING BRICK	I	CONC-RETE	C
NATURAL GROUND	N				

SOIL DESCRIPTION LEGEND KEY

COMPACTION		WATER LEVEL		SOIL TYPE	
LOOSE	L	DRY	D	CLAY	C
SOFT	D	MOIST	M	LOAM	L
HARD	H	WET	E	SAND	S
SOLID	HH	STANDING WATER	WW	SILT	Z

UTILITY UNIQUE IDENTIFIER LINE-STYLES

ELECTRIC RECORDED	E1 THRU E10
ELECTRIC DESIGNATED	E1 THRU E10
TRAFFIC CONTROL RECORDED	TF1 THRU TF5
TRAFFIC CONTROL DESIGNATED	TF1 THRU TF5
TELEPHONE RECORDED	T1 THRU T10
TELEPHONE DESIGNATED	T1 THRU T10
CABLE TV RECORDED	TV1 THRU TV10
CABLE TV DESIGNATED	TV1 THRU TV10
IRRIGATION RECORDED	I1 THRU I5
IRRIGATION DESIGNATED	I1 THRU I5
SLURRY RECORDED	R1 THRU R5
SLURRY DESIGNATED	R1 THRU R5
GAS RECORDED	G1 THRU G10
GAS DESIGNATED	G1 THRU G10
FUEL/PETROL RECORDED	F1 THRU F5
FUEL/PETROL DESIGNATED	F1 THRU F5
STEAM RECORDED	ST1 THRU ST5
STEAM DESIGNATED	ST1 THRU ST5
COMPRESSED GASES RECORDED	CA1 THRU CA5
COMPRESSED GASES DESIGNATED	CA1 THRU CA5
WATER RECORDED	W1 THRU W10
WATER DESIGNATED	W1 THRU W10
GRAVITY SEWER	S1 THRU S10
FORCED SEWER RECORDED	FS1 THRU FS10
FORCED SEWER DESIGNATED	FS1 THRU FS10
AERIAL SIGNAL LINE	SIG
AERIAL UTILITY LINE	OH1 THRU OH20
AERIAL GUY WIRE	GW
MISCELLANEOUS RECORDED	M1 THRU M5
MISCELLANEOUS DESIGNATED	M1 THRU M5
DUCT BANK RECORDED	DB1 THRU DB5
DUCT BANK DESIGNATED	DB1 THRU DB5
UTILITY TUNNEL	TNL
UNKOWN DESIGNATED	UNK
SWEEP LIMIT	SUE
AERIAL COMMUNICATIONS	T1

QUALITY LEVEL DEFINITIONS

Level D. This level information comes solely from existing utility records. It may provide an overall "feel" for the congestion of utilities, but it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should be confined to project planning and route selection activities.

Level C. This level involves surveying visible aboveground utility facilities (e.g., manholes, valve boxes, posts) and correlating this information with existing utility records. When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, should be confined to rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.

Level B. This level involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities. This activity is called "designating." Two-dimensional mapping information is obtained. This information is usually sufficient to accomplish preliminary engineering goals. Decisions can be made on where to place storm drainage systems, footers, foundations and other design features in order to avoid conflicts with existing utilities. Slight adjustments in the design can produce substantial cost savings by eliminating utility relocations.

Level A. This level involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material and other characteristics. This activity is called "locating." It is the highest level presently available. When surveyed and mapped, precise plan and profile information are available for use in making final design decisions. By knowing exactly where a utility is positioned in three dimensions, the designer can often make small adjustments in elevations or horizontal locations and avoid the need to relocate utilities. Additional information (e.g., utility materials, condition, size, soil contamination, paving thickness) also assists the designer and Utility Company in their decisions.

U SHEET - UTILITY COORDINATION LEGEND

SYM	ABV	DESCRIPTION
	UCP	NEW / RELOCATED UTILITY POLE
	URP	REMOVE UTILITY POLE
W	UCW	NEW / RELOCATE WATER STRUCTURE
T	UCT	NEW / RELOCATE TELECOMMUNICATION PEDESTAL
G	UCG	NEW / RELOCATE GAS STRUTURE
E	UCE	NEW / RELOCATE ELECTRIC STRUCTURE
S	UCS	NEW / RELOCATE SEWER STRUCTURE
S	UCF	NEW / RELOCATE TRAFFIC STRUCTURE
U	UCU	NEW / RELOCATE MISC STRUCTURE

PROPOSED UTILITY LINES

T1 THRU T10	TELEPHONE
TV1 THRU TV10	CABLE TV
E1 THRU E10	ELECTRIC
TF1 THRU TF5	TRAFFIC CONTROL
W1 THRU W10	WATER
G1 THRU G10	GAS
FS1 THRU FS10	FORCED SEWER
F1 THRU F5	FUEL / PETROLEUM
OH1 THRU OH20	AERIAL UTILITIES
DB1 THRU DB5	DUCT BANK
M1 THRU M5	MISCELLANEOUS

U SHEET PLAN NOTES

U-SHEET LINEWORK WILL BE USED WHEN UTILITY RELCOATION PLANS ARE INCLUDED IN THE PLAN SET.

ALL U-SHEET UUI LINES WILL BE DETAILED ON THE U-SHEET DATA SHEET.

"MISCELLANEOUS" UUI U-SHEET LINEWORK CAN BE USED FOR ANY UTILITY NOT REPRESENTED WITH A RELOCATION UUI.

ON U-SHEETS, EXISTING UTILITIES ARE DEPICTED ON A GREYSCALE.

REMOVED UTILITIES

ABANDONED/REMOVED	
X X X X	TELEPHONE
X X X X	CABLE TV
X X X X	ELECTRIC
X X X X	TRAFFIC CONTROL
X X X X	WATER
X X X X	GAS
X X X X	FORCED SEWER
X X X X	FUEL / PETROLEUM
X X X X	AERIAL UTILITIES
X X X X	DUCT BANK
X X X X	MISCELANEOUS

PROJECT SPECIFIC NOTES

1. SUE WAS PERFORMED BY SAM FOR SCDOT.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
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3			
2			
1			

PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY LEGEND SHEET

SCALE: N/A RTE. US 21 DWG. NO. U2

UTILITY DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U3

FOR INFORMATION ONLY

UTILITY	ALIGNMENT / ROUTE / RD	STATION RANGE	OFFSET RANGE	ITEM IN PLACE	OWNERSHIP	REMARKS / MISC NOTES
E1	US21, SC51			UNDERGROUND POWER	YORK ELECTRIC CORP.	
E1-1	US21, SC51			AERIAL SINGLE PHASE POWER	YORK ELECTRIC CORP.	
E1-2	US21, SC51			AERIAL TWO PHASE POWER	YORK ELECTRIC CORP.	
E1-3	US21, SC51			AERIAL THREE PHASE POWER	YORK ELECTRIC CORP.	
E2-TRANS	US21, SC51, SC641			AERIAL TRANSMISSION POWER	DUKE POWER	44kV & 100kV OVERHEAD TRANSMISSION
E3-3 TRANS	US21			AERIAL TRANSMISSION POWER	SANTEE COOPER POWER	3-PHASE OVERHEAD TRANSMISSION
T1	US21, SC51, SC641			UNDERGROUND TELEPHONE	COMPORIUM	
T1-C	US21, SC51, SC641			AERIAL TELEPHONE COPPER	COMPORIUM	COPPER
T1-F	SC51, SC641			AERIAL TELEPHONE FO	COMPORIUM	FIBER OPTIC
T2	US21, SC51, SC641			UNDERGROUND TELEPHONE FO	DUKE NET	
T2-F	US21, US21 BUS, SC98			AERIAL TELEPHONE FO	DUKE NET	FIBER OPTIC
T3	US21, US21 BUS			UNDERGROUND TELEPHONE FO	AT&T	
TV1	US21, US21 BUS, SC51			AERIAL & UNDERGROUND CATV	COMPORIUM	
TV2	US21, SC51, SC641			UNDERGROUND FO	TWC	
G1	US21, US21 BUS, SC51			UNDERGROUND GAS	YORK CO. NATURAL GAS	
W1	US21, US21 BUS, SC51, SC98			UNDERGROUND WATER	YORK CO. WATER & SEWER	
W2	AMELIA, FERN FOREST, FOREST			UNGROUND WATER	FERN FOREST MHP	
S1	US21, US21 BUS, SC51, SC98			UNDERGROUND SAN. SEWER	YORK CO. WATER & SEWER	
TF1	US21, US21 BUS, SC51, SC98			AERIAL & UNDERGROUND SIGNAL	SC DOT	
OH1	US21, SC51, SC641, SC98			OVERHEAD POWER	YORK ELECTRIC CORP.	ALSO CARRIES AT VARIOUS LOCATIONS T1, TV1, T2, TF1
OH2	US21, SC51			OVERHEAD TRAFFIC SIGNAL	SC DOT	
OH3	US21			OVERHEAD POWER	SANTEE COOPER POWER	OVERHEAD TRANSMISSION
OH4	US21, SC51, SC98			OVERHEAD TELEPHONE & CATV	COMPORIUM	
OH5	SC51, SC641			OVERHEAD POWER	DUKE POWER	DOUBLE CIRCUIT 44kV OVERHEAD TRANSMISSION
OH5	US21			OVERHEAD POWER	DUKE POWER	DOUBLE CIRCUIT 100kV OVERHEAD TRANSMISSION

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

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6			
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4			
3			
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PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

UTILITY DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U3

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4A

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
1				York Electric	40 N	33'	9"	Wood	Pwr
2				York Electric		39'	11"	Wood	Pwr
3				York Electric		24'	7"	Wood	Pwr
4				York Electric	OSN	42'	11"	Wood	Pwr
5				York Electric	OSN	43'	12"	Wood	Pwr
6				York Electric		24'	7"	Wood	Pwr
7				SCDOT	5133A/350-N-6497A	27'	15"	Concrete	Signal
8				York Electric		42'	11"	Wood	Pwr
9				York Electric		43'	11"	Wood	Pwr
10				York Electric		42'	11"	Wood	Pwr
11				SCDOT	8-150/350-5767A	27'	15"	Wood	Signal
12				York Electric		43'	11"	Concrete	Pwr
13				York Electric		12'	4x6	Wood	Pwr
14				York Electric		34'	10"	Wood	Pwr
15				York Electric		35'	10"	Wood	Pwr
16				York Electric		12'	4x6	Wood	Pwr
17				SCDOT	1-188/350N-6022A	27'	15"	Concrete	Signal
18				SCDOT	7-133A/350-N-6497A	27'	15"	Concrete	Signal, Pwr, Tel
19				York Electric	40N	42'	11"	Wood	Pwr
20				York Electric		34'	11"	Wood	Pwr
21				York Electric		38'	11"	Wood	Pwr
22				York Electric		29'	9"	Wood	Pwr
23				York Electric		38'	11"	Wood	Pwr
24				York Electric		33'	10"	Wood	Pwr
25				York Electric	20N	42'	11"	Wood	Pwr
26				York Electric		38'	11"	Wood	Pwr
27				York Electric		34'	10"	Wood	Pwr
28				York Electric		37'	11"	Wood	Pwr
29				Santee Cooper	16# 156475	60'	14"	Wood	Pwr
30				Santee Cooper	15# 165474	77'	14"	Wood	Pwr
31				Santee Cooper	14# 165473	68'	14"	Wood	Pwr
32				York Electric		36'	12"	Wood	Pwr
33				York Electric		40'	12"	Wood	Pwr
34				York Electric		40'	12"	Wood	Pwr
35				York Electric	30N 3CACA1	37'	11"	Wood	Pwr
36				York Electric		49'	14"	Wood	Pwr
37				York Electric		39'	11"	Wood	Pwr
38				York Electric		35'	10"	Wood	Pwr
39				York Electric		34'	10"	Wood	Pwr
40				York Electric	2ST	34'	10"	Wood	Pwr
41				York Electric		38'	10"	Wood	Pwr, Tel, Ctv
42				York Electric	10N	28'	10"	Wood	Pwr
43				York Electric		52'	12"	Wood	Pwr
44				York Electric	30N	42'	12"	Wood	Pwr
45				York Electric		34'	10"	Wood	Guy
46				York Electric	2 12	34'	10"	Wood	Pwr, Tel, Ctv
47				York Electric		24'	9"	Wood	Pwr
48				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
49				York Electric	11	33'	9"	Wood	Pwr, Tel, Ctv
50				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
51				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
52				York Electric		32'	8"	Wood	Pwr, Tel, Ctv
53				York Electric		28'	8"	Wood	Pwr, Tel, Ctv
54				York Electric		44'	12"	Wood	Pwr
55				York Electric	30N	42'	12"	Wood	Pwr
56				York Electric		38'	11"	Wood	Guy
57				Comporium	3CAB1	24'	11"	Wood	Tel, Ctv
58				York Electric		22'	8"	Wood	Pwr
59				York Electric	22	32'	9"	Wood	Pwr, Tel, Ctv
60				York Electric		24'	9"	Wood	Pwr, Tel, Ctv
61				York Electric	3	33'	10"	Wood	Pwr, Tel, Ctv
62				York Electric		26'	7"	Wood	Pwr, Tel, Ctv
63				York Electric	4	34'	10"	Wood	Pwr, Tel, Ctv
64				York Electric		24'	8"	Wood	Pwr, Tel, Ctv
65				York Electric		11'	8"	Wood	Pwr, Tel, Ctv
66				York Electric		28'	8"	Wood	Pwr, Tel, Ctv
67				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
68				York Electric		25'	7"	Wood	Pwr, Tel, Ctv
69				York Electric		29'	7"	Wood	Pwr, Tel, Ctv
70				York Electric	5	34'	9"	Wood	Pwr, Tel, Ctv
71				York Electric	AB6	34'	9"	Wood	Pwr, Tel, Ctv
72				Duke Power		93'		Metal	Pwr
73				Duke Power		90'		Metal	Pwr
74				York Electric		41'	12"	Wood	Pwr
75				York Electric		30'	9"	Wood	Pwr, Tel, Ctv
76				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
77				York Electric		48'	14"	Wood	Pwr
78				York Electric		28'	9"	Wood	Guy
79				York Electric		25'	8"	Wood	Guy
80				York Electric		29'	9"	Wood	Guy
81				York Electric	11	43'	12"	Wood	Pwr, Tel, Ctv
82				York Electric		25'	8"	Wood	Pwr, Tel, Ctv
83				York Electric	3AAA 10	43'	12"	Wood	Pwr, Tel, Ctv
84				York Electric		25'	7"	Wood	Pwr, Tel, Ctv
85				York Electric		33'	10"	Wood	Pwr
86				York Electric		33'	10"	Wood	Pwr
87				York Electric		43'	12"	Wood	Pwr
88				York Electric		44'	12"	Wood	Pwr

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4A

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4B

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
89				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
90				York Electric	7	43'	11"	Wood	Pwr, Tel, Ctv
91				York Electric	6.5	43'	11"	Wood	Pwr, Tel, Ctv
92				York Electric	3C6	48'	13"	Wood	Pwr, Tel, Ctv
93				York Electric	20N	48'	12"	Wood	Pwr, Tel, Ctv
94				SCDOT	350-5698A	27'	15"	Concrete	Signal
95				SCDOT	350-698A	26'	15"	Concrete	Signal
96				SCDOT	350N-5698A	27'	15"	Concrete	Signal
97				SCDOT	350N-5614A	27'	15"	Concrete	Signal
98				York Electric		43'	12"	Wood	Pwr
99				York Electric		37'	12"	Wood	Pwr
100				York Electric		43'	12"	Wood	Pwr, Tel
101				York Electric		33'	10"	Wood	Pwr, Tel
102				York Electric		42'	11"	Wood	Pwr
103				York Electric		41'	11"	Wood	Pwr, Tel
104				York Electric	10N	32'	10"	Wood	Pwr
105				York Electric		33'	10"	Wood	Pwr
106				York Electric		33'	10"	Wood	Pwr
107				York Electric		24'	8"	Wood	Pwr
108				York Electric		33'	11"	Wood	Pwr
109				York Electric		42'	12"	Wood	Pwr
110				York Electric		43'	12"	Wood	Pwr
111				York Electric		24'	8"	Wood	Pwr
112				York Electric	40N	42'	12"	Wood	Pwr
113				York Electric		48'	12"	Wood	Pwr
114				York Electric	60N 40N	34'	12"	Wood	Pwr
115				York Electric		24'	8"	Wood	Pwr
116				York Electric		52'	12"	Wood	Pwr, Tel, Ctv
117				York Electric	3B4	43'	12"	Wood	Pwr, Tel, Ctv
118				York Electric		43'	12"	Wood	Pwr
119				York Electric		33'	10"	Wood	Pwr
120				York Electric		35'	10"	Wood	Pwr
121				York Electric		38'	11"	Wood	Pwr
122				York Electric	20N 4A	36'	10"	Wood	Pwr
123				York Electric		24'	7"	Wood	Pwr
124				York Electric		44'	11"	Wood	Pwr
125				York Electric	3BS	43'	11"	Wood	Pwr, Tel, Ctv
126				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
127				York Electric		29'	8"	Wood	Pwr
128				York Electric		34'	10"	Wood	Pwr
129				York Electric		25'	8"	Wood	Pwr, Tel
130				York Electric		42'	12"	Wood	Pwr, Tel, Ctv
131				York Electric		42'	12"	Wood	Pwr
132				York Electric		44'	13"	Wood	Pwr
133				York Electric		44'	12"	Wood	Pwr, Tel, Ctv
134				York Electric		33'	10"	Wood	Pwr, Tel, Ctv
135				York Electric		29'	10"	Wood	Pwr, Tel, Ctv
136				York Electric		44'	11"	Wood	Pwr, Tel, Ctv
137				York Electric		38'	11"	Wood	Pwr, Tel, Ctv
138				York Electric	1ST	34'	10"	Wood	Pwr, Tel, Ctv
139				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
140				York Electric		29'	9"	Wood	Pwr
141				York Electric		30'	8"	Wood	Pwr, Tel, Ctv
142				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
143				York Electric		34'	11"	Wood	Pwr, Tel, Ctv
144				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
145				York Electric		29'	9"	Wood	Tel, Ctv
146				York Electric		29'	9"	Wood	Tel, Ctv
147				York Electric		29'	8"	Wood	Pwr, Tel, Ctv
148				York Electric	3BAIC 5N 30N	37'	12"	Wood	Pwr, Tel
149				York Electric	30N	42'	12"	Wood	Pwr, Tel, Ctv
150				York Electric		43'	13"	Wood	Pwr, Tel, Ctv
151				York Electric	10N	33'	12"	Wood	Pwr, Tel, Ctv
152				York Electric		42'	13"	Wood	Pwr, Tel, Ctv
153				York Electric		28'	9"	Wood	Pwr
154				Comporium		30'	7"	Wood	Tel, Ctv
155				York Electric	30N	42'	11"	Wood	Pwr, Tel, Ctv
156				SCDOT		29'	13"	Wood	Signal
157				York Electric	40N	36'	11"	Wood	Pwr
158				York Electric	60N	38'	11"	Wood	Pwr
159				SCDOT		33'	11"	Wood	Signal
160				York Electric		13'	4x6	Wood	Pwr
161				York Electric		25'	8"	Wood	Pwr
162				SCDOT		30'	11"	Wood	Signal
163				York Electric		44'	12"	Wood	Pwr
164				York Electric		43'	12"	Wood	Pwr
165				York Electric	40N	44'	12"	Wood	Pwr, Tel, Ctv
166				York Electric		28'	8"	Wood	Pwr
167				York Electric		28'	10"	Wood	Pwr
168				York Electric		42'	12"	Wood	Pwr, Tel, Ctv
169				York Electric		20'	9"	Wood	Pwr
170				York Electric	5N	38'	12"	Wood	Pwr, Tel, Ctv
171				York Electric		28'	8"	Wood	Pwr
172				SCDOT	400N-5767B	30'	15"	Concrete	Signal
173				York Electric		24'	8"	Wood	Pwr
174				York Electric		25'	8"	Wood	Pwr, Ctv
175				York Electric	5A	28'	9"	Wood	Pwr, Tel, Ctv
176				York Electric		24'	8"	Wood	Pwr, Tel, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4B

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4C

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
177				York Electric		24'	7"	Wood	Pwr
178				SCDOT	400-4558B	30'	15"	Concrete	Signal
179				York Electric		42'	11"	Wood	Pwr, Tel, Ctv
180				SCDOT	400M-5767B	29'	15"	Concrete	Signal
181				SCDOT	400M-4400A	29'	15"	Concrete	Signal
182				York Electric	30N	42'	13"	Wood	Pwr, Tel, Ctv
183				York Electric		41'	9"	Wood	Pwr, Tel, Ctv
184				York Electric		43'	12"	Wood	Pwr, Ctv
185				York Electric	50N	33'	11"	Wood	Pwr
186				York Electric		43'	11"	Wood	Pwr, Ctv
187				York Electric		42'	12"	Wood	Pwr, Ctv
188				York Electric		43'	11"	Wood	Pwr, Tel, Ctv
189				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
190				York Electric		24'	8"	Wood	Pwr
191				York Electric		43'	10"	Wood	Pwr, Tel, Ctv
192				York Electric		42'	10"	Wood	Pwr, Tel, Ctv
193				York Electric		53'	13"	Wood	Pwr, Ctv
194				York Electric		25'	9"	Wood	Pwr
195				York Electric		52'	13"	Wood	Pwr
196				York Electric		43'	13"	Wood	Pwr
197				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
198				York Electric		33'	9"	Wood	Pwr, Tel, Ctv
199				York Electric		24'	7"	Wood	Pwr, Tel, Ctv
200				Fort Mill Telephone		27'	10"	Wood	Tel, Ctv
201				York Electric		43'	12"	Wood	Pwr
202				York Electric		42'	12"	Wood	Pwr
203				York Electric		34'	9"	Wood	Pwr
204				York Electric		47'	13"	Wood	Pwr, Tel, Ctv
205				SCDOT		28'	15"	Wood	Signal
206				SCDOT		28'	12"	Wood	Signal
207				York Electric		29'	9"	Wood	Guy
208				SCDOT		29'	11"	Wood	Signal
209				SCDOT		29'	11"	Wood	Signal
210				York Electric		23'	11"	Wood	Tel, Ctv
211				York Electric		43'	7"	Wood	Pwr, Tel, Ctv
212				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
213				York Electric		33'	12"	Wood	Pwr
214				York Electric		39'	10"	Wood	Pwr
215				York Electric		29'	9"	Wood	
216				York Electric		43'	12"	Wood	Pwr, Ctv
217				York Electric		36'	11"	Wood	Pwr, Tel
218				York Electric	30N	38'	11"	Wood	Pwr, Tel
219				York Electric		29'	8"	Wood	Pwr, Tel
220				York Electric		24'	8"	Wood	Pwr
221				SCDOT		32'	15"	Concrete	Signal
222				SCDOT		31'	15"	Concrete	Signal
223				SCDOT		32'	15"	Concrete	Signal
224				York Electric	20	34'	9"	Wood	Pwr
225				SCDOT		31'	15"	Concrete	Signal
226				York Electric		39'	11"	Wood	Pwr
227				York Electric		21'	9"	Wood	Pwr
228				York Electric		34'	10"	Wood	Pwr, Tel
229				York Electric		33'	10"	Wood	Pwr, Tel
230				York Electric	15N	44'	11"	Wood	Pwr, Tel
231				York Electric	30N	33'	9"	Wood	Pwr, Tel
232				York Electric		34'	10"	Wood	Pwr, Tel
233				Comporium		25'	8"	Wood	Tel
234				York Electric		36'	10"	Wood	Pwr
235				Comporium		30'	8"	Wood	Tel, Ctv
236				York Electric	BN1	40'	10"	Wood	Pwr, Tel, Ctv
237				York Electric		39'	10"	Wood	Pwr, Tel, Ctv
238				York Electric		23'	8"	Wood	Pwr
239				York Electric		37'	11"	Wood	Pwr
240				York Electric		38'	11"	Wood	Pwr, Tel
241				York Electric		36'	11"	Wood	Pwr, Tel
242				York Electric		42'	13"	Wood	Pwr, Tel
243				York Electric		34'	10"	Wood	Pwr
244				York Electric		36'	10"	Wood	Pwr
245				York Electric		34'	10"	Wood	Pwr
246				York Electric		38'	11"	Wood	Pwr, Tel
247				York Electric		30'	9"	Wood	Pwr
248				York Electric		34'	11"	Wood	Pwr, Tel
249				York Electric		38'	11"	Wood	Pwr, Tel
250				York Electric		32'	10"	Wood	Pwr, Tel
251				York Electric	3BP5	42'	13"	Wood	Pwr, Tel
252				York Electric		38'	11"	Wood	Pwr
253				York Electric		32'	9"	Wood	Pwr
254				York Electric		33'	11"	Wood	Pwr
255				York Electric		36'	11"	Wood	Pwr, Tel, Ctv
256				York Electric		33'	11"	Wood	Pwr, Tel, Ctv
257				York Electric		37'	10"	Wood	Pwr, Tel, Ctv
258				York Electric	3BP912 15N	35'	11"	Wood	Pwr, Tel, Ctv
259				York Electric	5N	37'	11"	Wood	Pwr, Tel, Ctv
260				York Electric		38'	11"	Wood	Pwr, Tel, Ctv
261				Comporium		34'	10"	Wood	Pwr, Tel, Ctv
262				York Electric		35'	10"	Wood	Pwr
263				York Electric		34'	11"	Wood	Pwr
264				York Electric		33'	8"	Wood	Pwr, Tel, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE	COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05	STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23	OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE	Reference the Utility Pole ID Number	P001, P25	OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L	POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC	ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH	REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4C

POLE DATA

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U4D

FOR INFORMATION ONLY

POLE	ALIGNMENT / ROUTE / RD	STATION	OFFSET	OWNER	POLE DATA				RIDING UTILITIES
					OWNER No	HEIGHT	DIAMETER	MATERIAL	
265				York Electric		24'	10"	Wood	Pwr
266				York Electric	4.5	36'	11"	Wood	Pwr, Tel, Ctv
267				Comporium		33'	8"	Wood	Pwr, Tel, Ctv
268				York Electric		24'	9"	Wood	Pwr, Tel
269				Comporium		25'	10"	Wood	Tel
270				York Electric		30'	10"	Wood	Pwr
271				York Electric		26'	9"	Wood	Pwr
272				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
273				Duke Power		92'		Metal	Pwr
274				York Electric		33'	10"	Wood	Pwr
275				York Electric		32'	10"	Wood	Pwr, Tel, Ctv
276				York Electric		34'	11"	Wood	Pwr, Tel, Ctv
277				Comporium		34'	10"	Wood	Pwr, Tel, Ctv
278				York Electric	3B16	43'	12"	Wood	Pwr, Tel, Ctv
279				SCDOT	350N-5299B	28'	15"	Concrete	Signal
280				York Electric		25'	8"	Wood	Pwr, Tel
281				SCDOT		28'	15"	Concrete	Signal
282				SCDOT	E-350N-5299B	28'	15"	Concrete	Signal
283				SCDOT	350N-5299B	28'	15"	Concrete	Signal
284				York Electric	3B17	43'	13"	Wood	Pwr, Tel, Ctv
285				York Electric	3BE20	30'	10"	Wood	Pwr, Tel, Ctv
286				York Electric		29'	10"	Wood	Pwr
287				York Electric		33'	10"	Wood	Pwr, Tel, Ctv
288				York Electric		28'	9"	Wood	Pwr
289				Duke Power	5	43'	11"	Wood	Pwr
290				Duke Power		105'		Metal	Pwr
291				York Electric	30N	31'	10"	Wood	Pwr, Tel, Ctv
292				Duke Power	1	42'	13"	Wood	Pwr, Tel
293				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
294				Duke Power	2	51'	13"	Wood	Pwr
295				York Electric	99	35'	12"	Wood	Pwr, Tel
296				York Electric		34'	9"	Wood	Pwr
297				York Electric	3BEC1	34'	10"	Wood	Pwr, Tel, Ctv
298				York Electric		33'	9"	Wood	Pwr
299				York Electric		34'	11"	Wood	Pwr
300				York Electric		35'	10"	Wood	Pwr, Tel, Ctv
301				York Electric		39'	11"	Wood	Pwr, Tel, Ctv
302				York Electric		34'	9"	Wood	Pwr, Tel, Ctv
303				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
304				York Electric		43'	12"	Wood	Pwr, Tel, Ctv
305				York Electric		38'	10"	Wood	Pwr, Tel, Ctv
306				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
307				York Electric		39'	11"	Wood	Pwr
308				York Electric		38'	11"	Wood	Pwr
309				York Electric	30N	33'	12"	Wood	Pwr
310				York Electric		39'	12"	Wood	Pwr
311				York Electric	20N	39'	12"	Wood	Pwr
312				York Electric		34'	10"	Wood	Pwr, Tel, Ctv
313				York Electric		30'	9"	Wood	Pwr, Tel
314				York Electric	23	37'	10"	Wood	Pwr, Tel
315				York Electric		38'	11"	Wood	Pwr
316				Duke Power		90'		Metal	Pwr
317				York Electric		38'	10"	Wood	Pwr, Tel, Ctv, Signal
318				York Electric		38'	12"	Wood	Pwr, Tel, Ctv
319				York Electric		38'	12"	Wood	Pwr, Tel, Ctv, Signal
320				York Electric		38'	12"	Wood	Pwr, Tel, Ctv, Signal
321				York Electric	30N	38'	10"	Wood	Pwr, Tel, Ctv, Signal
322				York Electric		29'	9"	Wood	Pwr
323				York Electric		29'	9"	Wood	Pwr
324				York Electric		28'	9"	Wood	Pwr
325				York Electric		26'	9"	Wood	Pwr
326				York Electric		29'	9"	Wood	Pwr
327				York Electric		24'	9"	Wood	Pwr
328				York Electric	30N	33'	10"	Wood	Pwr
329				York Electric	12N	34'	9"	Wood	Pwr
330				York Electric		33'	12"	Wood	Pwr
331				York Electric		33'	10"	Wood	Pwr
332				York Electric		35'	10"	Wood	Pwr
333				York Electric		33'	11"	Wood	Pwr
334				York Electric		33'	10"	Wood	Pwr
335				York Electric		34'	12"	Wood	Pwr
336				York Electric		34'	10"	Wood	Pwr
337				York Electric		24'	9"	Wood	Pwr
338				York Electric		34'	10"	Wood	Pwr
339				York Electric			11"	Wood	Pwr
340				SCDOT			11"	Wood	Signal
341				York Electric			11"	Wood	Pwr, Tel
342				SCDOT			11"	Wood	Signal
343				York Electric			11"	Wood	Pwr
344				York Electric			11"	Wood	Pwr
345				York Electric			11"	Wood	Pwr, Ctv
346				Duke Power			13"	Wood	Pwr
347				York Electric	30N		11"	Wood	Pwr, Ctv

UTILITY & POLE DATA TABLE DESCRIPTION

COLUMN	DESCRIPTION	EXAMPLE
UTILITY	a) Reference the Utility Unique Identifier (UUI) b) Reference Sewer Manhole Number (SMN) c) Reference Utility Information Tags (UIT)	E1, G1, OH15 S001, SMH-02 U001, U05
POLE	Reference the Utility Pole ID Number	P001, P25
ALIGNMENT ROUTE ROAD	Reference the Alignment used for Stationing Use design alignments when available ~All geometric data used will be referenced to the project datum~	 MAIN ST. MAIN ST. RELOC

COLUMN	DESCRIPTION	EXAMPLE
STATION RANGE	a) Reference the station of the begin & end of linear utility b) Reference the station location of utility appurtenance c) Reference the station location of manhole	01+23 - 45+67 01+23 01+23
OFFSET RANGE	a) Reference the offset of the begin & end of linear utility b) Reference the offset location of utility appurtenance c) Reference the offset location of manhole	15R - 15R 25L 25L
ITEM IN PLACE	a) Reference utility type, size & material b) Reference the utility appurtenance type c) Reference manhole	TELE, COPPER / GAS 6" DI U/G PEDESTAL SEWER MH

COLUMN	DESCRIPTION	EXAMPLE
OWNERSHIP	Reference utility owner by name or by Owner Ref Abbr from Title Sheet	LOCAL POWER CO. LPC
POLE DATA	Reference Owner Number, Height, Diameter and Material of pole	DPC123, 35', 12", WOOD
REMARKS MISC NOTES	a) Further details including capacity, etc. b) List Sewer rims and invert elevations c) List details and desc, sizes, record information, etc.	RIM=123.45, INV IN=123.45 INV OUT=123.45 RECORDS SHOW INFO

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
POLE DATA SHEET

SCALE: N/A RTE. US 21 DWG. NO. U4D

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21 SC 51	U5

GENERAL NOTES

THESE PLANS ARE TO BE USED ONLY AS REFERENCE FOR UTILITY RELOCATIONS.

ALL RELOCATIONS ARE APPROXIMATE BASED ON INFORMATION PROVIDED BY THE INDIVIDUAL UTILITY OWNERS.

ALL PROPOSED RELOCATIONS ARE CONSIDERED INCOMPLETE AND THE INDIVIDUAL UTILITY OWNERS MAY REQUIRE ADDITIONAL RELOCATIONS.

ACTUAL FIELD CONDITIONS WILL DICTATE THE PRECISE LOCATION OF THE RELOCATED UTILITY THROUGH COORDINATION BETWEEN THE CONTRACTOR AND THE UTILITY OWNER.

THE CONTRACTOR IS REQUIRED TO CONTACT 811 AS WELL AS THE NON-811 MEMBER UTILITIES THREE DAYS PRIOR TO EXCAVATING ACTIVITIES.
1-888-721-7877

SPECIAL PROVISIONS

UTILITY STAKING:

CONTRACTOR SHALL BE AWARE ON AS NEEDED BASIS, UTILITIES MAY REQUEST STAKING OF CONSTRUCTION ITEMS AND RIGHT-OF-WAY TO HELP FACILITATE RELOCATIONS AND TO AVOID POTENTIAL CONFLICT WITH ROADWAY CONSTRUCTION AND OTHER UTILITIES.

UTILITY RELOCATION CLEARING SEQUENCE:

UTILITY RELOCATION APPROACH:

IT IS THE INTENTION OF THE UTILITIES TO RELOCATE ACCORDING TO THE FOLLOWING CONSTRUCTION SEQUENCE. THE CLEARING CONTRACTOR SHALL CLEAR AND GRUB ACCORDING TO THE PRIORITY SHOWN IN CHART.

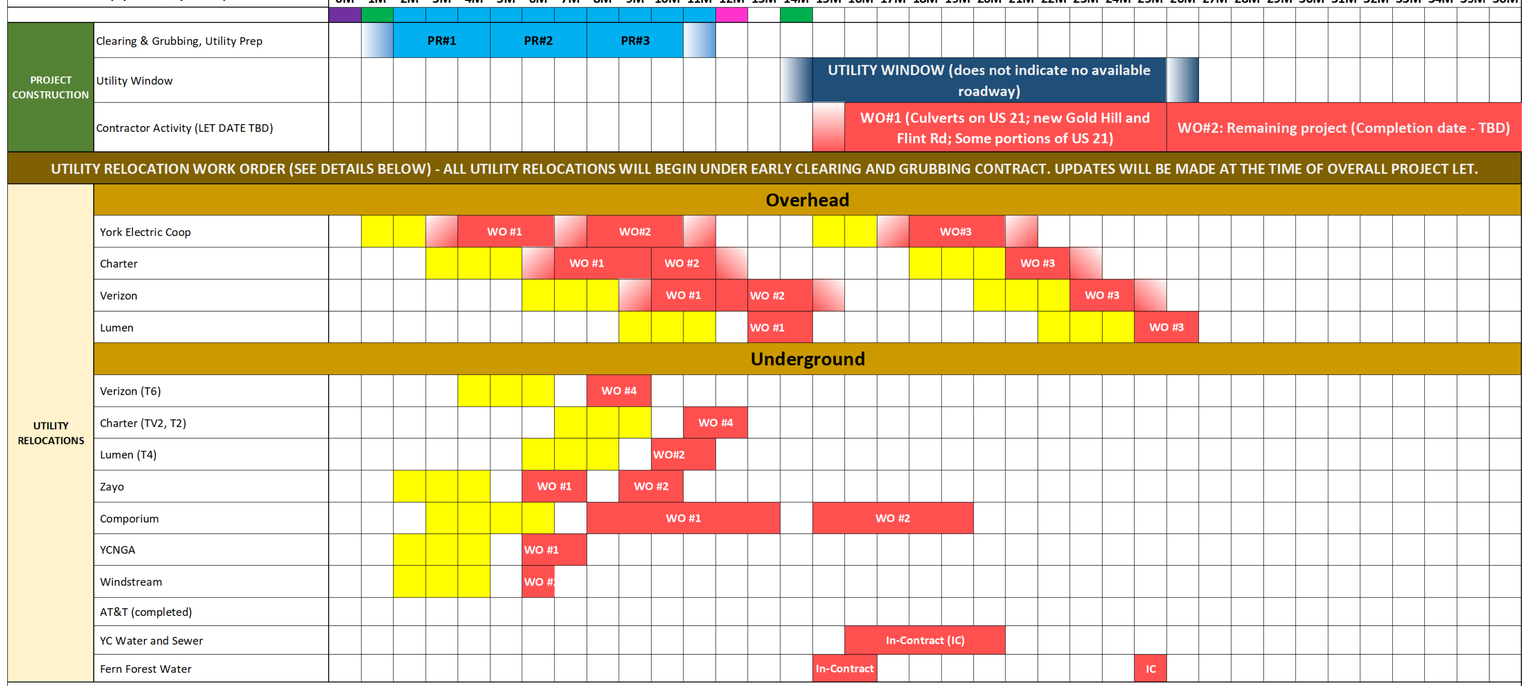
IT IS THE INTENT THAT UTILITIES WILL START WORKING IN ALL AVAILABLE LOCATIONS, WHERE AND WHEN POSSIBLE. EXISTING UTILITIES WILL REMAIN ACTIVE UNTIL ALL NEW FACILITIES ARE INSTALLED AND CUT OVER.

KEY

- notifications (permitting, procurement, scheduling)
- active relocation/ construction activity
- some activity
- no activity
- Project Bid (Early C&G only)
- NTP
- Contractor on-site for C&G operations
- Utility Window
- Project Bid (TBD - For visual purpose only)

**THIS BAR CHART IS FOR INFORMATION ONLY. THE PURPOSE IS TO VISUALLY SHOW THE ORDER OF UTILITY RELOCATIONS IN RELATION TO OTHER CONSTRUCTION ACTIVITY AND NEEDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY UTILITY RELOCATION STATUS. CONTRACTOR ACTIVITY FOR THE PROJECT WILL EXTEND FURTHER THAN WHAT IS SHOWN.

US 21/ SC 51 Widening
(Updated Sept 2023)



WORK AREAS, CONTRACTOR ACTIVITY, AND PRECEDING RELOCATION REQUIRED FOR UTILITY RELOCATION

York Electric Cooperative (E1):
WO #1: SC 51 (need clearing and new alignment graded)
WO #2: Old Nations to SC 51
WO#3: Remaining US 21 (require fill efforts from prime)

Charter (TV2, T2):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 72+00

Verizon (T6):
WO #1: SC 51 (need clearing/grading & YEC OH)
WO #2: Old Nations to SC 48 (need clearing/grading & YEC OH)
WO #3: Remaining US 21 (need YEC OH)
WO #4: US 21 - UG from Sta 45+00 to 61+00

Zayo (T5):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

Comporium (T1):
WO #1: Gold Hill to SC 51 & SC 51 (need clearing/grading)
WO #2: SC 460 to Gold Hill (need clearing/grading)

AT&T (T3):
Work is complete for Encrochment #A029Y30

Windstream:
WO #1: Adjust as needed; 1 month notification

Lumen (T4):
WO #1: Old Nations to end of SC 51 (OH) (need YEC & Tele OH
WO #2: Gold Hill to Old Nations (UG only) (need C&G)
WO #3: All remaining OH (need YEC OH & Other OH Telecoms

YCNGA (G1):
WO #1: SC 51 (need clearing & grubbing)
WO#2: All remaining relocations

York County Water/Sewer (W1/SS1):
In-contract

Fern Forest Water (T2):
In-contract (2 parts)

Clearing Priorities:
PR#1:
C&G SC51 and Flint Hill Road (new and existing); Includes rough grading new alignments of existing ground
PR#2:
C&G RT/LT Side from Gold Hill to SC 43 and cut from Sta 44+00 to 54+00 LT on US 21; Includes rough grading for new alignment for Gold Hill of existing ground
PR#3:
Remaining project

STV Incorporated
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SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

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6			
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4			
3			
2			
1			

PREPARED BY _____ CHK'D BY _____ REVIEWED BY _____

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

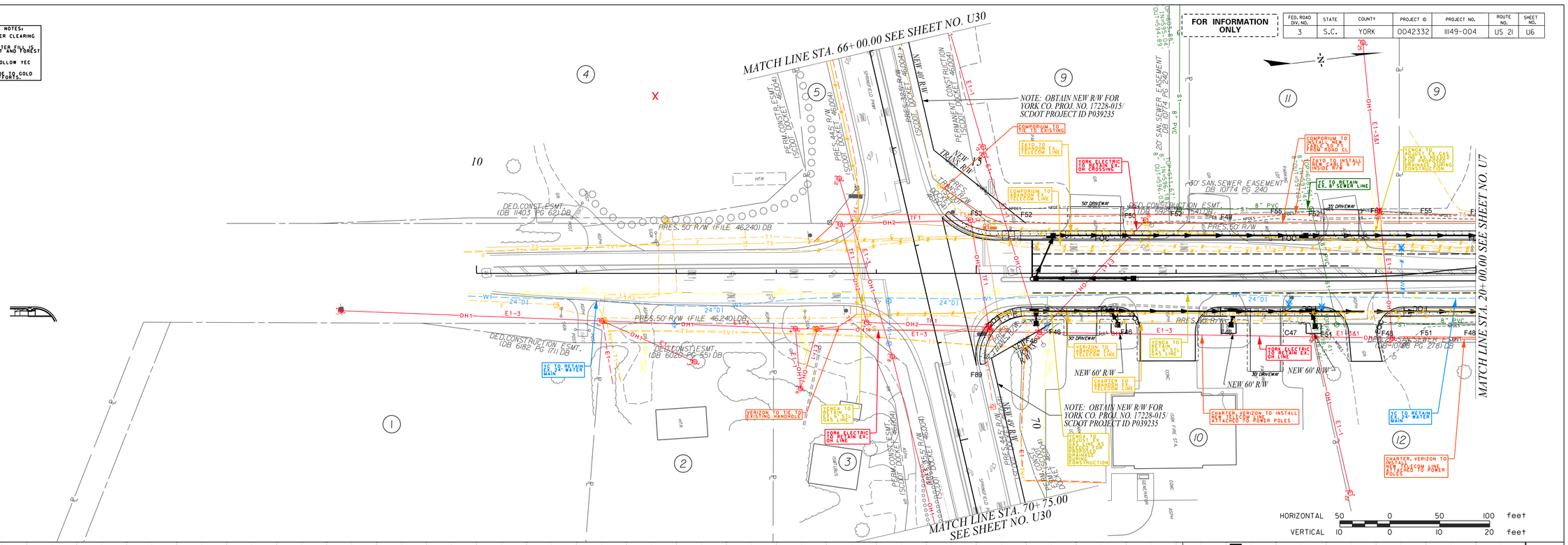
UTILITY GENERAL NOTES SHEET

SCALE: N/A RTE. US 21 DWG. NO. U5

PHASE 3 UTILITY RELOCATIONS NOTES:
COMPORIUM TO RELOCATE AFTER CLEARING EFFORTS.
YEC TO RELOCATE OH LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE
CHARTER AND VERIZON WILL FOLLOW YEC RELOCATIONS.
ZAYO TO RELOCATE ON L.T. SIDE TO GOLD HILL ROAD AFTER CLEARING EFFORTS.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U6



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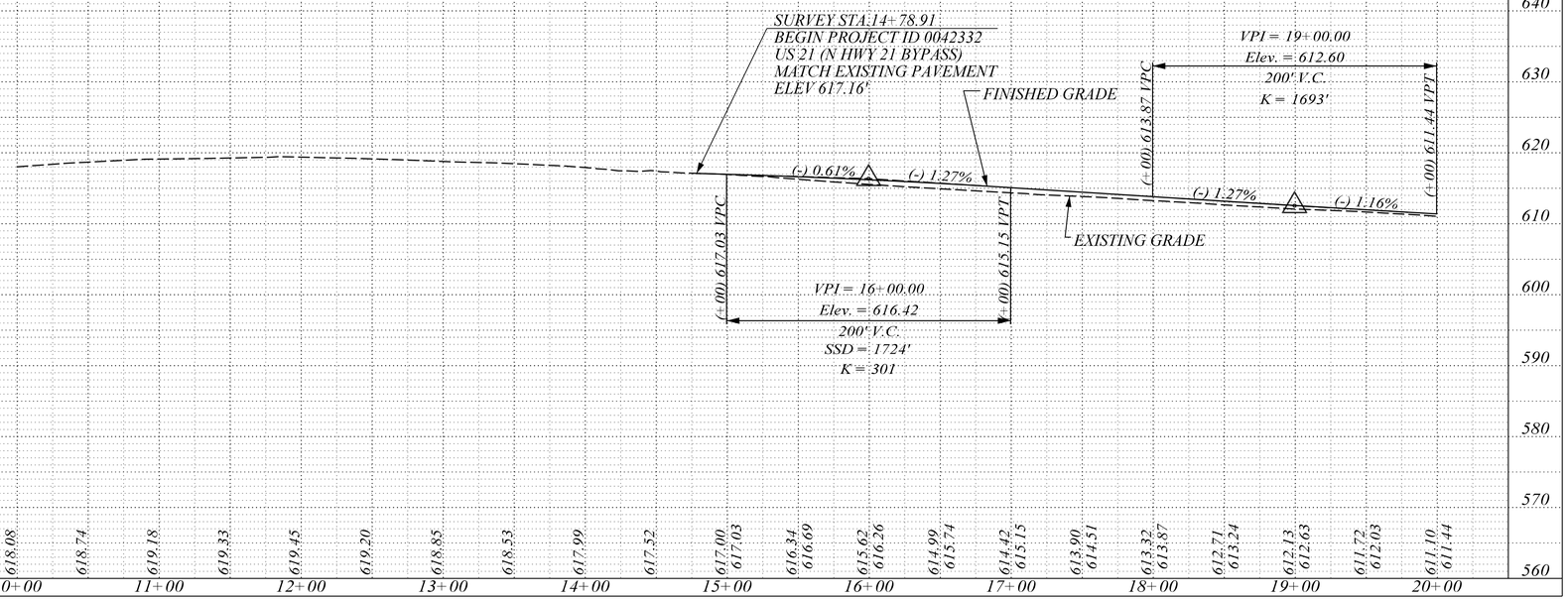
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)



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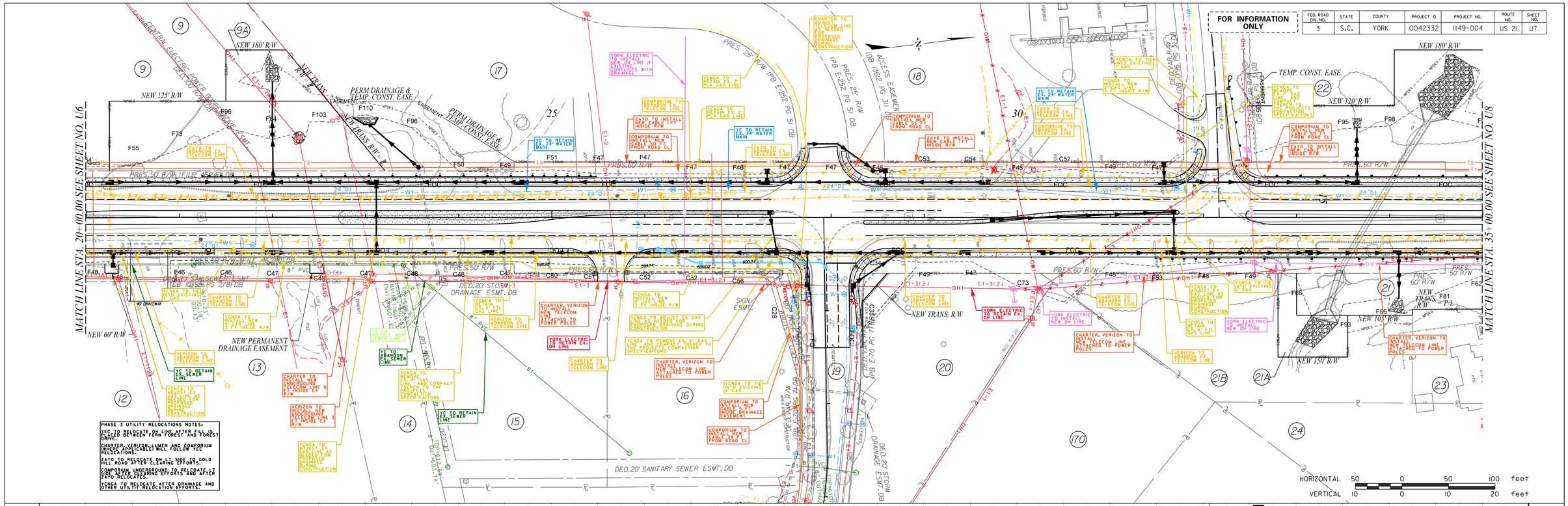
FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	U7

FOR INFORMATION ONLY



PHASE 3 UTILITY RELOCATIONS NOTES:

YEC TO RELOCATE ON LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE.

CHARTER, VERIZON, LUMEN AND COMPORIUM (WHERE APPLICABLE) WILL FOLLOW YEC RELOCATIONS.

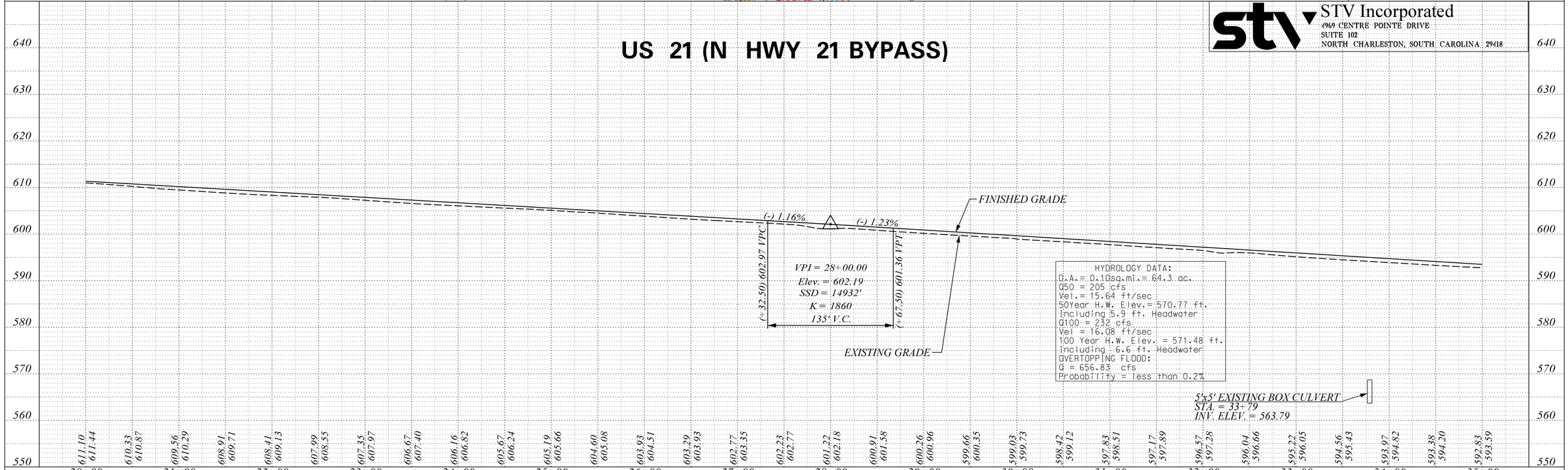
ZAYO TO RELOCATE ON LT SIDE TO GOLD HILL ROAD AFTER CLEARING EFFORTS.

COMPORIUM UNDERGROUND TO RELOCATE LT SIDE AFTER CLEARING EFFORTS AND AFTER ZAYO RELOCATES.

YCNGA TO RELOCATE AFTER DRAINAGE AND OTHER UTILITY RELOCATION EFFORTS.

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)



PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:
COLD HILL TO SR 38 AND CUT SIDE FROM SR 38 TO SR 38 AND CUT SIDE FROM CARTER TO LAKESHORE DR. INCLUDES ROUGH GRADING FOR NEW ALIGNMENT FOR COLD HILL

VERIZON TO RELOCATE SCSI TO ELSIE IN LATER CLEARING/GRADING IS COMPLETE.

VERIZON TO RELOCATE FROM COMPORIUM MH TO COLD HILL PRIOR TO COMPORIUM MH. VERIZON HAS TO INCLUDE THEIR MH FROM CARTER TO COLD HILL. VERIZON MH MUST BE RELOCATED BEFORE COMPORIUM MH OR ELSE IT WILL HOLD UP COMPORIUM.

VERIZON HAS TO BE 9' FEET AT STATION 40+00 FROM RIGHT ROW, DRAINAGE DEPTH AND COMPORIUM.

PHASE 3 UTILITY RELOCATIONS NOTES:
COMPORIUM UNDERGROUND TO RELOCATE AFTER GRADING ESTIMATE COMPORIUM TO BEGIN AT LAKESHORE DR. SIDE AND PROCEEDING TO COLD HILL. NEED GRADING CLEARING IN GOOD SHAPE AND FUTURE GRADING IF ANY SIDE CUTS ARE NEEDED DUE TO ZATO AND/OR CLEARING EFFORTS.

FEC TO RELOCATE POLE JUST AFTER FILL IS COMPLETE BETWEEN CRN, PONDS AND FOREST DRIVE.

CHARTER, VERIZON AND LUMEN TO FOLLOW FEC RELOCATIONS.

ZATO TO RELOCATE ON LT SIDE TO COLD. COMPORIUM TO BE ON RT SIDE FROM BEGINNING TO COLD HILL AND CUT ARE BETWEEN LAKESHORE AND COLD HILL

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	U8

MATCH LINE STA. 35+00.00 SEE SHEET NO. U7

MATCH LINE STA. 50+00.00 SEE SHEET NO. U9

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

HYDROLOGY DATA:
D.A.= 0.142sq.mi.= 90.9 ac.
Q50 = 249 cfs
Vel.= 14.65 ft/sec
50Year H.W. Elev.= 574.56 ft.
Including 7.1 ft. Headwater
Q100 = 281 cfs
Vel = 15.06 ft/sec
100 Year H.W. Elev. = 575.56 ft.
Including 8.1 ft. Headwater
OVERTOPPING FLOOD:
Q = 539.95 cfs
Probability = less than 0.2%

VPI = 41+00.00
Elev. = 586.22
K = 106
430' V.C.

(+ 85) 588.86 VPC

(+ 15) 592.31 VPT

LOW POINT
40+15.01
ELEV. = 588.06

(-) 1.23%

(+) 2.84%

FINISHED GRADE

EXISTING GRADE

5'x5' EXISTING BOX CULVERT
STA. = 41+06
INV. ELEV. = 566.73

	35+00	36+00	37+00	38+00	39+00	40+00	41+00	42+00	43+00	44+00	45+00	46+00	47+00	48+00	49+00	50+00
	592.83	592.29	591.64	590.92	590.32	589.66	589.01	588.46	587.95	587.49	587.28	587.42	587.81	588.40	589.13	590.02
	593.59	592.98	592.36	591.75	591.13	590.52	589.90	589.29	588.68	588.26	588.07	588.12	588.40	588.92	589.68	590.67
	591.00	592.31	593.79	595.32	596.83	598.30	599.74	601.18	602.58	604.01	605.45	606.87	608.29	609.74	611.20	
	591.90	593.31	594.72	596.14	597.56	598.98	600.39	601.81	603.23	604.65	606.07	607.48	608.90	610.32	611.74	

640 630 620 610 600 590 580 570 560 550

PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL TO SC 49 AND CUT FROM STA. 28+00 TO 29+65 ON DOUBLEMOCKS ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL

ZATO TO RELOCATE TO SCSI TO BE TIE IN AFTER CLEARING/GRADING IS COMPLETE.

RT SIDE UNDERGROUND TELECOM RELOCATION SEQUENCE: VERIZON > COMPORIUM > LUMEN > CHARTER

PHASE 3 UTILITY RELOCATIONS NOTES:

COMPORIUM TO RELOCATE BOTH SIDES AFTER CLEARING EFFORTS.

YEC TO RELOCATE ON LINE AFTER FILL IS PLACED BETWEEN FERN FOREST AND FOREST DRIVE.

CHARTER AND VERIZON WILL FOLLOW YEC RELOCATIONS.

ZATO TO RELOCATE ON LT SIDE TO GOLD HILL AFTER CLEARING EFFORTS

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U9

MATCH LINE STA. 31+00.00 S-1726 (GOLD HILL ROAD) SEE SHEET NO. U19

MATCH LINE STA. 50+00.00 SEE SHEET NO. U8

MATCH LINE STA. 65+00.00 SEE SHEET NO. U10

MATCH LINE STA. 12+50.00 US 21 BUSINESS SEE SHEET NO. U20

HORIZ 50 0 50 100 feet
VERT 10 0 10 20 feet

US 21 (N HWY 21 BYPASS)

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SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

HIGH POINT
STA. 62+65.06
ELEV. = 642.15

(+) 2.84% (-) 1.29%

FINISHED GRADE

EXISTING GRADE

(+80) 636.69 VPC

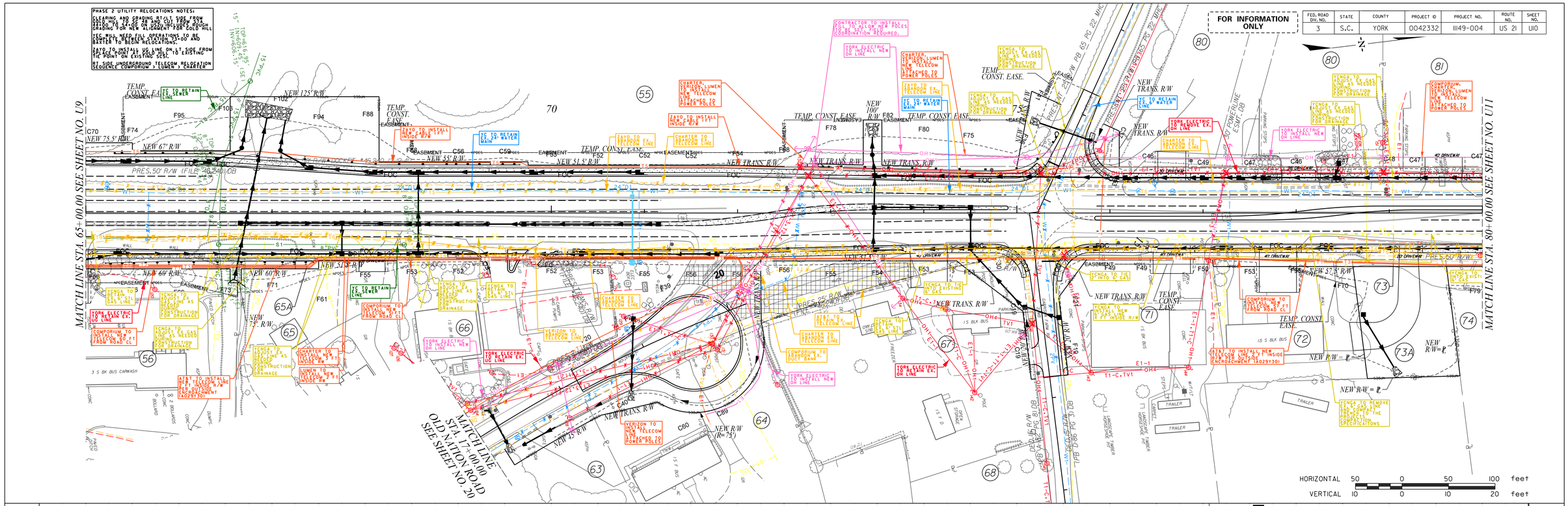
(+40) 641.03 VPT

VPI = 61+60.00
Elev. = 644.63
SSD = 541'
K = 136
560' V.C.

670	660	650	640	630	620	610	600	590	580

50+00	51+00	52+00	53+00	54+00	55+00	56+00	57+00	58+00	59+00	60+00	61+00	62+00	63+00	64+00	65+00
611.20 611.74	612.54 613.16	613.95 614.57	615.41 615.99	616.86 617.41	618.28 618.83	619.67 620.25	621.05 621.66	622.41 623.08	623.84 624.50	625.26 625.92	626.71 627.34	628.19 628.75	629.63 630.17	631.06 631.59	632.48 633.01	633.92 634.42	635.32 635.84	636.68 637.25	637.91 638.50	638.98 639.57	639.79 640.45	640.45 641.15	640.96 641.67	641.32 642.00	641.32 642.14	641.50 642.11	641.31 641.89	640.92 641.48	640.39 640.90	639.71 640.25

PROLINE.DGN


FOR INFORMATION ONLY
FED. ROAD DIV. NO. 3
STATE S.C.
COUNTY YORK
PROJECT ID 0042332
PROJECT NO. 11149-004
ROUTE NO. US 21
SHEET NO. U10
MATCH LINE STA. 65+00.00 SEE SHEET NO. U9
MATCH LINE STA. 80+00.00 SEE SHEET NO. U11
MATCH LINE STA. 17+00.00 OLD NATION ROAD SEE SHEET NO. 20
HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418
US 21 (N HWY 21 BYPASS)
VPI = 69+00.00
Elev. = 635.10
K = 180
550' V.C.
(+25) 638.64 VPC
(+75) 639.95 VPT
LOW POINT
STA. 68+57.13
ELEV. = 637.15
(-) 1.29%
(+) 1.76%
FINISHED GRADE
EXISTING GRADE
(+10) 649.39 VPC
(+) 1.76%
(-) 1.22%
VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.
670
660
650
640
630
620
610
600
590
580
65+00
66+00
67+00
68+00
69+00
70+00
71+00
72+00
73+00
74+00
75+00
76+00
77+00
78+00
79+00
80+00

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PHASE 2 UTILITY RELOCATIONS NOTES:

CLEARING AND GRADING RT/LT SIDE FROM GOLD MILL TO ZZ+78 AND CUT FROM 37+ 22+50 TO 24+66 OR USED INCLUDES ROUGH GRADING FOR NEW ALIGNENT FOR COLD HILL

ZAYO TO INSTALL UNDERGROUND 12- FEET DEEP TO AVOID PROPOSED DRAINAGE ACTIVITIES AND CUT OF EXISTING AT STATION 85+00 AND 7- FEET DEEP UNTIL STATION 98+00 WHERE THERE IS BETTER SEPARATION.

COMPORIUM TO INSTALL UNDERGROUND 12- FEET DEEP TO AVOID PROPOSED DRAINAGE ACTIVITIES AND CUT OF EXISTING AT STATION 85+00 AND 7- FEET DEEP UNTIL STATION 98+00 WHERE THERE IS BETTER SEPARATION.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	U11

MATCH LINE STA. 80+00.00 SEE SHEET NO. U10

MATCH LINE STA. 95+00.00 SEE SHEET NO. U12

MATCH LINE STA. 12+00.00
J3-107 (REGENT PARKWAY)
SEE SHEET NO. U25

NEW TEMPORARY CONSTRUCTION EASEMENT

CONTROL OF ACCESS EASEMENT DB

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

HIGH POINT
STA. 80+05.77
ELEV. = 652.00

(-) 1.22%

(+10) 650.75 VPT

VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.

VPI = 87+85.00
Elev. = 643.75
K = 82
280' V.C.

(+45) 645.46 VPC

LOW POINT
STA. 87+45.14
ELEV. = 644.85

(-) 1.22%

(+) 2.19%

(+25) 646.81 VPT

FINISHED GRADE

EXISTING GRADE

	80+00	81+00	82+00	83+00	84+00	85+00	86+00	87+00	88+00	89+00	90+00	91+00	92+00	93+00	94+00	95+00
EXISTING	652.00	651.94	651.73	651.38	650.87	650.27	649.66	649.05	648.44	647.83	647.22	646.61	646.00	645.40	644.97	644.85
FINISHED	652.00	651.45	651.29	650.96	650.46	648.92	648.41	648.56	647.91	647.30	646.67	646.02	645.38	644.81	644.42	644.34
EXISTING	644.85	644.97	645.03	645.51	646.30	647.36	648.45	649.55	650.64	651.74	652.83	653.92	655.02	656.11	657.21	658.30	659.39
FINISHED	644.34	644.51	644.93	645.74	646.69	647.60	648.87	650.15	651.19	652.26	653.24	654.38	655.54	656.70	657.83	658.88	

700 690 680 670 660 650 640 630 620 610

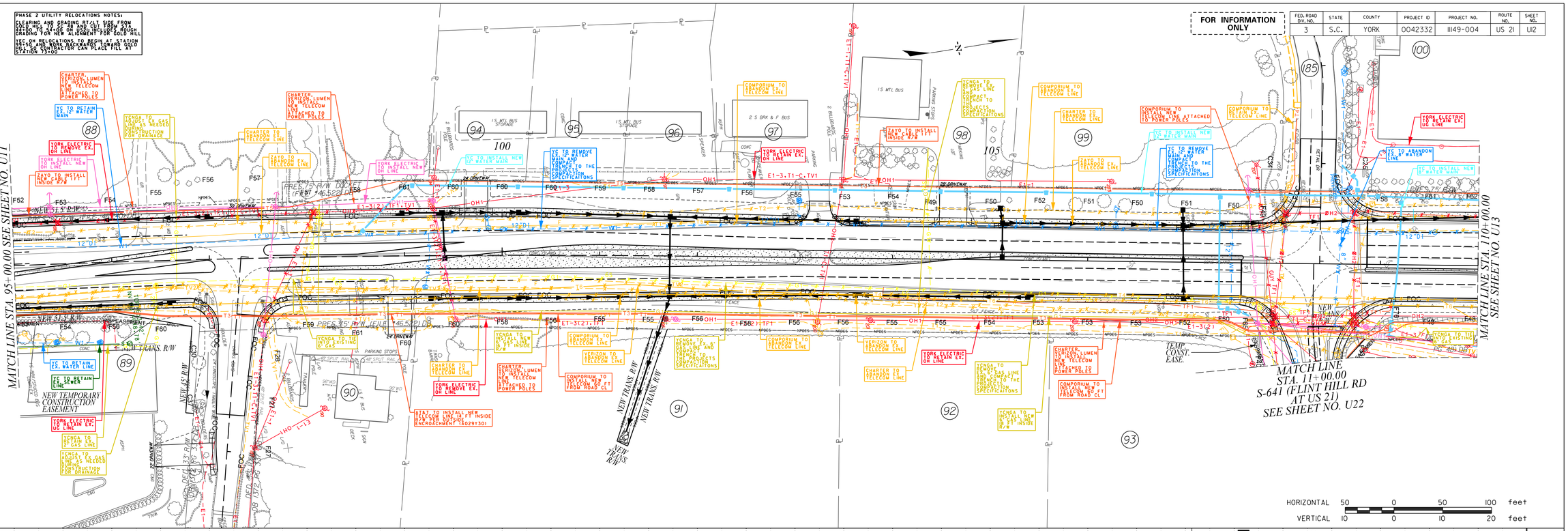
PROLINE.DGN

PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL ST. TO 30' NW AND CUT FROM STA. 102+00 TO STA. 97+00 OR DEPENDING ON ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL

TEC-DH RELOCATIONS TO BEGIN AT STATION 99+50 AND WORK BACKWARDS TOWARD GOLD HILL. TO CONTRACTOR CAN PLACE FILL BY STATION 73+00

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U12



STV Incorporated
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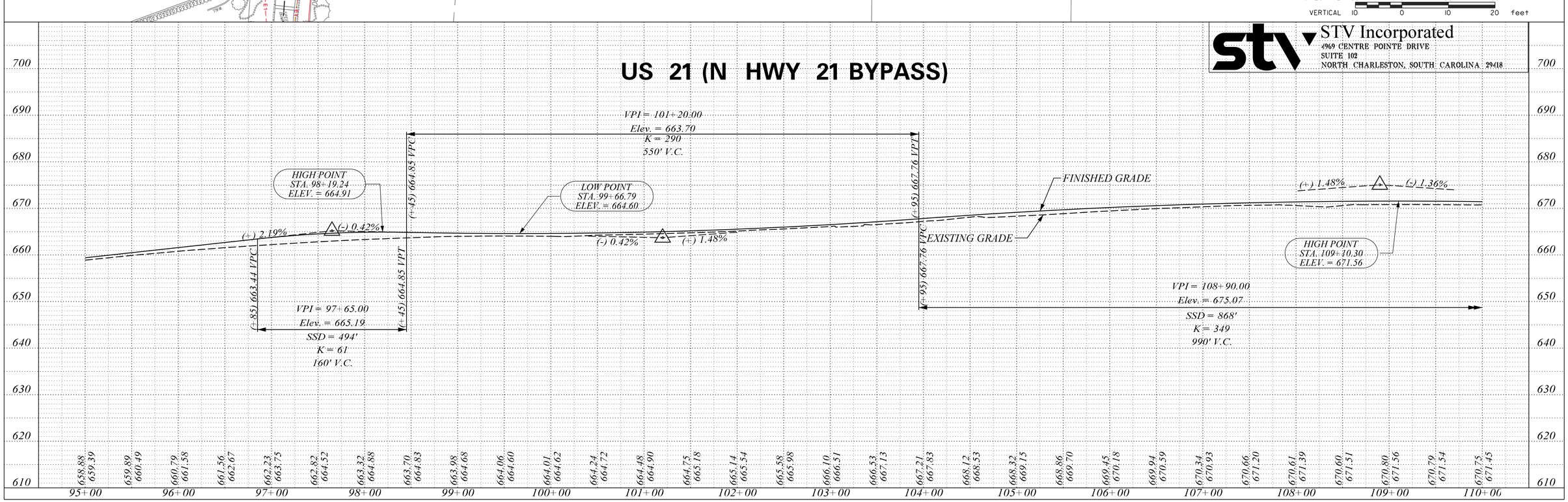
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

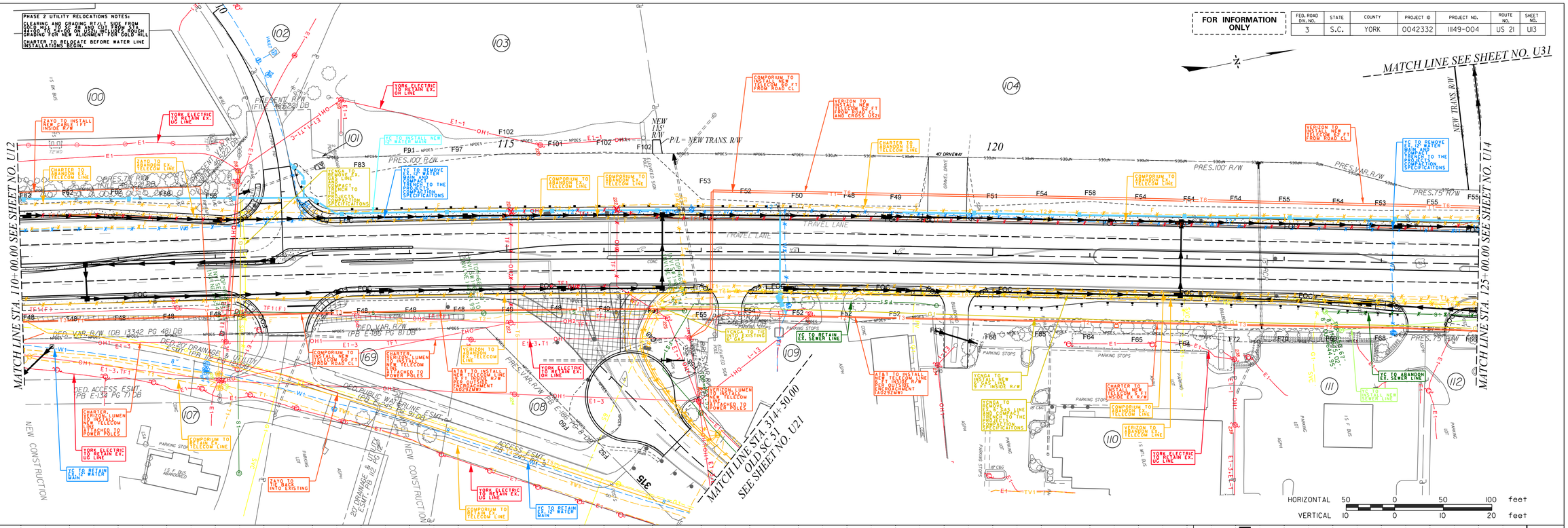


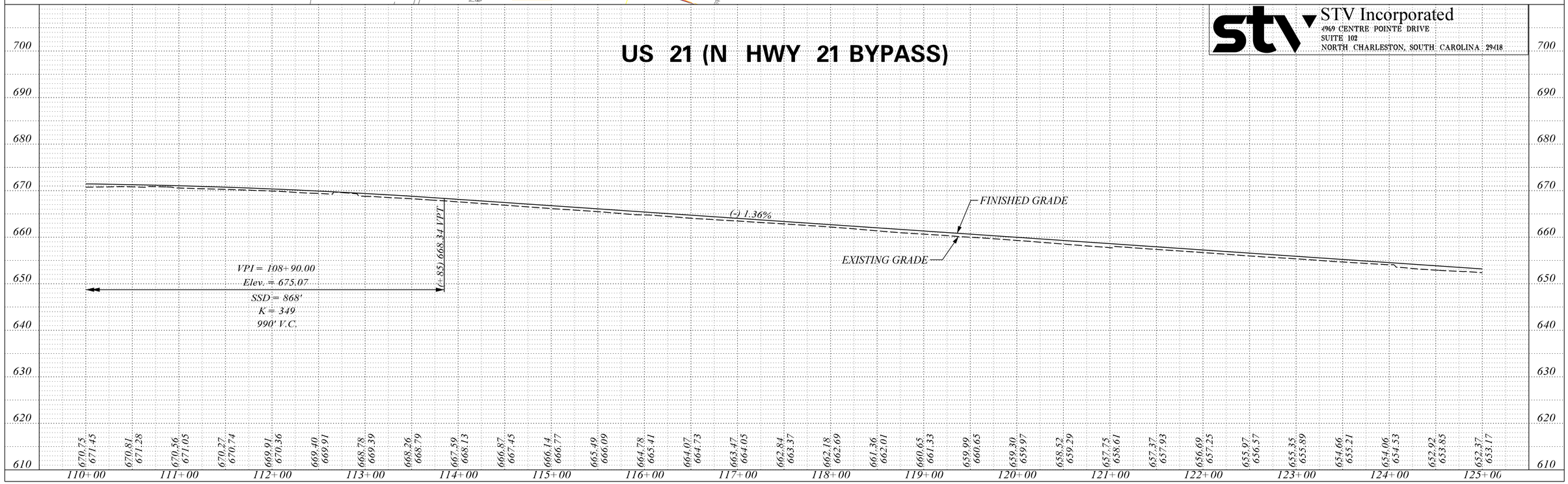
PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING AT/LT SIDE FROM STA. 110+00 TO STA. 120+00 (OLD STORY SW) GRADING FOR NEW ALIGNMENT FOR ZOLO HILL

CHARTER TO RELOCATE BEFORE WATER LINE INSTALLATIONS BEGIN.

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	U13





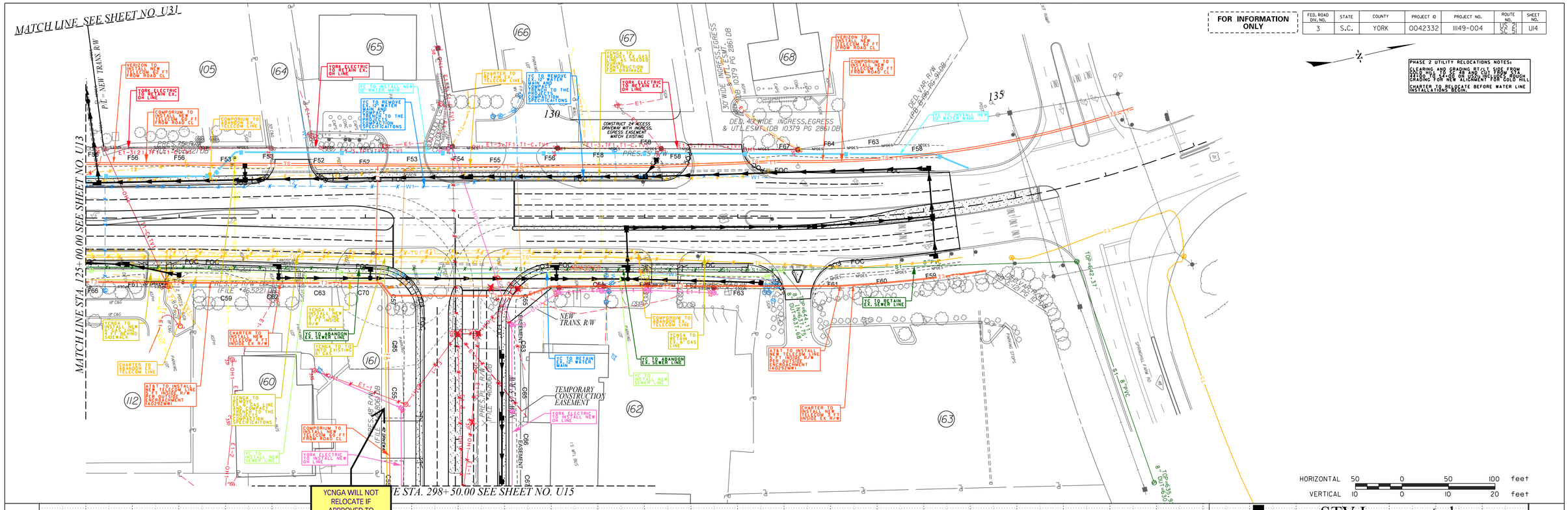
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21 SC 51	U14

PHASE 2 UTILITY RELOCATIONS NOTES:
CLEARING AND GRADING RT/LT SIDE FROM GOLD HILL TO SC 48 AND CUT FROM STA. 44+00 TO 54+00 ON US21 INCLUDES ROUGH GRADING FOR NEW ALIGNMENT FOR GOLD HILL
CHARTER TO RELOCATE BEFORE WATER LINE INSTALLATIONS BEGIN.



YCNGA WILL NOT RELOCATE IF APPROVED TO REMAIN IN PLACE ON SC 51.

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4969 CENTRE POINTE DRIVE
SUITE 102
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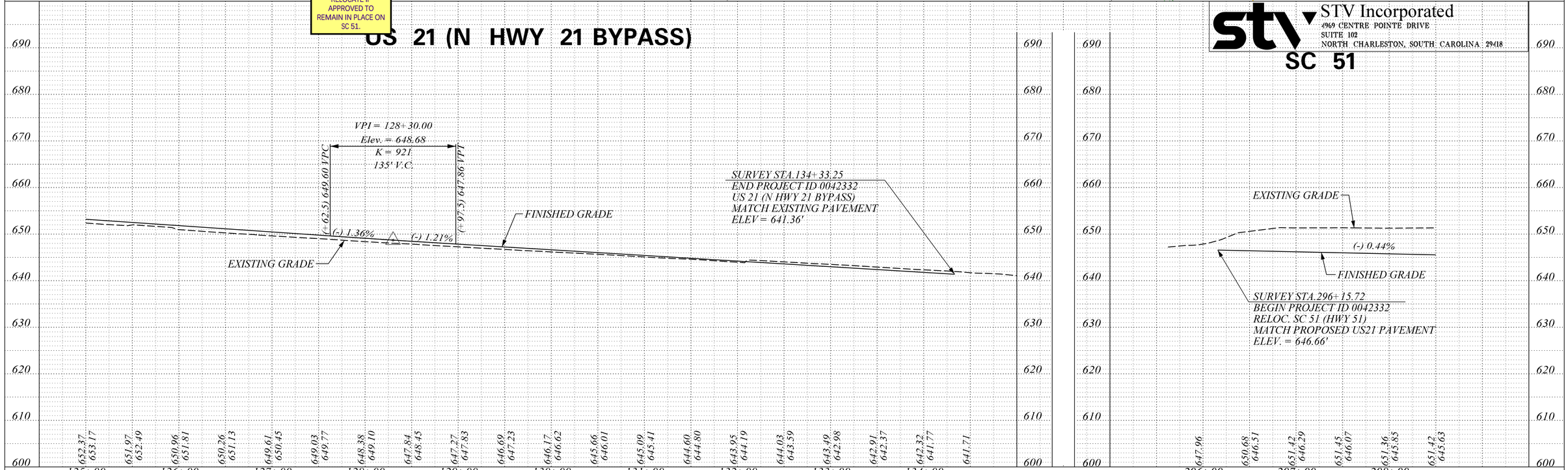
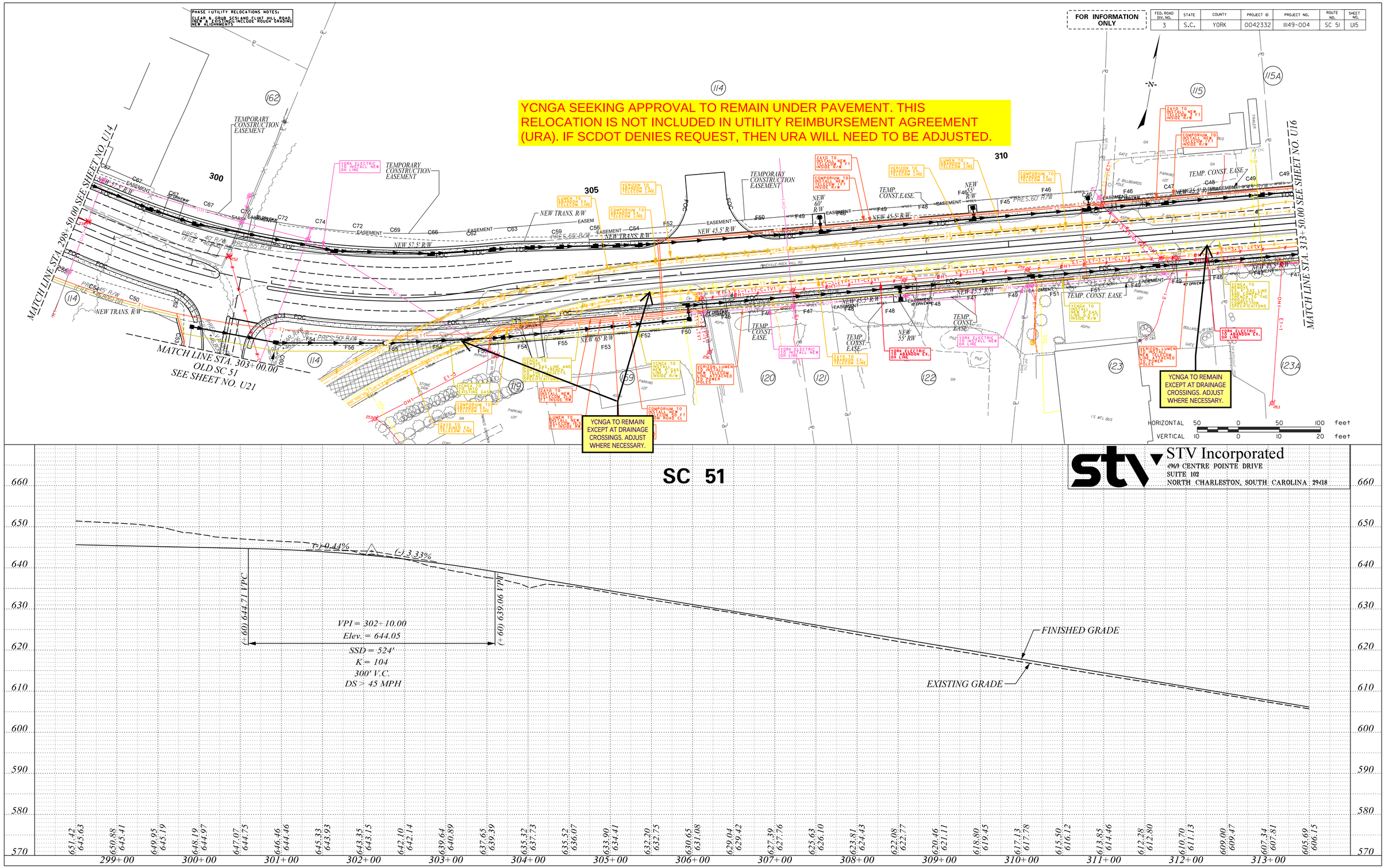


PROLINE.DGN



PHASE I UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SCSI AND FLINT HILL ROAD
NEW & EXISTING INCLUDE ROUGH GRADING
NEW ALIGNMENTS
FOR INFORMATION ONLY
FED. ROAD DIV. NO. 3
STATE S.C.
COUNTY YORK
PROJECT ID 0042332
PROJECT NO. 11149-004
ROUTE NO. SC 51
SHEET NO. U15
YCNGA SEEKING APPROVAL TO REMAIN UNDER PAVEMENT. THIS RELOCATION IS NOT INCLUDED IN UTILITY REIMBURSEMENT AGREEMENT (URA). IF SCDOT DENIES REQUEST, THEN URA WILL NEED TO BE ADJUSTED.
MATCH LINE STA. 298+50.00 SEE SHEET NO. U14
MATCH LINE STA. 303+00.00 OLD SC 51 SEE SHEET NO. U21
MATCH LINE STA. 313+50.00 SEE SHEET NO. U16
TEMPORARY CONSTRUCTION EASEMENT
NEW TRANS. R/W
NEW 57.5' R/W
NEW 45.5' R/W
NEW 60' R/W
NEW 65' R/W
NEW 55' R/W
TEMP. CONST. EASE.
YCNGA TO REMAIN EXCEPT AT DRAINAGE CROSSINGS. ADJUST WHERE NECESSARY.
HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418
SC 51
(-) 0.44%
(-) 3.33%
(+60) 644.71 VPC
(+60) 639.06 VPT
VPI = 302+10.00
Elev. = 644.05
SSD = 524'
K = 104
300' V.C.
DS > 45 MPH
FINISHED GRADE
EXISTING GRADE
660
650
640
630
620
610
600
590
580
570
651.42 645.63
650.88 645.41
649.95 645.19
648.19 644.97
647.07 644.75
646.46 644.46
645.33 643.93
643.35 643.15
642.10 642.14
639.64 640.89
637.65 639.39
635.32 637.73
635.52 636.07
633.90 634.41
632.20 632.75
630.65 631.08
629.04 629.42
627.39 627.76
625.63 626.10
623.81 624.43
622.08 622.77
620.46 621.11
618.80 619.45
617.13 617.78
615.50 616.12
613.85 614.46
612.28 612.80
610.70 611.13
609.00 609.47
607.34 607.81
605.69 606.15
299+00
300+00
301+00
302+00
303+00
304+00
305+00
306+00
307+00
308+00
309+00
310+00
311+00
312+00
313+00

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U16

FOR INFORMATION ONLY

PHASE 1 UTILITY RELOCATIONS NOTES:
CLEAR & GRUB SC51 AND FLINT HILL ROAD NEW & EXISTING INCLUDE ROUGH GRADING NEW ALIGNMENTS

MATCH LINE STA. 313+ 50.00 SEE SHEET NO. U15

MATCH LINE STA. 328+ 50.00 SEE SHEET NO. U17

MATCH LINE STA. 29+ 00.00
S-48 (SPRINGHILL FARM ROAD RELOC.)
SEE SHEET NO. U23

MATCH LINE STA. 17+ 00.00
S-641 (FLINT HILL AT SC 51)
SEE SHEET NO. U22

YCNGA TO REMAIN EXCEPT AT DRAINAGE CROSSINGS. ADJUST WHERE NECESSARY.

YCNGA TO REMAIN EXCEPT AT DRAINAGE CROSSINGS. ADJUST WHERE NECESSARY.

YCNGA SEEKING APPROVAL TO REMAIN UNDER PAVEMENT. THIS RELOCATION IS NOT INCLUDED IN UTILITY REIMBURSEMENT AGREEMENT (URA). IF SCDOT DENIES REQUEST, THEN URA WILL NEED TO BE ADJUSTED.

Tie new 2" PL to existing 4" STL

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

VPI = 316+15.00
Elev. = 597.33
K = 84
490' V.C.
DS = 45 MPH

(+ 70) 605.48 VPC

(- 60) 603.45 VPT

LOW POINT
STA. 316+49.93
ELEV. = 600.83

(-) 3.33%

(+) 2.50%

EXISTING GRADE

FINISHED GRADE

(+ 85) 614.05 VPC

(+) 2.50%

(-) 0.31%

HIGH POINT
STA. 328+18.13
ELEV. = 620.70

VPI = 325+85.00
Elev. = 621.54
SSD = 684'
K = 214
600' V.C.
DS > 45 MPH

6'x6' EXISTING BOX CULVERT
(EP-6) STA. = 316+23
INV. ELEV. = 589.30

HYDROLOGY DATA:
D.A.= 0.06sq.mi.= 38.5 ac.
Q50 = 53 cfs
Vel.= 8.53 ft/sec
50Year H.W. Elev.= 595.22 ft.
Including 4.0 ft. Headwater
Q100 = 59 cfs
Vel = 8.99 ft/sec
100 Year H.W. Elev. = 595.37 ft.
Including 4.2 ft. Headwater
OVERTOPPING FLOOD:
Q = 271.31 cfs
Probability = less than 0.2%

650 640 630 620 610 600 590 580 570 560

605.69 606.15 | 604.05 604.54 | 602.44 603.20 | 600.99 602.16 | 599.92 601.42 | 599.34 600.98 | 599.20 600.83 | 599.59 600.98 | 600.40 601.42 | 601.55 602.16 | 602.76 603.20 | 603.98 604.45 | 605.22 605.69 | 606.46 606.94 | 607.76 608.19 | 609.02 609.44 | 610.26 610.68 | 611.55 611.93 | 612.84 613.18 | 614.04 614.42 | 615.18 615.58 | 616.20 616.61 | 617.09 617.53 | 617.83 618.34 | 618.52 619.02 | 619.05 619.59 | 619.50 620.04 | 619.80 620.38 | 620.00 620.60 | 620.05 620.70 | 620.00 620.68

314+00 315+00 316+00 317+00 318+00 319+00 320+00 321+00 322+00 323+00 324+00 325+00 326+00 327+00 328+00

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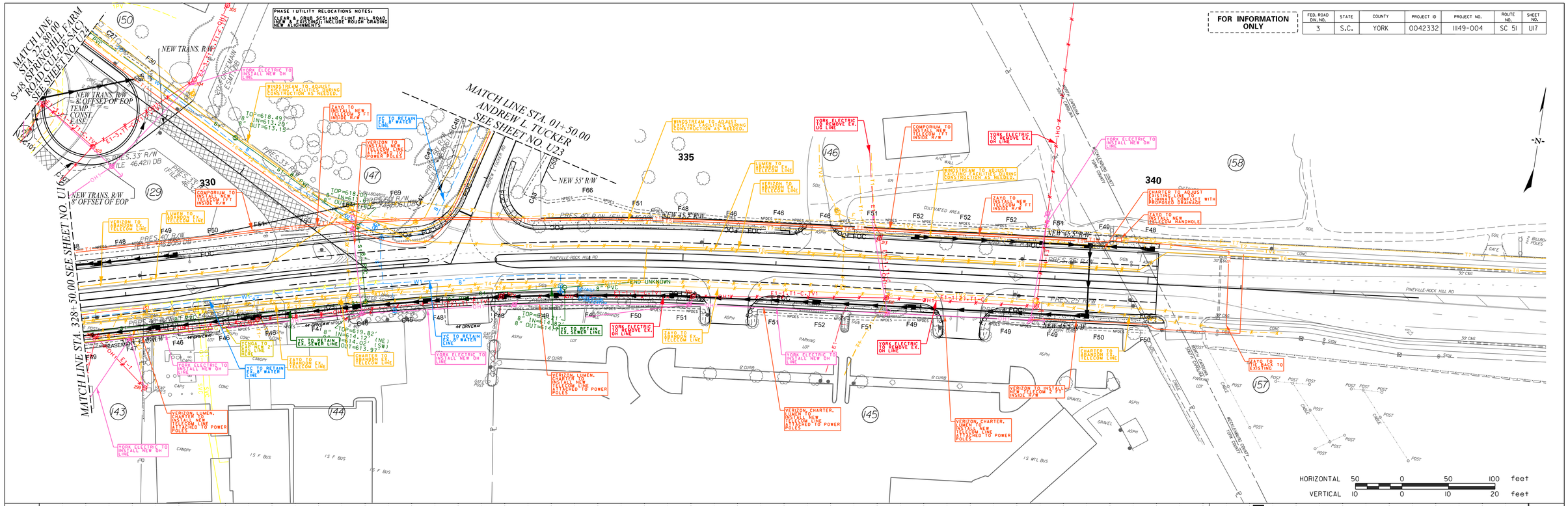
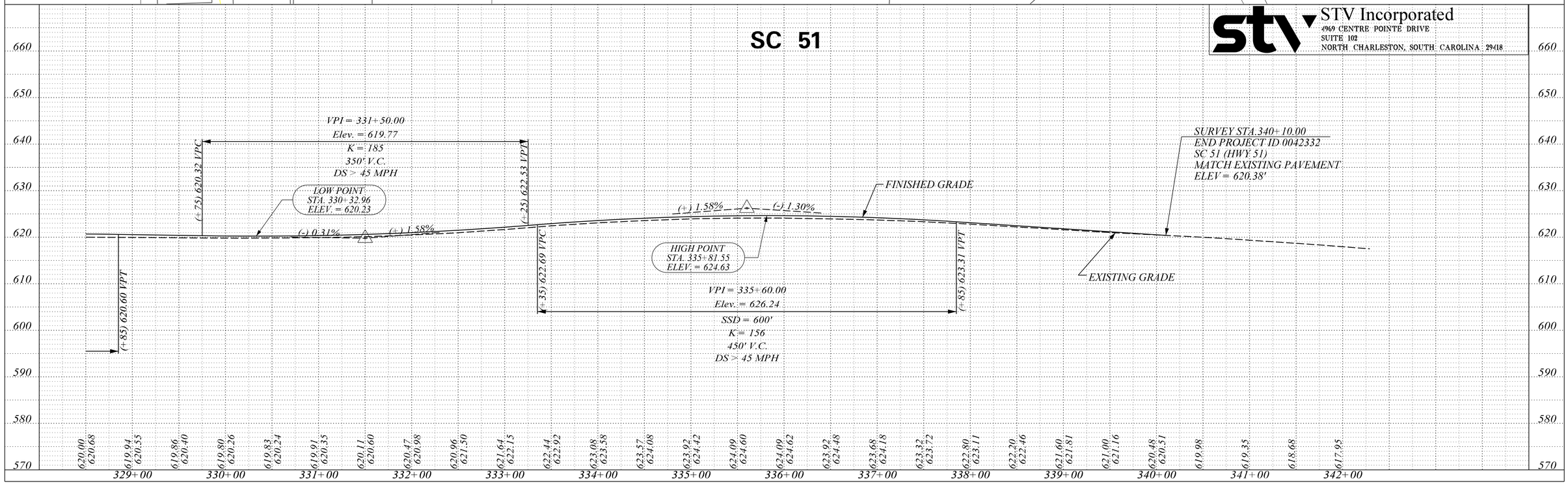
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 51	U17



STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

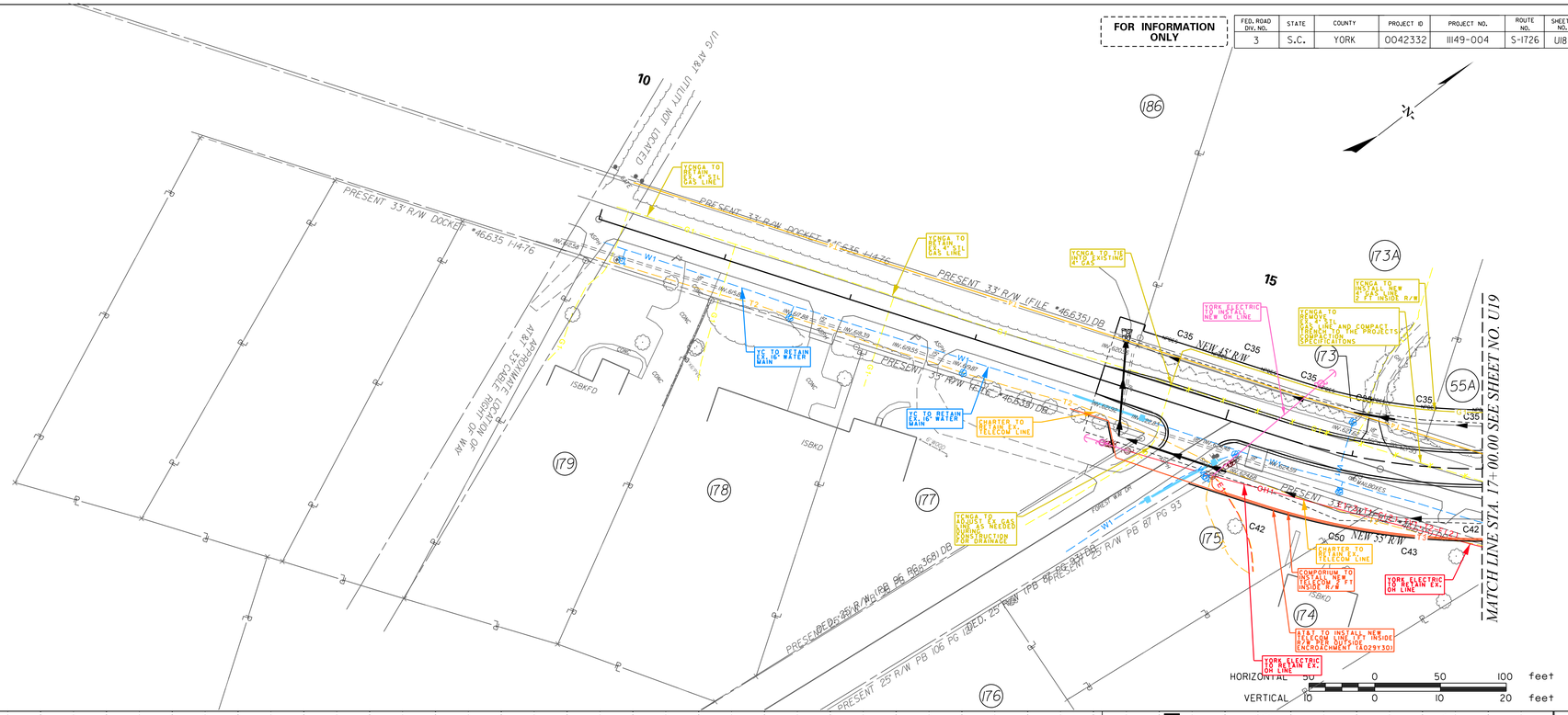
SC 51



PROLINE.DGN

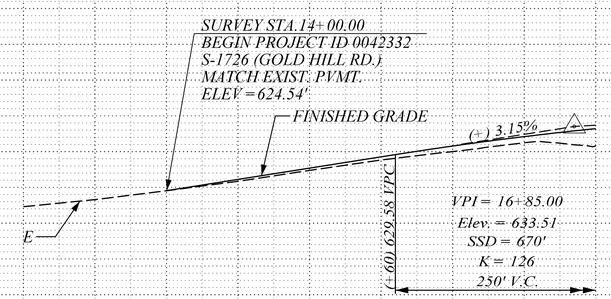
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	S-1726	U18



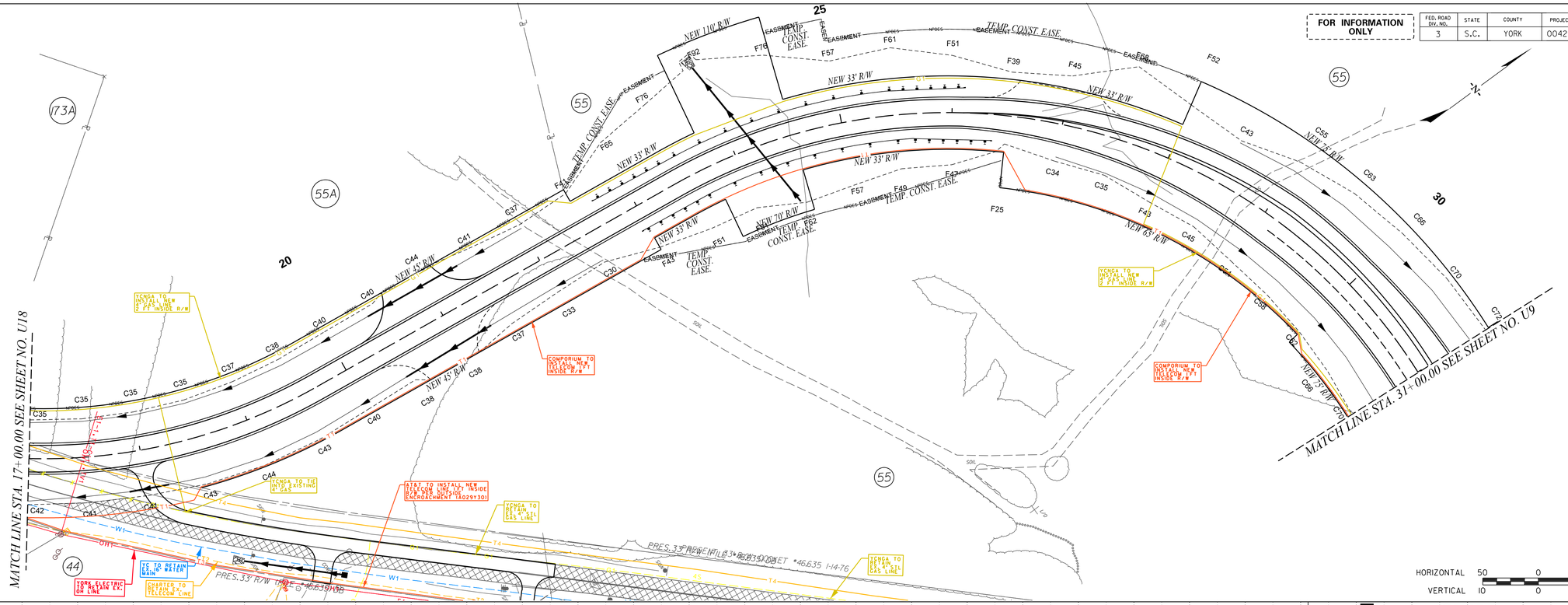
S–1726 (GOLD HILL RD.)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



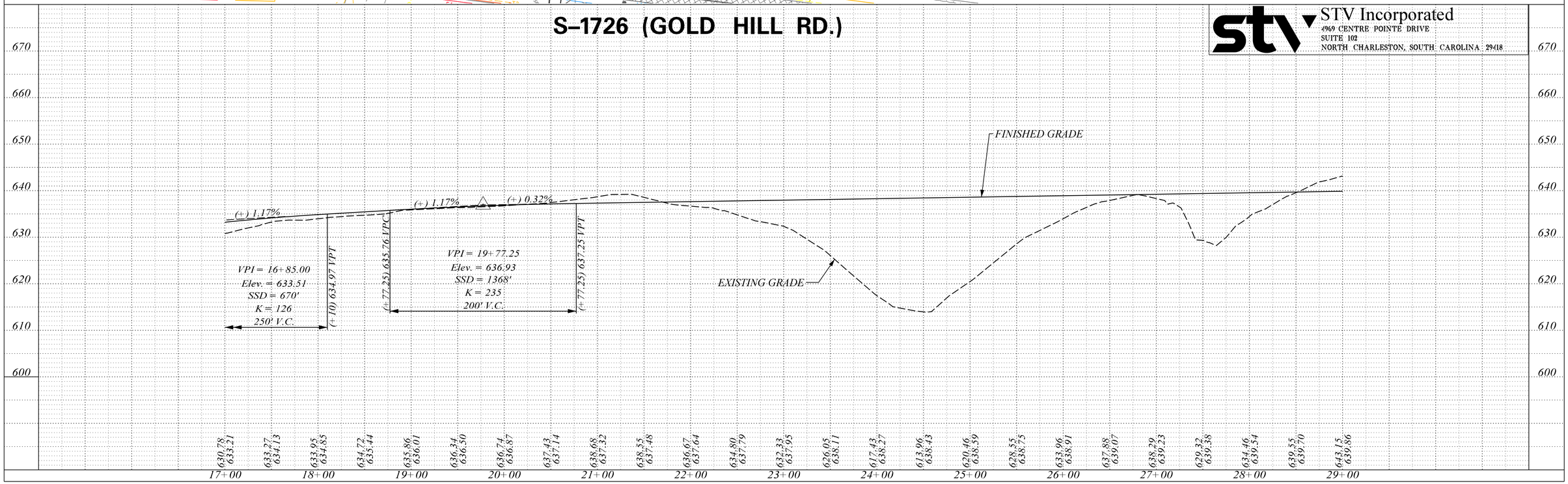
FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-1726	U19

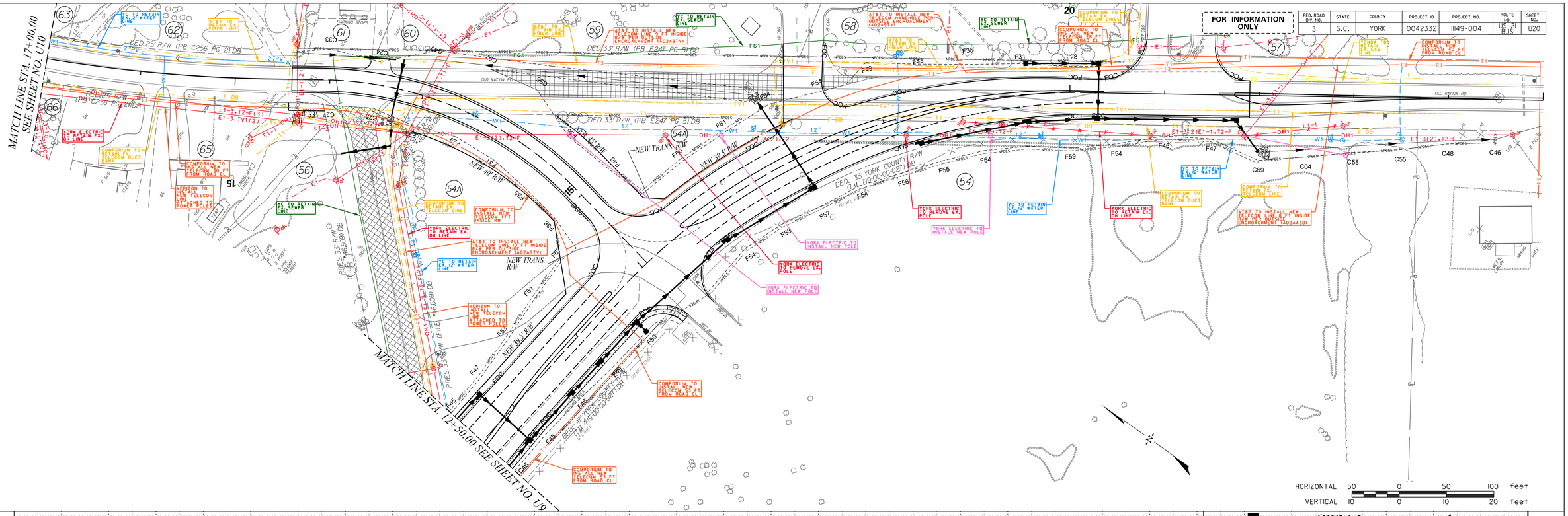


S-1726 (GOLD HILL RD.)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

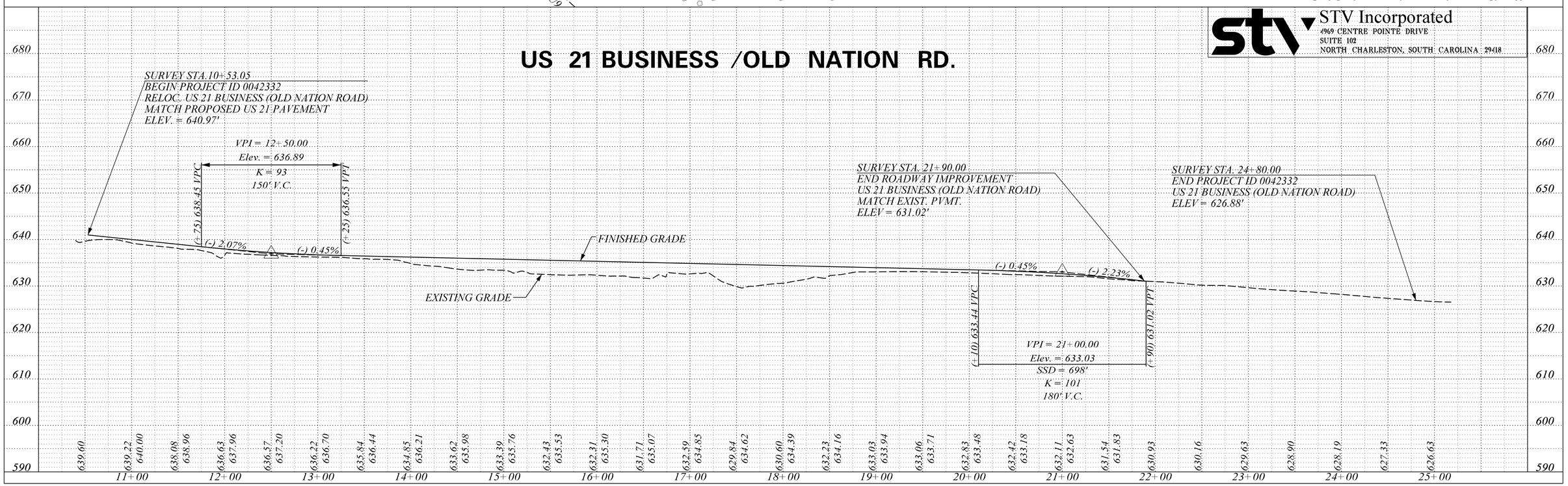


PROLINE.DGN



US 21 BUSINESS /OLD NATION RD.

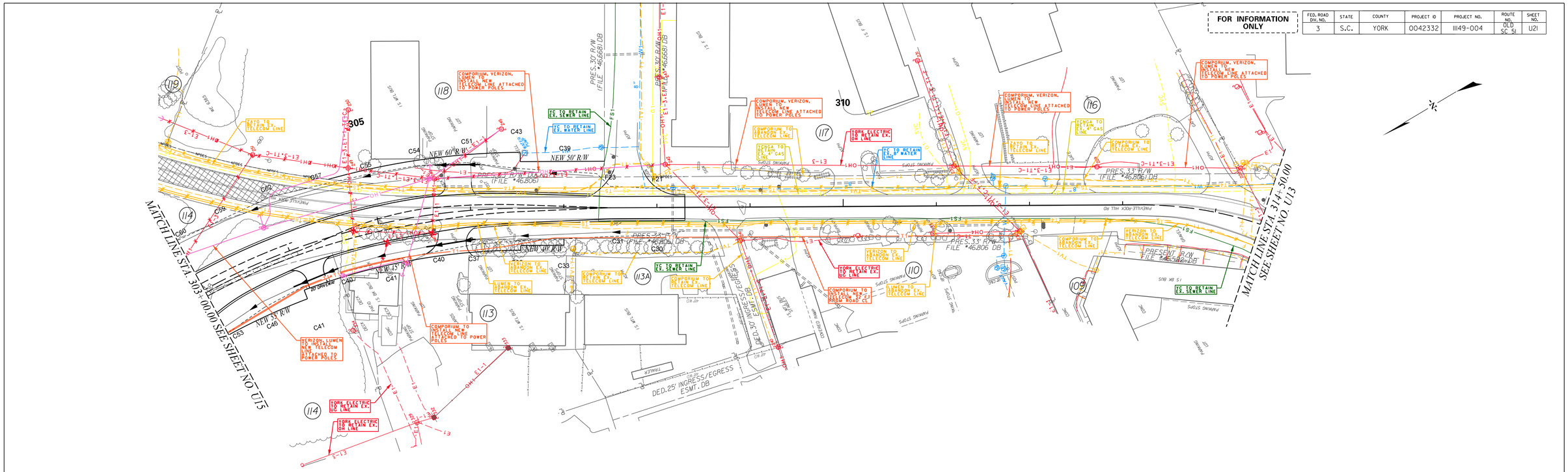
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

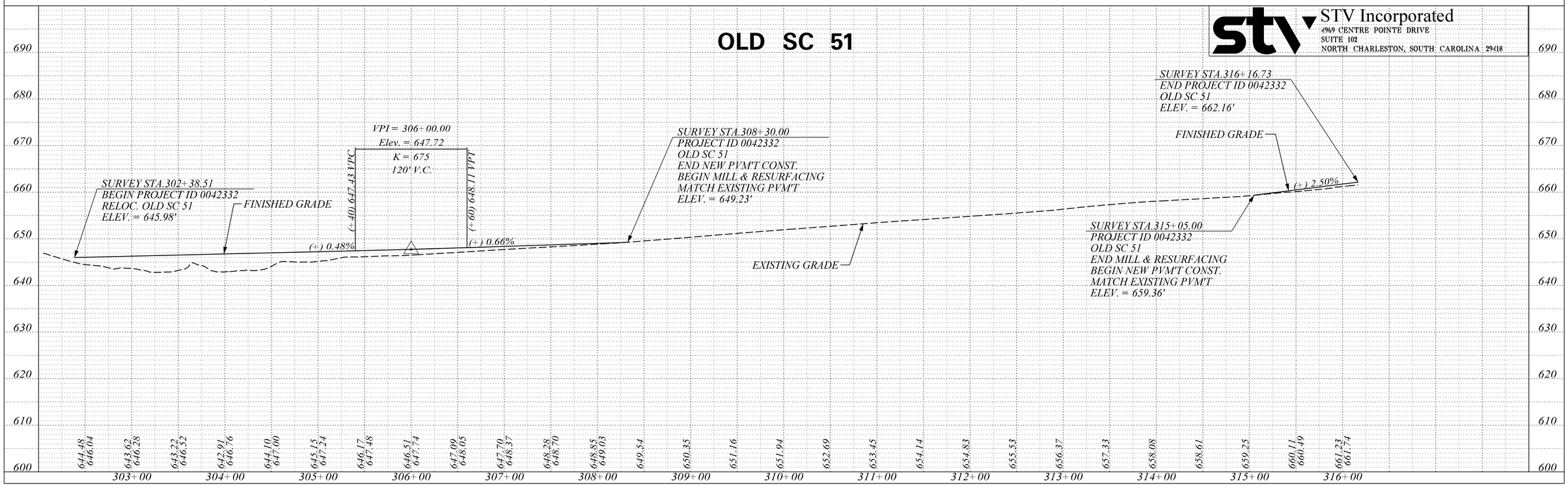


PROLINE.DGN

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	OLD SC 51	U21



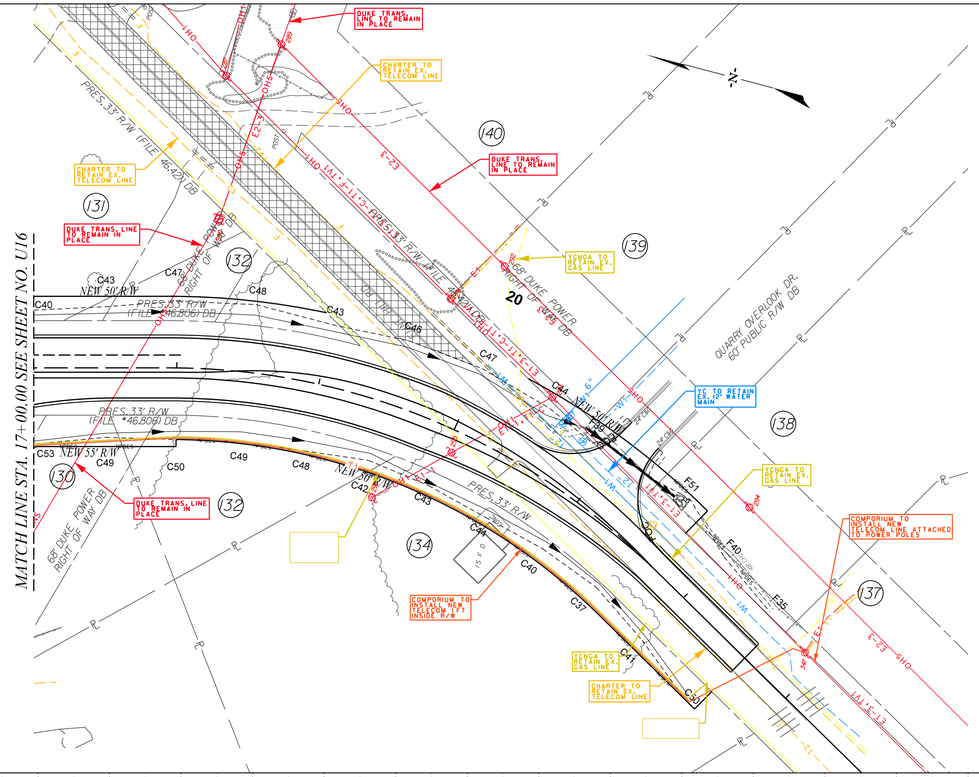


STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

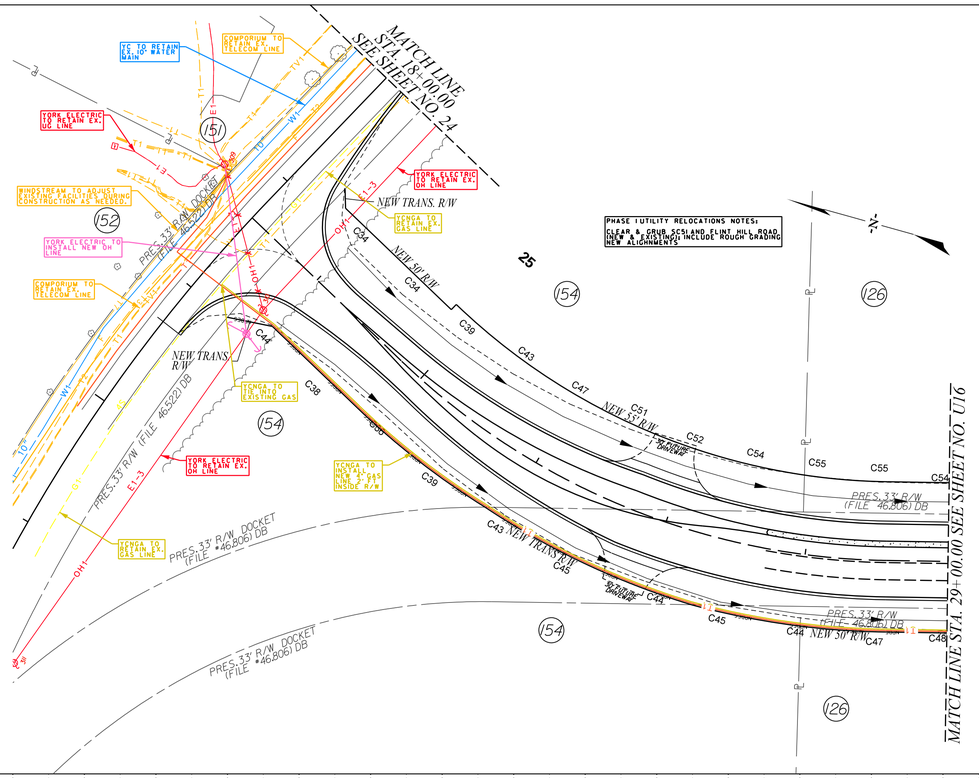
FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-641	U22

FOR INFORMATION ONLY

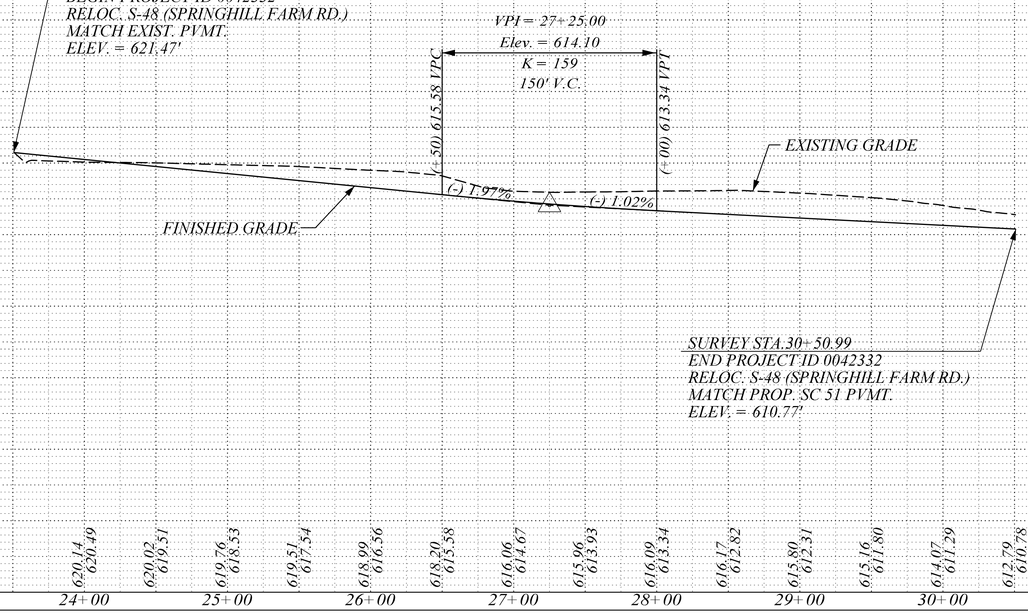


FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	S-48 S-328	U23

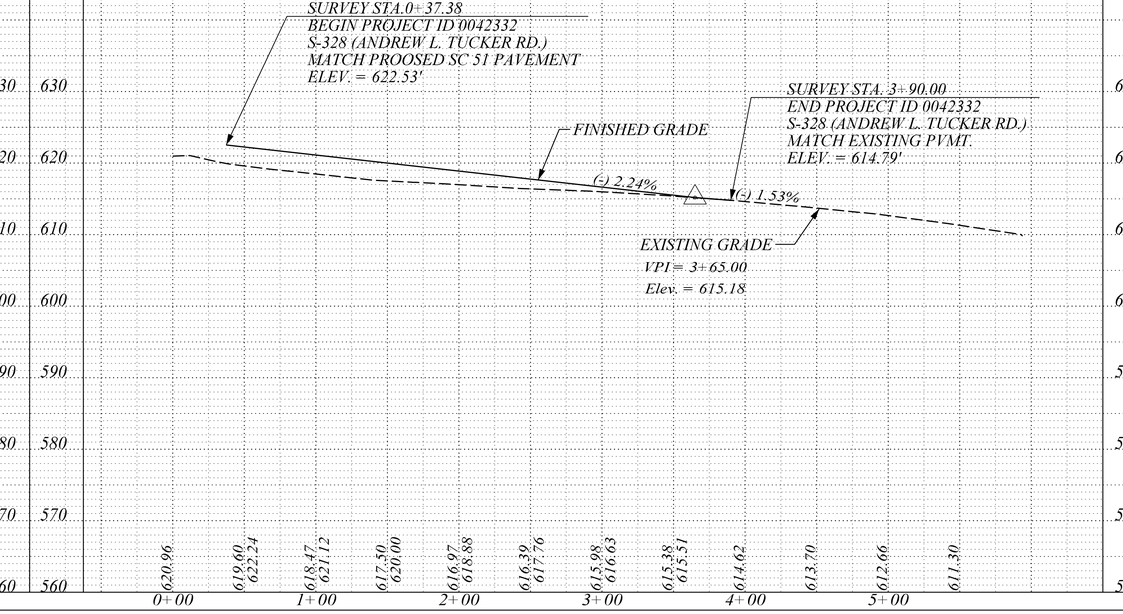
FOR INFORMATION ONLY



S–48 (SPRINGHILL FARM RD. RELOC.)



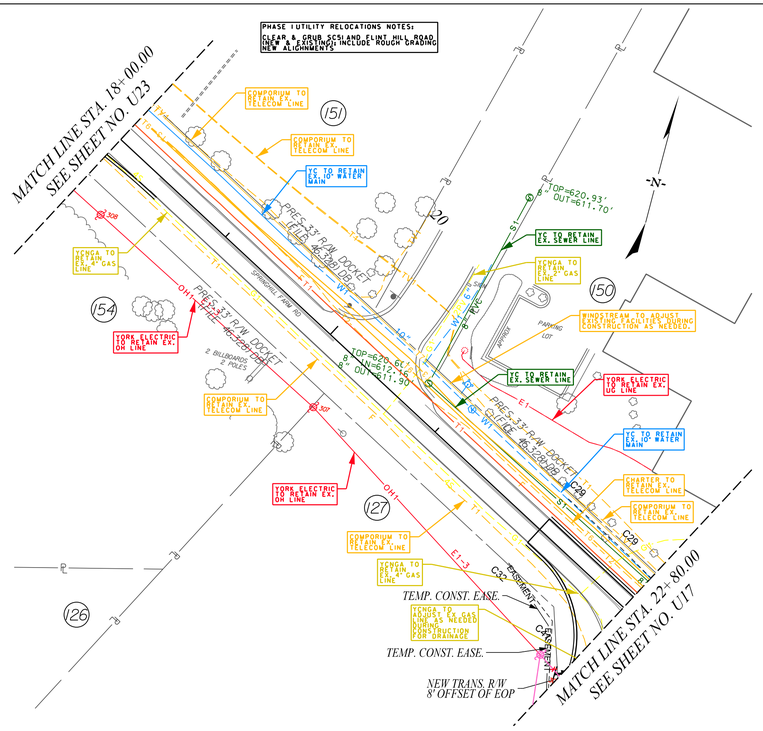
S–328 (ANDREW L. TUCKER RD.)



STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

PROLINE.DGN

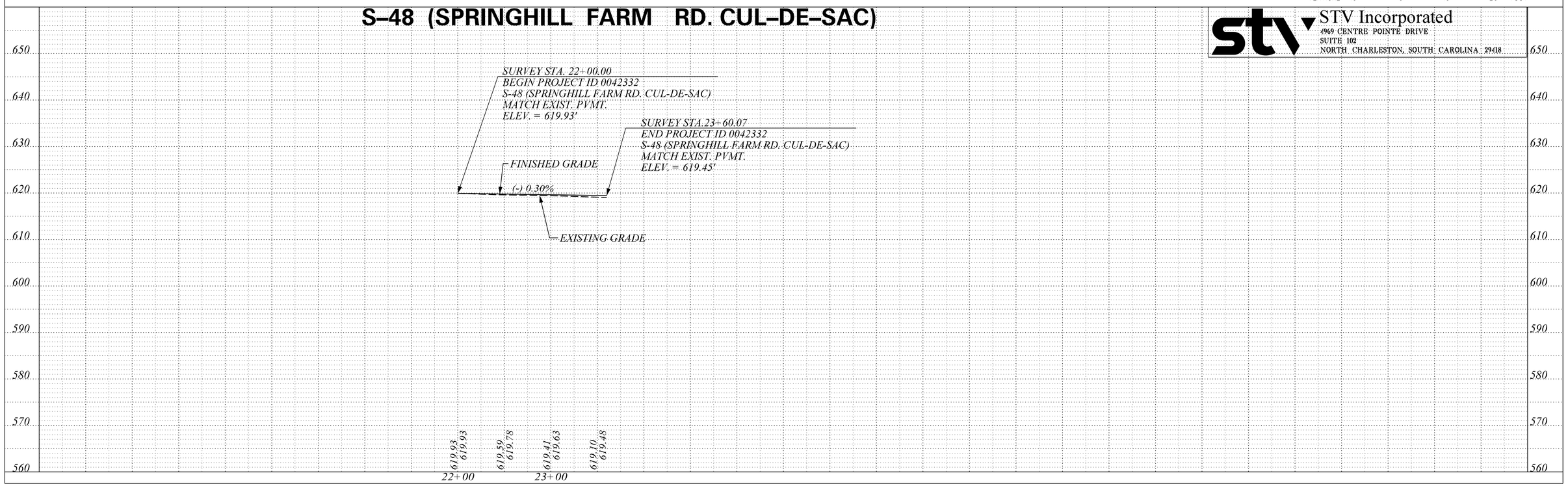
FOR INFORMATION ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	11149-004	S-48	U24



HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

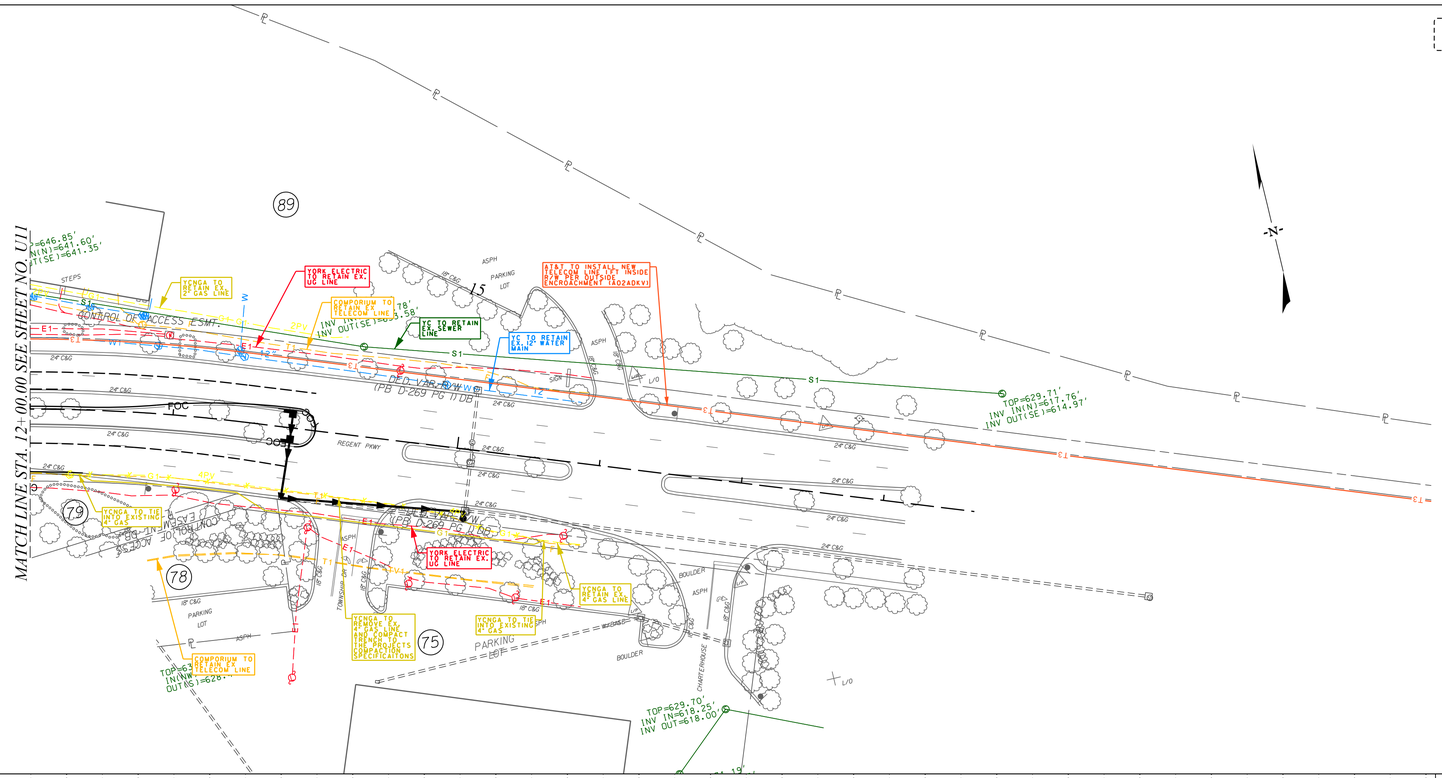
S–48 (SPRINGHILL FARM RD. CUL–DE–SAC)

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



PROLINE.DGN

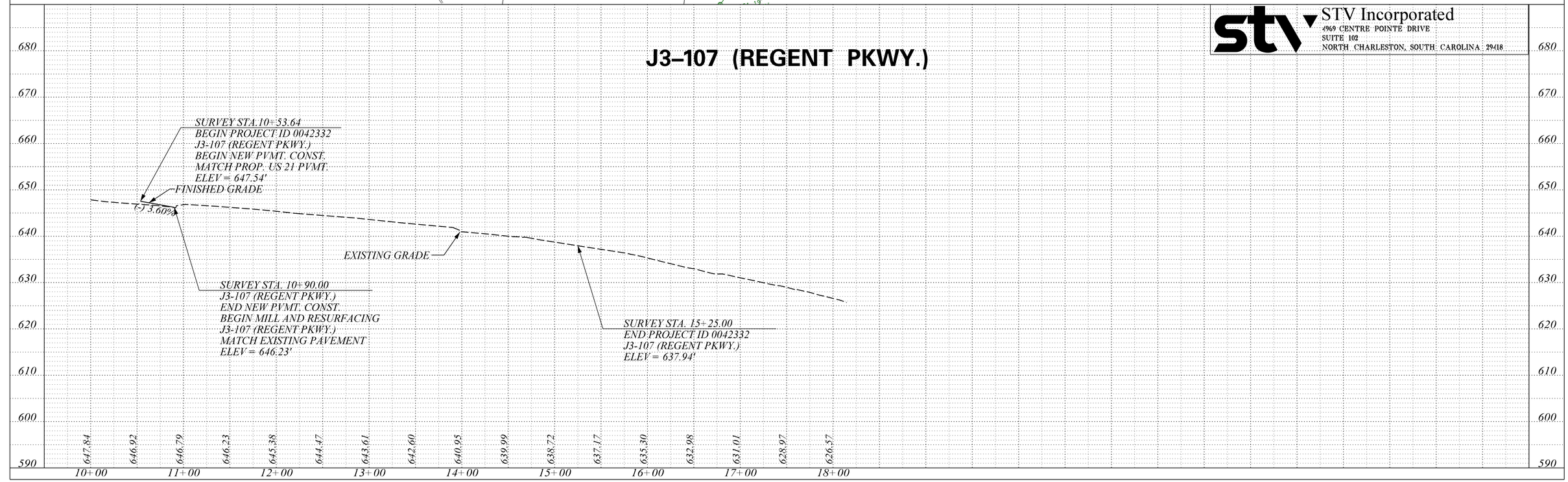
FOR INFORMATION ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	1149-004	J3-107	U25



HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

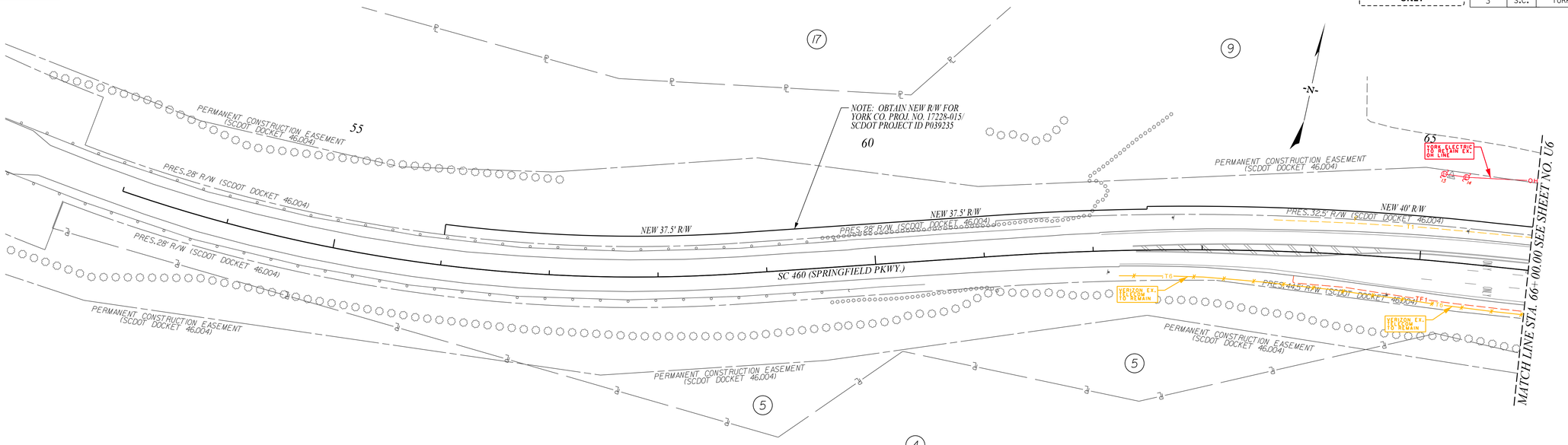
J3–107 (REGENT PKWY.)

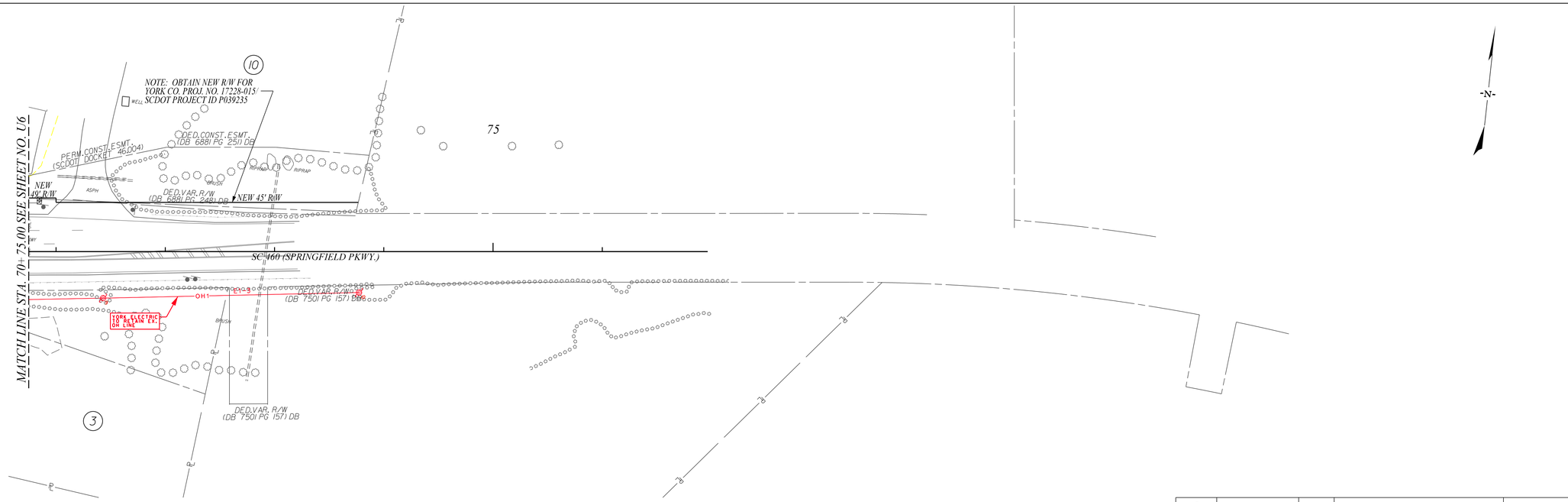


PROLINE.DGN

FOR INFORMATION ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	SC 460	U30





STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

SCALE 1" = 50' RTE. DWG. NO. U30

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

H:\U\Projects\255776\255776.000\90_CAD Models and Sheets\04_CT_Transportation\Utilities\Utility Plan Sheets & PDFs\UTL_255776 PLN SHT30.dgn
7/22/2024

August 20, 2024

Steven Moss
Sr. Construction Project Manager - Engineering
York County Government
6 S Congress Street
York, SC 2975

RE: Project No. P0042332/11149-004 – US21/SC51
York Co: Relocation Package – York Electric Corporation

Dear Mr. Moss –

Below you will find a brief description of the proposed work and submittal explanation. Please refer to York Electric's individual plans for details, or this document for plan status.

Scope of Work and Package Contents

Relocation Package

- Updated Utility Agreement
- Updated Detailed Cost Estimate
- Encroachment Permit Application
- Relocation Plans and associated U-sheets

Scope of Work Summary

Location	Utility Type	Scope of Work	Cost*
US21	OH poles & services	Install new primary pole line from Sta 30+00 to 45+00	York County
US21	OH poles & services	Install new primary pole line from Sta 71+00 to 100+00	York County
US21	OH poles & services	Install new primary pole line from Sta 129+00 to 132+00	York County
SC51	OH poles & services	Install new primary pole line from Sta 295+00 to 339+00	York County
Gold Hill	OH pole	Install new primary pole at Sta 15+50	York County
Old Nation	OH poles	Install new primary poles along Old Nation Road	York County

It is STV's recommendation that this relocation package be approved and proceed to the formal agreement.

Should you have any additional questions or comments, please feel free to call me (843-207-2031) or email me at natalie.roumillat@stvinc.com .

Sincerely,

N. Oriana Roumillat

N. Oriana Roumillat, P.E.
Utility Coordinator
STV Incorporated

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US 21 NORTH AND HWY 51

This Agreement made this 4th day of June, 20 24 by and between

York County, hereinafter called "County" and the utility company

York Electric Cooperative, Inc.

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

~~Relocate overhead and underground facilities as required for the entire project.~~

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $ 1,517,235.03

County Share $ 1,517,235.03 Company Share $ 0.00

(a) The Company ☑ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☐ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately 50 years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: Wes Dover
Phone Number: 803-627-0824
Email: wes.dover@yorkelectric.net

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

(●) BY COMPANY'S REGULAR FORCES

( ) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

_____

_____

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

☑ Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

☐ Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company’s delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Company agree participate in pre-litigation mediation and agree to diligently work in good faith to resolve any disputes associated with the costs charged to the Company for extreme delays. The parties shall select a mediator approved by both parties and set forth any resolutions in writing signed by both parties.

Should the parties fail to reach an agreement through pre-litigation mediation, the parties may seek a resolution for the dispute through the Court of Common Pleas located in York County, South Carolina, or the United States District Court for the State of South Carolina. This agreement shall be governed exclusively by the laws of the State of South Carolina without giving effect to its conflicts of law provisions.

12. The County shall have the right to inspect all recovered materials from the permanent facility prior to disposal by sale or scrap. This requirement will be satisfied by the Company giving notice to the County of the time and place the materials will be available for inspection. This notice is the responsibility of the Company and it may be held accountable for full value of materials disposed of without notice. The Company shall furnish a listing on final billings of major items not eligible for salvage credit and reasons therefore.

13. The Company will abide by the contract cost principles as set forth in FAPG 23 CFR 645A.

14. The Company will not participate directly or indirectly in any practice that subjects persons to discrimination because of their race, color, religion, sex, or national origin.

COMPANY: York Electric Cooperative Inc.

ADDRESS: 1385 East Alexander Love Hwy, York

BY: Wesley G. Dover

NAME: Wesley G. Dover

TITLE: Manager of Field Staking

YORK COUNTY

BY: _____
Joshua S. Edwards
County Manager

INSTRUCTIONS: Submit three original copies of this agreement form and three prints of drawings showing present location and proposed location of poles or lines with reference to highway survey stations and centerline.

SCDOT Form 3068-B

DETAILED ESTIMATE OF DIRECT COST

File No. 42332 **F. A./State Project No.** 11149-004
PIN **Route/Road No.** US 21 NORTH AND SC 51

1. DETAIL OF PRELIMINARY ENGINEERING:			**ESTIMATE**
A. Labor			$ 60,000.00
B. Equipment and Mileage			
C. Other expenses (meals, lodging, etc.)			
D. Overhead:	**Percent**		
F.O.A.B.			
Federal Unemployment			
State Unemployment			
Workman's Compensation			
Public Liability			
Hospital Insurance			
Retirement			
Paid Leave and Holidays			
Overhead Subtotal:			**$ -**
Detail of Preliminary EngineeringTotal:			**$ 60,000.00**
2. LABOR:			
A. Temproary Installation			$ 18,000.00
B. Removal			$ 283,357.00
C. Permanent Installation			$ 623,294.64
D. Other expenses (meals, lodging, etc.)			
E. Overhead:	**Percent**		
F.O.A.B.			
Federal Unemployment			
State Unemployment			
Workman's Compensation			
Public Liability			
Hospital Insurance			
Retirement			
Paid Leave and Holidays			
Overhead Subtotal:			**$ -**
Labor Total:			**$ 924,651.64**
3. MATERIALS: (Itemize major components or list units)			
A. Temproary Installation			$ 21,559.13
B. Permanent Installation			$ 409,623.55
C. Handling Costs			$ 90,512.69
Materials Total:			**$ 521,695.37**

DETAILED ESTIMATE OF DIRECT COST

4. EQUIPMENT		
A. Mileage and cost per mile (Hour)		above labor includes 200
	Equipment Total:	**$ -**
5. RIGHT OF WAY		
A. Labor		$ 30,000.00
B. Transportation		$ -
C. Acquisition		$ -
D. Other (Meals, Lodging, etc.)		$ -
	Right of Way Total:	**$ 30,000.00**
LESS CREDITS:		
1. Betterment (Show computations)		$ -
2. Extended Service Life (Show Computations)		$ -
3. Salvage:		
A. Materal recovered from:		
1. Permanent Facility		$ 14,111.98
2. Temporary Facility		$ 5,000.00
	Less Credits Total:	**$ 19,111.98**
	NET COST OF ADJUSTMENT:	**$ 1,517,235.03**

NOTE: If estimate is made on the unit basis, attach separate listing showing unit, quantity, material cost, labor cost, and total for each unit. Show separate listing for temporary installation, removal and permanent installation. Labor on company records must be kept on daily basis showing hours worked and rates of pay.

Submit six copies with agreement.

LISTING OF CHANGES BY STATIONS:

Application for Encroachment Permit

S.C. Department of Transportation

Form 637 (Rev 09/2015)

Contact Information

Applicant: YorkElectricCooperativeInc

Street: 1385 East Alexander Love HWY

City: York

State: SC **Zip Code:** 29745

Phone: (803)628-5545 **Fax:**

Email: Tim.Scism@yorkelectric.net

Contact: Tim Scism

Project Location

Primary County: York

County	Road Name
York	**Highway 21 Byp N (US 21)**
York	**Highway 51 (SC 51)**

1. Type of Encroachment: ELECTRIC

YEC will be relocating overhead and underground facilities along US 21 North & SC 51 also maintaining prior rights. The facilities being relocated were found to be in conflict with the US 21 North Phase I and SC 51 widening project.

2. Description of Location:

The overhead and underground YEC facilities being relocated are located throughout this entire project.

(Attach sketch indicating roadway features such as: pavement width, shoulder width, sidewalk and curb and gutter location, significant drainage structure, north arrow, right of way width, and location of the proposed encroachment with respect to the roadway centerline and the nearest intersecting road on the State system.)

Customer Agreement

3. **The undersigned applicant hereby requests the SCDOT to permit encroachment on the SCDOT right of way as described herein. It is expressly understood that the encroachment, if and when constructed, shall be installed in accordance with the sketch attached hereto and made a part hereof. The applicant agrees to comply with and be bound by the SCDOT's "A Policy for Accommodating Utilities on Highways Rights of way", "Standard Specifications for Highway Construction", the "General Provisions" and "Special Provisions", attached hereto or made a part hereof by reference, during the installation, operation and maintenance of said encroachment within the SCDOT's Right of Way. DISCHARGES OF STORM WATER AND NON-STORM WATER: Work within State Highway right-of-way shall be conducted in compliance with all applicable requirements of the National Pollutant Discharge Elimination System (NPDES) permit(s) issued to the Department of Transportation (Department), to govern the discharge of storm water and non-storm water from its properties. Work shall also be in compliance with all other applicable Federal, State and Local laws and regulations, and with the Department's Encroachment Permits Manual and encroachment permit. The encroachment permit will not be issued until the applicant has received an NPDES construction permit from SC Department of Health and Environmental Control.**

The applicant agrees to comply with all current SCDOT Standards Specifications for Highway Construction including all Supplemental Technical Specifications. The applicant hereby further agrees, and binds his/her/its heirs, personal representatives, successors, assigns, to assume any and all liability for accidents or injuries to persons, or damage to property, including the highway, that may be caused by the construction, maintenance, use, moving or removing of the physical appurtenances contemplated herein, and the applicant agrees to indemnify and hold SCDOT harmless from and against any and all claims for personal injury and/or property damage, including attorney fees and costs, which may be sustained by reason of the construction, maintenance or existence of said encroachment on the SCDOT's right of way.

Applicant's Name: William T Scism **Date:** 10/22/2021

(Please print or type)

Applicant's Sig: _____ **Title:** Engineer

For Office Use Only

For Office Use Only

In accordance with your request and subject to all the provisions, terms, conditions, and restrictions stated in the application and the general and special provisions attached hereto, the SCDOT hereby approves your application for an encroachment permit. This permit shall become null and void unless the work contemplated herein shall have been completed prior to:

See Attached Special Provision and/or Permit Requirements

NPDES Permit Nbr:

(Date received by res. Maint. Engr.) **(SCDOT Approval)** **(Date)**

COMPANY	CONTACT	PHONE NO.
POWER - E1 York Electric Corporation	Tim Scism PO Box 150 1385 A. Alexander Love Hwy York, SC 29745	803-684-4247
POWER - E2 Duke Energy	Mike Robinson 526 South Church St. Charlotte, NC 28202	980-373-4228
POWER - E3 Santee Cooper	Christine Pope One Riverwood Dr. PO Box 2946101 Moncks Corner, SC 29461	843-761-8000 Ext. 5084
TELECOM - T1 Comporium	Jake Stevenson 471-A Lakeshore Pkwy Rock Hill, SC 29730	803-326-6129
TELECOM - T2 Duke Net	Raymond Ragusky 400 S. Tryon St. Suite 29B Charlotte, NC 28285	704-382-6640
TELECOM - T3 AT&T	Mike Nat 100 Belton Dr. Spartanburg, SC 29301	864-573-4016 864-494-4822

COMPANY	CONTACT	PHONE NO.
TELECOM - TV1 Comporium	Jake Stevenson 471-A Lakeshore Pkwy Rock Hill, SC 29730	803-326-6129
TELECOM - TV2 Time Warner Communications	Gus Yoannon 4606 Margaret Wallace Rd. Matthews, NC 28105	704-416-5930
GAS - G1 York County Natural Gas	Stephen Comer 979 W. Main st. Rock Hill, SC 29731	803-323-5388
WATER - W1 York County Water and Sewer	Ron Pompey 6 South Congress St. York, SC 29745	803-684-8571
Sewer - S1 York County Water and Sewer	Ron Pompey 6 South Congress St. York, SC 29745	803-684-8571
TRAFFIC CONTROL - TF1 SCDOT	John Huskins 338 Robertsion Rd. West Rock Hill, SC 29730	803-324-3545 Ext. 25

FINAL PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT
	3	S.C.	YORK	0042332	1149-(

MATCH LINE STA. 66+00.00 SEE SHEET NO. 30

SURVEY STA. 14+78.91
BEGIN PROJECT ID 0042332
US 21 (N HWY 21 BYPASS)
MATCH EXISTING PAVEMENT

N 6° 53' 17" E
US 21 (N HWY 21 BYPASS)

76°53' 44"

N 83° 47' 01" E
SC 460 (SPRINGFIELD PKWY.)

NOTE: OBTAIN NEW R/W FOR YORK CO. PROJ. NO. 17228-015/ SCDOT PROJECT ID P039235

NEW TRANS R/W

PERM. CONST. ESMT. (SCDOT DOCKET 46004)

PRES. 50' R/W (FILE 46240) DB

DED. CONST. ESMT. (DB 11403 PG 62) DB

DED. CONSTRUCTION ESMT. (DB 6182 PG 171) DB

DED. CONST. ESMT. (DB 6020 PG 65) DB

DED. CONSTRUCTION ESMT. (DB 5304 PG 54) DB

20' SAN. SEWER EASEMENT DB 10774 PG 240

30' SAN. SEWER EASEMENT DB 10774 PG 240

20' SAN. SEWER ESMT. (DB 10798 PG 278) DB

4' CONCRETE MEDIAN 4' PAINTED MEDIAN

320' STORAGE

50' DRIVEWAY

NEW 60' R/W

R=670'

R=2°

+55.95

+60.22

+61.62

+75.95

+11.00 40.00

+50.00 50.00

+35.00 50.00

+26.74 49.00

+16.09

+45.00 50.00

+60.00 50.00

+30.00 50.00

+75.00 50.00

+50.00 50.00

+25.00 50.00

+60.00 50.00

TIE- EQUALITY
① STA. 14+45.18 US 21 =
STA. 68+28.35 SC 460

SEE SHEETS 4 - 4D FOR R/W DAT
SEE SHEETS 5A - 5G FOR REFERE
SEE SHEET D6 FOR DRAINAGE

HORIZONTAL 50 0 50
VERTICAL 10 0 10

MATCH LINE STA. 70+75.00
SEE SHEET NO. 30

STA. 14+78.91 TO STA. 44+50.00

	UNCLASSIFIED =		3800 C.Y.
	BORROW =		47962 C.Y.
EXE. =	3800 C.Y.	EMB. =	36894 C.Y.
BOR. =	47962 C.Y.	+30% =	11068 C.Y.
		WASTE =	3800 C.Y.
SUBTOTAL =	51762 C.Y.	SUBTOTAL =	51762 C.Y.
LESS =	47962 C.Y.	LESS =	47962 C.Y.
TOTAL =	3800 C.Y.	TOTAL =	3800 C.Y.

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

US 21 (N HWY 21 BYPASS)

SURVEY STA. 14+78.91
BEGIN PROJECT ID 0042332
US 21 (N HWY 21 BYPASS)
MATCH EXISTING PAVEMENT
ELEV 617.16'

FINISHED GRADE

EXISTING GRADE

(-) 0.61% (-) 1.27% (-) 1.27% (-) 1.16%

VPI = 16+00.00
Elev. = 616.42
200' V.C.
SSD = 1724'
K = 301

VPI = 19+00.00
Elev. = 612.60
200' V.C.
K = 1693'

	10+00	11+00	12+00	13+00	14+00	15+00	16+00	17+00	18+00	19+00
EXISTING	618.08	618.74	619.18	619.33	619.45	619.20	618.85	618.53	617.99	617.52
PROPOSED							617.03	616.69	616.26	615.74
EXISTING							617.00	616.34	615.62	614.99	614.42	613.90	613.32	612.71	612.13	611.72
PROPOSED							617.03	616.69	616.26	615.74	615.15	614.51	613.87	613.24	612.63	612.03

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5	TGM	9/9/2020	TRACT 10: ADDED NEW R/W
4	JDS	7/22/2020	TRACT 9: ADDED NEW R/W
3	JDS	3/24/2020	TRACT 12: REVISED SLOPES/DITCHES
2	JDS	3/12/2020	MOVED STOP BAR AT US 21/SPRINGFIELD INT.
1	MHC	9/23/2019	REVISED TYPICAL SECTION ALONG TRs 9-17

STV 100 Years — STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAR

SOUTH CAROLINA PROFESSIONAL ENGINEER
No. 22780
CHRISTOPHER E. CARTER
CERTIFICATE OF AUTHORIZATION

masthig
k:\Projects\2S5776\2S5776.000190.CAD Models and Sheets\04_CT_Transportation\Roadway\Plan Sheets\2S5776 PLN SHT6.dgn
4/30/2020

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	7

FINAL PLANS
FOR REVIEW ONLY

CONST. 312.5 LF MGS2C GUARDRAIL
CONST. TYPE MT3 LEADING END TREATMENT
CONST. TYPE MB TRAILING END TREATMENT

CONST. PREMASH TRAILING W-BEAM TYPE B
CONST. 75 LF PREMASH W-BEAM STRONG POST WSP3
CONST. 37.5 LF PREMASH W-BEAM
TIGHT CURVE SYSTEM (26.7' R)
SEE SHEET 8 FOR MAINLINE GUARDRAIL NOTE

SURVEY STA.10+33.50
BEGIN PROJECT ID 0042332
MERCANTILE PLACE
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.13+85.00
BEGIN PROJECT ID 0042332
S-1134 (LAKE VIEW ROAD)
MATCH EXISTING PAVEMENT

SURVEY STA.11+40.00
END PROJECT ID 0042332
MERCANTILE PLACE
MATCH EXISTING PAVEMENT

SURVEY STA.14+84.26
END PROJECT ID 0042332
S-1134 (LAKE VIEW ROAD)
MATCH PROPOSED US 21 PAVEMENT

CONST. 287.5 LF MGS2C GUARDRAIL
CONST. TYPE MT3 LEADING END TREATMENT
CONST. TYPE MB TRAILING END TREATMENT

MATCH LINE STA. 20+00.00 SEE SHEET NO. 6

MATCH LINE STA. 35+00.00 SEE SHEET NO. 8

US 21
N 6°53'17" E
15' PAINTED MEDIAN
15' CONCRETE MEDIAN
4' CONCRETE MEDIAN
150' STORAGE
80' STORAGE

PRES. 50' R/W (FILE 46-240) DB
PRES. 60' R/W
PRES. 85' R/W (PB E252 PG 5) DB
PRES. 25' R/W (PB E252 PG 5) DB

CENTRAL ELECTRIC POWER COOPERATIVE
TEMP. CONST. EASE.
EASEMENT - TEMP. CONST. EASE.
NEW TRANS. R/W
NEW PERMANENT DRAINAGE EASEMENT
DED. 20' STORM DRAINAGE ESMT. DB
DED. 20' SANITARY SEWER ESMT. DB
DED. 20' SAN. SEWER ESMT. DB (DB 10798 PG 278) DB
SIGN ESMT.
ACCESS EASEMENT (DB 1366 PG 301) DB
CRESCENT MOON DRIVE
LAKE VIEW RD.
MERCANTILE PLACE
PC=12+52.80
CURVE 1

CONSTRUCT 5' SIDEWALK
TIE TO EXISTING SIDEWALK
CONSTRUCT 2' C&G
CONTRACTOR TO DESIGN & CONSTRUCT EXTENSION TO EXISTING BLOCK WALL. SEE NOTE BELOW.
NEW TRANS. R/W
REMOVE WALL FROM PROP. R/W SEE SHTS 2-28 FOR PAY ITEM & MOVING & DISPOSAL

RELOCATE S-1134 CENTERLINE
STA. 10+00.00 TO STA. 15+17.77

NOTE: BLOCK WALL SHALL MATCH EXISTING BLOCK WALL AND BE CONSTRUCTED AT R/W LINE ON PROPERTY OWNER'S SIDE AS DIRECTED BY THE ENGINEER.

TIE- EQUALITY
(2) STA. 27+92.17 US 21 =
STA. 10+00.00 MERCANTILE PLACE
(3) STA. 32+16.97 US 21 =
STA. 15+17.77 S-1134

Robertson may be Required to work in conflict with storm drainage

Pals Should Be OK AS IS

Pals Tabulated 6-2021 for Sea West-Sold Phase II Development

OK AS IS

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 26 FOR MERCANTILE PLACE PROFILE
SEE SHEET 26 S-1134 (LAKEVIEW RD.) PROFILE
SEE SHEET D7 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV Incorporated
7960 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

(-) 1.16%
(-) 1.23%
FINISHED GRADE
EXISTING GRADE

VPI = 28+00.00
Elev. = 602.19
SSD = 14932'
K = 1860
135' V.C.

HYDROLOGY DATA:
D.A. = 0.10sq.mi. = 64.3 ac.
Q50 = 205 cfs
Vel. = 15.64 ft/sec
50Year H.W. Elev. = 570.77 ft.
Including 5.9 ft. Headwater
Q100 = 232 cfs
Vel = 16.08 ft/sec
100 Year H.W. Elev. = 571.48 ft.
Including 6.6 ft. Headwater
OVERTOPPING FLOOD:
Q = 656.83 cfs
Probability = less than 0.2%

5'x5' EXISTING BOX CULVERT
STA. = 33+79
INV. ELEV. = 563.79

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CRAWFORD

SOUTH CAROLINA STV INCORPORATED NO. C00336 CERTIFICATE OF AUTHORIZATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
9	JDS	1/22/2020	TR. 6 CHANGED R/W TO PERM. DRAINAGE EASEMENT.
8	JDS	2/24/2020	ADDED WALL EXCAVATION LIMITS ON TRACT 20
5	JDS	2/06/2020	REMOVED/REDUCED OBTAIN AREA
4	MHC	1/02/2019	ADDED NOTE FOR RETAINING WALL TO TR 20
3	MHC	09/23/2018	REVISED TYPICAL AND R/W ALONG TRs 9-17
2	JDS	08/14/2018	TRACT 2a INCREASED OBTAIN AREA
1	JDS	7/27/2018	REVISED OBTAIN AREA FROM TR 18 TO TR 20

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	8

FINAL PLANS FOR REVIEW ONLY

RELOCATE S-1467 CENTERLINE STA. 10+00.00 TO STA. 14+20.91	RELOCATE S-1133 CENTERLINE STA. 11+66.22 TO STA. 14+46.61
RELOCATE S-1469 CENTERLINE STA. 10+36.18 TO STA. 12+14.79	RELOCATE S-1470 CENTERLINE STA. 10+00.00 TO STA. 15+82.31

TIE- EQUALITY

(4) STA. 35+94.86 US 21 = STA. 10+00.00 S-1467
(5) STA. 39+40.82 US 21 = STA. 10+00.00 S-1469
(6) STA. 42+87.88 US 21 = STA. 14+16.61 S-1133
(7) STA. 44+70.74 US 21 = STA. 10+00.00 S-1470

REMOVE EXISTING PAVEMENT
MILLING/RESURFACING

CONST. 925 LF PREMASH W-BEAM STRONG POST WSP3
CONST. PREMASH TRAILING W-BEAM TYPE B
CONST. 75 LF PREMASH W-BEAM
MEDIUM SHOP BENT SYSTEM (34.6' R)
SEE SHEET 8 FOR MAINLINE GUARDRAIL NOTE
CONST. PREMASH TRAILING W-BEAM TYPE B BOTH ENDS
CONST. 425 LF PREMASH W-BEAM STRONG POST WSP3
CONST. 75 LF PREMASH W-BEAM
TIGHT CURVE SYSTEM (38.3' R)

MATCH LINE STA. 35+00.00 SEE SHEET NO. 7
MATCH LINE STA. 50+00.00 SEE SHEET NO. 9

SURVEY STA.10+ 33.50
BEGIN PROJECT ID 0042332
S-1467 (AMELIA DRIVE)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.11+ 80.00
END PROJECT ID 0042332
S-1467 (AMELIA DRIVE)
MATCH EXISTING PAVEMENT

SURVEY STA.11+65.00
END PROJECT ID 0042332
S-1469 (FERN FOREST CT.)
MATCH EXISTING PAVEMENT

SURVEY STA.10+ 33.50
BEGIN PROJECT ID 0042332
S-1469 (FERN FOREST CT.)
MATCH PROP. US 21 PVMT

SURVEY STA.12+ 70.00
BEGIN PROJECT ID 0042332
S-1133 (LAKE SHORE DRIVE)
MATCH EXISTING PAVEMENT

SURVEY STA.14+ 13.11
END PROJECT ID 0042332
S-1133 (LAKE SHORE DRIVE)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.11+65.00
BEGIN PROJECT ID 0042332
S-1470 (FOREST DRIVE)
MATCH EXISTING PAVEMENT

SURVEY STA.12+30.00
END PROJECT ID 0042332
S-1470 (FOREST DRIVE)
MATCH EXISTING PAVEMENT

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 26 FOR S-1467 PROFILE
SEE SHEET 26 FOR S-1469 PROFILE
SEE SHEET 27 FOR S-1133 PROFILE
SEE SHEET D8 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

US 21 (N HWY 21 BYPASS)

STA. 44+50.00 TO STA. 74+50.00

HYDROLOGY DATA:
D.A. = 0.142sq.mi. = 90.9 ac.
Q50 = 249 cfs
Vel. = 14.65 ft/sec
50Year H.W. Elev. = 574.56 ft.
Including 7.1 ft. Headwater
Q100 = 281 cfs
Vel. = 15.06 ft/sec
100 Year H.W. Elev. = 575.56 ft.
Including 8.1 ft. Headwater
OVERTOPPING FLOOD:
Q = 539.95 cfs
Probability = less than 0.2%

UNCLASSIFIED =	16245 C.Y.		
BORROW =	21880 C.Y.		
EXE. =	16245 C.Y.	EMB. =	16831 C.Y.
BOR. =	21880 C.Y.	+30% =	5049 C.Y.
		WASTE =	16245 C.Y.
SUBTOTAL =	38125 C.Y.	SUBTOTAL =	38125 C.Y.
LESS =	21880 C.Y.	LESS =	21880 C.Y.
TOTAL =	16245 C.Y.	TOTAL =	16245 C.Y.

VPI = 41+00.00
Elev. = 586.22
K = 106
430' V.C.
(+85) 588.86 VPC
(+15) 592.31 VPT
LOW POINT
40+15.01
ELEV. = 588.06
(-) 1.23%
(+) 2.84%
FINISHED GRADE
EXISTING GRADE
5'x5' EXISTING BOX CULVERT
STA. = 41+06
INV. ELEV. = 566.73

| STA | | |

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 27 FOR EMBASSY DRIVEWAY PROFILE
SEE SHEET D9 FOR DRAINAGE

FINAL PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	9

REMOVE EXISTING PAVEMENT

TIE- EQUALITY
(8) STA. 57+11.96 US 21 =
STA. 10+00.00 EMBASSY DRIVE
(9) STA. 63+03.79 US 21 =
RELOC. STA. 32+91.33 S-1726
(10) STA. 63+11.29 US 21 =
STA. 10+00.00 RELOC. US 21 BUSINESS

RELOCATE S-1726 CENTERLINE
STA. 15+45.08 TO STA. 32+91.33

RELOCATE US 21 BUSINESS CENTERLINE
STA. 10+ 00 .00 TO STA. 20+17.53

MATCH LINE STA. 50+00.00 SEE SHEET NO. 8

MATCH LINE STA. 31+00.00
S-1726 (GOLD HILL ROAD)
SEE SHEET NO. 19

MATCH LINE STA. 63+00.00 SEE SHEET NO. 10

MATCH LINE STA. 12+50.00 US 21 BUSINESS SEE SHEET NO. 20

US 21
N 64°54'17" E
15' PAINTED MEDIAN

4' PAINTED MEDIAN

2' CONCRETE MEDIAN

PRES. 50' R/W (FILE #46240) DB

PRES. 33' R/W (FILE #46535) DB

PRES. VAR. R/W (FILE #46535) DB

NEW 65' R/W

NEW 75' R/W

NEW 60' R/W

NEW 73.5' R/W

NEW TRANS. R/W

DED. 20' UTILITY ESMT. (PB. E-153 PG. 10) DB

DED. 75' R/W (YORK COUNTY)

DED. 47' YORK COUNTY R/W (TM 719-00-00-027) DB

YORK COUNTY WATER AND SEWER EASEMENT (DB 1109 PG 287) DB

CONSTRUCT 5' SIDEWALK

CONSTRUCT 2' C&G

CONSTRUCT 2'C&G

CONSTRUCT 5' SIDEWALK

NEW TEMP. CONST. EASE.

CONST. PREMASH TYPE T TL3 LEADING 50FT
CONST. 587.5 LF PREMASH W-BEAM STRONG POST WSP3
CONST. 50 LF PREMASH W-BEAM
TIGHT CURVE SYSTEM (32.1' R)
CONST. PREMASH TRAILING W-BEAM TYPE B

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

SURVEY STA.32+39.84
END PROJECT ID 0042332
S-1726 (GOLD HILL ROAD)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.10+33.52
BEGIN PROJECT ID 0042332
EMBASSY DRIVEWAY (PRIVATE)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.11+45.00
END PROJECT ID 0042332
EMBASSY DRIVEWAY (PRIVATE)
MATCH EXISTING PAVEMENT

SURVEY STA. 10+53.05
BEGIN PROJECT ID 0042332
RELOC. US 21 BUSINESS (OLD NATION ROAD) 4' PAINTED MEDIAN
MATCH PROPOSED US 21 PAVEMENT

PC= 11+36.36
PT= 11+71.67
POT= 12+45.10
PT= 31+24.21

150' STORAGE
275' STORAGE
300' STORAGE
250' STORAGE
710' STORAGE
524' STORAGE

180' LANE TAPER RT

US 21 (N HWY 21 BYPASS)

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

HIGH POINT
STA. 62+65.06
ELEV. = 642.15

(+) 2.84% (-) 1.29%

FINISHED GRADE

EXISTING GRADE

℄ SAG 636.69 VPC

℄ 641.03 VPT

VPI = 61+60.00
Elev. = 644.63
SSD = 541'
K = 136
560' V.C.

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CARLSEN

SOUTH CAROLINA STV INCORPORATED NO. C03308 CERTIFICATE OF AUTHORIZATION

STA.	ELEV.
50+00	611.20 / 611.74
51+00	612.54 / 613.16
52+00	613.95 / 614.57
53+00	615.41 / 615.99
54+00	616.86 / 617.41
55+00	618.28 / 618.83
56+00	619.67 / 620.25
57+00	621.05 / 621.66
58+00	622.41 / 623.08
59+00	623.84 / 624.50
60+00	625.26 / 625.92
61+00	626.71 / 627.34
62+00	628.19 / 628.75
63+00	629.63 / 630.17
64+00	631.06 / 631.59
65+00	632.48 / 633.01
	633.92 / 634.42
	635.32 / 635.84
	636.68 / 637.25
	637.91 / 638.50
	638.98 / 639.57
	639.79 / 640.45
	640.45 / 641.15
	640.96 / 641.67
	641.32 / 642.00
	641.52 / 642.14
	641.50 / 642.11
	641.31 / 641.89
	640.92 / 641.48
	640.39 / 640.90
	639.71 / 640.25

DESCRIPTION OF REVISION | DATE | BY | REV. NO.

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	10

FINAL PLANS
FOR REVIEW ONLY

REMOVE EXISTING PAVEMENT

MILLING/RESURFACING

TIE- EQUALITY
⟨11⟩ STA. 75+13.65 US 21 = STA. 10+00.00 S-676
⟨12⟩ STA. 75+22.21 US 21 = STA. 15+12.55 J3-040

MATCH LINE STA. 65+00.00 SEE SHEET NO. 9

MATCH LINE STA. 80+00.00 SEE SHEET NO. 11

CONSTRUCT 5' SIDEWALK
CONSTRUCT 2' C&G
NEW 125' R/W
50:1 LINE TAPER RT
NEW 67' R/W
PRES. 50' R/W (FILE 46,240) DB
710' STORAGE US 21
524' STORAGEN 6°53' 17"E
4' CONCRETE MEDIAN
PRES. 50' R/W (FILE 46,240) DB
NEW 60' R/W
EASEMENT
CONSTRUCT 2' C&G
CONSTRUCT 5' SIDEWALK
NEW 75' R/W
CONST. 325 LF MGS2C GUARDRAIL
CONST. TYPE MT3 LEADING END TREATMENT
CONST. TYPE MB TRAILING END TREATMENT
NEW 55' R/W
NEW 51.5' R/W
NEW TRANS. R/W
CONST. 1125 LF MGS2C GUARDRAIL
CONST. TYPE MT3 LEADING END TREATMENT
CONST. TYPE MB TRAILING END TREATMENT
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 27 FOR S-676 PROFILE
SEE SHEET 27 FOR J3-040 PROFILE
SEE SHEET 28 FOR OLD NATION RD.PROFILE
SEE SHEET D10 FOR DRAINAGE

SURVEY STA. 18+20.00
PROJECT ID 0042332
OLD NATION ROAD
END MILL AND RESURFACING
BEGIN NEW PAVEMENT CONSTRUCTION
MATCH EXISTING PAVEMENT

MATCH LINE STA. 17+00.00 OLD NATION ROAD SEE SHEET NO. 20

270' CENTER TAPER
CONST. PREMASH TRAILING W-BEAM TYPE B BOTH ENDS
CONST. 187.5 LF PREMASH W-BEAM STRONG POST WSP3
CONST. 62.5 LF PREMASH W-BEAM
MEDIUM SHOP BENT SYSTEM (60.4' R)R/W
NEW 100' R/W
PRES. 80' R/W (FILE 46,240) DB
PRES. 50' R/W (FILE 46,240) DB
PRES. 25' R/W (FILE 46,240) DB
OLD NATION ROAD
CURVE 2
NEW 45' R/W
NEW R/W R=75'
NEW TRANS. R/W
150' STORAGE
4' CONCRETE MEDIAN

SURVEY STA. 19+98.87
END PROJECT ID 0042332
OLD NATION ROAD
MATCH EXISTING PAVEMENT

SURVEY STA. 13+75.00
BEGIN PROJECT ID 0042332
J3-040 (BAXTER LANE)
MATCH EXISTING PAVEMENT

PRES. 80' R/W (PB 85 PG 22) MHC
PRES. 80' R/W (PB 85 PG 22) MHC
PRES. 80' R/W (PB 85 PG 22) MHC
PRES. 80' R/W (PB 85 PG 22) MHC
PRES. 80' R/W (PB 85 PG 22) MHC
PRES. 80' R/W (PB 85 PG 22) MHC
NEW TRANS. R/W
NEW TRANS. R/W
NEW TRANS. R/W

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	II

FINAL PLANS
FOR REVIEW ONLY

SURVEY STA.13+16.63
BEGIN PROJECT ID 0042332
J3-076 (CENTRAL CAROLINAS PARKWAY)
MATCH EXISTING PAVEMENT

SURVEY STA.13+75.40
END PROJECT ID 0042332
J3-076 (CENTRAL CAROLINAS PARKWAY)
MATCH PROPOSED US 21 PAVEMENT

MATCH LINE STA. 80+00.00 SEE SHEET NO. 10

MATCH LINE STA. 95+00.00 SEE SHEET NO. 12

MATCH LINE STA. 12+00.00
J3-107 (REGENT PARKWAY)
SEE SHEET NO. 25

SURVEY STA.10+33.50
BEGIN PROJECT ID 0042332
REGENT DRIVEWAY (PRIVATE)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.11+50.00
END PROJECT ID 0042332
REGENT DRIVEWAY (PRIVATE)
MATCH EXISTING PAVEMENT

SURVEY STA.10+53.64
BEGIN PROJECT ID 0042332
J3-107 (REGENT PARKWAY)
BEGIN NEW PAVEMENT CONSTRUCTION
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.10+90.00
PROJECT ID 0042332
J3-107 (REGENT PARKWAY)
END NEW PAVEMENT CONSTRUCTION
BEGIN MILL AND RESURFACING
MATCH EXISTING PAVEMENT

POT=12+68.62

MILLING/RESURFACING

TIE- EQUALITY
- (13) STA. 82+67.39 US 21 = STA. 10+00.00 REGENT DRIVEWAY
- (14) STA. 82+72.83 US 21 = STA. 14+09.21 J3-076
- (13) STA. 90+13.92 US 21 = STA. 10+00.00 J3-107

RELOCATE US 21 CENTERLINE STA. 94+94.30 TO STA. 101+94.41

RELOCATE J3-076 CENTERLINE STA. 10+00.00 TO STA. 14+09.21

RELOCATE J3-107 CENTERLINE STA. 10+00.00 TO STA. 18+64.05

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 28 FOR J3-076 PROFILE
SEE SHEET 28 FOR REGENT DRIVEWAY PROFILE
SEE SHEET 29 FOR J3-107 PROFILE
SEE SHEET DII FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years — STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

VPI = 87+85.00
Elev. = 643.75
K = 82
280' V.C.
(+45) 645.46 VPC
(+25) 646.81 VPT
LOW POINT
STA. 87+45.14
ELEV. = 644.85
(-) 1.22%
(+) 2.19%
FINISHED GRADE
EXISTING GRADE
HIGH POINT
STA. 80+05.77
ELEV. = 652.00
(-) 1.22%
VPI = 79+60.00
Elev. = 653.80
SSD = 612'
K = 168
500' V.C.
(+10) 650.75 VPT

80+00	81+00	82+00	83+00	84+00	85+00	86+00	87+00	88+00	89+00	90+00	91+00	92+00	93+00	94+00	95+00
652.00	651.94	651.73	651.38	650.87	650.27	649.66	649.05	648.44	647.83	647.22	646.61	646.00	645.40	644.97	644.85
651.82	651.45	651.29	650.96	650.46	648.92	648.41	648.56	647.91	647.30	646.67	646.02	645.38	644.81	644.42	644.34
										646.30	645.03	645.51	645.40	644.97	644.85
										646.30	645.03	644.93	644.51	645.74	646.69
														646.30	647.36
															647.60
															648.45
															648.87
															649.55
															650.15
															650.64
															651.19
															651.74
															652.26
															652.83
															653.24
															653.92
															654.38
															655.02
															655.54
															656.11
															656.70
															657.21
															657.83
															658.30
															658.88
															659.39

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5	MKC	1/05/09	REVISED PERM TO TCE ON TR 75
4	MKC	9/25/08	REMOVED TURN LANE, REVISED LIMITS & R/W ON TRs 74,75,& 76
3	MKC	09/09/08	ADDED NOTES TO TR 85 FOR 4dt 2dSLOPES
2	JDS	8/14/08	TRs. 75: REVISED CONSTRUCTION LIMITS S. OF REGENT
1	JDS	6/20/08	TRs. 72,73,74: REVISED SLOPES/MEDIES
REV. NO.	BY	DATE	DESCRIPTION OF REVISION

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CRAVEN
SOUTH CAROLINA STV INCORPORATED No. C01336 CERTIFICATE OF AUTHORIZATION

mastiltg
L:\Projects\256776\000\30-CAD Models and Sheets\04-CT_Transportation\RoadwayPlan Sheets\256776 PLN SHTS.dgn
4/30/2009

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	12

FINAL PLANS
FOR REVIEW ONLY

MILLING/RESURFACING

TIE- EQUALITY
(16) STA. 97+32.31 US 21 =
STA. 10+00.00 LAKES BOULEVARD
(17) STA. 108+31.68 US 21 =
STA. 10+00.00 S-641
(18) STA. 108+37.88 US 21 =
STA. 14+02.72 RETAIL DRIVE

MATCH LINE STA. 95+00.00 SEE SHEET NO. 11

MATCH LINE STA. 110+00.00 SEE SHEET NO. 13

SURVEY STA.12+75.00
BEGIN PROJECT ID 0042332
RETAIL DRIVE (PRIVATE)
MATCH EXISTING PAVEMENT

SURVEY STA.13+69.22
END PROJECT ID 0042332
RETAIL DRIVE (PRIVATE)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.10+41.68
BEGIN PROJECT ID 0042332
LAKES BOULEVARD
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA.11+62.36
END NEW PVMT CONST.
BEGIN MILL & RESURFACING

SURVEY STA.12+21.42
END PROJECT ID 0042332
LAKES BOULEVARD
MATCH EXISTING PAVEMENT

SURVEY STA.10+33.55
BEGIN PROJECT ID 0042332
S-641 (FLINT HILL ROAD) AT US 21
MATCH PROPOSED US 21 PAVEMENT

MATCH LINE
STA. 11+00.00
S-641 (FLINT HILL RD AT US 21)
SEE SHEET NO. 22

RELOCATE LAKES BLVD CENTERLINE STA. 10+00.00 TO STA. 14+25.56
RELOCATE RETAIL DR CENTERLINE STA. 10+00.00 TO STA. 14+02.72
RELOCATE S-641 CENTERLINE STA. 10+00.00 TO STA. 10+97.54
RELOCATE US 21 CENTERLINE STA. 94+94.30 TO STA. 101+94.41

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET 29 FOR LAKES BLVD.PROFILE
SEE SHEET 29 FOR RETAIL DR.PROFILE
SEE SHEET DI2 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

STA. 104+50.00 TO STA. 134+33.25

UNCLASSIFIED =	6124 C.Y.		
BORROW =	10826 C.Y.		
EXE. =	6124 C.Y.	EMB. =	8328 C.Y.
BOR. =	10826 C.Y.	+30% =	2498 C.Y.
		WASTE =	6124 C.Y.
SUBTOTAL =	16950 C.Y.	SUBTOTAL =	16950 C.Y.
LESS =	10826 C.Y.	LESS =	10826 C.Y.
TOTAL =	6124 C.Y.	TOTAL =	6124 C.Y.

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
0969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

VPI = 101+20.00
Elev. = 663.70
K = 290
550' V.C.

HIGH POINT
STA. 98+19.24
ELEV. = 664.91

LOW POINT
STA. 99+66.79
ELEV. = 664.60

FINISHED GRADE

EXISTING GRADE

(+) 2.19%
(-) 0.42%
(-) 0.42%
(+) 1.48%
(+) 1.48%
(-) 1.36%

(+45) 664.85 VPC
(+95) 667.76 VPT
(+95) 667.76 VPC
(+45) 664.85 VPT
(+85) 663.44 VPC

VPI = 97+65.00
Elev. = 665.19
SSD = 494'
K = 61
160' V.C.

VPI = 108+90.00
Elev. = 675.07
SSD = 868'
K = 349
990' V.C.

HIGH POINT
STA. 109+10.30
ELEV. = 671.56

| | | |

FINAL PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	11149-004	US 21	13

MATCH LINE STA. 110+00.00 SEE SHEET NO. 12

MATCH LINE SEE SHEET NO. 31

MATCH LINE STA. 125+00.00 SEE SHEET NO. 14

CONST. 425 LF PREMASH W-BEAM STRONG POST WSP3
CONST. 62.5 LF PREMASH W-BEAM
MEDIUM SHOP BENT SYSTEM (44.6' R)
CONST. PREMASH TRAILING W-BEAM TYPE B

RELOCATE US 21 CENTERLINE
STA. 111+93.54 TO STA. 137+13.92

RELOCATE OLD SC 51 CENTERLINE
STA. 313+18.12 TO STA. 316+16.73

SURVEY STA. 111+75.00
BEGIN PROJECT ID 0042332
J2-010 (TERRYS ROAD)
MATCH EXISTING PAVEMENT

SURVEY STA. 12+32.80
END PROJECT ID 0042332
J2-010 (TERRY'S ROAD)
MATCH PROPOSED US 21 PAVEMENT

SURVEY STA. 316+16.73
END PROJECT ID 0042332
OLD SC 51

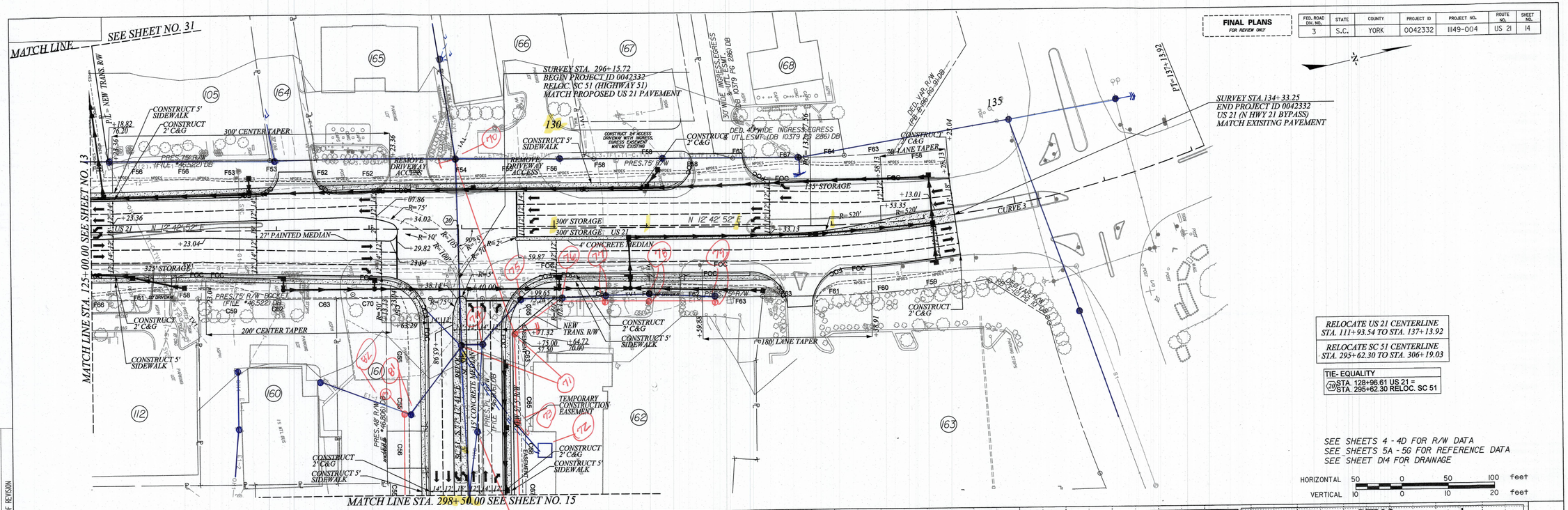
SURVEY STA. 315+05.00
PROJECT IS 0042332
OLD SC 51
END MILL AND RESURFACING
BEGIN NEW PAVEMENT CONSTRUCTION
MATCH EXISTING PAVEMENT

MATCH LINE STA. 314+50.00
OLD SC 51
SEE SHEET NO. 21

CONSTRUCT 5' SIDEWALK
CONSTRUCT 2' C&G
140' LANE TAPER
CONSTRUCT 5' SIDEWALK
CONSTRUCT 2' C&G
180' LANE TAPER
CONSTRUCT 5' SIDEWALK
CONSTRUCT 2' C&G

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	14

FINAL PLANS
FOR REVIEW ONLY



RELOCATE US 21 CENTERLINE
STA. 111+93.54 TO STA. 137+13.92

RELOCATE SC 51 CENTERLINE
STA. 295+62.30 TO STA. 306+19.03

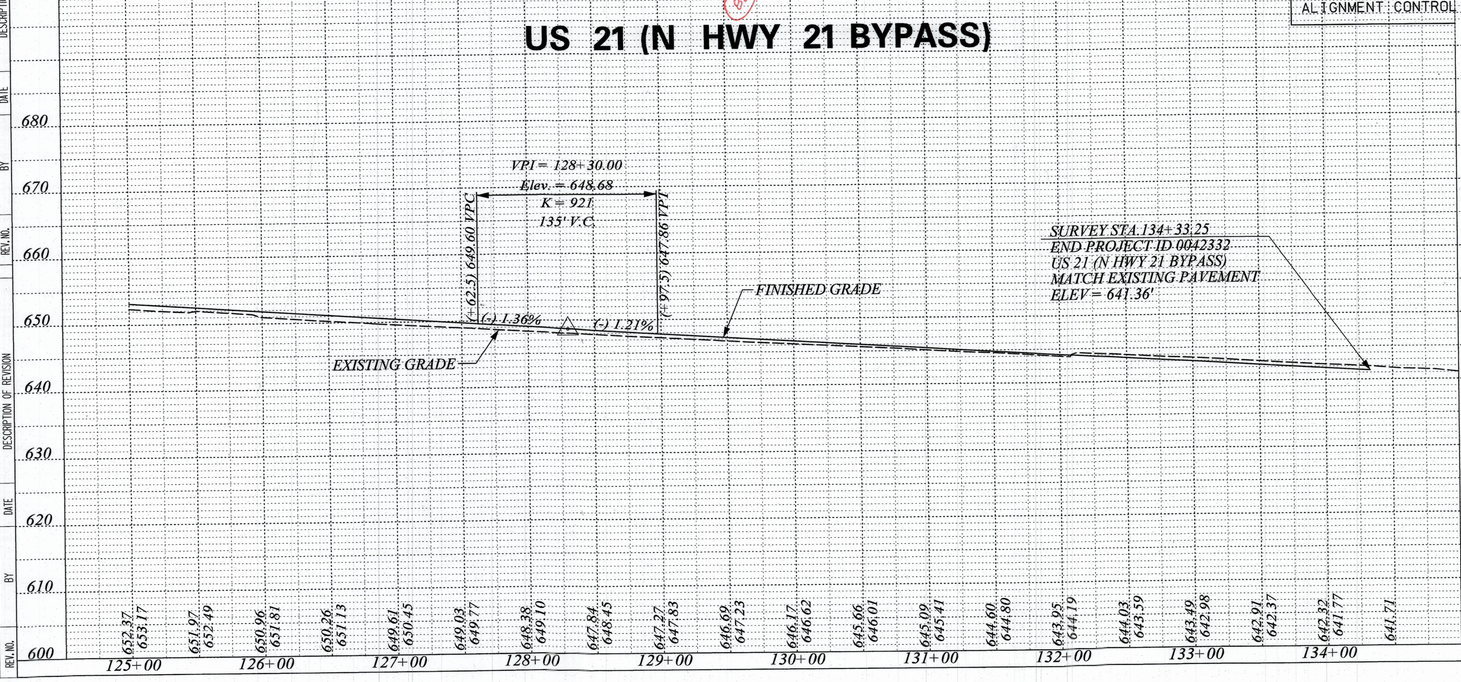
TIE- EQUALITY
(20) STA. 128+96.61 US 21 =
STA. 295+62.30 RELOC. SC 51

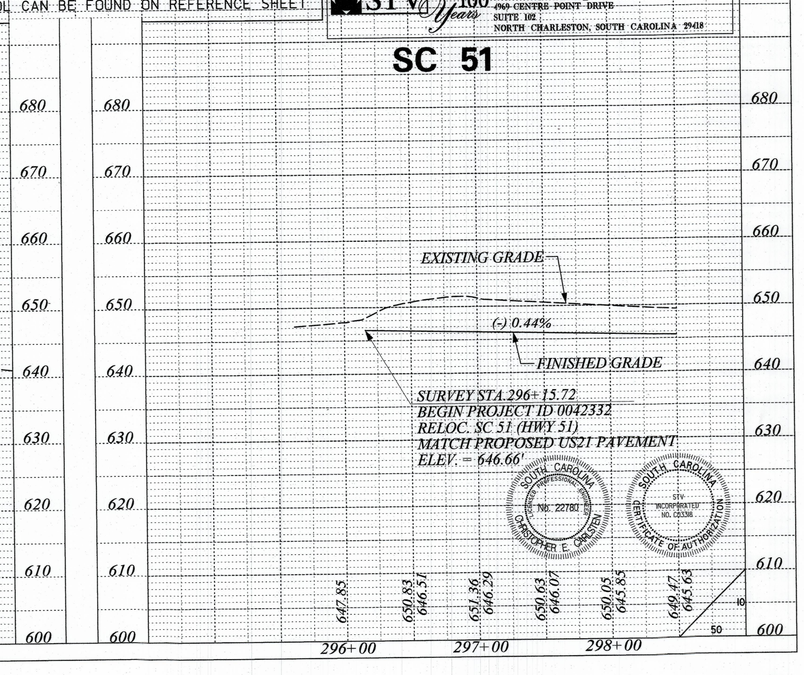
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D14 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418





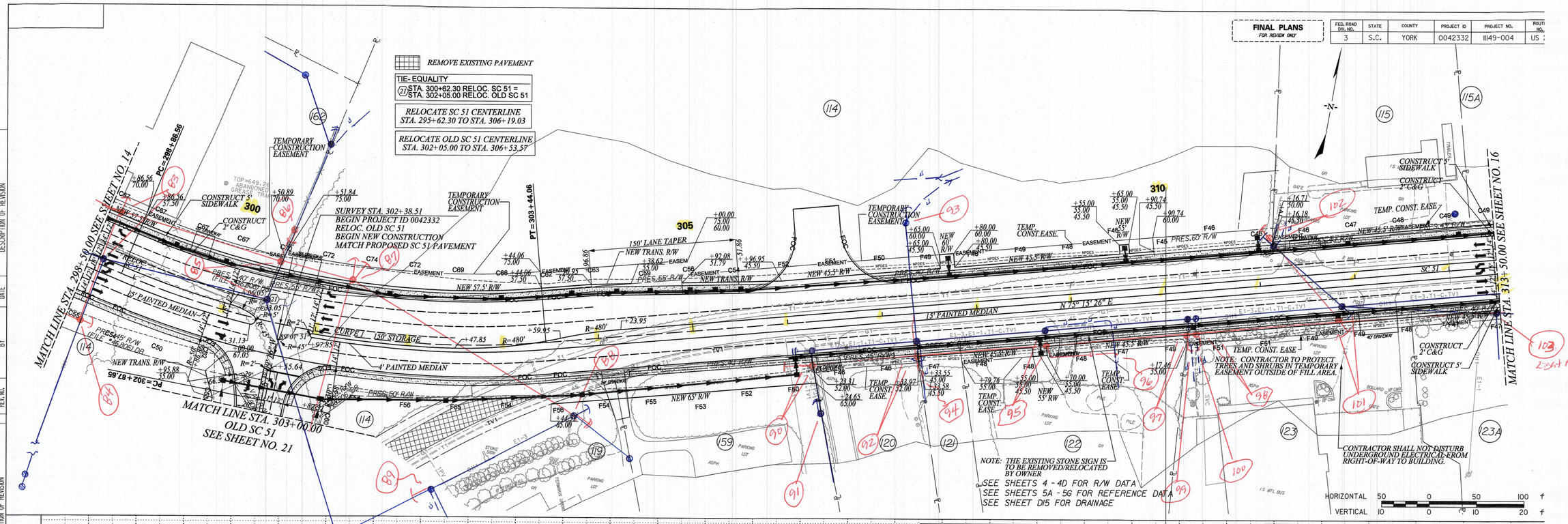
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	JDS	7/14/2020	TRACT 104: UPDATED SURVEY, REVISED DRAINAGE
2	JDS	5/25/2018	TRACT 163: REMOVED NEW R/W
1			
6			
5			
4			

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.
3	S.C.	YORK	0042332	11149-004	US 2

FINAL PLANS
FOR REVIEW ONLY

#15



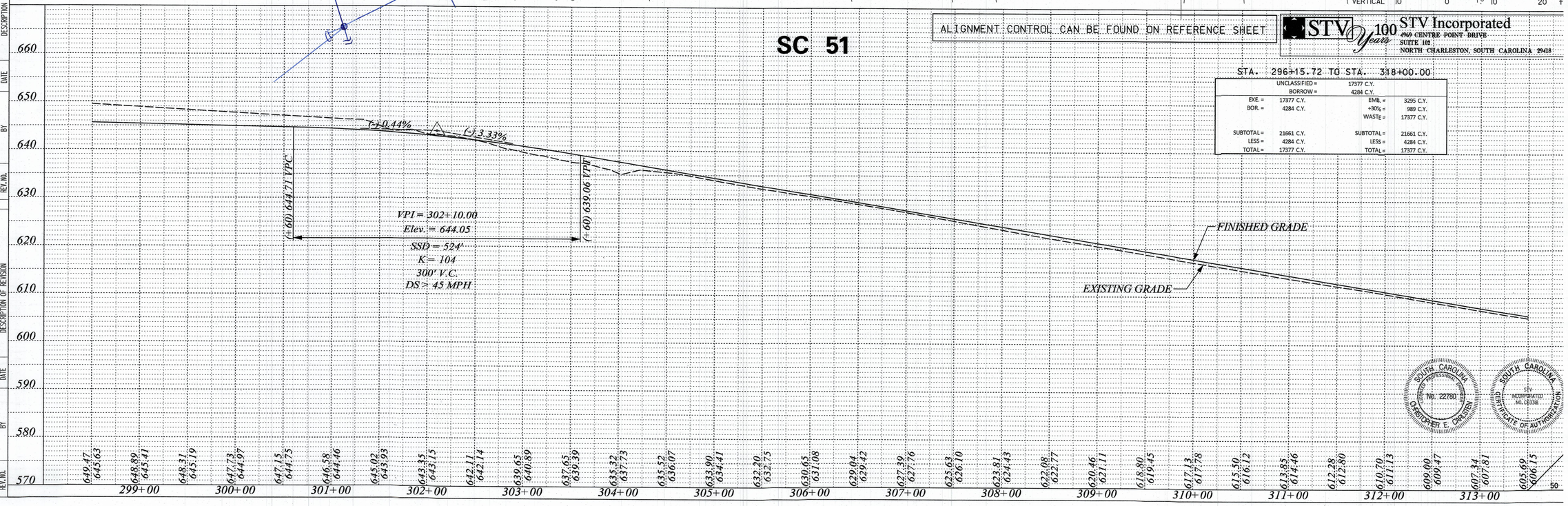
ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SC 51

STA. 296+15.72 TO STA. 318+00.00

UNCLASSIFIED =	17377 C.Y.		
BORROW =	4284 C.Y.		
EXE. =	17377 C.Y.	EMB. =	3295 C.Y.
BOR. =	4284 C.Y.	+30% =	989 C.Y.
		WASTE =	17377 C.Y.
SUBTOTAL =	21661 C.Y.	SUBTOTAL =	21661 C.Y.
LESS =	4284 C.Y.	LESS =	4284 C.Y.
TOTAL =	17377 C.Y.	TOTAL =	17377 C.Y.



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	MHC	04/05/19	ADDED TCE & REMOVED PERM. FOR TR. I20
2	MHC	02/01/19	REVISED RW & ADDED TCE FOR TR. I22
1	MHC	10/19/18	ADDED TCE & REMOVED PERM. FOR TR. I14
6	JDS	02/27/2020	ADDED TREE/SHRUB & ELECTRIC NOTES TO TR I23
5	MHC	10/31/2019	REVISED TR I14 OBTAIN, ADDED UNECONOMIC REMAIN.
4	MHC	04/18/19	ADDED TCE & REMOVED PERM. FOR TR. I15 & I23
8	JDS	06/10/20	ADDED REMOVE/RELOCATE SIGN NOTE TO TR. I22
7	JDS	05/13/20	ADDED DRIVEWAYS TO TR. I14

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
8	TGM	10/30/20	SUBDIVIDED I15 & I23, ADDED I15A & I23A

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CHRISTEN

SOUTH CAROLINA STV INCORPORATED NO. C-3338 CERTIFICATE OF AUTHORIZATION

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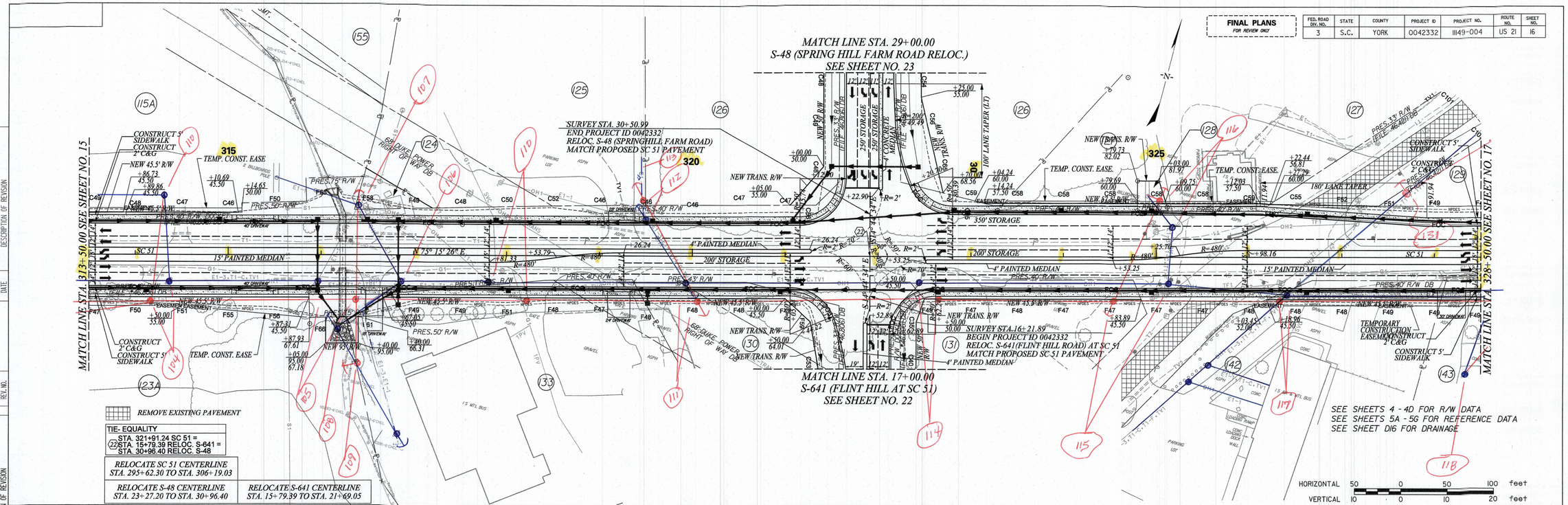
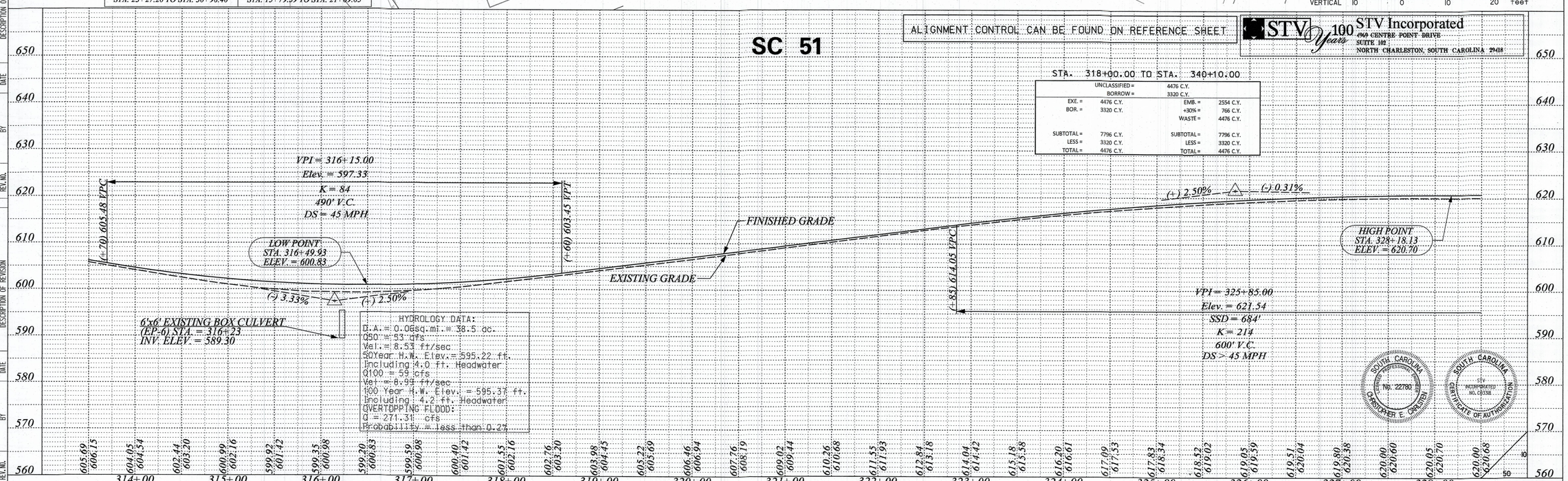
4/30/2021

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	16

FINAL PLANS
FOR REVIEW ONLY





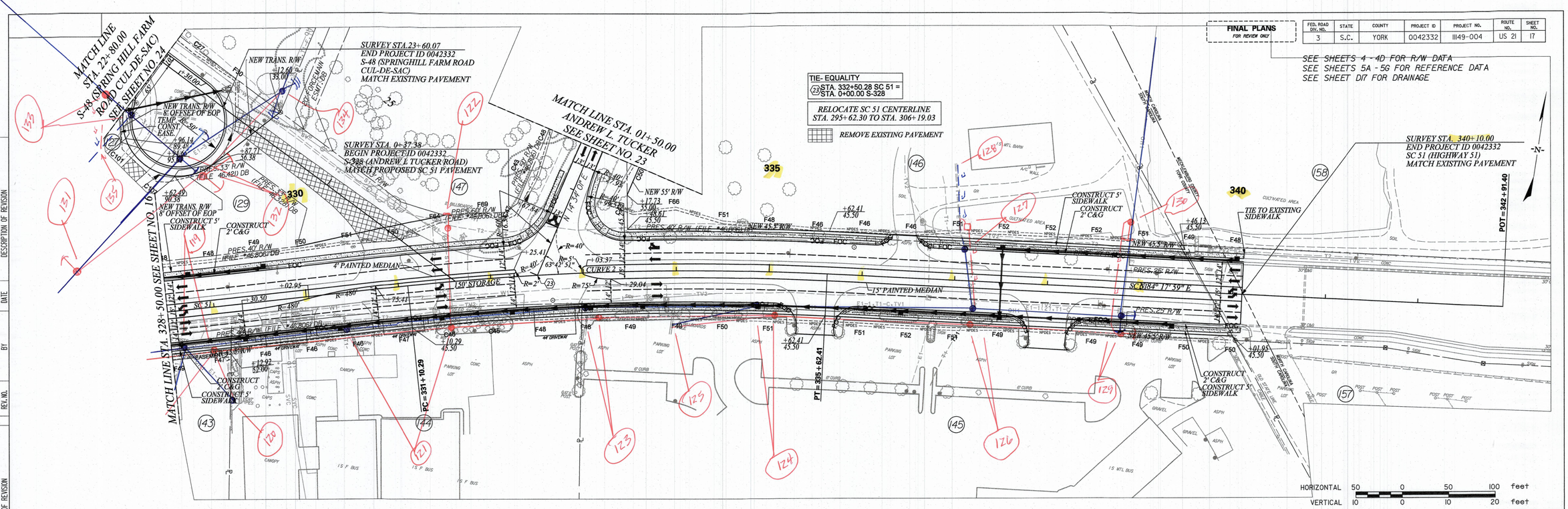
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
9			
8	TGM	11/11/20	ADDED 40' DROP CURB DRIVEWAY - TR 15A & 123A
7	TGM	10/30/20	SUBDIVIDED 115 & 123, ADDED 115A & 123A
6	JDS	03/27/20	ADDED CONC. MEDIAN TO SPRING HILL FARM
5	MHC	04/08/19	ADDED TCE & REMOVED RW PERM. FOR TR 115 & 123
4	MHC	04/02/19	ADDED TCE & REMOVED RW PERM. FOR TR 126 & 127
3	MHC	01/22/19	ADDED TCE & REMOVED RW PERM. FOR TR 142 & 143
2	JDS	12/14/2017	ADDED TCE & REMOVED RW PERM. FOR TR. 127
1	JDS	12/14/2017	TR. 126: REDUCED R/W TRIANGLES

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	17

FINAL PLANS
FOR REVIEW ONLY

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D17 FOR DRAINAGE



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
9			
8			
7	MHC	04/02/09	ADDED TCE & REMOVED RW PERM. FOR TRACT 127

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6	MHC	03/28/09	REV. RW LINE ACROSS EX. RW ON TRACTS 127 & 129
5	MHC	02/01/09	REVISED RW TO TIE TO NEW STATE LINE
4	MHC	01/22/09	ADDED TCE & REMOVED RW PERM. FOR TRACT 143

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	MHC	09/13/2008	ADDED RW LINE ACROSS EX. RW FOR TRACT 127
2	JDS	8/23/2008	ADDED NEW STATE LINE
1	JDS	5/25/2008	MOVED NPDES LINE OFF OF TRACT 158

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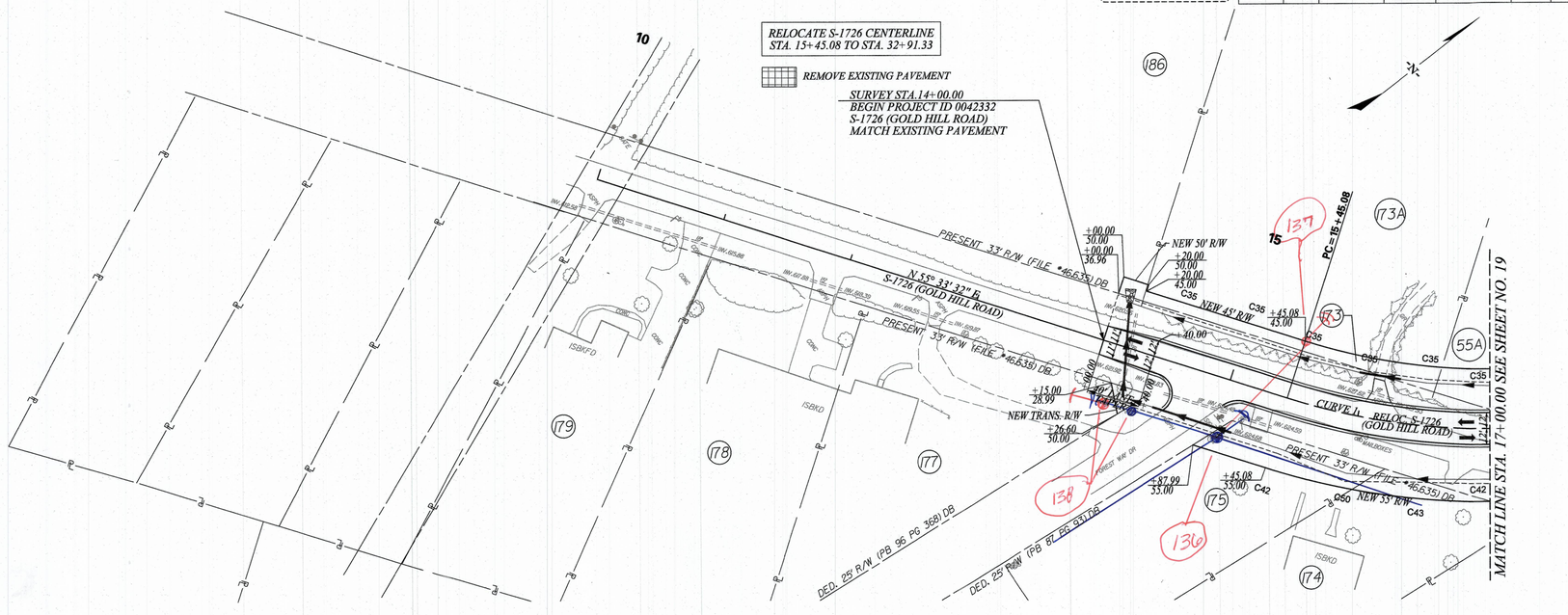
4/30/2021

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	18

FINAL PLANS
FOR REVIEW ONLY



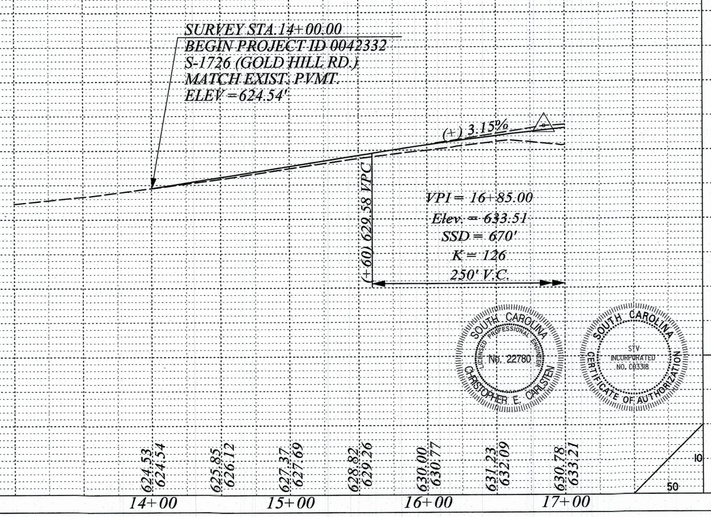
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D18 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S-1726 (GOLD HILL RD.)

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CRAVEN

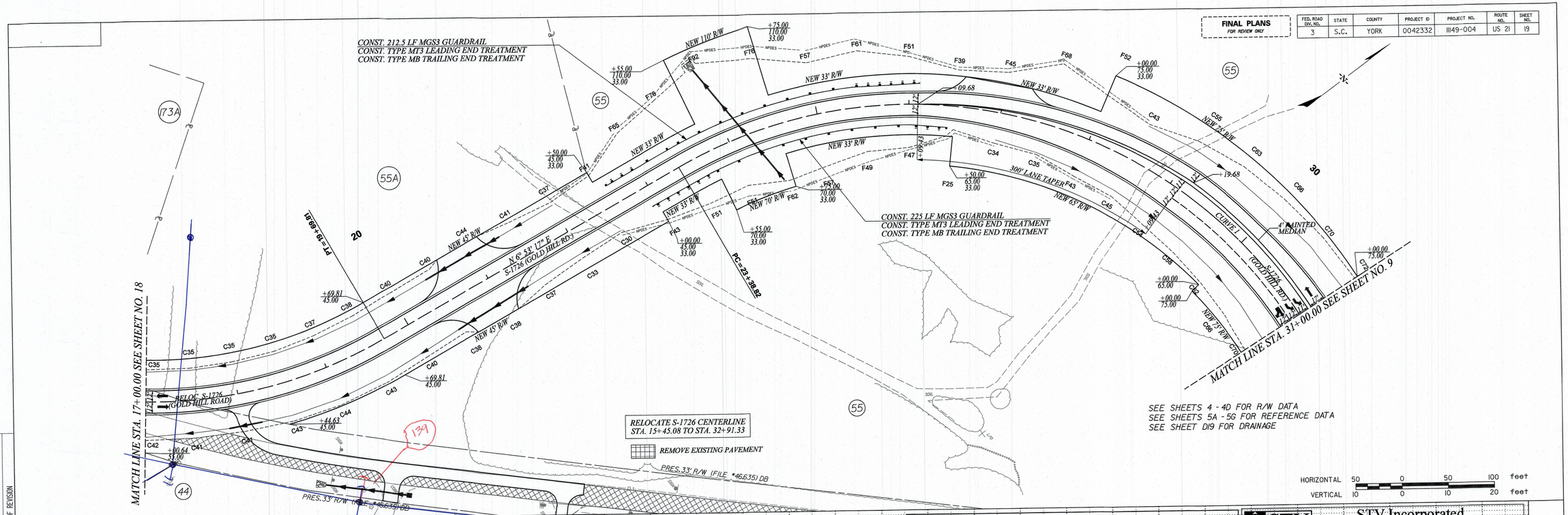
STV INCORPORATED NO. C03308 CERTIFICATE OF AUTHORIZATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	19

FINAL PLANS
FOR REVIEW ONLY



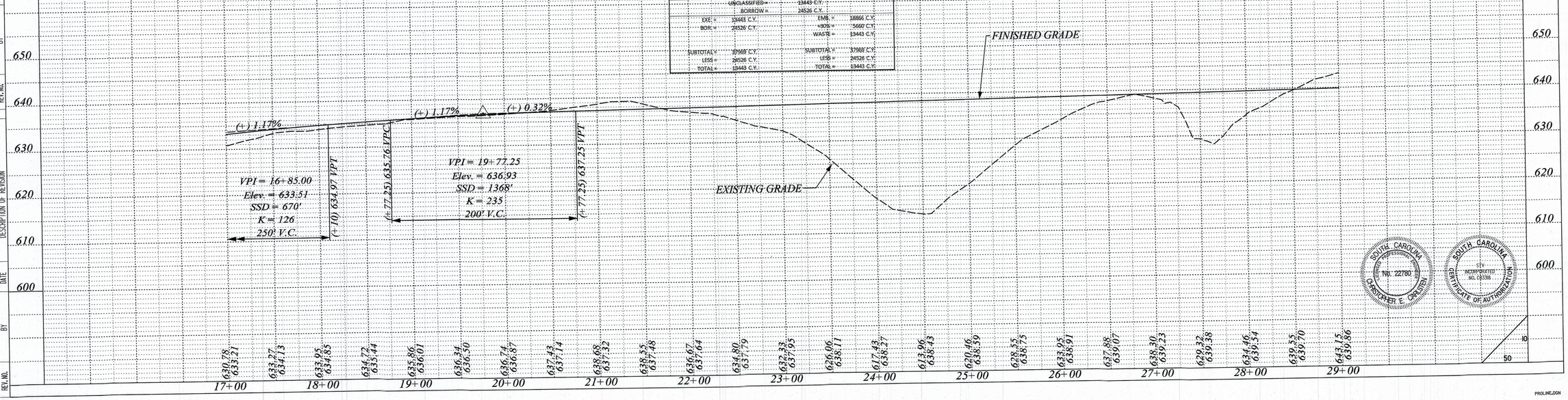
S-1726 (GOLD HILL RD.)

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

STA. 14+00.00 TO STA. 32+39.84

UNCLASSIFIED =	13443 C.Y.		
BORROW =	24526 C.Y.		
EXE. =	13443 C.Y.	EMB. =	18866 C.Y.
BOR. =	24526 C.Y.	+30% =	5660 C.Y.
		WASTE =	13443 C.Y.
SUBTOTAL =	37969 C.Y.	SUBTOTAL =	37969 C.Y.
LESS =	24526 C.Y.	LESS =	24526 C.Y.
TOTAL =	13443 C.Y.	TOTAL =	13443 C.Y.



SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CHRISTEN

SOUTH CAROLINA STV INCORPORATED NO. C03318 CERTIFICATE OF AUTHORIZATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
2	TGM	8/11/20	ADDED TR 173A REVISED TR 173
1	MHC	01/17/18	TRACT 55 R/W OBTAIN
5			
4			

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	20

FINAL PLANS
FOR REVIEW ONLY

MATCH LINE STA. 17+00.00
SEE SHEET NO. 10

SURVEY STA. 14+ 40.00
PROJECT ID 0042332
OLD NATION ROAD
END NEW PAVEMENT CONSTRUCTION
BEGIN MILL AND RESURFACING
MATCH EXISTING PAVEMENT

CURVE 2
OLD NATION ROAD
N 34° 22' 01" W
DED. 25' R/W (PB C256 PG 2) DB
DED. 33' R/W (PB E247 PG 5) DB
CURVE 1
RELOC. OLD NATION ROAD
NEW 40' R/W
NEW 33' R/W
NEW EX R/W
NEW TRANS. R/W
NEW 39.5' R/W
NEW TRANS. R/W
PRES. 33' R/W (FILE #46609) DB
DED. 35' YORK COUNTY R/W (TM #050-00-00271) DB
DED. 4' YORK COUNTY R/W (TM #050-00-00067) DB
REMOVE EXISTING ASPHALT PAVEMENT
4' PAINTED MEDIAN
15' PAINTED MEDIAN
CONST. C&G
EXIST. PAINTED MEDIAN
320' LANE TAPER
RELOC. US 21 BUSINESS
50' STORAGE
WOOD RAMP
PC=11+07.99
PC=14+56.03
PT=20+17.53
R=667.5'
R=652.5'
R=682'
R=1000'
R=75'
R=50'
R=2'
S 34° 22' 01" E
N 34° 22' 01" W
N 10° 40' 53" E

SURVEY STA. 10+ 31+ 50
BEGIN PROJECT ID 0042332
RELOC. OLD NATION ROAD
BEGIN NEW PAVEMENT CONSTRUCTION
MATCH PROPOSED RELOC. US 21 BUSINESS PAVEMENT

SURVEY STA. 21+ 90.00
END PROJECT ID 0042332
RELOC. US 21 BUSINESS (OLD NATION ROAD)
MATCH EXISTING PAVEMENT

MILLING/RESURFACING
REMOVE EXISTING PAVEMENT

TIE- EQUALITY
(24) STA. 15+06.79 RELOC. US 21 BUSINESS (OLD NATION ROAD)=
STA. 10+00.00 RELOC. OLD NATION ROAD

RELOCATE US 21 BUSINESS CENTERLINE
STA. 10+00 .00 TO STA. 20+ 17.53

RELOCATE OLD NATION RD CENTERLINE
STA. 10+00.00 TO STA. 14+06.77

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D20 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years — STV Incorporated
969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 BUSINESS /OLD NATION RD.

STA. 10+53.05 TO STA. 24+80.00

UNCLASSIFIED =	1235 C.Y.		
BORROW =	5775 C.Y.		
EXE. =	1235 C.Y.	EMB. =	4442 C.Y.
BOR. =	5775 C.Y.	+30% =	1333 C.Y.
		WASTE =	1235 C.Y.
SUBTOTAL =	7010 C.Y.	SUBTOTAL =	7010 C.Y.
LESS =	5775 C.Y.	LESS =	5775 C.Y.
TOTAL =	1235 C.Y.	TOTAL =	1235 C.Y.

SURVEY STA. 10+ 53.05
BEGIN PROJECT ID 0042332
RELOC. US 21 BUSINESS (OLD NATION ROAD)
MATCH PROPOSED US 21 PAVEMENT
ELEV. = 640.97'

VPI = 12+ 50.00
Elev. = 636.89
K = 93
150' V.C.
(+.25) 638.45 VPC
(+.25) 636.55 VPT
(-) 2.07%
(-) 0.45%
FINISHED GRADE
EXISTING GRADE

SURVEY STA. 21+ 90.00
END PROJECT ID 0042332
US 21 BUSINESS (OLD NATION ROAD)
MATCH EXIST. PVMT.
ELEV = 631.02'

(-) 0.45%
(-) 2.23%
(-) 101 633.44 VPC
(-) 90 631.02 VPT
VPI = 21+00.00
Elev. = 633.03
SSD = 698'
K = 101
180' V.C.

10+00	11+00	12+00	13+00	14+00	15+00	16+00	17+00	18+00	19+00	20+00	21+00
639.60	639.22	638.08	636.63	636.57	636.22	635.84	634.85	633.62	633.39	632.43	632.31
640.00	638.96	637.96	637.20	636.70	636.44	636.21	634.85	633.98	635.76	635.53	635.30
631.71	632.59	629.84	630.60	632.23	633.03	633.06	632.83	632.42	632.11	631.54	
635.07	634.85	634.62	634.39	634.16	633.94	633.71	633.48	633.18	632.63	631.83	

590 600 610 620 630 640 650

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	TGM	8/24/2020	REVISED NEW R/W TRANS - TR 54A
2	JDS	5/25/2018	EXTENDED SIDEWALK ALONG TRACT 54 ON US 21BUS.
1			
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CRAWFORD

SOUTH CAROLINA STV INCORPORATED NO. C03316 CERTIFICATE OF AUTHORIZATION

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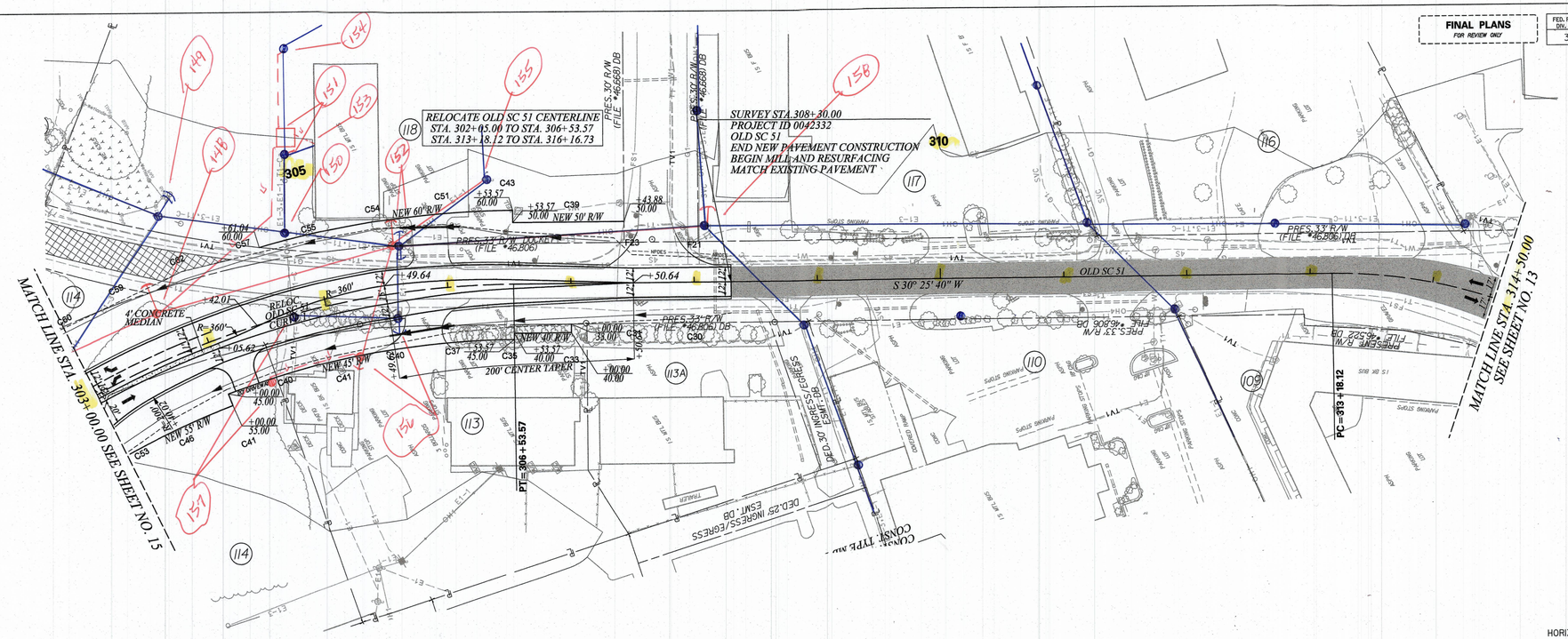
4/30/2021

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	21

FINAL PLANS
FOR REVIEW ONLY



MILLING/RESURFACING

REMOVE EXISTING PAVEMENT

RELOCATE OLD SC 51 CENTERLINE
STA. 302+05.00 TO STA. 306+53.57
STA. 313+18.12 TO STA. 316+16.73

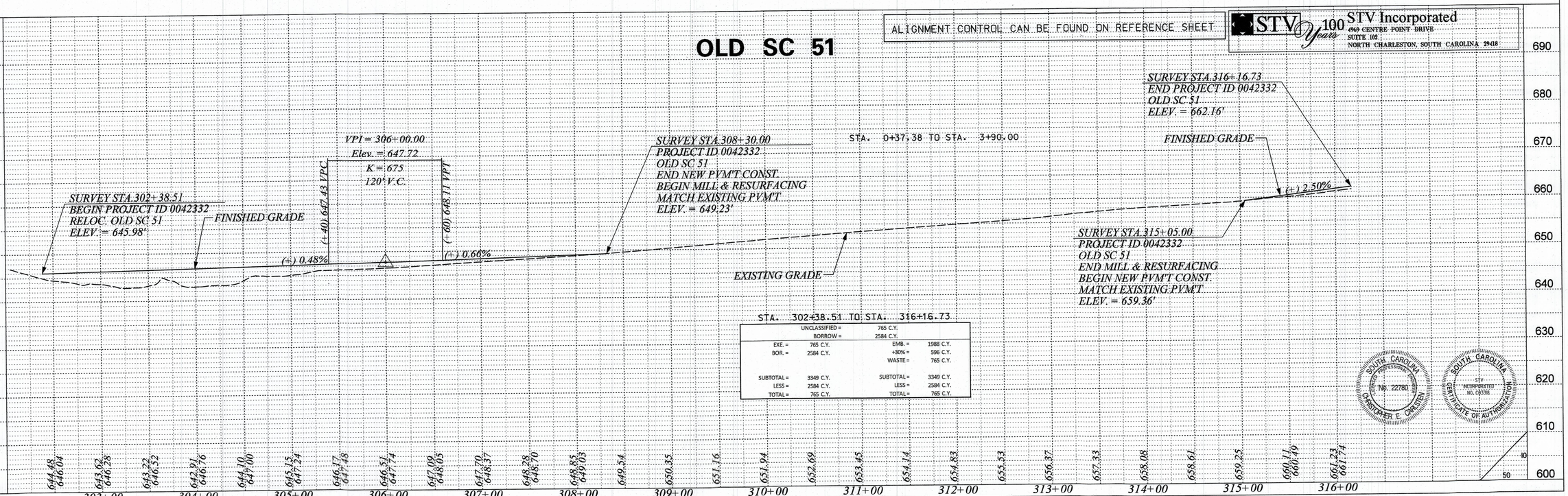
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D21 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

OLD SC 51



STA. 302+38.51 TO STA. 316+16.73

UNCLASSIFIED =	765 C.Y.		
BORROW =	2584 C.Y.		
EXE. =	765 C.Y.	EMB. =	1988 C.Y.
BOR. =	2584 C.Y.	+30% =	596 C.Y.
		WASTE =	765 C.Y.
SUBTOTAL =	3349 C.Y.	SUBTOTAL =	3349 C.Y.
LESS =	2584 C.Y.	LESS =	2584 C.Y.
TOTAL =	765 C.Y.	TOTAL =	765 C.Y.

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CARLSTEN

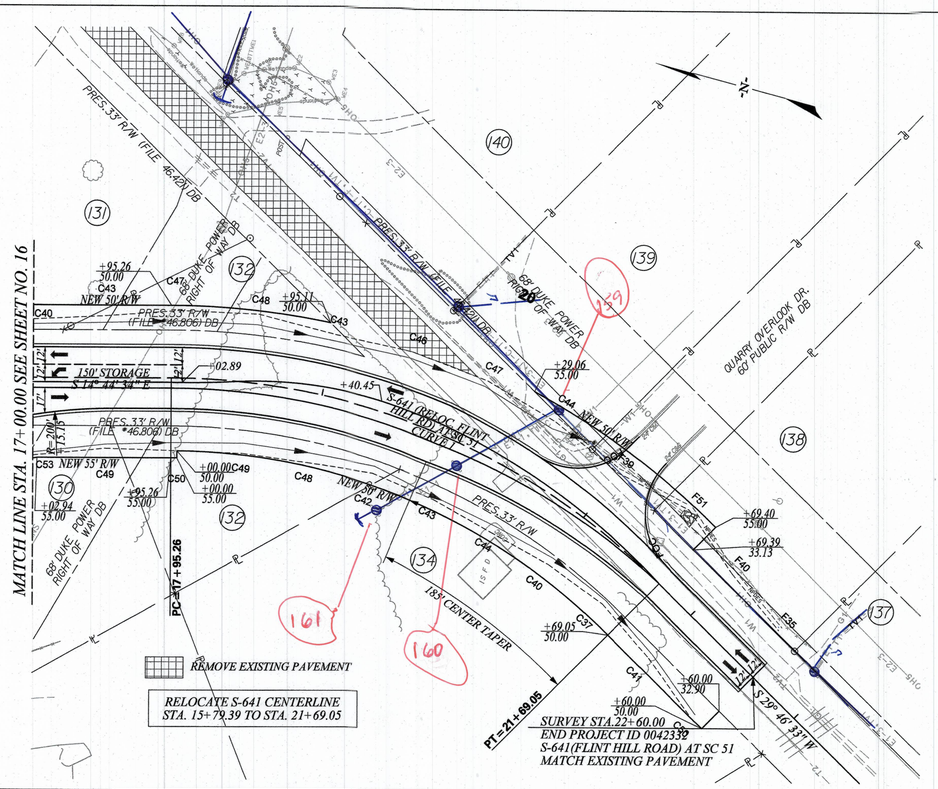
SOUTH CAROLINA STV INCORPORATED NO. C-3338 CERTIFICATE OF AUTHORIZATION

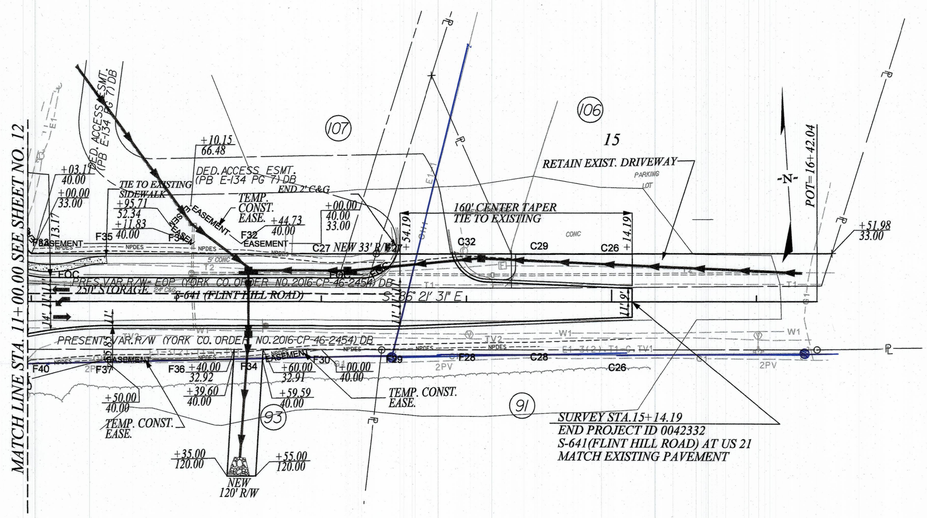
REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3	JDS	05/13/2020	ADDED DRIVEWAYS TO TR. 114
2	MHC	08/27/2019	ADDED TR 113A, SPLIT FROM TR 113
1			
6			
5			
4			

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	22

FINAL PLANS
FOR REVIEW ONLY

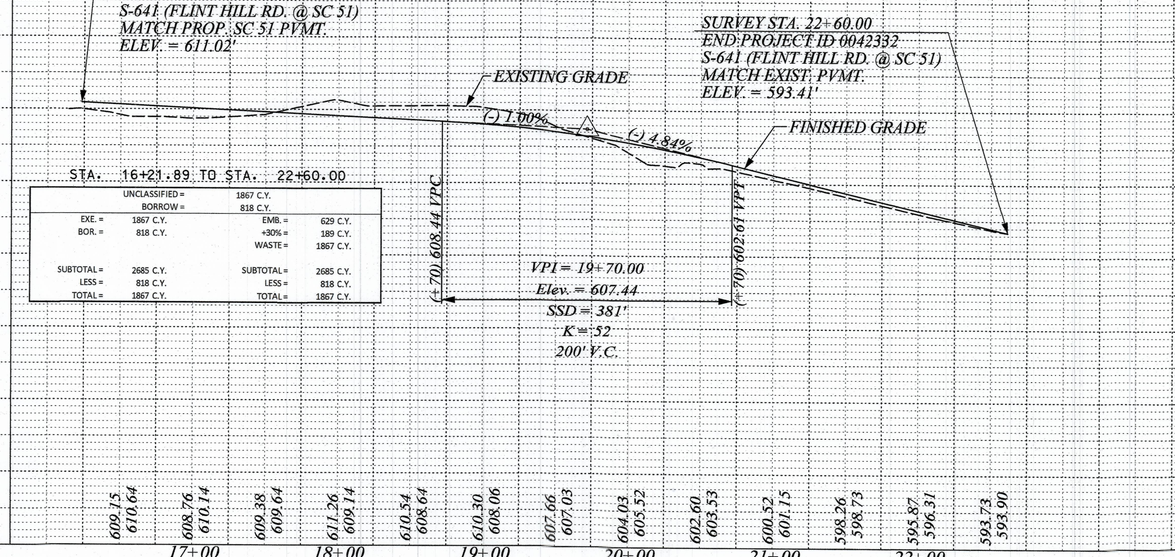




SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D22 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S-641 (FLINT HILL RD. AT SC 51)

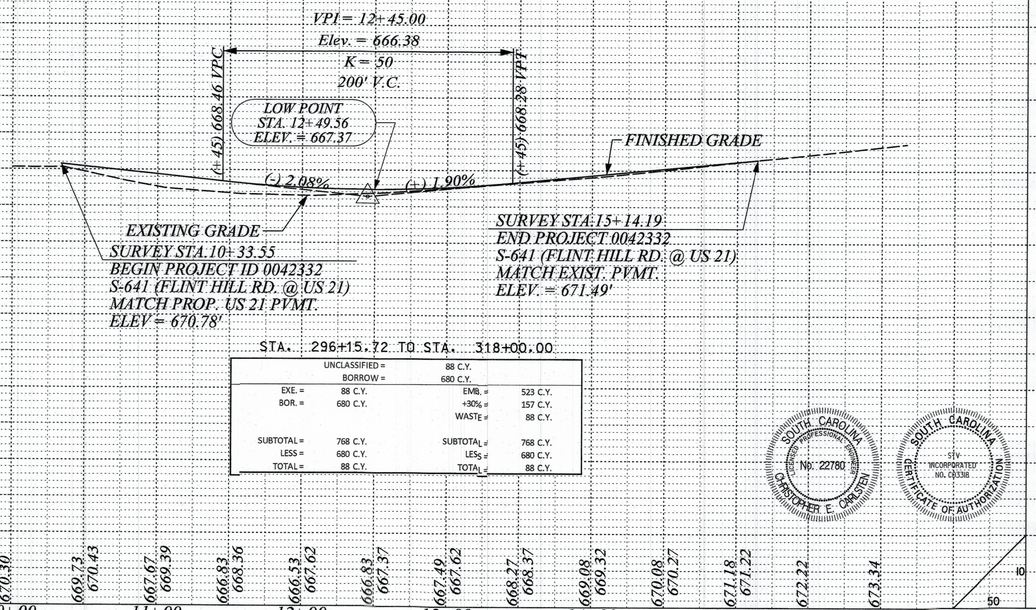


UNCLASSIFIED =	1867 C.Y.		
BORROW =	818 C.Y.		
EXE. =	1867 C.Y.	EMB. =	629 C.Y.
BOR. =	818 C.Y.	+30% =	189 C.Y.
		WASTE =	1867 C.Y.
SUBTOTAL =	2685 C.Y.	SUBTOTAL =	2685 C.Y.
LESS =	818 C.Y.	LESS =	818 C.Y.
TOTAL =	1867 C.Y.	TOTAL =	1867 C.Y.

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

S-641 (FLINT HILL RD. AT US 21)



UNCLASSIFIED =	88 C.Y.		
BORROW =	680 C.Y.		
EXE. =	88 C.Y.	EMB. =	523 C.Y.
BOR. =	680 C.Y.	+30% =	157 C.Y.
		WASTE =	88 C.Y.
SUBTOTAL =	768 C.Y.	SUBTOTAL =	768 C.Y.
LESS =	680 C.Y.	LESS =	680 C.Y.
TOTAL =	88 C.Y.	TOTAL =	88 C.Y.

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CARLSTEN

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION STV INCORPORATED NO. C03318

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6	TOM	09/14/2020	ADDED NOTE TO RETAIN EXIST DRIVEWAY - TR 106
5	MHC	08/23/2019	REMOVED TRACT 141, COMBINED WITH TRACT 140
4			
3	MHC	01/31/2019	ADDED TCE TO TR 107
2	MHC	01/08/2019	ADDED TCE TO TR 93, REMOVED PERM. FROM TR 91
1	JDS	11/30/18	REVISED EX. & PROP. R/W ON TRs. 94, 93, 106, & 107

PROLINE.DGN

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	23

FINAL PLANS *FOR REVIEW ONLY*

MATCH LINE STA. 15+00.00 SEE SHEET NO. 24

PRES. 33' R/W DOCKET (FILE #46806) DB

S-48 (EXISTING SPRINGHILL FARM ROAD CUL-DE-SAC)

CURVE 1 R= 30' Δ= 129° 42' 43" W

RELOC. S-48 (SPRINGHILL FARM ROAD) PT= 16+80.67

PC=24+82.06

PT=28+56.91

SURVEY STA. 23+50.63
BEGIN PROJECT ID 0042332
RELOC. S-48 (SPRINGHILL FARM ROAD)
MATCH EXISTING PAVEMENT

SURVEY STA. 15+60.00
BEGIN PROJECT ID 0042332
S-48 (EXISTING SPRINGHILL FARM ROAD CUL-DE-SAC)
BEGIN MILL AND RESURFACING
MATCH EXISTING PAVEMENT

REMAINDER OF FUTURE DRIVEWAY TO BE CONST. BY OTHERS, APPROVED BY SCDOT
CONST DRIVE TO SHLD

PAINTED MEDIAN CURVE 1

4' CONCRETE MEDIAN

NEW TRANS. R/W

NEW 30' R/W

NEW 55' R/W

PRES. 33' R/W (FILE #46806) DB

MILLING/RESURFACING

REMOVE EXISTING PAVEMENT

TIE- EQUALITY
(23) STA. 23+37.20 RELOC. S-48 (SPRING HILL FARM ROAD) =
STA. 16+64.58 S-48 (EXISTING SPRING HILL FARM ROAD CUL-DE-SAC) =

RELOCATE S-48 CENTERLINE
STA. 23+27.20 TO STA. 30+96.40

MATCH LINE STA. 29+00.00 SEE SHEET NO. 16

Nothing IN this AREA

MATCH LINE STA. 01+50.00 SEE SHEET NO. 17

N 14° 34' 01" E
ANDREW L TUCKER RD

10' WATERLINE ESMT. DB

NEW 50' R/W

SURVEY STA. 3+90.00
END PROJECT ID 0042332
S-328 (ANDREW L TUCKER ROAD)
MATCH EXISTING PAVEMENT

POT=5+94.04

SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D23 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

S-48 (SPRING HILL FARM RD. RELOC.)

SURVEY STA 23+50.63
BEGIN PROJECT ID 0042332
RELOC. S-48 (SPRINGHILL FARM RD.)
MATCH EXIST. PVMT.
ELEV. = 621.47'

VPI = 27+25.00
Elev. = 614.10
K = 159
150' V.C.

(+)50 615.58 VPC
(+)00 613.34 VPT

(-) 1.97%
(-) 1.02%

EXISTING GRADE
FINISHED GRADE

SURVEY STA 30+50.99
END PROJECT ID 0042332
RELOC. S-48 (SPRINGHILL FARM RD.)
MATCH PROP. SC 51 PVMT.
ELEV. = 610.77'

STA. 23+50.63 TO STA. 30+50.99

UNCLASSIFIED =	7179 C.Y.		
BORROW =	125 C.Y.		
EXE. =	7179 C.Y.	EMB. =	96 C.Y.
BOR. =	125 C.Y.	+30% =	29 C.Y.
		WASTE =	7179 C.Y.
SUBTOTAL =	7304 C.Y.	SUBTOTAL =	7304 C.Y.
LESS =	125 C.Y.	LESS =	125 C.Y.
TOTAL =	7179 C.Y.	TOTAL =	7179 C.Y.

S-328 (ANDREW L. TUCKER RD.)

SURVEY STA. 0+37.38
BEGIN PROJECT ID 0042332
S-328 (ANDREW L. TUCKER RD.)
MATCH PROOSED SC 51 PAVEMENT
ELEV. = 622.53'

FINISHED GRADE

(-) 2.24%
(-) 1.53%

SURVEY STA. 3+90.00
END PROJECT ID 0042332
S-328 (ANDREW L. TUCKER RD.)
MATCH EXISTING PVMT.
ELEV. = 614.79'

EXISTING GRADE
VPI = 3+65.00
Elev. = 615.18

STA. 0+37.38 TO STA. 3+90.00

UNCLASSIFIED =	119 C.Y.		
BORROW =	1455 C.Y.		
EXE. =	119 C.Y.	EMB. =	1119 C.Y.
BOR. =	1455 C.Y.	+30% =	336 C.Y.
		WASTE =	119 C.Y.
SUBTOTAL =	1574 C.Y.	SUBTOTAL =	1574 C.Y.
LESS =	1455 C.Y.	LESS =	1455 C.Y.
TOTAL =	119 C.Y.	TOTAL =	119 C.Y.

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CHARTEN

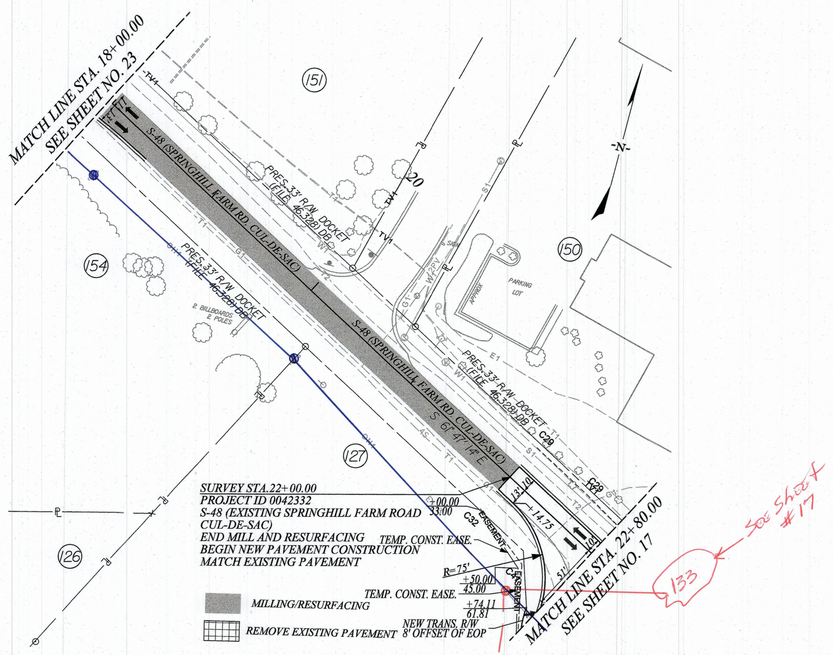
SOUTH CAROLINA STV INCORPORATED NO. C0138 CERTIFICATE OF AUTHORIZATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4	BY	DATE	DESCRIPTION OF REVISION
3	TGM	09/20/2021	REVISED FUTURE DRIVEWAY TO BE CONST BY OTHER NOTE & ADD CONST DRIVEWAY TO SHLD NOTE - TRACT 154
2	TGM	1/7/2020	ADDED NEW TRANS R/W BETWEEN PRES R/W & ADDED NOTE FUTURE DRIVEWAY TO BE CONST BY OTHER - TRACT 154
1	MJS	04/02/2020	ADDED DRIVEWAYS TO TR 154 AND REVISED MEDIAN

mcsiftg
N:\Projects\256776.000\90.CAD Models and Sheets\04.CT_Transportation\Roadway\Plan Sheets\256776 PLN SHT23.dgn
4/20/2021

PROLINE.DGN

FINAL PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	11149-004	US 21	24



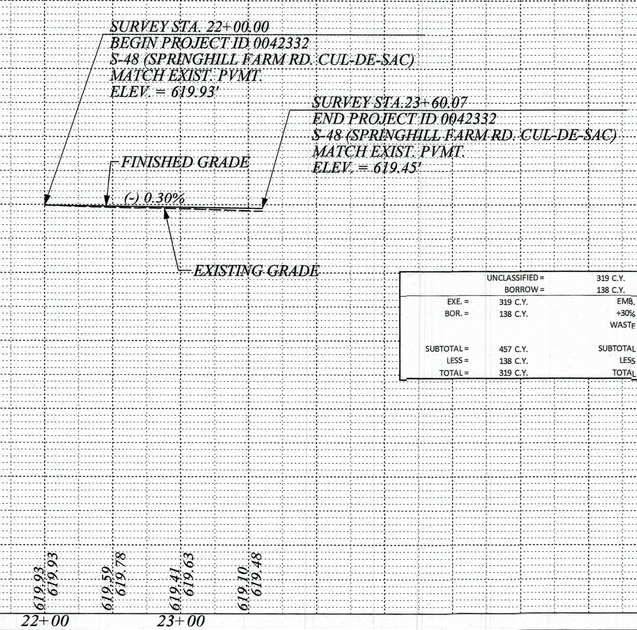
SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5G FOR REFERENCE DATA
SEE SHEET D24 FOR DRAINAGE

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

S-48 (SPRING HILL FARM RD. CUL-DE-SAC)

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418



	UNCLASSIFIED =	319 C.Y.		
	BORROW =	138 C.Y.		
EXE. =	319 C.Y.	EMB. =	106 C.Y.	
BOR. =	138 C.Y.	+30% =	32 C.Y.	
		WASTE =	319 C.Y.	
SUBTOTAL =	457 C.Y.	SUBTOTAL =	457 C.Y.	
LESS =	138 C.Y.	LESS =	138 C.Y.	
TOTAL =	319 C.Y.	TOTAL =	319 C.Y.	

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CHRISTIE

SOUTH CAROLINA STV INCORPORATED NO. C01336 CERTIFICATE OF AUTHORIZATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3			
2			
1	MHC	04/20/21	ADDED TCE & REMOVED RW PERM FOR TRACT 127
4			
5			
6			

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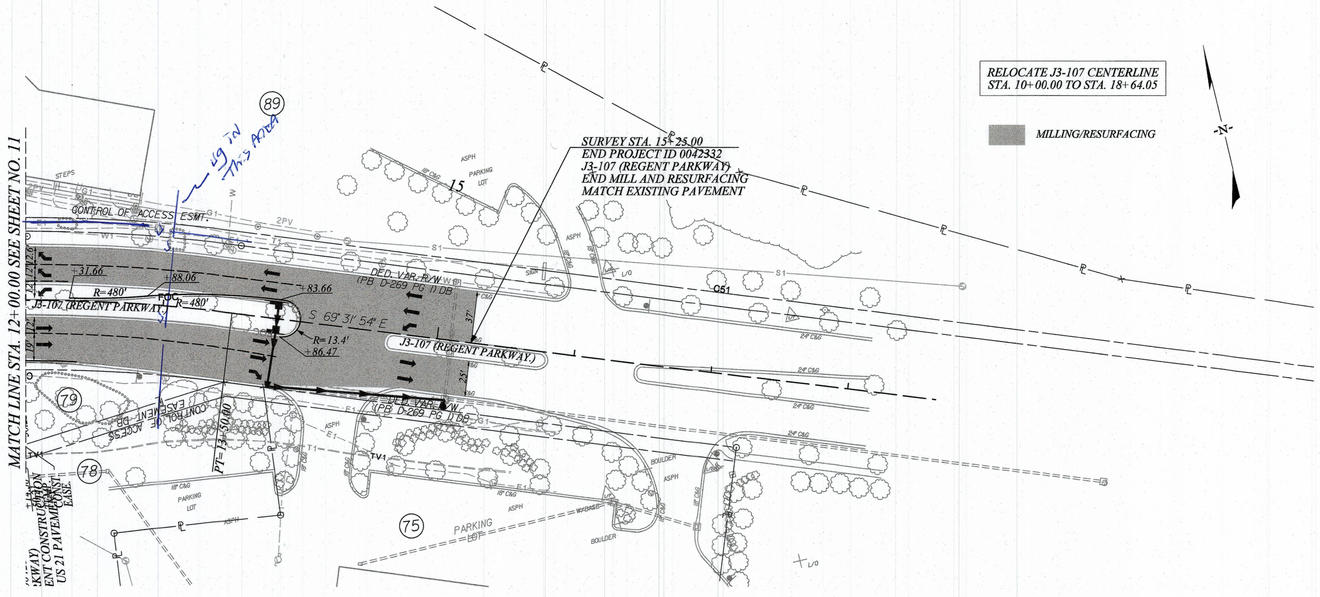
4/30/2021

PROLINE.DGN

FINAL PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	1149-004	US 21	25



SEE SHEETS 4 - 4D FOR R/W DATA
SEE SHEETS 5A - 5I FOR REFERENCE DATA
SEE SHEET D25 FOR DRAINAGE DATA

HORIZONTAL 50 0 50 100 feet
VERTICAL 10 0 10 20 feet

ALIGNMENT CONTROL CAN BE FOUND ON REFERENCE SHEET

STV 100 Years — STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

J3–107 (REGENT PKWY.)

SURVEY STA.10+53.64
BEGIN PROJECT ID 0042332
J3-107 (REGENT PKWY.)
BEGIN NEW PVMT. CONST.
MATCH PROP. US 21 PVMT.
ELEV = 647.54'
FINISHED GRADE

6.3.60%

EXISTING GRADE

SURVEY STA. 10+90.00
END PROJECT ID 0042332
J3-107 (REGENT PKWY.)
END NEW PVMT. CONST.
BEGIN MILL AND RESURFACING
MATCH EXISTING PAVEMENT
ELEV = 646.23'

STA. 10+53.64 TO STA. 13+50.00

UNCLASSIFIED =	212 C.Y.		
BORROW =	26 C.Y.		
EXE. =	212 C.Y.	EMB. =	20 C.Y.
BOR. =	26 C.Y.	+30% =	6 C.Y.
		WASTE =	212 C.Y.
SUBTOTAL =	238 C.Y.	SUBTOTAL =	238 C.Y.
LESS =	26 C.Y.	LESS =	26 C.Y.
TOTAL =	212 C.Y.	TOTAL =	212 C.Y.

650 640 630 620 610 600 590

647.84 646.92 646.79 646.23 645.38 644.47 643.61 642.60 640.95 639.99 638.72 637.17 635.30 632.98 631.01 628.97 626.57

10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00

SOUTH CAROLINA PROFESSIONAL ENGINEER No. 22780 CHRISTOPHER E. CRASTEN

SOUTH CAROLINA STV INCORPORATED NO. C03318 CERTIFICATE OF AUTHORIZATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

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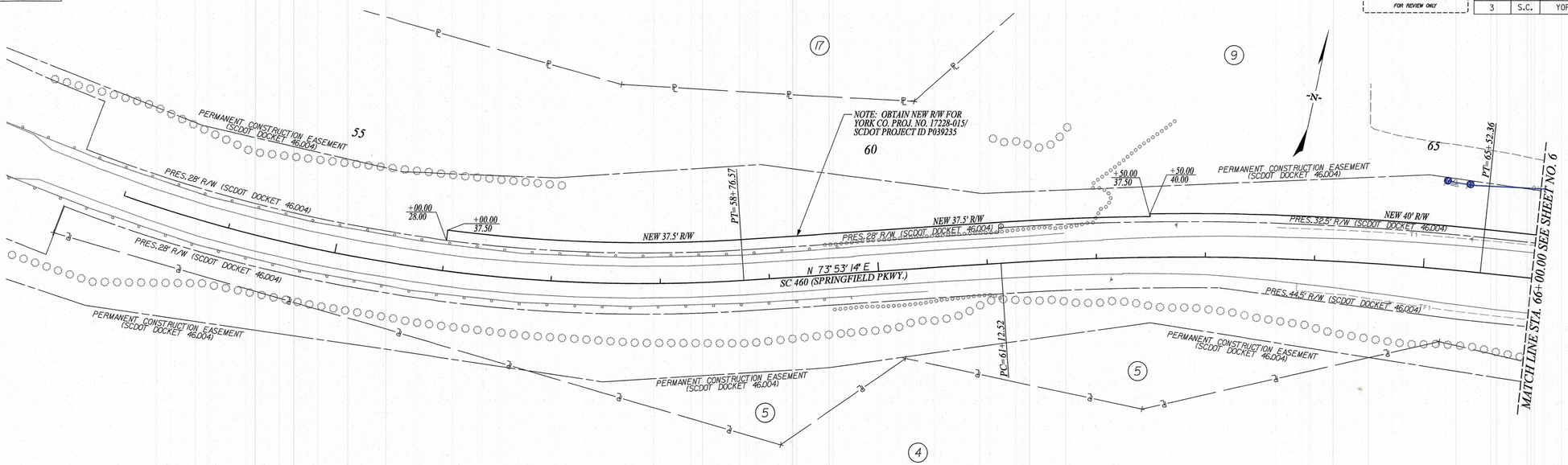
4/30/2020

FINAL PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	30





50 0 50 100
scale feet

STV 100 Years
STV Incorporated
4969 CENTRE POINT DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

SOUTH CAROLINA — STV INCORPORATED NO. C0338 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 22780 — CHRISTOPHER E. CARLSTEN

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2	TGM	9/9/2020	ADDED SHEET 30 TO SHOW NEW R/W ON TRACT 10
1	JDS	7/22/2020	ADDED SHEET 30 TO SHOW NEW R/W ON TRACT 9

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51

SCALE 1" = 50' RTE. DWG. NO.

msmith
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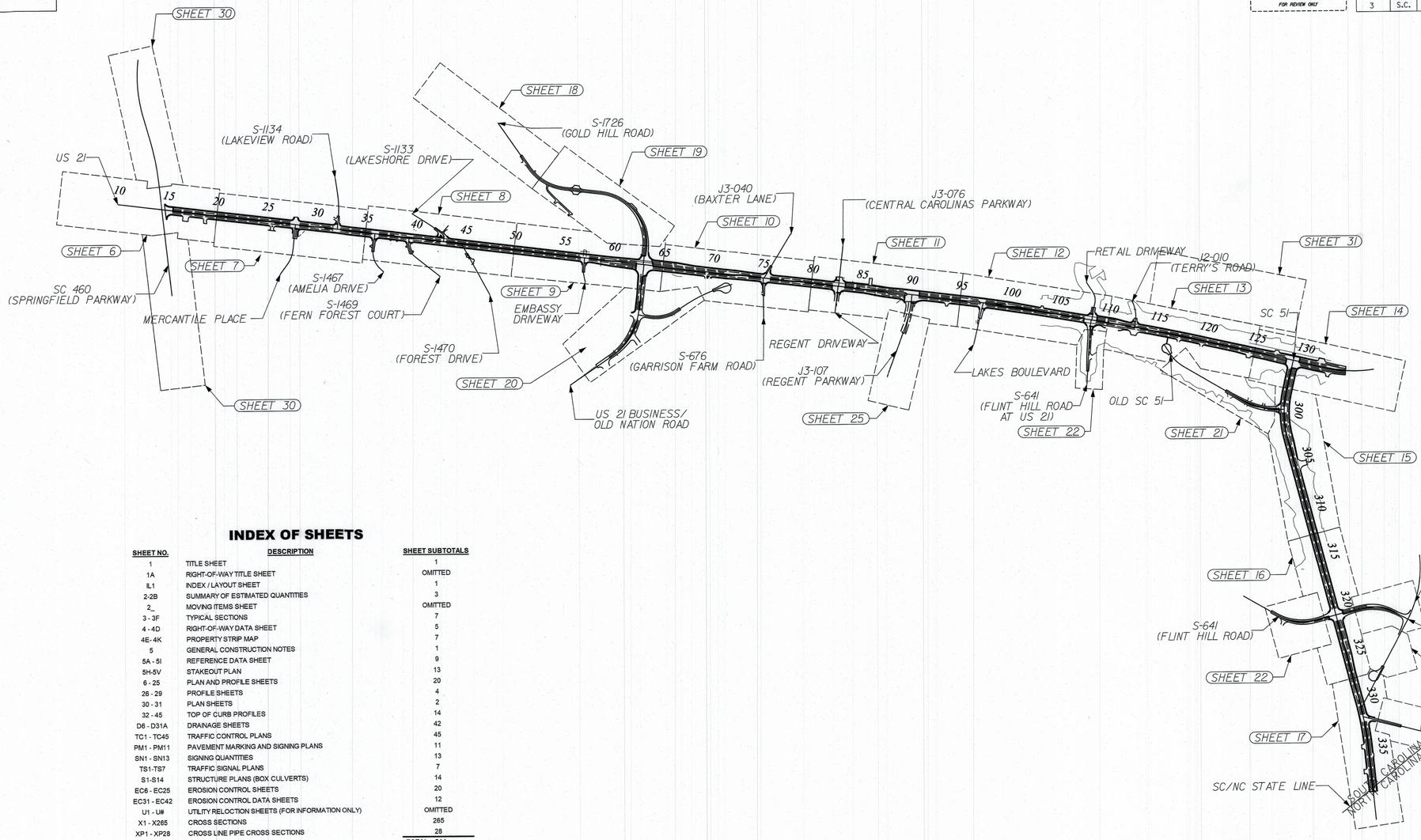
4/30/2020

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	IL1

FINAL PLANS
FOR REVIEW ONLY



INDEX OF SHEETS

SHEET NO.	DESCRIPTION	SHEET SUBTOTALS
1	TITLE SHEET	1
1A	RIGHT-OF-WAY TITLE SHEET	OMITTED
IL1	INDEX / LAYOUT SHEET	1
2-2B	SUMMARY OF ESTIMATED QUANTITIES	3
2_	MOVING ITEMS SHEET	OMITTED
3 - 3F	TYPICAL SECTIONS	7
4 - 4D	RIGHT-OF-WAY DATA SHEET	5
4E - 4K	PROPERTY STRIP MAP	7
5	GENERAL CONSTRUCTION NOTES	1
5A - 5I	REFERENCE DATA SHEET	9
5H-5V	STAKEOUT PLAN	13
6 - 25	PLAN AND PROFILE SHEETS	20
26 - 29	PROFILE SHEETS	4
30 - 31	PLAN SHEETS	2
32 - 45	TOP OF CURB PROFILES	14
D6 - D31A	DRAINAGE SHEETS	42
TC1 - TC45	TRAFFIC CONTROL PLANS	45
PM1 - PM11	PAVEMENT MARKING AND SIGNING PLANS	11
SN1 - SN13	SIGNING QUANTITIES	13
TS1-TS7	TRAFFIC SIGNAL PLANS	7
S1-S14	STRUCTURE PLANS (BOX CULVERTS)	14
EC6 - EC25	EROSION CONTROL SHEETS	20
EC31 - EC42	EROSION CONTROL DATA SHEETS	12
U1 - U#	UTILITY RELOCTION SHEETS (FOR INFORMATION ONLY)	OMITTED
X1 - X265	CROSS SECTIONS	265
XP1 - XP28	CROSS LINE PIPE CROSS SECTIONS	28
		TOTAL 544

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 5
ROCK HILL, SOUTH CAROLINA 29730

scale 500 0 500 1000 feet

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2	JDS	07/22/2020	ADDED SHEET 30 TO SHOW R/W ON TR. 9 ALONG SPRINGFIELD PKWY.
1	JDS	07/16/2020	ADDED SHEETS 31, D31, AND D31A TO SHOW PIPE OUTFALL ON TRACT 104

PREPARED BY MHC CHK'D BY CTC REVIEWED BY SSW

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
INDEX / LAYOUT SHEET

SCALE 1"=500' RTE. US 21 DWG. NO. IL1

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6/30/2021 8:00:26 PM

Agreement # _____

UTILITY AGREEMENT

York County Project No. 11149-004 Route (or Road No.) US 21 NORTH AND SC 51

This Agreement made this ~~20TH~~ 2nd day of ~~May~~ December, 20 24 by and between

York County, hereinafter called "County" and the utility company _

Zayo

hereinafter called "Company."

DEFINITIONS

Plans – detailed drawings or diagrams showing the stages for the relocation project

Schedule – the estimated number of days to complete each stage of the relocation project

Cost Estimate – the approximate cost of the relocation project

Actual Cost – the amount the Company pays to complete the relocation project

W I T N E S S E T H:

1. It is mutually agreed by and between the parties hereto that the Company shall perform or cause to be performed, the following work to its utility property facilities as shown on the Plans and Cost Estimate attached and incorporated into this agreement.

General description:

Directional Drill pulling back (3) 1.25" conduits, Pull Fiber 144 FT, Add 24x36x30 (or equivalent) Handholes, conduit- (3) 1.25" HDPE, Concrete Cut/Remove/Replace, Fiber Cable, Singlemode, 144 ct (replacing a 144ct) Single Armor, Single Jacket, Loose Tube, Zero Water Peak, Dry/Dry, Remove and abandon Existing duct run. Remove existing fiber and dispose, Remove and abandon 3 handholes.

2. The Company hereby agrees to relocate its utility facilities in conflict with highway construction in accordance with the provisions set forth in the Federal Highway Administration's FAPG 23 C.F.R. § 645A and the SCDOT's "A Policy for Accommodating Utilities on Highway Rights-of-Way." The Cost Estimate is:

TOTAL $ 507,676.00

County Share $ 507,676.00 Company Share $ 0

(a) The Company ☒ does have the right of occupancy in its existing location by reason of holding the fee, an easement, or other real property interest or ☐ does not and is in the existing right of way by encroachment.

(b) This section of line has been in service for approximately 7 years.

(c) Such work as is necessary to relocate, alter, or maintain the facility will be done in such a manner to minimize interference with or endangering the safety of the general public in their use of the roads as a highway. Traffic control and signing will be in accordance with "The Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways".

3. The Company shall designate an employee or agent who possesses knowledge of the relocation project and authority to make decisions on behalf of the Company to serve as the Designated Contact Person. The Designated Contact Person shall attend all bi-weekly construction meetings or ensure that any temporary designee attending a bi-weekly meeting possesses knowledge of the relocation project and authority to make decisions on behalf of the Company. The County shall communicate with the Company about the relocation project through the Designated Contact Person. The Company shall notify the County in writing of any changes to the Designated Contact Person within seven calendar days of the change. The Company designates the following person as the Designated Contact Person for this project:

Name: James Black
Phone Number: 719.216.8508
Email: Zayo.Relo.South_Carolina@zayo.com

4. The County shall provide the Company written notice, by email, of the date the County intends to begin advertising the bid. The Company shall update its Schedule within forty five days after receiving written notice of the bid advertisement. The County shall provide the Company notice of the preconstruction meeting, which the Company's Designated Contact Person shall attend.

5. The Company shall begin relocation project work promptly upon receiving authorization in writing, by email, from the County and complete the work in accordance with the schedule and as promptly as is practicable. Within ten calendar days of receiving written authorization, the Company shall provide notice to the County of the date on which work is expected to begin.

6. The Company will perform the work provided for in this agreement by the method checked below, in accordance with the provisions FAPG 23 CFR § 645.115:

( ) BY COMPANY'S REGULAR FORCES

(X) BY CONTRACT: (State one of recognized reasons for necessity of performing work in this manner)

Zayo is not adequately staffed and equipped to perform such relocation work with its own forces and equipment at a time convenient to and in coordination with the associated highway construction

If the Company, subject to prior approval, proposes to contract a portion of or all of the work covered by this agreement, then the Company must submit a list of items in the Cost Estimate that will be accomplished by contract. Where the Company elects to solicit competitive bids from a list of qualified contractors rather than through advertising in a publication, the names and addresses of those contractors must be written on the Cost Estimate or furnished to the County in advance of the Company's solicitation of bids.

7. The County will reimburse the utility company for costs incurred for work performed in accordance with the Plans and Cost Estimate. The Company must provide accurate records supporting all costs incurred and submitted for reimbursement. The method of developing the relocation costs shall be one of the following alternatives.

☐ Actual and related direct costs accumulated in accordance with a work order accounting procedure prescribed by the applicable Federal or State regulatory body.

☒ 4 Unit costs, such as broad gauge units of property, as used in own operations. (This method must have prior approval.)

The County will not pay for any components or items considered to be an upgrade unless such upgrades are required by applicable law, necessitated by the relocation, or proven to be more cost efficient.

8. All work performed by the Company shall be performed according to the plans and estimates approved by the County. The County is not obligated to reimburse the Company for any work not included in the Plans or Cost Estimate. The County Engineer may approve reimbursement for Actual Costs or additional work not included in the Plans or Cost Estimate if (1) the Actual Costs or additional work is necessary for the relocation project and (2) the Actual Costs or additional work do not exceed the Cost Estimate by more than 50%. The Company must seek and receive prior written approval before incurring costs for additional work.

9. The Plans must show the existing facilities, permanent changes to be made, and the stages by which these changes are to be accomplished. The Schedule must estimate the time required for each stage.

10. Periodic progress billings of incurred costs may be made by the Company to the County not to exceed monthly intervals and amounting to at least $2500.00; however, total progress billing payments shall not exceed the Cost Estimate or approved Actual Cost.

Upon completion of the work and no later than three months thereafter, the Company shall, at the earliest date practicable, furnish the County with five (5) copies of its final and complete billing of all costs incurred in connection with the work performed hereunder, such statement to follow as closely as possible the order of the items contained in the Cost Estimate. The totals for labor, overhead construction cost, travel expense, transportation, equipment, material and supplies, handling cost, and other services shall be shown in such a manner as will permit ready comparison with the Plans and Cost Estimates. Items of materials shall be itemized where they represent major components.

Credit shall be given for usable materials recovered from permanent or temporary installations. The final billing shall show the description and site of the project, the date on which the first work was performed; or, if preliminary engineering or right-of-way items are involved, the date on which the earliest item of billed expense was incurred, the completion date and the location where the records and accounts billed can be audited. The Company shall make adequate reference in the billing to its records, accounts, and other documents. Contractors and any subcontractors are to maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred and to make such materials available at their respective offices at all reasonable times during the contract for inspection by the County or any authorized representatives of the County. Copies shall be furnished if requested.

Final billings submitted by the Company shall carry a statement certifying that all items claimed have been reviewed and are in conformity with the provisions of the agreement, that credits have been given for all salvaged materials as required, and that all contractor's bills have been paid in full. This statement shall be signed by an authorized representative of the Company.

In the event a final and complete billing has not been received by the County three months following the completion of work and the Company has not during that period demonstrated to the County's satisfaction a hardship in completing that billing, the County may, in its sole discretion, consider the last payment made to be the final payment due under this agreement.

11. An extreme delay means the Company failed to begin relocation project work after receiving notice from the County to begin work and caused a thirty-day delay to the entire road construction project. The County shall notify the Company in writing if the Company causes an extreme delay. The Company shall have thirty calendar days from the date of the notice to stop the delay and expeditiously work to complete the relocation project. If the Company fails to stop the delay within thirty days after receiving notice of the delay, the County may require the Company to pay the costs associated with the delay of the project. The costs may include contractor remobilization costs, traffic control costs for the time of the delay, and any other costs attributable to the Company's delay. The County may deduct these costs from the retainage or any reimbursement owed to the Company. Should the costs of the delay exceed the amount of retainage or reimbursement owed to the Company, the County may invoice the Company for the costs of the delay, and the Company shall pay any invoices for the costs associated with extreme delays by the Company. The County may pursue any remedy available in law or equity to recover the costs of the delay.

Should a substantial hardship prevent the Company from performing the relocation project work and cause an extreme delay, the Company may apply in writing for a waiver excusing all or a portion of the delay and waiving all or a portion of the costs associated with the extreme delay. In its application, the Company shall state the cause of the delay and the time in which the Company shall resolve the hardship and continue with the relocation project work. The County Engineer shall determine whether to grant the waiver and what portion of the costs to waive.

Should a dispute arise about the cost levied upon the Company for an extreme delay, the County and the

Company agree participate in pre-litigation mediation and agree to diligently work in good faith to resolve any disputes associated with the costs charged to the Company for extreme delays. The parties shall select a mediator approved by both parties and set forth any resolutions in writing signed by both parties.

Should the parties fail to reach an agreement through pre-litigation mediation, the parties may seek a resolution for the dispute through the Court of Common Pleas located in York County, South Carolina, or the United States District Court for the State of South Carolina. This agreement shall be governed exclusively by the laws of the State of South Carolina without giving effect to its conflicts of law provisions.

12. The County shall have the right to inspect all recovered materials from the permanent facility prior to disposal by sale or scrap. This requirement will be satisfied by the Company giving notice to the County of the time and place the materials will be available for inspection. This notice is the responsibility of the Company and it may be held accountable for full value of materials disposed of without notice. The Company shall furnish a listing on final billings of major items not eligible for salvage credit and reasons therefore.

13. The Company will abide by the contract cost principles as set forth in FAPG 23 CFR 645A.

14. The Company will not participate directly or indirectly in any practice that subjects persons to discrimination because of their race, color, religion, sex, or national origin.

COMPANY: Zayo Group, LLC

ADDRESS: 1401 Wynkoop Street | Suite 500 | Denver, CO 80202

BY: Tess Bentayou

NAME: Tess Bentayou

TITLE: Director, Underlying Rights and Govt. Relations

YORK COUNTY

BY: _____

Joshua S. Edwards
County Manager

INSTRUCTIONS: Submit three original copies of this agreement form and three prints of drawings showing present location and proposed location of poles or lines with reference to highway survey stations and centerline.

Job Name: Zayo - SC 51/460

2. Directional Drill 14078 @ $21.00 = **$295,638.00**

(pulling back (3) 1.25" conduits)

3. Pull Fiber 15000 @ $2.50 = **$37,500.00**

(144f)

4. Hand Hole Labor and material 8 @ $3,000.00 = **$24,000.00**

(24x36x30 (or equivalent))

5. Conduit 3 @ $15,000.00 = **$45,000.00**

((3) 1.25" HDPE)

6. Miscellaneous materials 1 @$1,500.00 = **$1,500.00**

(Gravel, mule tape, couplings, etc)

7. traffic control 1@ $3,500.00 = **$3,500.00**

8. Concrete Cut/Remove/Replace 1 @ $2,500.00 = **$2,500.00**

9. Fiber 15000 @ $1.20 = **$18,000.00**

(Fiber Cable, Singlemode, 144 ct (replacing a 144ct) Single Armor, Single Jacket, Loose Tube, Zero Water Peak, Dry/Dry)

10. Remove and abandon 13946 @ $1.00 = **$13,946.00**

(Existing duct run. Remove existing fiber and dispose)

Remove and abandon 3 @ $1,000.00 = **$3,000.00**

(Hand holes)

12. Tracer wire labor and material 14200 @ $2.50= **$35,500.00**

Total $480,084.00

Quote for: RFP-ZAYOID22_SC/US21 - SC51/from SC 460 to the SC/NC-Splicing

State Line Jurisdiction Type-County Project

Project Name/Description Qty Rate Total

Fiber splicing (4 locations - 288 ct fiber) 1152 @ 21.00 = **$24,192.00**

EX splice cases 4 @ 850.00 = **$3,400.00**

Total: 27,592.00 Grand Total: $507,676.00

#20014463S

Application for Encroachment Permit

S.C. Department of Transportation
Form 637 (Rev 09/2015)

Contact Information

Applicant: Zayo Group
Street: 1805 29th Street
Unit 2050
City: Boulder
State: CO **Zip Code:** 80301
Phone: (719)216-8508 **Fax:**
Email: Zayo.Relo.South_Carolina@zayo.com
Contact: James R Black

Project Location

Primary County: York

County	Road Name
York	Springfield Pkwy (SC 460)

1. Type of Encroachment: COMMUNICATIONS (Cable TV, Telephone & Other)

Relocation of existing fiber optic lines.

2. Description of Location:

us 21 North Ph1 and Sc 51 From SC 460 to the SC/NC State Line

(Attach sketch indicating roadway features such as: pavement width, shoulder width, sidewalk and curb and gutter location, significant drainage structure, north arrow, right of way width, and location of the proposed encroachment with respect to the roadway centerline and the nearest intersecting road on the State system.)

Customer Agreement

3. **The undersigned Applicant hereby requests SCDOT to permit encroachment on SCDOT right of way as described herein. It is expressly understood that every encroachment, if and when constructed, shall be installed in accordance with the sketch attached hereto and made a part hereof. Applicant agrees to comply with and be bound by SCDOT's "A Policy for Accommodating Utilities on Highways Rights of way", "Standard Specifications for Highway Construction", the "General Provisions" and "Special Provisions", attached hereto or made a part hereof by reference, during the installation, operation and maintenance of said encroachment within SCDOT's right of way.**

DISCHARGES OF STORM WATER AND NON-STORM WATER: Work within State Highway right of way shall be conducted in compliance with all applicable requirements of the National Pollutant Discharge Elimination System (NPDES) permit(s) issued to SCDOT, to govern the discharge of storm water and non-storm water from SCDOT properties. Work shall also be in compliance with all other applicable Federal, State and Local laws and regulations, and with SCDOT's Encroachment Permits Manual and the encroachment permit. The encroachment permit will not be issued until Applicant has received an NPDES construction permit from SC Department of Health and Environmental Control.

Applicant and Permittee agrees to comply with all current SCDOT Standards Specifications for Highway Construction including all Supplemental Technical Specifications. Applicant and Permittee hereby further agrees, and binds his/her/its heirs, personal representatives, successors and assigns, to assume any and all liability for accidents or injuries to persons, or damage to property, including the highway and all SCDOT facilities in the right of way, that may be caused by the construction, maintenance, use, moving or removing of the physical appurtenances contemplated herein , and Applicant and Permittee agrees to indemnify and hold SCDOT harmless from and against any and all claims for personal injury and/or property damage, including attorney fees and costs, which may be sustained by reason of the construction, maintenance or existence of Permittee's encroachment on SCDOT's right of way.

Applicant's Name: James Black **Date:** 10/22/2024

(Please print or type)

Applicant's Sign: _____ **Title:** Regional OSP Operations Spc

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For Office Use Only

For Office Use Only

In accordance with your request and subject to all the provisions, terms, conditions, and restrictions stated in the application and the general and special provisions attached hereto, the SCDOT hereby approves your application for an encroachment permit. This permit shall become null and void unless the work contemplated herein shall have been completed prior to:

See Attached Special Provision and/or Permit Requirements

NPDES Permit Nbr:

(Date received by res. Maint. Engr.) **(SCDOT Approval)** **(Date)**

10/28/2024

NSR Group Inc

General Provisions

Application for Encroachment Permit
General Provisions

1. **DEFINITIONS: The word "Permittee" used herein shall mean the name of the person, firm, or corporation to whom this permit is addressed, his, her, its, heirs, personal representatives, successors and assigns. The word "DEPARTMENT" shall mean the South Carolina Department of Transportation.**
2. **NOTICE PRIOR TO STARTING WORK: Before starting the work contemplated herein within the limits of the highway right of way, the Department's Resident Maintenance Engineer in the county in which the proposed work is located shall be notified 24 hours in advance so that he may be present while the work is under way.**
3. **PERMIT SUBJECT TO INSPECTION: This permit shall be kept at the site of the work at all times while said work is under way and must be shown to any representative of the Department or law enforcement officer on demand.**
4. **PROTECTION OF HIGHWAY TRAFFIC: The applicant shall be responsible for the protection of the highway traffic at all times during the construction, maintenance, removing or moving of the encroachment permitted herein. Detours, barricades, warning signs and flagmen, as necessary, shall be provided by and at the expense of the Permittee and shall be in accordance with the "Manual on Uniform Traffic Control Devices" (MUTCD). The work shall be planned and carried out so that there will be the least possible inconvenience to the motoring public. The Permittee agrees to observe all rules and regulations of the Department while carrying on the work contemplated herein and take all other precautions that circumstances warrant.**
5. **STANDARDS OF CONSTRUCTION: All work shall conform to the Department's standards of construction and shall be performed in a workman-like manner. The applicant shall make adequate provisions for maintaining the proper drainage of the highway as it may be affected by the encroachment permitted herein. All work shall be subject to the supervision and satisfaction of the Department.**
6. **FUTURE MOVING OF PHYSICAL APPURTENANCES: If, in the opinion of the State Highway Engineer, it should ever become necessary to move or remove the physical appurtenances, or any part thereof contemplated herein, on account of change in location of the highway, widening of the highway, or for any other sufficient reason, such moving shall be done on demand of the Department at the expense of the Permittee.**
7. **RESTORATION OF HIGHWAY FACILITIES UPON MOVING OR REMOVING OF PHYSICAL APPURTENANCES: If, and when, the physical appurtenances contemplated herein shall be moved or removed, either on the demand of the Department or at the option of the Permittee, the highway and facilities shall immediately be restored to their original condition at the expense of the Permittee.**
8. **COSTS: All work in connection with the construction, maintenance, moving or removing of the physical appurtenances contemplated herein shall be done by and at the expense of the Permittee.**
9. **ADDITIONAL PERMISSIONS:**
   (a) It is distinctly understood that this permit does not in any way grant or release any rights lawfully possessed by the abutting property owners. The Permittee shall secure any such rights, as necessary, from said abutting property owners.
   (b) The Permittee shall be responsible for obtaining all other approvals or permits necessary for installation of the encroachment from other government entities.

(c) There shall be no excavation of soil nearer than two feet to any public utility line or appurtenant facility except with the consent of the owner thereof, or except upon special permission of this Department after an opportunity to be heard is given the owner of such line or appurtenant facility.

10. **ADDITIONAL WORK PERFORMANCE:**

(a) All crossings over the highway shall be constructed in accordance with "Specifications for Overhead Crossings of Light and Power Transmission Lines and Telegraph Lines over each other and over Highway Rights of Way in South Carolina," as approved by the Public Service Commission of South Carolina and effective as of date of this permit.

(b) All tunneling, boring, or jacking shall be done in such a way as not to disturb the highway surfacing.

(c) No pavement shall be cut unless specifically authorized herein.

(d) No excavation shall be nearer than three feet to the edge of pavement unless specifically authorized herein.

(e) Underground facilities will be located at minimum depths as defined in the "Utility Accommodations Manual" for the transmittant, generally as follows: 4 feet minimum for hazardous or dangerous transmittant, 3 feet minimum for other lines. The Department may approve shallower depths if adequate protection is provided. Such approval must be obtained in writing.

(f) Service and other small diameter pipes shall be jacked, driven, or otherwise forced underneath the pavements on any surfaced road without disturbing the pavement. The section under the highway pavement and within a distance of three (3) feet on either side shall be continuous without joints.

11. **ACCESS:**

(a) Permittee is responsible for maintaining reasonable access to private driveways during construction.

(b) It is expressly provided that, with respect to any limited access highway, the Permittee shall not have or gain access from the main traveled way of the highway, or the on or off ramps to such facility, except upon approval by the Department.

12. **DRIVEWAYS:**

(a) The existing crown of the highway shall be continued to the outside shoulder line of the highway.

(b) If the driveway or approach is concrete pavement, the pavement shall be constructed at least 6 inches thick and with a minimum of class 2500 concrete. There shall be a bituminous expansion joint, not less than 3/4 inches in thickness, placed between the highway paving and the paving of the approach for the full width of the approach.

13. **BEAUTIFICATION:**

(a) All trees, plants, flowers, etc. shall be placed in accordance with the provisions specifically stipulated herein.

(b) All trees, plants, flowers, etc. shall be maintained by, and at the expense of, the Permittee and the provisions of this permit shall become null and void, if and when said Permittee ceases to maintain aid trees, plants, flowers, etc.

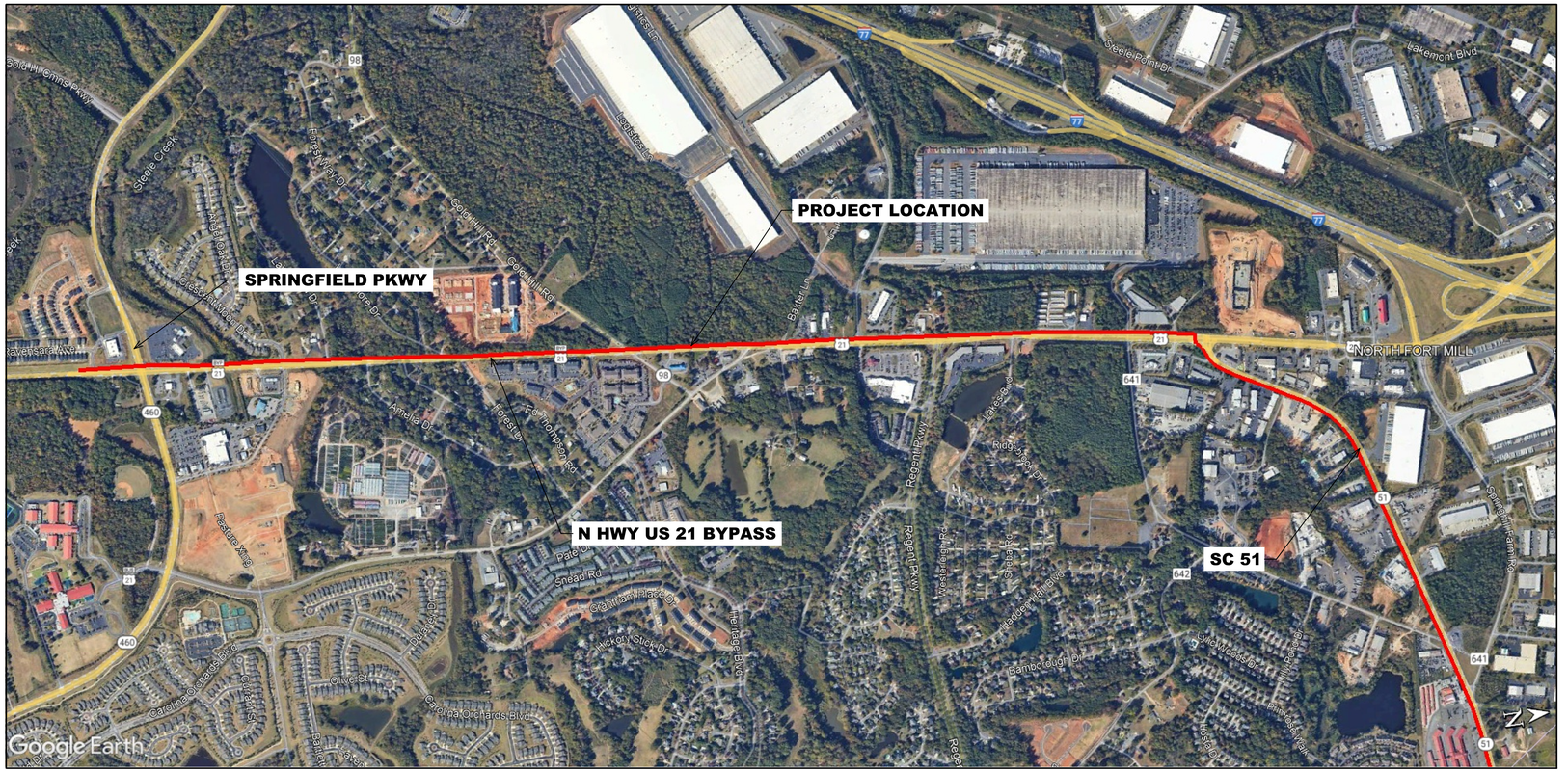
14. **AS-BUILT PLANS:**

(a) The applicant shall provide the Department with survey-quality as-built plans in accordance with the requirements set forth in the Department's "A Policy for Accommodating Utilities on Highway Rights of Way".

15. **COMPLETE STREETS:**

Reference Departmental Directive 28, "Complete Streets". For encroachment permit types that require a Traffic Impact Study (TIS), the applicant shall consider the inclusion of walking, bicycling, and transit accommodations within the scope of the encroachment. The applicant shall review walking, bicycling, and transit plans from Metropolitan Planning Organizations (MPOs), Councils of Government (COGs), and regional transit providers to determine the scope of accommodations for complete streets. Coordination with the District Permit Engineer is required to determine if the inclusion of walking, bicycling, and transit accommodations are conducive for implementation based on the scope of the encroachment.

FIBER SEGMENT
CONSTRUCTION DRAWINGS
US 21 NORTH PHASE 1 AND SC 51
FROM SC 460 TO THE SC/NC STATE LINE
ROAD WIDENING
PID 0042332
YORK COUNTY, SC



THIS IS TO SERVE AS ZAYO GROUP, LLC ACKNOWLEDGEMENT, THAT WE UNDERSTAND ANY SMALL CELL CONSTRUCTION REQUIRES ITS OWN SEPARATE PERMIT AND THAT THE ROW PERMIT TO INSTALL CONDUIT AND FIBER DOES NOT ALLOW US TO INSTALL ANY SMALL CELL STRUCTURES OR ATTACH SMALL CELLS RADIO OR ANTENNA TO ANY EXISTING STRUCTURES IN THE ROW.

CONTRACTOR SHALL VERIFY ALL PLANS & EXISTING DIMENSIONS & CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ARCHITECT OR ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

811 Know what's below. Call before you dig.

REVISIONS		
DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

MANAGER: #

PHONE: #

CobbFendley
Texas Registration No. 274
4424 W Sam Houston Parkway N, Suite 600
Houston, Texas 77041
713.462.3242 | fax 713.462.3262 |
www.cobbfendley.com

zayo GROUP

COVER SHEET
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT		
DRAFTER:	OG	SCALE:	NTS	SHEET:	01 OF 21	REVISION:	0

UTILITY LINECODES

	EXISTING	TO BE REMOVED	PROPOSED	TYPE OF UTILITY
OVERHEAD	E	E	E	ELECTRIC
	E-T	E-T	E-T	ELECTRIC/TELECOMMUNICATIONS
	E-TV	E-TV	E-TV	ELECTRIC/CABLE TV
	E-T-TV	E-T-TV	E-T-TV	ELECTRIC/TELECOMMUNICATIONS/CABLE TV
	GW	GW	GW	GUY WIRE
	T	T	T	TELECOMMUNICATIONS
	T-TV	T-TV	T-TV	TELECOMUNICATIONS/CABLE TV
	TV	TV	TV	CABLE TV
UNDERGROUND	E	E	E	ELECTRIC
	T	T	T	TELECOMMUNICATIONS
	TV	TV	TV	CABLE TV
	W	W	W	WATER
	##"W	##"W	##"W	WATER FOR LABELED PIPE SIZES
	NW	NW	NW	NON-POTABLE WATER
	##NW	##NW	##NW	NON-POTABLE WATER FOR LABELED PIPE SIZES
	STM	STM	STM	STEAM
	##STM	##STM	##STM	STEAM FOR LABELED PIPE SIZES
	SS	SS	SS	SANITARY SEWER WITH FLOW DIRECTION
	##SS	##SS	##SS	SANITARY SEWER WITH FLOW DIRECTION FOR LABELED PIPE SIZES
	SFM	SFM	SFM	SANITARY SEWER FORCE MAIN WITH FLOW DIRECTION
	G	G	G	GAS
	##G	##G	##G	GAS FOR LABELED PIPE SIZES
	P	P	P	PETROLEUM
	##P	##P	##P	PETROLEUM FOR LABELED PIPE SIZES

T EXISTING AERIAL

T EXISTING AERIAL TO BE RELOCATED

T PROPOSED NEW AERIAL

T EXISTING BURIED

T EXISTING BURIED TO BE RELOCATED

T PROPOSED NEW BURIED

UTILITY SYMBOLS

EXISTING	PROPOSED	TEMPORARY	
			UTILITY POLE/GUY POLE
			LIGHT POLE
			GUY ANCHOR
M	M	M	MARKER
X	X	X	SPLICE BOX
			CABINET
			VENT
E	E	E	ELECTRIC MANHOLE
H	H	H	HAND HOLE
E	E	E	TRANSFORMER
E	E	E	ELECTRIC METER
E	E	E	ELECTRIC BOX
			TRANSMISSION TOWER
T	T	T	TELECOMMUNICATIONS MANHOLE
T	T	T	TELECOMMUNICATIONS PEDESTAL
SLC	SLC	SLC	SUBCRIBER LOOP CARRIER (aka "SLICK")
H H/H	H	H	HAND HOLE
			GUY ANCHOR
			SPLICE CASE
			PHONE BOOTH
			CABLE TV PEDESTAL
TV	TV	TV	CABLE TV MANHOLE
W	W	W	WATER VALVE
W	W	W	WATER METER
W	W	W	WATER MANHOLE

EXISTING	PROPOSED	TEMPORARY	
			FIRE HYDRANT ASSEMBLY (INCLUDES ASSOCIATED VALVE)
BFP	BFP	BFP	BACKFLOW PREVENTER
PIV	PIV	PIV	PRESSURE INDICATOR VALVE
ARV	ARV	ARV	AIR RELEASE VALVE
W	W	W	WELL
W	W	W	WATER VAULT
W	W	W	WATER VALVE MARKER
			STAND PIPE
			CLEANOUT
SS	SS	SS	SANITARY SEWER MANHOLE
ARV	ARV	ARV	AIR RELEASE VALVE
GT	GT	GT	GREASE TRAP
S	S	S	SANITARY SEWER FORCE MAIN VALVE
G	G	G	GAS VALVE
G	G	G	GAS METER
G	G	G	GAS MANHOLE
GPR	GPR	GPR	GAS PRESSURE REGULATOR
G	G	G	GAS VAULT
GTS	GTS	GTS	GAS TEST STATION
P	P	P	PETROLEUM VALVE

THE EXISTING ZAYO FACILITIES DEPICTED ON THIS DRAWING WERE INSERTED BASED ON AS-BUILTS AND/OR DESIGNATION. ALL OFFSETS AND DEPTHS HAVE BEEN OBTAINED ELECTRONICALLY AND ARE FOR DESIGN PURPOSES ONLY. PHYSICAL VERIFICATION OF DEPTHS REQUIRED FOR CONSTRUCTION

ALL DEPTHS HAVE BEEN OBTAINED ELECTRONICALLY AND ARE FOR DESIGN PURPOSES ONLY. PHYSICAL VERIFICATION OF DEPTHS REQUIRED FOR CONSTRUCTION

EXSITING ZAYO HANDHOLE (48"X32") FIBERGLASS

OWNER L23'/H18'
5/8 3E
10M
P=8

PROPOSED ZAYO HANDHOLE (48"X32") FIBERGLASS TO BE PLACE AT STA# 0+00,00' R/L

ZAYO PROPOSED PLACEMENT OF(2)-1.25 DUCTS E/W SIZE/CT FOC INSIDE THE BACK 5' OF R/W AT 36" MIN. DEPTH

NO ZAYO CONFLICTS ON THIS DRAWING

ZAYO PROPOSED (2)HDPE CONDUITS E/W ... CT FIBER TO BE PLACED IN BACK5' OF R/O/W

PWR POLE(S) IN CONFLICT ZAYO WILL TRANSFER/REPLACE CABLES TO NEW PWR POLES

THE EXACT SPLICE LOCATION FOR THE PROPOSED CABLE TO BE DETERMINED ON THE DESIGN PORTION OF THIS PROJECT

EXISTING ZAYO (2)-1.25" DUCT E/W SIZE CT FOC TO REMAIN AND BE RETAINED

NO ZAYO FACILITIES ON THIS DRAWING OR "NO FACILITIES FROM 24-003 THUR 24-007" ADD THIS TO THE ADD JOINING PAGES WITH FACILITIES

ZAYO TO AJUST HANDHOLE/ M/H LID CONFLICTS TO FINAL GRADE OF GROUND/ SIDEWALK

STA# 000+00
COBB EMC 3/45(00)
EOP/BOC 00'
POLE #
PRI:'-"
TRAN:'-"
TRAN DL:'-"
2ND DL:'-"
TRPL:'-"
DPLX:'-"
NEUT:'-"
TRAF:'-"
DOT:'-"
CATV:'-"
CATV:'-"
AT&T:'-"
AT&T:'-"

DOWN GUY SIZES
16,12,10,6.6M

122'
1-10M
AJAA-50 (73)

MS 17'-9"

CL 18'-6"

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REVISIONS		
DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

MANAGER: #

PHONE: #

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Houston, Texas 77041
713.462.3242 | fax 713.462.3262 |
www.cobbfendley.com

zayo GROUP

LEGEND
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE:	NTS	SHEET: 02 OF 21	REVISION: 0

1/24/2024
\\frjscserver\common\Departments\Broadband\CLIENTS\ZAYO\ZAYO - SOUTH CAROLINA\Zayo\022 - SC US21 - SC51_CAD\Design_Sets\03_CD\Sheets\01-08-CD_TYPICALS.dgn

CONSTRUCTION NOTES

1. WHERE TRENCHING TECHNIQUES ARE USED THE MINIMUM DEPTH TO THE TOP OF CONDUIT WILL BE 48” UNLESS APPROVED BY THE PROJECT ENGINEER.
2. ALL EXCAVATIONS WILL HAVE FIBER OPTIC WARNING TAPE INSTALLED A MINIMUM OF 11”BELOW FINAL GRADE.
3. WHENEVER DIRECTIONAL BORING IS UTILIZED TO INSTALL CONDUITS ALL EXCAVATIONS SHALL BE BACKFILLED PER MUNICIPALITY REQUIREMENTS.
4. UTILITIES SHOWN ARE FOR DESIGN PLANNING PURPOSES ONLY. CONTRACTOR IS TO FOLLOW THE SC 811 ONE CALL SYSTEM REQUIREMENTS FOR THE MARKING OF ALL EXISTING UTILITIES AND WORK TO RESOLVE CONFLICTS WITH THE FIELD ENGINEER. THE CONTRACTOR SHALL NOT RELY UPON ANY UTILITY LOCATION SHOWN ON THE PLAN AS A REPRESENTATION OF A UTILITY LOCATION OR ABSENCE OF EXISTING UTILITIES. CONTRACTOR IS TO TEST PIT AND EXPOSE ALL UTILITIES ALONG THE PROPOSED ALIGNMENT PRIOR TO BEGINNING OF EXCAVATION, BORING OR PLOWING.
5. CONTACT SOUTH CAROLINA 811 72 HOURS IN ADVANCE OF CONSTRUCTION AT 800-432-4770 FOR LOCATION OF BURIED UTILITIES.
6. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO HAVE ALL TRAFFIC LOOPS LOCATED. CONFIRM WITH ZAYO, WITH MUNICIPALITY CORRESPONDENCE, THAT ALL TRAFFIC LOOP LOCATIONS HAVE BEEN COORDINATED FOR MARKING.
7. AT THE END OF EACH WORK DAY CONDUIT CAPS WILL BE PLACED ON ALL VACANT DUCTS.
8. A MAXIMUM BENDING RADIUS OF 24” FOR FIBER CABLE WILL BE ADHERED TO.
9. MAXIMUM CABLE INSTALLATION TENSION SHALL NOT EXCEED 600 POUNDS.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL AND STORAGE OF ALL SHRUBBERY TO BE REPLACED.
11. RESTORATION OF THE CONSTRUCTION AREA TO ORIGINAL OR BETTER CONDITION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
12. PLACE 6” OF ¾” CRUSHED ROCK IN THE BOTTOM OF THE PIT PRIOR TO PLACING THE HANDHOLE.
13. ALWAYS HAND DIG WITHIN 2' OF UTILITIES.
14. PLACE A COIL OF SLACK IN EACH HANDHOLE/MANHOLE AS SPECIFIED.
15. EXCAVATE OUTSIDE THE DRIP LINE OF ALL TREES TO PREVENT ROOT DAMAGE.
16. CONSTRUCTION MATERIALS AND STAGING AREAS ARE NOT PERMITTED WITHIN 25' BUFFER ZONE OF WETLANDS, CREEKS, AND STREAMS.
17. THE CURB AND GUTTER IS NOT TO BE DISTURBED WITHOUT PRIOR APPROVAL.
18. IN THE EVENT THAT IT IS NECESSARY TO REMOVE ANY PORTION OF THE CURB AND GUTTER, IT IS TO BE REPLACED SEAM TO SEAM IN A MATCHING CONFIGURATION TO THE ADJACENT CURB AND GUTTER.
19. ALL CONSTRUCTION WITHIN RIGHT OF WAYS TO BE IN ACCORDANCE WITH THE UTILITY ACCOMMODATION MANUAL AND/OR SPECS.
20. RIGHT-OF-WAYS ARE DEPICTED BASED ON FIELD OBSERVATION AND THE LATEST COUNTY RECORDS AVAILABLE, CONTRACTOR MUST FIELD VERIFY. IF FURTHER ACCURACY IS REQUIRED, LAND SURVEYS WILL BE NECESSARY.

GENERAL NOTES

1. GENERAL NOTES SHALL APPLY TO ALL DRAWINGS.
2. ALL WORK SHALL COMPLY WITH APPLICABLE STATE, COUNTY, & LOCAL REGULATORY AGENCIES. INCLUDING BUT NOT LIMITED TO OSHA, SCDOT, ETC.
3. THE CONTRACTOR SHALL CONTACT THE ADJACENT PROPERTY OWNERS A MINIMUM OF 12 HOURS IN ADVANCE OF CONSTRUCTION AT THE WORK SITE.
4. ALL TRAFFIC CONTROL DEVICES SHALL BE IN PLACE BEFORE WORK IS STARTED. DEVICES NO LONGER REQUIRED SHALL BE REMOVED AS SOON AS POSSIBLE.
5. PEDESTRIAN TRAFFIC AREAS MUST BE MAINTAINED AT ALL TIMES. PEDESTRIANS MAY NOT BE REROUTED ONTO PRIVATE PROPERTY OR INTO STREETS.
6. NO EQUIPMENT OR MATERIALS SHALL BE STORED OR PERMITTED TO STAND UNPROTECTED WHERE TRAFFIC IS MAINTAINED.
7. NO EQUIPMENT OR MATERIALS SHALL BE STORED ON ROAD SURFACE DURING NON-WORKING PERIODS.
8. NO EQUIPMENT OR MATERIALS SHALL BE STORED ON SIDEWALK AT ANY TIME.
9. EXCAVATION MATERIAL SHALL BE STORED AWAY FROM THE PAVED ROADWAY, ALL SPILLED MATERIAL WILL BE REMOVED IMMEDIATELY.
10. EXISTING SIGNS, DELINEATORS, GUARDRAILS, MARKERS, TREES, SHRUBS, FENCES, WALKS, STEPS, ETC. THAT ARE DISTURBED BY THIS CONSTRUCTION SHALL BE REPLACED OR RESTORED TO THEIR ORIGINAL CONDITION OR TO THE SATISFACTION OF THE INSPECTING ENGINEER, PROPERTY OWNER, CITY, COUNTY, STATE AND/OR ANY OTHER AGENCY HAVING AUTHORITY/JURISDICTION.
11. CITY, COUNTY, STATE ROAD SIGNS, DELINEATORS, GUARDRAILS, ETC. SHALL NOT BE REMOVED. WRITTEN PERMISSION SHALL BE REQUIRED PRIOR TO ANY EXCAVATION IN THIS AREA.
12. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE CITY, COUNTY, STATE SPECIFICATIONS AND STANDARDS.
13. ALL PERSONS WHO FLAG TRAFFIC ON STATE RIGHT-OF-WAY MUST BE CERTIFIED.
14. ALL SURFACE AND SUBSURFACE RESTORATION IS TO BE IDENTICAL TO THE ADJACENT UNDISTURBED AREAS.
15. THE CONTRACTOR IS RESPONSIBLE FOR ANY UTILITY DAMAGES. WHEN ANY PERSON DAMAGES A UTILITY LINE OR PROTECTIVE COATING DURING EXCAVATION OR DEMOLITION THE ON SITE FULTON COUNTY INSPECTOR AND THE AFFECTED UTILITY WILL BE NOTIFIED.
16. ON ALL WORK ASSOCIATED WITH MUNICIPALITY PROJECTS THE RESIDENT ADMINISTRATOR OF THAT MUNICIPALITY MUST BE NOTIFIED AT LEAST 48 HRS BEFORE STARTING WORK.
17. CONTRACTOR IS RESPONSIBLE FOR ALL COMPACTING AND SEDIMENT CONTROL REGULATIONS.

** NO HANDHOLES ARE TO BE PLACED WITHIN DITCHLINES.

811 Know what's below. Call before you dig.

REVISIONS		
DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

MANAGER: #

PHONE: #

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4424 W Sam Houston Parkway N, Suite 600
Houston, Texas 77041
713.462.3242 | fax 713.462.3262 |
www.cobbfendley.com

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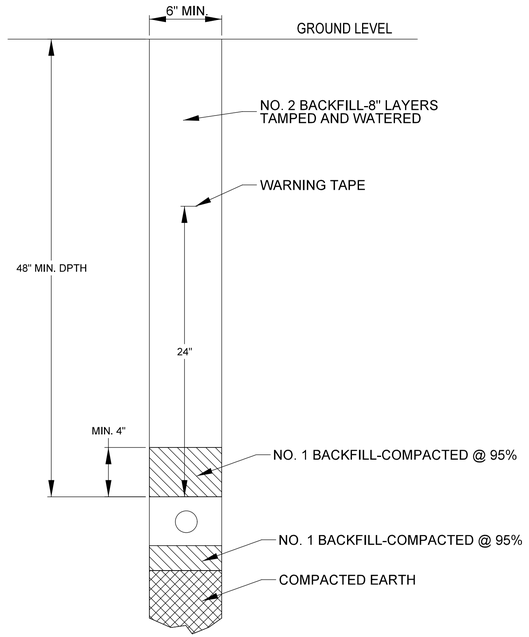
GENERAL NOTES
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

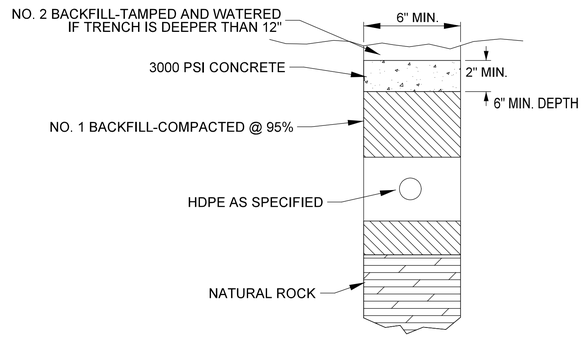
FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT		
DRAFTER:	OG	SCALE:	NTS	SHEET:	03 OF 21	REVISION:	0

TYPICAL TRENCH DETAIL

N.T.S.



TRENCH IN SOIL



TRENCH IN ROCK

CONSTRUCTION NOTES:

1. NO. 1 BACKFILL WILL BE CLEAN NATURAL SAND WHICH IS FREE OF DEBRIS AND HAS BEEN SIEVED THROUGH A NO. 16 SIEVE. PULVERIZED CLAY WILL NOT BE USED.
2. NO. 2 BACKFILL WILL BE EARTH WHICH IS FREE FROM DEBRIS, CINDERS AND ROCKS MEASURING 4 INCHES, (10CM). OR GREATER ACROSS THEIR LARGEST DIMENSION.
3. A WATERPROOF SEALING PLUG WILL BE AROUND THE FIBER OPTIC CABLE TO SEAL THE OPENING IN THE CONDUIT.
4. A MINIMUN OF 6" OF NO. 1 BACKFILL SHALL COVER THE CONDUIT IN THE AREAS OF HANDHOLE EXCAVATION. THIS COVER WILL TRANSITION TO 4" AROUND TRENCHING EXCAVATION.

811 Know what's below. Call before you dig.

REVISIONS		
DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

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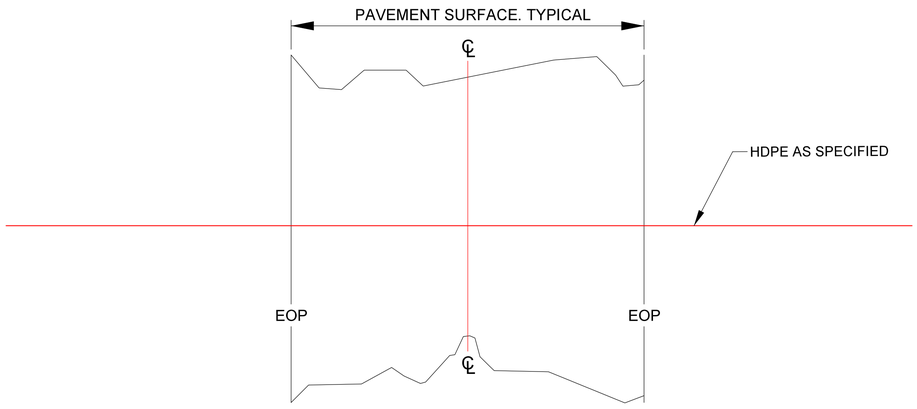
TYPICAL TRENCH DETAIL
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

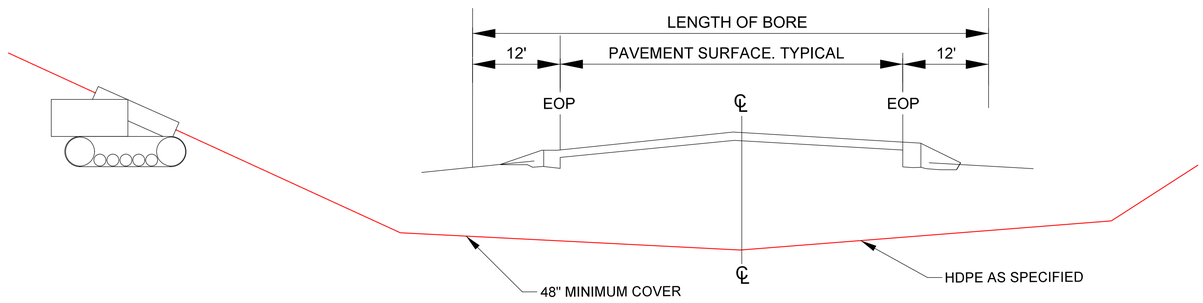
FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT		
DRAFTER:	OG	SCALE:	NTS	SHEET:	04 OF 21	REVISION:	0

1/24/2024
\\fs1sceserver\common\Departments\Braddock\CLIENTS\ZAYO\ZAYO - SOUTH CAROLINA\Zayo1022 - SC US21 - SC51_CAD\Design_Sets\03_CD\Sheets\01-08-CD_TYPICALS.dgn

TYPICAL BORE

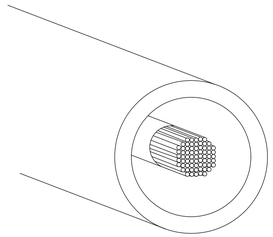


PLAN VIEW



TYPICAL PROFILE / BORE REQUIREMENTS

PLACING CONDUIT



TYPICAL CONDUIT REQUIREMENTS

COUNT FIBER AS SPECIFIED

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DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

MANAGER: #

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Texas Registration No. 274
4424 W Sam Houston Parkway N, Suite 600
Houston, Texas 77041
713.462.3242 | fax 713.462.3262 |
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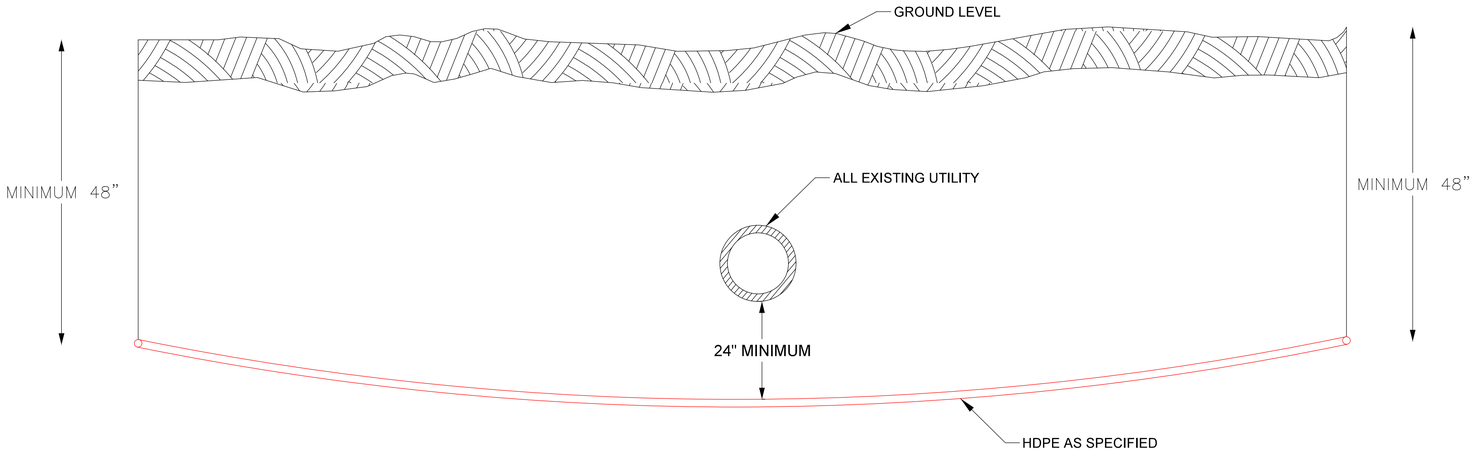
TYPICAL BORE DETAIL
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

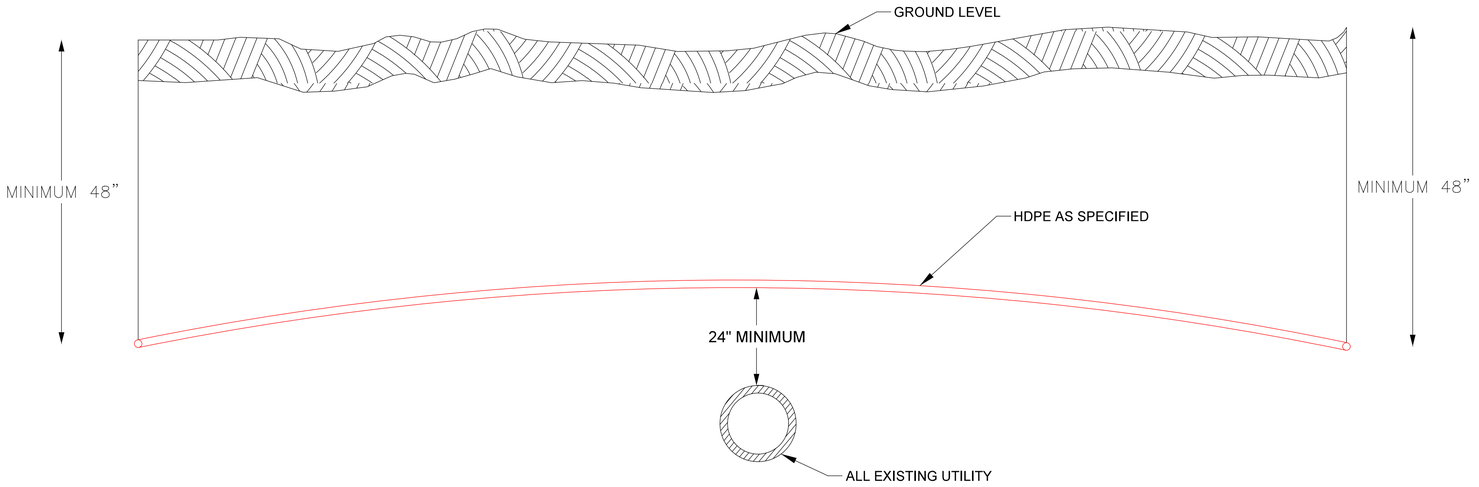
FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE: NTS	SHEET: 05 OF 21	REVISION:	0

1/24/2024
\\frlscoserver\common\Departments\Broadband\CLIENTS\ZAYO\ZAYO - SOUTH CAROLINA\Zayo1022 - SC US21 - SC51_CAD\Design_Sets\03_CD\Sheets\01-08-CD_TYPICALS.dgn

TYPICAL UTILITY CROSSING

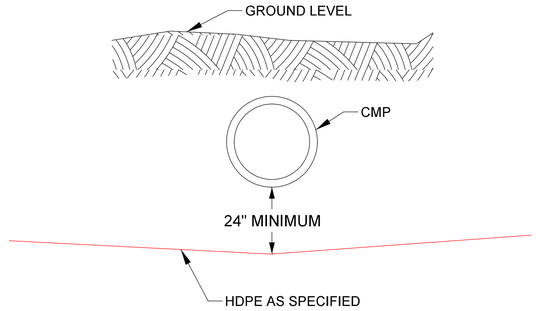
UTILITY CROSSING DETAIL

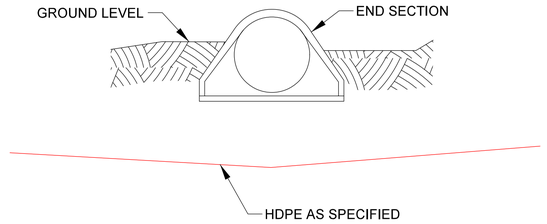




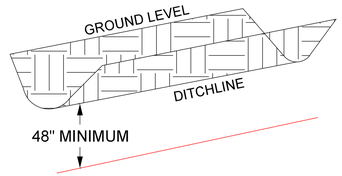
UTILITY CROSSING DETAIL

STORM CULVERTS





DITCHLINE DETAIL



NOTES:

1. A MINIMUM OF 24" SEPARATION IS REQUIRED BY OTHER UTILITY COMPANIES.
2. UTILITIES INCLUDE BUT ARE NOT LIMITED TO WATER, GAS, SEWER AND POWER.

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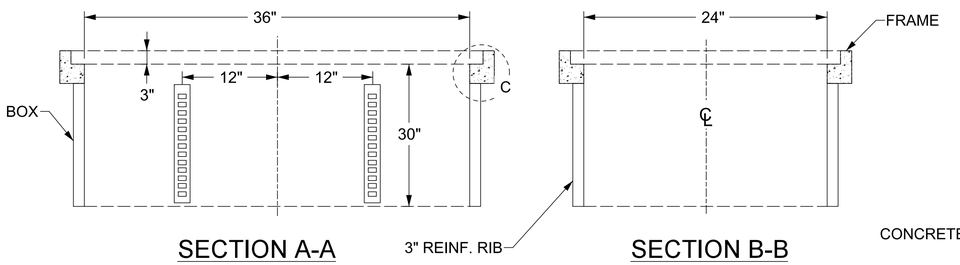
TYPICAL UTILITY CROSSING
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT		
DRAFTER:	OG	SCALE:	NTS	SHEET:	06 OF 21	REVISION:	0

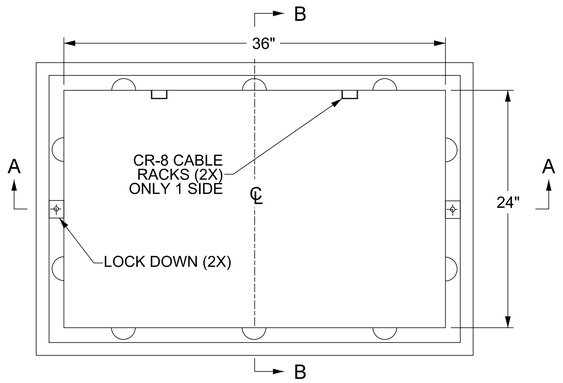
1/24/2024 \\frlcsserver\Common\Department\Broadband\CLIENTS\ZAYO\ZAYO - SOUTH CAROLINA\Zayo\022 - SC US21 - SC51_CADD\Design_Sets\03_CD\Sheets\01-08-CD_TYPICALS.dgn

24" X 36" X 30" HANDHOLE DETAIL

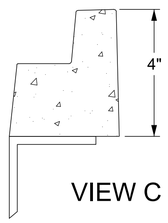


SECTION A-A

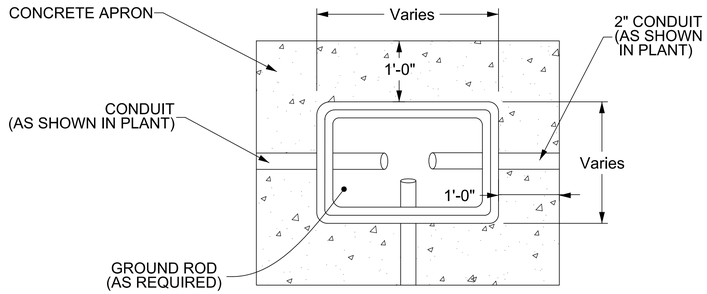
SECTION B-B



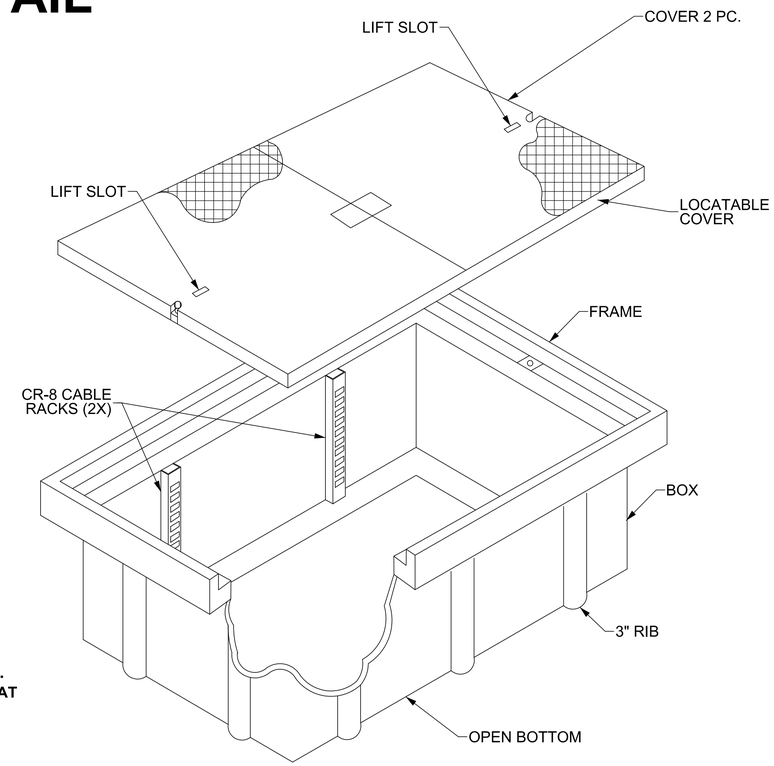
TOP VIEW



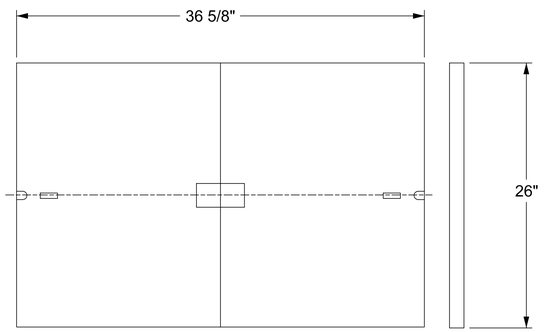
VIEW C



HANDHOLES TO BE INSTALLED PER GDOT DESIGN STANDARD 635-001. A 12" CONCRETE RING MUST BE INSTALLED AROUND HANDHOLES THAT ARE NOT PROPOSED IN CONCRETE SIDEWALK.



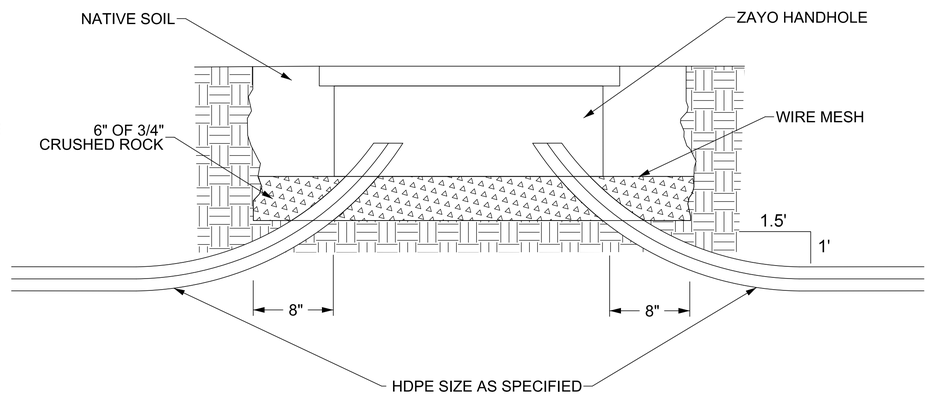
PROFILE



COVER

NOTES:

1. PLACE 6" OF 3/4" CRUSHED ROCK IN THE BOTTOM OF THE EXCAVATION.
2. WIRE MESH (TWO SQUARES PER INCH) SHALL BE PLACED OVER THE ROCK. IT WILL BE NECESSARY TO CUT OPENINGS FOR HDPE IN WIRE MESH.
3. HANDHOLE WILL BE SET FLUSH WITH EXISTING GRADE AND IN LINE WITH & CENTERED OVER R/L & BACKFILLED AS PER TYPICAL
4. HDPE SDR 11 CONDUIT SHALL BE PLACED IN THE CORNERS OF HANDHOLE.
5. TERMINATE THE HDPE CONDUIT A MINIMUM OF SIX (6) INCHES ABOVE THE WIRE MESH. DO NOT TERMINATE THE HDPE SDR 11 CONDUIT MORE THAN EIGHT (8) INCHES ABOVE THE WIRE MESH.
6. LOADING COMPLY WITH ANSI/SCTE 77. BOXES WITH DESIGN LOAD OF 22,000 LBS, & TEST LOAD OF 33,750 LBS. MEET AND/OR EXCEED TIER 15 TEST.
7. PLACE EXPANSION PLUGS IN ALL CONDUITS.
8. 95% COMPACTION IN 6" LIFTS OR 2 SACK MIX AROUND HANDHOLE.
9. NO HANDHOLES ARE TO BE PLACED WITHIN THE DITCHLINE.



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HANDHOLE DETAIL
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE:	NTS	SHEET: 07 OF 21	REVISION: 0

1/24/2024
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TOTAL SUMMARY

DESCRIPTION	QTY.
288CT FOC (FT.)	14,078
(3) 1.25" HDPE (FT.)	14,078
(3) 1.25" HDPE ABND. (FT.)	13,946
TRACER WIRE (FT.)	14,078
SPLICE KIT (EA.)	4
HH (2'X3'X2.5') (EA.)	1
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	3

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REVISIONS

DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

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TOTALS SUMMARY
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	01-08-CD_TYPICALS	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT		
DRAFTER:	OG	SCALE:	NTS	SHEET:	08 OF 21	REVISION:	0

1/24/2024
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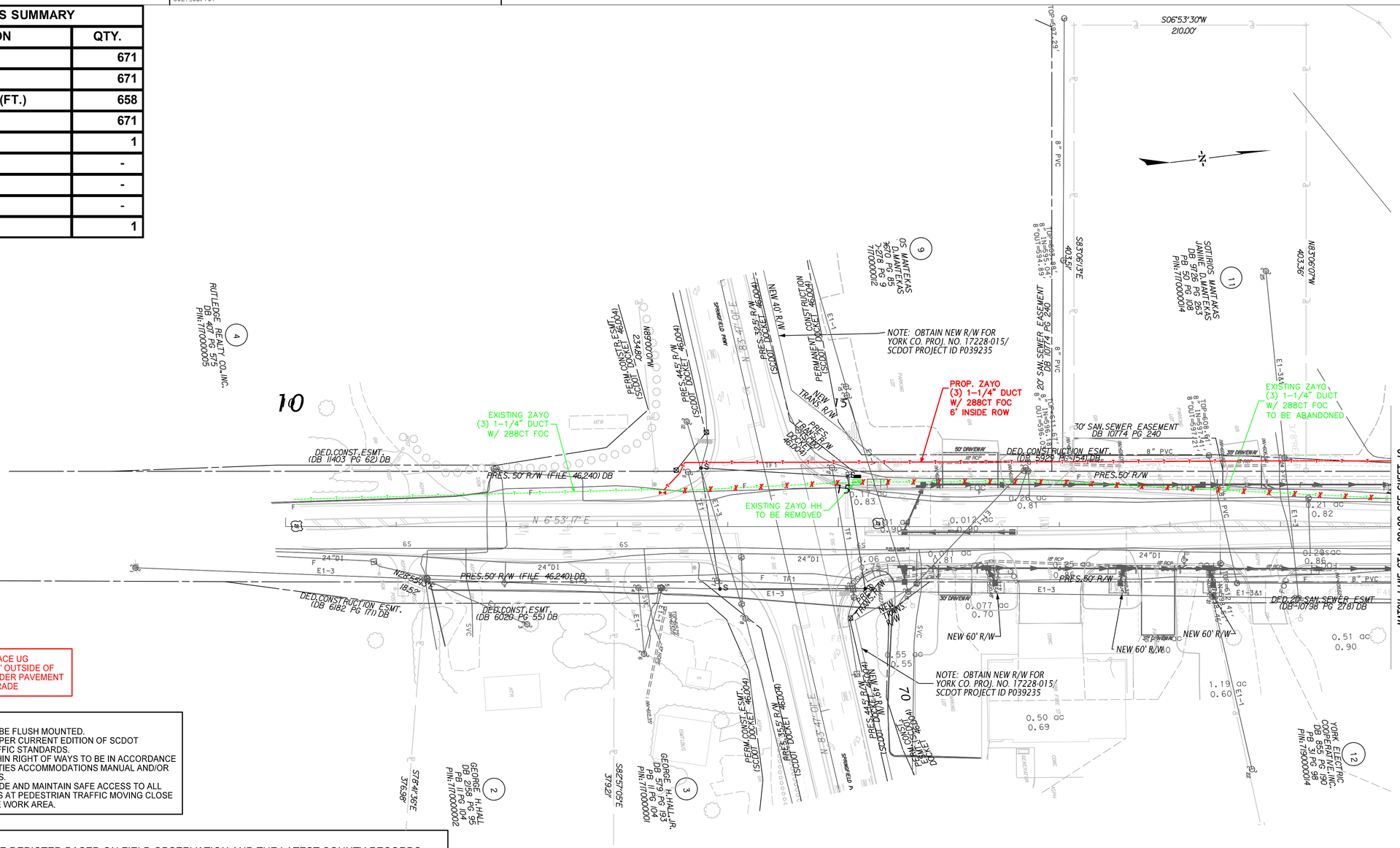
MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	671
(3) 1.25" HDPE (FT.)	671
(3) 1.25" HDPE ABND. (FT.)	658
TRACER WIRE (FT.)	671
SPLICE KIT (EA.)	1
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	1



ZAYO CONTRACTOR TO PLACE UG FOC AT A MIN DEPTH OF 48" OUTSIDE OF PAVEMENT AND 60" MIN UNDER PAVEMENT FROM PROPOSED FINAL GRADE

NOTES:
-ALL HANDHOLES ARE TO BE FLUSH MOUNTED.
-TRAFFIC CONTROL PLAN PER CURRENT EDITION OF SCDOT MAINTENANCE OF TRAFFIC STANDARDS.
-ALL CONSTRUCTION WITHIN RIGHT OF WAYS TO BE IN ACCORDANCE WITH THE SCDOT UTILITIES ACCOMMODATIONS MANUAL AND/OR SCDOT SPECIFICATIONS.
-PERMITTEE SHALL PROVIDE AND MAINTAIN SAFE ACCESS TO ALL ADJACENT PROPERTIES AT PEDESTRIAN TRAFFIC MOVING CLOSE AND/OR CROSSING THE WORK AREA.

CAUTION:
-RIGHT-OF-WAYS ARE DEPICTED BASED ON FIELD OBSERVATION AND THE LATEST COUNTY RECORDS AVAILABLE, CONTRACTOR MUST FIELD VERIFY. IF FURTHER ACCURACY IS REQUIRED, LAND SURVEYS WILL BE NECESSARY.
-UTILITIES SHOWN ARE FOR DESIGN PLANNING PURPOSES ONLY. CONTRACTOR IS TO FOLLOW THE SC 811 ONE CALL SYSTEM REQUIREMENTS FOR THE MARKING OF ALL EXISTING UTILITIES AND WORK TO RESOLVE CONFLICTS WITH THE FIELD ENGINEER. THE CONTRACTOR SHALL NOT RELY UPON ANY UTILITY LOCATION SHOWN ON THE PLAN AS A REPRESENTATION OF A UTILITY LOCATION OR ABSENCE OF EXISTING UTILITIES. CONTRACTOR IS TO TEST PIT AND EXPOSE ALL UTILITIES ALONG THE PROPOSED ALIGNMENT PRIOR TO BEGINNING OF EXCAVATION, BORING OR PLOWING.

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DATE	DESCRIPTIONS	BY

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MANAGER: #
PHONE: #

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Houston, Texas 77041
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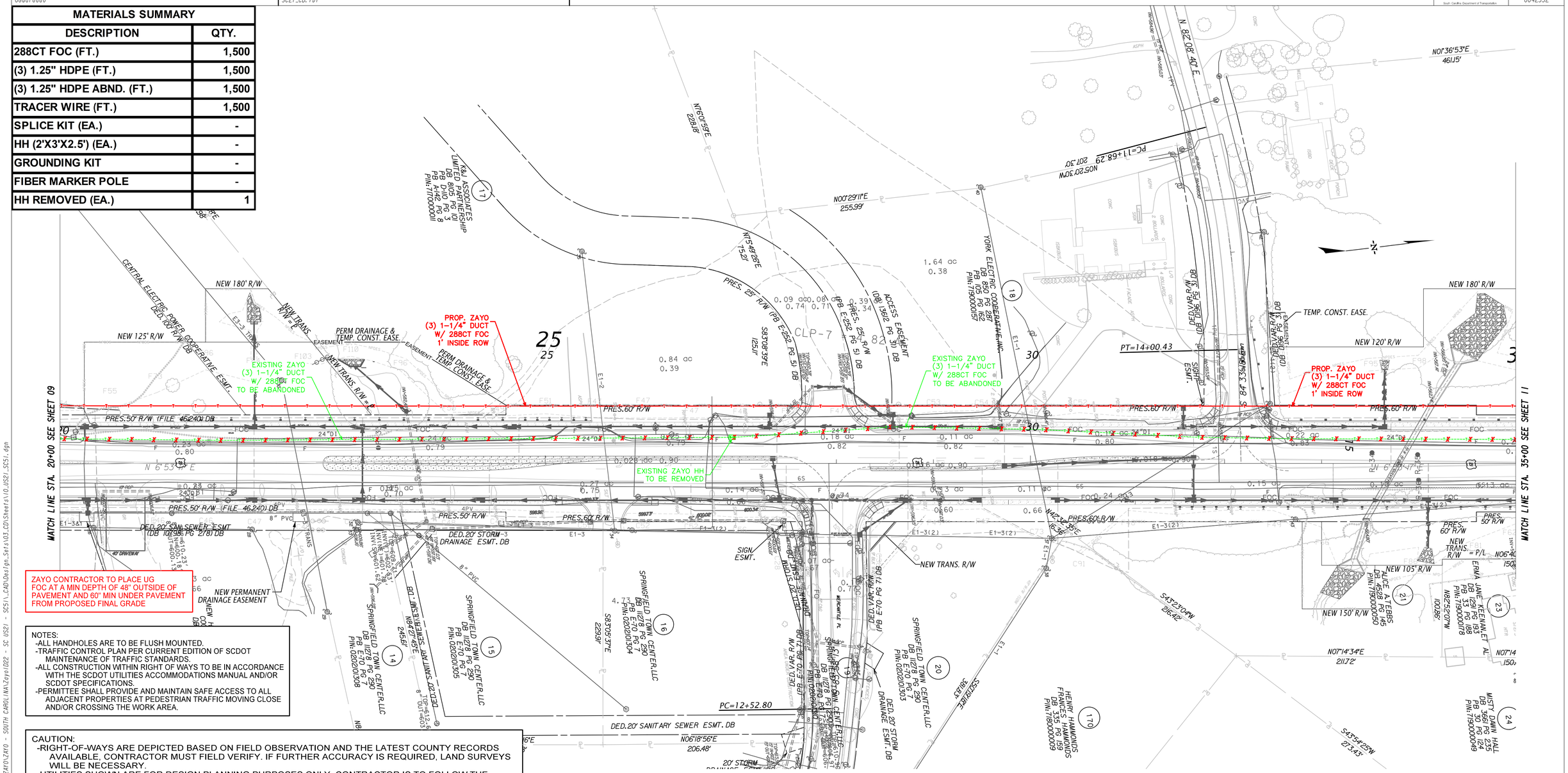
UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	09_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT		
DRAFTER:	OG	SCALE:	1:50	SHEET:	09 OF 21	REVISION:	0

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,500
(3) 1.25" HDPE (FT.)	1,500
(3) 1.25" HDPE ABND. (FT.)	1,500
TRACER WIRE (FT.)	1,500
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	1



NOTES:
- -ALL HANDHOLES ARE TO BE FLUSH MOUNTED.
- -TRAFFIC CONTROL PLAN PER CURRENT EDITION OF SCDOT MAINTENANCE OF TRAFFIC STANDARDS.
- -ALL CONSTRUCTION WITHIN RIGHT OF WAYS TO BE IN ACCORDANCE WITH THE SCDOT UTILITIES ACCOMMODATIONS MANUAL AND/OR SCDOT SPECIFICATIONS.
- -PERMITTEE SHALL PROVIDE AND MAINTAIN SAFE ACCESS TO ALL ADJACENT PROPERTIES AT PEDESTRIAN TRAFFIC MOVING CLOSE AND/OR CROSSING THE WORK AREA.

CAUTION:
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UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	10_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE:	1:50	SHEET: 10 OF 21	REVISION: 0

1/24/2024
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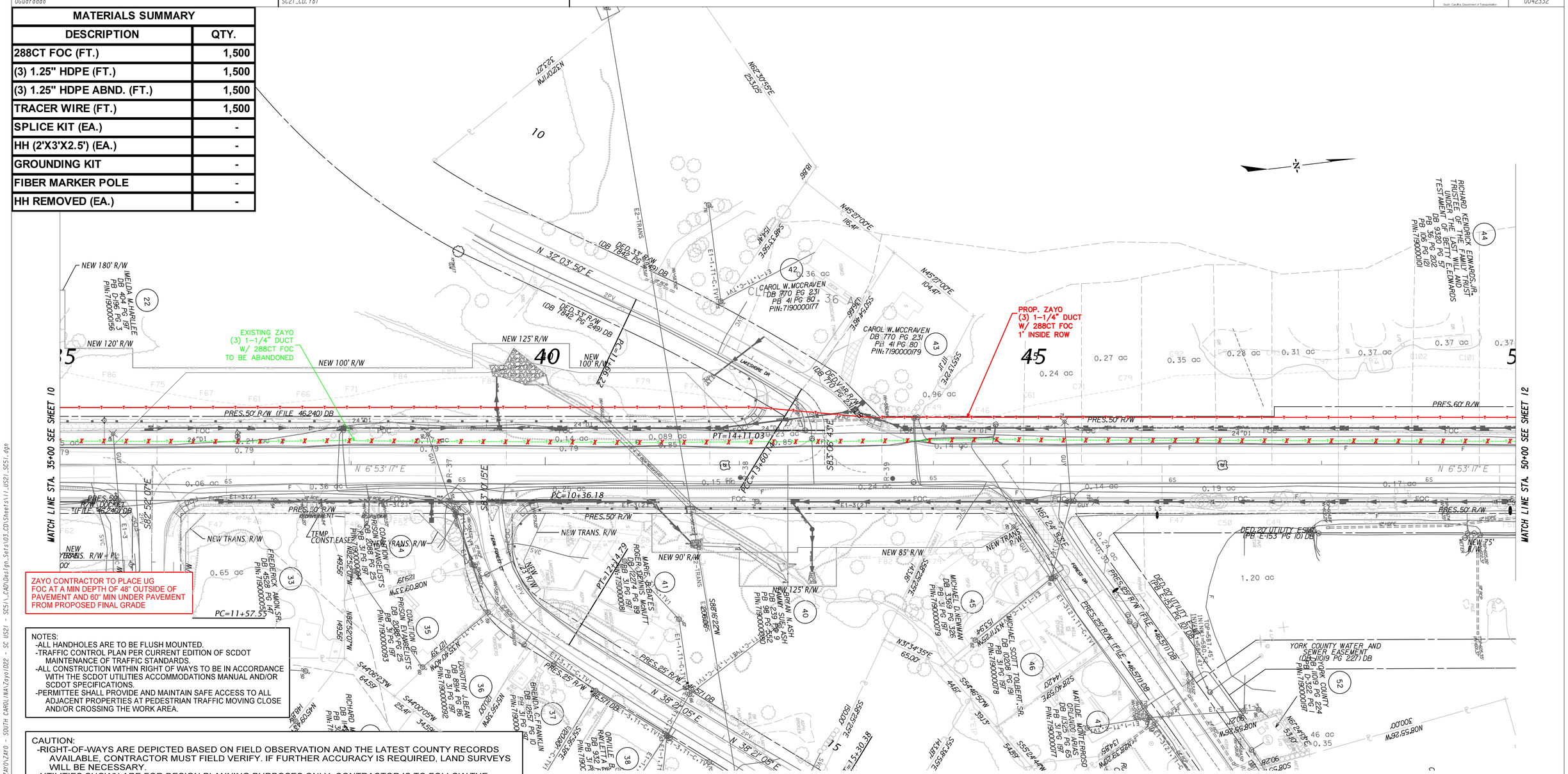
MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,500
(3) 1.25" HDPE (FT.)	1,500
(3) 1.25" HDPE ABND. (FT.)	1,500
TRACER WIRE (FT.)	1,500
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-


MATCH LINE STA. 35+00 SEE SHEET 10
MATCH LINE STA. 50+00 SEE SHEET 12
NEW 180' R/W
NEW 120' R/W
NEW 125' R/W
NEW 100' R/W
NEW 90' R/W
NEW 85' R/W
NEW 75' R/W
NEW TRANS. R/W
PRES.50' R/W (FILE 46240) DB
PRES.60' R/W
PRES.25' R/W (FILE 46571) DB
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC TO BE ABANDONED
PROP. ZAYO (3) 1-1/4" DUCT W/ 288CT FOC 1' INSIDE ROW
IMELDA M. HARLLEE DB 404 PG 197 PB 19 PG 3 PIN:7190000056
CAROL W.MCCRAVEN DB 770 PG 231 PB 41 PG 80 PIN:7190000177
CAROL W.MCCRAVEN DB 770 PG 231 PB 41 PG 80 PIN:7190000179
RICHARD KENDRICK EDWARDS, JR., TRUSTEE OF THE LAST WILL AND TESTAMENT OF BETTY E. EDWARDS DB 9320 PG 237 PB 36 PG 121 PB 106 PG 121 PIN:7190000101
FREDERICK MYON SR. DB 4525 PG 147 PIN:7190000057
COALITION OF PRISCILLA EVANGELISTS DB 2088 PG 25 PB 31 PG 197 PIN:7190000033
DOROTHY L. BEAN DB 3854 PG 86 PB 31 PG 197 PIN:7190000092
BRENDA C. FRANKLIN DB 2657 PG 10 PB 31 PG 197 PIN:7190000
ORVILLE B. RAYLETTA DB 932 PB 31 PG 197 PIN:7190
ROGER DENNIS BRYANT DB 1227 PG 89 PB 31 PG 197 PIN:7190000081
MARIE B. BEATES
CAROLYN N. ASH DB 239 PG 22 PB 98 PG 239 PIN:7190000080
MICHAEL D. HERMAN DB 3358 PG 326 PB 31 PG 197 PIN:7190000079
MICHAEL SCOTT TOLBERT SR. DB 10208 PG 191 PB 31 PG 197 PIN:7190000018
MATILDE MONTERROSO DB 11 PG 197 PB 31 PG 65 PIN:7190000077
YORK COUNTY WATER AND SEWER EASEMENT (DB 10019 PG 227) DB
YORK COUNTY DB 10019 PG 227 PB 106 PG 121 PIN:7190000197
DED.20' UTILITY ESMT. (PB E-153 PG 10) DB
DED.33' R/W (DB 1842 PG 249) DB
DED.VAR.R/W (DB 1842 PG 249) DB
PC=11+57.55
PT=14+11.03
PC=13+60.18
PT=12+14.79
PC=10+36.18
PC=15+30.38
N 32°03'50" E
N 6°53'17" E
S 83°05'43" E
S 82°52'07" E
S 37°01'15" E
N 36°21'05" E
N 62°24'58" E
N 45°27'00" E
N 32°01'W 323.27'
N 62°39'05" E 253.05'
S 44°08'23" W 64.59'
S 44°00'05" W 345.91'
N 82°52'07" W 149.56'
N 40°08'55" E 121.69'
N 40°08'55" E 121.69'
N 36°55'15" W 182.00'
S 55°57'39" E 150.00'
S 55°46'50" W 391.73'
S 55°52'44" W 548.91'
N 36°55'26" W 300.00'
N 62°24'58" E 53.10'
S 83°05'43" E 143.47'
S 37°01'15" E 65.00'
N 37°34'35" E 65.00'
N 36°55'15" W 44.61'
N 28°40'39" E 44.20'
N 28°55'20" W 90.28'
S 28°55'20" E 90.28'
N 28°55'20" W 90.28'
N 36°55'26" W 300.00'
S 83°05'43" E 143.47'
S 37°01'15" E 65.00'
N 37°34'35" E 65.00'
N 36°55'15" W 44.61'
N 28°40'39" E 44.20'
N 28°55'20" W 90.28'
S 28°55'20" E 90.28'
N 28°55'20" W 90.28'
N 36°55'26" W 300.00'
0.21 ac
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0.089 ac
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0.06 ac
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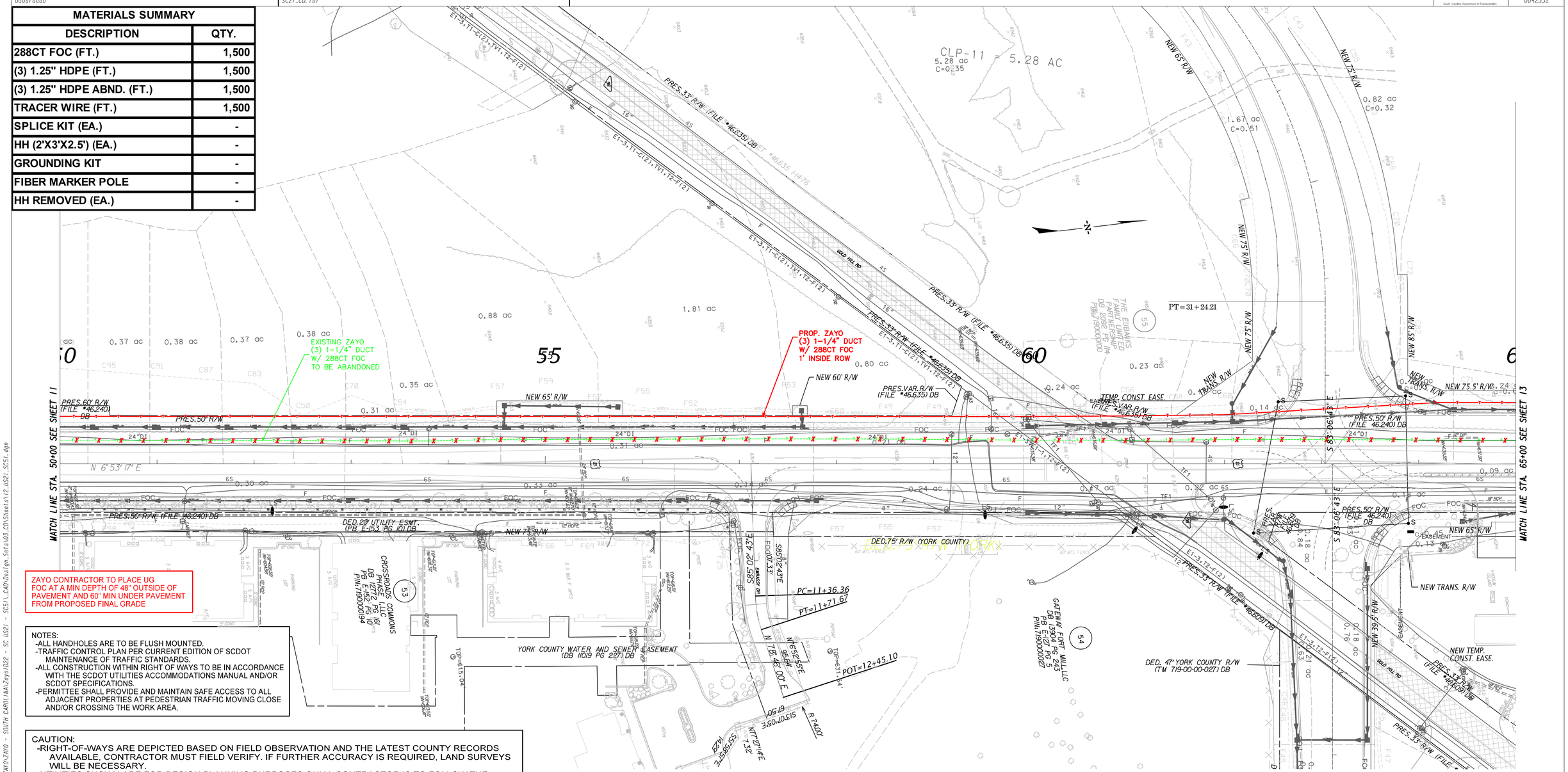
0.27 ac
0.35 ac
0.28 ac
0.31 ac
0.37 ac
0.37 ac
0.37 ac
1.20 ac
0.46 ac
0.35
0.79
0.85
0.85
0.85

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,500
(3) 1.25" HDPE (FT.)	1,500
(3) 1.25" HDPE ABND. (FT.)	1,500
TRACER WIRE (FT.)	1,500
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-



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PHONE: #

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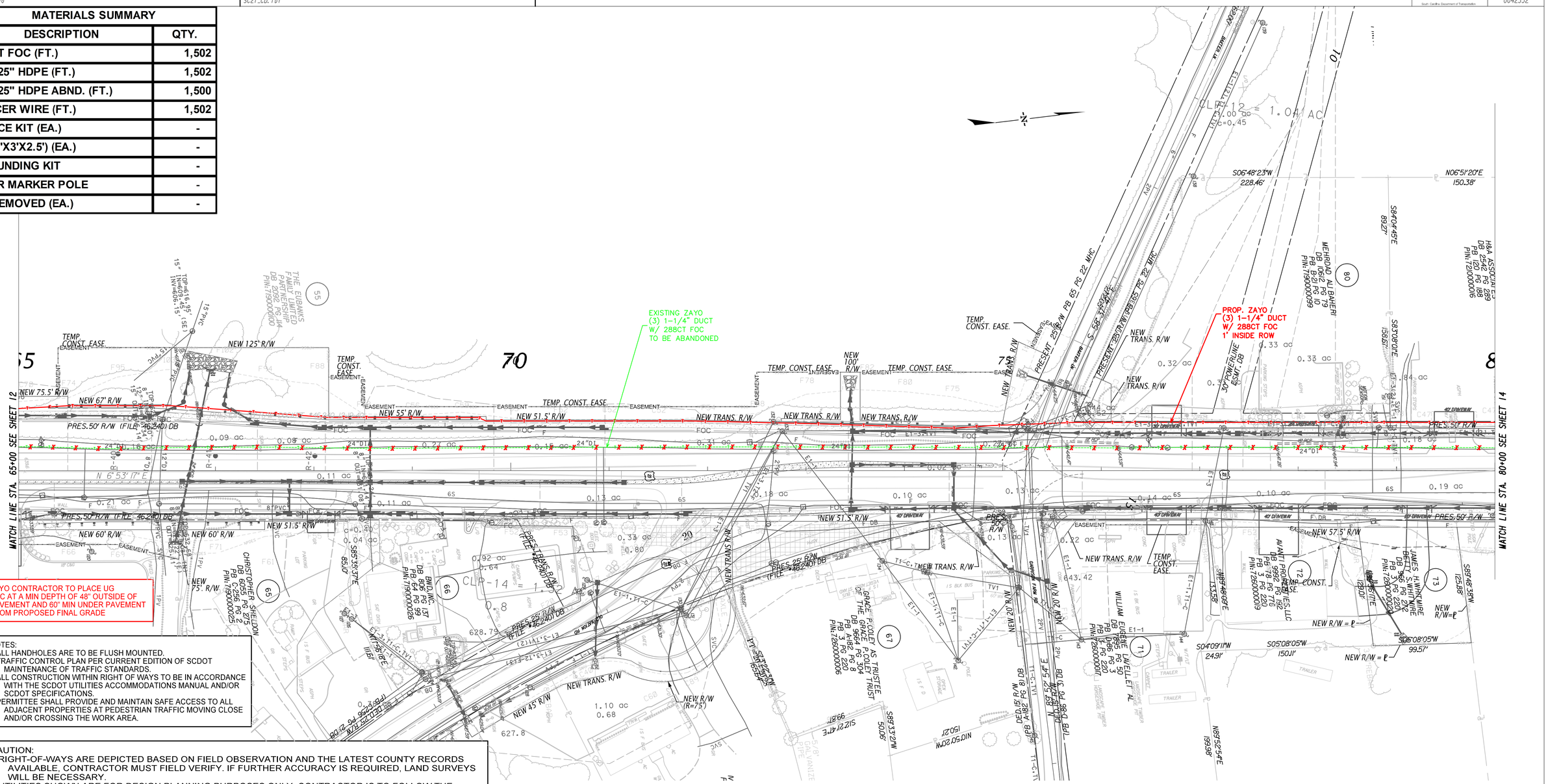
UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	12_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE:	1:50	SHEET: 12 OF 21	REVISION: 0

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,502
(3) 1.25" HDPE (FT.)	1,502
(3) 1.25" HDPE ABND. (FT.)	1,500
TRACER WIRE (FT.)	1,502
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-


MATCH LINE STA. 65+00 SEE SHEET 12
MATCH LINE STA. 80+00 SEE SHEET 14
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC TO BE ABANDONED
PROP. ZAYO (3) 1-1/4" DUCT W/ 288CT FOC 1' INSIDE ROW
ZAYO CONTRACTOR TO PLACE UG FOC AT A MIN DEPTH OF 48" OUTSIDE OF PAVEMENT AND 60" MIN UNDER PAVEMENT FROM PROPOSED FINAL GRADE
NOTES:
-ALL HANDHOLES ARE TO BE FLUSH MOUNTED.
-TRAFFIC CONTROL PLAN PER CURRENT EDITION OF SCDOT MAINTENANCE OF TRAFFIC STANDARDS.
-ALL CONSTRUCTION WITHIN RIGHT OF WAYS TO BE IN ACCORDANCE WITH THE SCDOT UTILITIES ACCOMMODATIONS MANUAL AND/OR SCDOT SPECIFICATIONS.
-PERMITTEE SHALL PROVIDE AND MAINTAIN SAFE ACCESS TO ALL ADJACENT PROPERTIES AT PEDESTRIAN TRAFFIC MOVING CLOSE AND/OR CROSSING THE WORK AREA.
CAUTION:
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NEW 125'R/W
NEW 75.5' R/W
NEW 67' R/W
NEW 55' R/W
NEW 51.5' R/W
NEW 100' R/W
NEW TRANS. R/W
NEW 60' R/W
NEW 75' R/W
NEW 45' R/W
NEW R/W (R=75')
PRES.50' R/W (FILE #46240) DB
PRES.25' R/W (FILE #46240) DB
PRES.TRANS R/W (FILE #46240) DB
PRES.50' R/W
PRES.25' R/W
PRES.TRANS R/W
TEMP. CONST. EASE.
EASEMENT
CLR-14 = 1.08 AC
CLR-12 = 1.04 AC
0.33 ac
0.32 ac
0.84 ac
0.09 ac
0.08 ac
0.27 ac
0.15 ac
0.31 ac
0.22 ac
0.11 ac
0.13 ac
0.18 ac
0.10 ac
0.14 ac
0.19 ac
1.10 ac
0.68
0.92 ac
0.64
0.80
0.54
0.94
0.12 ac
0.13
643.42
628.79
627.8
S06°48'23"W 228.46'
N06°51'20"E 150.38'
S89°04'45"E 89.27'
S83°08'05"E 158.67'
S89°48'36"W 125.88'
S04°09'11"W 24.91'
S05°08'05"W 150.11'
S05°08'05"W 99.57'
N89°52'54"E 199.98'
S85°35'37"E 85.0'
N 6°53'17"E
S12°27'47"E 99.8'
N10°50'20"W 150.27'
S83°43'20"W 165.52'
S87°38'10"E 133.58'
S87°38'10"E 129.01'
S87°38'10"E 158.67'
S87°38'10"E 84.18'
S87°38'10"E 84.18'
S87°38'10"E 84.18

1/24/2024 3:43:02 PM
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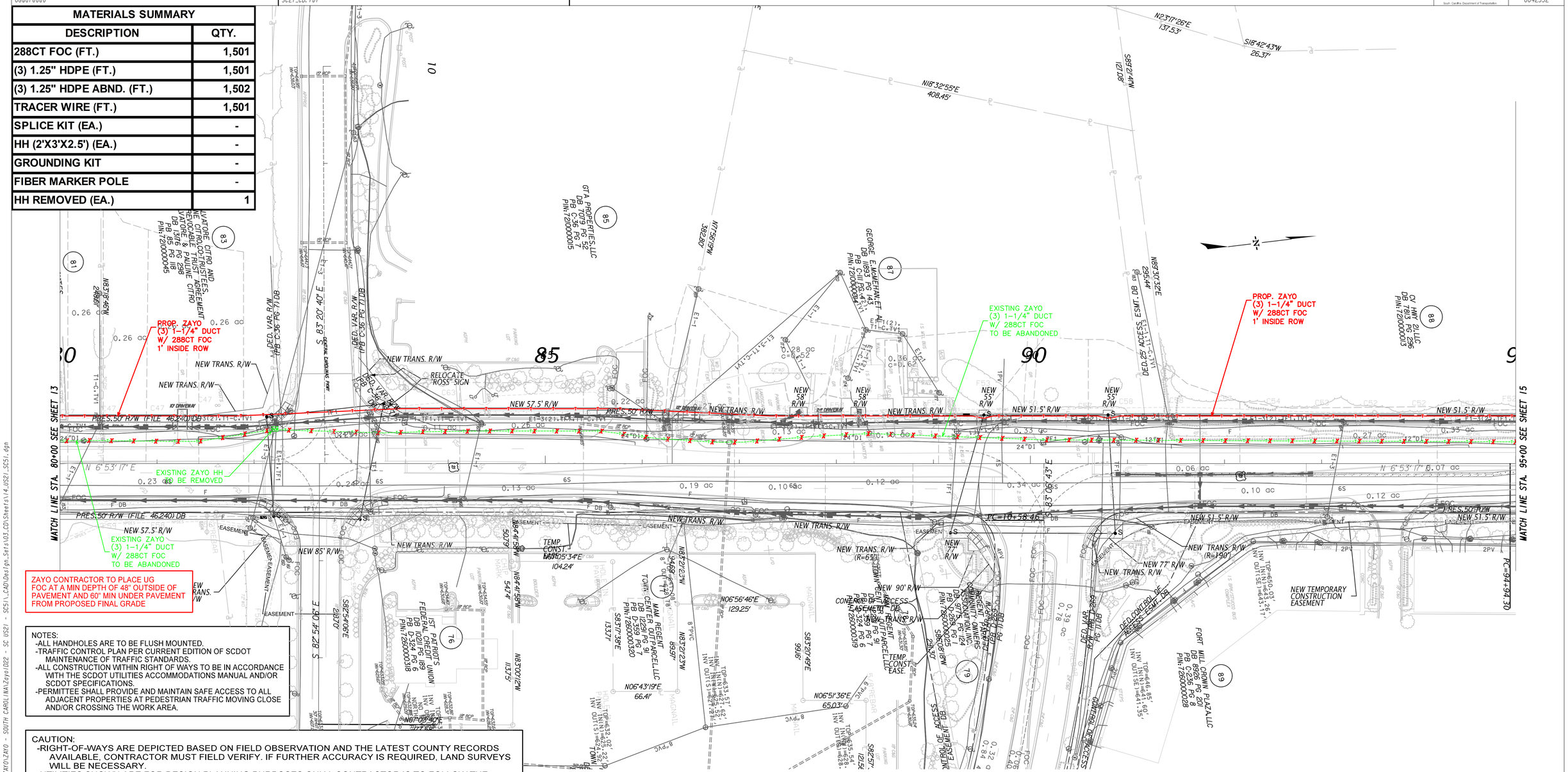
SC21_CD.tbl
14_US21_SC51.dgn
SCDOT South Carolina Department of Transportation
P. I. No. 0042332

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,501
(3) 1.25" HDPE (FT.)	1,501
(3) 1.25" HDPE ABND. (FT.)	1,502
TRACER WIRE (FT.)	1,501
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	1



ZAYO CONTRACTOR TO PLACE UG FOC AT A MIN DEPTH OF 48" OUTSIDE OF PAVEMENT AND 60" MIN UNDER PAVEMENT FROM PROPOSED FINAL GRADE

NOTES:
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811 Know what's below. Call before you dig.

REVISIONS		
DATE	DESCRIPTIONS	BY

CONSTRUCTION FIRM

MANAGER: #

PHONE: #

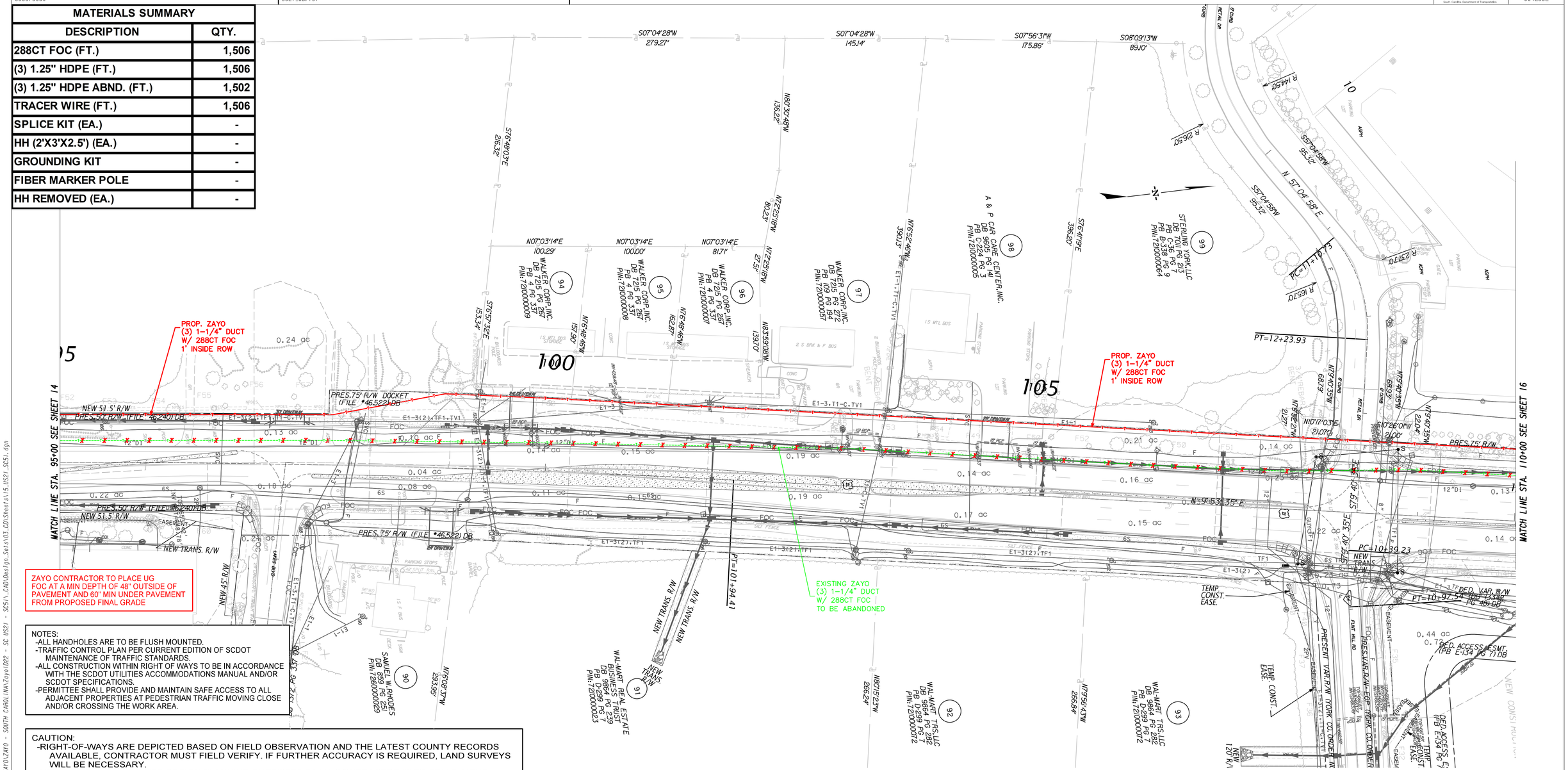
CobbFendley
Texas Registration No. 274
4424 W Sam Houston Parkway N, Suite 600
Houston, Texas 77041
713.462.3242 | fax 713.462.3262 |
www.cobbfendley.com

zayo GROUP

UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	14_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE: 1:50	SHEET: 14 OF 21	REVISION:	0

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,506
(3) 1.25" HDPE (FT.)	1,506
(3) 1.25" HDPE ABND. (FT.)	1,502
TRACER WIRE (FT.)	1,506
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-



NOTES:
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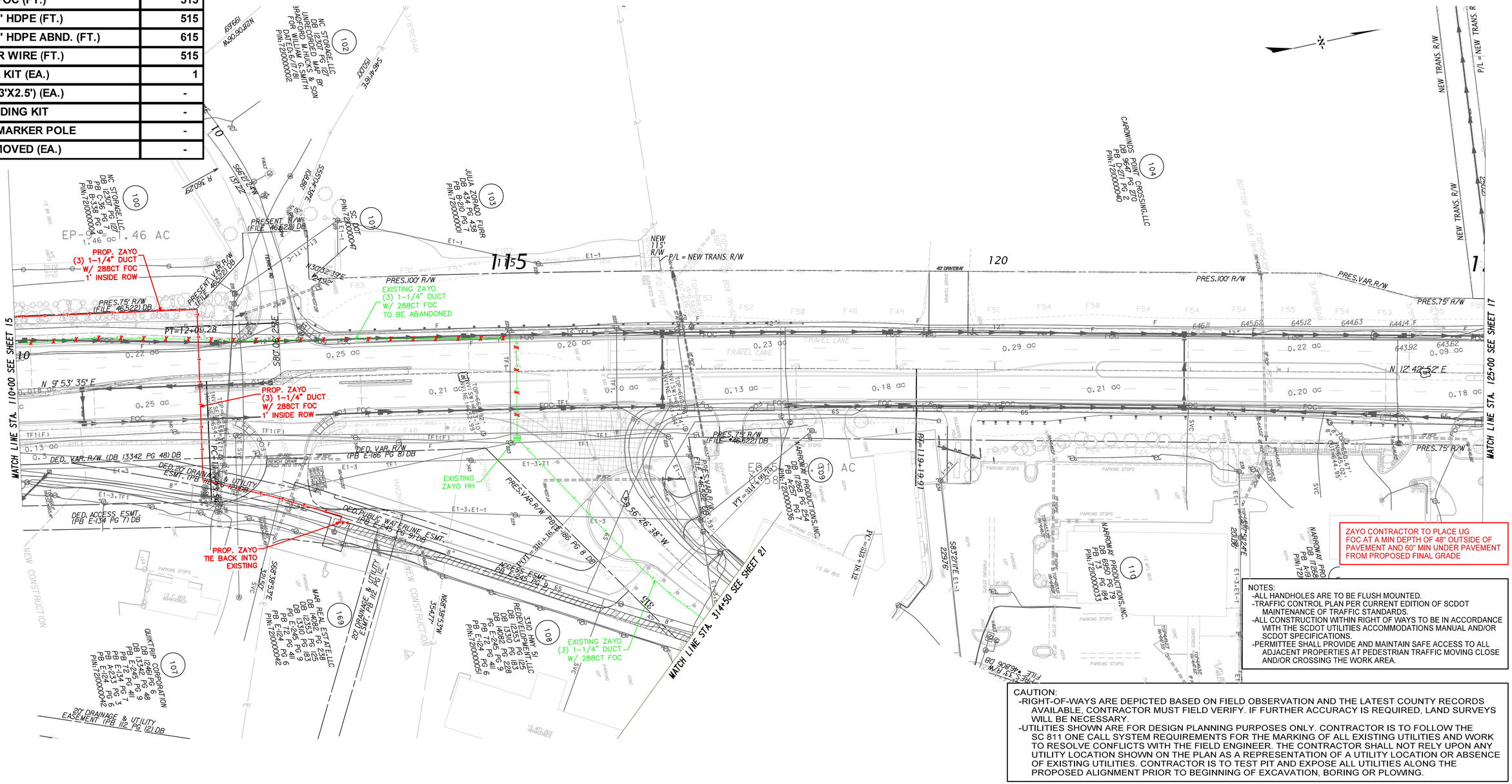
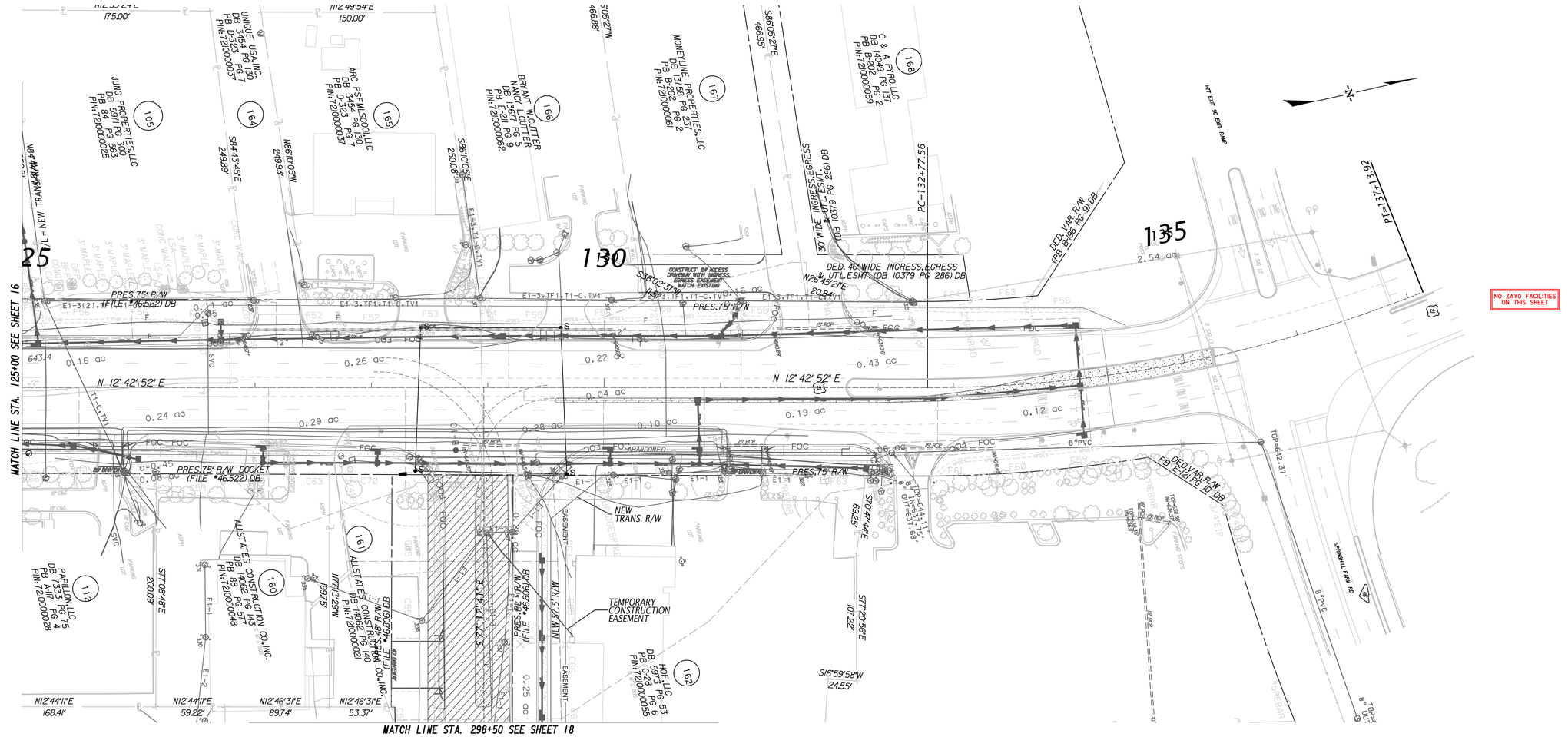
zayo GROUP

UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	15_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE:	1:50	SHEET: 15 OF 21	REVISION: 0

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	515
(3) 1.25" HDPE (FT.)	515
(3) 1.25" HDPE ABND. (FT.)	615
TRACER WIRE (FT.)	515
SPLICE KIT (EA.)	1
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-


MATCH LINE STA. 110+00 SEE SHEET 15
MATCH LINE STA. 125+00 SEE SHEET 17
MATCH LINE STA. 314+50 SEE SHEET 21
PROP. ZAYO (3) 1-1/4" DUCT W/ 288CT FOC 1' INSIDE ROW
PROP. ZAYO TIE BACK INTO EXISTING
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC TO BE ABANDONED
EXISTING ZAYO HH
PRES.100' R/W
PRES.75' R/W
PRES.VAR.R/W
NEW 115' R/W
P/L = NEW TRANS. R/W
NEW TRANS. R/W
PRESENT VAR R/W (FILE 46522) DB
DED. VAR. R/W (DB 13342 PG 48) DB
DED. 20' DRAINAGE & UTILITY ESMT. (PB 112 PG 121) DB
DED. ACCESS ESMT. (PB E-134 PG 71) DB
DED. PUBLIC WATER LINE ESMT. (PB E-245 PG 9) DB
20' DRAINAGE & UTILITY EASEMENT (PB 112 PG 121) DB
ACCESS ESMT. (PB E-245 PG 9) DB
DED. VAR. R/W (PB E-186 PG 8) DB
PRES.VAR.R/W (PB E-186 PG 8) DB
NARROWAY PRODUCTIONS,INC. DB 6950 PG 84 PB 73 PIN:7210000033
CAROWINDS POINT CROSSING,LLC DB 9647 PG 270 PB 127 PG 2 PIN:7210000040
JULIA ZORADO FURR DB 434 PG 438 PB 1250 PG 7 PIN:7210000001
SC DOT PIN:7210000047
NC STORAGE LLC (2130) DB 12301 PG 127 PB B-336 PG 9 PIN:7210000043
NC STORAGE LLC DB 12301 PG 127 PB B-336 PG 9 PIN:7210000044
QUIKTRIP CORPORATION DB 13462 PG 48 PB E-245 PG 9 PB E-134 PG 71 PB A-233 PG 6 PB E-124 PG 6 PIN:7210000042
MAR REAL ESTATE,LLC DB 13563 PG 183 PB E-245 PG 9 PB E-124 PG 6 PB 124 PG 6 PIN:7210000042
REDEVELOPMENT,LLC DB 13563 PG 183 PB E-245 PG 9 PB E-124 PG 6 PB 124 PG 6 PIN:7210000005
NARROWAY PRODUCTIONS,INC. DB 7268 PG 254 PB A-259 PG 7 PIN:7210000036
EP-9 1.46 AC
EP-10 1.46 AC
EP-11 1.46 AC
EP-12 1.46 AC
EP-13 1.46 AC
EP-14 1.46 AC
EP-15 1.46 AC
EP-16 1.46 AC
EP-17 1.46 AC
EP-18 1.46 AC
EP-19 1.46 AC
EP-20 1.46 AC
EP-21 1.46 AC



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zayo GROUP

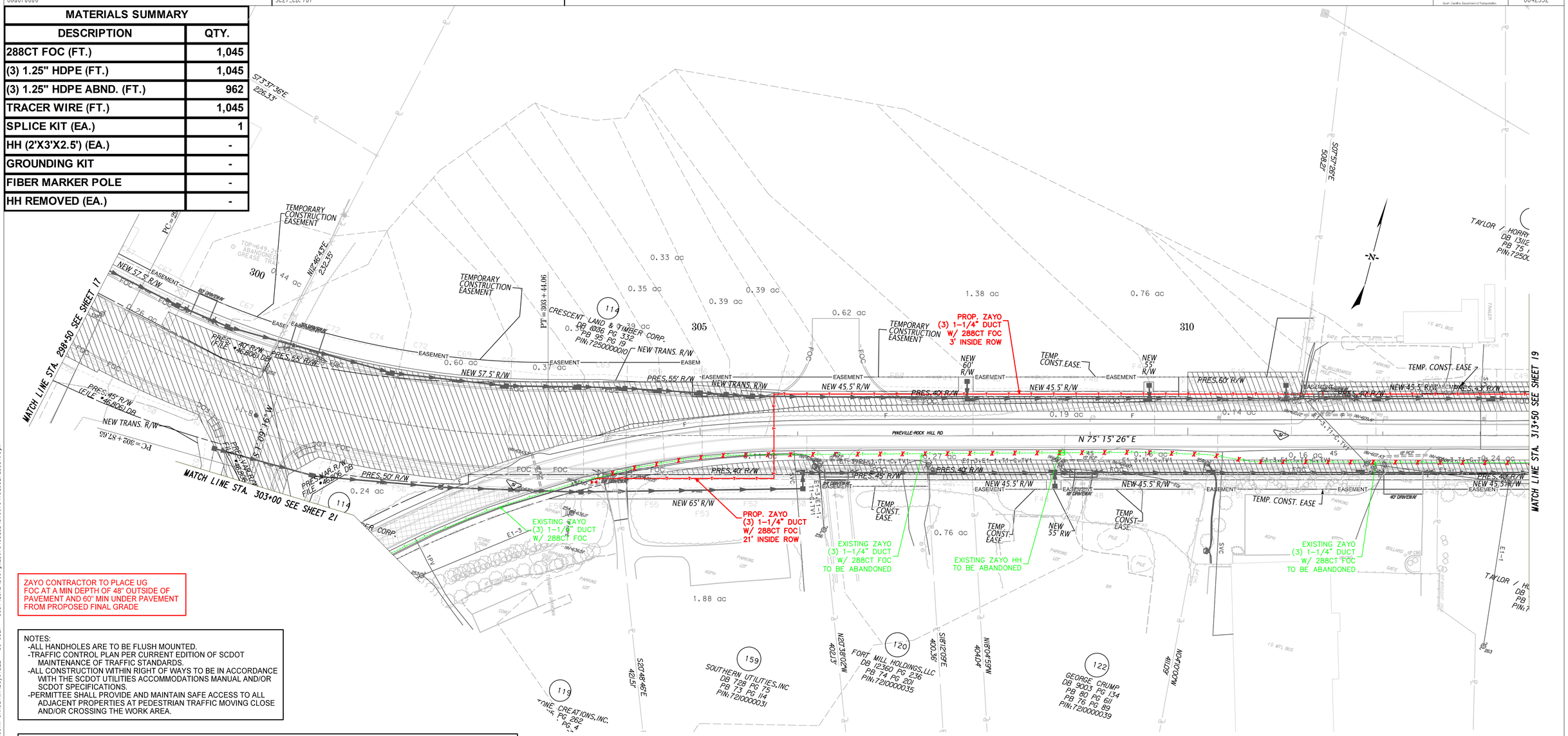
UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	17_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE: 1:50	SHEET: 17 OF 21	REVISION:	0

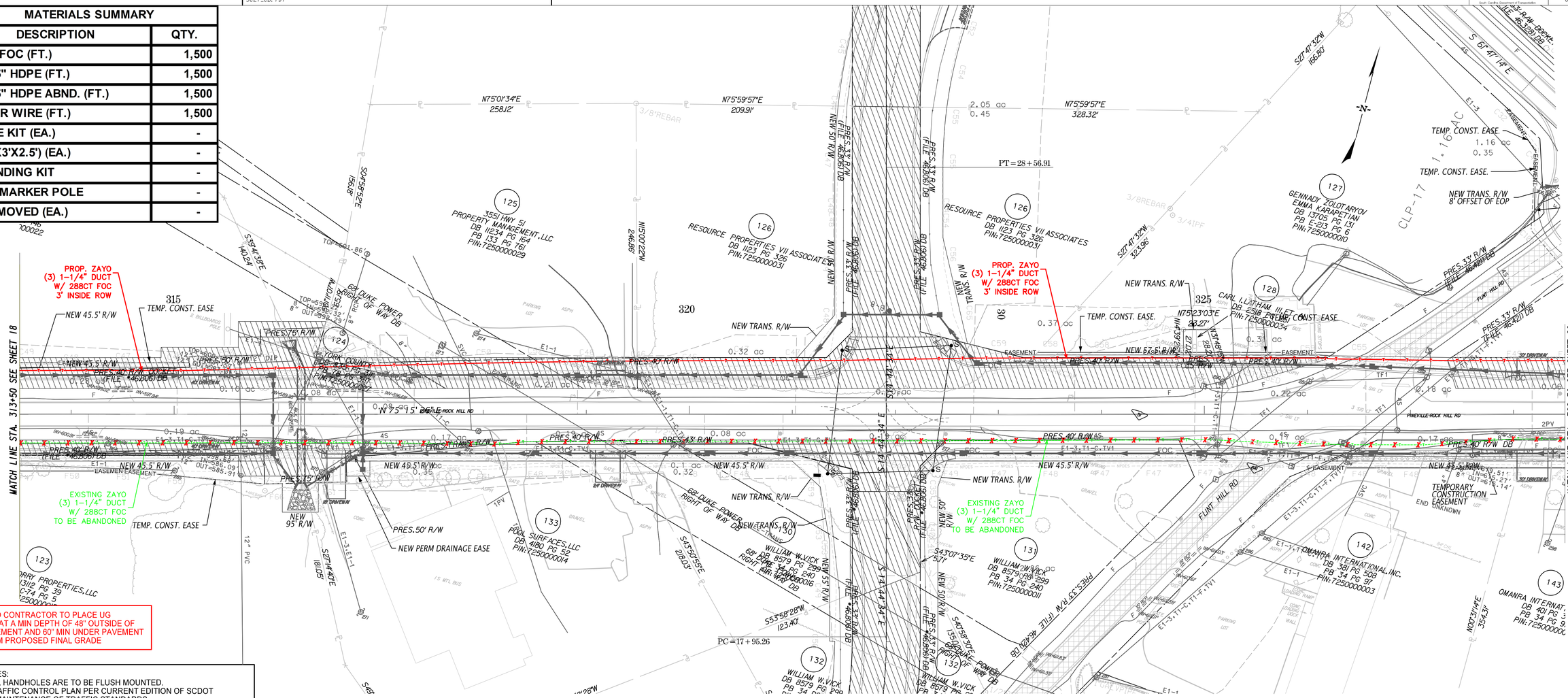
811 Know what's below. Call before you dig.

1/24/2024
\\friscoserver\common\Departments\Broadband\CLIENTS\ZAYO\ZAYO - SOUTH CAROLINA\Zayo1022 - SC US21 - SC51_CAD\Design_Sets\03_CD\Sheets\17_US21_SC51.dgn

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,045
(3) 1.25" HDPE (FT.)	1,045
(3) 1.25" HDPE ABND. (FT.)	962
TRACER WIRE (FT.)	1,045
SPLICE KIT (EA.)	1
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-


MATCH LINE STA. 298+50 SEE SHEET 17
MATCH LINE STA. 303+00 SEE SHEET 21
MATCH LINE STA. 313+50 SEE SHEET 19
TEMPORARY CONSTRUCTION EASEMENT
PROP. ZAYO (3) 1-1/4" DUCT W/ 288CT FOC 3' INSIDE ROW
PROP. ZAYO (3) 1-1/4" DUCT W/ 288CT FOC 21' INSIDE ROW
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC TO BE ABANDONED
EXISTING ZAYO HH TO BE ABANDONED
TEMP. CONST. EASE
TEMP. CONST. EASE.
NEW 57.5' R/W
NEW 45.5' R/W
NEW 60' R/W
NEW 55' R/W
NEW TRANS. R/W
NEW 65' R/W
PRES. 40' R/W
PRES. 45' R/W
PRES. 50' R/W
PRES. 55' R/W
PRES. 60' R/W
PINEVILLE-ROCK HILL RD
N 75° 15' 26" E
CRESCENT LAND & TIMBER CORP. DB 1866 PG 332 PB 95 PG 19 PIN:7250000101
SOUTHERN UTILITIES,INC DB 728 PG 75 PB 73 PG 114 PIN:7210000031
FORT MILL HOLDINGS,LLC DB 12360 PG 236 PB 74 PG 201 PIN:7210000035
GEORGE CRUMP DB 9003 PG 134 PB 80 PG 611 PB 76 PG 89 PIN:7210000039
TAYLOR / HORRY DB 13112 PB 75 PIN:7250
S75°37'36"E 226.33'
N12°46'43"E 232.35'
S20°48'46"E 421.51'
N20°38'20"E 421.51'
S18°20'09"E 400.36'
N18°05'49"W 404.04'
N10°10'09"W 410.07'
0.33 ac
0.35 ac
0.39 ac
0.39 ac
0.62 ac
1.38 ac
0.76 ac
0.60 ac
0.37 ac
0.44 ac
0.26 ac
0.19 ac
0.14 ac
0.24 ac
0.16 ac
1.88 ac
0.76 ac
PC=302+81.65
PT=308+44.06
300
305
310
114
119
120
122
159
263
50' DRIVEWAY
40' DRIVEWAY
45' DRIVEWAY
N
TRAILER
I-5 MTL BUS
PARKING LOT
ASPH
GR
GATE
BOLLARD
SVC
PILE
STONE CONC
RIPRAP
INVERT
CONC
SIGN
SIGN
SIGN

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,500
(3) 1.25" HDPE (FT.)	1,500
(3) 1.25" HDPE ABND. (FT.)	1,500
TRACER WIRE (FT.)	1,500
SPLICE KIT (EA.)	-
HH (2'X3'X2.5') (EA.)	-
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-


MATCH LINE STA. 313+50 SEE SHEET 18
MATCH LINE STA. 328+50 SEE SHEET 20
PROP. ZAYO (3) 1-1/4" DUCT W/ 288CT FOC 3' INSIDE ROW
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC TO BE ABANDONED
ZAYO CONTRACTOR TO PLACE UG FOC AT A MIN DEPTH OF 48" OUTSIDE OF PAVEMENT AND 60" MIN UNDER PAVEMENT FROM PROPOSED FINAL GRADE
NEW 45.5' R/W
NEW TRANS. R/W
TEMP. CONST. EASE
TEMP. CONST. EASE. 1.16 ac 0.35
NEW TRANS. R/W 8' OFFSET OF EOP
NEW PERM DRAINAGE EASE
TEMPORARY CONSTRUCTION EASEMENT END EASEMENT UNKNOWN
PT = 28+56.91
PC = 17+95.26
PINEVILLE-ROCK HILL RD
FLINT HILL RD
68' DUKE POWER RIGHT OF WAY DB
PRES. 33' R/W (FILE 46.421) DB
PRES. 40' R/W
PRES. 50' R/W
PRES. 75' R/W
CLP-17 1.16 AC
GENNADY ZOLOTARYOV EMMA KARAPETIAN DB 13705 PG 131 PB E-213 PG 6 PIN: 725000000010
RESOURCE PROPERTIES VII ASSOCIATES DB 1123 PG 326 PIN: 725000003I
CARL LATHAM III ET UX DB 5518 PG 181 PIN: 725050003+
355I HWY 5I PROPERTY MANAGEMENT, LLC DB 1234 PG 164 PB 133 PG 76I PIN: 7250000029
YORK COUNTY PB 125 PG 39 PIN: 725000200?
WILLIAM W.VICK DB 8579 PG 299 PB 34 PG 240 PIN: 725000001I
OMANRA INTERNATIONAL, INC. DB 391 PG 508 PB 34 PG 9I PIN: 7250000003
POOL SURFACES, LLC DB 4180 PG 52 PIN: Y250000014
N75°01'34"E 258.12'
N75°59'57"E 209.91'
N75°59'57"E 328.32'
S27°41'32"W 166.80'
S27°41'32"W 323.96'
S61°47'14"E
S14°44'34"E
N75°23'03"E 83.27'
S43°07'35"E 54.17'
S40°58'30"E 135.00'
S53°58'28"W 123.40'
S43°50'55"E 218.03'
N00°31'14"E 354.31'
S27°14'40"E 181.05'
S39°41'35"E 140.24'
N15°00'22"W 246.86'
N15°00'22"W 325.85'
2.05 ac 0.45
0.37 ac
0.32 ac
0.21 ac
0.08 ac
0.19 ac
0.17 ac
0.1 ac 0.32
0.39 ac
0.22 ac
0.18 ac
0.49 ac
0.06
0.04
0.03
0.01
0.02
0.03
0.05
0.07
0.09
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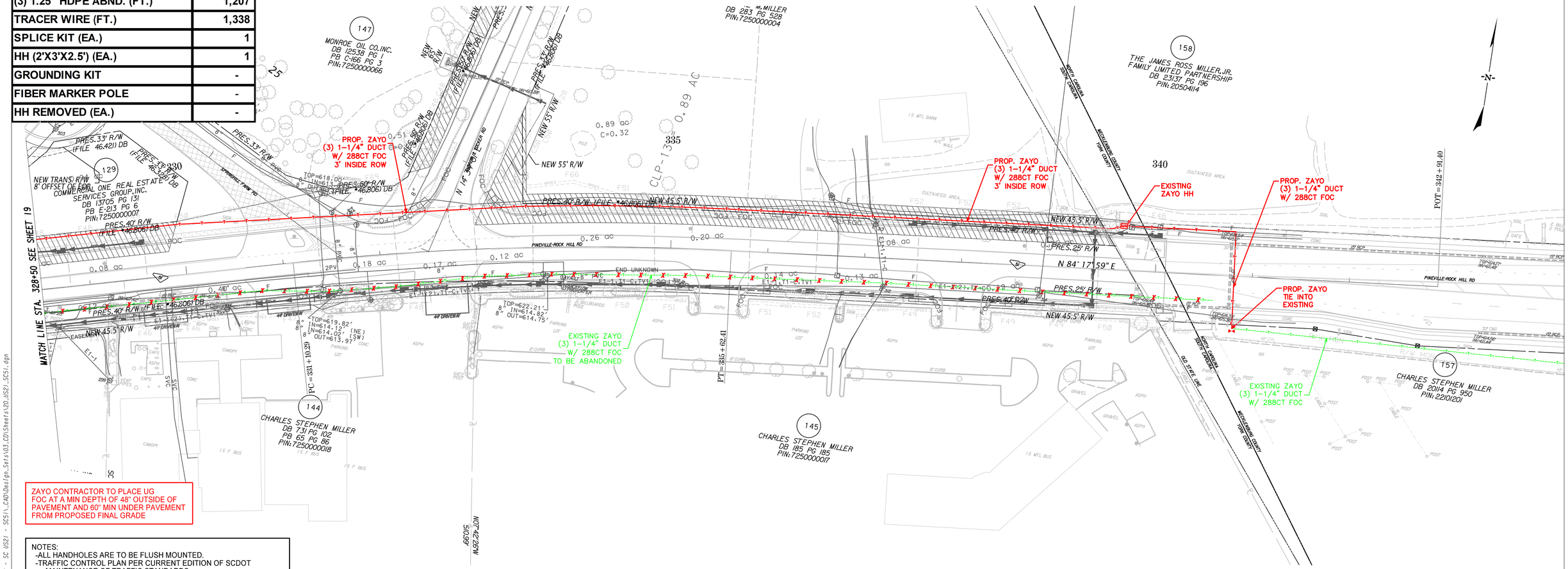
0.39
0.40
0.41
0.42
0.43
0.44
0.45
0.46
0.47
0.48
0.49
0.50

MATERIALS SUMMARY	
DESCRIPTION	QTY.
288CT FOC (FT.)	1,338
(3) 1.25" HDPE (FT.)	1,338
(3) 1.25" HDPE ABND. (FT.)	1,207
TRACER WIRE (FT.)	1,338
SPLICE KIT (EA.)	1
HH (2'X3'X2.5') (EA.)	1
GROUNDING KIT	-
FIBER MARKER POLE	-
HH REMOVED (EA.)	-



ZAYO CONTRACTOR TO PLACE UG FOC AT A MIN DEPTH OF 48" OUTSIDE OF PAVEMENT AND 60" MIN UNDER PAVEMENT FROM PROPOSED FINAL GRADE

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- -ALL CONSTRUCTION WITHIN RIGHT OF WAYS TO BE IN ACCORDANCE WITH THE SCDOT UTILITIES ACCOMMODATIONS MANUAL AND/OR SCDOT SPECIFICATIONS.
- -PERMITTEE SHALL PROVIDE AND MAINTAIN SAFE ACCESS TO ALL ADJACENT PROPERTIES AT PEDESTRIAN TRAFFIC MOVING CLOSE AND/OR CROSSING THE WORK AREA.

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DATE	DESCRIPTIONS	BY

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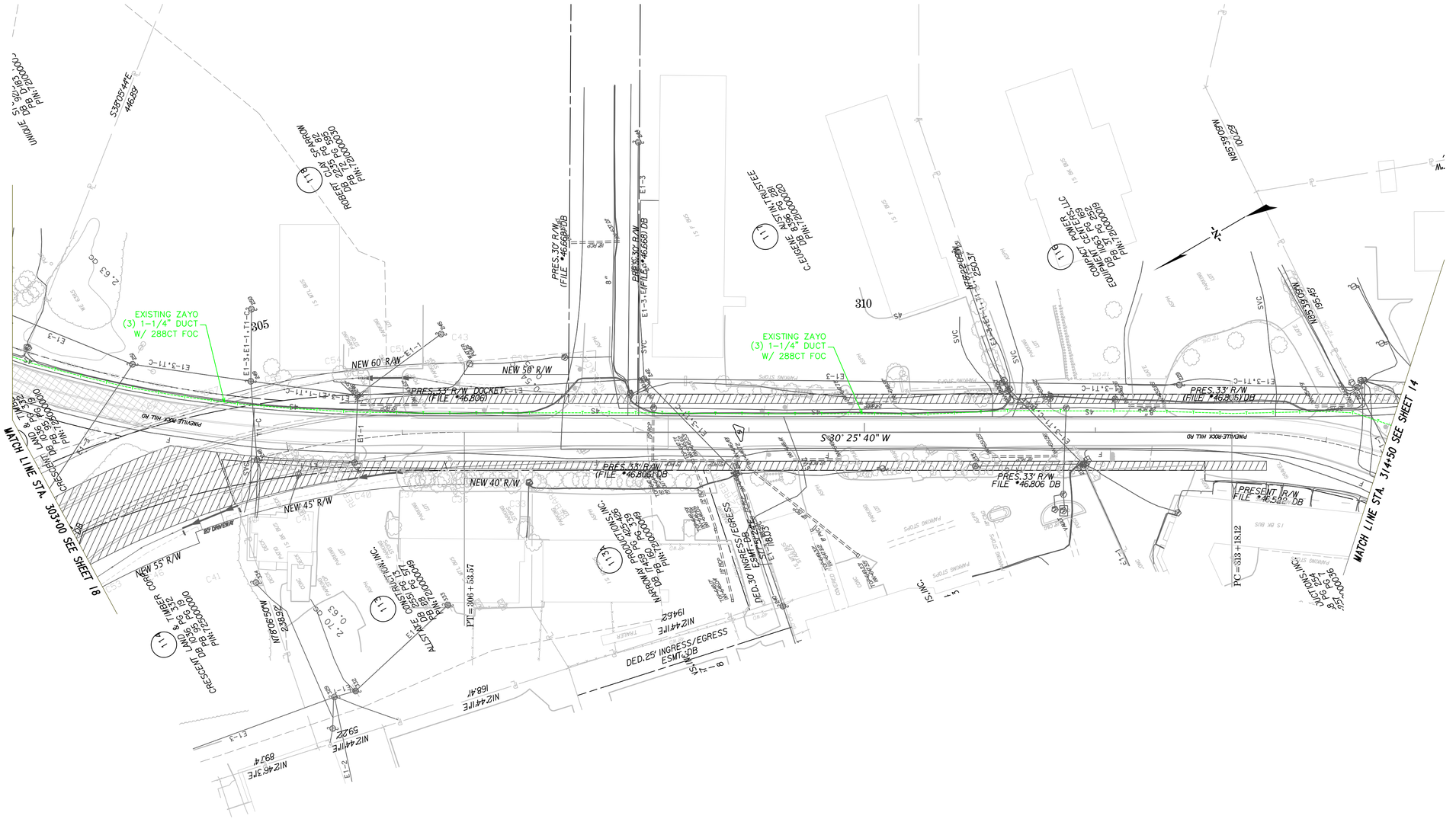
zayo GROUP

UTILITY PLANS
US 21 NORTH PHASE 1
& SC 51
CONSTRUCTION DRAWING

FILE NAME:	20_US21_SC51	COUNTY-STATE:	YORK, SC	JURISDICTION:	SCDOT
DRAFTER:	OG	SCALE:	1:50	SHEET: 20 OF 21	REVISION: 0


MATCH LINE STA. 303+00 SEE SHEET 18
MATCH LINE STA. 314+50 SEE SHEET 14
PINEVILLE-ROCK HILL RD
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC
EXISTING ZAYO (3) 1-1/4" DUCT W/ 288CT FOC
NEW 60' R/W
NEW 50' R/W
NEW 45' R/W
NEW 40' R/W
NEW 55' R/W
PRES. 33' R/W DOCKET (FILE #46,806)
PRES. 33' R/W (FILE #46,806) DB
PRES. 30' R/W (FILE #46,668) DB
PRES. 33' R/W FILE #46,806 DB
PRESENT R/W FILE #46,502 DB
S 30° 25' 40" W
S 35° 05' 44" E 46.89'
N 85° 39' 09" W 100.29'
N 85° 39' 09" W 95.45'
N 27° 06' 59" W 238.92'
N 12° 44' 11" E 168.41'
N 12° 44' 11" E 592.22'
N 12° 44' 11" E 19.62'
N 12° 48' 37" E 89.37'
DED. 30' INGRESS/EGRESS ESMT DB
DED. 25' INGRESS/EGRESS ESMT DB
PT = 306 + 58.57
PC = 313 + 18.12
UNDUE SL 90.83 DB PIN: 72000001
ROBERT CLAY SARRON DB PG 25 PG 585 PIN: 72000030
C. EUGENE RASTIN TRUSTEE DB 1236 PG 281 PIN: 72000002
COMPACT POWER EQUIPMENT CENTER LLC DB PG 1163 35 PIN: 72000019
CRESCENT LAND & TIMBER CORP DB 1936 PG 18 PIN: 72000010
CRESCENT LAND & TIMBER CORP DB 1936 PG 18 PIN: 72000010
PRODUCTIONS, INC. DB 1450 PG 329 PIN: 72000049
CONSTRUCTION, INC. DB 1450 PG 327 PIN: 72000049
ALLSTATE DB 1450 PG 327
NARROW DB 1450 PG 329
PRODUCTIONS, INC. DB 1450 PG 329 PIN: 72000049
PRODUCTIONS, INC. DB 1450 PG 329 PIN: 72000049
PINEVILLE-ROCK HILL RD
305
310
C41
C42
C43
C51
C54
E1-3
E1-3,T1-C
E1-3,T1-C
E1-3,T1-C

Healthy People. Healthy Communities

March 21, 2024

Lisa Hagwood
York County
P.O. Box 148
York, SC 29745

RE: US 21 North Phase 1 and SC51 Widening, York County
NPDES Coverage Number: SCR10ZEW6

Dear Lisa Hagwood:

The Department of Health and Environmental Control (Department or DHEC) has approved the Stormwater Pollution Prevention Plan (SWPPP) for the referenced project on **March 21, 2024**. Based on your submission of the Notice of Intent (NOI) and in accordance with the NPDES General Permit for Stormwater Discharges from Construction Activities (CGP), this project has been granted coverage under the CGP. This project's general permit coverage number is **SCR10ZEW6**. The total disturbed area for this site is **52.6 acres**.

Additional sets of final plans must be provided to the Department so that stamped, final plans are available for use on site, as required by the CGP.

- Because this project impacts waters of the U.S./State, make sure you obtain all necessary permits and certifications from USACOE and SCDHEC 401 Water Quality Certification, Standards Section before land-disturbing activities begin in those areas.
- Please ensure that any easements and permissions are obtained as necessary for any site outfalls.

The CGP can be downloaded at the following website: http://www.scdhec.gov/Environment/docs/CGP-permit.pdf or you may request a copy from us via email (stormwatercgp@dhec.sc.gov). You are responsible for ensuring your contractor(s) complies with the approved SWPPP and the minimum requirements of the CGP. Also, you are responsible for overall compliance with the Storm Water Management and Sediment Reduction Act of 1991 (1991 Act), SC Pollution Control Act, and the Federal Clean Water Act (CWA). Failure to comply with the approved SWPPP or applicable statutes and regulations may result in enforcement actions.

You must notify this DHEC EQC Regional Office prior to starting any land-disturbing activity. The address and telephone number of the EQC office are as follows:

Midlands EA Lancaster
2475 DHEC Road
Lancaster, SC 29720
803-285-7461

Inspections of this site must be performed by qualified personnel as described in Section 4.2.E of the CGP.

You should be aware that this approval is only applicable for the SWPPP that was submitted for this project. Any additional construction or land disturbing activity beyond the scope of the approved plans is not authorized. Any future work for this project not shown on the stamped, approved plans will require that you submit another site plan for review and approval. All major modifications require review and approval by the Department. Minor modifications to the approved SWPPP may be made by the SWPPP preparer and do not require review and approval by the Department; these changes should be signed and dated by the SWPPP preparer. If you have a question about whether a modification is major or minor, contact the Stormwater Permitting Section at (803) 898-4300.

A copy of the stamped, approved SWPPP (including a copy of the CGP, contractor certifications, inspection records, rainfall data, etc.), NOI, and CGP coverage letter from DHEC must be retained and available at the construction site (or accessible within 30 minutes during normal business hours) from the date of commencement of construction activities to the date of final stabilization. If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the plan's location must be posted near the main entrance at the construction site.

All contractors who will conduct land-disturbing activities at the site must complete a Contractor Certification Form. You are also responsible for listing all contractors in the SWPPP and for holding a pre-construction conference with each contractor before they can conduct land-disturbing activity at the site.

The Department may conduct periodic inspections of your site. Any violations found during these inspections may result in enforcement action.

This NPDES coverage should be terminated by the permittee when one of the conditions listed in Section 5.1 of the CGP has been met. You must submit a Notice of Termination (NOT) to cancel your NPDES coverage under the CGP. Please see section 5.1 of the CGP for additional information required to be submitted with the NOT.

You are responsible for obtaining any other federal, state, or local permit that may be required for this project. In particular, any permits through the U.S. Army Corps of Engineers for the placement of fill material in Waters of the United States. Please note we have not sent a copy of this letter to

any county or city building official. You must send a copy of this letter to these agencies, if necessary.

If material excavated during construction activities leaves the site, a mine operating permit may be needed. You are responsible for contacting the Mining and Reclamation Section to determine if a mining permit is required for the site. The Mining and Reclamation Section can be reached at (803)898-1362 or via e-mail at AskMines@dhec.sc.gov.

Please see the enclosed "Guide to Board Review" document for information about the procedures for appealing this NPDES coverage.

If you have any questions or cannot access the referenced websites, please call me at 803-898-4005.

Sincerely,

Sloan E. Jackson
Stormwater Permitting Section

CC: Guy P. Peters
Midlands EA Lancaster

Exhibit 1
South Carolina Board of Health and Environmental Control
Guide to Board Review
Pursuant to S.C. Code Ann. § 44-1-60

The decision of the South Carolina Department of Health and Environmental Control (Department) becomes the final agency decision fifteen (15) calendar days after notice of the decision has been mailed to the applicant, permittee, licensee and affected persons who have requested in writing to be notified, unless a written request for final review accompanied by a filing fee in the amount of $100 is filed with the Department by the applicant, permittee, licensee or affected person.

Applicants, permittees, licensees, and affected parties are encouraged to engage in mediation or settlement discussions during the final review process.

If the Board declines in writing to schedule a final review conference, the Department's decision becomes the final agency decision and an applicant, permittee, licensee, or affected person may request a contested case hearing before the Administrative Law Court within thirty (30) calendar days after notice is mailed that the Board declined to hold a final review conference. In matters pertaining to decisions under the South Carolina Mining Act, appeals should be made to the South Carolina Mining Council.

I. Filing of Request for Final Review

1. A written Request for Final Review (RFR) and the required filing fee of one hundred dollars ($100) must be received by Clerk of the Board within fifteen (15) calendar days after notice of the staff decision has been mailed to the applicant, permittee, licensee, or affected persons. If the 15th day occurs on a weekend or State holiday, the RFR must be received by the Clerk on the next working day.
2. RFRs should be filed on-line (scdhec.gov/FileRFR) or in person or by mail at the following address:
   South Carolina Board of Health and Environmental Control
   Attention: Clerk of the Board
   2600 Bull Street
   Columbia, South Carolina 29201
   Alternatively, RFRs may be filed with the Clerk by electronic mail (boardclerk@dhec.sc.gov).
3. RFRs shall be in writing and should include, at a minimum, the following information:
   - The grounds for amending, modifying, or rescinding the staff decision;
   - a statement of any significant issues or factors the Board should consider in deciding how to handle the matter;
   - the relief requested;
   - a copy of the decision for which review is requested; and
   - the name of the Requestor and the Requestor's mailing address, email address, if applicable, and phone number(s) at which the Requestor can be contacted. If the Requestor consists of a group of individuals, a representative of the group should be identified to receive all notices and communications related to the RFR for the group.

   All information submitted is subject to release under the Freedom of Information Act. If the RFR and accompanying documentation contain information the Requestor believes should not be released, such information should be identified.

4. The filing fee may be paid by cash, check or credit card and must be received by the 15th day. Credit card payments may be made by phone (803-898-3460, option 2) or on-line at scdhec.gov/FileRFR.
5. If there is any perceived discrepancy in compliance with this RFR filing procedure or any other procedural question, the Clerk should consult with the Chairman or, if the Chairman is unavailable, the Vice-Chairman. The Chairman or the Vice-Chairman will determine whether the RFR is timely and properly filed and direct the Clerk to (1) process the RFR for consideration by the Board or (2) return the RFR and filing fee to the requestor with a cover letter explaining why the RFR was not timely or properly filed. Processing an RFR for consideration by the Board shall not be interpreted as a waiver of any claim or defense by the agency in subsequent proceedings concerning the RFR.
6. If the RFR will be processed for Board consideration, the Clerk will send an Acknowledgement of RFR to the Requestor and the applicant, permittee, or licensee, if other than the Requestor.
7. If an RFR pertains to an emergency order, the Clerk will, upon receipt, immediately provide a copy of the RFR to all Board members. The Chairman, or in his or her absence, the Vice-Chairman shall, based on the circumstances, decide whether to refer the RFR to the RFR Committee for expedited review or to decline in writing to schedule a Final Review Conference. If the Chairman or Vice-Chairman determines review by the RFR Committee is appropriate, the Clerk will forward a copy of the RFR to Department staff and Office of General Counsel. A Department response and RFR Committee review will be provided on an expedited schedule defined by the Chairman or Vice-Chairman.
8. Following any necessary redaction, the Clerk will email the RFR to staff and Office of General Counsel and request a Department Response within ten (10) working days. If the Requestor is not the applicant, permittee, or licensee, the Clerk will email the RFR to the applicant, permittee, or licensee and give them the option of providing a response within ten (10) working days. Upon receipt of the Department Response and, if timely received, the applicant, permittee, or licensee response, the Clerk will forward the RFR and response(s) to all Board members for review, and all Board members will confirm receipt of the RFR package to the Clerk by email. The responses will also be provided by the Clerk to the Requestor and the applicant, permittee, or licensee if not the Requestor, when provided to the Board; however, questions by RFR Committee members notwithstanding, no subsequent submittals by the parties will be provided to the Board until and if a Conference is scheduled.

If a Board member does not confirm receipt of the RFR within a twenty-four (24) hour period, the Clerk will attempt to contact the Board member and confirm receipt. If a Board member believes the RFR should be considered by the RFR Committee, he or she will respond to the Clerk's email within seventy-two (72) hours and will request further review. If no Board member requests further review of the RFR within the seventy-two (72) hour period, the Clerk will send a letter by certified mail to the Requestor, with copy by regular mail to the applicant, permittee, or licensee, if not the Requestor, stating the Board will not hold a Final Review Conference. Contested case guidance will be included within the letter.
NOTE: If the time periods described in this provision end on a weekend or State holiday, the time is automatically extended to the next business day.

9. If the RFR is to be considered by the RFR Committee, the Clerk will notify the Board that further review is requested. The Board member(s) requesting further review will appear at the RFR Committee meeting to discuss the matter with the RFR Committee unless excused by the presiding member. If time allows, an RFR Committee member may submit questions to the parties via the Clerk to be answered in writing prior to the RFR Committee meeting. RFR Committee meetings are open to the public and will be public noticed at least twenty-four (24) hours in advance.
10. Following RFR Committee or Board consideration of the RFR, if it is determined no Conference will be held, the Clerk will send a letter by certified mail to the Requestor, with copy by regular mail to the applicant, permittee, or licensee, if not the Requestor, stating the Board will not hold a Conference. Contested case guidance will be included within the letter.

II. Final Review Conference Scheduling

1. If a Conference will be held, the Clerk will send a letter by certified mail to the Requestor, with copy by regular mail to the applicant, permittee, or licensee, if not the Requestor, informing the Requestor of the determination.
2. The Clerk will send Notice of Final Review Conference to the parties at least ten (10) days before the Conference. The Conference will be publicly noticed and the Notice should:
    - include the place, date and time of the Conference;
    - state the presentation times allowed in the Conference;
    - state evidence may be presented at the Conference;
    - if the conference will be held by a committee other than the RFR Committee or a designee, include a copy of the Chairman's order appointing the committee or the designee; and
    - inform the Requestor of his or her right to request a transcript of the proceedings of the Conference prepared at Requestor's expense.
3. Information submitted to the Clerk at least twenty-four (24) hours prior to the Conference will be provided to the Board for consideration prior to the Conference. Such information will also be provided to the parties. While parties may distribute handouts at the Conference, information received by the Clerk after this deadline will not be provided to the Board or the parties.
4. Slide presentations for the Conference must be provided to the Clerk at least twenty-four (24) hours prior to the Conference to allow time for uploading. Slide presentations will be provided to the Board and the parties prior to the Conference.
5. If a party requests a transcript of the proceedings of the Conference and agrees to pay all related costs in writing, including costs for the transcript, the Clerk will schedule a court reporter for the Conference.

III. Final Review Conference and Decision

1. The order of presentation in the Conference will, subject to the presiding officer's discretion, be as follows:
    - Department staff will provide an overview of the staff decision and the applicable law to include [15 minutes]:
        - Type of decision (permit, enforcement, etc.) and description of the program.
        - Parties
        - Description of facility/site
        - Applicable statutes and regulations
        - Decision and materials relied upon in the administrative record to support the staff decision.
    - Requestor(s) will state the reasons for protesting the staff decision and may provide evidence to support amending, modifying, or rescinding the staff decision. [20 minutes] *NOTE: The burden of proof is on the Requestor(s)*
    - Rebuttal by Department staff [20 minutes]
    - Rebuttal by applicant, permittee, or licensee, if not the Requestor [5 minutes]
    - Rebuttal by Requestor(s) [15 minutes]

    Note: Times noted in brackets are for information only and are superseded by times stated in the Notice of Final Review Conference or by the presiding officer.
2. Parties may present evidence during the conference; however, the rules of evidence do not apply.
3. At any time during the conference, the officers conducting the Conference may request additional information and may question the Requestor, the staff, and anyone else providing information at the Conference.
4. The presiding officer, in his or her sole discretion, may allow additional time for presentations and may impose time limits on the Conference.
5. All Conferences are open to the public.
6. The officers may deliberate in closed session.

7. The officers may announce the decision at the conclusion of the Conference or it may be reserved for consideration.
8. The Clerk will mail the written final agency decision (FAD) to parties within thirty (30) days after the Conference. The written decision must explain the basis for the decision and inform the parties of their right to request a contested case hearing before the Administrative Law Court or in matters pertaining to decisions under the South Carolina Mining Act, to request a hearing before the South Carolina Mining Council. The FAD will be sent to the parties by certified mail, return receipt requested.
9. Communications may also be sent by electronic mail, in addition to the forms stated herein, when electronic mail addresses are provided to the Clerk.

The above information is provided as a courtesy; parties are responsible for complying with all applicable legal requirements.

NOTICE OF INTENT (NOI)
For Coverage(s) of Primary Permittees Under South Carolina NPDES General Permit For Stormwater Discharges From Construction Activities SCR100000
(Maintain As Part of On-Site SWPPP)

For Official Use Only
File Number: _____
Permit Number: SCR10_____
Submittal Package Complete: _____

*Submission of this Notice of Intent constitutes notice that the Applicant identified in Section II intends to be authorized as a Primary Permittee in the state of South Carolina under NPDES General Permit SCR1000000. **Fees required for review and NPDES coverage of each application type are as listed on page 2 of the Instructions.***

SOUTH CAROLINA
DEPT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL QUALITY CONTROL
STORMWATER PERMITTING SECTION
APPROVED - FOR CONSTRUCTION ONLY
DHEC PERMIT #: SCR10ZEW6
FILE #: ——
DATE ISSUED: 3/21/24
BY: [signature]

Date: 01/24/2023
Project/Site Name: US 21 North Phase 1 and SC51 Widening **County:** York
(Modification or Change of Information Only) **Prior Approved NPDES Permit or File Number:** _____

Do you want this project to be considered for the Expedited Review Program (ERP)? ☐ Yes or ☑ No (See instructions)

I. Notice of Intent (NOI) Application Type(s)

A. **Project (Application/Review) Type(s)** (Select ALL that apply)
- ☑ New Project (Initial Notification) Ongoing Project: ☐ Permitted or ☐ Un-Permitted
- ☐ Late Notification ☐ Low Impact Development (LID) or Project Design Above Regulatory Requirements
- ☐ New Owner/Operator or Company Name Change **(see instructions, attach Form A (Transfer of Ownership))**
- ☐ Major Modification: **(see instructions, attach Form B (Major Modifications))**
- ☐ MS4 Project Review
- ☐ Ocean and Coastal Resource Management (OCRM) Review
- ☐ Change of Information/Other (Specify): _____

B. If Applicable, identify the entity designated as **MS4 Reviewer and MS4 Operator** (i.e., Lexington County, City of Greer, etc.): **MS4 Reviewer**_____ **MS4 Operator** _____

II. Primary Permittee Information ☐ Change of Information

☐ Person or ☑ Company | If a Company, are you a ☐ Lending Institution or ☑ Government Entity?
Company EIN (If applicable): EIN: 57-6000418

A. **Primary Permittee Name:** York County
Mailing Address: P.O. Box 148 City: York State: SC Zip: 29745
Phone: 803 818 5733 Fax: _____ Email Address: engineering@yorkcountygov.com

B. **Contact /ODSA Name** (If different from above OR if owner is a company): Lisa W. Hagood, PE
Mailing Address: P.O. Box 148 City: York State: SC Zip: 29745
Phone: 803 684 8571 Fax: 803 684 8596 Email Address: penniesforprogress@yorkcountygov.com

C. **Property Owner Name** (If different from above): South Carolina Department of Transportation
Mailing Address: 338 Robertson Road West City: Rock Hill State: SC Zip: 29730
Phone: 803 324 3545 Fax: _____ Email Address: JohnstonCJ@scdot.org

III. Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) Preparer Information ☐ Change of Information

A. **C-SWPPP Preparer Name:** Guy P. Peters, PE, CFM
B. **Registered Professional** ☑ Engineer ☐ Landscape Architect ☐ Tier B Land Surveyor **S. C. Registration #:** 21220
C. **Company/Firm Name:** STV Incorporated **S. C. COA # :** C03318
Mailing Address: 454 S. Anderson Rd Ste 3 BTC 517 City: Rock Hill State: SC Zip: 29730
Phone: 803 656 2014 Fax: 803 980 4099 Email Address: guy.peters@stvinc.com

IV. Project/Site Information ☐ Change of Information

A. **Type of Construction Activity(ies)** (Select ALL that apply)
- ☐ Commercial ☐ Industrial ☐ Institutional ☐ Mass Grading ☑ Linear ☐ Utility/Infrastructure
- ☐ Residential: Single-family ☐ Residential: Multi-family ☐ Multi-use (Commercial & Residential)
- ☐ Site Preparation (No New Impervious Area) ☐ Other (Specify) _____

B. **Site Address/Location** (street address, nearest intersection, etc.) SC51 fr NC border to intx US21; US21 fr intx US21 to SC460
City/Town (If in limits): _____ Zip Code: _____
Latitude: 35 ° 05 ' 02 " N Longitude: - 80 ° 56 ' 00 " W (Source): ☐ GPS ☑ Web Site: Google Earth Pro
Tax Map Number (s) (List all): SCDOT right of way

C. Is this site located on **Indian Land?** ☐ Yes ☑ No

D. **Proposed Start Date:** 10/01/2022 **Proposed Completion Date:** 03/31/2024

E. **Disturbed Area** (nearest tenth of an acre): 52.6 **Total Area** (acres): 55.6

F. **Modification Only:** (nearest tenth of an acre): **Disturbed Area: Current (Approved) Area:** _____
Disturbed Area Change (Increase Only): _____ **Total Disturbed Area (After Change):** _____

G. Is this project part of a **Larger Common Plan for Development or Sale (LCP)?** ☐ Yes ☑ No
LCP/ Overall Development Name: _____ Check here if this is the **First Phase.** ☐

Previous State Permit/File Number: _____ **Previous NPDES Coverage Number:** SCR10 _____

H. Any **Flooding Problems** exist downstream of or adjacent to this site? ☐ Yes ☑ No (If yes, provide detailed description of flooding problems and applicable floodway/flood zone information in the C-SWPPP).

I. Active **S.C. DHEC Warning Notice, Notice to Comply or Notice of Violation** for this site or LCP? ☐ Yes ☑ No

J. List Relevant **State and Federal Environmental Permits or Approvals** applied for or obtained for this site (e.g., **RCRA, USACOE, Nationwide**, etc.). **If None, list None.**
SAC-2015-00812

K. **Any Waiver(s)/Variances/Exceptions Requested for this Project?** (If yes, identify below and include **Waiver Request and Justifications** in the C-SWPPP for each proposed request).

1. Small Construction Activity Waiver(s) From NPDES permitting **(Section 1.4 & Appendix B)?** ☐ Yes ☑ No
If yes, Identify requested waiver: ☐ Rainfall Erosivity Waiver ☐ TMDL Waiver ☐ Equivalent Analysis Waiver

2. Detention Waiver **(72-302(B)?** ☑ Yes ☐ No | 3. Other (Specify): _____

V. Waterbody Information (Attach additional sheet(s) as needed)

☐ **Change of Information**

A. **Receiving Waterbody(s) (RWB) Information** (List the nearest and next nearest receiving waterbodies to which the sites stormwater discharges will drain. If stormwater discharges drain to multiple waterbodies, list all such waterbodies).

1. Name of Receiving Waterbodies (RWB)	2. Distance to RWB (feet)	3. Classification of RWB
a. Nearest: UT Steele Creek	380	FW
b. Next Nearest: Steele Creek	700	FW
c. Coastal Zone ONLY: Coastal Receiving Water (CRW):		Not Applicable
d. Other Waterbodies:		

B. **Waters of the U.S. / State Information** (Attach additional sheet(s) as needed)

Waters of the U.S./ State	1. On the site?	2. Delineated/ Identified?	3. Impacts?	4. Amount of impacts
a. Jurisdictional wetlands	☑ Yes ☐ No	☑ Yes ☐ No	☑ Yes ☐ No	0.09 Ac
b. Non-jurisdictional wetlands	☑ Yes ☐ No	☑ Yes ☐ No	☐ Yes ☐ No	_____ Ac
c. Other Water(s): jurisdictional streams	☑ Yes ☐ No	☑ Yes ☐ No	☑ Yes ☐ No	_____ Ac 635 Feet
d. Coastal Zone ONLY: Direct Critical Area	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	_____ Ac _____ Feet

5. If yes for impacts in B.3, describe each impact and activity, and list all permits (e.g., USACOE Nationwide Permit, DHEC General Permit) and certifications that have been applied for or obtained for each impact:
Storm drain pipe extensions in jurisdictional streams authorized by USACOE NWP SAC-2015-00812 attached

C. **S.C. Navigable Waters (SCNW) Information (Section 2.6.5)** The Department will address any issues related to State Navigable Waters' Program under SC Regulation 19-450 during the review of the C-SWPPP for activities that will **NOT** require a 404 permit or a 401 certification. (Attach additional sheet(s) as needed).

1. Are S. C. Navigable Waters (SCNW) on the site: ☐ Yes ☑ No
a. If **no**, do not complete this question. Proceed to Section D (Impaired Waterbodies).
b. If **yes**, provide the name of S.C. Navigable Waters (SCNW) on the site: _____

2. If **yes for C.1**, will construction activities cross over or occur in, under, or thru the SCNW? ☐ Yes ☐ No
If yes, describe SCNW activities (e.g., road crossing, sub-aqueous utility line, temporary or permanent structures, etc.) and proceed to Section C.3: _____

3. Identify permits providing coverage of SCNW activities proposed for your site. If NONE, list none.

Permits/Certifications	Permit or Certification No.	Corresponding Covered SCNW Activity(ies)
a. DHEC General/ Other DHEC Permit		
b. USACOE 404 Permit or 401 Certification		
c. SCNW Permit If applied for or issued, identify **Date applied for or issued:** _____		☐ **All Activities** or ☐ **Some Activities (Describe):**

d. If a SCNW Permit has NOT been applied for provide an additional plan sheet that shows plan and profile views (drawn to scale) of the SCNW and associated activities. Include a description of all proposed activities on this plan.

D. **Impaired Waterbodies Information** (Attach additional sheet(s) as needed)

1. 303(d) Listed Impaired Waterbodies

a. Name of **Nearest DHEC Water Quality Monitoring Stations (WQMS)(s)** that receives stormwater from your construction site and/or thru an MS4 and the **Name of the Corresponding Waterbody?**		b. **Is this WQMS(s) listed on the most current 303(d) List? If No, proceed to Section 2 of this table. If Yes, complete items c thru f.**	c. List the pollutant(s) identified as **"CAUSES"** of the impairment	d. Will any pollutants causing the impairment be present in your site's construction stormwater discharges?	e. If **yes for d**, list the **"USE SUPPORT"** impairment(s) affected by the pollutant(s) identified in c.
Nearest DHEC WQMS(s)	**Corresponding Waterbody**				
CW-681	Steele Creek	☐ Yes ☑ No		☐ Yes ☑ No	
		☐ Yes ☑ No		☐ Yes ☑ No	
		☐ Yes ☐ No		☐ Yes ☐ No	

f. If **yes for d** above, **will use of the BMPs proposed for your project ensure the site's discharges will NOT contribute to or cause further WQS violations for the impairment(s) listed in c?** ☐ Yes ☐ No
(NOTE: If no for f, this site is NOT eligible for coverage under the CGP). See Instructions.

2. TMDL Impaired Waterbodies

a. Name of **Nearest DHEC Water Quality Monitoring Stations (WQMS)(s)** that receives stormwater from your construction site and/or thru an MS4?	b. Has a TMDL(s) been developed for this WQMS(s)? **If No, identify as such below and proceed to Section VI. If Yes, complete items c thru f of this table.**	c. **If yes for b,** what pollutants are listed as "CAUSES" or causing the impairment?	d. If **yes for b**, has the standard been **"ATTAINED" or " Fully Supported"** for the impairment(s)?	e. If **no for d (Not Attained),** will any pollutants causing the impairment be present in your site's construction stormwater discharges?
CW-203	☐ Yes ☑ No	fecal coliform	☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☑ No		☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☐ No		☐ Yes ☐ No	☐ Yes ☐ No

f. If **yes for e** above, **are your discharges consistent with the assumptions and requirements of the TMDL(s)?** ☐ Yes ☐ No
(NOTE: If no for f, this site is NOT eligible for coverage under the CGP). See Instructions.

VI. Signatures and Certifications

DO **NOT** SIGN IN BLACK INK! **Read the Certifications below (in entirety). Provide date, printed name, and signatures below.** If you are a **New Owner/Operator,** as Primary Permittee you must also sign and date the applicable Comprehensive SWPPP Acceptance & Compliance Agreement below.

C-SWPPP PREPARER: "One copy of the C-SWPPP, all specifications and supporting calculations, forms, and reports are herewith submitted and made a part of this application. I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000." **(This should be the person identified in Section III).**

Guy P. Peters, PE, CFM — **Printed Name of C-SWPPP Preparer**

Guy P. Peters — **Signature of C-SWPPP Preparer**

21220 — **S. C. Registration #**

PRIMARY PERMITTEE: "I or I (on behalf of my company and its contractors and agents), as the case may be, certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I understand that DHEC enforcement actions may be taken if the terms and conditions of the C-SWPPP are not met and I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

"I or I (on behalf of my company and its contractors and agents), as the case may be, also hereby certify that all land-disturbing construction and associated activity pertaining to this site shall be accomplished pursuant to and in keeping with the terms and conditions of the approved plans and SCR100000. I also certify that a responsible person will be assigned to the project for day-to-day control. I hereby grant authorization to the to S. C. Department of Health and Environmental Control (DHEC) and/or the local implementing agency the right of access to the site at all times for the purpose of on site inspections during the course of construction and to perform maintenance inspections following the completion of the land-disturbing activity." **(See Section 122.22 of S.C. Reg. 61-9 for signatory authority information.)** Having understood the above information, I am signing this certification as Primary Permittee to the aforementioned NPDES general permit."

Lisa W. Hagood, PE — **Printed Name of Primary Permittee**

Lisa W. Hagood — **Signature of Primary Permittee**

County Engineer — **Title/Position**

2/26/2024 — **Date Signed**

Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) For Construction Activities:

Project/Site Name:

US 21 & SC 46-48 (SC 51) Widening

Project Address/Location:
US 21 from SC 460 to SC 46-48
Fort Mill, South Carolina 29715

Primary Permittee:

York County
6 South Congress Street
Box 148
York, South Carolina 29745

Permittee/Owner Contact:
Lisa W. Hagood, PE
County Engineer
P.O. Box 148
York, South Carolina 29745

SWPPP Preparer:

STV Incorporated
Guy P. Peters, PE, CFM
454 South Anderson Road Ste. 3, BTC 517
Rock Hill, South Carolina 29730-3392
803 207 2025
guy.peters@stvinc.com

Day-to-Day Operator:

Steven Moss
Construction Inspector
6 South Congress Street
P.O. Box 148
York, South Carolina 29745



C-SWPPP Preparation Date:

17 February 2023
22 December 2023 r1

Modification Dates:
Modification I: __ __ / __ __ / __ __ __ __
Modification II: __ __ / __ __ / __ __ __ __



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Appendix A - Completed NOI Form & Checklist
Appendix B - Additional Permits, Approvals, & Certification
Appendix C - Receiving Waterbodies Map & Information
Appendix D - Erosion Control Standard Drawings
Appendix E - Stormwater Management Design Study (includes site maps and drainage maps)
Appendix F - Inspection Log and Reports (OS-SWPPP** Only)
Appendix G - Rainfall Records (OS-SWPPP** Only)
Appendix H - Additional Site Logs and Records (OS-SWPPP** Only)
Appendix I - Construction General Permit (CGP) - *SCR100000*
Appendix J - Construction plan set

SOUTH CAROLINA STV INCORPORATED NO. C03318 CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA Professional LICENSED ENGINEER No. 21220 GUY PARIS PETERS 22Dec23

**C-SWPPP is acronym for Comprehensive Storm Water Pollution Prevention Plan*
***OS-SWPPP is acronym for On-Site Storm Water Pollution Prevention Plan*

Section 1 PROJECT OVERVIEW

1.1 Narrative (CGP Section 3.2.1)

Construction Activities and BMP Summary

York County has contracted STV Incorporated to provide professional engineering services for the proposed US 21 and SC 51 improvement project. The project extends along US 21 from SC 460 north to the newly aligned SC 51 and extends along SC 51 to the North Carolina / South Caroline state line. The project area is noted in Figure 1.1, shown below.

The sediment and erosion control structures for this project consist of silt fence, sediment tubes, sediment basins, inlet filters, and outlet protection. Proposed stormwater conveyances, consisting of grass lined channels and ditch berms will address permanent water quality.

The project will widen US 21 for approximately 12,000 feet, disturbing existing pavement and grading shoulders within the proposed construction limits. The approximate total disturbed area is 49.0 acres. Proposed construction along the route will affect wetlands in the area.

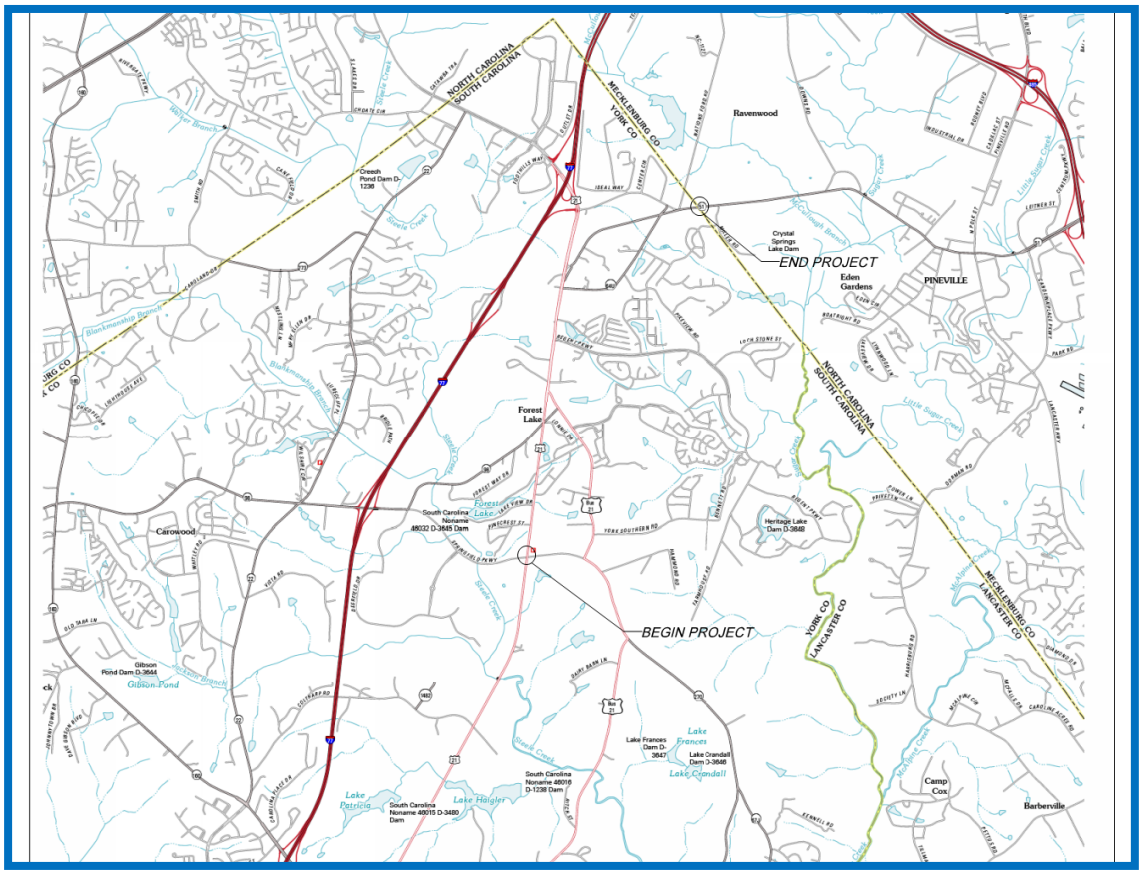


Figure 1.1: Project Location

Pre-Development Conditions

The project is located north of the town of Fort Mill in York County, South Carolina. The project area is rolling terrain with elevations ranging from 583 to 671 feet above sea level. The existing ground gradients typically range from 0.1 to 14 percent. The existing site soil features, as identified by The United States Department of Agriculture NRCS Web Soil Survey of York County, South Carolina, consist predominantly of loamy sands and clay loam. Additional soils information and a soils map are in Appendix E, Stormwater Management Design Study.

The existing on-site drainage is predominantly collected in roadside ditches that drain toward Steele Creek to the west and Sugar Creek to the east. Both Steele and Sugar Creeks are the project's ultimate outfalls and are located directly to the west and east respectively of the project. In general, runoff flows north and south along this state road and then is directed to either of these two creeks via existing channels.

Post-Development Conditions

Post-development conditions will closely mimic existing conditions. Minor widening of existing roadway will technically increase peak runoff, but the amount is negligible when compared to runoff from the existing pavement. The existing outfalls will be maintained and will accept the proposed project's drainage. Existing grass lined channels will be utilized where feasible and permanent vegetation will be established on disturbed soil areas after the construction has been completed. Peak discharge increases will not impose any adverse impacts to Steele Creek or adjoining properties. Please also refer to Section 1.6 – Certification Statement and Detention Waiver.

Pre vs. Post Development Peak Discharges Comparison Table

Outfall ID	2-Yr Pre (cfs)	2-Yr Post (cfs)	10-Yr Pre (cfs)	10-Yr Post (cfs)
Outfall 1	40	86	75	145
Outfall 2	45	30	108	84
Outfall 3	106	112	220	227
Outfall 4	3	4	8	9
Outfall 5	2	2	6	7
Outfall 6	24	18	45	35
Outfall 7	11	7	18	13
Outfall 8	1	1	3	2
Outfall 9	8	8	15	15
Outfall 10	7	9	20	22
Outfall 11	83	86	177	182
Outfall 14	36	50	82	102

Outfall 15	2	1	4	3
Outfall 16	4	1	8	3
Outfall 17	2	1	4	3
Outfall 18	1	1	2	2
Outfall 19	28	17	57	33
Outfall 20	2	2	5	5

Please see Appendix E of the Stormwater Management Design Study for further information. *The Stormwater Management Design Study is wholly contained in Appendix E of this SWPPP.*

As shown in SCDOT and consultant correspondence contained in Appendix E, York County and the designer were urged in the strongest terms by SCDHEC to design the project such that peak flows at outfalls draining to Forest Lake - a private man-made lake/dam/residential development - will not be increased in the post-development condition. The design meets that objective by reallocating discharges from Outfall 2 and 3 to Outfalls 1 and 6 respectively.

Flooding Issues

The existing overall topography will not be modified and there is no anecdotal evidence of flooding issues on – or adjoining – the project. The drainage paths through the watershed are well-established. The project is located outside the FEMA mapped floodplain as shown on Federal Government Emergency Management Agency Flood Insurance Rate Maps (FEMA FIRM). See Appendix E, Stormwater Management Design Study for further information. There are no foreseeable flooding issues that would arise due to the proposed road widening.

1.2 Stormwater Management and Sediment Control (CGP Section 3.2.2)

Erosion Prevention BMPs

As the existing site is cleared, grubbed, and graded to the proposed elevations shown on the construction plans, erosion prevention BMPs shall be placed throughout the construction site to aid in the prevention of sediment-laden stormwater runoff. These BMPs shall be focused in areas with high potential of erosion, areas preceding infiltration practices, and shall be applied to all steep slopes (i.e., slopes equal to or greater than 3H:1V).

Each erosion prevention measure shall be selected on a site-specific basis and details have been provided on the construction plans (see Appendix J). The plans identify all proposed Erosion Prevention BMPs and the recommended installation, maintenance and inspection procedures.

Examples of Erosion Prevention BMPs are, but are not limited to, surface roughening, temporary seeding, erosion control blankets, turf reinforcement mats, sodding, riprap, outlet protection, dust control and polyacrylamide (PAM). Information on the design and

proper use of Erosion Prevention BMPs can be located in the SC DHEC's BMP Handbook, and Standard Drawings. The primary erosion control devices employed for Stage 1 of the project are rolled erosion control blankets, sediment basins, rock check dams (ditch checks), silt fence and inlet protection.

Sediment Control BMPs

Sediment Control BMPs are designed to remove some of the sediment accumulated within stormwater runoff, to the best extent practicable. These BMPs help prevent sediment impacts to adjacent properties and water bodies from stormwater discharges originating from construction sites.

Typically, these BMPs are placed near each of the site's outfalls and are installed prior to clearing and grubbing of the site (before large areas of soil are exposed). However, these BMPs can also be located throughout the construction site and, in these circumstances, are installed after mass grading has occurred. Placement, sizing and modifications of Sediment Control BMPs should be left to the SWPPP preparer and/or the Site Engineer. Contractors must consult the SWPPP Preparer as listed at the front of this SWPPP before making any significant changes to these BMPs.

Each sediment control BMP shall be selected on a site-specific basis. Examples of Sediment Control BMPs are, but are not limited to sediment traps, sediment basins, silt fence, rock check dams, rock sediment dikes, sediment tubes and inlet protection. Please consult SC DHEC's BMP Handbook for more information on Sediment Control BMPs.

Structural Control BMPs and Floodplain Placement

This site-specific SWPPP utilizes the following structural control BMPs: permanent vegetated swales and storm sewer systems. These practices have been designed to either divert flows from exposed soils to retain/detain flows, and to otherwise limit the runoff and the discharge of pollutants from disturbed areas of the construction site.

Throughout the lifespan of the construction project these BMPs will be installed and maintained, as required by the SWPPP and the construction plans, until final stabilization has been achieved for the areas draining to each BMP. Upon final stabilization, each structural control BMP must be modified to the post-construction conditions shown within the approved construction site plans or removed, if the structural BMP was a temporary structure.

No Structural Control BMPs are proposed within any 100-yr floodplains for the project.

Construction Entrances and Dust Control

Each access area into and out of the limits of disturbance, will incorporate a construction entrance. Access locations will be determined in the field by the contractor. The use of this BMP will limit the amount of sediment being transported by construction vehicles onto existing roadways or other impervious areas. Any tracked sediment, along with any attached pollutants, deposited on impervious areas could be washed downstream during the next rain event. Each construction entrance must be installed as shown in the details section of the construction plans.

If a new entrance or exit is required, that is not shown on the plans, install the construction entrance as noted by the construction entrance detail, mark the location on the plans and make a record of this minor modification in the SWPPP's modification log, which is located within one of the appendices of the On-site SWPPP.

Roads where vehicles are utilizing construction accesses will be monitored for sediment tracking and accumulated sediments will be removed from the road surface. Maintenance of roads shall be conducted as needed throughout shiftwork and at the end of each shift.

During extremely dry conditions, drought, and/or excessive winds, the construction site should be treated for dust control to prevent the suspension of fine sediment particles into the air, being carried offsite, and deposited on adjacent properties or surface waters. This practice may not be directly called out for on the construction plans. A water tanker used to spray the soil down may be an effective way to prevent excessive dust at a construction site.

Water Quality BMPs During Construction

Site-specific water quality BMPs (e.g., sediment basins, sediment traps, rock check dams, and rock sediment dikes) must be installed prior to the mass clearing, grubbing and grading of the site, and must be kept in functioning order throughout the lifespan of all construction activities. Each of these BMPs must be maintained and inspected until all areas draining to these BMPs have reached final stabilization, approved by the construction site inspector or the SWPPP Preparer and recorded within the stabilization log located as an appendix of the On-site SWPPP.

The location, installation procedures, and maintenance procedures for each water quality BMP can be found within the approved construction site plans.

Post-Construction Water Quality

All construction sites disturbing 5 acres or more, including construction activities associated with Larger Common Plans disturbing 5 acres or more (for sites located within an MS4 this may be 1 acre or more), must be designed to treat water quality post-construction. These water quality controls must be installed and stabilized prior to terminating coverage under the CGP. These controls will require routine maintenance to remain functional. This is to be conducted by the Primary Permittee or the entity that accepts responsibility for these structures once construction has been completed. Additional information, including permanent maintenance and inspection procedures, can be found in Appendix E of the OS-SWPPP or within the construction site plans.

Upon final stabilization, each construction site will have to make the transition from temporary BMPs to permanent BMPs. This transition may include the conversion of a sediment basin to a detention basin, a sediment trap to a bioretention area, or diversion swales to permanently vegetated swales. All post-construction (permanent) water quality and water quantity BMPs are identified in the final phase of the Erosion and Sediment Control or drainage sheets located within the construction plans.

Other Stormwater Management Procedures

Based on the nature, conditions, and/or procedures associated with this construction site, the following items must be followed and adopted by all those conducting land disturbing activities at this site:

- All construction debris must be stockpiled in designated areas, which have been provided with the proper BMPs to prevent the discharge of pollutants through stormwater runoff from building or other similar materials off-site or into surface waters.
- Any additional waste material or stockpile material (i.e., soil and mulch) must also be stored in the designated areas as shown on the Construction Site Plans or as the contractor, responsible for day-day activities at this site, deems appropriate. Silt fence or an approved equal shall surround all stockpiled materials.
- All parties conducting work at this construction site must be informed of and make note of pollutant sources, both industrial and construction, at this site, and be informed of all controls and measures the will be implemented to prevent the discharge of these pollutants in stormwater runoff.
- Any additional non-stormwater discharges, as referenced in the CGP, should be eliminated or reduced to the maximum extent feasible. All unpreventable non-stormwater discharges shall be treated through the approved stormwater management system before release off-site. Following is a list of allowable non-stormwater discharges:
  - Fire hydrant flushing
  - Wash water without detergents
  - Water used for dust control
  - Potable water
  - Building wash down water without detergents
  - Uncontaminated pavement wash water
  - Uncontaminated condensation from mechanical equipment
  - Uncontaminated ground or spring water
  - Water from foundation of footing drains
  - Uncontaminated excavation dewatering
  - Landscape irrigation.

1.3 Sequence of Construction

The construction sequence for this project has been provided on the construction site plans, provided in Appendix J. Each item/step of that construction sequence has been listed is the sequence that they should be implemented.

For additional information or questions on the sequencing please contact the SWPPP Preparer or the Permittee referenced on the cover of this SWPPP.

1.4 Non-Numeric Effluent Limits

Stormwater Volume and Velocity Control

During the implementation of construction activities, all parties performing work at this construction site whose work may affect the implementation of the SWPPP must be informed of and directed on how to comply with this non-numeric effluent limit, which requires the management of stormwater runoff within the construction site and at each outfall. The purpose of this requirement is to control the stormwater volume and velocity at these locations to minimize erosion.

Specifically, each responsible party should be made aware of the practices that have been or should be implemented at the construction site to accomplish these stormwater management practices. Below is a list of practices that may be utilized within the disturbed area and at each outfall at construction sites to control stormwater volume and velocity:

Volume Control

- Limiting the amount of disturbed area and exposed soils
- Staging and/or phasing of the construction sequence.
- Sediment basins and sediment traps
- Diverting off-site flow around the construction site.
- Controlling the drainage patterns within the construction site.
- Temporary stabilization of disturbed areas.

Velocity Control

- Surface roughening and/or another slope stabilization practice.
- Level spreaders, riprap plunge pools and/or other velocity dissipation BMPS located at the construction site and sediment basin outfalls.
- Use of rock checks, sediment tubes, etc. in temporary diversions swales and ditches.
- Use of erosion control blankets, turf reinforcement mats, and other non-vegetative BMPs that can be used to quickly stabilize disturbed areas.

The SWPPP Preparer/Engineer should approve any modifications (Additional BMPs or changes to existing BMPs) to address the management of stormwater volume and velocity prior to implementation. All approved SWPPPs that were issued coverage under

the CGP should include ample BMPs and other control measures to address this specific non-numeric effluent Limit.

Soil Exposure, Compaction and Preservation

Throughout construction activities, the amount of soil exposed during construction should be kept to a minimum. This may be accomplished by minimizing the amount the disturbed area within the permitted Limits of Disturbance (shown on the approved construction site plans) to only that which is necessary to complete the proposed work. For areas that have already been disturbed and where construction activities will not begin for a period of 14 days or more, temporary stabilization techniques must be implemented.

Prior to implementation of any major grading activities, topsoil is to be preserved by placing it in areas designated for stockpiling until final grades are reached. Each stockpile must be equipped with proper sediment and erosion controls to preserve the topsoil and protect adjacent areas from impacts. Once final grades have been reached, the preserved topsoil should be utilized to apply to areas identified for stabilization. Topsoil contains nutrients and organisms that aid in the growth of vegetation.

Soil compaction should also be minimized to the degree practicable during grading activities. This is especially important during the replacement of topsoil to aid in a quick establishment of vegetative cover. Soil compaction may also reduce rainfall's ability to infiltrate into the soil, increasing the amount of stormwater runoff.

Soil Stabilization

Throughout construction activities, soil stabilization techniques are to be initiated as soon as practicable whenever any clearing, grading, excavating, or other land-disturbing activities have permanently or temporarily ceased on any portion of the construction site and will not resume for a period exceeding 14 calendar days. For areas where initiating stabilization measures is infeasible, (e.g., where snow cover, frozen ground, or drought conditions preclude stabilization), initiate vegetative or non-vegetative stabilization measures as soon as practicable.

Steep Slopes (Slopes of 30% grade or greater)

All disturbed steep slopes (30% grade, ~3H:1V, or greater), and steep slopes to be created through grading activities must be managed in a fashion that limits the potential of erosion along the slopes. All parties whose work is/was responsible for the creation/disturbance of steep slopes must comply with the following items:

- Minimize the disturbance of all steep slopes, when possible.
- Divert concentrated or channelized flows of stormwater away from and around steep slope disturbances.
- Use specialized BMP controls including temporary and permanent seeding with soil binders, erosion control blankets, surface roughening, reducing continuous slope length with terracing or diversions, gradient terraces, interceptor dikes and swales, grass-lined channels, pipe slope drains, subsurface drains, level spreaders, check

dams, seep berms, and triangular silt dikes to minimize erosion.

- Initiate stabilization measures as soon as practicable on any disturbed steep slope areas where construction activities have permanently or temporarily ceased and will not resume for a period exceeding 7 calendar days.
- A vegetative and/or non-vegetative cover must be established within 3 working days from the time that stabilization measures were initiated.

Stabilization of steep slopes should be a priority for those performing work at the construction site. At the very least, runoff control BMPs should be implemented to transport stormwater runoff from the top of the slope to the toe of the slope. An example of this is to install diversion swales along the top of slope and direct the runoff towards pipe slopes drains to transports the runoff to the toe of the slope. All pipe slope drain outlets are to be equipped proper outlet protection.

Sediment Discharge Minimization

Permittees, contractors, and all other parties responsible for conducting land-disturbing activities are required to install and maintain all erosion and sediment BMPs that are identified on the approved construction site plans. These BMPs have been designed and approved to address such factors as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soils particle sizes expected to be present on the construction site. Proper installation, inspection, and maintenance will allow these BMPs to operate at maximum efficiencies in order to minimize sediment discharges to the maximum extent practical.

Pollutant Discharge Minimization

Permittees, Contractors, and all other parties responsible for conducting land-disturbing activities are required to install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants. At a minimum, the following items must be implemented:

- Minimize the discharge of pollutants from dewatering trenches and excavations by managing runoff with the appropriate controls. Otherwise these discharges are prohibited;
- Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters. Wash waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
- Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials present on the site to precipitation and to stormwater; and
- Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.

Prohibited Discharges

Permittees, Contractors, and all other responsible parties for conducting land-disturbing activities are prohibited to discharges, from the construction site, the following items:

- Wastewater from washout of concrete, unless managed by an appropriate control;
- Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; and
- Soaps or solvents used in vehicle and equipment washing.

1.5 Buffer Zone Management

There are no buffer zones to be located or maintained associated with this project.

1.6 Certification Statements & Detention Waivers - following

Detention Waiver – Outfall 1

I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000.

The 2-year and 10-year storm event pre- and post-development peak flows were compared at the Mimosa Lane (OP 010) outfall for this project. Pre and post development flows were computed by the SCS peak flow estimation method. Because post-development flows equal pre-development flows in both the 2- and 10-year storms, the post-development discharge will not result in adverse impacts to the downstream receiving waterbody and/or downstream properties.

SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change**
40	*86*	*115*	*75*	*145*	*93*

**refer to narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

A copy of this certification statement and detention waiver has been included under a separate cover as requested by SCDHEC.

Detention Waiver – Outfall 2

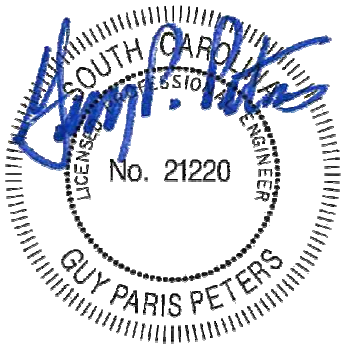
I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000.

The 2-year and 10-year storm event pre- and post-development peak flows were compared at the Mimosa Lane (OP 010) outfall for this project. Pre and post development flows were computed by the SCS peak flow estimation method. Because post-development flows equal pre-development flows in both the 2- and 10-year storms, the post-development discharge will not result in adverse impacts to the downstream receiving waterbody and/or downstream properties.

SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change**
45	*30*	*-33*	*108*	*84*	*-22*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

A copy of this certification statement and detention waiver has been included under a separate cover as requested by SCDHEC.

Detention Waiver – Outfall 3

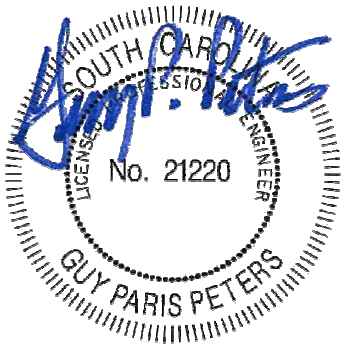
I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000.

The 2-year and 10-year storm event pre- and post-development peak flows were compared at the Mimosa Lane (OP 010) outfall for this project. Pre and post development flows were computed by the SCS peak flow estimation method. Because post-development flows equal pre-development flows in both the 2- and 10-year storms, the post-development discharge will not result in adverse impacts to the downstream receiving waterbody and/or downstream properties.

SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
106	*112*	*5.7*	*220*	*227*	*3.2*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

A copy of this certification statement and detention waiver has been included under a separate cover as requested by SCDHEC.

Detention Waiver – Outfall 4

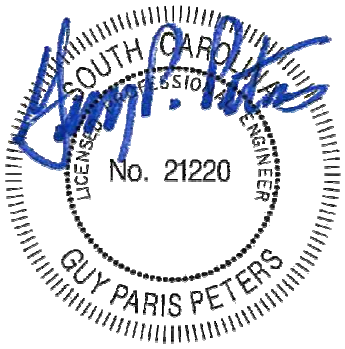
I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000.

The 2-year and 10-year storm event pre- and post-development peak flows were compared at the Mimosa Lane (OP 010) outfall for this project. Pre and post development flows were computed by the SCS peak flow estimation method. Because post-development flows equal pre-development flows in both the 2- and 10-year storms, the post-development discharge will not result in adverse impacts to the downstream receiving waterbody and/or downstream properties.

SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
3	*4*	*33*	*8*	*9*	*13*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

A copy of this certification statement and detention waiver has been included under a separate cover as requested by SCDHEC.

Detention Waiver – Outfall 5

I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000.

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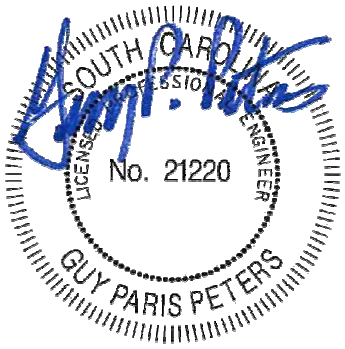
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
2	*2*	*0*	*6*	*7*	*17*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 6

I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000.

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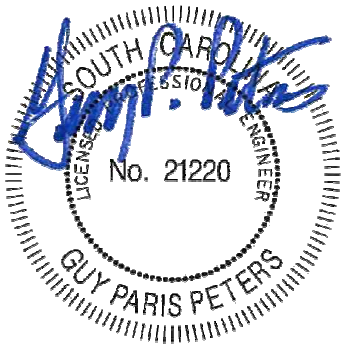
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change**
24	*18*	*-25*	*45*	*35*	*-22*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 7

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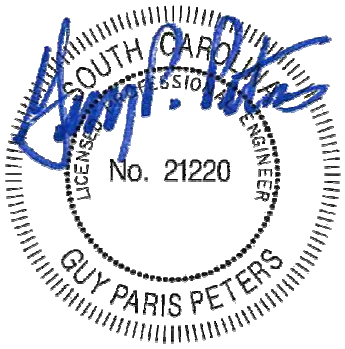
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
11	*7*	*-36*	*18*	*13*	*-28*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 8

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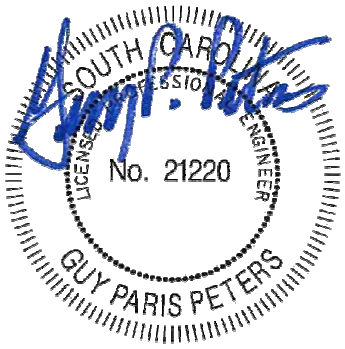
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
1	*1*	*0*	*3*	*2*	*-33*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 9

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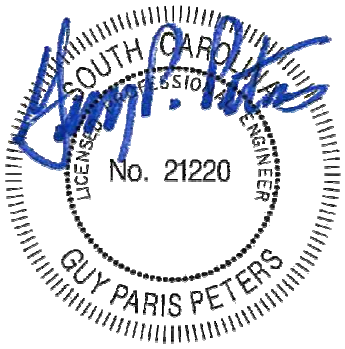
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
8	*8*	*0*	*15*	*15*	*0*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 10

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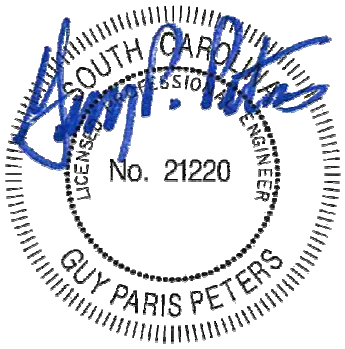
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
7	*9*	*29*	*20*	*22*	*10*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 11

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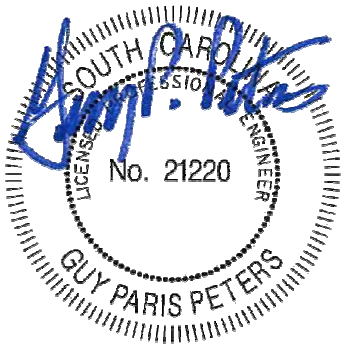
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
83	*86*	*3.6*	*177*	*182*	*2.8*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 14

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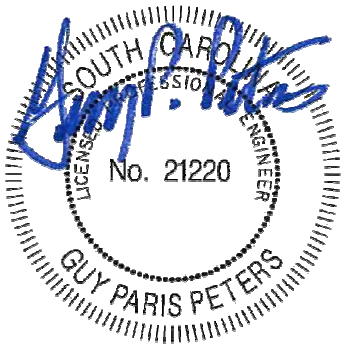
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
36	*50*	*39*	*82*	*102*	*24*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 15

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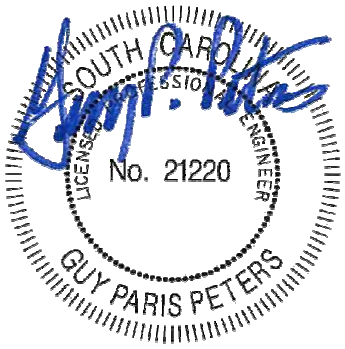
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
2	*1*	*-50*	*4*	*3*	*-25*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 16

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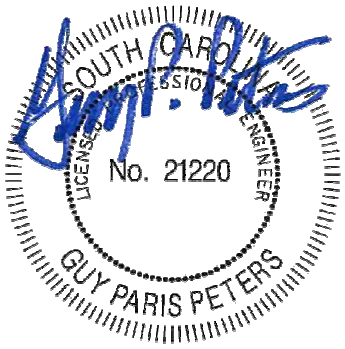
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
4	*1*	*-75*	*8*	*3*	*-63*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 17

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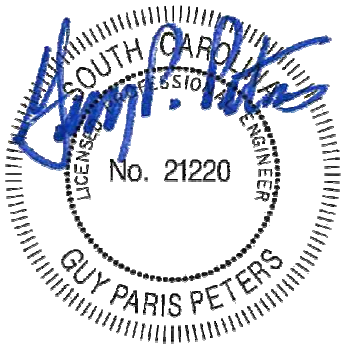
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
2	*1*	*-50*	*4*	*3*	*-25*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 18

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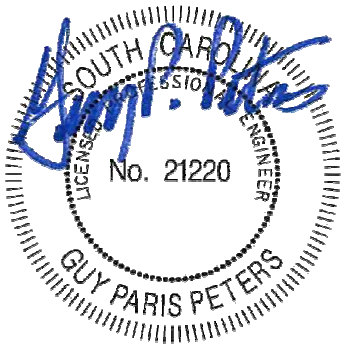
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
1	*1*	*0*	*2*	*2*	*0*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 19

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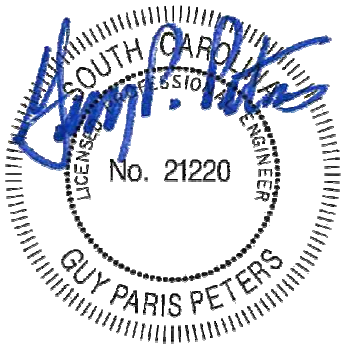
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
28	*17*	*-39*	*57*	*33*	*-42*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Detention Waiver – Outfall 20

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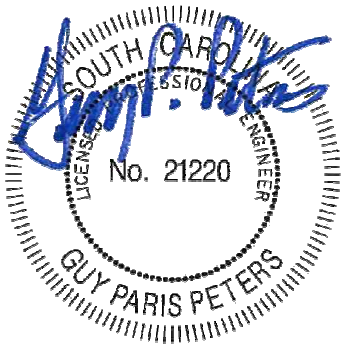
SUMMARY OF DISCHARGES					
2-year (50% AEP, cfs)			*10-year (10% AEP, cfs)*		
Pre	*Post*	*% change**	*Pre*	*Post*	*% change*
40	*86*	*115*	*75*	*145*	*0*

**see narrative section 1.1 for explanation*

Following this statement are supporting calculations for runoff estimation by the SCS method.



Name: Guy P. Peters, PE, CFM

Title: Senior Engineer

Date: 22 December 2023

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Section 2

SITE FEATURES AND SENSITIVE AREAS

2.1 Sources of Pollution

Throughout construction activities, each permittee, contractor, and person responsible for conducting work will need to ensure that sources of pollution are managed to prevent their discharge from the construction site. Expected pollution sources during construction have been identified in Table 2.1, but due to the nature of construction activities, it is often tough to predict all pollution sources that may appear throughout the life of a construction project. For that reason, the following table has also been provided to help all those performing work at this construction site identify possible sources of pollution

Stormwater runoff subjected to the identified pollution sources must be treated by the appropriate BMPs as directed by this SWPPP.

In the event that any additional sources of pollution are identified during construction, the person(s) with day-to-day operational control at the site is to add the new source(s) to Table 2.1 and consult with the SWPPP Preparer to properly address this source and to prevent the discharge of its pollutant through stormwater runoff.

Table 2.1: Potential Sources of Pollution

Source	Material or Chemical	Location*	Appropriate Control Measures
Loose soil exposed/disturbed during clearing, grubbing and grading activities	Sediment	All areas within the Limits of Disturbance	As directed by the construction Plans. This includes Silt Fence, sediment tubes, sediment basins, and sediment traps.
Areas where construction equipment are cleaned, a.k.a. concrete washout	Heavy Metals & pH	Selected locations as needed	Concrete Washout Basin.
Water encountered during trenching	Nutrients & Sediment	In and around any trenching activities.	Direct water into filter bags and/or impoundments such as basins or traps to allow for the sedimentation of the listed pollutants.
Material Delivery and Storage Areas	Nutrients, pH, Sediment, Heavy Metals, oils & grease	All areas used as storage areas	Silt fence and/or sediment dikes
Equipment fueling and maintenance areas	Metals, hydrocarbons, oils and greases	Areas surrounding fuel tanks	Provide secondary containments, locate in upland areas. Repair leaking and broken hoses.
Paints	Metal oxides, solvents, talc, calcium-carbonate, arsenic	Throughout site, primarily in areas of building construction	Wash-water should be contained and is prohibited from being discharged

*Area where material/chemical is used on site.

2.2 Surface Waters

Stormwater runoff from the proposed construction site will discharge into existing drainage systems as identified in Section 1. These outfalls discharge to both Steele Creek to the west and Sugar Creek to the east. Ultimately, both these waterways make their way to the Catawba River. The overall general flow paths are shown below in Figure 2.1 with dark blue arrows and the project area shown in red.

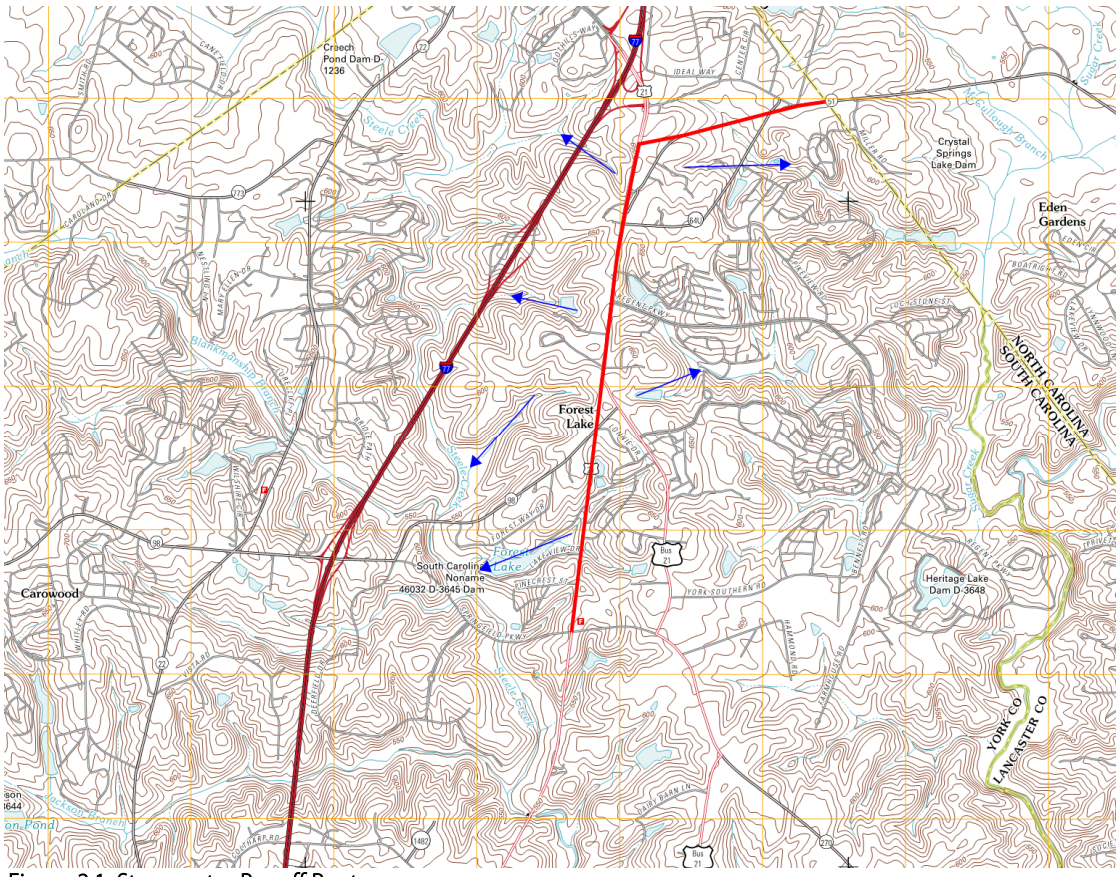


Figure 2.1: Stormwater Runoff Route

2.3 Impairments and TMDLs

Some Waters of the State (WoS) have been identified as not meeting the State's water quality standards for recreational swimming, fish consumption aquatic life use, and/or shellfish harvesting for one or more pollutants even after controls for point and nonpoint source pollution have been put in place. These waterbodies have been classified as "impaired." Once these waterbodies have been identified they are listed on the State's 303(d) List of Impaired Waterbodies. South Carolina lists impairments as "stations" where samples were taken along a waterbody.

The most recently-approved 303(d) list can be found at the following webpage:

https://scdhec.gov/bow/south-carolina-303d-list-impaired-waters-tmdls

After a pre-determined period of time, SCDHEC is obliged to develop a Total Maximum Daily Load (TMDL) for the pollutant of concern for each impaired station listed on the

303(d) List. A TMDL is the amount of a single pollutant (such as bacteria, nutrients, or metals) that can enter a waterbody on a daily basis and that waterbody still meet water quality standards. "TMDL" refers to both a calculation of a pollutant entering a waterbody as well as the document containing this calculation along with source assessments, watershed, and land use information, reductions and allocations information, implementation and other relevant information, maps, figures, and pictures.

Once a TMDL has been developed and approved by the EPA, the impaired WoS is removed from the 303(d) list. A separate list is maintained for WoS with approved TMDLs.

Any construction site whose discharges are released in a WoS listed on the 303(d) List or for which an EPA-approved TMDL has been developed must address the specific pollutant set forth in the TMDL and/or potential pollutants for the impairment. The SWPPP must include a description of BMPs to address these pollutants.

The primary permittee and/or contractor must ensure that the construction site discharges remain in compliance with the State's water quality standards. To do so, these parties will have to ensure the function of all approved BMPs to handle the specific pollutant.

Construction Stormwater Discharges are expected to contain pollutants that contribute and/or can caused the following impairments to receiving water bodies: BIO (Macroinvertebrate Community), Turbidity, TP (Total Phosphorus), TN (Total Nitrogen), CHLA (Chlorophyll-a), and Fecal Coliform in waters classified for Shellfish Harvesting in the coastal zone. The presence of any of these impairments in receiving waters will require approval control of the site's construction stormwater discharges. Information on each of these impairments and how to treat stormwater runoff for these impairments has been provided below.

Impairments Effected by Construction Site Discharges and Methods to Control Potential Pollutants Causing or Contributing to the Impairments

1. BIO (Macroinvertebrate Community): A balanced and varied group of Macroinvertebrate organisms is an indicator of a healthy stream that supports aquatic life. A balanced community can be defined as a natural, diverse group of organisms (including Macroinvertebrate) characterized by the ability to sustain itself through season changes, presence of food chain species and a lack of domination by pollutant tolerant or invasive species. If these conditions do not exist, then the site may be considered impaired due to the presence of an undesirable or non-existent Macroinvertebrate community. Sediment from construction sites may further threaten the propagation of these organisms.

   Address by: Examples include limiting the amount of disturbed area, designing sediment control BMPs to remove the maximum amount of sediment possible, immediate stabilization of disturbed areas, and other practices may be utilized to control the discharge of sediment from construction sites.

2. Turbidity: Turbidity can be generally defined as the "cloudiness" of a waterbody and may be caused by the growth of aquatic phytoplankton and the presence of

suspended solids in the water column. In SC, a water quality standard for turbidity is applicable to all waters of the State (see R. 61-68 D. 11. for numeric targets by waterbody classification). Turbidity levels that exceed the water quality standard may reduce light penetration, thereby inhibiting aquatic flora growth, **and may reduce the ability of fauna, such as fish, to absorb oxygen across their gills.**

Address by: Examples include limiting the amount of disturbed area, designing sediment control BMPs to remove the maximum amount of sediment possible, immediate stabilization of disturbed areas, and other practices may be utilized to control the discharge of sediment from construction sites.

3. TP (Total Phosphorus): Similar to total nitrogen, TP is an essential nutrient for the propagation of aquatic life. In SC, a water quality standard for TP is applicable to lakes greater than 40 acres (see R. 61-68 D. 11. for numeric and narrative targets). At acceptable levels, TP is assimilated by aquatic flora ensures the propagation of an overall balanced, indigenous aquatic community. TP levels that exceed the water quality standard are considered impaired and may cause negative impacts to the overall health of the aquatic community by promoting excessive algal growth in lakes. Phosphorous may enter a site's stormwater when excess amounts of the nutrient are applied to the site during temporary or final stabilization.

   Address by: To prevent this soil should be tested to determine the quantity of the nutrient present in the soil and the correct amount that needs to be added so that it is absorbed by the vegetation.

   TN (Total Nitrogen): Similar to total phosphorus, TN is an essential nutrient for the propagation of aquatic life. In SC, a water quality standard for TN is applicable to lakes greater than 40 acres (see R. 61-68 D. 11. for numeric and narrative targets). At acceptable levels, TN is assimilated by aquatic flora and ensures the propagation of an overall balanced, indigenous aquatic community. TN levels that exceed the water quality standard are considered impaired and may cause negative impacts to the overall health of the aquatic community by promoting excessive algal growth in lakes. Nitrogen may enter a site's stormwater when excess amounts of the nutrient are applied to the site during temporary or final stabilization

   Address by: Examples include that the soil should be tested to determine the quantity of the nutrient present in the soil and the correct amount that needs to be added so that it is absorbed by the vegetation.

4. Chlorophyll-a (CHLA): CHLA is a pigment present in the cells of photosynthetic flora and some algal species. The presence of CHLA in an aquatic environment is a water quality indicator of the overall productivity in the aquatic system. CHLA is linked to the levels of TP, TN and light penetration in the water column. In SC, a water quality standard for CHLA is applicable to lakes greater than 40 acres (see R. 61-68 D. 11. for numeric and narrative targets). CHLA levels that exceed the water quality standard may suggest that other undesirable water quality impacts are present as the aquatic system may be too productive to support the propagation of an overall balanced, indigenous aquatic community. Excess nutrients may discharge from a construction site during temporary and final stabilization. Limiting the amount of phosphorus and

nitrogen applied while **establishing vegetation will prevent excessive levels of CHLA in receiving waters.**

Address by: Examples include that the soil should be tested to determine the quantity of the nutrients present in the soil and the correct amount that needs to be added so that it is absorbed by the vegetation.

5. Fecal Coliform (FC) in Shellfish Harvesting waters: Fecal Coliform is an indicator bacteria for other pathogens which may be present in a waterbody. Shellfish Harvesting Waters are tidal salt-waters protected for shellfish harvesting and must be protected to a higher standard than other waters because of the risk to human health posed by ingesting shellfish from areas with high levels of bacteria. Bacteria levels increase following rain events. Potential sources of bacteria on construction sites include improperly located porta-johns and litter that may attract rodents and other animals.

   Address by: Porta-johns should be placed away from WoS and not placed on catch basins and other drainage structures. Litter and construction debris should be placed in identified areas and emptied on a routine basis.

Impairment Sources and Prevention

Construction sites can contribute to these impairments directly through the release of excess soil and/or nutrients within stormwater runoff. For this reason, proper sediment and erosion control BMPs should be implemented and the design of the stormwater management systems, during both construction and post-construction, should address the control of stormwater runoff. A reduction in the volume released or the rate at which this volume is released can significantly improve the quality of stormwater runoff and limit the amount of the pollutants that contribute to the above listed impairments.

As an example, sediment basins and/or traps should be used during construction to allow for sedimentation of soils/nutrients, and to control the release of stormwater into the impaired water body. Vegetated Detention and Infiltration structures should be implemented as post-construction BMPs to control stormwater volumes. Caution is advised when using fertilizers to reach Final Stabilization; excess fertilizer can contribute to each of the above listed impairments.

Site-Specific Requirements

This construction site's discharges drain into Sugar Creek, which currently has only a BIO impairment designation. Due to the possibility of pollutants in construction stormwater discharges from this site creating an impairment, the following must be conducted throughout the lifespan of all land-disturbing activities at this site:

- Bi-weekly inspections of all the primary sediment control BMPs;
- Employee training/acknowledgement during the Pre-Construction Meeting;
- Installation of additional BMPs to meet the water quality standards (as directed by the SWPPP preparer and as approved by the regulating agency); and

- All sediment control BMPs have been designed to meet or exceed an 80% trapping efficiency.

2.4 Critical Areas

There are no Critical Areas located within or directly adjacent to the disturbed areas.

Section 3

Compliance Requirements

3.1 SWPPP Availability

Section 3.1.6 of the CGP requires that a copy of the On-Site SWPPP (OS-SWPPP), as defined by Section 3.1.1.H of the CGP, must be retained at the locations where the OS-SWPPP can be easily accessed during normal business hours from the date of commencement to the date that final stabilization is reached. Due to the nature of this project, the OS-SWPPP will be retained at the construction site. The OS-SWPPP must be made available upon request and at the time of a construction site inspection by the EPA, SCDHEC, local government officials, and the Operator of the Municipal Separate Storm Sewer System (MS4).

3.2 Pre-Construction Conferences

A pre-construction conference must be held for this construction project and its approved On-Site Stormwater Pollution Prevention Plan (OS-SWPPP). Each contractor, subcontractor, utility provider, etc., who will work at a site must attend this conference in person. The primary purpose of this conference is for:

- The preparer of the SWPPP or someone with a registration equivalent to that of the preparer of the SWPPP; and/or
- The person with operational control of the plans and specifications (the Primary or Secondary Permittee) or their duly authorized representative (as defined in Section 122.22(b) of SC Regulation 61-9) to review and explain the On-Site SWPPP (OS-SWPPP) so that all are aware of the requirements before they start performing construction-related (land disturbing) activities that may affect the implementation of the approved OS-SWPPP. This conference may be held simultaneously with all contractors and builders present or may be conducted separately with one or more contractors, subcontractors, etc. present.

The conference must be held on-site and must specifically address Section 3.1.7 of the CGP detailing how each type of modification, Major and Minor, will be addressed and processed at the construction site to maintain compliance. The persons conducting the conference must document each contractor, subcontractor, utility provider, etc. attending the conference, and include the date, time, location, and identification of the attendees. These records must be maintained with the OS-SWPPP.

3.3 Inspection Requirements

Section 4.2 of the CGP requires that inspections be conducted on a routine basis of all areas disturbed by construction activity. These areas include perimeter BMPs and material storage areas exposed to precipitation. The purpose of the inspections is to look for evidence of, or potential for, inefficiencies within the On-Site SWPPP (OS-SWPPP), whether they are a direct result of improper design, installation, or maintenance. At a minimum, the inspections shall include the following:

- All areas of the site disturbed by construction activity and areas used for storage of materials that are exposed to precipitation.
- All stormwater conveyance systems for any evidence of, or the potential for, pollutants entering these systems.
- All BMPs identified in the OS-SWPPP.
- All discharge locations to ascertain whether the implemented BMPs are effective in preventing the discharge of sediment from the site. Where discharge locations are inaccessible, nearby downstream locations must be inspected to the extent that such inspections are practicable.
- Locations where vehicles enter or exit the site must be inspected for evidence of the off-site sediment tracking.

The Permittee shall provide qualified personnel and be responsible for inspections of the construction activity and performance of BMPs.

Frequency

The frequency of the inspections shall be at least bi-weekly after the date of commencement until the date that final stabilization is reached. The frequency may be increased based on the frequency of storm events of 0.5 inches or greater and under the direction of SCDHEC. The frequency of inspections may be reduced to at least once every month for areas that have reached and maintain temporary or final stabilization with no additional disturbance. If a definable area reaches final stabilization, this may be marked on the inspection reports of the OS-SWPPP, and no further inspections of the area will be required

Rainfall Data

Rainfall data for the days of inspection and rainfall events of 0.5 inches or greater must be maintained in the OS-SWPPP. The Permittee may maintain an on-site rain gauge or use data from a certified weather record within a reasonable proximity of the construction site to record the rainfall amounts.

Inspector Qualifications

"Qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment control who possesses the skills to assess conditions at the construction site that could impact Stormwater quality and to assess the effectiveness of any BMPs selected to control the quality of stormwater discharges from the construction site, This person must be either the preparer of the approved C-SWPPP or an individual who is under the direct supervision of the preparer or the approved C-SWPPP and who meets the requirements of qualified personnel as described below or an individual who has been certified through a Constructions Site Inspector Certification Course that has been approved by SCDHEC. Inspections may also be conducted by a person with a registration equivalent to the registration of the preparer of the C-SWPPP and who meets the qualifications listed below or an individual who is under the direct supervision of the person with an equivalent registration and who meets the requirements listed below.

Inspection Reports

For each inspection required above, the Permittee, or designated personnel, must complete an inspection report. At a minimum, the inspection report must include:

- The inspection data.
- Names, titles, and if not previously given in an inspection report, the qualifications of personnel making the inspection, unless those qualifications change.
- Weather information for the period since the last inspection (or since commencement of construction activity if the first inspection) including a best estimate of the beginning of each storm event, duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any additional discharges have occurred. At the very least, the total rainfall (in inches) since the time of the last inspection must be recorded.
- Weather information and a description of any discharges occurring at the time of the inspection.
- Location(s) of discharges of sediment of other pollutants form the site.
- Location(s) of BMPs that need maintenance.
- Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location.
- Location(s) where additional BMPs are needed that did not exist at the time of inspection.
- Corrective action required including any changes to the OS-SWPPP necessary and implementation dates.
- Site Name, Operator Name and permit number.
- Verification that all BMPs and stormwater controls identified in the OS-SWPPP have been installed and are operating as designed.

A record of each inspection and of any actions taken in accordance with the Permit must be retained as part of the OS-SWPPP for at least three years from the date that permit coverage expires or is terminated and must be signed by the qualified inspector(s).

3.4 Maintenance Requirements

Construction Maintenance

While conducting construction activities, the BMPs and other protective measures identified on the plans and in the OS-SWPPP must remain in effective operating condition. If inspections find BMP's that are not operating effectively, maintenance must be performed before the next scheduled inspection or as soon as reasonably possible before the next storm event, whenever practicable.

If inspections reveal that a BMP has been used inappropriately or incorrectly, the Permittee must address the necessary replacement or modification required to correct the issue within 48 hours of identification of the issue. If existing BMPs need to modified or additional BMPs are necessary to comply with the requirements of the General Construction Permit, the implementation must be before the next storm even whenever

practicable. If implementation before the next storm event is impracticable, the situation bust be documented in the inspection report in the OS-SWPPP, and alternatives implemented as soon as reasonable possible.

Sediment collected by Silt Fence and other sediment control measures must be removed once the deposited sediment reaches 1/3 the height of the above ground portion of the BMP or lower height as specified by the manufacturer.

Permanent Maintenance

After construction activities have been terminated, the Permittee shall be responsible for maintaining the stormwater management items located within the site. The maintenance of these items shall include the following:

- Moving grass
- Removal of trash and sediment within the ditches
- Cleaning and unclogging pipes
- Inspecting for and addressing erosion of side slopes, if present

The frequency of completing the maintenance activities will be based on an as-needed basis.

3.5 Record Keeping

In addition to and in accordance with Section 3.1.1.H.V. of the CGP, the OS-SWPPP must contain appendices with the following documents:

- SCDHEC Construction General Permit. Provisions may be made for the copy of general permit to be accessed electronically as long as a hard copy can be made available by the end of the working day when required.
- Stamped and Approved Notice of Intent
- NPDES Coverage Approval
- CZC Certification
- North Charleston Municipal Separate Storm Sewer System (MS4) Approval
- Any and all logs as deemed necessary to comply with the Permit which includes, but is not limited to, preconstruction attendance, inspections reports, and rainfall data.

3.6 Final Stabilization

As the final grades for the site are established, the site will be transitioned to final stabilization. The Project Area will be stabilized by permanent seeding. Once temporary BMPs have been removed or converted to post construction BMP's and final stabilization has been reached on all disturbed areas, the Notice of Termination shall be submitted.

Appendix A

Completed NOI Form and Checklist

NOTICE OF INTENT (NOI)
For Coverage(s) of Primary Permittees Under South Carolina NPDES General Permit For Stormwater Discharges From Construction Activities SCR100000
(Maintain As Part of On-Site SWPPP)

For Official Use Only
File Number: _____
Permit Number: SCR10_____
Submittal Package Complete: _____

Submission of this Notice of Intent constitutes notice that the Applicant identified in Section II intends to be authorized as a Primary Permittee in the state of South Carolina under NPDES General Permit SCR1000000. ***Fees required for review and NPDES coverage of each application type are as listed on page 2 of the Instructions.***

Date: 01/24/2023
Project/Site Name: US 21 North Phase 1 and SC51 Widening **County:** York
(Modification or Change of Information Only) **Prior Approved NPDES Permit or File Number:** _____

Do you want this project to be considered for the Expedited Review Program (ERP)? ☐ **Yes or** ☑ **No (See instructions)**

I. Notice of Intent (NOI) Application Type(s)

A. **Project (Application/Review) Type(s)** (Select **ALL** that apply):
- ☑ New Project (Initial Notification) Ongoing Project: ☐ Permitted or ☐ Un-Permitted
- ☐ Late Notification ☐ Low Impact Development (LID) or Project Design Above Regulatory Requirements
- ☐ New Owner/Operator or Company Name Change **(see instructions, attach Form A (Transfer of Ownership))**
- ☐ Major Modification: **(see instructions, attach Form B (Major Modifications))**
- ☐ MS4 Project Review
- ☐ Ocean and Coastal Resource Management (OCRM) Review
- ☐ Change of Information/Other (Specify): _____

B. If Applicable, identify the entity designated as **MS4 Reviewer and MS4 Operator** (i.e., Lexington County, City of Greer, etc.): **MS4 Reviewer**_____ **MS4 Operator** _____

II. Primary Permittee Information ☐ Change of Information

☐ Person or ☑ Company	If a Company, are you a ☐ Lending Institution or ☑ Government Entity? Company EIN **(If applicable):** EIN: _____

A. **Primary Permittee Name:** York County
Mailing Address: P.O. Box 148 City: York State: SC Zip: 29745
Phone: 803 818 5733 Fax: _____ Email Address: engineering@yorkcountygov.com

B. **Contact /ODSA Name** (If different from above OR if owner is a company): Lisa W. Hagood, PE
Mailing Address: P.O. Box 148 City: York State: SC Zip: 29745
Phone: 803 684 8571 Fax: 803 684 8596 Email Address: penniesforprogress@yorkcountygov.com

C. **Property Owner Name** (If different from above): South Carolina Department of Transportation
Mailing Address: 338 Robertson Road West City: Rock Hill State: SC Zip: 29730
Phone: 803 324 3545 Fax: _____ Email Address: JohnstonCJ@scdot.org

III. Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) Preparer Information ☐ Change of Information

A, **C-SWPPP Preparer Name:** Guy P. Peters, PE, CFM
B. **Registered Professional** ☑ Engineer ☐ Landscape Architect ☐ Tier B Land Surveyor **S. C. Registration #:** 21220
C. **Company/Firm Name:** STV Incorporated **S. C. COA # :** C03318
Mailing Address: 454 S. Anderson Rd Ste 3 BTC 517 City: Rock Hill State: SC Zip: 29730
Phone: 803 656 2014 Fax: 803 980 4099 Email Address: guy.peters@stvinc.com

IV. Project/Site Information ☐ Change of Information

A. **Type of Construction Activity(ies)** (Select **ALL** that apply):
- ☐ Commercial ☐ Industrial ☐ Institutional ☐ Mass Grading ☑ Linear ☐ Utility/Infrastructure
- ☐ Residential: Single-family ☐ Residential: Multi-family ☐ Multi-use (Commercial & Residential)
- ☐ Site Preparation (No New Impervious Area) ☐ Other (Specify) _____

B. **Site Address/Location** (street address, nearest intersection, etc.) SC51 fr NC border to intx US21; US21 fr intx US21 to SC460
City/Town (If in limits): _____ Zip Code: _____
Latitude: 35 ° 05 ' 02 " N Longitude: - 80 ° 56 ' 00 " W (Source): ☐ GPS ☑ Web Site: Google Earth Pro
Tax Map Number (s) (List all): SCDOT right of way

C. Is this site located on **Indian Land**? ☐ Yes ☑ No

D. **Proposed Start Date**: 10/01/2022 **Proposed Completion Date**: 03/31/2024

E. **Disturbed Area** (nearest tenth of an acre): 52.6 **Total Area** (acres): 55.6

F. **Modification Only:**(nearest tenth of an acre)**: Disturbed Area: Current (Approved) Area:** _____
Disturbed Area Change (Increase Only): _____ **Total Disturbed Area (After Change):** _____

G. Is this project part of a **Larger Common Plan for Development or Sale (LCP)**? ☐ Yes ☑ No
LCP/ Overall Development Name: _____ Check here if this is the **First Phase**. ☐

Previous State Permit/File Number: _____ **Previous NPDES Coverage Number**: SCR10 _____

H. Any **Flooding Problems** exist downstream of or adjacent to this site? ☐ Yes ☑ No (If yes, provide detailed description of flooding problems and applicable floodway/flood zone information in the C-SWPPP).

I. Active **S.C. DHEC Warning Notice**, **Notice to Comply or Notice of Violation** for this site or LCP? ☐ Yes ☑ No

J. List Relevant **State and Federal Environmental Permits or Approvals** applied for or obtained for this site (e.g., **RCRA, USACOE, Nationwide**, etc.). **If None, list None**.
SAC-2015-00812

K. **Any Waiver(s)/Variances/Exceptions Requested for this Project**? (If yes, identify below and include **Waiver Request and Justifications** in the C-SWPPP for each proposed request).

1. Small Construction Activity Waiver(s) From NPDES permitting **(Section 1.4 & Appendix B)**? ☐ Yes ☑ No
If yes, Identify requested waiver: ☐ Rainfall Erosivity Waiver ☐ TMDL Waiver ☐ Equivalent Analysis Waiver

2. Detention Waiver **(72-302(B)**? ☑ Yes ☐ No | 3. Other (Specify): _____

V. Waterbody Information (Attach additional sheet(s) as needed) ☐ Change of Information

A. **Receiving Waterbody(s) (RWB) Information** (List the nearest and next nearest receiving waterbodies to which the sites stormwater discharges will drain. If stormwater discharges drain to multiple waterbodies, list all such waterbodies).

1. Name of Receiving Waterbodies (RWB)	2. Distance to RWB (feet)	3. Classification of RWB
a. Nearest: UT Steele Creek	380	FW
b. Next Nearest: Steele Creek	700	FW
c. Coastal Zone ONLY: Coastal Receiving Water (CRW): _____		Not Applicable
d. Other Waterbodies: _____		

B. **Waters of the U.S. / State Information** (Attach additional sheet(s) as needed)

Waters of the U.S./ State	1. On the site?	2. Delineated/ Identified?	3. Impacts?	4. Amount of impacts
a. Jurisdictional wetlands	☑ Yes ☐ No	☑ Yes ☐ No	☑ Yes ☐ No	0.09 Ac
b. Non-jurisdictional wetlands	☑ Yes ☐ No	☑ Yes ☐ No	☐ Yes ☐ No	____ Ac
c. Other Water(s): jurisdictional streams	☑ Yes ☐ No	☑ Yes ☐ No	☑ Yes ☐ No	____ Ac 635 Feet
d. Coastal Zone ONLY: Direct Critical Area	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	____ Ac ____ Feet

5. If yes for impacts in B.3, describe each impact and activity, and list all permits (e.g., USACOE Nationwide Permit, DHEC General Permit) and certifications that have been applied for or obtained for each impact:
Storm drain pipe extensions in jurisdictional streams authorized by USACOE NWP SAC-2015-00812 attached

C. **S.C. Navigable Waters (SCNW) Information (Section 2.6.5)** The Department will address any issues related to State Navigable Waters' Program under SC Regulation 19-450 during the review of the C-SWPPP for activities that will **NOT** require a 404 permit or a 401 certification. (Attach additional sheet(s) as needed).

1. Are S. C. Navigable Waters (SCNW) on the site: ☐ Yes ☑ No
a. If **no**, do not complete this question. Proceed to Section D (Impaired Waterbodies).
b. If **yes**, provide the name of S.C. Navigable Waters (SCNW) on the site: _____

2. If **yes for C.1**, will construction activities cross over or occur in, under, or thru the SCNW? ☐ Yes ☐ No
If yes, describe SCNW activities (e.g., road crossing, sub-aqueous utility line, temporary or permanent structures, etc.) and proceed to Section C.3: _____

3. Identify permits providing coverage of SCNW activities proposed for your site. If NONE, list none.

Permits/Certifications	Permit or Certification No.	Corresponding Covered SCNW Activity(ies)
a. DHEC General/ Other DHEC Permit		
b. USACOE **404 Permit or 401 Certification**		
c. SCNW Permit If applied for or issued, identify **Date applied for or issued:** _____		☐ **All Activities** or ☐ **Some Activities (Describe):**

d. If a SCNW Permit has NOT been applied for provide an additional plan sheet that shows plan and profile views (drawn to scale) of the SCNW and associated activities. Include a description of all proposed activities on this plan.

D. **Impaired Waterbodies Information** (Attach additional sheet(s) as needed)

1. 303(d) Listed Impaired Waterbodies

a. Name of **Nearest DHEC Water Quality Monitoring Stations (WQMS)(s)** that receives stormwater from your construction site and/or thru an MS4 and the **Name of the Corresponding Waterbody?**		b. **Is this WQMS(s) listed on the most current 303(d) List? If No, proceed to Section 2 of this table. If Yes, complete items c thru f.**	c. List the pollutant(s) identified as **"CAUSES"** of the impairment	d. Will any pollutants causing the impairment be present in your site's construction stormwater discharges?	e. If **yes for d**, list the **"USE SUPPORT"** impairment(s) affected by the pollutant(s) identified in c.
Nearest DHEC WQMS(s)	**Corresponding Waterbody**				
CW-681	Steele Creek	☐ Yes ☑ No		☐ Yes ☑ No	
		☐ Yes ☑ No		☐ Yes ☑ No	
		☐ Yes ☐ No		☐ Yes ☐ No	

f. If **yes for d** above, **will use of the BMPs proposed for your project ensure the site's discharges will NOT contribute to or cause further WQS violations for the impairment(s) listed in c?** ☐ Yes ☐ No
(NOTE: If no for f, this site is NOT eligible for coverage under the CGP). See Instructions.

2. TMDL Impaired Waterbodies

a. Name of **Nearest DHEC Water Quality Monitoring Stations (WQMS)(s)** that receives stormwater from your construction site and/or thru an MS4?	b. Has a TMDL(s) been developed for this WQMS(s)? **If No, identify as such below and proceed to Section VI. If Yes, complete items c thru f of this table.**	c. If **yes for b**, what pollutants are listed as "CAUSES" or causing the impairment?	d. If **yes for b**, has the standard been **"ATTAINED" or " Fully Supported"** for the impairment(s)?	e. If **no for d (Not Attained)**, will any pollutants causing the impairment be present in your site's construction stormwater discharges?
CW-203	☐ Yes ☑ No	fecal coliform	☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☑ No		☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☐ No		☐ Yes ☐ No	☐ Yes ☐ No

f. If **yes for e** above, **are your discharges consistent with the assumptions and requirements of the TMDL(s)?** ☐ Yes ☐ No
(NOTE: If no for f, this site is NOT eligible for coverage under the CGP). See Instructions.

VI. Signatures and Certifications

DO **NOT** SIGN IN BLACK INK**!** **Read the Certifications below (in entirety). Provide date, printed name, and signatures below**. If you are a **New Owner/Operator**, as Primary Permittee you must also sign and date the applicable Comprehensive SWPPP Acceptance & Compliance Agreement below.

C-SWPPP PREPARER: "One copy of the C-SWPPP, all specifications and supporting calculations, forms, and reports are herewith submitted and made a part of this application. I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000." **(This should be the person identified in Section III).**

Guy P. Peters, PE, CFM		21220
Printed Name of C-SWPPP Preparer	**Signature of C-SWPPP Preparer**	**S. C. Registration #**

PRIMARY PERMITTEE: "I or I (on behalf of my company and its contractors and agents), as the case may be, certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I understand that DHEC enforcement actions may be taken if the terms and conditions of the C-SWPPP are not met and I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

"I or I (on behalf of my company and its contractors and agents), as the case may be, also hereby certify that all land-disturbing construction and associated activity pertaining to this site shall be accomplished pursuant to and in keeping with the terms and conditions of the approved plans and SCR100000. I also certify that a responsible person will be assigned to the project for day-to-day control. I hereby grant authorization to the to S. C. Department of Health and Environmental Control (DHEC) and/or the local implementing agency the right of access to the site at all times for the purpose of on site inspections during the course of construction and to perform maintenance inspections following the completion of the land-disturbing activity." **(See Section 122.22 of S.C. Reg. 61-9 for signatory authority information.)** Having understood the above information, I am signing this certification as Primary Permittee to the aforementioned NPDES general permit."

Lisa W. Hagood, PE	County Engineer
Printed Name of Primary Permittee	**Title/Position**
Signature of Primary Permittee	**Date Signed**

NPDES CGP FEE SCHEDULE A

(All Counties EXCEPT Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry, and Jasper)

The schedule should be attached to DHEC Form 2617. Do not send payment in window envelope. **DO NOT MAIL CASH**. DHEC will notify the Project Owner/ Operator if the submitted check or credit card payment cannot be processed. **The review clock will start when acceptable payment is received.**

1. Identify (√) the Project Review Type(s) **Enter NPDES Coverage Fee of $125 in the right-hand column if any of the following project/review types apply to this application.** Proceed to Item 2.	**(√)**	**NPDES Coverage Fee**
a. Project or LCP (Item IV.G) that will ultimately disturb one (1) acre or more Note: If your project will ultimately disturb less than one (1) acre **AND** is NOT a part of a Larger Common Plan, coverage under SCR100000 is not required; see http://www.scdhec.gov/administration/library/d-2628.pdf (Notification Form for Sites Disturbing Less Than 1-Acre Not Part of a Larger Common Plan, Non-Coastal County"	☑	$ _____. 00
b. New Owner/Operator (Transfer of Ownership)/Company Name Change ($125 NPDES Coverage fee is required by the Department for Transfers of Ownership and Company Name Changes)	☐	
c. Unpermitted Ongoing Project or Late Notification	☐	
d. MS4 Project Review (Item I.A and I.B) ($125 payable to Department thru MS4 Reviewer)	☐	
e. Other (Specify): Linear project - PfP Program roadway improvements	☑	

2. Determine the Project Review Fees (Review fees cannot exceed $2000 for a project)		
PROJECT OR LCP THAT WILL ULTIMATELY DISTRUB ONE (1) ACRE OR MORE	**(√)**	**Review Fees**
a. Enter the disturbed area (Item IV.E) for this project. Proceed to Items 2.b and 2.c.	52.6 (Nearest tenth of an acre)	
b. Will this project or LCP (Item IV.G) ultimately disturb more than 1.0 acres	☑ Yes ☐ No	
c. Is this project exempt from S. C. Reg. 72-300 et seq.?	☐ Yes ☑ No	
1. If this project will **not** ultimately disturb more than 1.0 acre, and is not part of an LCP, **your project is automatically covered under this permit and the NPDES coverage fee and review fee are not required.** See the **BOW-SPWS** for "Less Than 1-Acre of Land Disturbance – Non-Coastal Counties". 2. If this project will ultimately disturb more than 1.0 acre, proceed to Item 2.d.		
d. Enter the project review fees (based on $100/disturbed area) in the right-hand column. (Multiply the disturbed area (Item 2.a) by $100/disturbed area). If the disturbed area for this project (Item 2.a.) totals 20.0 acres or more, enter $2000 in the right-hand column. Review fees cannot exceed $2000 for a project.		$ 2000. 00

3. Total Required Fees **Add the values in the right-hand columns of Items 1 and 2.d.** Proceed to Item 4. **(The Department will not review this project until all required fees are received).**	$ 2000. 000

4. Identify the Method of Payment:

☐ **Payment by Check:**

Attach a **signed and dated check payable to S.C. DHEC** to the **front** of this Fee Schedule.
Please note that all checks must be **less than 30 days old** and must be for the **entire required fees**.

☑ **Payment by Credit Card**: **(Check here if you wish to pay via credit card using the on-line payment system).**

The Department will contact you to provide instructions and the invoice number necessary for online payment.
Please provide an e-mail address where the invoice number may be sent: penniesforprogress@yorkcountygov.com

For official use only: **Invoice Number** _____

Appendix B

Additional Permits, Approvals, & Certifications

Joint Federal and State Application Form
For Activities Affecting Waters of the United States
Or Critical Areas of the State of South Carolina

This Space for Official Use Only
Application No. _____
Date Received _____
Project Manager _____
Watershed # _____

Authorities: 33 USC 401, 33 USC 403, 33 USC 407, 33 USC 408, 33 USC 1341, 33 USC 1344, 33 USC 1413 and Section 48-39-10 et. Seq of the South Carolina Code of Laws. These laws require permits for activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. The Corps of Engineers and the State of South Carolina have established a joint application process for activities requiring both Federal and State review or approval. Under this joint process, you may use this form, together with the required drawings and supporting information, to apply for both the Federal and/or State permit(s).

Drawings and Supplemental Information Requirements: In addition to the information on this form, you must submit a set of drawings and, in some cases, additional information. A completed application form together with all required drawings and supplemental information is required before an application can be considered complete. See the attached instruction sheets for details regarding these requirements. You may attach additional sheets if necessary to provide complete information.

1. Applicant Last Name: Galloway	11. Agent Last Name (agent is not required): Kotheimer
2. Applicant First Name: Jackie	12. Agent First Name: Joshua
3. Applicant Company Name: SCDOT	13. Agent Company Name: STV Incorporated
4. Applicant Mailing Address: P.O. Box 191	14. Agent Mailing Address: 900 West Trade Street, Suite 715
5. Applicant City: Columbia	15. Agent City: Charlotte
6. Applicant State: South Carloina / 7. Applicant Zip: 29202-0191	16. Agent State: North Carolina / 17. Agent Zip: 28202-1444
8. Applicant Area Code and Phone No.: (803) 737-1337	18. Agent Area Code and Phone No.: (704) 816-2519
9. Applicant Fax No.: (803) 737-1078	19. Agent Fax No.: (704) 372-3393
10. Applicant E-mail: GallowayJA@scdot.org	20. Agent E-mail: joshua.kotheimer@stvinc.com

21. Project Name: US 21 North Phase I and II	22. Project Street Address: N/A
23. Project City: Fort Mill (nearest town) / 24. Project County: York	25. Project Zip Code: 29715 / 26. Nearest Waterbody: Steele Creek
27. Tax Parcel ID: Various	28. Property Size (acres): ~ 332 acres
29. Latitude: 35.07424° N	30. Longitude: -80.93534° W

31. Directions to Project Site (Include Street Numbers, Street Names, and Landmarks and attach additional sheet if necessary):
From Charleston, take I-26 West to I-77 North. Take I-77 North to SC 460 (Exit 88). Take Exit 88 and proceed on SC 460 East to its intersection with US 21. From the intersection, the Phase I section of the project extends to the north along US 21 to its intersection with SC 51 (Pineville-Rock Hill Road). From the SC 460 (Springfield Parkway) and US 21 intersection south along US 21 to SC 160 (White St) is the Phase II section of the project.

32. Description of the Overall Project and of Each Activity in or Affecting U.S. Waters or State Critical Areas (attach additional sheets if needed)
See Supplemental Information

33. Overall Project Purpose and the Basic Purpose of Each Activity In or Affecting U.S. Waters (attach additional sheets if needed):
See Supplemental Information

34. Type and quantity of Materials to Be Discharged

Dirt or Topsoil:	_____	☐ cubic yards
Clean Sand:	_____	☐ cubic yards
Mud:	_____	☐ cubic yards
Clay:	_____	☐ cubic yards
Gravel, Rock, or Stone:	_____	☐ cubic yards
Concrete:	_____	☐ cubic yards
Other (describe):	_____	☐ cubic yards
TOTAL:	_____	cubic yards

35. Type and Quantity of Impacts to U.S. Waters (including wetlands).

Filling:	0.893	■ acres	☐ sq.ft.	_____	☐ cubic yards
Backfill & Bedding:	_____	☐ acres	☐ sq.ft	_____	☐ cubic yards
Landclearing:	0.152	■ acres	☐ sq.ft	_____	☐ cubic yards
Dredging:	_____	☐ acres	☐ sq.ft.	_____	☐ cubic yards
Flooding:	_____	☐ acres	☐ sq.ft.	_____	☐ cubic yards
Draining/Excavation:	0.147	☐ acres	☐ sq.ft.	_____	☐ cubic yards
Shading:	_____	☐ acres	☐ sq.ft.	_____	☐ cubic yards

TOTALS: 1.192 acres _____ sq.ft. _____ cubic yards

36. Individually list wetland impacts including mechanized clearing, fill, excavation, flooding, draining, shading, etc. and attach a site map with location of each impact (attach additional sheets if needed).

Impact No.	Wetland Type	Distance to Receiving Water body (LF)	Purpose of Impact (road crossing, impoundment, flooding, etc)	Impact Size (acres)
See Supplemental Information				
			Total Wetland Impacts (acres)	

37. Individually list all seasonal and perennial stream impacts and attach a site map with location of each impact (attach additional sheets)

Impact No.	Seasonal or Perennial Flow	Average Stream Width (LF)	Impact Type (road crossing, impoundment, flooding, etc)	Impact Length (LF)
See Supplemental Information				
			Total Stream Impacts (Linear Feet)	

38. Have you commenced work on the project site? ☐ YES ■ NO If yes, describe all work that has occurred and provide dates.

39. Describe measures taken to avoid and minimize impacts to Waters of the United States:

See Supplemental Information

40. Provide a brief description of the proposed mitigation plan to compensate for impacts to aquatic resources or provide justification as to why mitigation should not be required (Attach a copy of the proposed mitigation plan for review).

See Supplemental Information

41. See the attached sheet to list the names and addresses of adjacent property owners.

See Supplemental Information

42. List all Corps Permit Authorizations and other Federal , State, or Local Certifications, Approvals, Denials received for work described in this application.

See Supplemental Information

43. Authorization of Agent. I hereby authorize the agent whose name is given on page one of this application to act in my behalf in the processing of this application and to furnish supplemental information in support of this application. [1]

Jacki Gillaspy — Applicant's Signature — 2/17/2022 — Date

44. Certification. Application is hereby made for a permit or permits to authorize the work and uses of the work as described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent for the applicant. [1]

Jacki Gillaspy — Applicant's Signature — 2/17/2022 — Date

Agent's Signature — Date

[1] **The application must be signed by the person who desires to undertake the proposed activity or it may be signed by a duly authorized agent if the authorization statement in blocks 11 and 43 have been completed and signed. 18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.**

Supplemental Information

32. Description of the Overall Project and of Each Activity in or Affecting U.S. Waters or State Critical Areas

Project Description

The South Carolina Department of Transportation (SCDOT), in cooperation with York County, proposes to widen approximately 5.4 miles of US 21 and approximately one mile of SC 51 (Pineville-Rock Hill Road) located within the Town of Fort Mill. US 21 would be widened from two to four lanes, with a center turn lane/median, from its intersection with White St (SC 160) north to its intersection with Springhill Farm Road (S-48). SC 51 would be widened from two to four lanes, with a center turn lane/median, from its intersection with US 21 east to the North Carolina state line. The proposed project also includes improvements to existing intersections along US 21. The project would require modifications to the existing stormwater drainage infrastructure and would require the relocation of existing utilities including sanitary sewer, water, power, and telecommunications located within the project construction limits. There were no additional impacts associated with utilities as part of this project. One water line will be located within the limits of a proposed permanent riprap armoring impact to Tributary C and will not require additional impacts to be installed.

The project is included in the Rock Hill-Fort Mill Area Transportation Study (RFATS) 2035 Long Range Transportation Plan and is being funded by the RFATS FY 2017-2022 Transportation Improvement Program (TIP) and York County 'Pennies for Progress 3' Program (PFP3 Project #11149-004) and 'Pennies for Progress 4' (PFP4 Project #17228-015); therefore, the preparation of a National Environmental Policy Act (NEPA) environmental document and review by the Federal Highway Administration (FHWA) is not necessary.

Existing Facility

The existing US 21 roadway facility within the southern portion of the PSA consists of two 11-foot wide travel lanes. Within the northern portion of the PSA, the existing US 21 roadway transitions from two to four lanes varying in width from 11 to 12 feet.

Stormwater drainage from the existing roadways is stored and/or conveyed through a combination of roadside ditches, pipes/culverts, curb and gutter, and detention ponds. One bridge within the PSA will be replaced. No impacts are anticipated for the replacement of the bridge.

Proposed Facility

The proposed typical section includes four travel lanes (12-foot wide inside lanes and 14-foot wide outside lanes), a center 15-foot median for left turns, 10-foot shoulders (two-foot paved and eight-foot grassed), and corresponding lane tapers. The proposed improvements to the US 21 roadway from Mercantile Place extending to the northern project limits would also include curb and gutter, a grassed strip, and sidewalk. Drainage ditches would be constructed alongside US 21 within the southern portion of the proposed roadway improvements.

Construction of the project would require the extension of seven existing drainage structures located on jurisdictional stream features. There will be a total of 0.099 acre of total wetland impacts with 0.054 acre being permanent in Phase I and 0.885 acre of total wetland impacts with 0.778 acre being permanent in Phase II for a combined project total of 0.832 acre of permanent wetland impacts (See Table 1).There will be a total of 635 linear feet of permanent stream impacts in the Phase I section and 743 linear feet of permanent impacts in the Phase II section for a combined project total of 1,378 linear feet of permanent stream impacts (See Table 2).

Construction of the Phase I project is anticipated to begin in 2022 with Phase II beginning in 2025. The project would be constructed utilizing staged construction methods in order to keep the existing roadways open to traffic during construction.

33. Overall Project Purpose and the Basic Purpose of Each Activity In or Affecting U.S. Waters

The purpose of the project is to improve US 21 and SC 51 and associated intersecting roadways to current SCDOT design standards to accommodate existing and future traffic loads and provide safer, more efficient travel ways for vehicles traveling on these roadways. US 21 serves as a primary route for vehicular traffic between the Town of Fort Mill and I-77, while SC 51 serves as a primary route for motorists traveling between US 21 and townships and cities in North Carolina.

The project as proposed is a single complete project with independent utility. The realignment and modifications to the roadways are not dependent on any larger actions for justification and the proposed work does not require prior or simultaneous actions to be taken for the project to be complete and successful.

36. Individually list wetland impacts including mechanized clearing, fill, excavation, flooding, draining, shading, etc. and attach a site map with location of each impact

Table 1. Summary of Impacts to Jurisdictional Wetlands

Impact No.	Wetland Type	Distance to Receiving Water body (LF)	Purpose of Impact (road crossing, impoundment, flooding, etc)	Impact Size (acres)
Phase I				
Wetland E	Freshwater wetland	0	drainage pipe installation	0.001
Wetland F	Freshwater wetland	0	roadway widening/culvert	0.066
Wetland G	Freshwater wetland	0	roadway widening	0.002
			Phase I Total	**0.099**
Phase II				
Wetland BB	Freshwater wetland	0	roadway widening/culvert	0.007
Wetland CC	Freshwater wetland	0	roadway widening/culvert	0.087

Impact No.	Wetland Type	Distance to Receiving Water body (LF)	Purpose of Impact (road crossing, impoundment, flooding, etc)	Impact Size (acres)
Wetland FF	Freshwater wetland	0	roadway widening/culvert	0.791
			Phase II Total	**0.885**
			Combined Project Total	**0.984**

37. Individually list all seasonal and perennial stream impacts and attach a site map with location of each impact

Table 2. Summary of Impacts to Jurisdictional Non-wetlands Waters

Impact No.	Seasonal or Perennial Flow	Average Stream Width (LF)	Impact Type (road crossing, impoundment, flooding, etc)	Length (LF)
Phase I				
Tributary A	Perennial	5	roadway widening/culvert	137
Tributary C	Perennial	6	roadway widening/culvert	270
Tributary D	Perennial	6	roadway widening/culvert	228
			Phase I Total	**635**
Phase II				
Tributary B	Perennial	7	roadway widening/culvert	162
Tributary C	Perennial	5	roadway widening/culvert	121
Tributary D	Perennial	8	roadway widening/culvert	147
Tributary E	Perennial	5	roadway widening/culvert	51
Tributary F	Perennial	7	roadway widening/culvert	262
			Phase II Total	**743**
			Combined Project Total	**1,378**

39. Describe measures taken to avoid and minimize impacts to Waters of the United States

The proposed project was designed to minimize adverse impacts to the human and natural environment, including jurisdictional waters of the U.S., to the maximum extent practicable; however, impacts to jurisdictional waters of the U.S. are unavoidable and necessary for construction of the project.

Efforts to avoid and/or minimize project impacts include the following:

- Fill slopes for the new roadways at the stream crossings along US 21 have been designed at 2:1 thereby reducing the length necessary of the proposed drainage structures and minimizing the impact footprint
- The extent (amount) of riprap proposed within the jurisdictional streams at the outfalls of the culverts and pipes has been determined through detailed hydraulic analyses and is the minimum amount necessary to adequately dissipate water flows and prevent scouring and bank failure during significant rainfall events. The placement of the riprap will not result in the loss of overall stream function or disrupt downstream hydrologic connectivity.
- Sediment and erosion control measures consistent with state-approved BMPs would be installed and monitored/maintained prior to, during, and immediately following project construction to prevent runoff and sedimentation of jurisdictional waters.
- Orange barrier fencing will be installed along the boundaries of jurisdictional waters (streams and wetlands) located outside the project limits but within the right-of-way as an additional form of protection and impact avoidance.
- Phase II alignment was shifted to avoid impacts to Schweinitz's sunflowers

40. Provide a brief description of the proposed mitigation plan to compensate for impacts to aquatic resources or provide justification as to why mitigation should not be required

Per the U.S. Army Corps of Engineers (USACE) Charleston District's guidance document entitled 'Guidelines for Preparing a Compensatory Mitigation Plan' (October 2010), it has been determined that the proposed project would require 6969.8 stream credits and 9.8042 freshwater wetland credits to compensate for impacts to jurisdictional waters of the U.S.

As compensatory mitigation for the impacts, York County will purchase 6969.8 stream credits and 9.8042 wetland credits from a USACE-approved mitigation banks. The County is currently in the process of reserving the required stream and wetland credits from multiple banks that service the area. At least half of the credits will be in the form of restoration credits and the remaining will be in the form of preservation credits. All required mitigation credits will be purchased and documentation of said purchase(s) provided to the USACE before the project begins construction.

41. See the attached sheet to list the names and addresses of adjacent property owners.

42. List all Corps Permit Authorizations and other Federal, State, or Local Certifications, Approvals, Denials received for work described in this application.

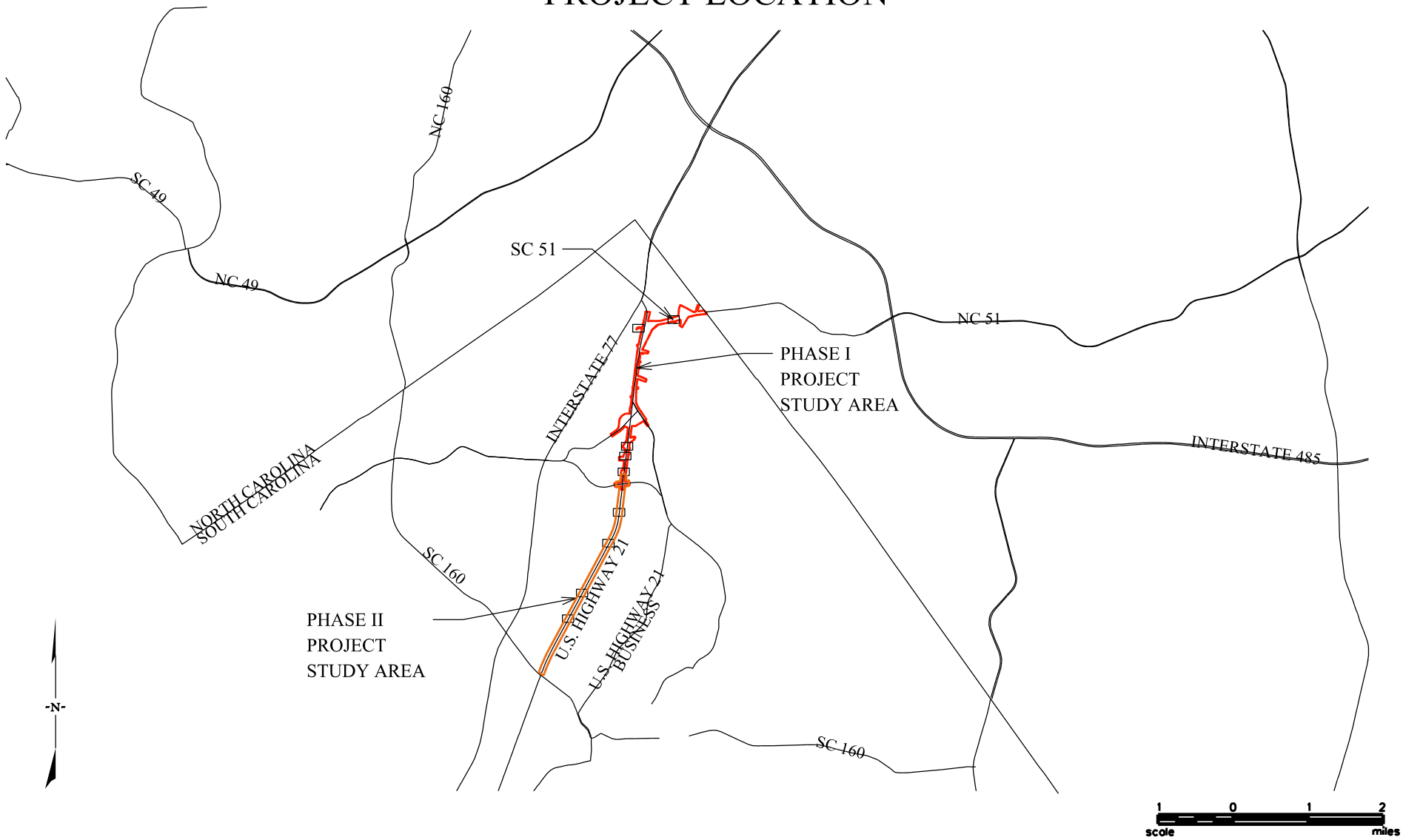
A Jurisdictional Determination (SAC 2015-00812-DS) for the Phase I project study area was issued on July 1, 2016. A revision to the Phase I Jurisdictional Determination (SAC 2015-00812-DS) was issued on November 23, 2021. A Jurisdictional Determination for Phase II (SAC 2019-013980 was issued on was received on January 23, 2020.



February 17, 2022

SCDOT Authorized Agent's Signature **Date**

US 21 NORTH PHASE I AND US 21 NORTH PHASE II
PROJECT LOCATION



US 21 NORTH PHASE I PROJECT STUDY AREA

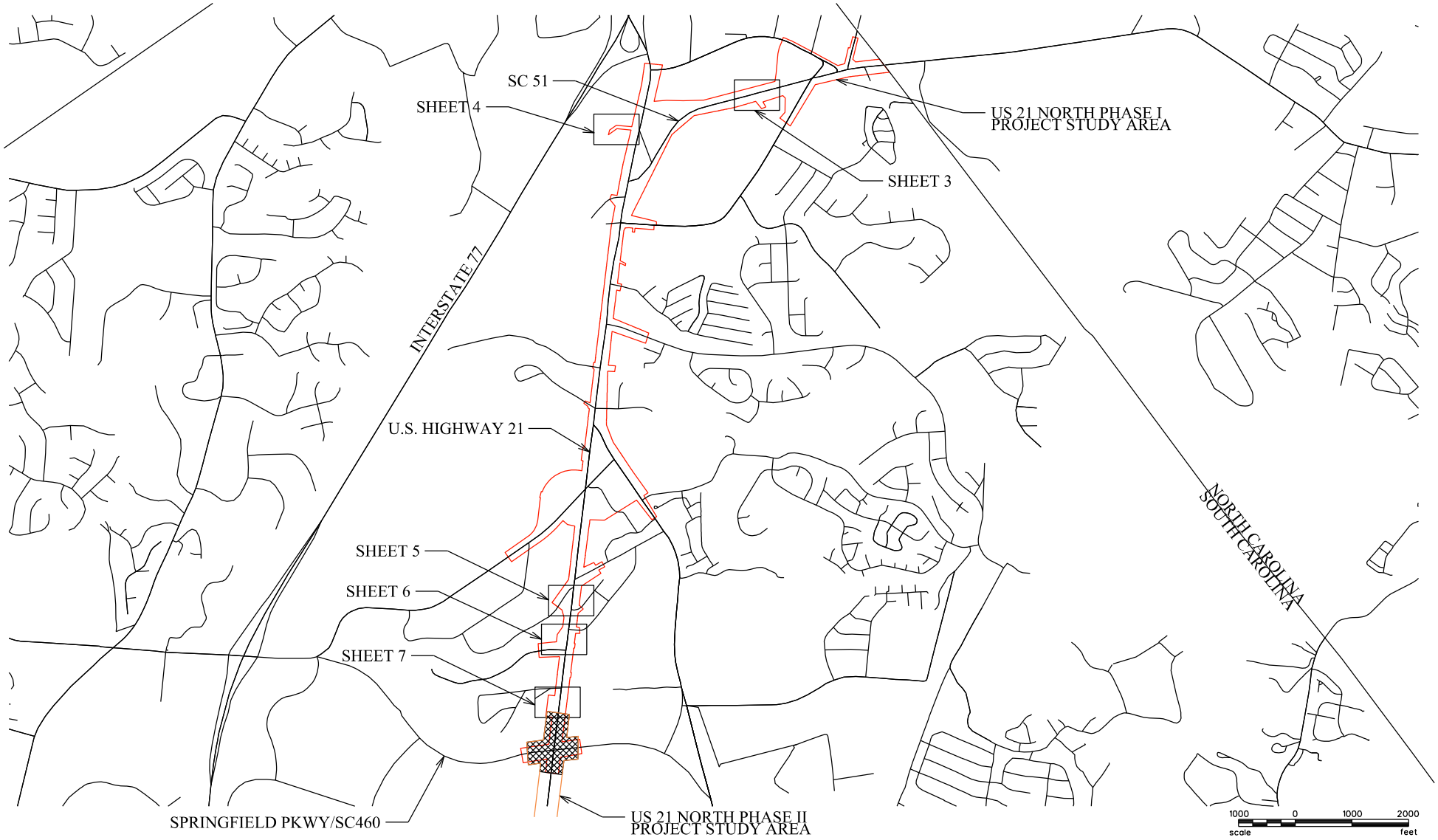
US 21 NORTH PHASE II PROJECT STUDY AREA

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730
(803) 980-4970 fax: (803) 980-4099

Campco Engineering Inc
156 Oakland Avenue
Rock Hill, South Carolina 29730
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 1 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
PROJECT OVERVIEW



US 21 NORTH PHASE I PROJECT STUDY AREA

US 21 NORTH PHASE II PROCECT STUDY AREA

OVERLAP BETWEEN PHASE I & II

PHASE I IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	166	0.024
PERMANENT TRIBUTARY PIPE IMPACT	469	0.074
PERMANENT WETLAND FILL IMPACT		0.054
TEMPORARY WETLAND CLEARING IMPACT		0.045
TOTAL PERMANENT TRIBUTARY IMPACTS	635	0.098
TOTAL TEMPORARY WETLAND IMPACTS		0.045
TOTAL PERMANENT WETLAND IMPACTS		0.054

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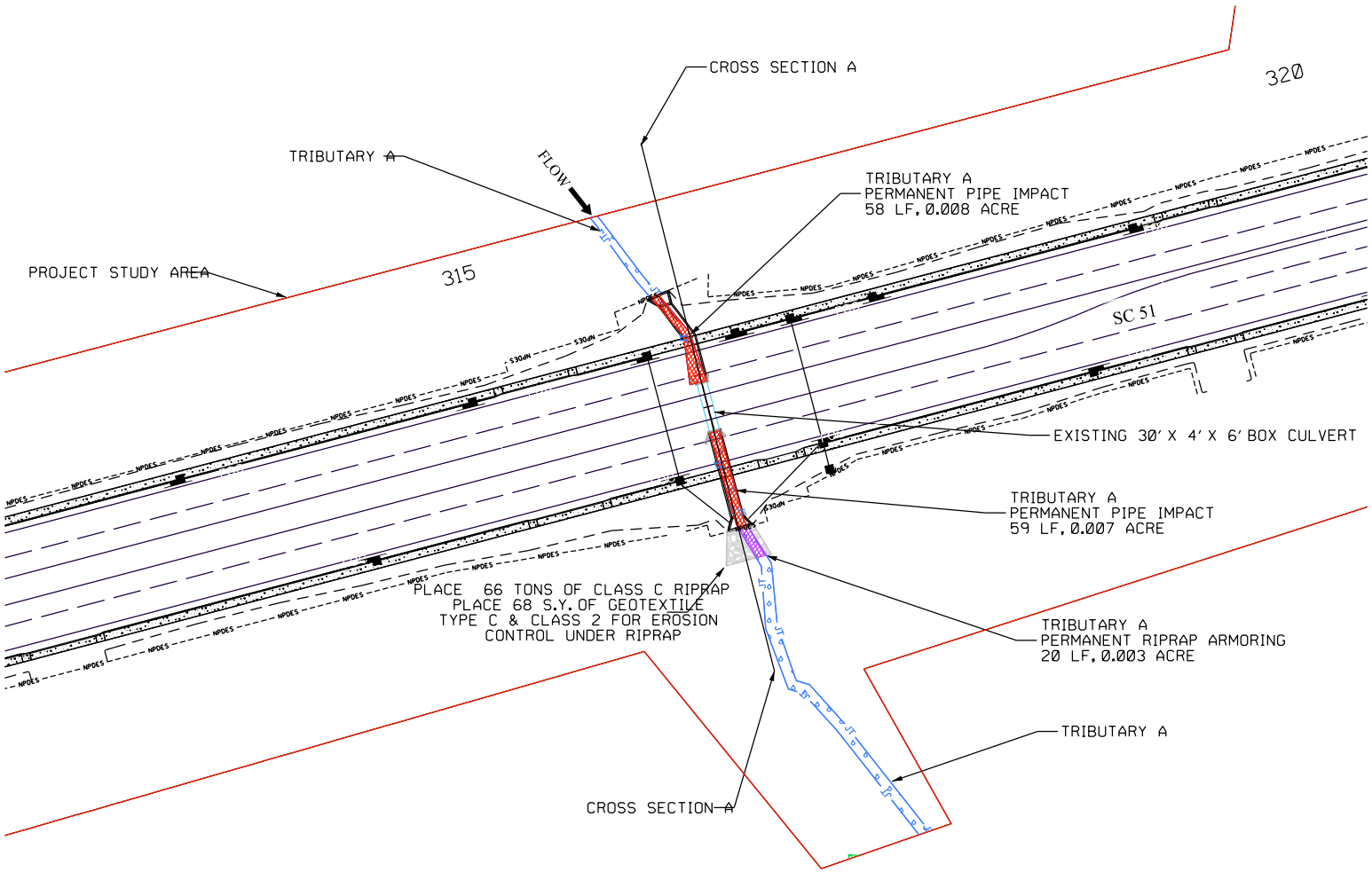
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 2 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



WETLAND
JURISDICTIONAL TRIBUTARY
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT
TEMPORARY IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	20	0.003
PERMANENT TRIBUTARY PIPE IMPACT	117	0.015
TOTAL PERMANENT TRIBUTARY IMPACTS	137	0.018

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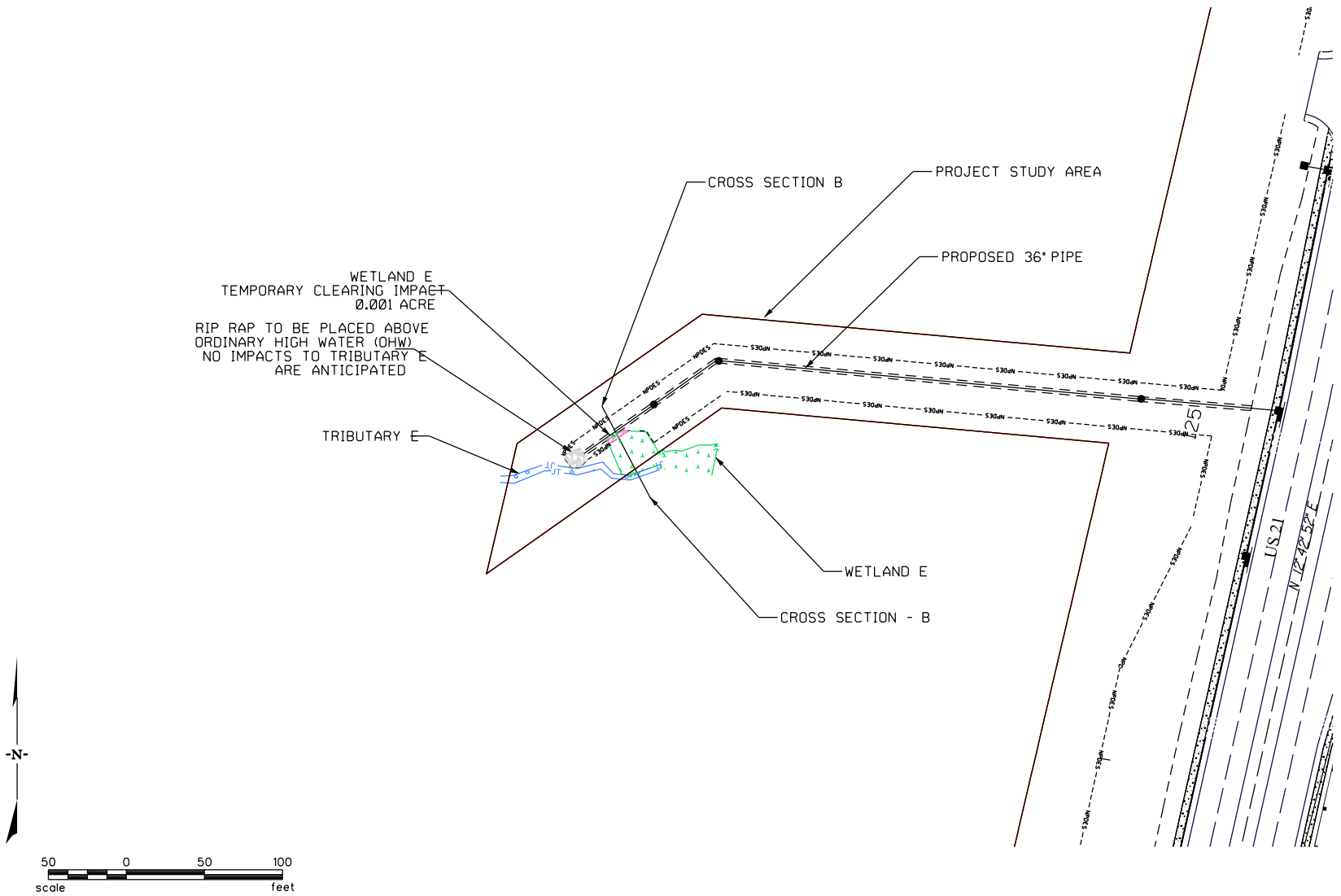
(803) 327-7121

APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 3 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



WETLAND	
JURISDICTIONAL TRIBUTARY	
RIPRAP	
PERMANENT RIPRAP ARMORING IMPACT	
PERMANENT PIPE/CULVERT IMPACT	
PERMANENT FILL IMPACT	
TEMPORARY IMPACT	

SHEET IMPACT TOTALS	LF	ACRE
TEMPORARY WETLAND CLEARING IMPACT		0.001

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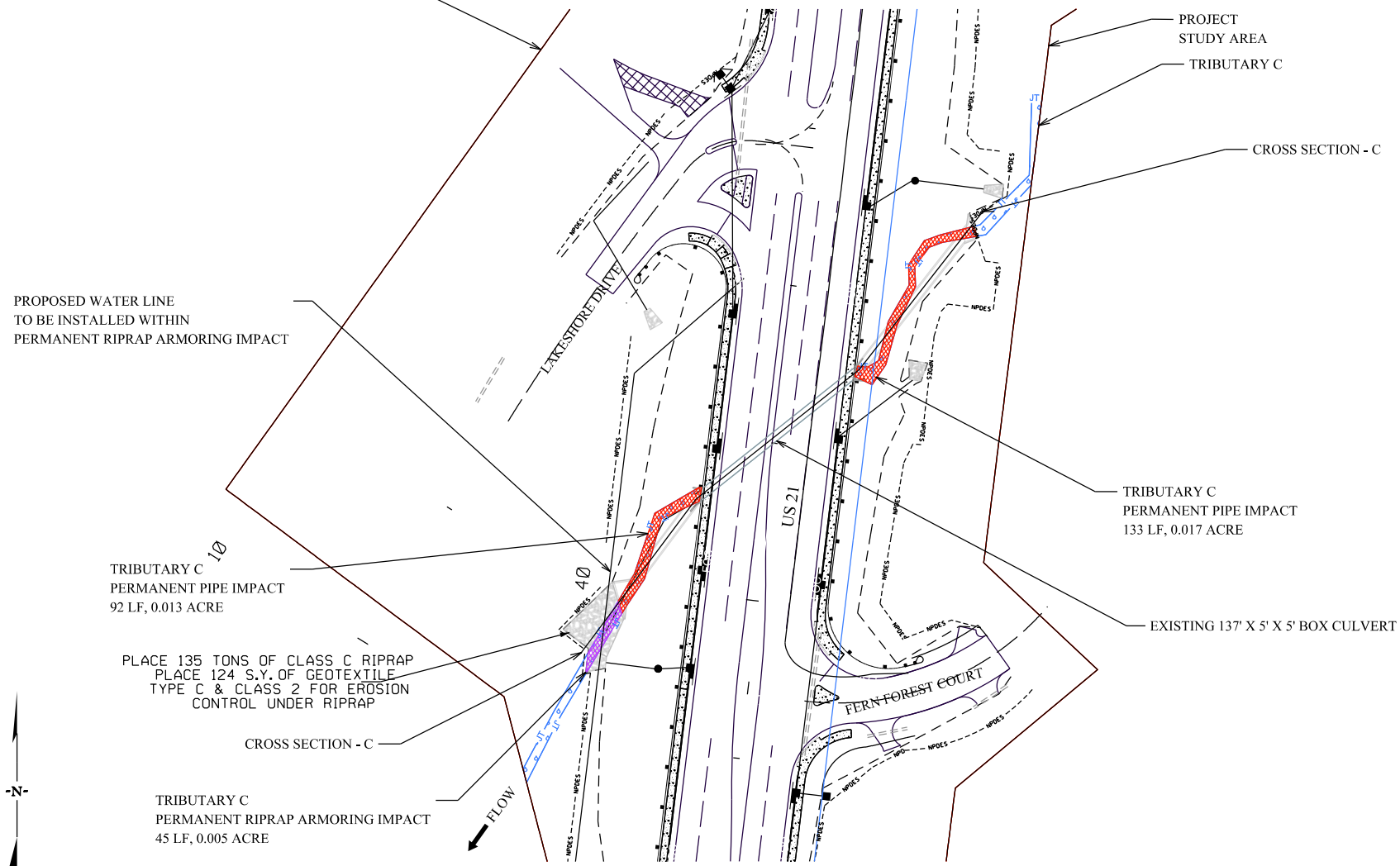
APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
PROJECT:	US 21 NORTH PHASE I AND SC 51 & US 21 NORTH PHASE II
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 4 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



WETLAND
JURISDICTIONAL TRIBUTARY
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT
TEMPORARY IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	45	0.005
PERMANENT TRIBUTARY PIPE IMPACT	225	0.030
TOTAL PERMANENT TRIBUTARY IMPACTS	270	0.035

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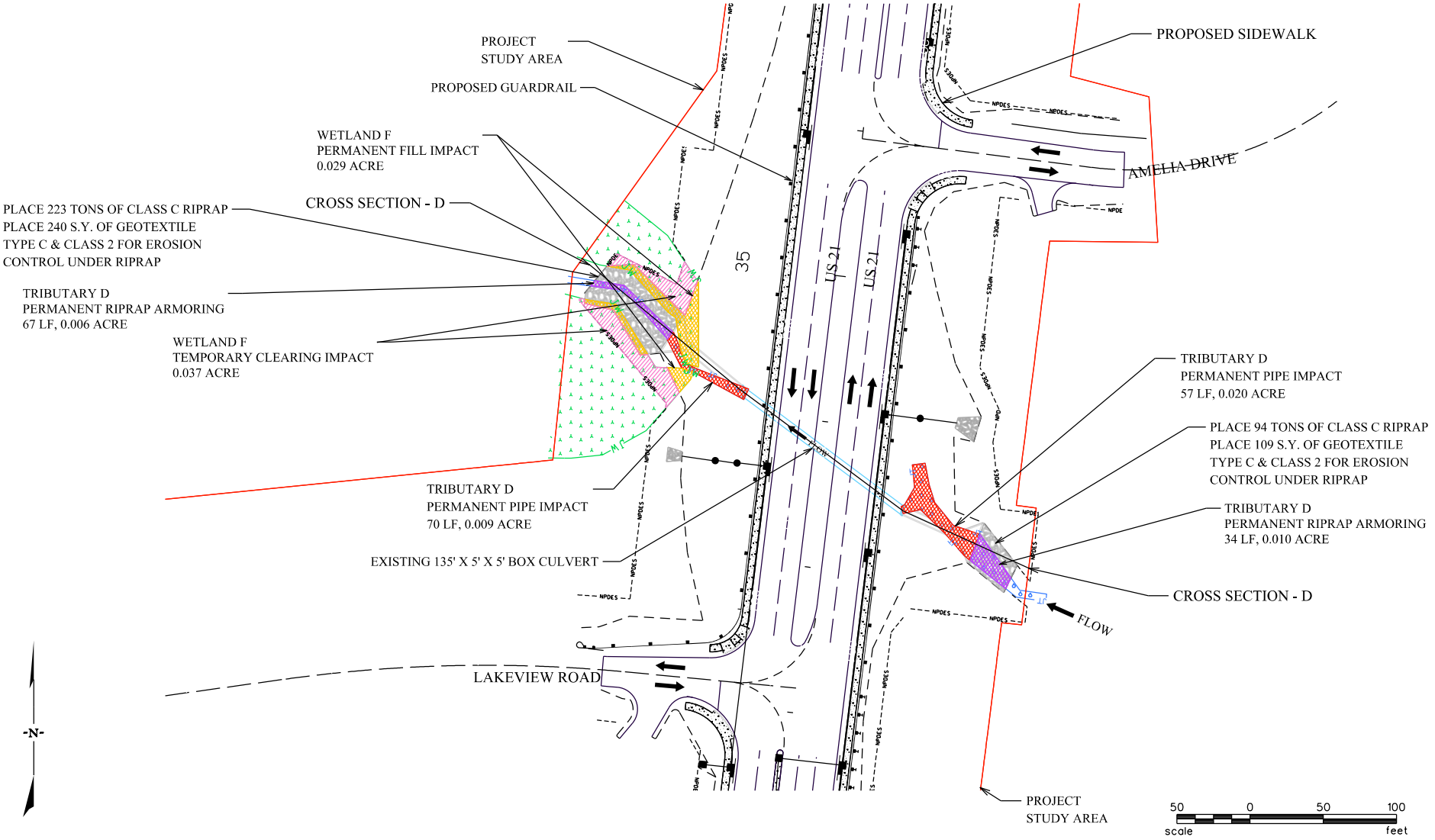
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 5 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



WETLAND	
JURISDICTIONAL TRIBUTARY	
RIPRAP	
PERMANENT RIPRAP ARMORING IMPACT	
PERMANENT PIPE/CULVERT IMPACT	
PERMANENT FILL IMPACT	
TEMPORARY IMPACT	

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	101	0.016
PERMANENT TRIBUTARY PIPE IMPACT	127	0.029
PERMANENT WETLAND FILL IMPACT		0.029
TEMPORARY WETLAND CLEARING IMPACT		0.037
TOTAL PERMANENT TRIBUTARY IMPACTS	228	0.045
TOTAL PERMANENT WETLAND IMPACTS		0.029
TOTAL TEMPORARY WETLAND IMPACTS		0.037

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APPLICANT:	SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
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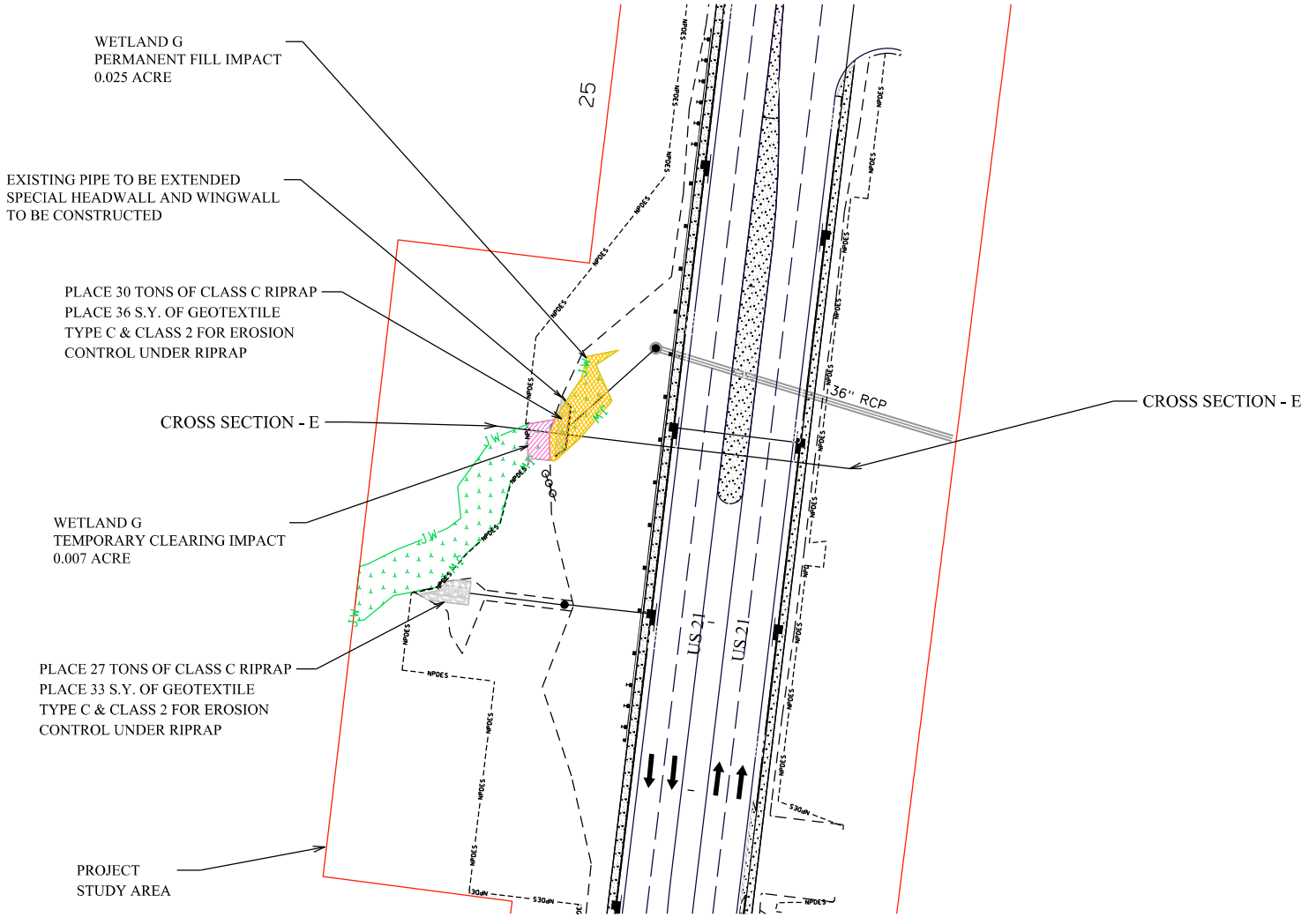
LOCATION:	YORK COUNTY, SOUTH CAROLINA
YORK COUNTY PROJECTS 11149-004 & 17228-015	
SCDOT PROJECT ID 42332 & 39235	
SHEET: 6 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
PLAN VIEW



WETLAND
JURISDICTIONAL TRIBUTARY
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT
TEMPORARY IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT WETLAND FILL IMPACT		0.025
TEMPORARY WETLAND CLEARING IMPACT		0.007
TOTAL PERMANENT WETLAND IMPACTS		0.025
TOTAL TEMPORARY WETLAND IMPACTS		0.007

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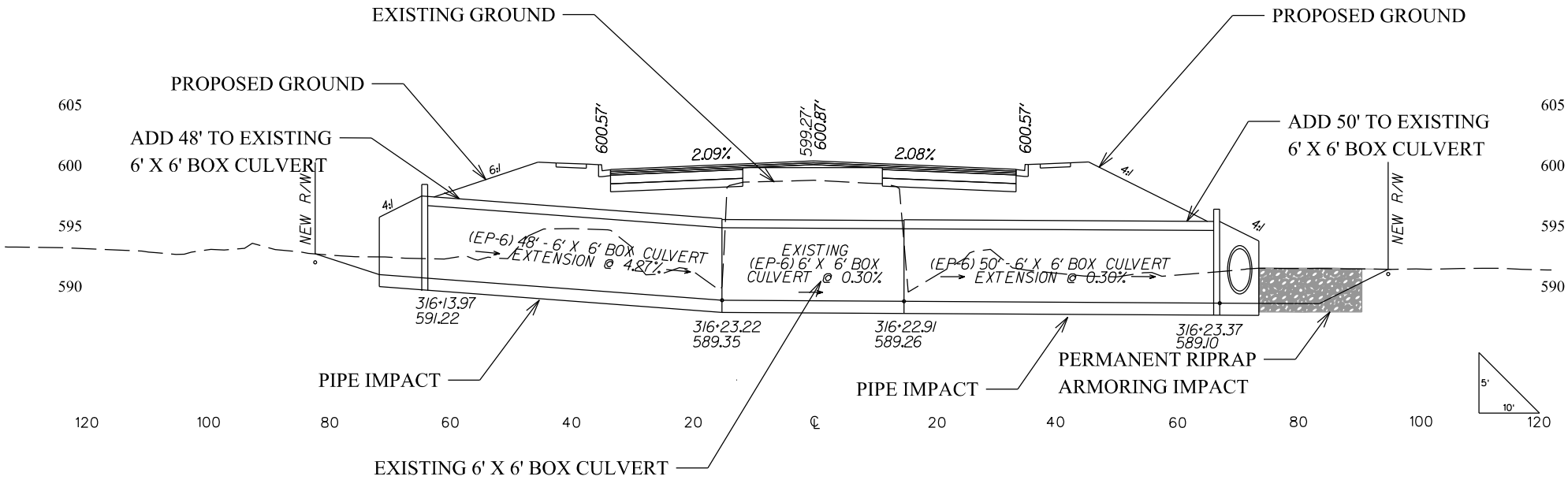
US 21 NORTH PHASE I AND SC 51
CROSS SECTION A - STA 316+23.05



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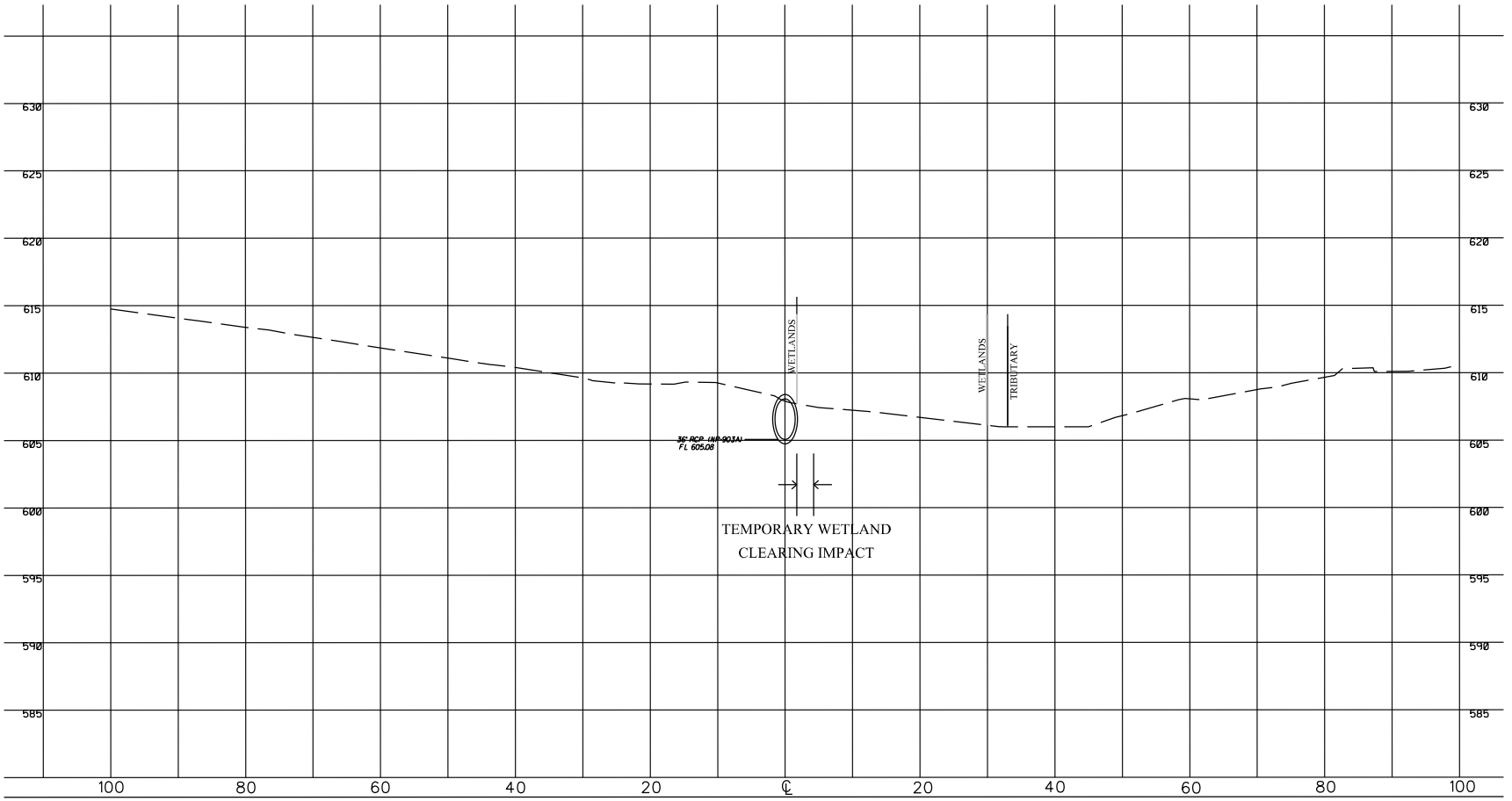
US 21 NORTH PHASE I AND SC 51
CROSS SECTION B - STA 124+7.00



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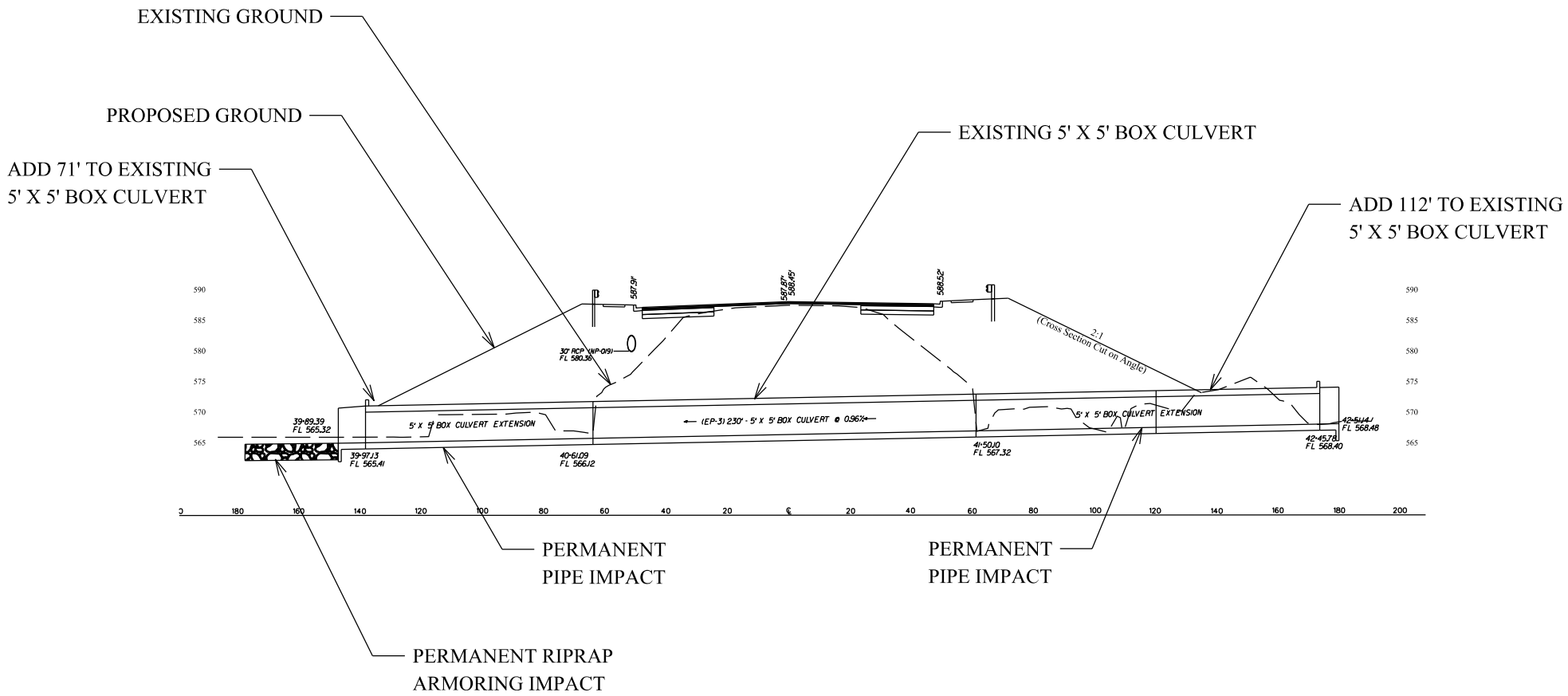
SHEET: 9 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION C - STA 41+06.45



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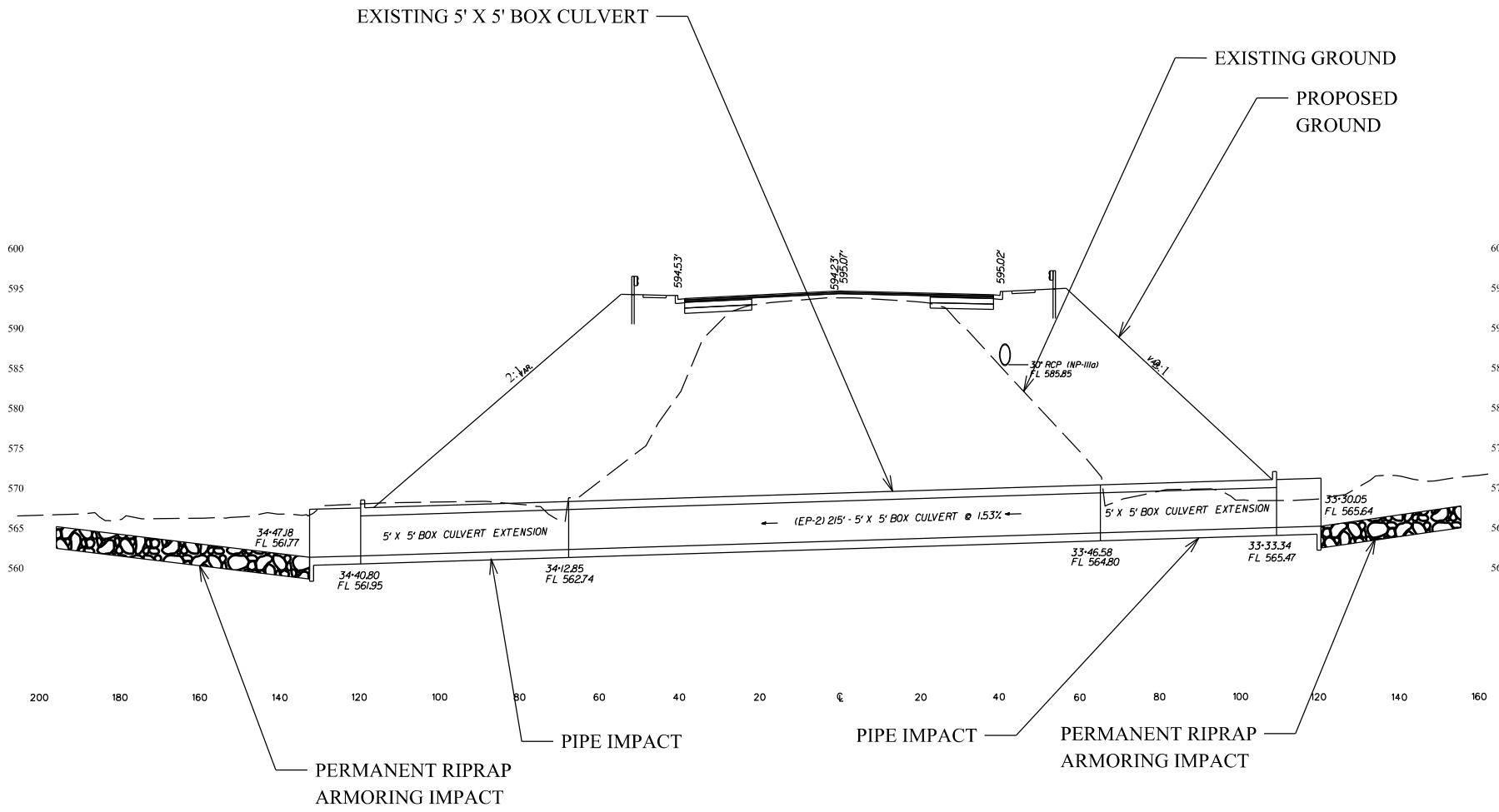
SCDOT PROJECT ID 42332 & 39235	
SHEET: 10 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION D - STA 33+79.00



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LOCATION:	YORK COUNTY, SOUTH CAROLINA
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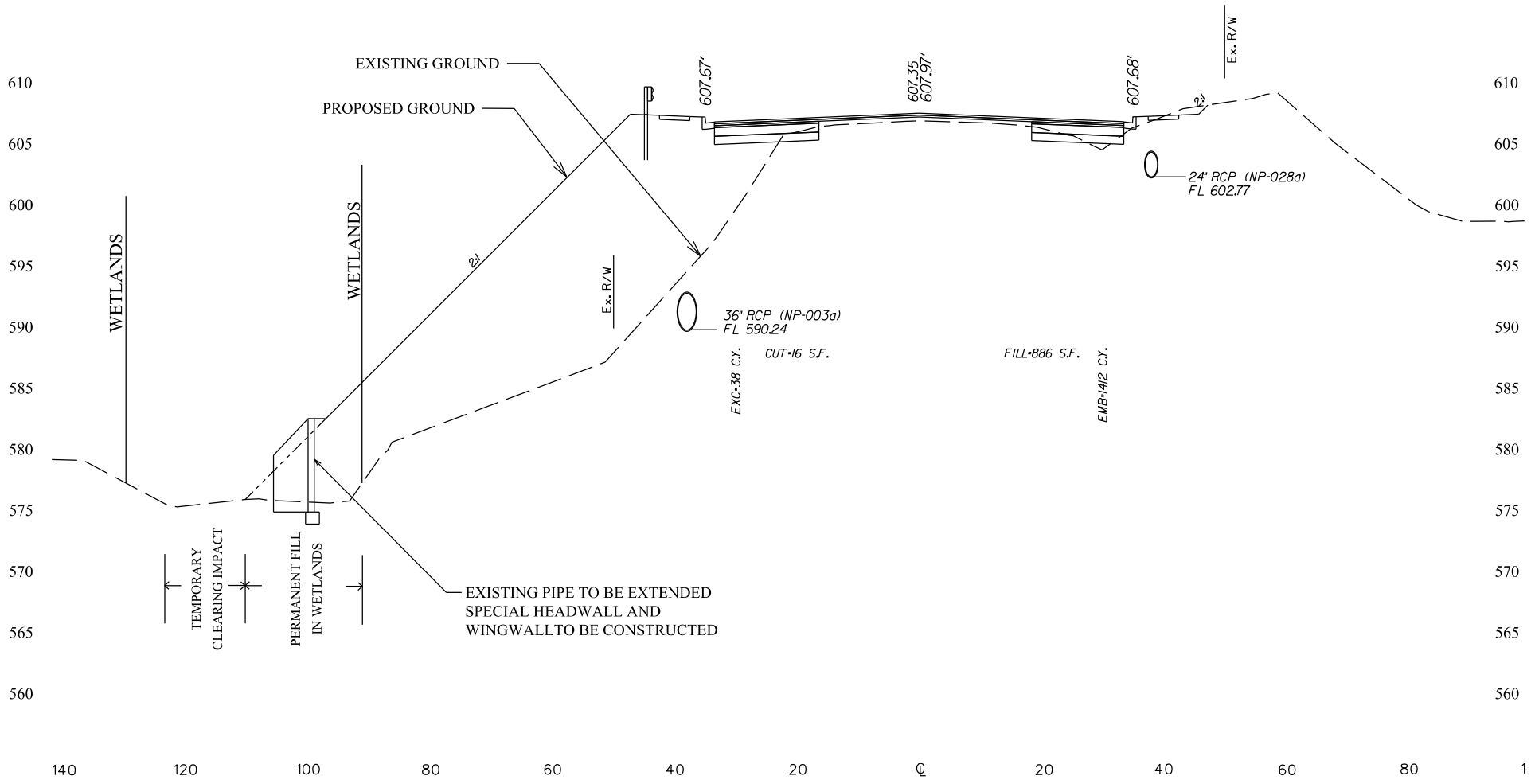
SCDOT PROJECT ID 42332 & 39235	
SHEET: 11 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE I AND SC 51
CROSS SECTION E - STA 23+00.00



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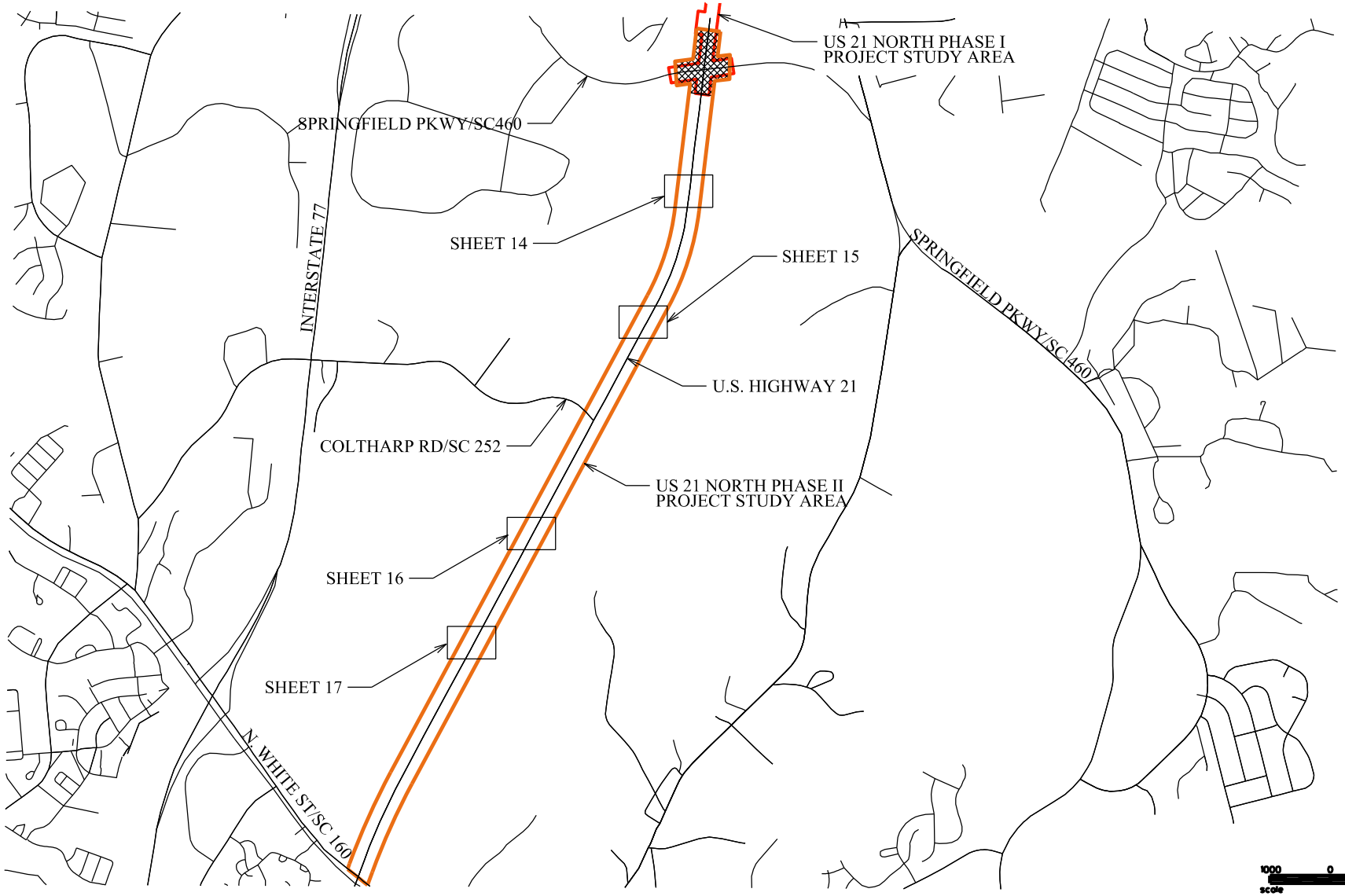
SCDOT PROJECT ID 42332 & 39235	
SHEET: 12 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE II
PROJECT SEGMENT OVERVIEW



US 21 NORTH PHASE I PROJECT STUDY AREA

US 21 NORTH PHASE II PROCECT STUDY AREA

OVERLAP BETWEEN PHASE I & II

PHASE II IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	193	0.028
PERMANENT TRIBUTARY PIPE IMPACT	550	0.082
PERMANENT WETLAND FILL IMPACT		0.631
PERMANENT WETLAND CUT IMPACT		0.147
TEMPORARY WETLAND CLEARING IMPACT		0.107
TOTAL PERMANENT TRIBUTARY IMPACTS	743	0.110
TOTAL PERMANENT WETLAND IMPACTS		0.778
TOTAL TEMPORARY WETLAND IMPACTS		0.107

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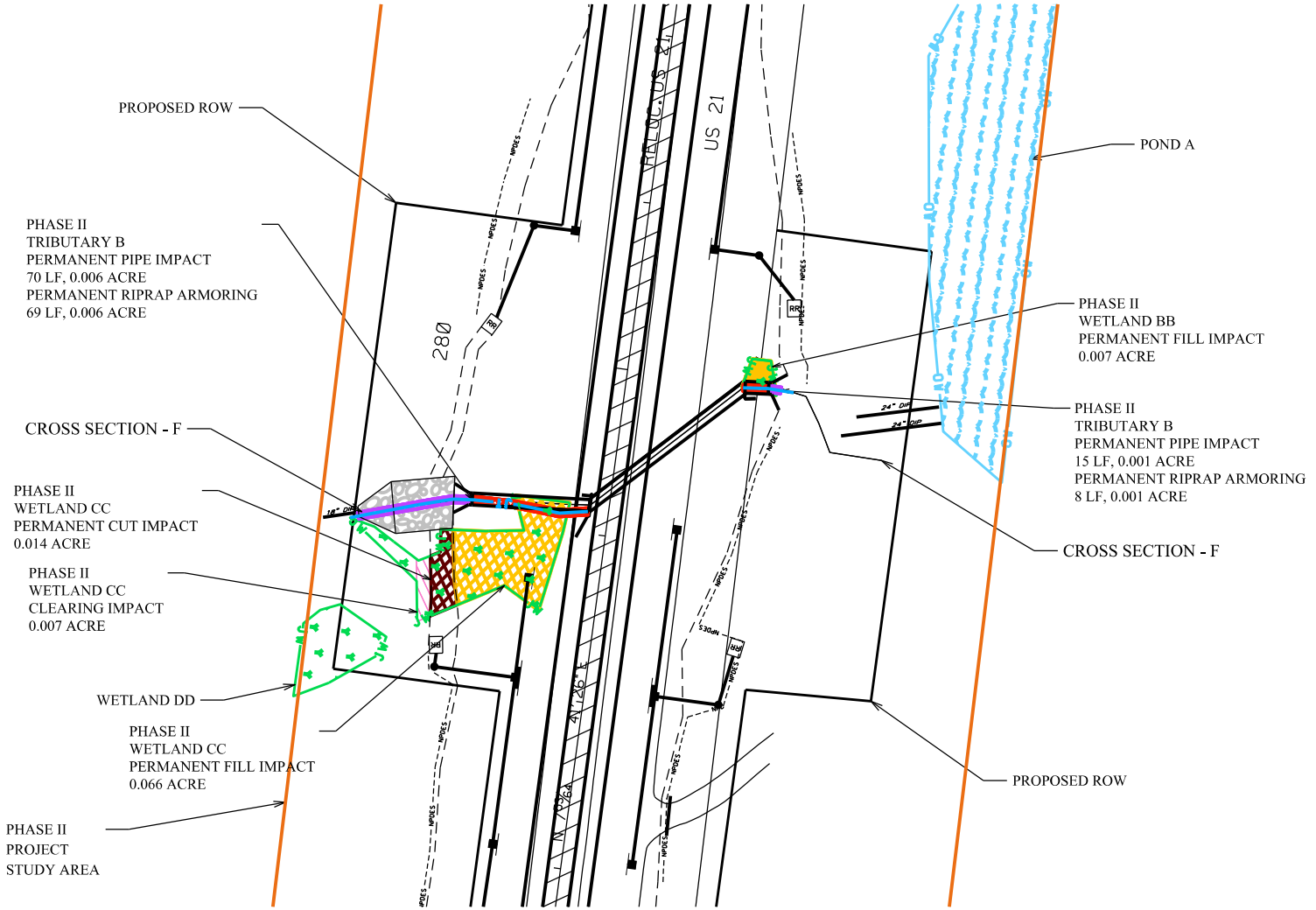
SCDOT PROJECT ID 42332 & 39235	
SHEET: 13 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE II
PLAN VIEW



WETLAND
JURISDICTIONAL TRIBUTARY
JURISDICTIONAL OPEN WATER
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT
PERMANENT CUT IMPACT
TEMPORARY CLEARING IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	77	0.007
PERMANENT TRIBUTARY PIPE IMPACT	85	0.007
PERMANENT WETLAND FILL IMPACT		0.073
PERMANENT WETLAND CUT IMPACT		0.014
TEMPORARY WETLAND CLEARING IMPACT		0.007
TOTAL PERMANENT TRIBUTARY IMPACTS	162	0.014
TOTAL PERMANENT WETLAND IMPACTS		0.087
TOTAL TEMPORARY WETLAND IMPACTS		0.007

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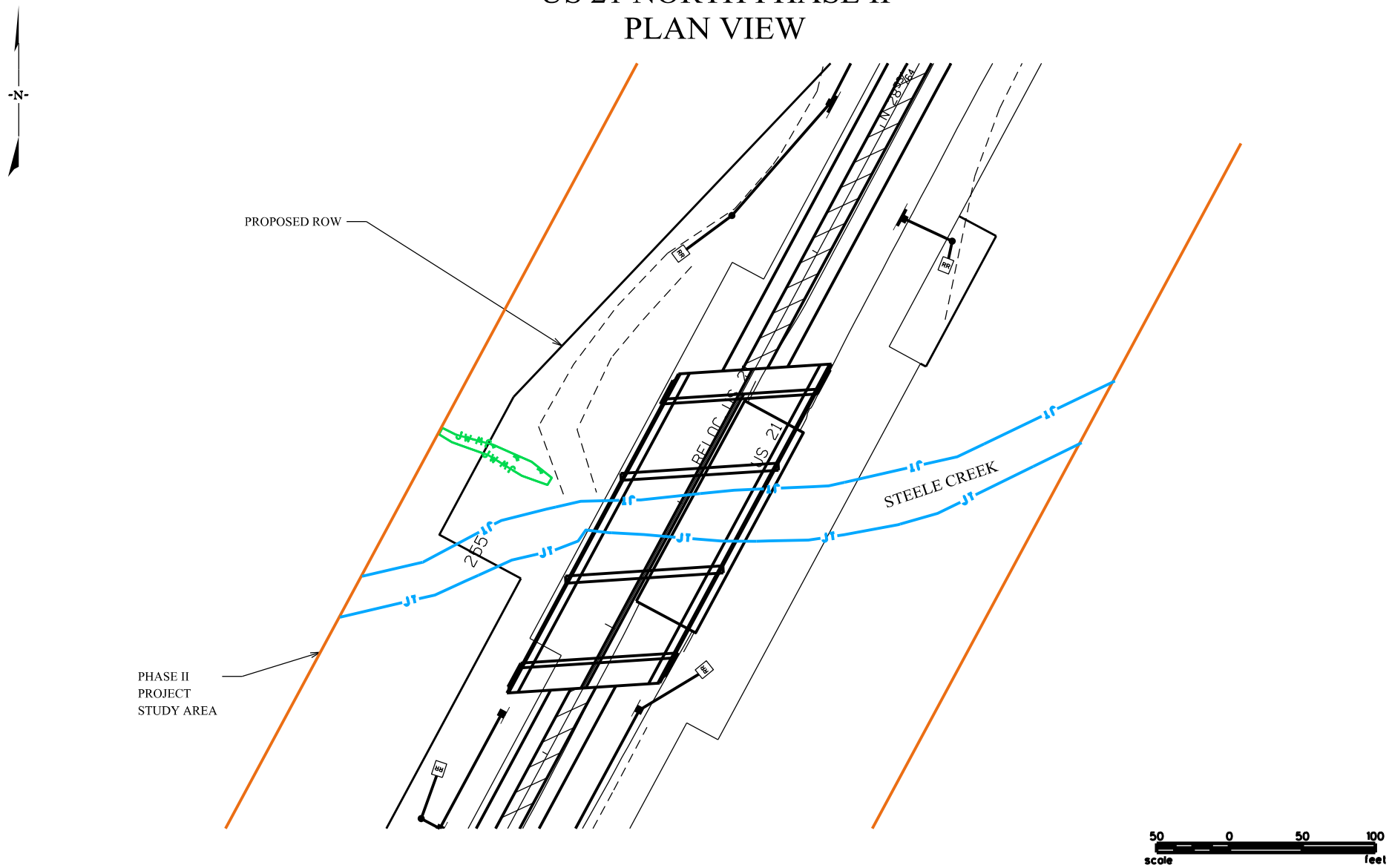
SCDOT PROJECT ID 42332 & 39235	
SHEET: 14 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE II
PLAN VIEW



WETLAND

JURISDICTIONAL TRIBUTARY

SHEET IMPACT TOTALS LF ACRE

NO IMPACTS

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SCDOT PROJECT ID 42332 & 39235	
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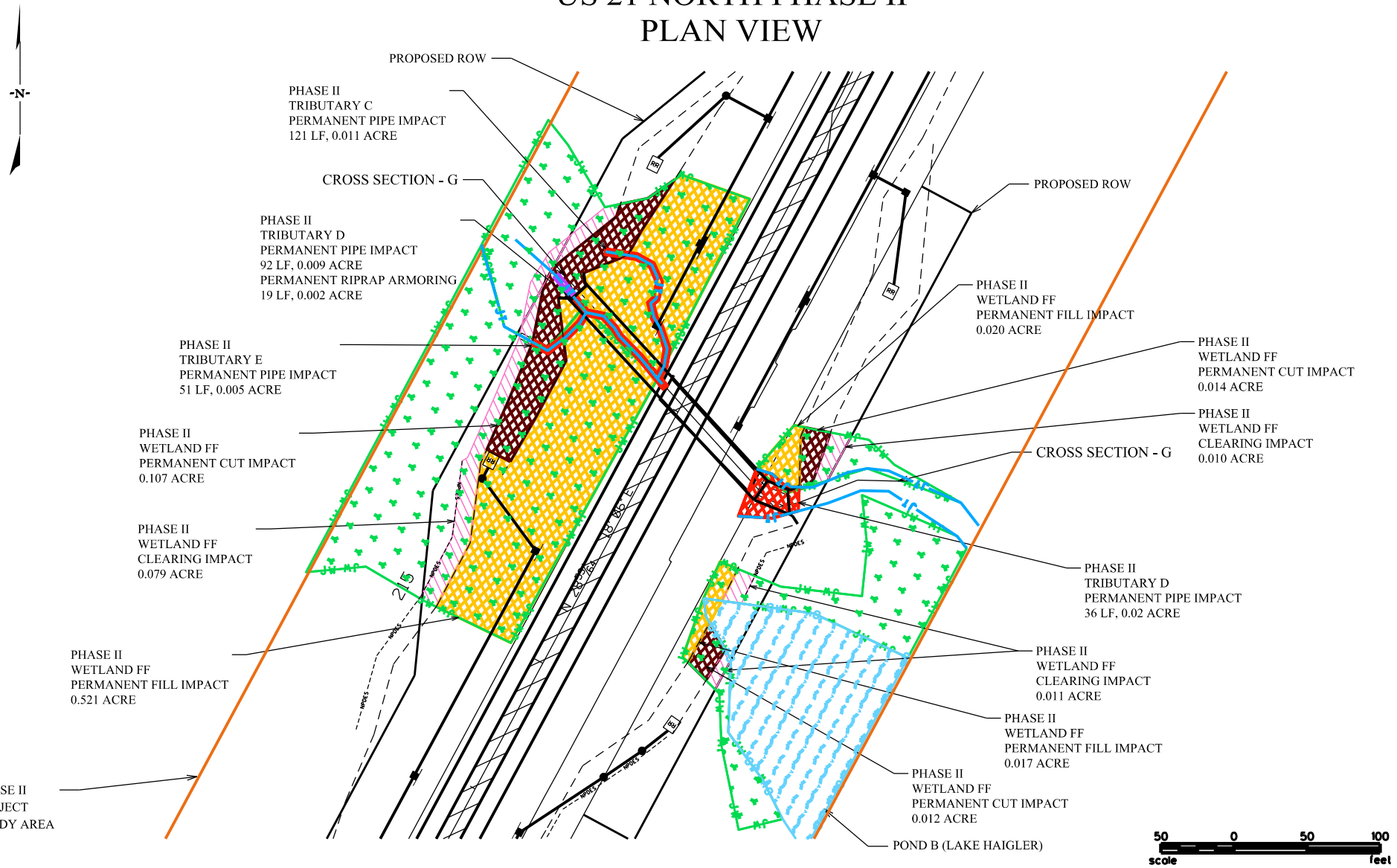
US 21 NORTH PHASE II
PLAN VIEW



WETLAND
JURISDICTIONAL TRIBUTARY
JURISDICTIONAL OPEN WATER
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT
PERMANENT FILL IMPACT
PERMANENT CUT IMPACT
TEMPORARY CLEARING IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	19	0.002
PERMANENT TRIBUTARY PIPE IMPACT	300	0.045
PERMANENT WETLAND FILL IMPACT		0.558
PERMANENT WETLAND CUT IMPACT		0.133
TEMPORARY WETLAND CLEARING IMPACT		0.100
TOTAL PERMANENT TRIBUTARY IMPACTS	319	0.047
TOTAL PERMANENT WETLAND IMPACTS		0.691
TOTAL TEMPORARY WETLAND IMPACTS		0.100

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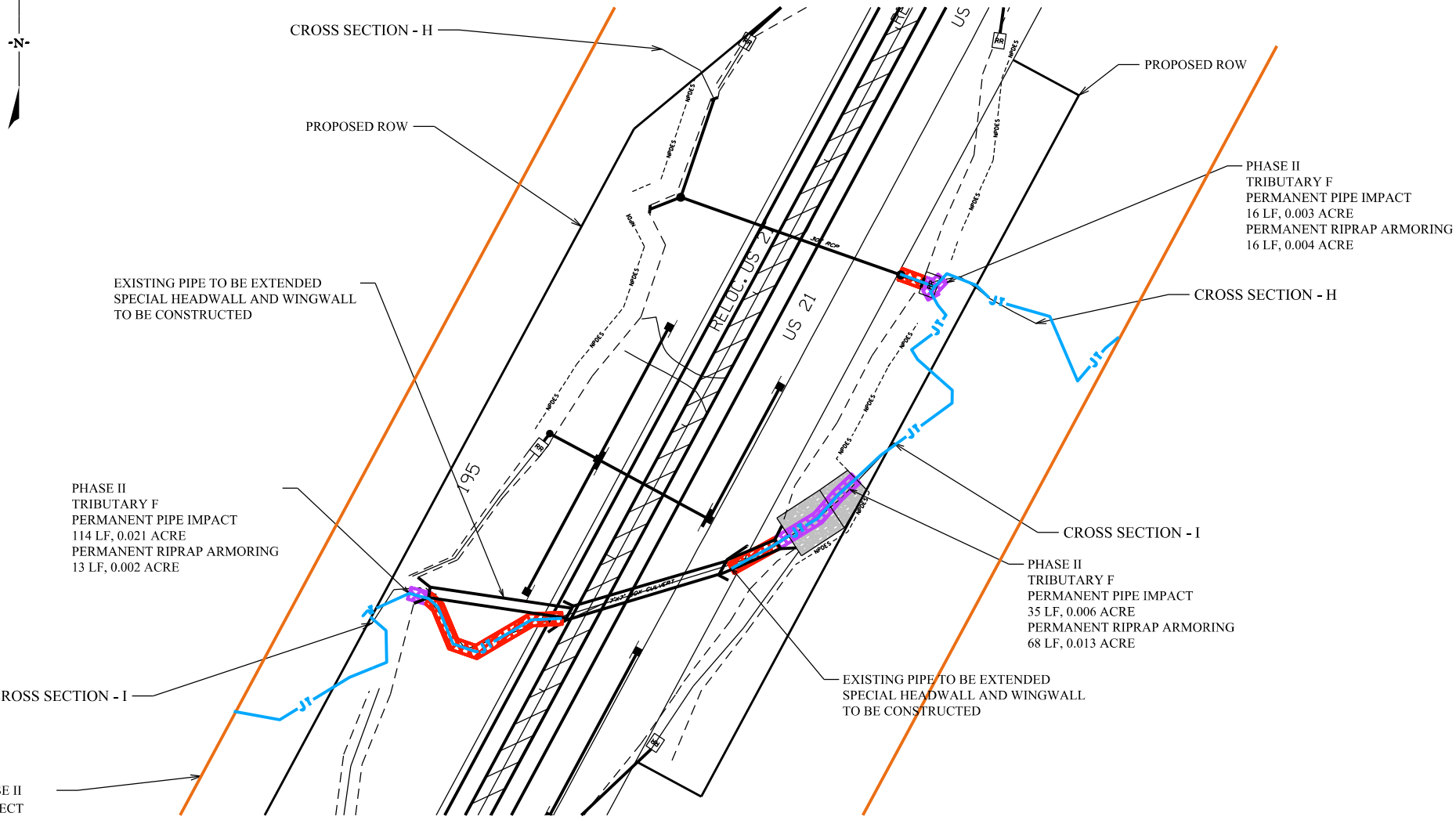
SCDOT PROJECT ID 42332 & 39235	
SHEET: 16 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE II
PLAN VIEW



JURISDICTIONAL TRIBUTARY
RIPRAP
PERMANENT RIPRAP ARMORING IMPACT
PERMANENT PIPE/CULVERT IMPACT

SHEET IMPACT TOTALS	LF	ACRE
PERMANENT TRIBUTARY ARMORING IMPACT	97	0.019
PERMANENT TRIBUTARY PIPE IMPACT	165	0.030
TOTAL PERMANENT TRIBUTARY IMPACTS	262	0.049

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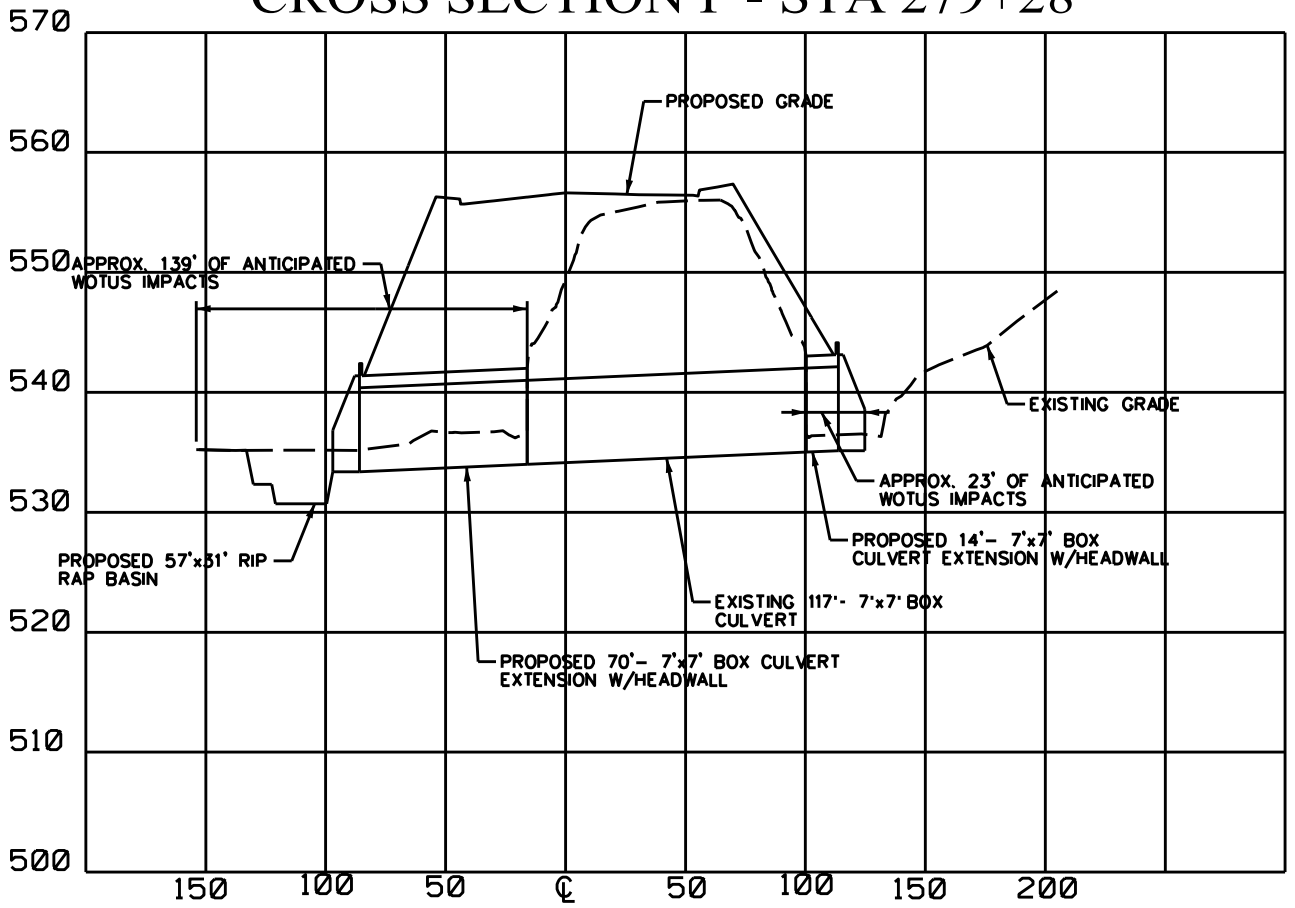
SCDOT PROJECT ID 42332 & 39235	
SHEET: 17 OF 21	DATE: Revised 12-17-2021

US 21 NORTH PHASE II
CROSS SECTION F - STA 279+28



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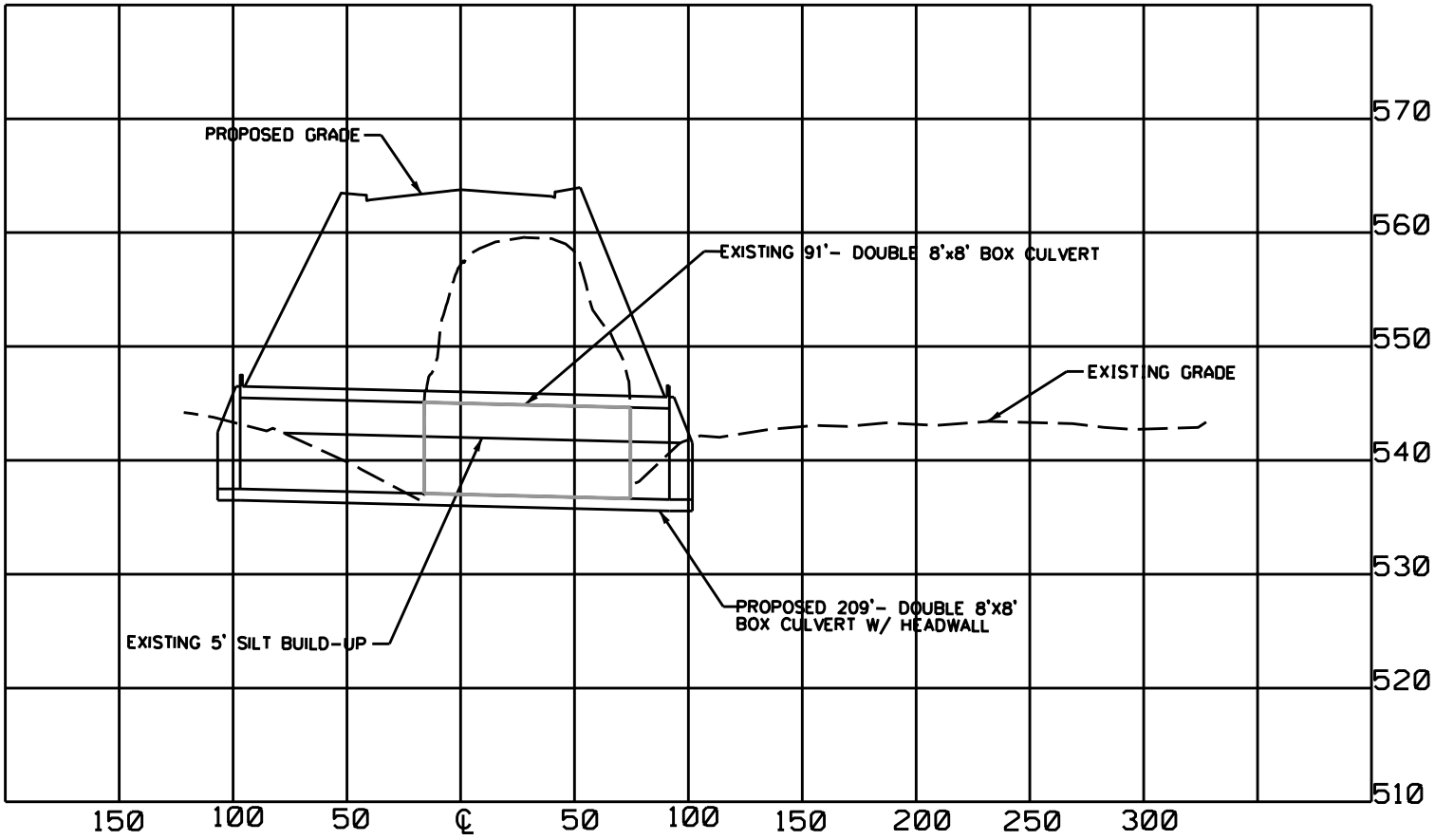
US 21 NORTH PHASE II
CROSS SECTION G - STA 217+06



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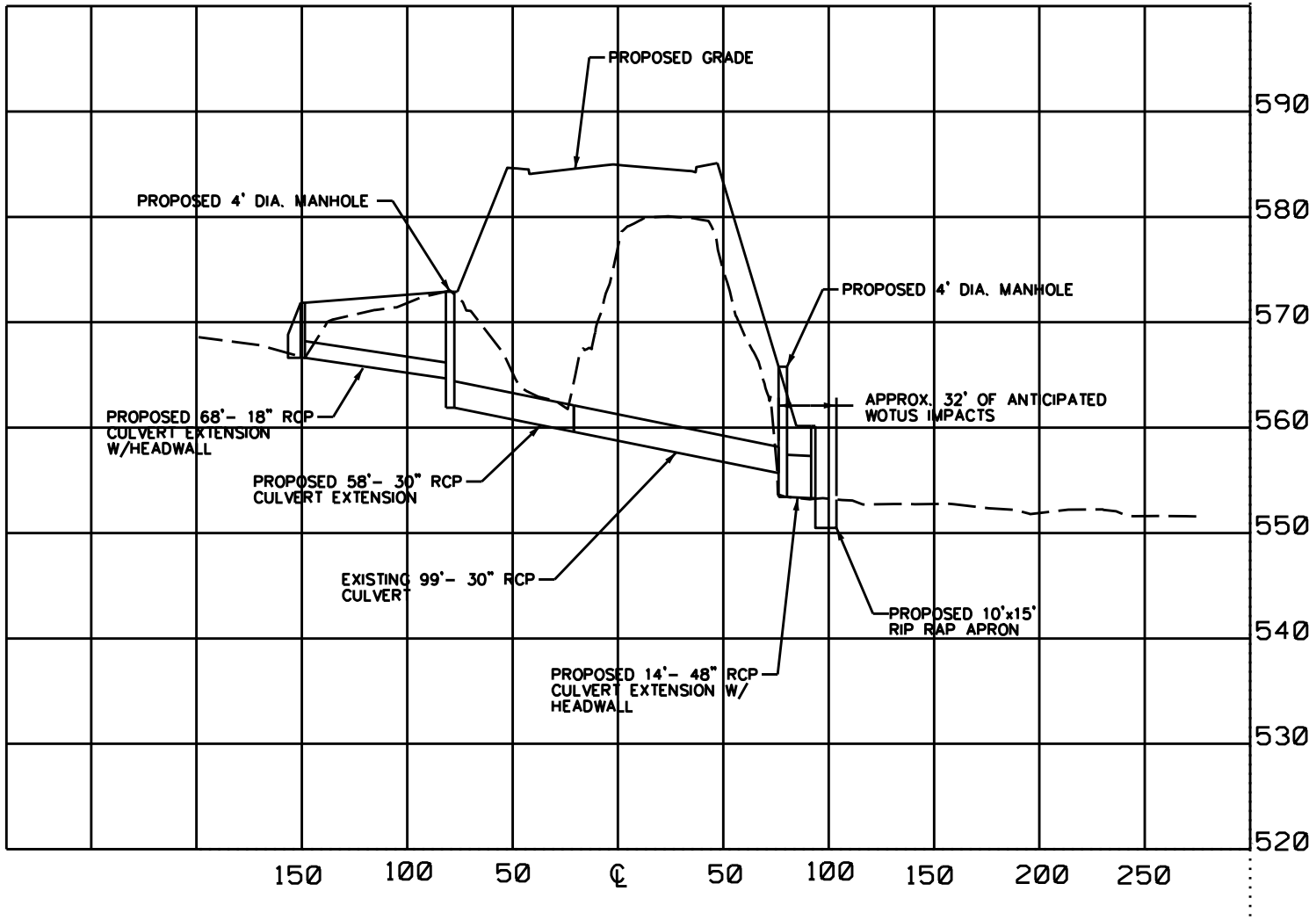
US 21 NORTH PHASE II
CROSS SECTION H - STA 197+46



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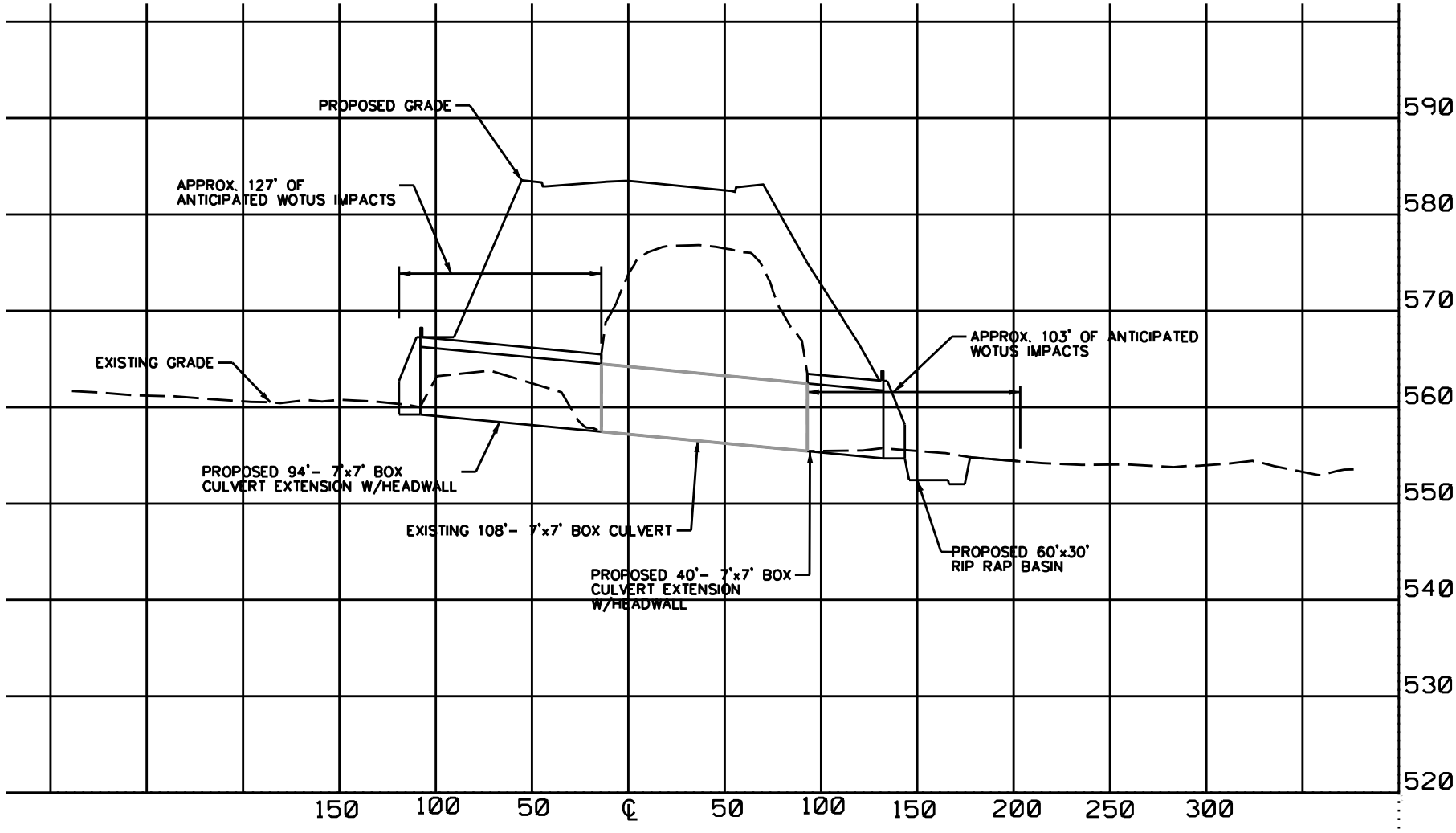
US 21 NORTH PHASE II
CROSS SECTION I - STA 194+87



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US 21 Phase I

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS

Factor	Options								
Stream Type *	Non-RPW 0.1			1st and 2nd Order RPWs 0.8			All Other Streams 0.4		
Priority Category	Tertiary 0.1			Secondary 0.4			Primary 0.6		
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75		Fully Functional 1.5		
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/Clear 0.05	Utility 0.15	Culvert 0.3	Armor 0.5	Dentention/Weir 0.75	Morphologic 1.5	Impound 2	Pipe 2.2	Fill 2.5
Cumulative Impact (lf)	< 50' 0.01	51-300' 0.1		301 - 500' 0.2		501 - 999' 0.4	1000 - 6000' 1.5	> 6000' 3	

Note: The cumulative impact factor for the overall project must be used in each reach column on the Required Mitigation Credits Worksheet below.

* Stream type does not include man-made features. These streams will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet US 21 Phase I

Factor	Tributary A Riprap	Tributary A Pipe	Tributary C Riprap	Tributary C Pipe	Tributary D Riprap	Tributary D Pipe
Stream Type	0.8	0.8	0.8	0.8	0.8	0.8
Priority Category	0.1	0.1	0.1	0.1	0.1	0.1
Existing Condition	0.75	0.75	0.75	0.75	0.75	0.75
Duration	0.3	0.3	0.3	0.3	0.3	0.3
Dominant Impact	0.5	2.2	0.5	2.2	0.5	2.2
Cumulative Impact	1.5	1.5	1.5	1.5	1.5	1.5
Sum of R Factors (R1)	**3.95**	**5.65**	**3.95**	**5.65**	**3.95**	**5.65**
Linear Feet Impact (LL1)	20	117	45	225	101	127
R x LL=	**79.0**	**661.1**	**177.8**	**1271.3**	**399.0**	**717.6**

Total Required Credits = (R x LL) = **3305.6**

US 21 Phase I

ADVERSE IMPACT FACTORS FOR WETLANDS

Factor	Options					
Lost Type	Type C 0.2		Type B 2.0		Type A 3.0	
Priority Category	Tertiary 0.5		Secondary 1.5		Primary 2.0	
Existing Condition	Very Impaired 0.1	Impaired 1.0		Partially Impaired 2.0		Fully Functional 2.5
Duration	0 to 1 year 0.2	1 to 3 years 0.5		3 to 5 years 1.0	5 to 10 years 1.5	Over 10 years 2.0
Dominant Impact	Shade 0.2	Clear 1.0	Drain 2.0	Dredge 2.5	Impound/Flood 2.5	Fill 3.0
Cumulative Impact (lf)	< 0.25 Acre 0.1	0.25 - 0.99 0.2		1.0 - 2.99 0.5	3.0 - 9.99 1.0	> 10.0 Acres 2.0

Note: The cumulative impact factor for the overall project must be used in each reach column on the Required Mitigation Credits Worksheet below.

Required Mitigation Credits Worksheet US 21 Phase I

Factor	Wetland E	Wetland F	Wetland F	Wetland G	Wetland G	
Lost Type	3	3	3	3	3	
Priority Category	0.5	0.5	0.5	0.5	0.5	
Existing Condition	2.0	2.0	2.0	2.0	2.0	
Duration	0.2	0.2	2.0	0.2	2.0	
Dominant Impact	1.0	1.0	3.0	1.0	3.0	
Cumulative Impact	0.2	0.2	0.2	0.2	0.2	
Sum of R Factors (R1)	**6.9**	**6.9**	**10.7**	**6.9**	**10.7**	**0**
Impact Area (AA)	0.001	0.037	0.029	0.007	0.025	
R x AA=	**0.007**	**0.255**	**0.310**	**0.048**	**0.268**	**0.000**

Factor						
Lost Type						
Priority Category						
Existing Condition						
Duration						
Dominant Impact						
Cumulative Impact						
Sum of R Factors (R1)	**0**	**0**	**0**	**0**	**0**	**0**
Impact Area (AA)						
R x AA=	**0**	**0**	**0**	**0**	**0**	**0**

Total Required Credits = (R xLL) = **0.8883**

US 21 Phase II

ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS

Factor	Options									
Stream Type *	Non-RPW 0.1			1st and 2nd Order RPWs 0.8			All Other Streams 0.4			
Priority Category	Tertiary 0.1			Secondary 0.4			Primary 0.6			
Existing Condition	Very Impaired 0.1		Impaired 0.5		Partially Impaired 0.75		Fully Functional 1.5			
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3			
Dominant Impact	Shade/Clear 0.05	Utility 0.15	Culvert 0.3	Armor 0.5	Dentention/Weir 0.75	Morphologic 1.5	Impound 2	Pipe 2.2	Fill 2.5	
Cumulative Impact (lf)	< 50' 0.01	51-300' 0.1		301 - 500' 0.2		501 - 999' 0.4	1000 - 6000' 1.5	> 6000' 3		

Note: The cumulative impact factor for the <u>overall</u> project must be used in each reach column on the Required Mitigation Credits Worksheet below.

* Stream type does not include man-made features. These streams will be evaluated on a case-by-case basis.

Required Mitigation Credits Worksheet US 21 Phase II

Factor	Tributary B Riprap	Tributary B Pipe	Tributary C Riprap	Tributary D Pipe	Tributary D Riprap	Tributary E Pipe
Stream Type	0.8	0.8	0.8	0.8	0.8	0.8
Priority Category	0.1	0.1	0.1	0.1	0.1	0.1
Existing Condition	0.75	0.75	0.75	0.75	0.75	0.75
Duration	0.3	0.3	0.3	0.3	0.3	0.3
Dominant Impact	0.5	2.2	0.5	2.2	0.5	2.2
Cumulative Impact	1.5	1.5	1.5	1.5	1.5	1.5
Sum of R Factors (R1)	**3.95**	**5.65**	**3.95**	**5.65**	**3.95**	**5.65**
Linear Feet Impact (LL1)	77	85	121	128	19	51
R x LL=	**304.2**	**480.3**	**478.0**	**723.2**	**75.1**	**288.2**

Factor	Tributary F Riprap	Tributary F Pipe				
Stream Type	0.8	0.8				
Priority Category	0.1	0.1				
Existing Condition	0.75	0.75				
Duration	0.3	0.3				
Dominant Impact	0.5	2.2				
Cumulative Impact	1.5	1.5				
Sum of R Factors (R1)	**3.95**	**5.65**	**0**	**0**	**0**	**0**
Linear Feet Impact (LL1)	97	165				
R x LL=	**383.2**	**932.3**	**0.0**	**0.0**	**0.0**	**0.0**

Total Required Credits = (R x LL) = **3664.2**

US 21 Phase II

ADVERSE IMPACT FACTORS FOR WETLANDS

Factor	Options					
Lost Type	Type C 0.2		Type B 2.0		Type A 3.0	
Priority Category	Tertiary 0.5		Secondary 1.5		Primary 2.0	
Existing Condition	Very Impaired 0.1	Impaired 1.0		Partially Impaired 2.0		Fully Functional 2.5
Duration	0 to 1 year 0.2	1 to 3 years 0.5		3 to 5 years 1.0	5 to 10 years 1.5	Over 10 years 2.0
Dominant Impact	Shade 0.2	Clear 1.0	Drain 2.0	Dredge 2.5	Impound/Flood 2.5	Fill 3.0
Cumulative Impact (lf)	< 0.25 Acre 0.1	0.25 - 0.99 0.2		1.0 - 2.99 0.5	3.0 - 9.99 1.0	> 10.0 Acres 2.0

Note: The cumulative impact factor for the overall project must be used in each reach column on the Required Mitigation Credits Worksheet below.

Required Mitigation Credits Worksheet US 21 Phase II

Factor	Wetland BB (Fill)	Wetland CC (Fill)	Wetland CC (Cut)	Wetland CC (Clearing)	Wetland FF (Fill)	Wetland FF (Cut)
Lost Type	3	3	3	3	3	3
Priority Category	0.5	0.5	0.5	0.5	0.5	0.5
Existing Condition	2.0	2.0	2.0	2.0	2.0	2.0
Duration	2.0	2.0	2.0	0.2	2.0	2.0
Dominant Impact	3.0	3.0	2.0	1.0	3.0	2.0
Cumulative Impact	0.2	0.2	0.2	0.2	0.2	0.2
Sum of R Factors (R1)	**10.7**	**10.7**	**9.7**	**6.9**	**10.7**	**9.7**
Impact Area (AA)	0.007	0.066	0.014	0.007	0.558	0.133
R x AA=	**0.075**	**0.706**	**0.136**	**0.048**	**5.971**	**1.290**

Factor	Wetland FF (Clearing)					
Lost Type	3					
Priority Category	0.5					
Existing Condition	2					
Duration	0.2					
Dominant Impact	1					
Cumulative Impact	0.2					
Sum of R Factors (R1)	**6.9**	**0**	**0**	**0**	**0**	**0**
Impact Area (AA)	0.1					
R x AA=	**0.69**	**0**	**0**	**0**	**0**	**0**

Total Required Credits = (R xLL) = 8.9159

OWNER NAME	MAILING ADDRESS	CITY/STATE	ZIP
JAMES ROSS MILLER JR	3685 HIGHWAY 51 N	FORT MILL SC	29715
MILLER CHARLES STEPHEN	3344 SCHOONER LN	CLOVER SC	29710
FAMILY LTD PARTNERSHIP	3685 HWY 51 N	FORT MILL SC	29715
MILLER JAMES ROSS &	3685 HWY 51	FORT MILL SC	29715
MILLER CHARLES STEPHEN ETAL	3344 SCHOONER LANE	CLOVER SC	29710
DFJ ENTERPRISES INC	1400 ROSEHILL DR	WAXHAW NC	28173
DAVIS DEIRDRE ANN & TRELLIS	7004 TEGA CAY DR	TEGA CAY SC	29708
DECOR-PRINT LLC	3581 ANDREW TUCKER RD UNIT 104	FORT MILL SC	29715
MIGHTY REALTY LLC	10915 DOWNS RD	PINEVILLE NC	28134
YANDINA HOLDINGS LLC	2764 PLEASANT RD #11405	FORT MILL SC	29708
HOLBEN PROPERTIES LLC	3581 ANDREW TUCKER RD STE 116	FORT MILL SC	29715
SHARON BUILDERS INC	PO BOX 2568	MATTHEWS NC	28106
LUNA INVESTMENTS LLC	3575 ANDREW L TUCKER RD STE100	FORT MILL SC	29715
LUNA INVESTMENTS LLC	3575 ANDREW L TUCKER RD	FORT MILL SC	29715
FMK MANAGEMENT LLC	3745 HIGHLAND CASTLE WAY	CHARLOTTE NC	28270
MONROE PROPERTY MANAGEMENT LLC	440 OCEANA WAY	CAROLINA BEACH NC	28428
WORLDWIDE VENTURES INC	3705 CENTER CIR	FORT MILL SC	29715
OMANRA INTERNATIONAL INC	6400 MORVEN LANE	CHARLOTTE NC	28270
FLEMING ANDREW ROBERT	481 FOREST WAY DR	FORT MILL SC	29715
SIMON & WATSON ENTERPRISES LLC	PO BOX 1327	FORT MILL SC	29716
CIRCLE B PROPERTIES LLC	PO BOX 607	FORT MILL SC	29716-0607
ENGLISH TRAILS HOMEOWNER ASSOC	PO BOX 4579 DEPT 207	HOUSTON TX	77210
TEAM PROPERTIES LP	2411 RIVER HILL RD	IRVING TEXAS	75061
RESOURCE PROPERTIES V ASSOC	1300 ALTURA RD	FORT MILL SC	29708
ZOLOTARYOV GENNADY & EMMA	14639 EAST GROVE DRIVE	PINEVILLE NC	28134
LATHAM CARL I III ETAL	PO BOX 10961	ROCK HILL SC	29731
3551 HWY 51 PROPERTY MGMT LLC	PO BOX 1325	PINEVILLE NC	28134-1325
YORK COUNTY	PO BOX 66	YORK SC	29745
VICK WILLIAM W	653 CARVERS FALLS RD	FAYETTEVILLE NC	28311
QUALITY POOLS GROUP INC	2508 DEVON DR	MONROE NC	28110
BROWN ENTERPRISES	PO BOX 7586	CHARLOTTE NC	28241
TAYLOR HORRY PROPERTIES LLC	411 WALNUT ST # 11779	GREEN CV SPGS FL	32043-3443
SILVER SPRINGHILL LLC	1805 SARDIS RD N STE 120	CHARLOTTE N C	28270
TAYLOR/YORK PROPERTIES LLC	411 WALNUT ST #11779	GREEN CV SPGS FL	32043-3443
194 SPRINGHILL FARMS RD LLC	400 PLAZA DR	SECAUCUS NJ	7096
CRUMP GEORGE	3500 HWY 51	FORT MILL SC	29715
MGD-SC REO LLC	2581 JUPITER PARK DR STE E16	JUPITER FL	33458
ATCF REO HOLDINGS LLC	150 S PINE ISLAND RD STE 430	PLANTATION FL	33324
CMJ FAIRFIELD RD LLC	4101 CHAIN BRIDGE RD #110	FAIRFAX VA	22030-4105
UNIQUE STONE CREATIONS INC	14315 DARIUS CT	CHARLOTTE NC	28273
SPARROW ROBERT CLAY	18341 ROYAL OAK RD	CHARLOTTE NC	28278-8719
GPT PARCEL C OWNER LLC	130 SOUTH JEFFERSON ST STE 300	CHICAGO IL	60661
S C DEPARTMENT OF TRANSPORTATION	955 PARK STREET	COLUMBIA SC	292011003
MCDONALDS REAL ESTATE COMPANY	PO BOX 182571	COLUMBUS OH	43218-2571
C&A PYRO LLC	5200 W 94TH TERRACE STE 114	PRAIRIE VILLAGE KS	66207
MONEYLINE PROPERTIES LLC	450 MEETING ST	CHARLESTON SC	72403-2107
CUTTER BRYANT W & NANCY L	123 BREVARD CT	CHARLOTTE NC	28202
HOF LLC	PO BOX 321	BLACKSBURG SC	29702
ARC PSFMLSC001	3473 US HWY 21	FORT MILL SC	29708
UNIQUE USA INC	104 WILLIAMSON ST	FORT MILL SC	29715
JUNG PROPERTIES LLC	2231 RICHARDSON DR	CHARLOTTE NC	28211
ALLSTATES CONSTRUCTION CO INC	6228 LAKE PROVIDENCE LN	CHARLOTTE NC	28277
PAPILLON LLC	1111 CENTRAL AVE STE 300	CHARLOTTE NC	28204
ALLSTATE CONSTRUCTION INC	PO BOX 78234	CHARLOTTE NC	28271
NARROWAY PRODUCTIONS INC	3386 HWY 21	FORT MILL SC	29715
NARROWAY PRODUCTIONS INC	3327 HWY 51	FORT MILL SC	29715
AUSTIN EUGENE TRUSTEE	238 CHAPMAN LOOP	PAWLEYS ISLAND SC	29585
COMPACT POWER EQUIPMENT INC	3326 HWY 51	FORT MILL SC	29715

OWNER NAME	MAILING ADDRESS	CITY/STATE	ZIP
HUDSON PROPERTY MANAGEMENT LLC	148 FLINT HILL RD	FORT MILL SC	29715
DAKA PROPERTIES LLC	12121 WILSHIRE BLVD STE 510	LOS ANGELES CA	90025
EXIT 68 LLC	PO BOX 3475 ATTN: LICENSING	TULSA OK	74101
COVINGTON DELANO BOYCE	449 FARM BRANCH RD	FORT MILL SC	29715
MSC CAROLINAS LLC	725 PARK CENTER DR	MATTHEWS NC	28105
ROSS DRESS FOR LESS INC	4440 ROSEWOOD DR	PLEASANTON CA	94588
STERLING YORK LLC	1616 CAMDEN RD STE 550	CHARLOTTE NC	28203
A & P CAR CARE CENTER INC	3215 HIGHWAY 21	FORT MILL SC	29715
WALKER CORP INC	3203 HWY 21	FORT MILL SC	29715
WALKER CORP INC	2026 GOLD HILL RD	FORT MILL SC	29708
WAL-MART TRS LLC	805 MOBERLY LN/PO BOX 8050	BENTONVILLE AR	72712-8050
RHODES JOSHUA C & SARAH ELLEN	3604 WHEAT ST	COLUMBIA SC	29205
CV HWY 21 LLC	PO BOX 36938	CHARLOTTE NC	28236
MCMEHAN GRADY E ETAL	3139 HWY 21 NORTH	FORT MILL SC	29715
GTA PROPERTIES LLC	2707 HUNTINGTOWNE FARMS LANE	CHARLOTTE NC	28210
FORT MILL CROWN PLAZA LLC	4707 SNAPDRAGON WAY	SAN LUIS OBISPO CA	93401
REGENT PARK COMM OWNERS ASSOC	4523 PARK RD SUITE 201A	CHARLOTTE NC	28237
HILLCREST FOODS INC	50 SATELLITE BLVD NW STE G	SUWANEE GA	30024-7105
CANBERRA HOLDINGS LLC &	600 GREEN VALLEY RD #202	GREENBORO NC	27408
NARRA NAGADURGAVANI	726 SOUTH CREEK RD	CHARLOTTE NC	28277
1ST PATRIOTS FEDERAL CREDIT	2760 HOME DEPOT BLVD	ROCK HILL SC	29730
TOWN SQUARE OWNERS ASSOC	PO BOX 38809	CHARLOTTE NC	28278
CITRO SALVATORE & PAULINE	3048 US 21	FORT MILL SC	29715
H & A ASSOCIATES LLC	3031 HWY 21	FORT MILL SC	29715
BAHERI MEHRDAD ALI	4323 APPLEGATE RD	CHARLOTTE NC	28209-2707
PATTERSON J WAYNE	3035 VERNON ST	FORT MILL SC	29715
WHITMIRE JAMES H ETAL	638 RELIANCE CT	FORT MILL SC	29708
NORRIS JOYCE G & JOHN L	3026 VERNON ST	FORT MILL SC	29715
AVANTI PROPERTIES LLC	358 GRINGLEY HILL RD	FORT MILL SC	29715
SONG SONGMIN & SANG HUI	5645 SAINT JAMES LN	YORK SC	29745
THE EUBANKS FAMILY LTD	4598 DEER RUN	ROCK HILL SC	29732
COLEY GRACE P AS TRUSTEE	PO BOX 85	BLACKSTOCK SC	29014
BWD INC	PO BOX 795	LINCOLNTON NC	28092
SHELDON CHRISTOPHER	12081 SPINNAKER DR	TEGA CAY SC	29708
AMERICAS FINEST CAR WASH II	1310 SOUTH TRYON ST STE 104	CHARLOTTE NC	28203
IVAC OF THE CAROLINAS REAL	2950 OLD NATION ROAD STE 4	FORT MILL SC	29715
IVAC OF THE CAROLINAS REAL	2950 OLD NATION RD	FORT MILL SC	29715
N & W SMITH PROPERTIES FAMILY	1452 MUSEUM RD	ROCK HILL SC	29732
CORBI MICHAEL	2910 OLD NATION RD	FORT MILL SC	29715
GARRISON HOMEPLACE FARM LLC	198 GARRISON FARM RD	FORT MILL SC	29715
CAHILL DAVID E	1729 CHANTILLY LANE	CHESTER SPRINGS PA	19425
STORE MASTER FUNDING V LLC	8800 N GAINEY CENTER DR STE300	SCOTTSDALE AZ	85258
YORK COUNTY	2833 OLD NATION RD	FORT MILL SC	29715
GATEWAY FORT MILL LLC	6701 CARMEL RD STE 118	CHARLOTTE NC	28226
FORT MILL TELEPHONE CO	2801 OLD NATION RD	FORT MILL SC	29715
FAIRWAY TOWNES OWNERS ASSOC	PO BOX 3340	FORT MILL SC	29716
EDWARDS RICHARD KENDRICK SR	251 GOLD HILL RD	FORT MILL SC	29715
FORT MILL SCHOOL DISTRICT NO.4	2233 DEERFIELD DR	FORT MILL SC	29715
EUBANKS DONNA D	1330 INDIA HOOK RD APT 529	ROCK HILL SC	29732
CORDELL WALTER LAWRENCE &	343 GOLD HILL RD	FORT MILL SC	29715
CORVAIA KATHLEEN	339 GOLD HILL RD	FORT MILL SC	29715
HALL RAYMOND C JR	291 GOLD HILL RD	FORT MILL SC	29715
TOON JASON	344 LAKESHORE DRIVE	FORT MILL SC	29715
MCCRAVEN CAROL W	300 LAKE SHORE DR	FORT MILL SC	29715
RP FM221 LLC	STE P-177	PHOENIX AZ	85028
GOMEZ JUAN ANTONIO SANCHEZ	221 FOREST DR	FORT MILL SC	29715
MEACHAM CASSANDRA MULLER	231 FOREST DR	FORT MILL SC	29715
SOTO-PICAZO CARLOS	674 BERNICE LN	RICHBURG SC	29729

OWNER NAME	MAILING ADDRESS	CITY/STATE	ZIP
WATFORD RUSSELL S & CLARA R	251 FOREST DRIVE	FORT MILL SC	29715
GONZALEZ MARIA DE LOURDES	261 FOREST DR	FORT MILL SC	29715
GARCIA SAMUEL JR	271 FOREST DR	FORT MILL SC	29715
NEWMAN MICHAEL D	281 FOREST DR	FORT MILL SC	29715
ASH BRYAN N	1503 WILLIAMS RD	FORT MILL SC	29715
BATES MARIE B & ROGER DENNIS	260 FERN FOREST COURT	FORT MILL SC	29715
FRANKLIN BRENDA C	4428 TURKEY LN	ROCK HILL SC	29730
BEAN DOROTHY J	271 FERN FOREST COURT	FORT MILL SC	29715
COALITION OF PRISON EVANGELIST	PO BOX 7404	CHARLOTTE NC	27242-7404
MACIAS ANTONIO & GREGORIA	270 AMELIA DR	FORT MILL SC	29715
HARLLEE MARY F & DAVID S	328 LAKEVIEW DR	FORT MILL SC	29715
HARLLEE DAVID STUART SR &	328 LAKEVIEW DRIVE	FORT MILL SC	29715
BUCHANAN MARK D TRUSTEE	343 LAKEVIEW DRIVE	FORT MILL SC	29715
YORK ELECTRIC COOPERATIVE INC	PO BOX 150	YORK SC	29745
TEBBS ALICE A	5212 SATTLER PL	SARASOTA FL	34232-2677
KEENAN ERMA JANE & BETTY JANE	109 AMELIA DR	FORT MILL SC	29715
SCOTT SHERRI LIFE ESTATE	279 AMELIA DR	FORT MILL SC	29715
SPRINGFIELD TOWN CENTER LLC	PO BOX 1777	FORT MILL SC	29716
SPRINGVIEW MEADOWS HOMEOWNERS	11121 CARMEL COMMONS BLVD	CHARLOTTE NC	28226
THORNE JONATHAN & CHELSEY L	1027 CRESCENT MOON DR	FORT MILL SC	29715
HUITT CHRISTINA B & JUSTIN D	1031 CRESCENT MOON DR	FORT MILL SC	29715
MARKUS DONNA M & WILLIAM PETER	1035 CRESCENT MOON DR	FORT MILL SC	29715
MANTEKAS SOTIRIOS & JANIE D	16622 ANSLEY WALK LN	CHARLOTTE NC	28277
MANTEKAS SOTIRIOS & JANICE	16622 ANSLEY WALK LANE	CHARLOTTE N C	28277
HARRIS TEETER PROPERTIES LLC	PO BOX 10100	MATTHEWS NC	28106-0100
NEW HORIZON ELECTRIC	PO BOX 1169	LAURENS SC	29360
FLINT HILL VOLUNTEER FIRE DEPT	1950 HWY 21 BYPASS	FORT MILL SC	29715
C4 HOLDINGS LLC	121 W TRADE ST STE 2550	CHARLOTTE NC	28202
RUTLEDGE LAND & REALTY LLC	1486 GREENWOOD LN	ROCK HILL SC	29730
HALL GEORGE H JR	1938 HWY 21 BY-PASS	FORT MILL SC	29715
HALL GEORGE H	1938 HWY 21 BY PASS	FORT MILL SC	29715
D & DG LLC	512 COOLEEWEE CT	FORT MILL SC	29715
BLACKSTOCK CEMETERY	3385 HWY 21	FORT MILL SC	29715

OWNER NAME	MAILING ADDRESS	CITY/STATE	ZIP
AMISUB OF SOUTH CAROLINA INC	PO BOX 92129	SOUTHLAKE TX	76092
BUCHANAN CLYDE E & JOHN T	1624 HWY 21 BYPASS	FORT MILL SC	29715
C4 HOLDINGS LLC	121 W TRADE ST STE 2550	CHARLOTTE NC	28202
CATO LAND DEVELOPMENT LLC	8100 DENMARK RD	CHARLOTTE NC	28273
CLEAR SPRINGS KINGSLEY LLC	PO BOX 1777	FORT MILL SC	29715
CLEAR SPRINGS LAND CO LLC	PO BOX 1777	FORT MILL SC	29715
CLEAR SPRINGS LAND CO LLC	951 MARKET ST STE 203	FORT MILL SC	29708
CLEAR SPRINGS SPRINGFIELD LLC	PO BOX 1777	FORT MILL SC	29716
CLOSE ANNE SPRINGS	PO BOX 1449	FORT MILL SC	29716
CLOSE FAMILY REAL ESTATE#2 LLC	PO BOX 1777	FORT MILL SC	29715
D & DG LLC	512 COOLEEWEE CT	FORT MILL SC	29715
FLINT HILL VOLUNTEER FIRE DEPT	1950 HWY 21 BYPASS	FORT MILL SC	29715
FORT MILL SCHOOL DIST# 4	2233 DEERFIELD DR	FORT MILL SC	29715
GASKIN JERALD E JR & OLIVA D	1718 HWY 21 BYPASS	FORT MILL SC	29715
HALL GEORGE H	1938 HWY 21 BYPASS	FORT MILL SC	29715
HART WILLIAM DEHLER	1750 HIGHWAY 21 BYPASS	FORT MILL SC	29715
LEROY SPRINGS & CO INC	PO BOX 1209	FORT MILL SC	29715
LEROY SPRINGS & CO INC	PO DRAWER 460	LANCASTER SC	29721
MANTEKAS SOTIRIOS & JANICE	16622 ANSLEY WALK LANE	CHARLOTTE NC	28277
MYERS RONALD R	1650 US HWY 21 N	FORT MILL SC	29715
NEW HORIZON ELECTRIC	PO BOX 1169	LAURENS SC	29360
RUTLEDGE LAND & REALTY LLC	1486 GREENWOOD LN	ROCK HILL SC	29730
SPRINGFIELD COMMERCIAL	PO BOX 1777	FORT MILL SC	29716
YORK ELECTRIC COOPERATIVE INC	PO BOX 150	YORK SC	29745
ZEK DEL CAUSAL LLC	9789 CHARLOTTE HWY	FORT MILL SC	29707

Appendix C

Receiving Waterbodies Map and Information

U.S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

The National Map US Topo

FORT MILL QUADRANGLE
SOUTH CAROLINA-NORTH CAROLINA
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 17S
10 000-foot ticks: South Carolina Coordinate System of 1983, North Carolina Coordinate System of 1983

Imagery.....NAIP, April 2009
Roads.....©2006-2010 Tele Atlas
Names.....GNIS, 2010
Hydrography.....National Hydrography Dataset, 2009
Contours.....National Elevation Dataset, 2011
Boundaries.....Census, IBWC, IBC, USGS, 1972 - 2010

UTM GRID AND 2011 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN. 7° 17' 129 MILS
GN 0° 2' 1 MILS

U.S. National Grid
100,000-m Square ID
NU
Grid Zone Designation
17S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with version 0.5.10 of the USGS US Topo Product Standard.
A metadata file associated with this product is draft version 0.5.16



QUADRANGLE LOCATION

Belmont	Charlotte West	Charlotte East
Lake Wylie	Fort Mill	Weddington
Rock Hill West	Rock Hill East	Catawba NE

ADJOINING 7.5' QUADRANGLES

ROAD CLASSIFICATION

Interstate Route	State Route
US Route	Local Road
Ramp	4WD

Interstate Route · US Route · State Route

FORT MILL, SC-NC
2011

Watershed and Water Quality Information

Healthy People Healthly Communities

Applicant Name: York County Pennies For Progress
Address: 110 FLINT HILL RD, FORT MILL, SC, 29715
MS4 Designation: Small MS4
Within Coastal Critical Area: No
Waterbody Name: Unnamed Trib

Permit Type: Construction
Latitude/Longitude: 35.082277 / -80.933846
Monitoring Station: CW-681
Water Classification (Provisional): FW
Entered Waterbody Name:

NH3N	Ammonia	CD	Cadmium	CR	Chromium
CU	Copper	HG	Mercury	NI	Nickel
PB	Lead	ZN	Zinc	DO	Dissolved Oxygen
PH	pH	TURBIDITY	Turbidity	ECOLI	Escherichia coli (Freshwaters)
FC	Fecal Coliform (Shellfish)	BIO	Macroinvertebrates (Bio)	TP	(Lakes) Phosphorus
TN	(Lakes) Nitrogen	CHLA	(Lakes) Chlorophyll a	ENTERO	Enterococcus (Coastal Waters)
HGF	Mercury (Fish Tissue)	PCB	PCB (Fish)		

Station	NH3N	CD	CR	CU	HG	NI	PB	ZN	DO	PH	TURBIDITY	ECOLI	FC	BIO	TP	TN	CHLA	ENTERO	HGF	PCB
CW-681	X	X	X	X	X	X	X	X	X	N	X	X	X	X	X	X	X	X	X	X

F = Standards full supported
N = Standards not supported
A = Assessed at upstream station
X = Parameter not assessed at station
WnTN = Within TMDL, parameter not supported
InTN = In TMDL, parameter not supported
WnTF = Within TMDL, parameter full supported
InTF = In TMDL, parameter full supported

PH - pH

In TMDL Watershed: Yes
TMDL Report No: 010-07
TMDL Site: CW-203
TMDL Parameter: Fecal
TMDL Document Link: https://www.scdhec.gov/sites/default/files/docs/HomeAndEnvironment/Docs/tmdl_steeleck_fc.pdf

Report Date: February 15, 2023

Appendix D

Erosion Control Standard Drawings

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER NO. 8858 EDWIN SYLVESTER EAGLE, II

SIGNATURE

MARCH 2, 2009
DATE

6			
5			
4			
3			
2			
1	3/2009	JBH	GENERAL REVISIONS
0	3/2008	DSO	GENERAL REVISIONS
#	DATE	CHK	DESCRIPTION

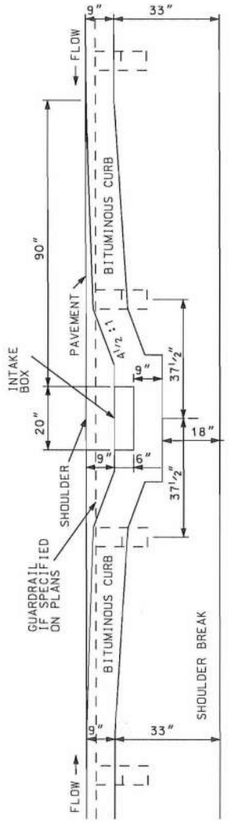
SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

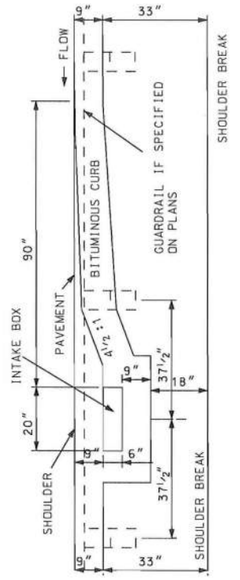
12" SLOPE DRAIN (METAL INTAKE SPILLWAY ASSEMBLY & BITUMINOUS CURB)

803-105-00

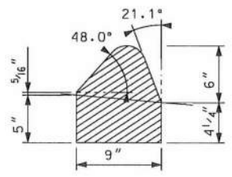
EFFECTIVE LETTING DATE: MAY, 2009



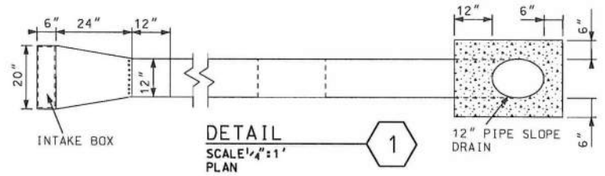
DETAIL 3
SCALE 1/4":1'
BITUMINOUS CURB CONSTRUCTION AT LOW POINT OF GRADE



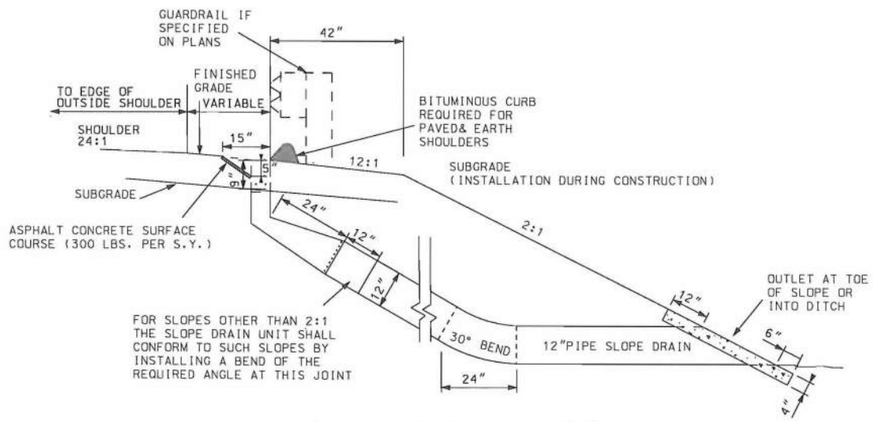
DETAIL 4
SCALE 1/4":1'
BITUMINOUS CURB CONSTRUCTION ON GRADE



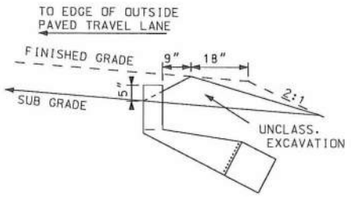
DETAIL 5
SCALE 3/4":1'
BITUMINOUS CURB



DETAIL 1
SCALE 1/4":1'
PLAN



DETAIL 2
SCALE 1/4":1'
SIDE ELEVATION (POSITION OF EXTENSION ASSEMBLY FOR FINISHED GRADE)



DETAIL 6
SCALE 1/4":1'
POSITION OF EXTENSION ASSEMBLY FOR SUBGRADE

NOTES:

1. 16 GAUGE ALUMINUM ALCLAD 3004 TO BE USED THROUGHOUT INTAKE SPILLWAY ASSEMBLY, FABRICATED FROM FLAT SMOOTH METAL. USE ALUMINUM OR GALVANIZED STEEL FASTENERS.

2. TELESCOPED SECTION OF BOX TO BE FABRICATED TO OBTAIN A SNUG FIT SECURED WITH SCREWS AS INDICATED.

3. CONCRETE CURB ADJACENT TO BRIDGES SHALL BE CONSTRUCTED AT A LOCATION THAT WILL NOT INTERFERE WITH FUTURE PLACEMENT OF GUARDRAIL.

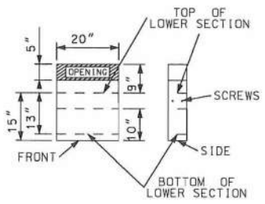
4. PIPE SLOPE DRAIN TO BE EXTENDED TO BERM DITCH WHERE THEY OCCUR, OTHERWISE, EXTEND TO GRADE POINT OF OUTLET DRAIN WITHIN RIGHT-OF-WAY.

5. END PROTECTORS SHALL BE CAST IN PLACE WITH CLASS 3000 OR BETTER CONCRETE.

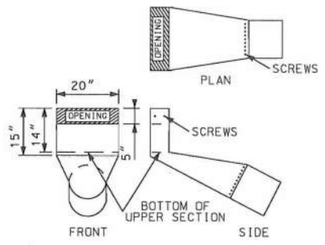
6. SURFACE COURSE TO BE PAID FOR IN THE UNIT CONTRACT PRICE BID FOR HOT MIX ASPHALT CONCRETE SURFACE COURSE. USE PAVEMENT MATERIAL TO MATCH ROADWAY PAVEMENT.

7. THE PAY ITEMS SHALL BE:

8035000 METAL INTAKE SPILLWAY ASSEMBLY_____EACH
8034120 12" PIPE SLOPE DRAIN_____L.F.
8036120 12" SLOPE DRAIN END PROTECTOR_____EACH
7211000 BITUMINOUS CURB_____L.F.
40303XX H/M ASPH.SURF.CR.(TYPE__)_____TON



DETAIL 7
SCALE 1/4":1'
METAL INTAKE SPILLWAY UPPER EXTENSION ASSEMBLY FABRICATE FOR SNUG FIT OVER LOWER ASSEMBLEY



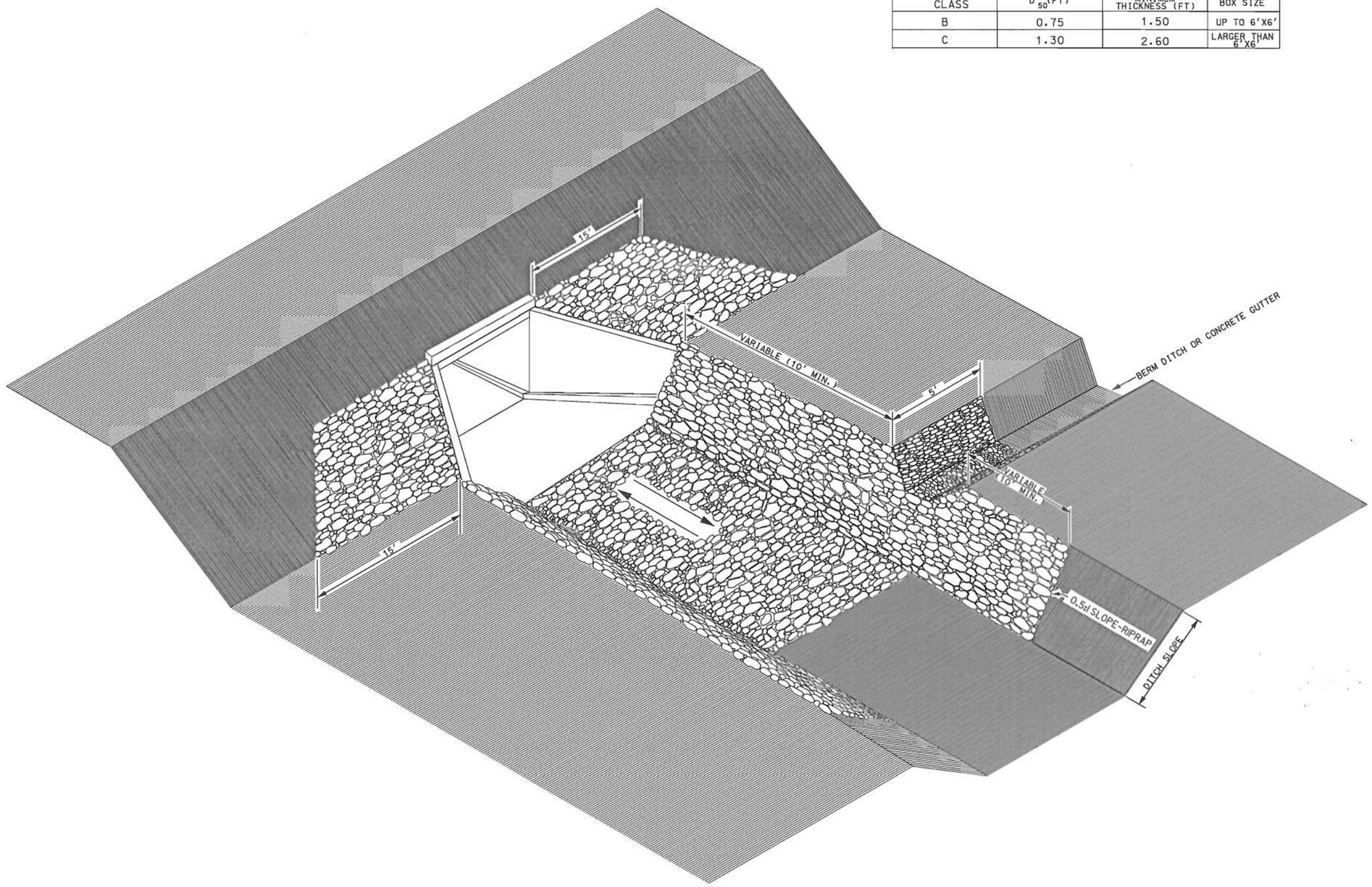
DETAIL 8
SCALE 1/4":1'
METAL INTAKE SPILLWAY LOWER EXTENSION ASSEMBLY

NOTES:

1. GEOTEXTILE FABRIC TO BE USED UNDER RIPRAP WHEN INCLUDED IN THE PLANS.
2. THE PAY ITEMS SHALL BE:
   RIPRAP - CLASS __ - _____TON
   GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP (CLASS I) TYPE __ - _____ S.Y.

CHART 804-205A
RIPRAP PLACEMENT

MINIMUM CLASS	D_{50}(FT)	MINIMUM THICKNESS (FT)	BOX SIZE
B	0.75	1.50	UP TO 6'X6'
C	1.30	2.60	LARGER THAN 6'X6'



THIS DRAWING IS NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER NO. 8858 EDWIN SYLVESTER EARGLE, II

SIGNATURE

MARCH 3, 2009
DATE

#	DATE	CHK	DESCRIPTION
6			
5			
4			
3			
2			
1	3/2009	DSO	CHANGED CHART 804-205A
0	3/2008	DSO	GENERAL REVISIONS

SCDOT

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

RIPRAP (BOX CULVERT)

804-205-00

EFFECTIVE LETTING DATE: MAY 2009

REFERENCES

NATIONAL DOCUMENTS

USDA NRCS ENGINEERING FIELD MANUAL

SCDOT DOCUMENTS

WQM

RELATED DRAWINGS & KEYWORDS

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

#	DATE	CHK	DESCRIPTION
6			
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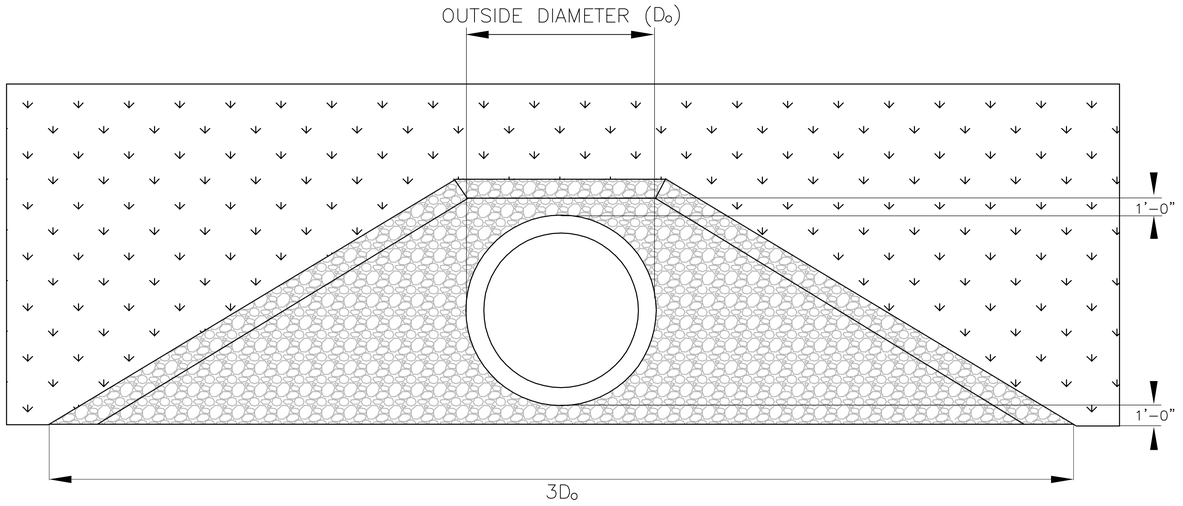
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

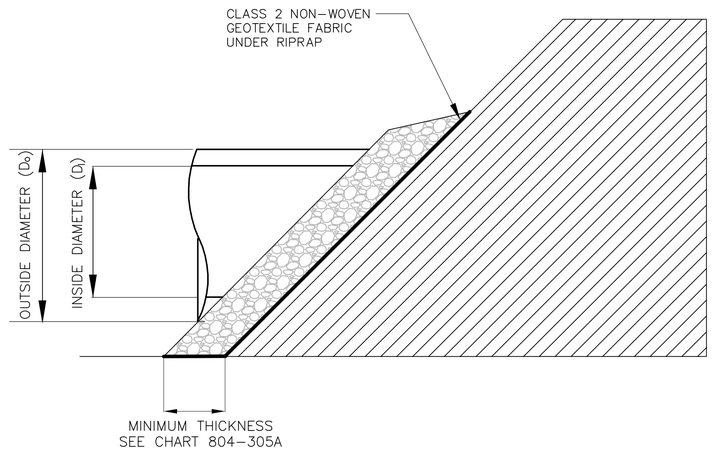
STANDARD DRAWING

OUTLET PROTECTION WITH NO DEFINED CHANNEL

804-305-01

EFFECTIVE LETTING DATE | JULY 2017





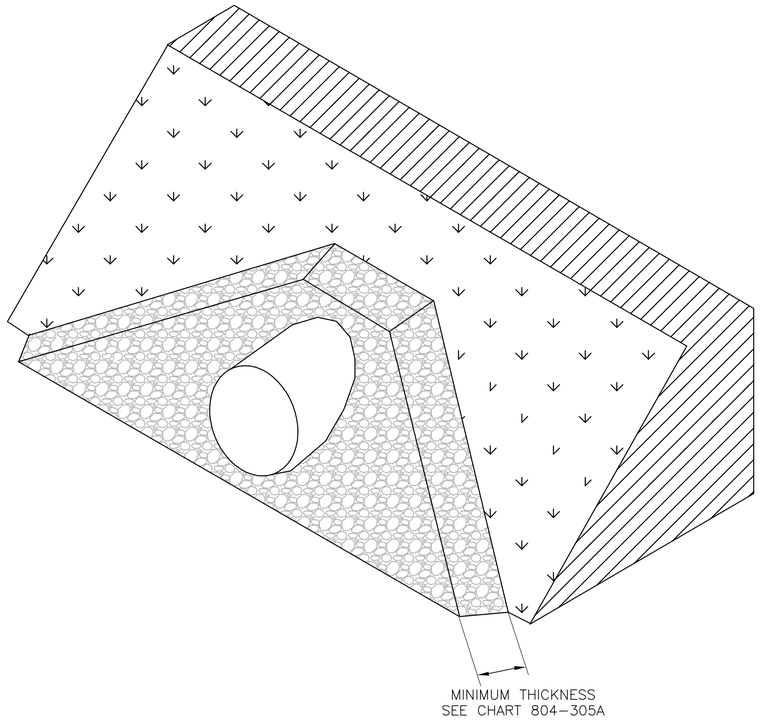


CHART 804-305A
SLOPE STABILIZATION RIPRAP PLACEMENT WITH MINIMUM TAILWATER

MINIMUM CLASS*	D_{50} (FT)	MINIMUM THICKNESS (FT)	OUTSIDE PIPE DIAMETER
A	0.50	1.00	UP TO 24"
B	0.75	1.50	UP TO 84"
C	1.30	2.60	LARGER THAN 84"

*WHEN RIPRAP APRON IS PRESENT, USE SAME CLASS OF RIPRAP ON SLOPE AS SPECIFIED FOR APRON. SEE DRAWING # 804-305-03 OR PLANS FOR APRON RIPRAP SPECIFICATIONS.

NOTES:

1) DESIGN OUTLET PROTECTION IN ACCORDANCE WITH THE SCDOT WATER QUALITY MANUAL.

2) OUTLET PROTECTION WILL HAVE A WIDTH THREE TIMES THE OUTSIDE DIAMETER OF THE OUTLET PIPE AT TOE OF SLOPE.

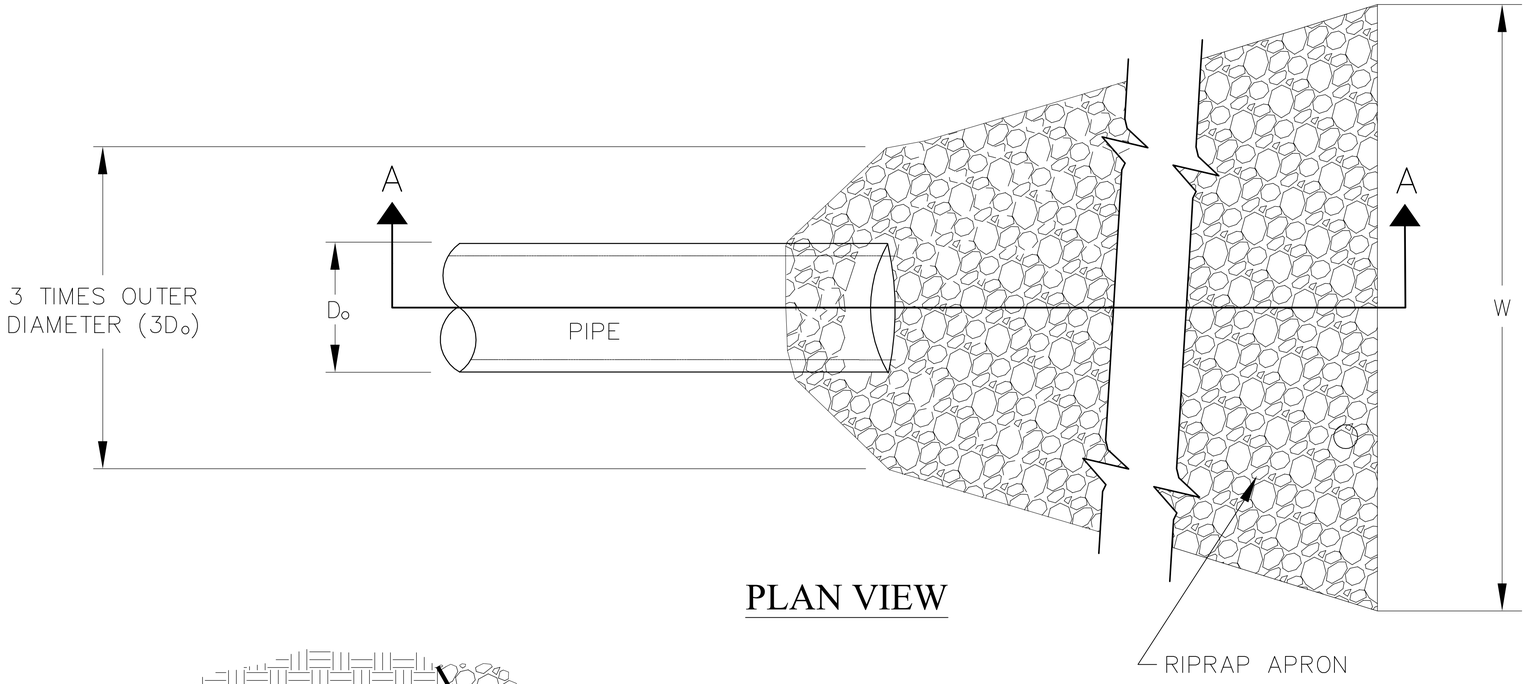
3) ADVANCE OUTLET PROTECTION UP THE SLOPE A MINIMUM OF 1 FOOT ABOVE TOP OF PIPE.

4) SEE DRAWINGS # 804-305-02 AND 804-305-03 FOR RIPRAP APRON DIMENSIONS.

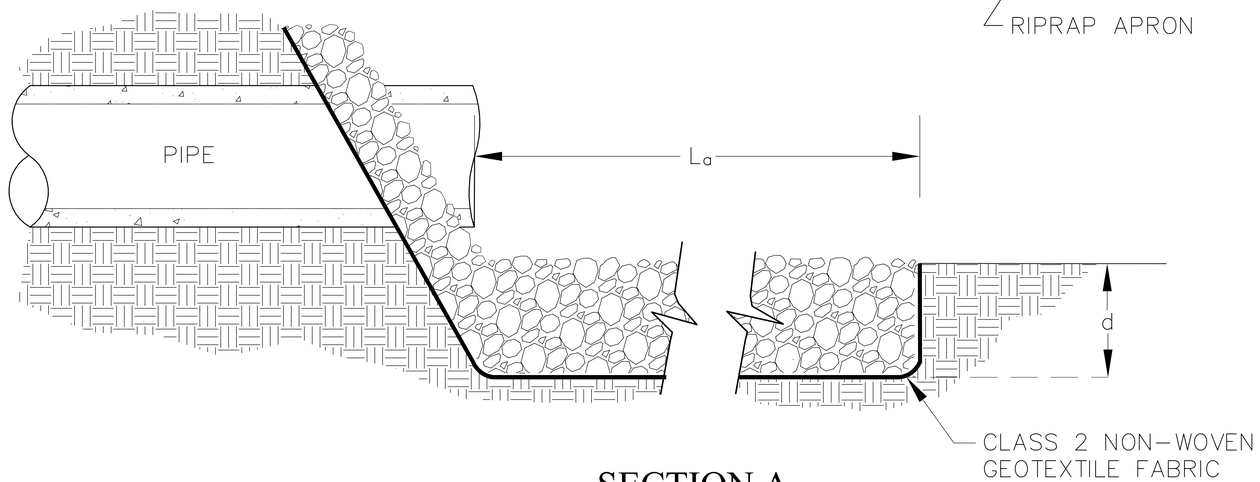
4) THE PAY ITEMS MAY INCLUDE:

2031000	UNCLASSIFIED EXCAVATION_____CY
8041010	RIPRAP (CLASS A)_____TON
8041020	RIPRAP (CLASS B)_____TON
8041030	RIPRAP (CLASS C)_____TON
8042800	GEOTEXTILE FABRIC FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)____SY
8151151	TURF REINFORCEMENT MATTING (TRM) TYPE 1_____SY
8151152	TURF REINFORCEMENT MATTING (TRM) TYPE 2_____SY
8151153	TURF REINFORCEMENT MATTING (TRM) TYPE 3_____SY

THIS DRAWING IS NOT TO SCALE



PLAN VIEW



SECTION A

NOTES:

1) L_a = THE LENGTH OF THE RIPRAP APRON.

2) W = WIDTH OF OUTLET PROTECTION AT END OF RIPRAP APRON.

3) D_o = OUTER DIAMETER OF OUTLET PIPE.

4) $3D_o$ = WIDTH OF OUTLET PROTECTION AT TOE OF SLOPE AT PIPE OUTLET.

5) SEE DRAWING # 804-305-03 OR PLANS FOR DIMENSIONS L_a, W, AND $3D_o$.

6) d = DEPTH OF RIPRAP = 2.0 TIMES THE MAXIMUM RIPRAP DIAMETER.

7) SEE DRAWING # 804-305-01 FOR RIPRAP SLOPE STABILIZATION AROUND PIPE.

THIS DRAWING IS NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

USDA NRCS ENGINEERING FIELD MANUAL

SCDOT DOCUMENTS

WQM

RELATED DRAWINGS & KEYWORDS

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

#	DATE	CHK	DESCRIPTION
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SCDOT

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

OUTLET PROTECTION WITH NO DEFINED CHANNEL

804-305-02

EFFECTIVE LETTING DATE | JULY 2017

REFERENCES

NATIONAL DOCUMENTS

USDA NRCS ENGINEERING FIELD MANUAL

SCDOT DOCUMENTS

WQM

RELATED DRAWINGS & KEYWORDS

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER NO. 21242 JAMES W. KENDALL, JR.

SIGNATURE

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DATE

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SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

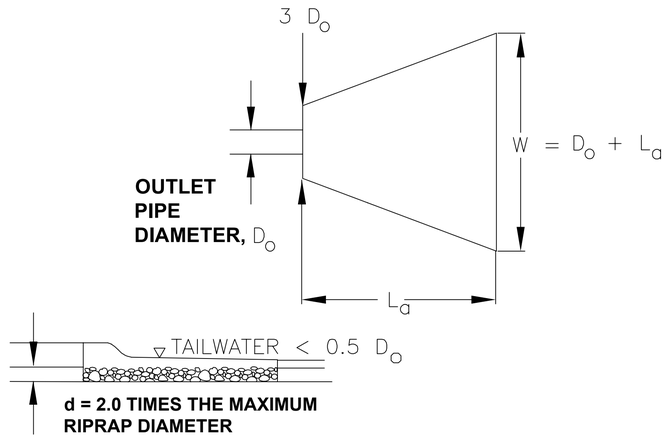
STANDARD DRAWING

OUTLET PROTECTION WITH NO DEFINED CHANNEL

804-305-03

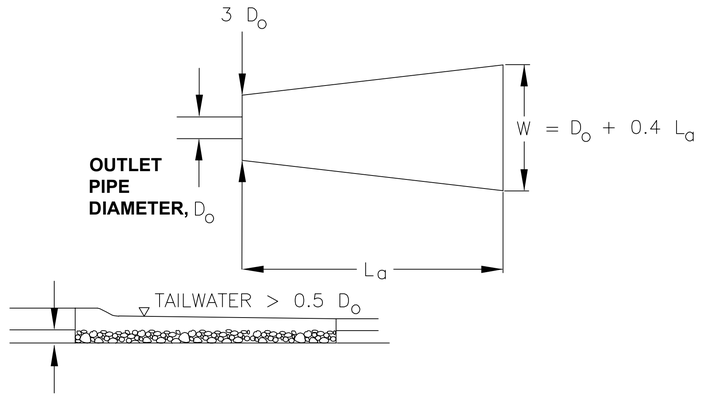
EFFECTIVE LETTING DATE | JULY 2017

PIPE OUTLET TO FLAT AREA WITH NO DEFINED CHANNEL MINIMUM TAILWATER CONDITION:



PIPE INSIDE DIAMETER (D_I) (FT)	MAX PIPE SLOPE	OUTLET PROTECTION DIMENSIONS			MIN RIPRAP CLASS	RIPRAP DEPTH (d) (FT)
		$3D_O$ (FT)	L_a (FT)	W (FT)		
1.5	≤ 1%	6	10	12	A	1.5
1.5	2%	6	14	16	A	1.5
1.5	5%	6	19	21	B	2.7
2.0	≤ 1%	8	14	17	A	1.5
2.0	2%	8	19	22	B	2.7
2.0	5%	8	26	29	B	2.7
2.5	≤ 1%	10	18	21	A	1.5
2.5	2%	10	25	28	B	2.7
2.5	5%	10	34	37	C	3.6
3.0	≤ 1%	12	24	28	B	2.7
3.0	2%	12	32	36	B	2.7
3.0	5%	12	42	46	C	3.6
3.5	≤ 1%	14	28	33	B	2.7
3.5	2%	14	37	42	C	3.6
3.5	5%	14	48	53	C	3.6
4.0	≤ 1%	16	33	38	B	2.7
4.0	2%	16	43	48	C	3.6

PIPE OUTLET TO FLAT AREA WITH NO DEFINED CHANNEL MAXIMUM TAILWATER CONDITON:



PIPE INSIDE DIAMETER (D_I) (FT)	MAX PIPE SLOPE	OUTLET PROTECTION DIMENSIONS			MIN RIPRAP CLASS	RIPRAP DEPTH (d) (FT)
		$3D_O$ (FT)	L_a (FT)	W (FT)		
1.5	≤ 1%	6	8	6	A	1.5
1.5	2%	6	23	11	A	1.5
1.5	5%	6	40	18	A	1.5
2.0	≤ 1%	8	14	8	A	1.5
2.0	2%	8	30	15	A	1.5
2.0	5%	8	55	25	B	2.7
2.5	≤ 1%	10	20	11	A	1.5
2.5	2%	10	39	19	A	1.5
2.5	5%	10	66	30	B	2.7
3.0	≤ 1%	12	27	15	A	1.5
3.0	2%	12	55	26	A	1.5
3.0	5%	12	91	40	C	3.6
3.5	≤ 1%	14	33	18	A	1.5
3.5	2%	14	66	31	B	2.7
3.5	5%	14	106	47	C	3.6
4.0	≤ 1%	16	42	22	A	1.5
4.0	2%	16	78	37	B	2.7

NOTES:

1) THESE TABLES ARE ONLY APPLICABLE FOR THE PIPE SIZES AND MAXIMUM PIPE SLOPES LISTED.

2) LARGER PIPES OR GREATER SLOPES REQUIRE ALTERNATIVE OUTLET PROTECTION DESIGN.

3) WHEN PLANS SPECIFY LARGER OR DIFFERENT OUTLET PROTECTION THAN SHOWN IN TABLES, INSTALL OUTLET PROTECTION PER THE PLANS.

4) SEE DRAWING # 804-305-02 FOR MORE INFORMATION ON OUTLET PROTECTION DIMENSIONS.

THIS DRAWING IS NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

WQM

RELATED DRAWINGS & KEYWORDS

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

#	DATE	CHK	DESCRIPTION
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SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

OUTLET PROTECTION WITH DEFINED CHANNEL

804–310–00

EFFECTIVE LETTING DATE | JULY 2017

THIS DRAWING IS NOT TO SCALE

CHART 804–310A
SLOPE STABILIZATION RIPRAP PLACEMENT WITH MINIMUM TAILWATER

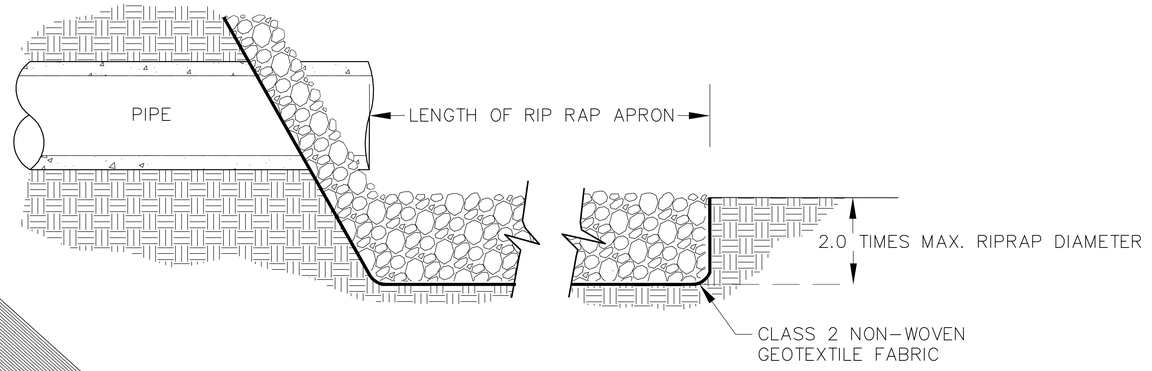
MINIMUM CLASS*	D_{50} (FT)	MINIMUM THICKNESS (FT)	OUTSIDE PIPE DIAMETER
A	0.50	1.00	UP TO 24"
B	0.75	1.50	UP TO 84"
C	1.30	2.60	LARGER THAN 84"

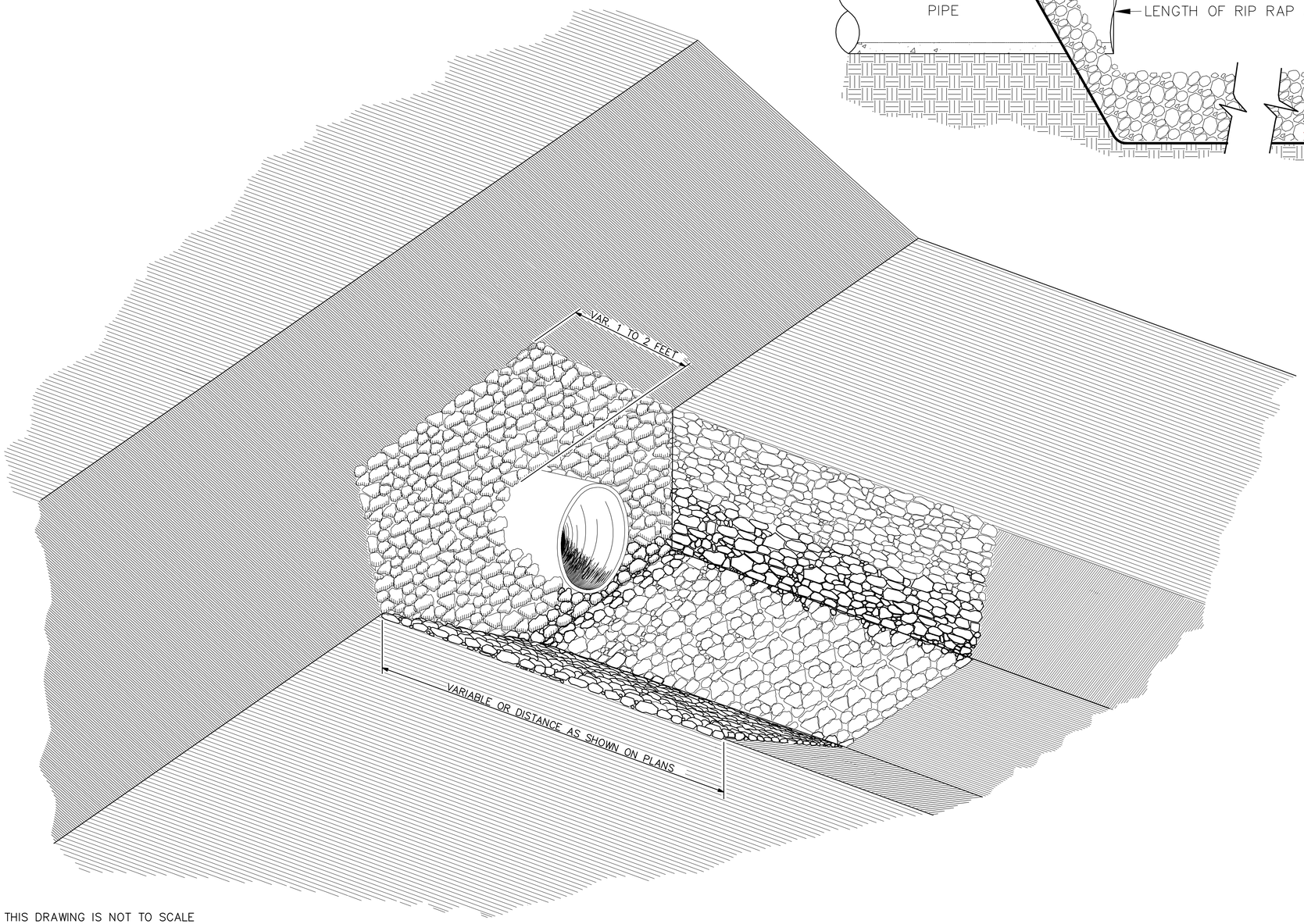
*WHEN RIPRAP CHANNEL IS PRESENT, USE SAME CLASS OF RIPRAP ON SLOPE AS SPECIFIED FOR CHANNEL ON THE PLANS.

NOTES:

1. CLASS 2 NON–WOVEN GEOTEXTILE FABRIC TO BE USED UNDER RIPRAP.
2. SEE STANDARD DRAWINGS SECTION 719–600–00 FOR ADDITIONAL PIPE END TREATMENT OPTIONS.
3. THE PAY ITEMS SHALL BE:

2031000	UNCLASSIFIED EXCAVATION_____CY
8041010	RIPRAP (CLASS A)_____TON
8041020	RIPRAP (CLASS B)_____TON
8041030	RIPRAP (CLASS C)_____TON
8042800	GEOTEXTILE FABRIC FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)___SY





REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-8
QPL 57

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 21242 JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016

DATE

5			
4			
3			
2	8/2016	DSO	GENERAL REVISIONS
1	8/2012	DSO	UPDATED DIMENSIONS AND NOTES
0	3/2008	DSO	GENERAL REVISIONS
#	DATE	CHK	DESCRIPTION

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TYPE A
INLET STRUCTURE
FILTERS

815-001-01

EFFECTIVE LETTING DATE | JUL 2017

THIS DRAWING IS NOT TO SCALE

INSTALLATION:

1. FILTER FABRIC IS USED FOR INLET PROTECTION WHEN STORMWATER FLOWS ARE RELATIVELY SMALL (1.0 CFS OR LESS) WITH LOW VELOCITIES, WHERE THE INLET DRAINS AREA HAS GRADES NO GREATER THAN 5% AND THE IMMEDIATE DRAINAGE AREA AROUND THE INLET (5 FOOT RADIUS) HAS GRADES LESS THAN 1%. DO NOT USE IN AREAS RECEIVING CONCENTRATED FLOW OR WHERE DITCHES ARE PAVED. A TRENCH SHALL BE EXCAVATED 6 INCHES WIDE AND 6 INCHES DEEP AROUND THE OUTER PERIMETER OF THE STAKES UNLESS FABRIC IS PNEUMATICALLY INSTALLED.

2. FILTER FABRIC SHALL CONFORM TO SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION (LATEST EDITION). FILTER FABRIC SHALL EXTEND A MINIMUM OF 12 INCHES INTO THE TRENCH. THE TRENCH SHALL BE BACKFILLED WITH SOIL OR CRUSHED STONE AND COMPACTED OVER THE FILTER FABRIC UNLESS FABRIC IS PNEUMATICALLY INSTALLED.

3. USE STEEL POSTS WITH A MINIMUM POST LENGTH OF 5 FEET CONSISTING OF STANDARD "T" SECTIONS WITH A WEIGHT OF 1.25 POUNDS PER FOOT (±8%). THE HEIGHT OF THE FILTER BARRIER ABOVE GROUND SHALL BE A MINIMUM OF 24 INCHES. POSTS SHALL BE SPACED AROUND THE PERIMETER OF THE INLET A MAXIMUM OF 2 FEET APART AND DRIVEN INTO THE GROUND A MINIMUM OF 24 INCHES. ATTACH FABRIC TO POSTS USING ONLY HEAVY DUTY PLASTIC TIES. ATTACH AT LEAST 4 EVENLY SPACED TIES IN A MANNER TO PREVENT SAGGING OR TEARING OF THE FABRIC.

4. FILTER FABRIC SHOULD BE IN A CONTINUOUS ROLL AND CUT TO THE LENGTH OF THE PROTECTED AREA TO AVOID THE USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER FABRIC SHOULD BE WRAPPED TOGETHER ONLY AT A SUPPORT POST WITH BOTH ENDS SECURELY FASTENED TO THE POST WITH A MINIMUM 6 INCH OVERLAP.

5. PROVIDE A FILTER FABRIC CAPABLE OF REDUCING EFFLUENT SEDIMENT CONCENTRATIONS BY NOT LESS THAN 80% UNDER TYPICAL SEDIMENT MIGRATION CONDITIONS.

INSPECTION AND MAINTENANCE:

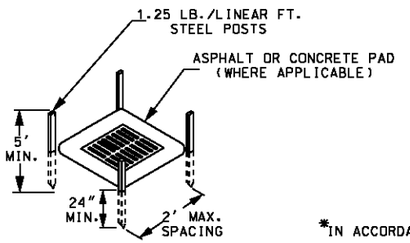
1. INSPECTIONS SHOULD BE MADE EVERY SEVEN (7) CALENDAR DAYS. ANY NEEDED REPAIRS SHOULD BE HANDLED IMMEDIATELY.

2. IF THE FABRIC BECOMES CLOGGED, IT SHOULD BE REPLACED.

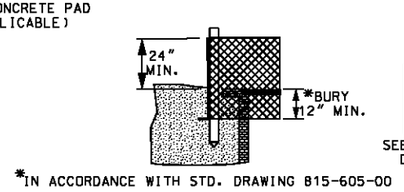
3. SEDIMENT SHOULD BE REMOVED WHEN IT REACHES APPROXIMATELY 1/3 THE HEIGHT OF THE FILTER FABRIC. IF A SUMP IS USED, SEDIMENT SHOULD BE REMOVED WHEN IT FILLS APPROXIMATELY 1/3 THE DEPTH OF THE HOLE. MAINTAIN THE POOL AREA, ALWAYS PROVIDING ADEQUATE SEDIMENT STORAGE VOLUME FOR THE NEXT STORM. TAKE CARE NOT TO DAMAGE OR UNDERCUT FABRIC WHEN REMOVING SEDIMENT. CLEANING INLET STRUCTURE FILTERS IS PAID FOR EACH (EA) FILTER CLEANED OF DEPOSITED SEDIMENT FROM THE AREA ADJACENT TO EACH INLET STRUCTURE FILTER.

4. STORM DRAIN INLET PROTECTION STRUCTURES SHOULD BE REMOVED ONLY AFTER THE DISTURBED AREAS ARE PERMANENTLY STABILIZED. REMOVE ALL CONSTRUCTION MATERIAL AND SEDIMENT, AND DISPOSE OF THEM PROPERLY. GRADE THE DISTURBED AREA TO DRAIN. USE APPROPRIATE PERMANENT STABILIZATION METHODS TO STABILIZE BARE AREAS AROUND THE INLET.

5. THE PAY ITEMS SHALL BE:
   8156219 INLET STRUCTURE FILTER TYPE A_____LF
   8154155 CLEANING INLET STRUCTURE FILTERS_____EA

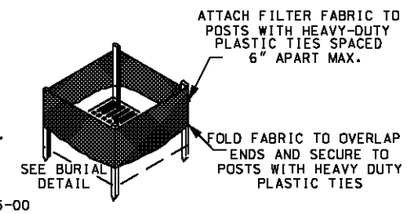


POST INSTALLATION DETAIL



*IN ACCORDANCE WITH STD. DRAWING 815-605-00

FILTER FABRIC BURIAL DETAIL



FILTER FABRIC INSTALLATION DETAIL

TYPE A
LOW FLOW INLET FILTERS
(FILTER FABRIC INLET PROTECTION)

INSTALLATION:

1. INSTALL SEDIMENT TUBES BY LAYING THEM FLAT ON THE GROUND. CONSTRUCT A SMALL TRENCH TO A DEPTH THAT IS 20% OF THE SEDIMENT TUBE DIAMETER. LAY THE SEDIMENT TUBE IN THE TRENCH AND COMPACT THE UPSTREAM SEDIMENT TUBE/SOIL INTERFACE. INSTALL ALL SEDIMENT TUBES SO NO GAPS EXIST BETWEEN THE SOIL AND THE BOTTOM OF THE SEDIMENT TUBE. LAP THE ENDS OF ADJACENT SEDIMENT TUBES A MINIMUM OF 6 INCHES TO PREVENT FLOW AND SEDIMENT FROM PASSING THROUGH THE FIELD JOINT. NEVER STACK SEDIMENT TUBES ON TOP OF ONE ANOTHER.

2. SHOULD SEDIMENT TUBE BECOME DAMAGED DURING INSTALLATION, PLACE A STAKE ON BOTH SIDES OF THE DAMAGED AREA TERMINATING THE TUBE SEGMENT AND INSTALL A NEW TUBE SEGMENT.

3. INSTALL SEDIMENT TUBES USING WOODEN STAKES WITH A MINIMUM POST LENGTH OF 4 FEET AND A MINIMUM MEASURED DIMENSION OF ¾" X ¾" AND A MAXIMUM MEASURED DIMENSION OF 2" X 2". OR USING STEEL POSTS (1.25lbs./linear foot). USE STEEL POSTS WITHOUT A SOIL PLATE AND PAINTING IS NOT REQUIRED. SPACE POSTS OR STAKES ON 2-FOOT CENTERS AND DRIVE THEM INTO THE GROUND TO A MINIMUM DEPTH OF 2 FEET. INSTALL THE STAKES ON THE DOWNSTREAM (1/3) OF THE SEDIMENT TUBE. ENSURE THE AREAS FOR STAKE INSTALLATION ARE COMPACTED SO THE POSTS ARE PROPERLY INSTALLED.

INSPECTION AND MAINTENANCE:

1. INSPECT SEDIMENT TUBES AFTER INSTALLATION FOR GAPS UNDER THE SEDIMENT TUBES AND FOR GAPS BETWEEN THE JOINTS OF ADJACENT ENDS OF SEDIMENT TUBES. REPAIR RILLS, GULLIES, AND ALL UNDERCUTTING NEAR SEDIMENT TUBES. INSPECT SEDIMENT TUBES EVERY 7 DAYS.

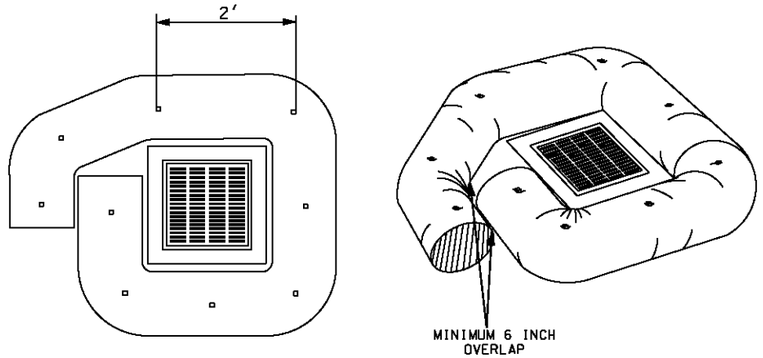
2. REMOVE SEDIMENT WHEN IT REACHES APPROXIMATELY ½ HEIGHT OF THE INLET STRUCTURE FILTER. IF A SUMP IS USED, REMOVE SEDIMENT WHEN IT FILLS APPROXIMATELY ½ THE DEPTH OF THE HOLE. MAINTAIN THE POOL AREA, ALWAYS PROVIDING ADEQUATE SEDIMENT STORAGE VOLUME FOR THE NEXT STORM EVENT. CLEANING INLET STRUCTURE FILTER IS PAID FOR EACH (EA) FILER CLEANED OF DEPOSITED SEDIMENT FROM THE AREA ADJACENT TO EACH INLET STRUCTURE FILTER.

3. REMOVE AND/OR REPLACE INSTALLED SEDIMENT TUBES AS REQUIRED TO ADAPT TO CHANGING CONSTRUCTION SITE CONDITIONS.

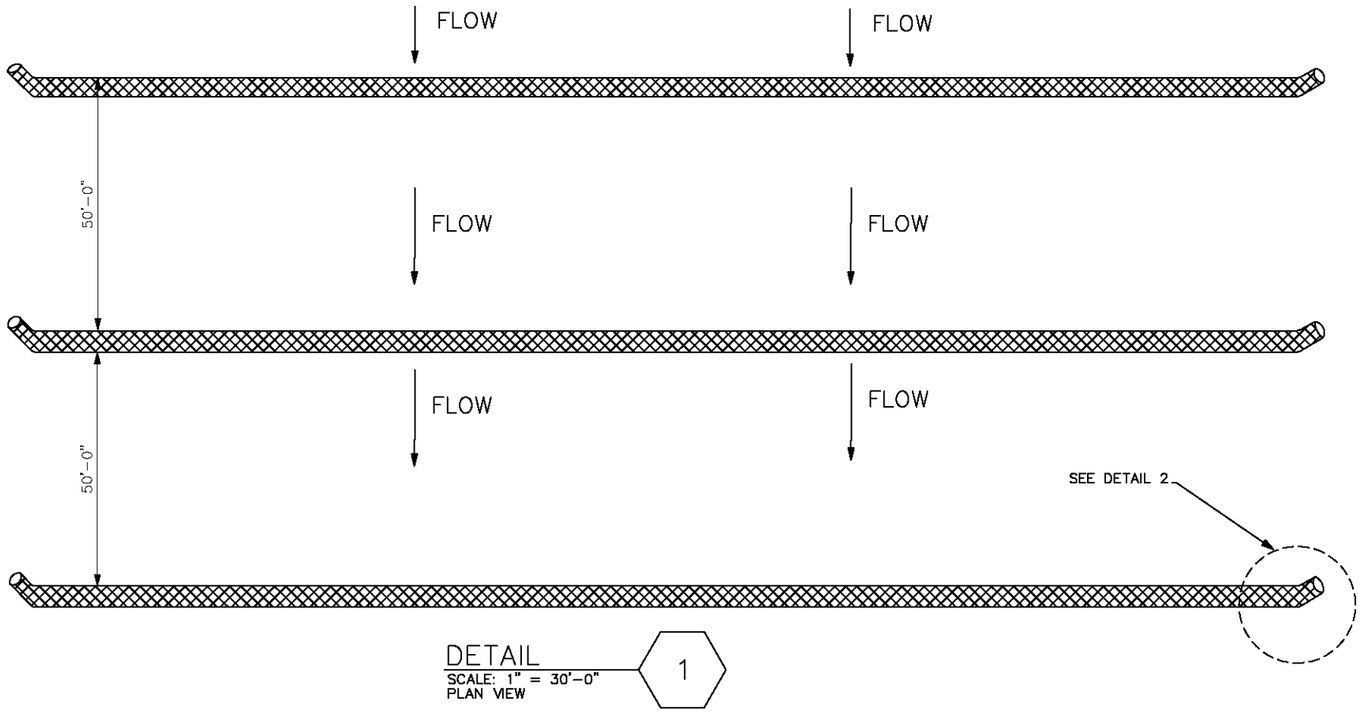
4. REMOVE ALL SEDIMENT TUBES FROM THE SITE WHEN THE FUNCTIONAL LONGEVITY IS EXCEEDED AS DETERMINED BY THE ENGINEER, INSPECTOR, OR MANUFACTURER'S REPRESENTATIVE.

5. DISPOSE OF SEDIMENT TUBES BY REGULAR MEANS AS NON-HAZARDOUS, INERT MATERIAL.

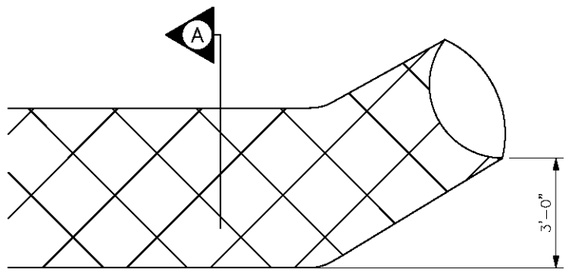
6. THE PAY ITEMS SHALL BE:
   8156219 INLET STRUCTURE FILTER TYPE A_____LF
   8154155 CLEANING INLET STRUCTURE FILTERS_____EA



TYPE A
LOW FLOW INLET FILTERS
(SEDIMENT TUBE INLET PROTECTION)



DETAIL 1
SCALE: 1" = 30'-0"
PLAN VIEW



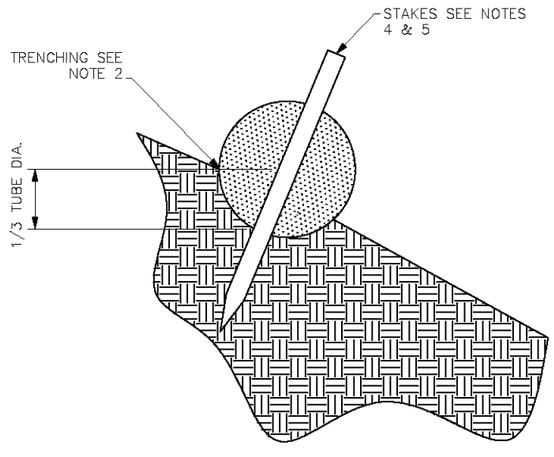
DETAIL 2

END VIEW OF TYPE F SLOPE INTERRUPTION DEVICE

THIS DRAWING IS NOT TO SCALE

NOTES:

1. INSTALL ALL NON-WEIGHTED INLET TUBES FOR SLOPE INTERRUPTION DEVICES FOR HECP APPLICATION PRIOR TO THE HECP INSTALLATION.
2. EXCAVATE A TRENCH ALONG (PARALLEL) THE CONTOUR OF THE SLOPE TO A DEPTH THAT IS ⅓ THE TUBE DIAMETER. PLACE THE EXCAVATED SOIL ON THE UP-SLOPE SIDE OF THE TRENCH. PLACE THE SLOPE INTERRUPTION DEVICE INTO THE TRENCH SO IT CONTOURS TO THE SOIL SURFACE, ENSURING NO GAPS EXISTS UNDERNEATH THE TUBE. COMPACT THE EXCAVATED SOIL AGAINST THE TUBE ON THE UP-SLOPE SIDE. ENSURE THE INSTALLATION OF THE SLOPE INTERRUPTION DEVICE DOES NOT DAMAGE THE PREPARED SEEDBED.
3. INSTALL NON-WEIGHTED INLET TUBES SLOPE INTERRUPTION DEVICES FOR ECB APPLICATION AFTER THE ECB INSTALLATION ON TOP OF THE ECB. TUBE TRENCHING IS NOT REQUIRED FOR ECB APPLICATIONS. ENSURE THE INSTALLATION OF THE SLOPE INTERRUPTION DEVICE DOES NOT DAMAGE THE INSTALLED ECB.
4. INSTALL NON-WEIGHTED INLET TUBE FOR SLOPE INTERRUPTION DEVICES USING WOODEN STAKES WITH A MINIMUM LENGTH OF 3' WITH A MINIMUM MEASURED DIMENSION OF ¾" X ¾" AND A MAXIMUM MEASURED DIMENSION OF 1" X 1". DO NOT USE STEEL POSTS FOR THIS APPLICATION . INSTALL A STAKE AT EACH END OF EACH TUBE AND SPACE STAKES ON MAXIMUM 4' CENTERS. DRIVE STAKES INTO THE GROUND PERPENDICULAR TO THE SLOPE TO A DEPTH OF 2' OR TO THE MAXIMUM EXTENT PRACTICABLE.
5. INSTALL THE STAKES THROUGH THE CENTER OF THE NON-WEIGHTED TUBE.
6. ABUT ADJACENT TUBES TIGHTLY, END TO END, WITHOUT OVERLAPPING THE ENDS. TIE THE TUBE ENDS TOGETHER USING HEAVY TWINE OR PLASTIC LOCKING TIES. TURN ENDS UP OF INTERRUPTION DEVICES UP SLOPE TO ENSURE CONTAINMENT AND THE PREVENTION OF CHANNELING OF RUNOFF.
7. ENSURE THE AREAS FOR POST INSTALLATION ARE COMPACTED SO THE POSTS ARE PROPERLY INSTALLED.
8. PAY SHALL BE:
   8152006 INLET STRUCTURE FILTER TYPE F (nonweighted)_____ LF



SECTION A
TYPE F SLOPE INTERRUPTION DEVICE CROSS SECTION

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS
SC-M-815-8
QPL 58

RELATED DRAWINGS & KEYWORDS

THIS DRAWING IS ONLY VALID FOR CONSTRUCTION WHEN SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. CHECK WWW.SCDOT.ORG FOR LATEST UPDATE.

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

#	DATE	CHK	DESCRIPTION
6	---	---	---
5	---	---	---
4	---	---	---
3	---	---	---
2	---	---	---
1	8/2016	DSO	3 TYPOS; 1 PAY #
0	8/2012	DSO	NEW DRAWING

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TYPE F SLOPE INTERRUPTION DEVICE

815-001-02
EFFECTIVE LETTING DATE JUL 2017

GENERAL NOTES:

1. THESE ARE APPLICABLE FOR INLETS WITH PEAK FLOW RATES LESS THAN 3 CFS WHERE THE INLET DRAIN AREA HAS GRADES LESS THAN 5%. FLOW VELOCITIES TO THE INLET MAY NOT EXCEED 3 FEET PER SECOND. USE THESE WHERE OVERFLOW CAPACITY IS NOT REQUIRED TO PREVENT EXCESSIVE PONDING AROUND THE STRUCTURE.

INSTALLATION:

1. HARDWARE FABRIC, OR COMPARABLE WIRE MESH, WITH A MAXIMUM OF 0.5 INCH X 0.5 INCH OPENINGS SHALL BE USED AS THE SUPPORTING MATERIAL AND SHALL BE EXTENDED A MINIMUM 6 INCHES INTO THE GROUND.

2. POSTS SHALL BE 1.25 LB./LINEAR FOOT STEEL POSTS WITH A MINIMUM POST LENGTH OF 48 INCHES. THE HEIGHT OF THE HARDWARE FABRIC ABOVE GRADE SHALL BE A MINIMUM OF 18 INCHES.

3. THE STEEL POSTS SHALL BE SPACED A MAXIMUM OF 2 FEET APART AROUND THE PERIMETER OF THE INLET AND DRIVEN INTO THE GROUND A MINIMUM OF 18 INCHES.

4. HEAVY DUTY WIRE TIES SPACED A MAXIMUM OF 6 INCHES APART SHALL BE USED TO ATTACH THE HARDWARE FABRIC MATERIAL TO THE STEEL POSTS.

5. THE STONE SHALL CONSIST OF AGGREGATE NO. 5 OR NO. 57 WASHED STONE AND SHALL EXTEND TO A MINIMUM HEIGHT OF 12 INCHES AND SHALL NOT EXCEED 24 INCHES AGAINST ALL 4 SIDES OF THE HARDWARE FABRIC.

INSPECTION AND MAINTENANCE:

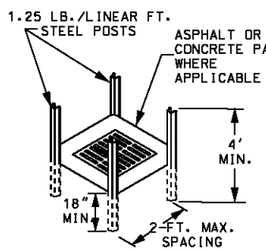
1. INSPECTIONS SHOULD BE MADE EVERY SEVEN (7) CALENDAR DAYS. ANY NEEDED REPAIRS SHOULD BE HANDLED IMMEDIATELY.

2. SEDIMENT SHOULD BE REMOVED WHEN IT REACHES APPROXIMATELY 1/3 THE HEIGHT OF THE STRUCTURE. IF A SUMP IS USED, SEDIMENT SHOULD BE REMOVED WHEN IT FILLS APPROXIMATELY 1/3 THE DEPTH OF THE HOLE. MAINTAIN THE POOL AREA, ALWAYS PROVIDING ADEQUATE SEDIMENT STORAGE VOLUME FOR THE NEXT STORM. CLEANING INLET STRUCTURE FILTERS IS PAID FOR EACH (EA) FILTER CLEANED OF DEPOSITED SEDIMENT FROM THE AREA ADJACENT TO EACH INLET STRUCTURE FILTER.

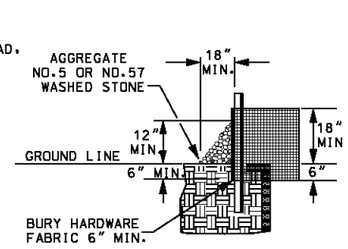
3. IF THE STONE BECOMES CLOGGED WITH SEDIMENT, THE STONES MUST BE PULLED AWAY FROM THE INLET AND CLEANED OR REPLACED. SINCE CLEANING OF GRAVEL AT A CONSTRUCTION SITE MAY BE DIFFICULT, AN ALTERNATIVE APPROACH WOULD BE TO REMOVE THE CLOGGED STONE AS FILL AND PUT FRESH STONE AROUND THE INLET. NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE FOR THIS WORK.

4. STORM DRAIN INLET PROTECTION STRUCTURES SHOULD BE REMOVED ONLY AFTER THE DISTURBED AREAS ARE PERMANENTLY STABILIZED. REMOVE ALL CONSTRUCTION MATERIAL AND SEDIMENT, AND DISPOSE OF THEM PROPERLY. GRADE THE DISTURBED AREA TO DRAIN. STABILIZE ALL BARE AREAS IMMEDIATELY.

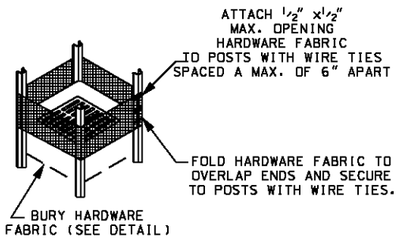
5. THE PAY ITEMS SHALL BE:
   8156210 INLET STRUCTURE FILTER TYPE B_____EA
   8154155 CLEANING INLET STRUCTURE FILTERS_____EA



POST INSTALLATION DETAIL



STONE AND HARDWARE FABRIC INSTALLATION DETAIL



HARDWARE FABRIC AND STONE INLET PROTECTION

TYPE B
MEDIUM FLOW, LOW VELOCITY INLET FILTERS

THIS DRAWING IS NOT TO SCALE

GENERAL NOTES:

TYPE D INLET FILTERS ARE APPLICABLE FOR DRAINAGE AREAS UP TO 2 ACRES WITH PEAK FLOW RATES GREATER THAN 3 CFS AND DRAINAGE AREAS WITH GRADES GREATER THAN 5%. FLOW VELOCITIES MAY EXCEED 3 FEET PER SECOND. HIGH FLOW, HIGH VELOCITY INLET FILTERS ARE PREFABRICATED AND WILL DIFFER ACCORDING TO THE TYPE OF DRAIN BEING PROTECTED.

THEY EXHIBIT THE FOLLOWING PROPERTIES:

1) COMPOSED OF A GEOTEXTILE FABRIC CONNECTED TO A RIGID STRUCTURE. THE GEOTEXTILE FABRIC IS NON-BIODEGRADABLE, RESISTANT TO DEGRADATION BY ULTRAVIOLET EXPOSURE, AND RESISTANT TO CONTAMINANTS COMMONLY ENCOUNTERED IN STORMWATER.

2) PROVIDE A RIGID STRUCTURE RESISTANT TO DEGRADATION BY ULTRAVIOLET EXPOSURE AND RESISTANT TO CONTAMINANTS COMMONLY ENCOUNTERED IN STORMWATER. PROVIDE A RIGID STRUCTURE THAT IS REUSABLE. DO NOT USE RIGID STRUCTURES COMPOSED OF STEEL, REBAR, CONCRETE OR WOOD.

3) PROVIDE A FILTER FABRIC CONSTRUCTED TO PROVIDE A DIRECT FIT ADJACENT TO THE ASSOCIATED RIGID STRUCTURE AND IS CAPABLE OF REDUCING EFFLUENT SEDIMENT CONCENTRATIONS BY NOT LESS THAN 80% UNDER TYPICAL SEDIMENT MIGRATION CONDITIONS.

4) HIGH FLOW, HIGH VELOCITY INLET FILTERS HAVE A TWO STAGE DESIGN. THE FIRST STAGE CONVEYS NORMAL FLOWS AT A MINIMUM CLEAN WATER FLOW RATE OF 100 GALLONS PER MINUTE PER SQUARE FOOT. THE SECOND STAGE CONVEYS HIGH FLOW RATES, WITH A MINIMUM APPARENT OPENING OF 0.5 INCH PER SQUARE INCH (NUMBER 12 STANDARD SIEVE OPENING).

5) TYPE D1 INLET FILTERS HAVE A FIRST STAGE MINIMUM HEIGHT OF 9 INCHES AND A MAXIMUM HEIGHT OF 12 INCHES IN ORDER TO ALLOW GREATER OVERFLOW CAPACITY AND PREVENT PONDING IN THE MEDIAN.

6) TYPE D2 INLET STRUCTURE FILTERS USED FOR SUMP APPLICATIONS HAVE A FIRST STAGE MINIMUM HEIGHT OF 12" AND A FIRST STAGE MAXIMUM HEIGHT OF 30" IN ORDER TO ALLOW GREATER PONDING IN THE SUMP.

7) HIGH FLOW, HIGH VELOCITY INLET FILTERS COMPLETELY SURROUND THE INLET.

8) HIGH FLOW, HIGH VELOCITY INLET FILTERS HAVE LIFTING DEVICES OR STRUCTURES TO ASSIST IN THE INSTALLATION AND TO ALLOW INSPECTION OF THE STORMWATER SYSTEM.

9) INLET STRUCTURE FILTER TYPE D1 IS TO BE USED IN MEDIAN APPLICATIONS, WHILE TYPE D2 IS TO BE USED IN SUMP APPLICATIONS. TYPE D1 INLET STRUCTURE FILTERS WILL HAVE GREATER OVERFLOW CAPACITY AND LESS FILTRATION AREA THAN TYPE D2 IN ORDER TO PREVENT PONDING IN THE MEDIANS. BOTH TYPES OF THESE INLET FILTERS ARE CAPABLE OF PROTECTING INLET STRUCTURES NOT ASSOCIATED WITH CURB INLETS AND MAY INCLUDE BUT ARE NOT LIMITED TO CATCH BASIN TYPE 9, YARD INLETS, DI 24 INCHES BY 24 INCHES, DI 24 INCHES BY 36 INCHES, AND MANHOLES.

INSTALLATION:

1. INSTALL TYPE D INLET FILTERS IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTALLATION INSTRUCTIONS. SECURE TYPE D INLET FILTERS WITH #5 OR #57 STONE AS BALLAST IN LIEU OF SOIL WHEN SOIL IS RECOMMENDED BY THE MANUFACTURER. PROPERLY INSTALL TYPE D INLET FILTERS SO THE INLET IS COMPLETELY ENCLOSED.

INSPECTION AND MAINTENANCE:

1. INSPECT AFTER INSTALLATION TO INSURE THAT NO GAPS EXIST THAT MAY PERMIT SEDIMENT TO ENTER THE STORM DRAIN SYSTEM.

2. INSPECTIONS SHOULD BE MADE EVERY SEVEN (7) CALENDAR DAYS. ANY NEEDED REPAIRS SHOULD BE HANDLED IMMEDIATELY.

3. SEDIMENT SHOULD BE REMOVED WHEN IT REACHES APPROXIMATELY 1/3 THE HEIGHT OF THE FILTERS. CLEANING INLET STRUCTURE FILTERS IS PAID FOR EACH (EA) FILTER CLEANED OF DEPOSITED SEDIMENT FROM THE AREA ADJACENT TO EACH INLET STRUCTURE FILTER.

4. CLEAN THE RIGID INLET PROTECTION FILTER MATERIAL WHEN IT BECOMES COVERED OR CLOGGED WITH DEPOSITED SEDIMENT.

5. REPLACE THE RIGID INLET PROTECTION FILTER MATERIAL AS DIRECTED BY THE ENGINEER.

6. THE PAY ITEMS SHALL BE:
   8156205 INLET STRUCTURE FILTER TYPE D1_____D1_____EA
   8156207 FILTER MATERIAL FOR INLET STRUCTURE FILTER TYPE D1_____EA
   8156215 INLET STRUCTURE FILTER TYPE D2_____D2_____EA
   8156217 FILTER MATERIAL FOR INLET STRUCTURE FILTER TYPE D2_____EA
   8154155 CLEANING INLET STRUCTURE FILTERS_____EA

REFERENCES

NATIONAL DOCUMENTS

ASTM D1117-99

SCDOT DOCUMENTS

SC-M-815-8
QPL 58

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
No. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016

DATE

5			
4			
3			
2	8/2016	DSO	GENERAL REVISIONS
1	8/2012	DSO	UPDATED NOTES AND DETAIL
0	3/2008	DSO	GENERAL REVISIONS
#	DATE	CHK	DESCRIPTION

SCDOT

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TYPE B, D1, & D2 INLET STRUCTURE FILTERS

815-002-00

EFFECTIVE LETTING DATE JUL 2017

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-8
QPL 58

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
No. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016

DATE

#	DATE	CHK	DESCRIPTION
5			
4			
3	11/2016	DSO	GENERAL REVISIONS
2	8/2016	DSO	GENERAL REVISIONS
1	8/2012	DSO	ADDED AND UPDATED NOTES
0	3/2008	DSO	GENERAL REVISIONS

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

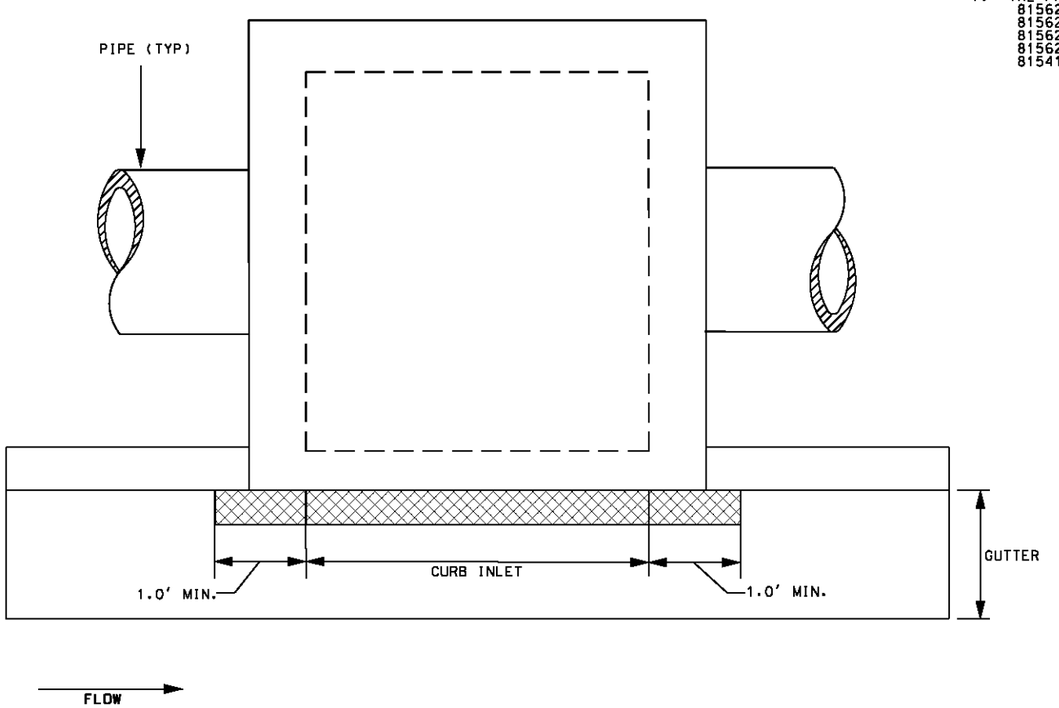
STANDARD DRAWING

TYPE E INLET STRUCTURE FILTERS

815-005-00

EFFECTIVE LETTING DATE | JUL 2017

THIS DRAWING IS NOT TO SCALE



TOP VIEW

NOTES:

1. DRAWING SHOWS TYPE 16 CATCH BASIN. TYPE E INLET STRUCTURE FILTERS ARE APPLICABLE FOR CATCH BASIN TYPE 1, 16, 17, AND 18 AFTER THE ROAD SURFACE COURSE IS PLACED.

2. PLACE CURB INLET FILTER AS SHOWN IN AREA WHERE SEDIMENT MAY SPILL OVER SIDEWALK AND CURB AFTER BASE IS PLACED.

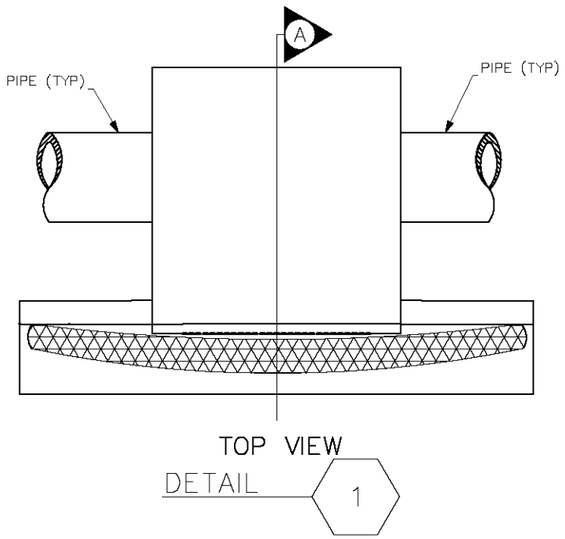
3. PROVIDE A TYPE E SURFACE COURSE INLET FILTER COMPOSED OF A UNIFORM FILTER FABRIC COVERING AN INTERNAL FILTER MATERIAL WHICH HAS AGGREGATE COMPARTMENTS FOR STONE, SAND OR OTHER WEIGHTED MATERIALS, OR PHYSICAL MECHANISMS TO HOLD THE UNIT IN PLACE. FURNISH A TYPE E SURFACE COURSE INLET FILTER THAT HAS A MAXIMUM HEIGHT THAT DOES NOT COMPLETELY BLOCK THE INLET OPENING AND A MINIMUM LENGTH THAT IS 2' LONGER THAN THE LENGTH OF THE CURB OPENING FOR FILTERS THAT DO NOT USE A PHYSICAL MECHANISM TO HOLD THE UNIT IN PLACE. DO NOT COMPLETELY BLOCK THE INLET OPENING WITH TYPE E SURFACE COURSE FILTERS TO ENSURE OVERFLOW CAN ENTER THE INLET OPENING.

4. PROVIDE A TYPE E SURFACE COURSE INLET FILTER COMPOSED OF A UNIFORM FILTER FABRIC THAT IS NON-BIODEGRADABLE AND RESISTANT TO DEGRADATION BY ULTRAVIOLET EXPOSURE AND RESISTANT TO CONTAMINANTS COMMONLY ENCOUNTERED IN STORMWATER. PROVIDE A TYPE E SURFACE COURSE INLET FILTER WITH FILTER MATERIAL THAT ALLOW STORMWATER TO FREELY FLOW WHILE TRAPPING SEDIMENT AND DEBRIS. ENSURE THAT THE FILTER MATERIAL IS RESISTANT TO CONTAMINANTS COMMONLY ENCOUNTERED IN STORMWATER. DO NOT USE STRAW BALES, PINE BALES, LEAF MULCH, OR GRASS CLIPPINGS AS FILTER MATERIALS.

5. WHEN A TYPE E SURFACE COURSE INLET FILTER UTILIZES A RIGID STRUCTURE, PROVIDE A REUSABLE RIGID STRUCTURE RESISTANT TO DEGRADATION BY ULTRAVIOLET EXPOSURE AND RESISTANT TO CONTAMINANTS COMMONLY ENCOUNTERED IN STORMWATER. DO NOT USE RIGID STRUCTURES COMPOSED OF STEEL, RE-BAR, CONCRETE OR WOOD.

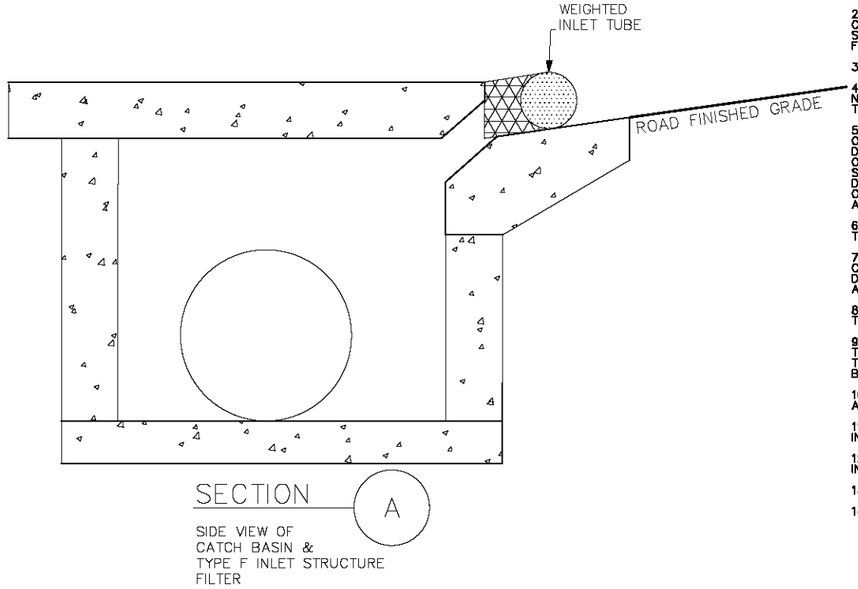
6. PONDING IS LIKELY IF SEDIMENT IS NOT REMOVED REGULARLY. INSPECTION OF CURB INLET FILTER SHOULD BE MADE EVERY SEVEN (7) CALENDAR DAYS. ANY NEEDED REPAIRS SHOULD BE HANDLED IMMEDIATELY. THE CURB INLET FILTER SHOULD BE CLEANED IF A VISUAL INSPECTION SHOWS SILT AND DEBRIS BUILT UP AROUND THE FILTER. CLEANING INLET STRUCTURE FILTERS IS PAID FOR EACH (EA) FILTER CLEANED OF DEPOSITED SEDIMENT FROM THE AREA ADJACENT TO EACH INLET STRUCTURE FILTER.

7. THE PAY ITEMS SHALL BE:
   - 8156211 INLET STRUCTURE FILTER - TYPE E (CATCH BASIN TYPE 1)_____EA
   - 8156212 INLET STRUCTURE FILTER - TYPE E (CATCH BASIN TYPE 16)_____EA
   - 8156213 INLET STRUCTURE FILTER - TYPE E (CATCH BASIN TYPE 17)_____EA
   - 8156214 INLET STRUCTURE FILTER - TYPE E (CATCH BASIN TYPE 18)_____EA
   - 8154155 CLEANING INLET STRUCTURE FILTERS_____EA



TOP VIEW

DETAIL 1



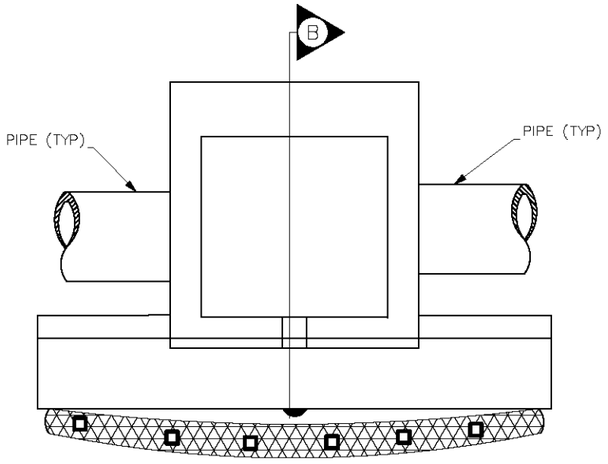
SECTION A

SIDE VIEW OF
CATCH BASIN &
TYPE F INLET STRUCTURE
FILTER

WEIGHTED INLET TUBE

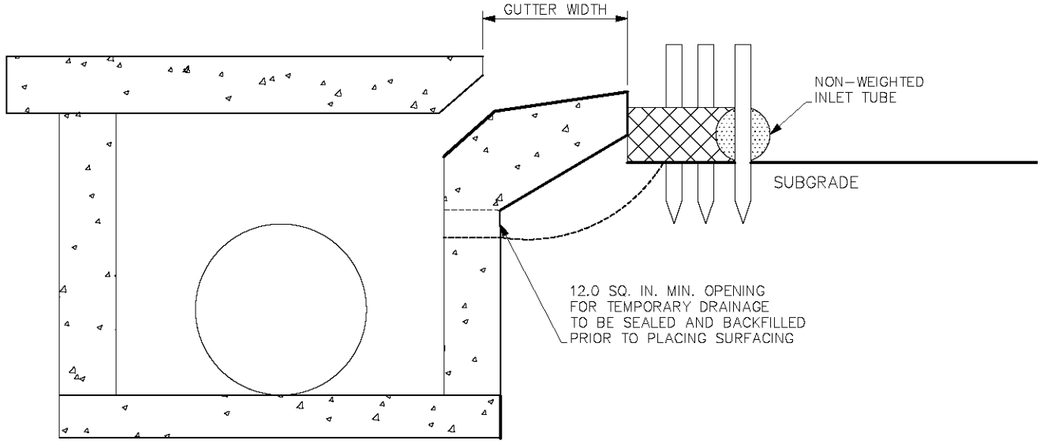
NOTES:

1. DRAWING SHOWS TYPE 16 CATCH BASIN.
2. NON-WEIGHTED TUBES SHALL BE INSTALLED IMMEDIATELY AFTER GRADING AND CONSTRUCTION OF CATCH BASIN BOX. NON-WEIGHTED TUBES SHALL BE MAINTAINED DURING SUBGRADE AND BASE PREPARATION UNTIL BASE COURSE IS PLACED. THEY ARE APPLICABLE FOR CATCH BASIN TYPES 1, 16, 17, AND 18 WITH DRAINAGE AREAS LESS THAN 1 ACRE.
3. INLET TUBES MAY BE TEMPORARILY MOVED DURING CONSTRUCTION AS NEEDED.
4. CONSTRUCT A SMALL U-SHAPED TRENCH TO A DEPTH THAT IS 20% OF THE NON-WEIGHTED INLET TUBE DIAMETER. LAY THE INLET TUBE FLAT IN THE U-SHAPED TRENCH AND COMPACT THE UPSTREAM INLET TUBE SOIL INTERFACE.
5. INSTALL NON-WEIGHTED INLET TUBES USING WOODEN STAKES WITH A MINIMUM LENGTH OF 3 FEET AND A MINIMUM MEASURED DIMENSION OF 3/4" X 3/4" AND A MAXIMUM MEASURED DIMENSION 2" X 2", OR 1.25 POUNDS PER FOOT STEEL POSTS WITH A MINIMUM LENGTH OF 3 FEET. USE STEEL POSTS WITHOUT A SOIL PLATE AND PAINTING IS NOT REQUIRED. SPACE POSTS OR STAKES ON 2 FOOT CENTERS AND DRIVE THEM INTO THE GROUND TO A MINIMUM DEPTH OF 2 FEET. INSTALL NON-WEIGHTED INLET TUBES SO THAT THE TOP IS BELOW THE TOP OF THE INSTALLED CURB LINE TO ENSURE THAT ALL OVERFLOW OR OVERTOPPING WATER HAS THE ABILITY TO ENTER THE INLET UNOBSTRUCTED.
6. PLACE STAKES ON THE DOWNSTREAM SIDE OF THE NON-WEIGHTED INLET TUBE. REFER TO MANUFACTURER'S RECOMMENDATION FOR OTHER STAKING DETAILS.
7. AFTER ROAD BASE COURSE IS PLACED, WEIGHTED INLET TUBES SHALL BE PLACED FOR CATCH BASIN TYPES 1, 9, 12, 14, 15, 16, 17, & 18, DI 24 INCHES X 24 INCHES, DI 24 INCHES X 36 INCHES, MANHOLES, AND TRENCH DRAINS. WEIGHTED INLET TUBES ARE APPLICABLE WHERE CONSTRUCTION TRAFFIC MAY OCCUR AROUND THE INLET.
8. INSTALL WEIGHTED INLET TUBES LYING FLAT ON THE GROUND WITH NO GAPS BETWEEN THE UNDERLYING SURFACE AND THE TUBE.
9. DO NOT COMPLETELY BLOCK INLETS WITH INLET TUBES. INSTALL WEIGHTED INLET TUBES IN SUCH A MANNER THAT ALL OVERFLOW CAN ENTER THE INLET UNOBSTRUCTED. TO AVOID POSSIBLE FLOODING, 2 OR 3 CONCRETE CINDER BLOCKS MAY BE PLACED BETWEEN THE WEIGHTED INLET TUBE AND THE INLET.
10. FOR WEEP HOLE APPLICATIONS, BOTH WEIGHTED AND NON-WEIGHTED INLET TUBES ARE APPLICABLE.
11. ALL WEIGHTED TYPE F INLET STRUCTURE FILTERS ARE APPLICABLE AS TYPE E INLET STRUCTURE FILTERS.
12. REPLACE INLET TUBES DURING INSTALLATION AS DIRECTED BY THE ENGINEER, INSPECTOR, OR MANUFACTURER'S REPRESENTATIVE AT THE CONTRACTOR'S EXPENSE.
13. ALL TYPE F INLET FILTERS SHALL BE INSPECTED EVERY 7 CALENDAR DAYS.
14. THE PAY ITEMS SHALL BE:
    - 8152004 INLET STRUCTURE FILTER TYPE F (WEIGHTED)_____LF
    - 8152006 INLET STRUCTURE FILTER TYPE F (NON-WEIGHTED)_____LF
    - 8154155 CLEANING INLET STRUCTURE FILTERS_____EA



TOP VIEW

DETAIL 2



SECTION B

SIDE VIEW OF
CATCH BASIN &
TYPE F INLET STRUCTURE
FILTER

NON-WEIGHTED INLET TUBE

THIS DRAWING IS NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-8
QPL 58

RELATED DRAWINGS & KEYWORDS

THIS DRAWING IS ONLY VALID FOR CONSTRUCTION WHEN SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA. CHECK WWW.SCDOT.ORG FOR LATEST UPDATE.

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

#	DATE	CHK	DESCRIPTION
6	---	---	---
5	---	---	---
4	---	---	---
3	---	---	---
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1	8/2016	DSO	TYPOS; PAY #
0	8/2013	DSO	UPDATED DRAWING

SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TYPE F
INLET STRUCTURE
FILTERS

815-006-00

EFFECTIVE LETTING DATE JUL 2017

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

RELATED DRAWINGS & KEYWORDS

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SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

09/30/2016

DATE

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0	8/2016	DSO	UPDATE

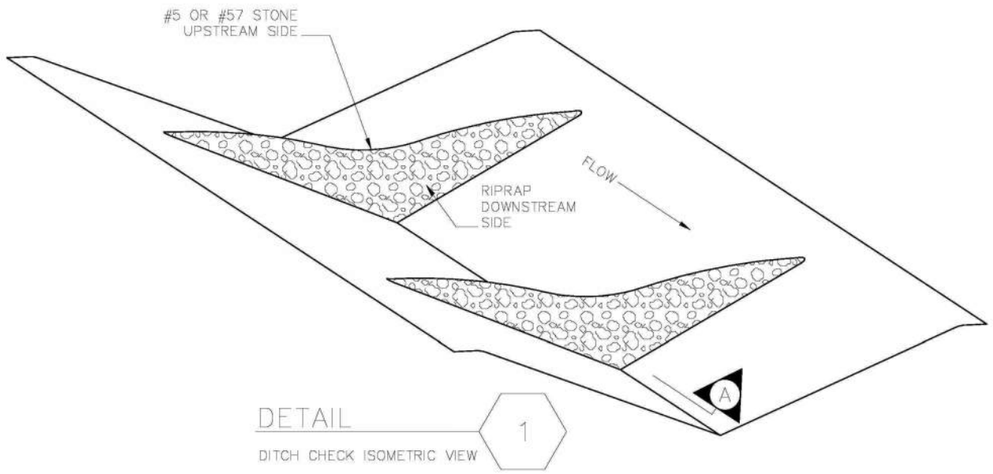
SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

DITCH CHECK

815-105-00

EFFECTIVE LETTING DATE: JULY, 2017

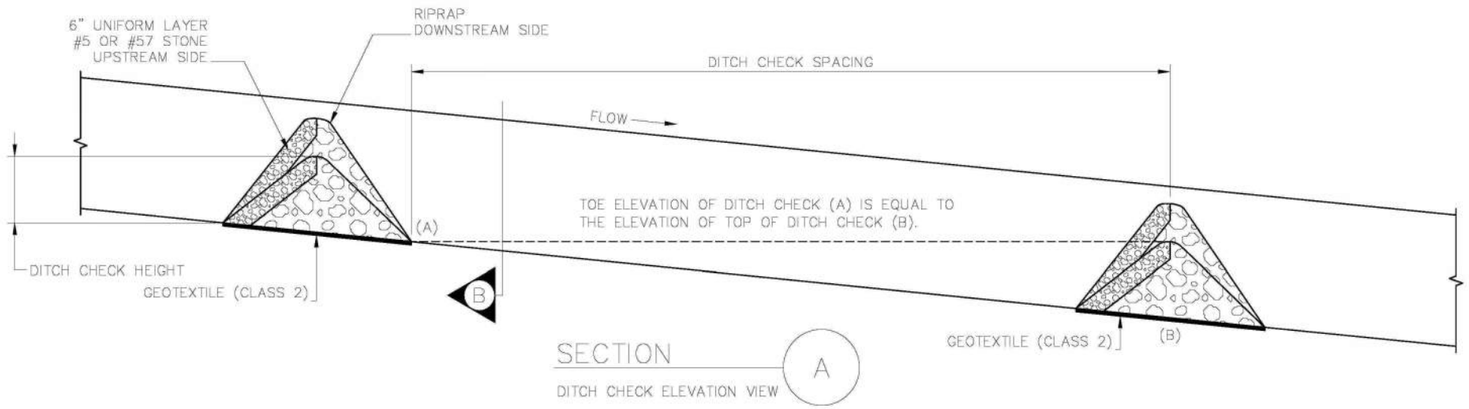


DETAIL 1
DITCH CHECK ISOMETRIC VIEW

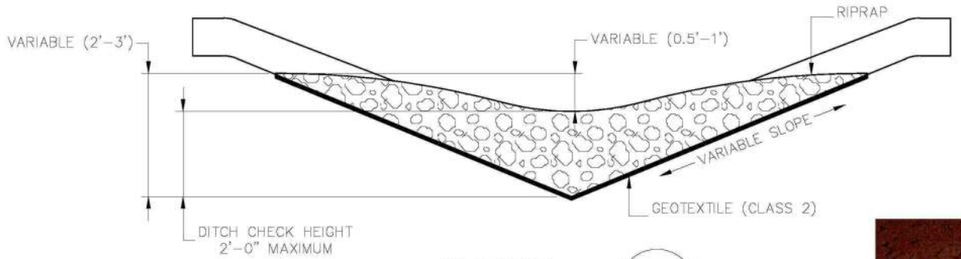
NOTES:

1. DITCH CHECK SHOULD NEVER BE USED IN LIVE STREAM.
2. DITCH CHECK IS NOT ADEQUATE FOR MORE THAN 2 ACRES OF DRAINAGE.
3. PLACE A CLASS 2 NON-WOVEN GEOTEXTILE FABRIC THAT MEETS THE REQUIREMENTS OF SECTION 804 BENEATH THE ROCK PRIOR TO INSTALLATION OF THE ROCK.
4. RIPRAP SHALL BE CLASS A.
5. RIPRAP MAY BE HAND PLACED OR MECHANICALLY PLACED AND SHAPED.
6. PLACE 6" UNIFORM LAYER OF AGGREGATE NO. 5 OR NO. 57 STONE ON THE UPSTREAM FACE OF ROCK DITCH CHECK.
7. SLOPES OF DITCH CHECK SHALL BE NO STEEPER THAN 2:1, BUT MAY BE FLATTENED DUE TO TRAFFIC SAFETY, AS DIRECTED BY THE ENGINEER.
8. HEIGHT OF DITCH CHECK SHALL BE NO MORE THAN 2.0 FEET.
9. DITCH CHECKS SHALL BE INSPECTED EVERY 7 DAYS.
10. REMOVE COLLECTED SEDIMENT IN FRONT OF DITCH CHECK AS DETERMINED BY THE ENGINEER. PAYMENT FOR REMOVAL AND DISPOSAL OF SEDIMENT WILL BE CLEANING SILT BASIN.
11. PAY ITEM SHALL BE:

8041010 RIPRAP (CLASS A)	TON
8042800 GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)	SY
8154010 CLEANING SILT BASINS	CY
8156410 AGGREGATE NO.5 OR NO.57 FOR EROSION CONTROL	TON

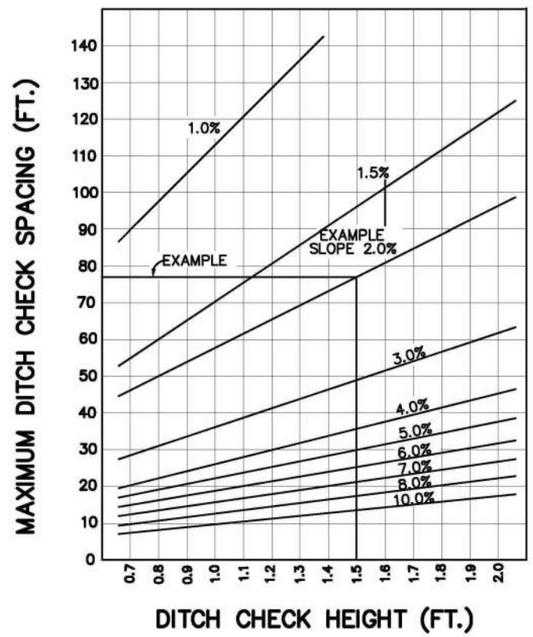


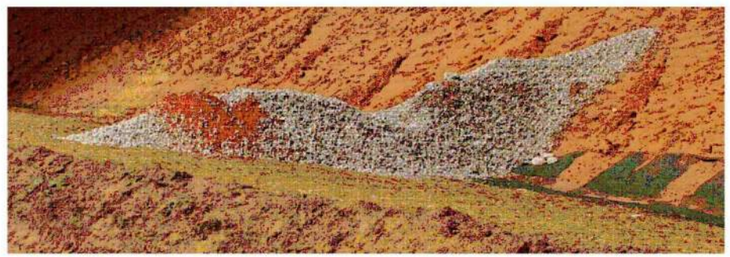
SECTION A
DITCH CHECK ELEVATION VIEW



SECTION B
DITCH CHECK END VIEW

DITCH CHECK SPACING





REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

RELATED DRAWINGS & KEYWORDS

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SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

James W. Kendall, Jr.

SIGNATURE

09/30/2016

DATE

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0	8/2016	DSO	UPDATE

SCDOT

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

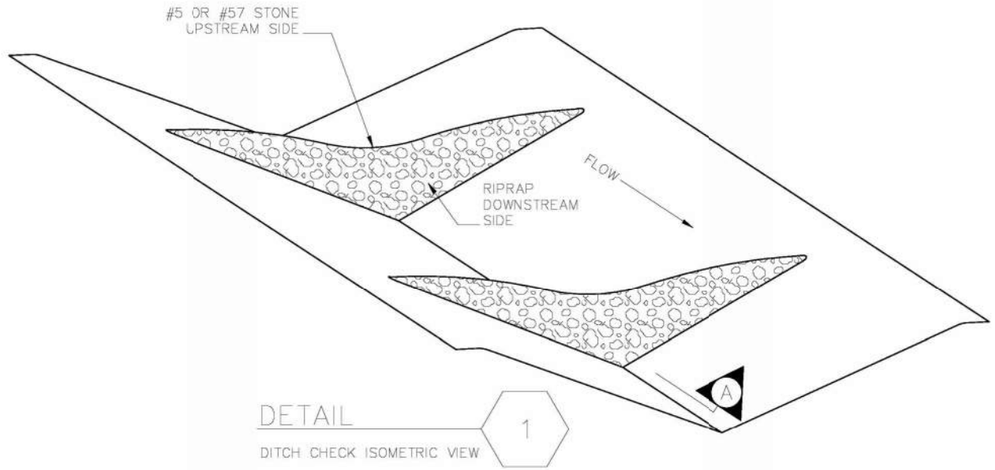
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

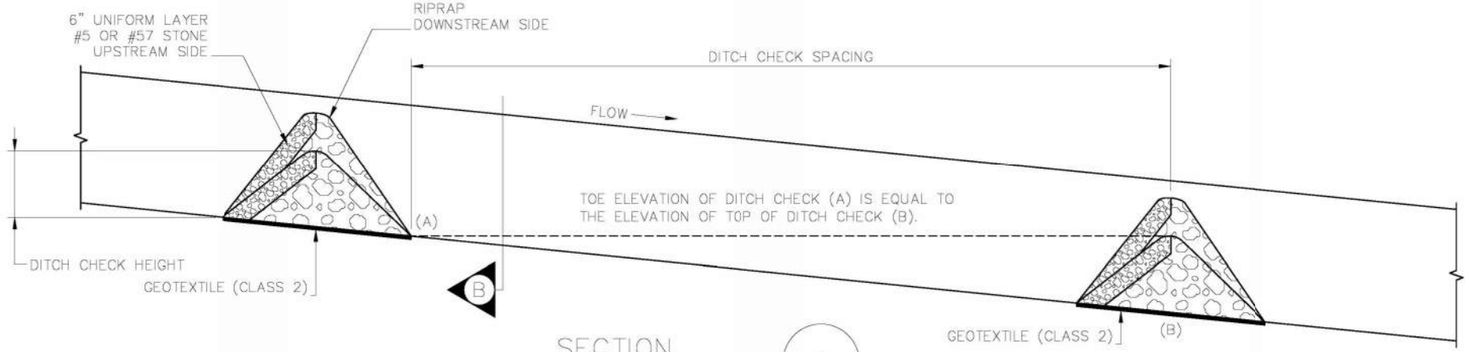
DITCH CHECK

815-105-00

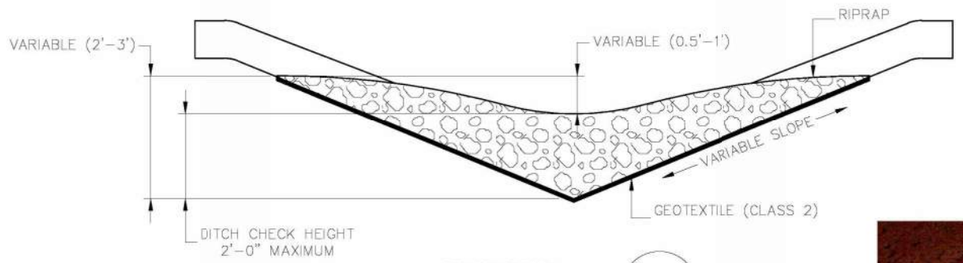
EFFECTIVE LETTING DATE: JULY, 2017



DETAIL 1
DITCH CHECK ISOMETRIC VIEW



SECTION A
DITCH CHECK ELEVATION VIEW



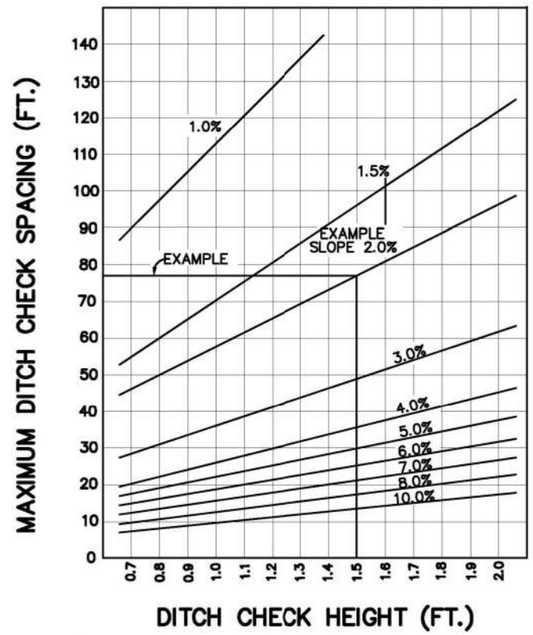
SECTION B
DITCH CHECK END VIEW

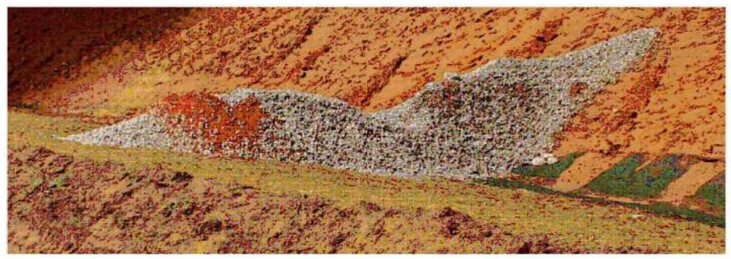
NOTES:

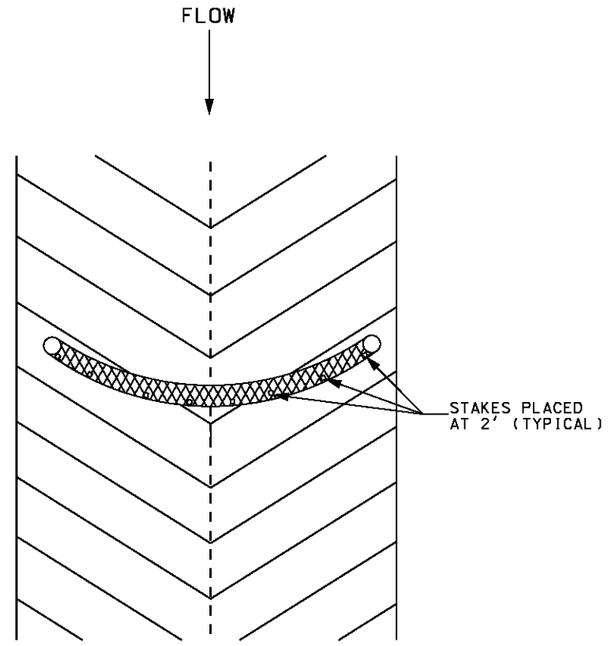
1. DITCH CHECK SHOULD NEVER BE USED IN LIVE STREAM.
2. DITCH CHECK IS NOT ADEQUATE FOR MORE THAN 2 ACRES OF DRAINAGE.
3. PLACE A CLASS 2 NON-WOVEN GEOTEXTILE FABRIC THAT MEETS THE REQUIREMENTS OF SECTION 804 BENEATH THE ROCK PRIOR TO INSTALLATION OF THE ROCK.
4. RIPRAP SHALL BE CLASS A.
5. RIPRAP MAY BE HAND PLACED OR MECHANICALLY PLACED AND SHAPED.
6. PLACE 6" UNIFORM LAYER OF AGGREGATE NO. 5 OR NO. 57 STONE ON THE UPSTREAM FACE OF ROCK DITCH CHECK.
7. SLOPES OF DITCH CHECK SHALL BE NO STEEPER THAN 2:1, BUT MAY BE FLATTENED DUE TO TRAFFIC SAFETY, AS DIRECTED BY THE ENGINEER.
8. HEIGHT OF DITCH CHECK SHALL BE NO MORE THAN 2.0 FEET.
9. DITCH CHECKS SHALL BE INSPECTED EVERY 7 DAYS.
10. REMOVE COLLECTED SEDIMENT IN FRONT OF DITCH CHECK AS DETERMINED BY THE ENGINEER. PAYMENT FOR REMOVAL AND DISPOSAL OF SEDIMENT WILL BE CLEANING SILT BASIN.
11. PAY ITEM SHALL BE:

8041010	RIPRAP (CLASS A)	TON
8042800	GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)	SY
8154010	CLEANING SILT BASINS	CY
8156410	AGGREGATE NO.5 OR NO.57 FOR EROSION CONTROL	TON

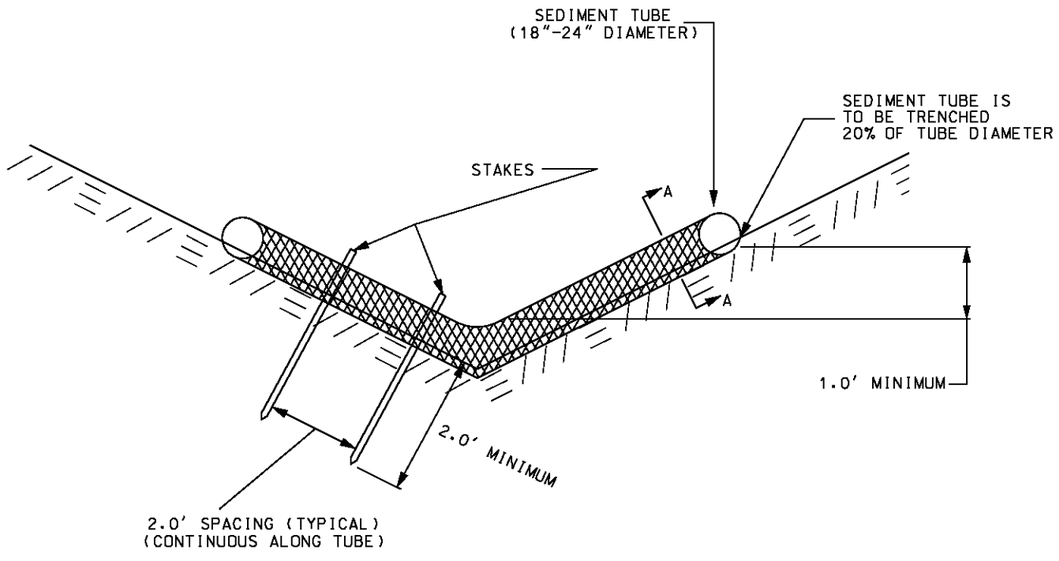
DITCH CHECK SPACING







TOP VIEW
OF DITCH



END VIEW
OF DITCH

THIS DRAWING IS NOT TO SCALE

NOTES:

1. SEDIMENT TUBE SHALL COMPLY WITH THE REQUIREMENTS OF SECTION 815 OF THE SCDOT STANDARD SPECIFICATION FOR HIGHWAY CONSTRUCTION (LATEST EDITION), AND MUST BE LISTED ON SCDOT QUALIFIED PRODUCT LIST NUMBER 57. SEDIMENT TUBES MUST MEET THE CRITERIA OUTLINED IN THE SUPPLEMENTAL SPECIFICATIONS BEFORE BEING LISTED ON QPL, AND BE FREE FROM DEFECTS OR TRANSPORTATION DAMAGE.

2. PROPER SITE PREPARATION IS ESSENTIAL TO ENSURE SEDIMENT TUBES ARE IN COMPLETE CONTACT WITH UNDERLYING SOIL. SEDIMENT TUBES ARE TO BE 18-24 INCHES IN DIAMETER AND ARE TO BE TRENCHED TO A DEPTH OF 20% OF TUBE DIAMETER. LAY THE SEDIMENT TUBE FLAT IN THE U-SHAPED TRENCH AND COMPACT THE UPSTREAM SEDIMENT TUBER SOIL INTERFACE. PLACE AND ANCHOR THE SEDIMENT TUBE ENDS SO THEY ARE POSITIONED UPSTREAM OF THE SEDIMENT TUBE CENTER POINT. SEDIMENT TUBES FOR DITCH CHECKS WEIGHING MORE THAN 18 POUNDS PER FOOT DO NOT REQUIRE TRENCHING.

3. SEDIMENT TUBE SHALL BE INSTALLED IMMEDIATELY AFTER GRADING AND CONSTRUCTION. SEDIMENT TUBE SHALL BE MAINTAINED DURING SUBGRADE AND BASE PREPARATION UNTIL BASE COURSE IS COMPLETE. SEDIMENT TUBES MAY BE TEMPORARILY MOVED DURING CONSTRUCTION.

4. SEDIMENT TUBES ARE TO BE INSTALLED PERPENDICULAR TO WATER FLOW AND EXTEND UP SIDE SLOPES A MINIMUM OF 1 FOOT ABOVE DESIGN FLOW DEPTH. SPACE TUBES ACCORDING TO THE FOLLOWING TABLE:

SLOPE	MAXIMUM SEDIMENT TUBE SPACING
LESS THAN 2%	150 FEET
2%	100 FEET
3%	75 FEET
4%	50 FEET
5%	40 FEET
6%	30 FEET
GREATER THAN 6%	25 FEET

5. STAKE SEDIMENT TUBES FOR DITCH CHECKS USING STAKES WITH A MINIMUM MEASURED DIMENSION OF ¾" X ¾" AND A MAXIMUM MEASURED DIMENSION OF 2" X 2", OR USING STEEL POSTS(1.25 lbs/linear foot)A MINIMUM OF 4' IN LENGTH. USE STEEL POSTS WITHOUT A SOIL PLATE AND PAINTING IS NOT REQUIRED. SPACE POSTS OR STAKES ON 2' CENTERS AND DRIVE THEM INTO THE GROUND TO A MINIMUM DEPTH OF 2'. INSTALL THE STAKES ON THE DOWNSTREAM THIRD OF THE SEDIMENT TUBE. SEDIMENT TUBES FOR DITCH CHECKS WEIGHING MORE THAN 18 POUNDS PER FOOT DO NOT REQUIRE STAKING.

6. SELECT PROPER LENGTH OF TUBE TO MINIMIZE THE NUMBER NEEDED TO SPAN THE WIDTH OF DRAINAGE AREA. ONE CONTINUOUS LENGTH IS PREFERRED COMPARED TO TWO OVERLAPPING TUBES. IF NECESSARY, SEDIMENT TUBES CAN BE LAPPED A MINIMUM OF 6 INCHES TO PREVENT PASSAGE OF FLOW AND SEDIMENT THROUGH FIELD JOINT.

7. INSTALL SEDIMENT TUBES FOR DITCH CHECKS OVER BARE SOIL, MULCHED AREAS, OR EROSION CONTROL BLANKETS. KEEP SEDIMENT TUBES FOR DITCH CHECKS IN PLACE UNTIL FULLY ESTABLISHED VEGETATION AND ROOT SYSTEMS HAVE COMPLETELY DEVELOPED AND CAN SURVIVE ON THEIR OWN.

8. INSPECT SEDIMENT TUBES AFTER INSTALLATION FOR GAPS UNDER THE SEDIMENT TUBES AND FOR GAPS BETWEEN THE JOINTS OF ADJACENT ENDS OF SEDIMENT TUBES. INSPECT SEDIMENT TUBES EVERY 7 DAYS. REPAIR ALL RILLS, GULLIES, AND UNDERCUTTING NEAR SEDIMENT TUBES. REMOVE ALL SEDIMENT DEPOSITS THAT IMPAIR THE FILTRATION CAPABILITY OF SEDIMENT TUBES WHEN THE SEDIMENT REACHES 1/3 THE HEIGHT OF THE EXPOSED SEDIMENT TUBE.

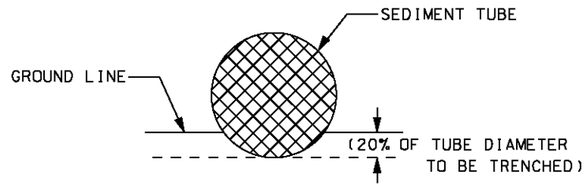
9. REMOVE AND/OR REPLACE INSTALLED SEDIMENT TUBES AS REQUIRED TO ADAPT TO CHANGING CONSTRUCTION SITE CONDITIONS. REMOVE SEDIMENT TUBES WHEN THE FUNCTIONAL LONGEVITY IS EXCEEDED AS DETERMINED BY THE ENGINEER, INSPECTOR, OR MANUFACTURER'S REPRESENTATIVE. GATHER SEDIMENT TUBES AND DISPOSE OF THEM IN REGULAR MEANS AS NON-HAZARDOUS, INERT MATERIAL.

10. PRIOR TO FINAL STABILIZATION, BACKFILL ALL TRENCHES, DEPRESSIONS, AND OTHER GROUND DISTURBANCES CAUSED BY THE REMOVAL OF SEDIMENT TUBES.

11. CLEAN OUT OF TUBES WILL BE PAID FOR AS CLEANING SILT BASINS.

12. PAYMENT SHALL INCLUDE ALL MATERIALS, LABOR, TOOLS, EQUIPMENT, MAINTENANCE, AND INCIDENTALS NECESSARY TO COMPLETE WORK.

13. THE PAY ITEMS SHALL BE:
8152007 SEDIMENT TUBE ..... LF
8154010 CLEANING SILT BASINS ..... CY



SECTION A-A

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-12
OPL 57

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION
SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
No. 21242
JAMES W. KENDALL, JR.

SIGNATURE
11/18/2016
DATE

#	DATE	CHK	DESCRIPTION
5			
4			
3			
2	8/2016	DSO	GENERAL REVISIONS
1	8/2012	DSO	UPDATED NOTES, WOOD TEXT REMOVED
0	3/2008	DSO	GENERAL REVISIONS

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

SEDIMENT TUBE DITCH APPLICATION

815-205-00

EFFECTIVE LETTING DATE JUL 2017

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

WQM, SC-M-810

RELATED DRAWINGS & KEYWORDS

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

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SCDOT
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING SEDIMENT DAM

815-405-01

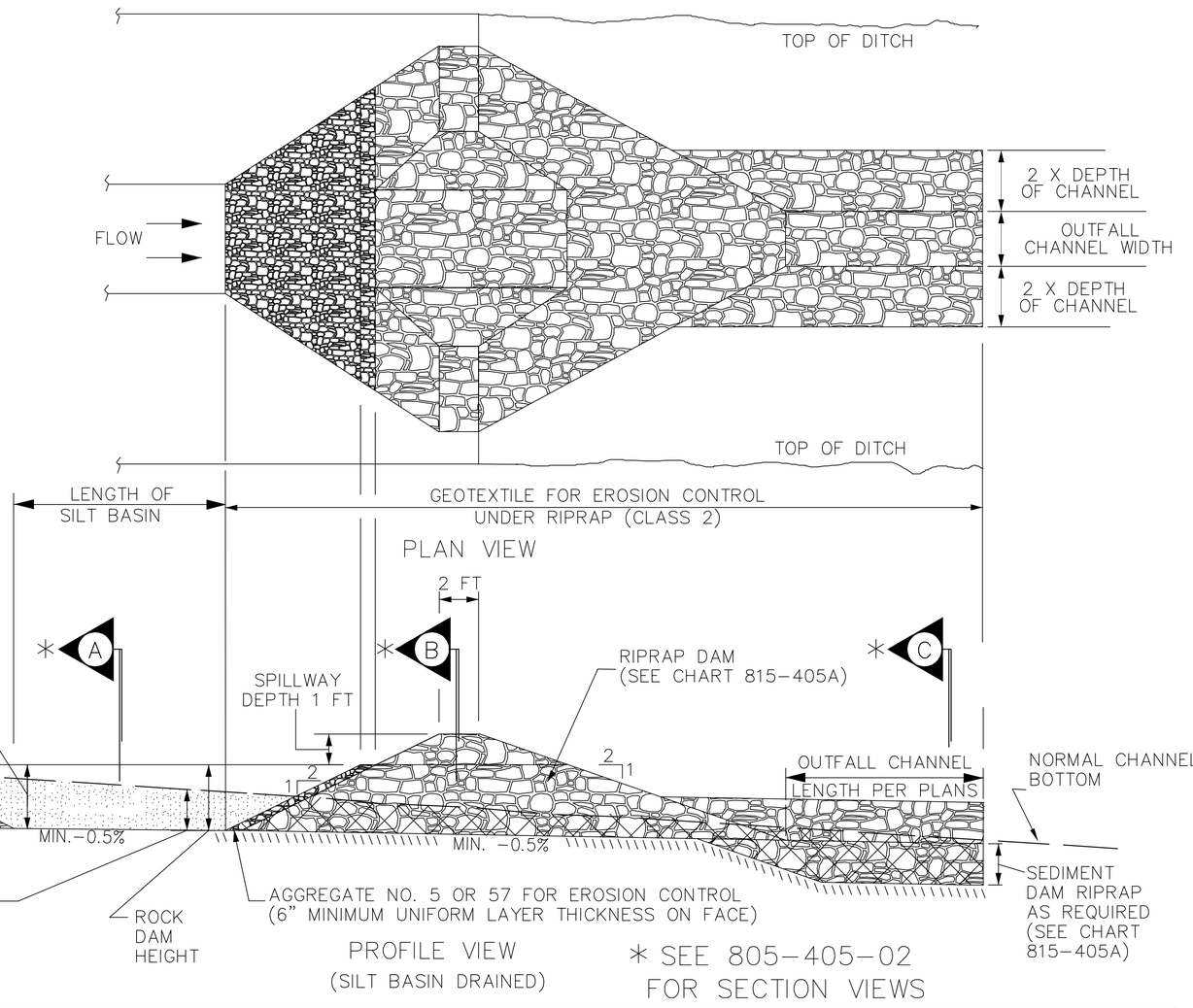
EFFECTIVE LETTING DATE | JULY 2017

NOTES:

1. SEDIMENT DAMS WILL BE DESIGNED IN ACCORDANCE WITH THE SCDOT WATER QUALITY MANUAL.
2. SILT BASIN MUST BE CLEANED OUT WHEN SEDIMENT STORAGE VOLUME IS HALF FULL. CLEAN OUT OF SILT BASIN WILL BE PAID FOR AS THE ITEM OF CLEANING SILT BASINS.
3. THE GRADATION CLASS OF SEDIMENT DAM RIPRAP WILL BE CLASS A FOR WATERSHEDS LESS THAN 3 ACRES.
4. THE GRADATION CLASS OF SEDIMENT DAM RIPRAP WILL BE CLASS B FOR WATERSHEDS 3 ACRES OR GREATER.
5. CONSTRUCTION OF SEDIMENT DAM RIPRAP WILL INCLUDE REMOVAL AND DISPOSAL OF RIPRAP.
6. ALL EARTHEN AREAS OF THE SILT BASIN WILL BE TEMPORARILY SEEDED EXCEPT FOR THE BOTTOM OF THE BASIN.
7. CROSS-HATCHED AREA, IF NECESSARY TO BE REMOVED FOR SEDIMENT DAM RIPRAP, WILL BE PAID FOR AS UNCLASSIFIED EXCAVATION.
8. USE CLASS 2 GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP.
9. SEE DRAWING # 815-405-02 FOR VIEWS OF SECTIONS A, B, AND C.
10. THE PAY ITEMS SHALL BE:

2031000	UNCLASSIFIED EXCAVATION	CY
8041010	RIPRAP (CLASS A)	TON
8041020	RIPRAP (CLASS B)	TON
8042800	GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)	SY
8154010	CLEANING SILT BASINS	CY
8156410	AGGREGATE NO. 5 OR 57 FOR EROSION CONTROL	TON

CHART 815-405A RIPRAP PLACEMENT		
CLASS	D_{50} (FT)	MINIMUM THICKNESS (FT)
A	0.50	1.00
B	0.75	1.50

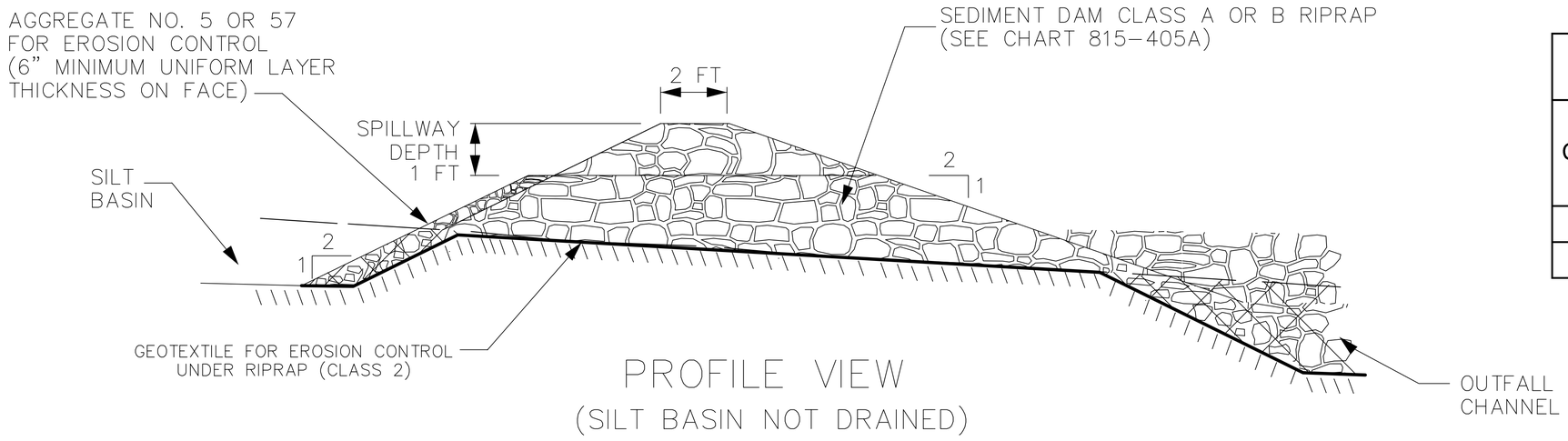


South Carolina Department of Transportation
Regional Sediment Basin Specification



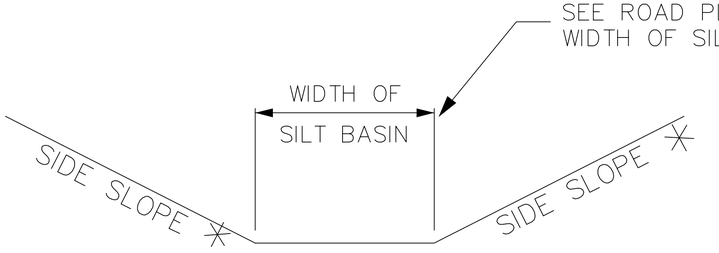
MAX AREA DRAINING TO DAM (ACRES)	LOWER STATE: TOTAL STORAGE VOLUME (FT^3)	UPPER STATE: TOTAL STORAGE VOLUME (FT^3)			ROCK DAM HEIGHT (TO BOTTOM OF SPILLWAY) (FT)	ROCK DAM BOTTOM WIDTH (FT)	SEDIMENT STORAGE HEIGHT (FT)	SPILLWAY BOTTOM WIDTH (FT)
		PERCENTAGE OF TOTAL DRAINAGE AREAS DISTURBED						
		75-100%	25-75%	0-25%				
1	1,450	2,815	2,115	1,505	3	3	0.50	9
2	2,900	5,630	4,225	3,010	3	3	0.50	9
3	4,350	8,445	6,335	4,510	4	3	0.75	11
4	5,800	11,260	8,445	6,015	4	4	0.75	12
5	7,250	14,075	10,560	7,520	4	4	0.75	12
6	8,700	16,890	12,670	9,025	4	4	0.75	12
7	10,150	19,705	14,780	10,530	4	6	0.75	14
8	11,600	22,520	16,890	12,030	4	6	0.75	14
9	13,050	25,335	19,000	13,535	4	6	0.75	14
10	14,500	28,150	21,115	15,040	4	6	0.75	14

THIS DRAWING IS NOT TO SCALE

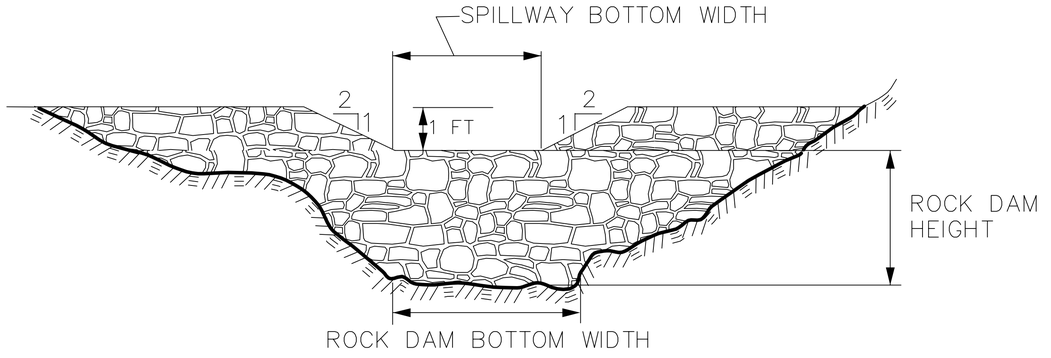


PROFILE VIEW
(SILT BASIN NOT DRAINED)

CHART 815-405A RIPRAP PLACEMENT		
CLASS	D_{50} (FT)	MINIMUM THICKNESS (FT)
A	0.50	1.00
B	0.75	1.50

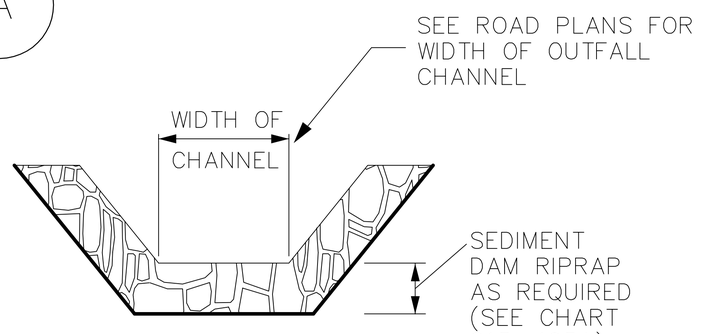


✳ SEE EROSION CONTROL DATA SHEET



SECTION A
SILT BASIN
CROSS SECTION

SECTION B
SEDIMENT DAM
CROSS SECTION



SECTION C
OUTFALL CHANNEL
CROSS SECTION

THIS DRAWING IS NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS
WQM

RELATED DRAWINGS & KEYWORDS

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NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
DATE

#	DATE	CHK	
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5			
4			
3			
2			
1			
0			

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ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING SEDIMENT DAM

815-405-02

EFFECTIVE LETTING DATE | JULY 2017

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-10

RELATED DRAWINGS & KEYWORDS

PRECONSTRUCTION SUPPORT ENGINEER

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 21242 JAMES W. KENDALL, JR.

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11/09/2016

DATE

#	DATE	CHK	DESCRIPTION
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4			
3	11/2016	DSO	GENERAL REVISIONS
2	8/2016	DSO	GENERAL REVISIONS
1	8/2012	DSO	ADDED CHART 815-505
0	3/2008	DSO	GENERAL REVISIONS

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STANDARD DRAWING

STABILIZED CONSTRUCTION ENTRANCE

815-505-00

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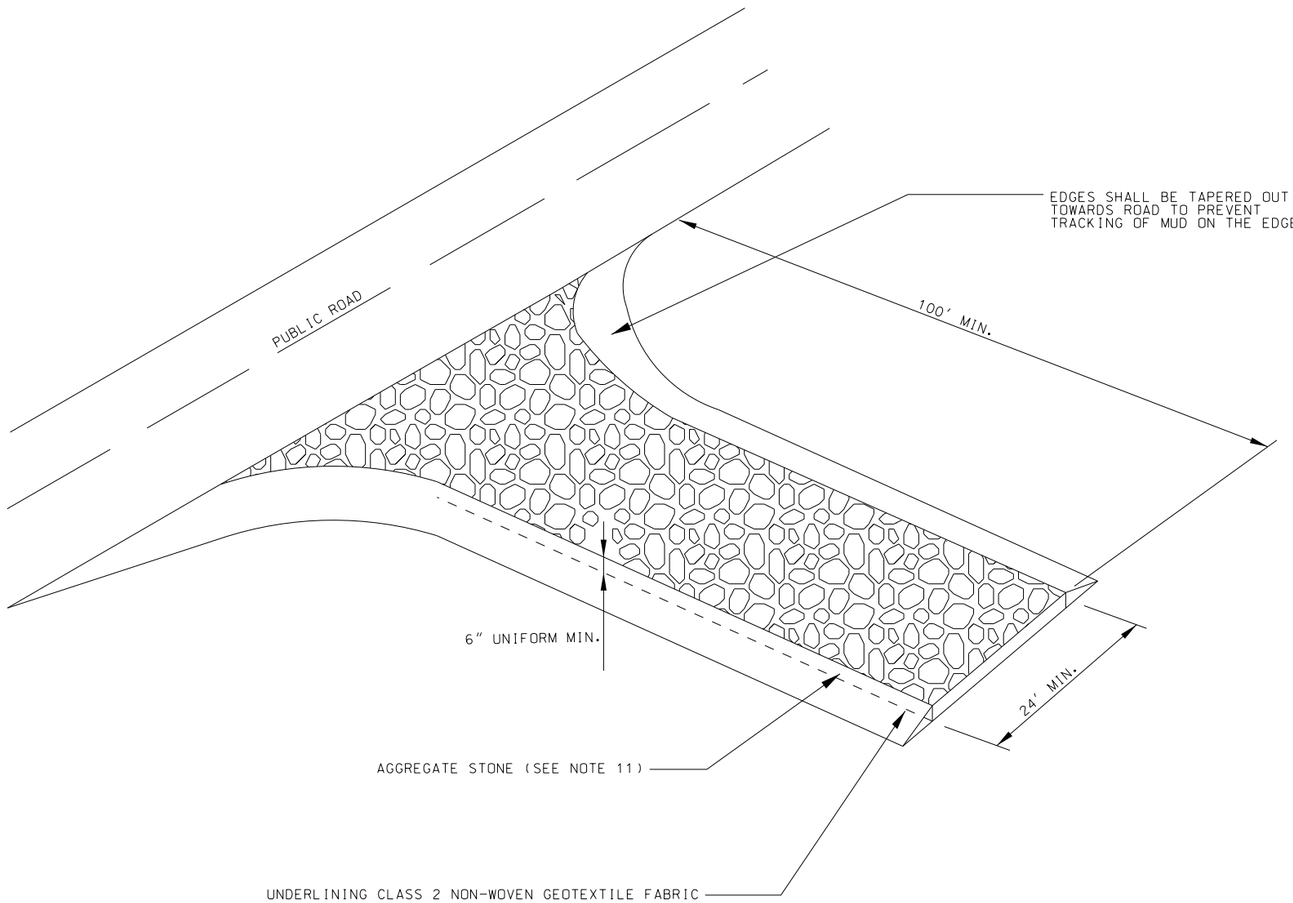


NOTES:

1. STABILIZED CONSTRUCTION ENTRANCES SHOULD BE USED AT ALL POINTS WHERE TRAFFIC WILL BE LEAVING A CONSTRUCTION SITE AND MOVING DIRECTLY ONTO A PUBLIC ROAD.

2. IF WASHING IS USED, PROVISIONS MUST BE MADE TO INTERCEPT THE WASH WATER AND TRAP THE SEDIMENT BEFORE IT IS CARRIED OFF SITE. WASHDOWN FACILITIES SHALL BE REQUIRED AS DIRECTED BY SCDOT AS NEEDED. WASHDOWN AREAS IN GENERAL MUST BE ESTABLISHED WITH CRUSHED GRAVEL AND DRAIN INTO A SEDIMENT TRAP OR SEDIMENT BASIN. CONSTRUCTION ENTRANCES SHOULD BE USED IN CONJUNCTION WITH THE STABILIZATION OF CONSTRUCTION ROADS TO REDUCE THE AMOUNT OF MUD PICKED UP BY VEHICLES.

3. REMOVE ALL VEGETATION AND ANY OBJECTIONABLE MATERIAL FROM THE FOUNDATION AREA.

4. DIVERT ALL SURFACE RUNOFF AND DRAINAGE FROM STONES TO A SEDIMENT TRAP OR BASIN.

5. INSTALL A CLASS 2 NON-WOVEN GEOTEXTILE FABRIC THAT MEETS THE REQUIREMENTS OF SECTION 804 OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, PRIOR TO PLACING ANY STONE.

6. MINIMUM DIMENSIONS OF THE ENTRANCE SHALL BE 24-FT WIDE x 100-FT LONG, AND MAY BE MODIFIED AS NECESSARY TO ACCOMMODATE SITE CONSTRAINTS.

7. INSPECT CONSTRUCTION ENTRANCES EVERY SEVEN (7) CALENDAR DAYS. CHECK FOR MUD AND SEDIMENT BUILDUP, AS WELL AS PAD INTEGRITY. MAINTENANCE IS REQUIRED MORE FREQUENTLY IN WET WEATHER CONDITIONS. RESHAPE THE STONE PAD AS NEEDED FOR DRAINAGE AND RUNOFF CONTROL.

8. WASH OR REPLACE STONES AS NEEDED AND AS DIRECTED BY THE ENGINEER. THE STONE IN THE ENTRANCE SHOULD BE WASHED OR REPLACED WHENEVER THE ENTRANCE FAILS TO REDUCE MUD BEING CARRIED OFF SITE BY VEHICLES. FREQUENT WASHING WILL EXTEND THE USEFUL LIFE OF STONE.

9. IMMEDIATELY REMOVE MUD AND SEDIMENT TRACKED OR WASHED ONTO PUBLIC ROADS BY BRUSHING OR SWEEPING. FLUSHING SHOULD ONLY BE USED WHEN THE WATER CAN BE DISCHARGED TO A SEDIMENT TRAP OR BASIN.

10. REPAIR ANY BROKEN PAVEMENT IMMEDIATELY.

11. USE AGGREGATE No. 1, 2, 24, OR 3 AS CONSTRUCTION ENTRANCE MATERIAL.

12. PAY ITEM:
8156490 STABILIZED CONSTRUCTION ENTRANCE_____SY

TABLE 815-605A				
HEIGHT OF FILL (y) IN FEET	FILL SLOPE	MINIMUM SILT FENCE OFFSET FROM TOE OF SLOPE (x) IN FEET	MINIMUM RIGHT OF WAY OFFSET FROM TOE OF SLOPE (NPDES LINE) (z) IN FEET	CHECK LENGTH IN FEET**
<6	2:1 4:1 6:1	2	3	2
6–10	2:1	12*	13*	5
	4:1 6:1	3	4	3
>10	2:1	12*	13*	5
	4:1 6:1	4	5	4

*THESE MINIMUM OFFSETS MAY BE REDUCED WHEN CURB AND GUTTER OR SOME OTHER FEATURE REDUCES THE FLOW OF WATER DOWN THE SLOPE. THE SMALL OFFSETS OF EACH GROUP OF HEIGHT OF FILL CANNOT BE REDUCED.

**SILT FENCE CHECKS WILL HAVE A MAXIMUM LENGTH OF FIVE (5) FEET OR UNTIL THEY TIE BACK INTO THE SLOPE.

SEE 815-605-10 FOR TEMPORARY DIVERSION DIKE

SEE 815-605-20 FOR TEMPORARY SILT DITCH

SEE 815-605-30 FOR ROLLED EROSION CONTROL PRODUCT

NOTES:
1. SILT FENCE CHECKS MUST BE LOCATED EVERY 100 FEET MAXIMUM AND AT LOW POINTS. FILTER FABRICS SHALL CONFORM TO SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION (LATEST EDITION).

2. USE POSTS CONFORMING TO SCDOT STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS. POSTS SHALL BE A MINIMUM OF 5 FEET LONG AND INSTALLED TO A MINIMUM DEPTH OF 24 INCHES WITH NO MORE THAN 3 FEET OF THE POST ABOVE GROUND. AT LEAST 1 TO 2 INCHES OF THE POSTS SHALL EXTEND ABOVE THE TOP OF THE FABRIC. POST SPACING WILL BE A MAXIMUM OF 6 FEET ON CENTER .

3. POSTS SHALL HAVE PROJECTIONS FOR FASTENING THE FABRIC TO THE POST. POSTS SHALL ALSO HAVE A SOIL PLATE NEAR THE BOTTOM OF THE POST, EXCEPT WHEN HEAVY CLAY SOILS ARE PRESENT ON-SITE.

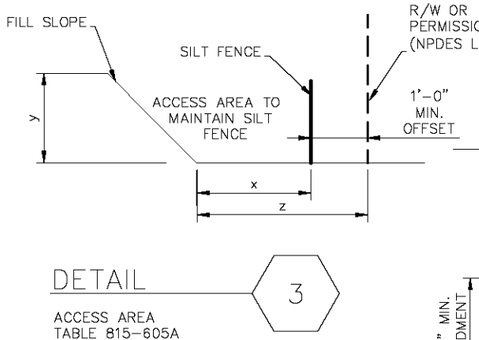
4. ATTACH FABRIC TO POSTS USING HEAVY-DUTY PLASTIC TIES THAT ARE EVENLY SPACED AND PLACED IN A MANNER TO PREVENT SAGGING OR TEARING OF THE FABRIC. IN ALL CASES TIES SHOULD BE AFFIXED IN NO LESS THAN 4 PLACES.

5. SILT SHALL BE REMOVED AND DISPOSED OF WHEN SILT ACCUMULATES TO ⅓ THE HEIGHT OF THE FENCE. TRAPPED SEDIMENT SHALL BE REMOVED OR STABILIZED ON-SITE. MAINTENANCE OF SILT FENCE WILL BE MEASURED AND PAID FOR BY THE ITEM OF REMOVAL OF SILT RETAINED BY SILT FENCE.

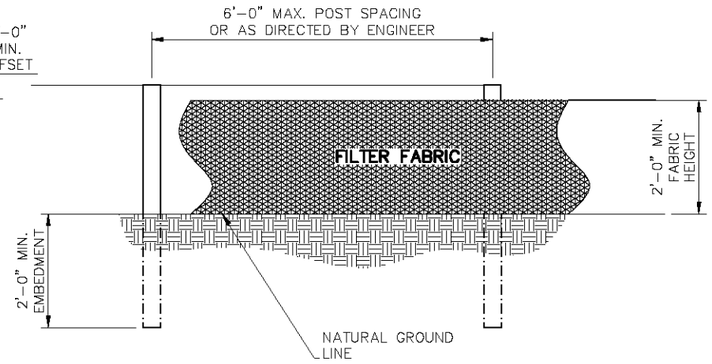
6. TYPICAL SILT FENCE APPLICATIONS REQUIRE 24 INCHES OF THE FABRIC TO BE ABOVE GROUND. WHEN NEEDED, THE HEIGHT OF SILT FENCE FABRIC ABOVE THE GROUND MAY BE GREATER THAN 24". SEE PLANS FOR APPLICATION OF HIGHER SILT FENCE, PAY ITEMS, AND INSTALLATION METHODS.

7. IN TIDAL AREAS, EXTRA SILT FENCE MAY BE REQUIRED. THE LENGTH OF POST WILL BE TWICE THE EXPOSED POST HEIGHT. POST SPACING WILL REMAIN AS SHOWN HEREON. EXTRA HEIGHT FABRIC WILL BE 4, 5, OR 6 FEET TOTAL WIDTH.

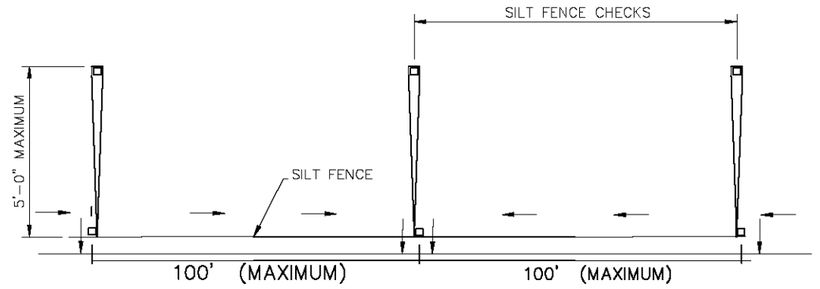
8. PAY ITEMS:
8153000 SILT FENCE _____ LF
8153005 SILT FENCE EXTRA HEIGHT _____ LF
8153090 REPLACE/REPAIR SILT FENCE _____ LF
8154050 REMOVAL OF SILT RETAINED BY SILT FENCE _____ LF



DETAIL 3
ACCESS AREA
TABLE 815-605A

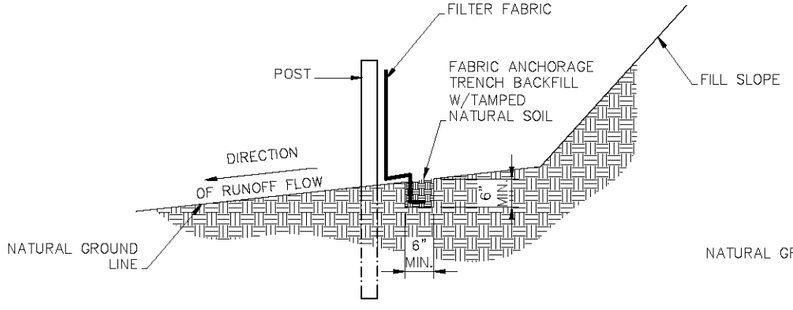


DETAIL 1
TYPICAL POST SPACING

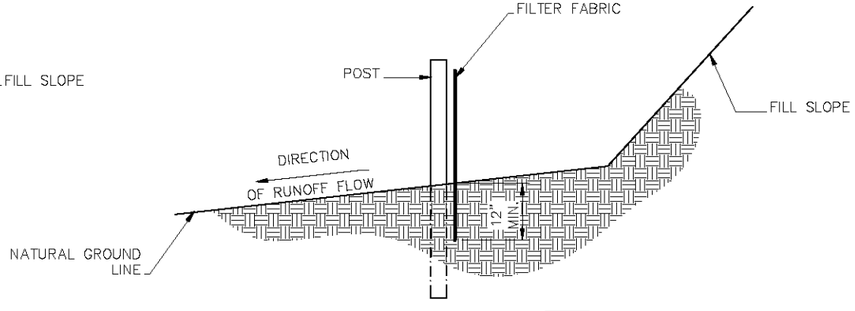


DETAIL 2
SILT FENCE CHECKS

12 INCHES OF THE FABRIC SHALL BE BURIED REGARDLESS, IF PLACED PNEUMATICALLY OR WITH A TRENCHER. BOTH METHODS SHOWN BELOW.



DETAIL 4
TRENCH METHOD



DETAIL 5
PNEUMATIC METHOD

NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-2, QPL 34

RELATED DRAWINGS & KEYWORDS

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SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER
NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

11/10/2016
DATE

#	DATE	CHK	DESCRIPTION
5			
4			
3	11/2016	DSO	GENERAL REVISIONS
2	8/2016	DSO	GENERAL REVISIONS
1	8/2012	KNB	ADDED SCDOT DOCUMENTS, REMOVED STEEL, CHANGED NOTES
0	3/2008	DSO	GENERAL REVISIONS

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
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955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TEMPORARY SILT FENCE

815-605-00

EFFECTIVE LETTING DATE: JULY, 2017

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-810
SC-M-815-9
QPL 55

RELATED DRAWINGS & KEYWORDS

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JAMES W. KENDALL, JR.

SIGNATURE

11/18/2016
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0	8/2016	DSO	NEW DRAWING

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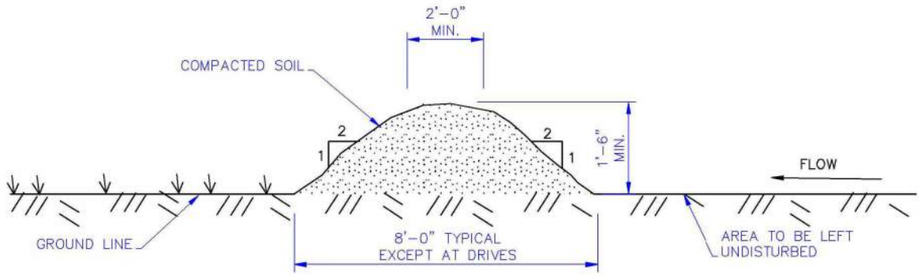
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TEMPORARY DIVERSION DIKE

815-605-10
EFFECTIVE LETTING DATE JULY, 2017

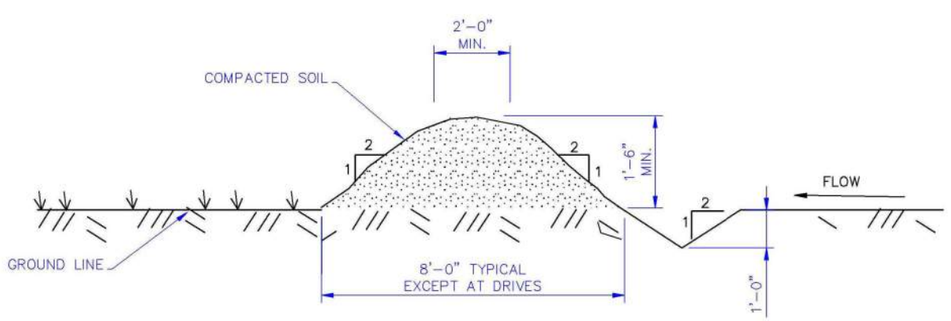


DETAIL 6

TEMPORARY DIVERSION DIKE

NOTES:

1. THIS ITEM IS FOR DIVERTING CLEAN WATER AROUND A CONSTRUCTION AREA.
2. CLEAR AND GRUB ALL TREES, BRUSH, STUMPS AND OTHER OBJECTIONABLE MATERIAL.
3. ENSURE THAT THE MINIMUM CONSTRUCTED CROSS SECTION MEETS ALL DIMENSIONS.
4. IMMEDIATELY AFTER CONSTRUCTION ESTABLISH VEGETATION BY SEEDING. PLACING TEMPORARY EROSION CONTROL BLANKET ON THE DIKE (AS APPLICABLE).
5. PAYMENT FOR TEMPORARY DIVERSION DIKE INCLUDES ALL MATERIALS IN PLACE, REMOVAL AND DISPOSAL OF MATERIALS, AND RESHAPING DIKE TO DRAIN. SEEDING TO BE PAID FOR SEPARATELY.
6. PAY ITEMS:
   8155100 TEMPORARY DIVERSION DIKE _____ LF
   8155110 TEMP DIVERSION DIKE W DITCH _____ LF
   8100100 PERMANENT COVER _____ ACRE
   8100200 TEMP. COVER _____ ACRE



DETAIL 7

TEMPORARY DIVERSION DIKE WITH DITCH

NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

SC-M-815-9
QPL 55, 56
SC-M-810

RELATED DRAWINGS & KEYWORDS

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0	8/2016	DSO	NEW DRAWING

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STANDARD DRAWING

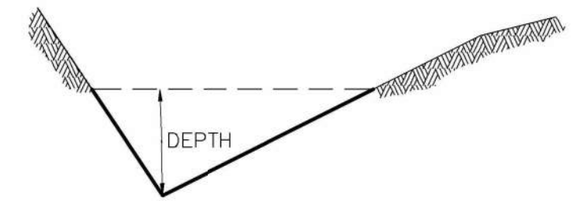
ROLLED EROSION CONTROL PRODUCT

815-605-30

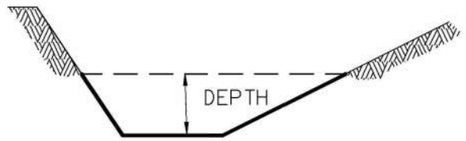
EFFECTIVE LETTING DATE JULY, 2017

NOTES:

1. THE DEPTH OF THE EROSION CONTROL PRODUCTS ARE TO BE DETERMINED BY DESIGN AND PLACED ON PLAN SHEETS.
2. INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
3. COST OF INSTALLATION AND MATERIALS SHALL BE INCLUDED IN THE PAY ITEM FOR ROLLED EROSION CONTROL PRODUCT.
4. PAY ITEMS:
8151150 TEMPORARY EROSION CONTROL BLANKET (ECB) _____ SY
8151151 TURF REINFORCEMENT MATTING (TRM) TYPE 1 _____ SY
8151152 TURF REINFORCEMENT MATTING (TRM) TYPE 2 _____ SY
8151153 TURF REINFORCEMENT MATTING (TRM) TYPE 3 _____ SY



DETAIL 9
ROLLED EROSION CONTROL
V DITCH



DETAIL 10
ROLLED EROSION CONTROL
FLAT BOTTOM DITCH

NOT TO SCALE

REFERENCES

NATIONAL DOCUMENTS

SCDOT DOCUMENTS

WQM, SC-M-810

RELATED DRAWINGS & KEYWORDS

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NO. 21242
JAMES W. KENDALL, JR.

SIGNATURE

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COLUMBIA, SC 29201

STANDARD DRAWING SEDIMENT DAM FOR PIPE INLET

815-406-00

EFFECTIVE LETTING DATE | JULY 2017

NOTES:

1. SEDIMENT DAM FOR PIPE INLET WILL BE DESIGNED IN ACCORDANCE WITH THE SCDOT WATER QUALITY MANUAL.

2. SILT BASIN MUST BE CLEANED OUT WHEN SEDIMENT STORAGE VOLUME IS HALF FULL. CLEAN OUT OF SILT BASIN WILL BE PAID FOR AS THE ITEM OF CLEANING SILT BASINS.

3. CONSTRUCTION OF SEDIMENT DAM RIPRAP WILL INCLUDE REMOVAL AND DISPOSAL OF RIPRAP.

4. ALL EARTHEN AREAS OF THE SILT BASIN WILL BE TEMPORARILY SEEDED EXCEPT FOR THE BOTTOM OF THE BASIN.

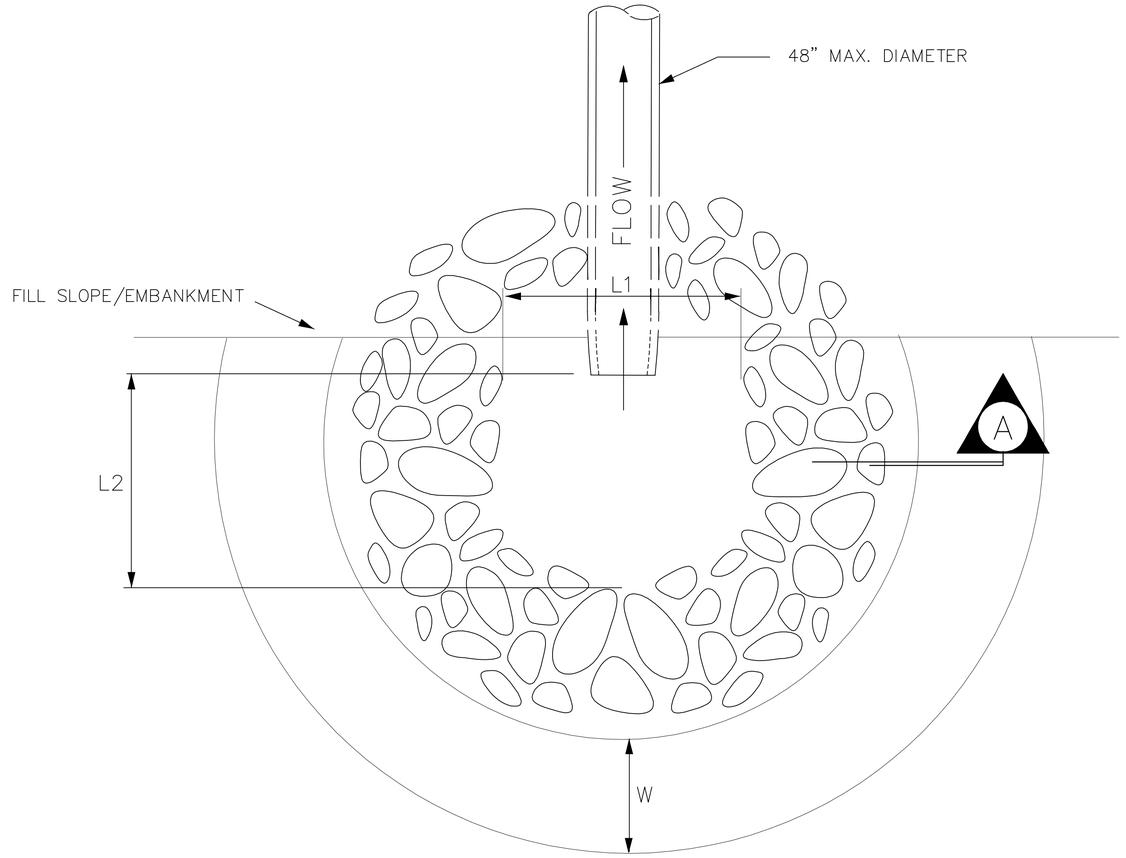
5. CROSS-HATCHED AREA, IF NECESSARY TO BE REMOVED FOR SEDIMENT DAM RIPRAP, WILL BE PAID FOR AS UNCLASSIFIED EXCAVATION.

6. USE CLASS 2 GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP.

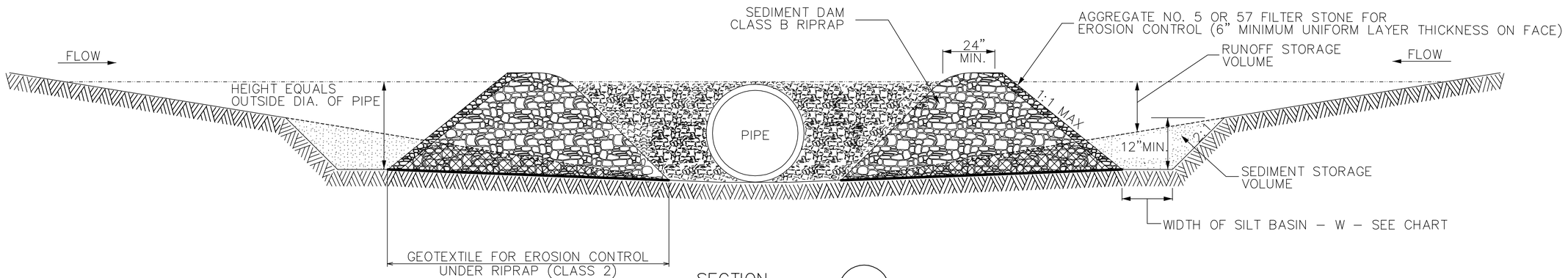
7. THE PAY ITEMS SHALL BE:

2031000	UNCLASSIFIED EXCAVATION	CY
8041020	RIPRAP (CLASS B)	TON
8042800	GEOTEXTILE FOR EROSION CONTROL UNDER RIPRAP (CLASS 2)	SY
8154010	CLEANING SILT BASINS	CY
8156410	AGGREGATE NO. 5 OR 57 FOR EROSION CONTROL	TON

PIPE SIZE (IN)	ROCK DAM HEIGHT (FT)	WIDTH OF SILT BASIN - W - (FT)				SEDIMENT DAM INSIDE L_1 (FT)	SEDIMENT DAM INSIDE L_2 (FT)
		MAX AREA DRAINING TO PIPE					
		0.5 AC	1.0 AC	1.5 AC	2.0 AC		
18	1.5	4.0	7.0	11.0	14.0	3.5	1.75
24	2.0	3.0	6.0	9.0	12.0	4.0	2.00
30	2.5	2.5	5.5	8.0	10.5	4.5	2.25
36	3.0	2.5	4.5	7.0	9.5	5.0	2.50
42	3.5	2.0	4.0	6.0	7.5	7.5	3.75
48	4.0	2.0	3.5	5.5	7.0	8.0	4.00



PLAN VIEW
SEDIMENT DAM
FOR PIPE INLET



SECTION A
ELEVATION
SEDIMENT DAM
FOR PIPE INLETS

THIS DRAWING IS NOT TO SCALE

Appendix E

Stormwater Management Design Study

STORMWATER MANAGEMENTDESIGN STUDY
FOR THE PROPOSED CONSTRUCTION
OF US 21 NORTH PHASE I & SC 51
YORK COUNTY, SOUTH CAROLINA
FINAL PLANS REPORT

ROUTE/ROAD NUMBER: US 21 North Phase I & SC 51

SCDOT PROJECT NO.: 0042332

YORK COUNTY PROJECT NO.: 11149-004

30 September 2021
13 April 2022 r1
19 July 2022 r2

PREPARED BY: Guy P. Peters, PE, CFM

CHECKED BY: Steven C. Noriega, PE

Hydraulic Design Reference for this study is the:

2009

Edition of SCDOT's "Requirements for Hydraulic Design Studies."





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Rock Hill, South Carolina 29730-3392
www.stvinc.com

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STORMWATER MANAGEMENT DESIGN STUDY FOR THE PROPOSED CONSTRUCTION OF US 21 PHASE I AND SC 51
FINAL PLANS REPORT
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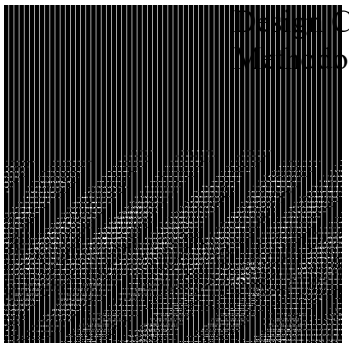

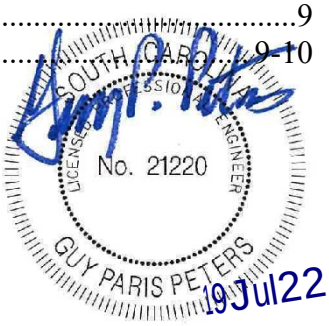

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- Time of Concentration - Culverts
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- Scour
- Culvert Assessment Report

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- Pre vs. Post Discharge Calculations
- Correspondence re: Forest Lake

Appendix F: Erosion Control Calculations

- Outlet Protection Riprap Apron Calculations
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Appendix G: Closed System Calculations

- Time of Concentration
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- GEOPAK Area Data
- GEOPAK Node Data
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Appendix H: Drainage Area Maps (Figures 7A and &B)





Introduction

STV Incorporated entered into an agreement with York County to provide professional engineering services for the proposed roadway widening of US 21 and SC 51 from SC 460 (Springfield Parkway) to 700 feet south of S-48 (Springhill Farm Road) (See Figure 1: Project Location Map). The project consists of widening the roadways from a 2 lane typical section to a 5 lane typical section with shoulder and ditches and a 5 lane section with curb and gutter. The studied area includes approximately 2.82 miles of US 21 and 0.84 miles of SC 51. This area also includes all applicable watershed areas that drain to the roadway. The project's total area of land disturbance is 52.6 acres. In accordance with guidance in SCDOT Water Quality Design Memorandum WQDM-02, the project area is computed as 55.6 acres.

This report contains drainage calculations and summary tables for hydrology, culvert hydraulics, open channel and closed system hydraulics, pre- versus post-construction discharge, and erosion control. The purpose of this report is to document the design procedures that were used to analyze the hydrology and hydraulics of the proposed roadway improvements.

Site Description

US 21 and SC 51 are existing roadways located in York County, South Carolina, within the town of Fort Mill (Figure 1). The project area is in rolling terrain, ranging in elevation from about 583 feet to 671 feet above sea level. The soils consist of loamy sands and clay loam. These soils vary between well drained and poorly drained; however they are mostly well drained (see Table 1 for general soils information and end of narrative section for Soils Map). These characteristics are common in this area of South Carolina.

TMDL/303d Impaired Waterbodies

The nearest Water Quality Monitoring Station, CW-203, for all project outfalls is located on Steele Creek at S-46-98 in York County. CW-203 is listed on the current SC DHEC 2017 list of approved TMDLs, for fecal coliform bacteria (FC). Site storm water runoff from the project is not anticipated to be a source for further FC impairment.

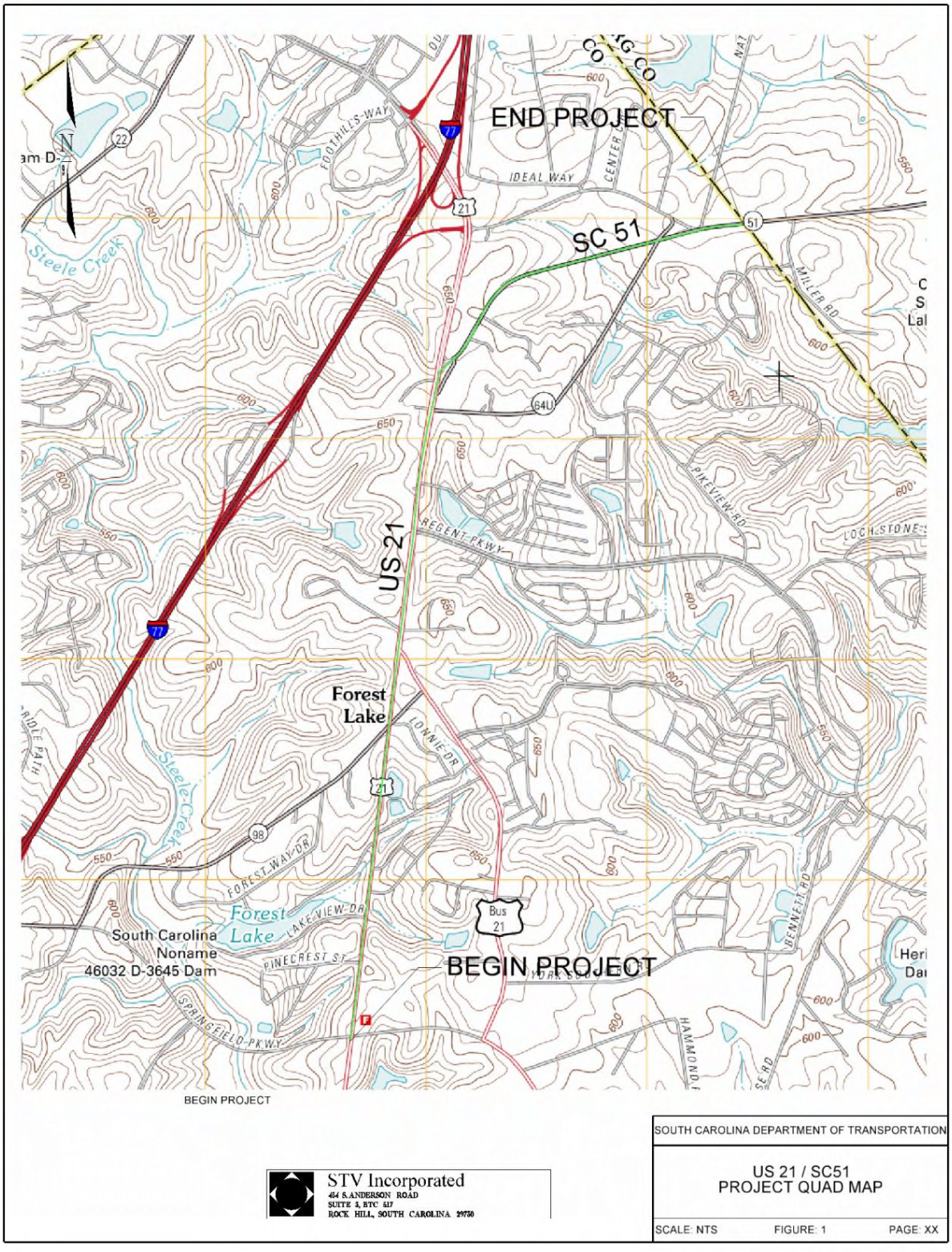


Figure 1: Project Location Map

Map Symbol	Soil Name	Description	Drainage	Hydrologic Soil Group
ArA	Armenia loam, 0 to 2 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* 6-18 inches (apparent) *Frequency of ponding:* None *Available water storage:* Moderate (~6.5 inches)	Poorly drained	D
BbA	Brewback fine sandy loam, 0 to 2 percent slopes	*Depth to restrictive feature:* 36 inches *Depth to water table:* About 6 - 40 inches (perched) *Frequency of ponding:* None *Available water storage:* Low (~4.2 inches)	Somewhat poorly drained	D
BbB	Brewback fine sandy loam, 2 to 6 percent slopes	*Depth to restrictive feature:* 36 inches *Depth to water table:* About 6 - 40 inches (perched) *Frequency of ponding:* None *Available water storage:* Low (~4.2 inches)	Somewhat poorly drained	D
CeB2	Cecil sandy clay loam, 2 to 6 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* High (~9.3 inches)	Well drained	B
CeC2	Cecil sandy clay loam, 6 to 10 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~8.4 inches)	Well drained	B
CfB3	Cecil clay loam, 2 to 6 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~8.8 inches)	Well drained	B
CfC3	Cecil clay loam, 6 to 10 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~8.8 inches)	Well drained	B
ChA	Chewacla loam. 0 to 2 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* About 6 - 72 inches *Frequency of ponding:* None *Available water storage:* High (~10.8 inches)	Somewhat poorly drained	B/D
MeB2	Mecklenburg-Wynott complex, 2 to 6 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~7.6 inches)	Well drained	C
MkB3	Mecklenburg-Wynott complex, 2 to 6 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~8.3 inches)	Well drained	C
MkC3	Mecklenburg-Wynott complex, 2 to 6 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~8.3 inches)	Well drained	C
PaD2	Pacolet sandy clay loam, 10 to 15 persent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~8.2 inches)	Well drained	B
PcE3	Pacolet clay loam, 15 to 25 percent slopes	*Depth to restrictive feature:* More than 80 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Moderate (~7.1 inches)	Well drained	B

Table 1: Soils Descriptions for US 21 and SC 51 Widening in York County, South Carolina

W	Water			
WbC2	Wynott-Brewback complex, 6 to 10 percent slopes	*Depth to restrictive feature:* 20-40 inches *Depth to water table:* N/A *Frequency of ponding:* None *Available water storage:* Low (~3.6 inches)	Well drained	D
WmD2	Wynott Mecklenburg-complex, 10 to 15 percent slopes	*Depth to restrictive feature:* 20-40 inches *Depth to water table:* >80 inches *Frequency of ponding:* None *Available water storage:* Low (~3.6 inches)	Well drained	C
WwE2	Wynott-Wilkes complex, 15 to 25 percent slopes	*Depth to restrictive feature:* 20-40 inches *Depth to water table:* >80 inches *Frequency of ponding:* None *Available water storage:* Low (~3.6 inches)	Well drained	D
WyB2	Wynott-Winnsboro complex, 6 to 10 percent slopes	*Depth to restrictive feature:* 20-40 inches *Depth to water table:* >80 inches *Frequency of ponding:* None *Available water storage:* Low (~3.6 inches)	Well drained	D
WyC2	Wynott-Winnsboro complex, 6 to 10 percent slopes	*Depth to restrictive feature:* 20-40 inches *Depth to water table:* >80 inches *Frequency of ponding:* None *Available water storage:* Low (~3.6 inches)	Well drained	D

Table 1: Soils Descriptions for US 21 and SC 51 Widening in York County, South Carolina

Calculations Methodology

Hydrology

Design Criteria

In accordance with the SCDOT's "Requirements for Hydraulic Design Studies" dated May 26, 2009, the following design criteria were used (see Appendices A, B, and C for calculations):

1) Roadside Ditches and Outfalls
   a) 10-year peak discharge for drainage areas from 0 to 40 acres.
   b) 25-year peak discharge for drainage areas from 40 to 500 acres.
   c) 50-year peak discharge for drainage areas greater than 500 acres.
2) Culverts
   a) 50-year peak discharge for primary road and interstate routes.
   b) 25-year peak discharge for secondary roads.
   c) 10-year peak discharge for driveway pipes.

Methodology

The rational method was used to calculate peak discharges for all drainage systems with drainage areas up to 100 acres. A spreadsheet is used to calculate Q. The Rational formula is as follows:

$$Q = C \cdot I \cdot DA \cdot C_f$$

Where: Q = discharge in cubic feet per second (cfs)
C = the runoff coefficient
I = the rainfall intensity in inches per hour (in/hr)
DA = Drainage Area (ac), and where
C_f, Runoff Factor, is defined by:

Recurrence Interval, Years	Return Period, % annual chance	Runoff Factor, C_f
2 – 10	50-10	1.0
25	4	1.1
50	2	1.2
100	1	1.25

Runoff Coefficient (C)

Runoff coefficients were determined from a visual inspection of the project area and the following table from SCDOT's "Requirements for Hydraulic Design Studies" dated May 26, 2009.

RUNOFF FACTORS FOR RATIONAL METHOD			
Land cover type	**Flat**	**Rolling**	**Hilly**
	0% - 2%	**2% - 10%**	**Over 10%**
Pavements & Roofs	0.90	0.90	0.90
Earth shoulders	0.50	0.50	0.50
Drives & Walks	0.75	0.80	0.85
Gravel Pavements	0.50	0.55	0.60
City Business Areas	0.80	0.85	0.85
Unpaved Road, Sandy Soils	0.34	0.45	0.59
Unpaved Road, Silty Soils	0.35	0.47	0.61
Unpaved Road, Clay Soils	0.40	0.53	0.69
Apartment Dwelling Areas	0.50	0.60	0.70
Suburban, Normal Residential	0.45	0.50	0.55
Dense Residential Sections	0.60	0.65	0.70
Lawns, Sandy Soils	0.10	0.15	0.20
Lawns, Heavy Soils	0.17	0.22	0.35
Grass Shoulders	0.25	0.25	0.25
Side Slopes, Earth	0.60	0.60	0.60
Side Slopes, Turf	0.30	0.30	0.30
Median Areas, Turf	0.25	0.30	0.30
Cultivated Land, Clay & Loam	0.50	0.55	0.60
Cultivated Land, Sand & Gravel	0.25	0.30	0.35
Industrial Areas, Light	0.50	0.70	0.80
Industrial Areas, Heavy	0.60	0.80	0.90
Parks & Cemeteries	0.10	0.15	0.25
Playgrounds	0.20	0.25	0.30
Woodland & Forest	0.10	0.15	0.20
Meadows & Pasture Land	0.25	0.30	0.35
Unimproved Areas	0.10	0.20	0.30
Rail Yards	0.25	0.30	NA
Expressways & Freeways*	0.60*	0.70*	0.75*
* The designer can also calculate weighted 'C' values for expressways and freeways using the values in the table for pavement, side slopes and planted medians. Revised 3/16/09			

Table 2: Runoff Coefficients for Rational Formula

Time of Concentration (Tc)

Time of Concentration is calculated using a spreadsheet based on the TR-55 method. All Tc values were derived from the existing conditions from digital mapping, field survey, and USGS topographic maps (see Appendices A, B, and C for calculations).

Rainfall intensity (I)

Rainfall intensities were determined using the following equation and the values indicated in the Rainfall Intensity Values charts provided by SCDOT at the time the project design phase was started.

$$i = \frac{a}{(b + t_c)^c}$$

The coefficients for Rock Hill, South Carolina for the 2-, 5-, 10-, 25-, 50-, and 100-year rainfalls are given in the table below as well as the intensity values for the 5-, 10-, and 15-minute times of concentration.

Rock Hill, South Carolina							
Frequency		a	b	c	i (t_c = 5)	i (t_c = 10)	i (t_c = 15)
% annual chance	*x*-year						
50	2	240.26568	35.61513	1.03559	5.19	4.60	4.13
20	5	254.71848	33.33552	1.02140	6.15	5.42	4.85
10	10	264.71357	31.82192	1.01175	6.89	6.06	5.40
4	25	276.98802	30.00177	1.00001	7.91	6.92	6.15
2	50	286.34575	28.61559	0.99107	8.80	7.66	6.79
1	100	294.57238	27.37215	0.98314	9.65	8.38	7.41

Table 3: Rainfall Intensities for Rock Hill, SC

Drainage Area (DA)

Drainage areas for ditches, and culverts were delineated with "Microstation V8i" utilizing field survey, USGS topographic maps, digital mapping, and field observation (see Figures 7a, 7b, 8a and 8b for Drainage Area Maps).

NRCS Win TR-55 Method

The Win TR-55 method is used to calculate peak discharges for all drainage areas from 100 acres up to 640 acres.

Open Channel Hydraulics

Design Criteria

1) Minimum Ditch Grade should be 0.30%.
2) Maximum Shear Stress allowable will be 1.00 lbs/ft^2 for Class 'C' vegetation.
3) Minimum ditch depth should be 1.0' below the sub-grade of the roadway.
4) No modifications will be made to natural channels unless to prevent scour and erosion.

Methodology

An in-house spreadsheet using the formulas and procedure from HEC-15 (FHWA-IP-87-7, April 1988), "Design of Roadside Channels with Flexible Linings", and the FHWA Hydraulic Toolbox were used to analyze proposed ditch sections and outfalls. The ditches were analyzed for shear stress and adequate ditch depth. Where ditch section analysis indicated instability due to shear stress, a permanent erosion control mat or riprap lining was proposed to stabilize the ditch (see Appendix A for ditch calculations). Shear stress is calculated using the formula:

$$\tau = \gamma dS$$

Where: τ = shear stress (lb/ft^2)
γ = unit weight of water (62.4 lb/ft^3)

D = flow depth (ft)
S = Channel gradient (ft/ft)

Storm Drain Systems Hydraulics

Design Criteria

1) Inlet Spacing (see Appendix E for inlet capacity calculations and spacing data)
   a) Design spread not to exceed or the shoulder width.
   b) Maximum spacing is 400'.
   c) Minimum spacing is typically 150'. However, due to flat longitudinal slopes and the need for yard inlets, spacing less than 150' will be required in some locations.
2) Pipes (see Appendix E for Geopak Calculations)
3) Minimum pipe slope should be 0.30%. A pipe slope of 0.10% to 0.2% was used when the minimum could not be achieved due to depth constraints.
   a) Minimum velocity for design discharge should be 3.0 fps.
   b) Minimum diameter should be 18", (15" for yard drains).
   c) Minimum cover should be 1.5', (0.5' for yard drains). Minimum cover was reduced where there was a depth constraint.
   d) Design flow depths should not exceed 0.94 times the pipe diameter. Flow depth was exceeded where there was a depth constraint.

Methodology

The SCDOT's "Inlet Spacing Charts" were used to determine the maximum allowable drainage area for each Type 16 catch basins. An inlet capacity spreadsheet was used to calculate spread for Type 1 catch basins. The median drainage was spaced for future widening using an inlet capacity spreadsheet based on HEC 12. (See Appendix E for inlet capacity calculations and spacing data).

The computer program Geopak Drainage was used to analyze and determine pipe sizes for closed systems. The SCDOT's "Specification Support Manual for Geopak Drainage", October 1, 2002, was used as a guide to set the program's internal design preferences and drainage library. (See Appendix E for storm pipe and hydraulic grade line computations).

Culvert Hydraulics

Design Criteria

1) Prevent potential damage to upstream property.
2) Headwater should be 1.0' below the subgrade of roadway.
3) Meet FEMA floodway or flood hazard requirements where applicable.
4) Design headwater should be limited to 1.2 times the height of the culvert.

Methodology

The FHWA computer program "HY-8" version 7.3 was used to perform the hydraulic analysis for the project culvert crossings. See Appendix B for culvert data summary and "HY-8" results. Outfall channels were also analyzed for the culvert design storm using the "HY8" uniform flow rating curve.

Pre vs. Post Analysis

Design Criteria

Pre and post development peak discharge rates were calculated for each outfall for the 2- and 10-year storm events. If post development discharges increased and/or if significant downstream impacts were anticipated, then the appropriate storm water management practice will be designed.

For this project, the change from a rural typical section to a curb and gutter typical section resulted in point discharges onto undeveloped property and into existing outfall ditches, where the existing discharge from the road is sheet flow. Downstream conditions were explored in the field and we do not anticipate adverse impacts from the new project outfalls. Figures 8a and 8b provide a complete depiction of pre and post development drainage areas. Discharge calculations can be found in Appendix C.

As a result of discussions with York County, roadway storm drainage was designed to reduce post development discharges below pre-development levels at receiving channels that drain to Forest Lake, the man-made pond that is a feature of the Forest Lake neighborhood. This was done in response to information contained in correspondence from SCDOT and from the Forest Lake Neighborhood Association, copies of which is provided in Appendix C

Methodology

The rational method was used to generate pre and post development peak discharges for all drainage areas less than 100 acres. The project outfalls were hydraulically analyzed to determine downstream impacts. See Appendix C for Pre versus Post construction discharge calculations. Based on these calculations, this project will not pose any adverse impacts to the downstream receiving water body and/or properties and will not require detention practices.

Sediment and Erosion Control

Design Criteria

The sediment and erosion control structures for this project consist of sediment dams, sediment dam for pipe inlet, silt fence, ditch checks/sediment tubes, erosion control blankets, permanent turf reinforcement matting and outlet protection. See Appendix D for detailed data and calculations. All projects that have one or more acres of disturbed area will be designed for sediment and erosion control in accordance with DHEC's General Permit and State Erosion Control regulations. All stormwater from the construction site should be treated before it is released.

Methodology

1) *Sediment Dams* (SCDOT Standard Drawing No. 815-405-01 and 815-405-02.) will be placed at the outfall locations as shown on the plans and are used to remove sediment from construction runoff where the total drainage area is less than 10 acres. Sediment dams will be designed in accordance with the SCDOT's "Stormwater Quality Design Manual."
2) *Sediment Dam for Pipe Inlet* (SCDOT Stand Drawing No. 815-406-00) will be placed at pipe inlet as shown on the plans and are used to remove sediment from construction runoff where the total disturbed area in less than 2 acres. Sediment dams for Pipe Inlet will be designed in accordance with the SCDOT's "Stormwater Quality Design Manual."

3) *Silt Fence* (SCDOT Standard Drawing No. 815-605-00) will be placed along the perimeter of the disturbed area where runoff is in sheet flow or concentrated flow less than 0.5 cfs. Silt Fence will act as a sediment filter by retarding flow and promoting deposition.
4) *Ditch Checks* (SCDOT Standard Drawing No. 815-105-00) or 20" Sediment Tubes (SCDOT Standard Drawing No. 815-205-00) will be placed in the roadside ditches and are intended to reduce erosion in the channel by restricting the velocity. The check dams will be placed so that the downstream toe of one check dam is level with the top of the next one downstream.
5) *Erosion Control Blankets and/or Turf Reinforcement Mats* (SCDOT Standard Drawing No. 815-6 05-00) will be placed in ditches as called out on the Erosion Control Data Sheet and on some 2:1 slopes. These rolled erosion control products will protect the exposed soil from the forces of raindrop impact and overland flow, and will promote growth of vegetation.
6) *Outlet Protection riprap aprons* will be placed at the outlet end of the cross culverts to protect the receiving channel from scour by reducing the discharge velocity and dissipating the energy.

Sediment and erosion control devices should be inspected weekly and after each storm event. Any damage to devices should be repaired immediately, and any silt accumulated should be removed. All disturbed areas should be covered with temporary or permanent vegetation as soon as practical. All devices should be properly maintained during all phases of construction and be removed once the area has been stabilized.

Appendix A

NRCS Soils Data

United States Department of Agriculture

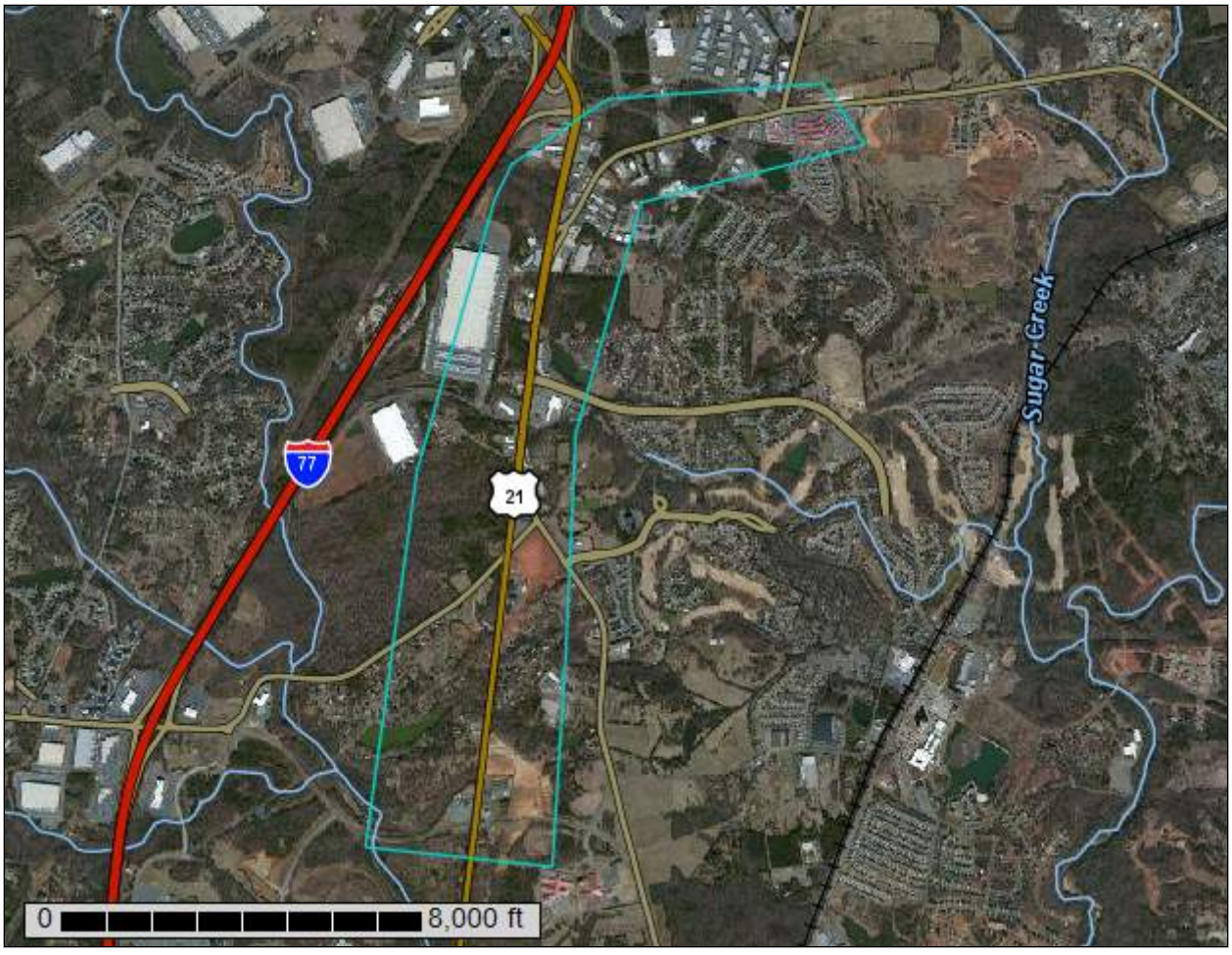
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Mecklenburg County, North Carolina, and York County, South Carolina

US 21 & SC 51



August 18, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

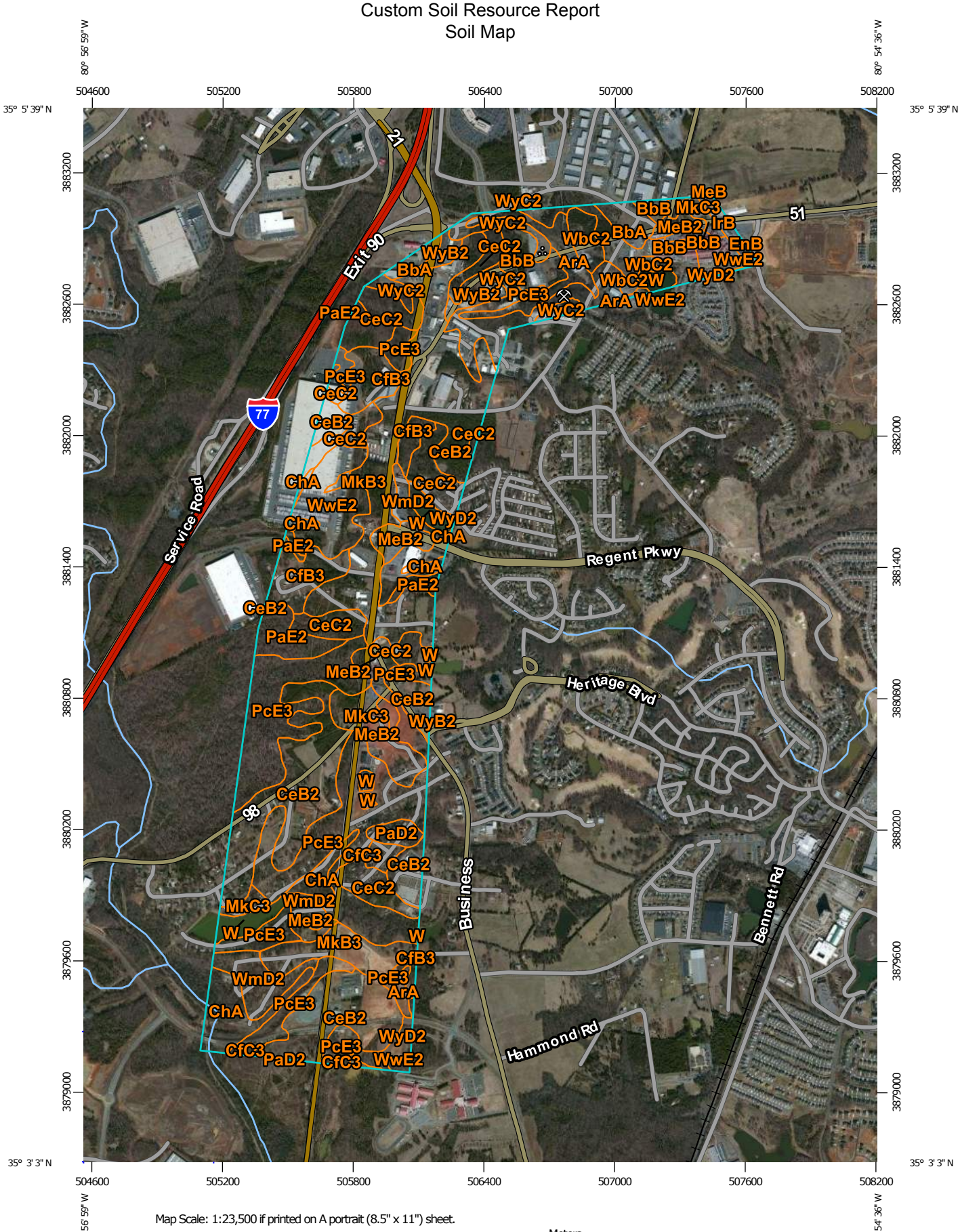
While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


80° 56' 59" W
80° 54' 36" W
504600
505200
505800
506400
507000
507600
508200
35° 5' 39" N
35° 3' 3" N
3883200
3882600
3882000
3881400
3880800
3880200
3879600
3879000
21
Exit 90
77
Service Road
51
98
Business
Regent Pkwy
Heritage Blvd
Bennett Rd
Hammond Rd
WyC2
MeB
BbB
MkC3
WyB2
CeC2
BbA
ArA
WbC2
MeB2
IrB
EnB
WwE2
WyD2
WbC2W
PcE3
PaE2
CfB3
CeB2
ChA
MkB3
WmD2
W
MeB2
PaD2
CfC3
ArA
Map Scale: 1:23,500 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 300 600 1200 1800
Feet
0 1000 2000 4000 6000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mecklenburg County, North Carolina
Survey Area Data: Version 14, Sep 10, 2014

Soil Survey Area: York County, South Carolina
Survey Area Data: Version 12, Sep 29, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 11, 2011—Feb 13, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Mecklenburg County, North Carolina (NC119)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
EnB	Enon sandy loam, 2 to 8 percent slopes	1.6	0.2%
IrB	Iredell fine sandy loam, 1 to 8 percent slopes	2.6	0.3%
MeB	Mecklenburg fine sandy loam, 2 to 8 percent slopes	0.8	0.1%
Subtotals for Soil Survey Area		**5.1**	**0.6%**
Totals for Area of Interest		**880.9**	**100.0%**

York County, South Carolina (SC091)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ArA	Armenia loam, 0 to 2 percent slopes, occasionally flooded	19.3	2.2%
BbA	Brewback fine sandy loam, 0 to 2 percent slopes	12.8	1.5%
BbB	Brewback fine sandy loam, 2 to 6 percent slopes	39.2	4.5%
CeB2	Cecil sandy clay loam, 2 to 6 percent slopes, moderately eroded	237.2	26.9%
CeC2	Cecil sandy clay loam, 6 to 10 percent slopes, moderately eroded	72.4	8.2%
CfB3	Cecil clay loam, 2 to 6 percent slopes, severely eroded	35.5	4.0%
CfC3	Cecil clay loam, 6 to 10 percent slopes, severely eroded	5.3	0.6%
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	30.7	3.5%
MeB2	Mecklenburg-Wynott complex, 2 to 6 percent slopes, moderately eroded	43.1	4.9%
MkB3	Mecklenburg-Wynott complex, 2 to 6 percent slopes, severely eroded	22.9	2.6%
MkC3	Mecklenburg-Wynott complex, 6 to 10 percent slopes, severely eroded	6.7	0.8%
PaD2	Pacolet sandy clay loam, 10 to 15 percent slopes, moderately eroded	5.7	0.6%
PaE2	Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded	19.0	2.2%

York County, South Carolina (SC091)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
PcE3	Pacolet clay loam, 15 to 25 percent slopes, severely eroded	180.0	20.4%
W	Water	20.2	2.3%
WbC2	Wynott-Brewback complex, 6 to 10 percent slopes, moderately eroded	10.4	1.2%
WmD2	Wynott-Mecklenburg complex, 10 to 15 percent slopes, moderately eroded	34.9	4.0%
WwE2	Wynott-Wilkes complex, 15 to 25 percent slopes, moderately eroded	32.6	3.7%
WyB2	Wynott-Winnsboro complex, 2 to 6 percent slopes, moderately eroded	16.8	1.9%
WyC2	Wynott-Winnsboro complex, 6 to 10 percent slopes, moderately eroded	25.2	2.9%
WyD2	Wynott-Winnsboro complex, 10 to 15 percent slopes, moderately eroded	5.9	0.7%
Subtotals for Soil Survey Area		**875.8**	**99.4%**
Totals for Area of Interest		**880.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used.

Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Mecklenburg County, North Carolina

EnB—Enon sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t8m
Elevation: 200 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Enon and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Enon

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from diorite and/or gabbro and/or diabase and/or gneiss

Typical profile

Ap - 0 to 7 inches: fine sandy loam
BA - 7 to 10 inches: sandy clay loam
Bt - 10 to 27 inches: clay
BC - 27 to 33 inches: clay loam
C - 33 to 80 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

IrB—Iredell fine sandy loam, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t8x
Elevation: 200 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Iredell and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Iredell

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Saprolite derived from diorite and/or gabbro and/or diabase and/or gneiss

Typical profile

A - 0 to 6 inches: fine sandy loam
Bt - 6 to 24 inches: clay
BC - 24 to 28 inches: clay loam
C - 28 to 80 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Sedgefield
Percent of map unit: 8 percent
Landform: Ridges
Landform position (two-dimensional): Summit, footslope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Wynott
Percent of map unit: 4 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Armenia, undrained
Percent of map unit: 3 percent
Landform: Drainageways on interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

MeB—Mecklenburg fine sandy loam, 2 to 8 percent slopes

Map Unit Setting
National map unit symbol: 3t92
Elevation: 200 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Mecklenburg and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mecklenburg

Setting
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Saprolite derived from diorite and/or gabbro and/or diabase and/or gneiss

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bt - 7 to 34 inches: clay
C - 34 to 80 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

York County, South Carolina

ArA—Armenia loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2lpwd
Elevation: 450 to 690 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Armenia, occasionally flooded, and similar soils: 86 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Armenia, Occasionally Flooded

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Alluvium derived from diabase and/or alluvium derived from gabbro and/or alluvium derived from diorite

Typical profile

A - 0 to 4 inches: loam
BA - 4 to 8 inches: clay loam
B1 - 8 to 51 inches: clay
B2 - 51 to 80 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Worsham, occasionally flooded

Percent of map unit: 14 percent
Landform: Depressions

Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

BbA—Brewback fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2lpzd
Elevation: 200 to 1,400 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Brewback and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brewback

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gabbro and/or residuum weathered from diorite and/or residuum weathered from diabase

Typical profile

A - 0 to 4 inches: fine sandy loam
BE - 4 to 10 inches: sandy clay loam
B - 10 to 30 inches: clay
BC - 30 to 36 inches: clay
Cr - 36 to 80 inches: weathered bedrock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Iredell

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

BbB—Brewback fine sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2lpzp
Elevation: 200 to 1,400 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Brewback and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brewback

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gabbro and/or residuum weathered from diorite and/or residuum weathered from diabase

Typical profile

A - 0 to 4 inches: fine sandy loam
BE - 4 to 10 inches: sandy clay loam
B - 10 to 30 inches: clay
BC - 30 to 36 inches: clay
Cr - 36 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Iredell

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

CeB2—Cecil sandy clay loam, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2th00
Elevation: 450 to 1,450 feet
Mean annual precipitation: 40 to 69 inches
Mean annual air temperature: 50 to 66 degrees F
Frost-free period: 180 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Cecil, moderately eroded, and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cecil, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and/or residuum weathered from gneiss

Typical profile

A - 0 to 3 inches: sandy clay loam
Bt - 3 to 48 inches: clay
BCt - 48 to 80 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Cataula, moderately eroded

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Bethlehem, moderately eroded

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

CeC2—Cecil sandy clay loam, 6 to 10 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2tqlf

Elevation: 220 to 1,160 feet
Mean annual precipitation: 40 to 69 inches
Mean annual air temperature: 50 to 66 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cecil, moderately eroded, and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cecil, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Typical profile

A - 0 to 3 inches: sandy clay loam
Bt - 3 to 48 inches: clay
BCt - 48 to 80 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Cataula, moderately eroded

Percent of map unit: 4 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Bethlehem, moderately eroded

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

CfB3—Cecil clay loam, 2 to 6 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2lpzy
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cecil, severely eroded, and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cecil, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Typical profile

A - 0 to 1 inches: sandy loam
BA - 1 to 3 inches: sandy clay loam
B - 3 to 80 inches: clay

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Cataula, moderately eroded

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

CfC3—Cecil clay loam, 6 to 10 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2lq03
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Cecil, severely eroded, and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cecil, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Typical profile

A - 0 to 1 inches: sandy loam
BA - 1 to 3 inches: sandy clay loam
B - 3 to 80 inches: clay

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Helena, moderately eroded

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

ChA—Chewacla loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2sclw
Elevation: 90 to 1,930 feet
Mean annual precipitation: 40 to 69 inches
Mean annual air temperature: 50 to 66 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Chewacla, frequently flooded, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chewacla, Frequently Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 10 inches: loam
Bw - 10 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Toccoa, frequently flooded

Percent of map unit: 15 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Wehadkee, ponded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

MeB2—Mecklenburg-Wynott complex, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq2k
Elevation: 410 to 960 feet

Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mecklenburg, moderately eroded, and similar soils: 50 percent
Wynott, moderately eroded, and similar soils: 36 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mecklenburg, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Typical profile

A - 0 to 4 inches: sandy loam
B - 4 to 35 inches: clay
BC - 35 to 50 inches: clay loam
C - 50 to 80 inches: loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay
BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 14 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

MkB3—Mecklenburg-Wynott complex, 2 to 6 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2lq2q
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Mecklenburg, severely eroded, and similar soils: 50 percent

Wynott, severely eroded, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mecklenburg, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Typical profile

A - 0 to 2 inches: sandy loam
B - 2 to 26 inches: clay
BC - 26 to 40 inches: sandy clay loam
CB - 40 to 80 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Wynott, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 2 inches: sandy loam
B - 2 to 26 inches: clay
BC - 26 to 32 inches: sandy clay loam
Cr - 32 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock

Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Cecil, severely eroded

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

MkC3—Mecklenburg-Wynott complex, 6 to 10 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2lq2t
Elevation: 400 to 980 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Mecklenburg, severely eroded, and similar soils: 50 percent
Wynott, severely eroded, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mecklenburg, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Typical profile

A - 0 to 2 inches: sandy loam
B - 2 to 26 inches: clay
BC - 26 to 40 inches: sandy clay loam
CB - 40 to 80 inches: sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Wynott, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 2 inches: sandy loam
B - 2 to 26 inches: clay
BC - 26 to 32 inches: sandy clay loam
Cr - 32 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Cecil, severely eroded

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

PaD2—Pacolet sandy clay loam, 10 to 15 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq32
Elevation: 250 to 600 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Pacolet, moderately eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pacolet, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and/or residuum weathered from gneiss

Typical profile

A - 0 to 2 inches: sandy loam
B - 2 to 26 inches: clay
BC - 26 to 43 inches: clay loam

C - 43 to 80 inches: loam

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Hard labor

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

PaE2—Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq33
Elevation: 220 to 750 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Pacolet, moderately eroded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pacolet, Moderately Eroded

Setting

Landform: Interfluves

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Typical profile

A - 0 to 2 inches: sandy loam
B - 2 to 26 inches: clay
BC - 26 to 43 inches: clay loam
C - 43 to 80 inches: loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Hard labor

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

PcE3—Pacolet clay loam, 15 to 25 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2lq31
Elevation: 220 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Pacolet, severely eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pacolet, Severely Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from gneiss and/or residuum weathered from granite

Typical profile

A - 0 to 1 inches: sandy clay loam
B - 1 to 26 inches: clay
BC - 26 to 80 inches: clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Wynott, moderately eroded

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Linear
Hydric soil rating: No

W—Water

Map Unit Setting
National map unit symbol: 4ts5
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WbC2—Wynott-Brewback complex, 6 to 10 percent slopes, moderately eroded

Map Unit Setting
National map unit symbol: 2lq4p
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition
Wynott, moderately eroded, and similar soils: 45 percent
Brewback, moderately eroded, and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynott, Moderately Eroded

Setting
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile
A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay

BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Brewback, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 2 inches: sandy loam
BE - 2 to 9 inches: sandy clay loam
B - 9 to 36 inches: clay
BC - 36 to 38 inches: sandy clay loam
Cr - 38 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 20 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WmD2—Wynott-Mecklenburg complex, 10 to 15 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq4s
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Wynott, moderately eroded, and similar soils: 45 percent
Mecklenburg, moderately eroded, and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay
BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock

Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Mecklenburg, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite

Typical profile

A - 0 to 4 inches: sandy loam
B - 4 to 35 inches: clay
BC - 35 to 50 inches: clay loam
C - 50 to 80 inches: loam

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 15 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex

Across-slope shape: Linear
Hydric soil rating: No

WwE2—Wynott-Wilkes complex, 15 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq4w
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Wynott, moderately eroded, and similar soils: 55 percent
Wilkes, moderately eroded, and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay
BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Wilkes, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 4 inches: sandy loam
B - 4 to 15 inches: sandy clay loam
BC - 15 to 18 inches: sandy loam
Cr - 18 to 45 inches: weathered bedrock
R - 45 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock; 40 to 72 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Winnsboro, moderately eroded

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WyB2—Wynott-Winnsboro complex, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq53
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wynott, moderately eroded, and similar soils: 55 percent
Winnsboro, moderately eroded, and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay
BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Winnsboro, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 4 inches: sandy loam
B - 4 to 25 inches: clay
BC - 25 to 32 inches: sandy clay loam
C - 32 to 52 inches: sandy loam
Cr - 52 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Mecklenburg, moderately eroded

Percent of map unit: 15 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WyC2—Wynott-Winnsboro complex, 6 to 10 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq56
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Wynott, moderately eroded, and similar soils: 55 percent
Winnsboro, moderately eroded, and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay
BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Winnsboro, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 4 inches: sandy loam
B - 4 to 25 inches: clay
BC - 25 to 32 inches: sandy clay loam
C - 32 to 52 inches: sandy loam
Cr - 52 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Wilkes, moderately eroded

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WyD2—Wynott-Winnsboro complex, 10 to 15 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 2lq58
Elevation: 410 to 960 feet
Mean annual precipitation: 42 to 55 inches
Mean annual air temperature: 51 to 72 degrees F
Frost-free period: 202 to 249 days
Farmland classification: Not prime farmland

Map Unit Composition

Wynott, moderately eroded, and similar soils: 50 percent
Winnsboro, moderately eroded, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wynott, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 5 inches: sandy loam
B - 5 to 21 inches: clay
BC - 21 to 29 inches: sandy clay loam
Cr - 29 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Winnsboro, Moderately Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from diorite and/or residuum weathered from gabbro

Typical profile

A - 0 to 4 inches: sandy loam
B - 4 to 25 inches: clay
BC - 25 to 32 inches: sandy clay loam
C - 32 to 52 inches: sandy loam
Cr - 52 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Wilkes, moderately eroded

Percent of map unit: 15 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

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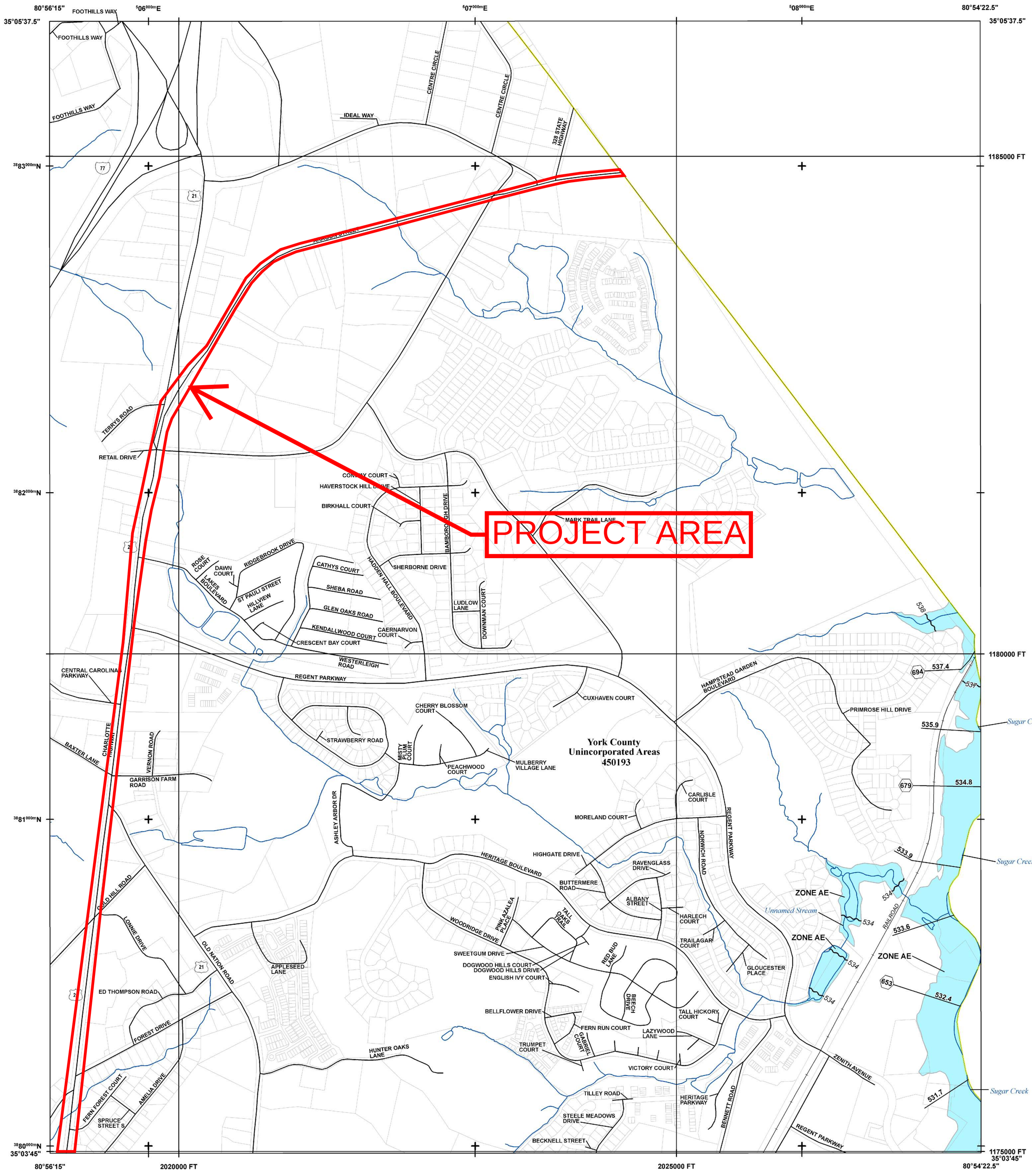
Appendix B

FEMA FIRMs



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*

OTHER AREAS
- NO SCREEN Areas of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike or Floodwall
- Non-accredited Levee, Dike or Floodwall
- E 18.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation (BFE)
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)

OTHER FEATURES
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

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Base map information shown on this FIRM was provided in digital format by York County, South Carolina and Catawba Regional Council of Governments, dated 2008.

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DNR

SCALE

N

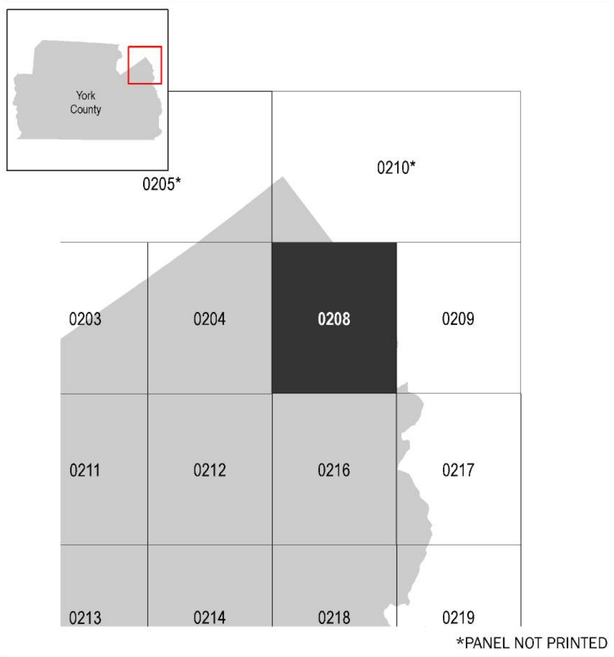
Map Projection:
State Plane Lambert Conformal Conic, FIPS 3900; North American Datum 1983 HARN; Western Hemisphere; Vertical Datum: North American Vertical Datum of 1988

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 feet

0 125 250 500 meters

PANEL LOCATOR



*PANEL NOT PRINTED

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

YORK COUNTY, SOUTH CAROLINA
and Incorporated Areas

PANEL 208 OF 505

FEMA

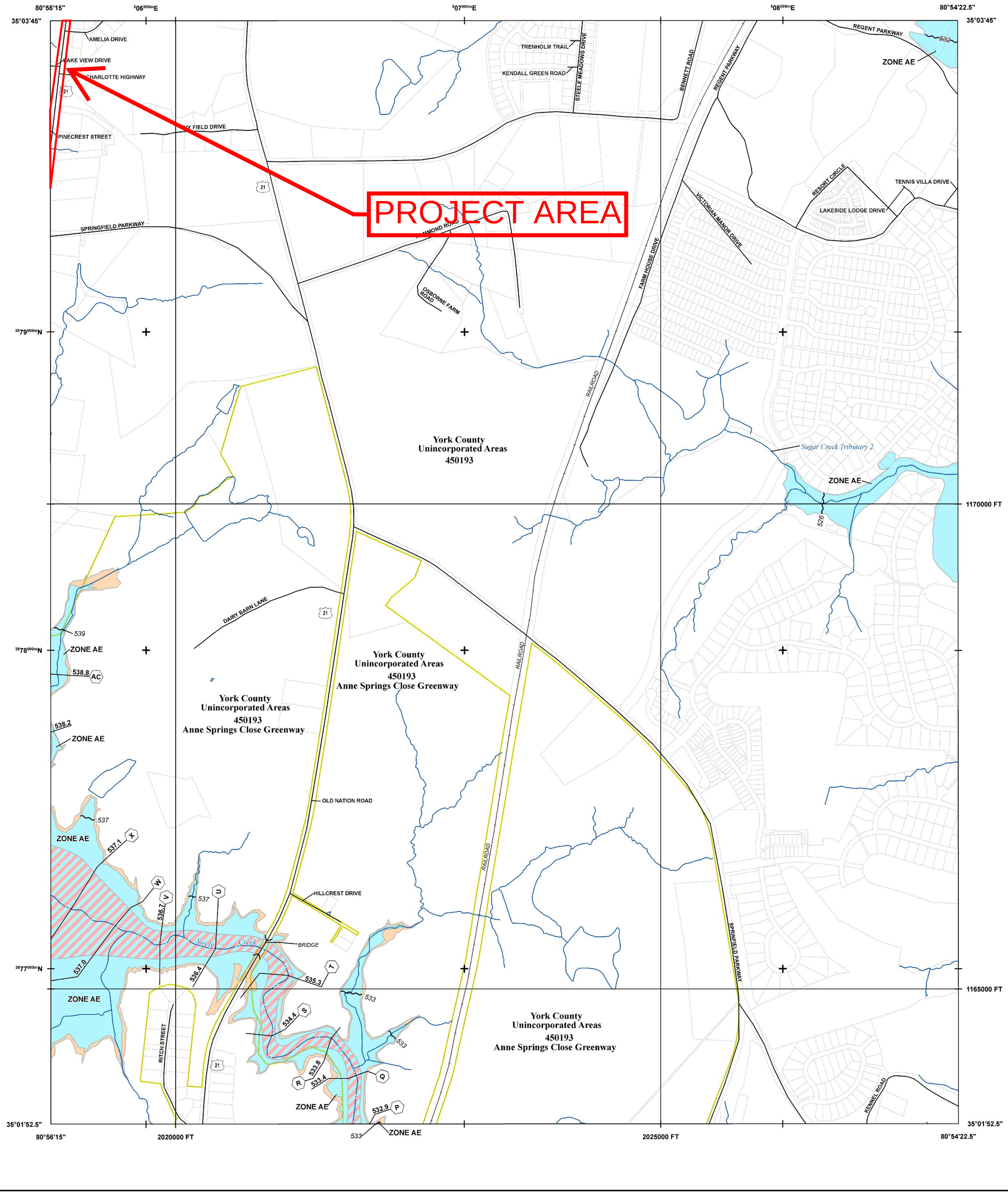
Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
YORK COUNTY	450193	0208	F

VERSION NUMBER
2.3.2.1

MAP NUMBER
45091C0208F

MAP REVISED
MAY 16, 2017



FLOOD HAZARD INFORMATION

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SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*

OTHER AREAS
- NO SCREEN Areas of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike or Floodwall
- Non-accredited Levee, Dike or Floodwall
- E 18.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation (BFE)
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)

OTHER FEATURES
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

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DNR

SCALE

N

Map Projection:
State Plane Lambert Conformal Conic, FIPS 3900; North American Datum 1983 HARN; Western Hemisphere; Vertical Datum: North American Vertical Datum of 1988

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 feet

0 125 250 500 meters

PANEL LOCATOR

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

YORK COUNTY, SOUTH CAROLINA
and Incorporated Areas

PANEL 216 OF 505

FEMA

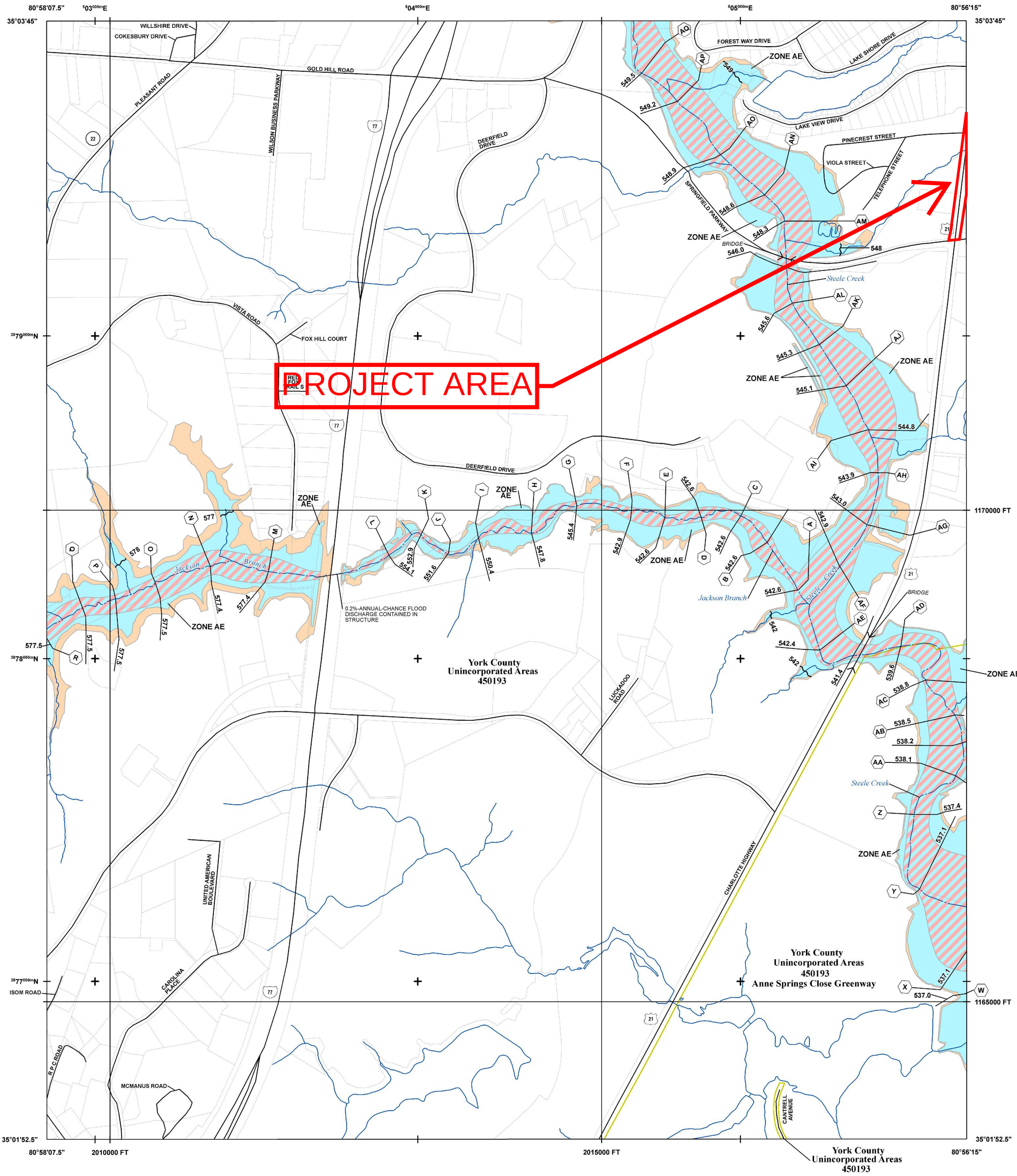
Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
YORK COUNTY	450193	0216	F

VERSION NUMBER
2.3.2.1

MAP NUMBER
45091C0216F

MAP REVISED
MAY 16, 2017



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

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SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*

OTHER AREAS
- NO SCREEN Areas of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike or Floodwall
- Non-accredited Levee, Dike or Floodwall

OTHER FEATURES
- 18.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation (BFE)
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
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- Jurisdiction Boundary

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DNR

SCALE

N

Map Projection:
State Plane Lambert Conformal Conic, FIPS 3900; North American Datum 1983 HARN; Western Hemisphere; Vertical Datum: North American Vertical Datum of 1988

1 inch = 500 feet 1:6,000

0 250 500 750 1,000 2,000 feet

0 125 250 500 meters

PANEL LOCATOR

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

YORK COUNTY, SOUTH CAROLINA
and Incorporated Areas

PANEL 212 OF 505

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
YORK COUNTY	450193	0212	F

VERSION NUMBER
2.3.2.1

MAP NUMBER
45091C0212F

MAP REVISED
MAY 16, 2017

Appendix C

Ditch Calculations

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-5 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		1 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Pavement	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.011	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	74	27	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0120	0.1000	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0184	0.0284	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	4.32		
13. Wetted perimeter, p_w	ft.	7.59		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.5692		
15. Channel slope, s	ft./ft.	0.0080		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.62		
17b. Input Velocity, FPS	ft./sec.	2.62		
18. Flow length, L	ft.	480		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0510	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0693	0.0284	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.07 Hour

4.2 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		2 SHEET
	SUBJECT: Ditch-6		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF 26
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	57		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0280		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0106	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	3.00		
13. Wetted perimeter, p_w	ft.	6.32		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4747		
15. Channel slope, s	ft./ft.	0.0120		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.84		
17b. Input Velocity, FPS	ft./sec.	2.84		
18. Flow length, L	ft.	479		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0469	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0575	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.06 Hour

3.5 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-7 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		3 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	67		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0240		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0128	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	6.75		
13. Wetted perimeter, p_w	ft.	9.49		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7113		
15. Channel slope, s	ft./ft.	0.0150		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.15		
17b. Input Velocity, FPS	ft./sec.	4.15		
18. Flow length, L	ft.	629		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0421	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0549	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.05 Hour

3.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-8 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		4 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	63		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0113	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	6.75		
13. Wetted perimeter, p_w	ft.	9.49		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7113		
15. Channel slope, s	ft./ft.	0.0170		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.42		
17b. Input Velocity, FPS	ft./sec.	4.42		
18. Flow length, L	ft.	574		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0361	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0474	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.05 Hour

2.8 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-9 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	5 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	81		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1545	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	217		
9. Watercourse slope, s	ft./ft.	0.0270		
10. Average velocity, V (figure 3-1)	ft./sec.	2.65		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0227	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	12.96		
13. Wetted perimeter, p_w	ft.	14.84		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.8733		
15. Channel slope, s	ft./ft.	0.0200		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.50		
17b. Input Velocity, FPS	ft./sec.	5.50		
18. Flow length, L	ft.	435		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0220	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1992	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.20 Hour

12 min

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-10 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	6 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	36		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0090		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0936	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0360		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	6.53		
17b. Input Velocity, FPS	ft./sec.	6.53		
18. Flow length, L	ft.	551		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0234	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1170	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.12 Hour

7 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-12 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	7 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	56		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0190		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0988	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	4.00		
13. Wetted perimeter, p_w	ft.	8.25		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4848		
15. Channel slope, s	ft./ft.	0.1540		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	10.31		
17b. Input Velocity, FPS	ft./sec.	10.31		
18. Flow length, L	ft.	127		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0034	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1022	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

6.1 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		8 SHEET
	SUBJECT: Ditch-16		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF
	CHECK'D BY: GPP	DATE: 8-Jul-16	26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	90		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0680		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0867	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0038		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.12		
17b. Input Velocity, FPS	ft./sec.	2.12		
18. Flow length, L	ft.	262		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0343	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1210	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.12 Hour

7.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-18 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	9 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	46		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0540		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0556	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.69		
17b. Input Velocity, FPS	ft./sec.	4.69		
18. Flow length, L	ft.	77		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0046	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0602	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.06 Hour

3.6 min

STV

STV
Consulting Engineers
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, SC 29730 (803) 980-4970

JOB: US 21/ SC 51 Phase I Widening
SUBJECT: Ditch-19
CALC'D BY: PRJ DATE: 7-Jul-16
CHECK'D BY: GPP DATE: 8-Jul-16

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0310		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1292	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	48		
9. Watercourse slope, s	ft./ft.	0.0430		
10. Average velocity, V (figure 3-1)	ft./sec.	3.35		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0040	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	18.75		
13. Wetted perimeter, p_w	ft.	15.81		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.1860		
15. Channel slope, s	ft./ft.	0.0160		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	6.03		
17b. Input Velocity, FPS	ft./sec.	6.03		
18. Flow length, L	ft.	342		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0157	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1489	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.15 Hour

8.9 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		11 SHEET
	SUBJECT: Ditch-21		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF 26
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	42		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0320		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0079	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	18.75		
13. Wetted perimeter, p_w	ft.	15.81		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.1860		
15. Channel slope, s	ft./ft.	0.0120		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.23		
17b. Input Velocity, FPS	ft./sec.	5.23		
18. Flow length, L	ft.	47		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0025	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0104	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.01 Hour

0.6 min

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STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-23 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		12 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	192		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1040		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1342	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1342	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.13 Hour

8.1 min

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Rock Hill, SC 29730 (803) 980-4970

JOB: US 21/ SC 51 Phase I Widening | SHEET: 13
SUBJECT: Ditch-24 | OF: 26
CALC'D BY: PRJ DATE: 7-Jul-16
CHECK'D BY: GPP DATE: 8-Jul-16

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	285		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0630		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2249	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	4.00		
13. Wetted perimeter, p_w	ft.	8.25		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4848		
15. Channel slope, s	ft./ft.	0.0380		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.12		
17b. Input Velocity, FPS	ft./sec.	5.12		
18. Flow length, L	ft.	134		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0073	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2322	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.23 Hour

14 min

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STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-25 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		14 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	115		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0350		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1376	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	2.50		
13. Wetted perimeter, p_w	ft.	5.39		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4638		
15. Channel slope, s	ft./ft.	0.0315		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.53		
17b. Input Velocity, FPS	ft./sec.	4.53		
18. Flow length, L	ft.	434		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0266	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1643	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.16 Hour

9.9 min

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STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-26 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		15 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1100		
6. $T_t = \frac{.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr.	0.0779	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	190		
9. Watercourse slope, s	ft./ft.	0.1000		
10. Average velocity, V (figure 3-1)	ft./sec.	5.10		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr.	0.0103	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	5.00		
13. Wetted perimeter, p_w	ft.	10.20		
14. Hydraulic Radius, $r = a / p_w$ Compute r	ft.	0.4902		
15. Channel slope, s	ft./ft.	0.0370		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.09		
17b. Input Velocity, FPS	ft./sec.	5.09		
18. Flow length, L	ft.	417		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr.	0.0228	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1109	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.7 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-27 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		16 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	105		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0350		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1280	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	2.50		
13. Wetted perimeter, p_w	ft.	5.39		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4638		
15. Channel slope, s	ft./ft.	0.0160		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.23		
17b. Input Velocity, FPS	ft./sec.	3.23		
18. Flow length, L	ft.	129		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0111	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1391	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

8.3 min

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STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-28 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		17 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

	Path #1	Path #2	Path #3
Segment ID	AB		
1. Surface Description (table 3-1)	Grass		
2. Manning's roughness coefficient, n (table 3-1)	0.150		
3. Flow length, L (total L ≤ 300 ft) ft.	246		
4. Two-year 24-hour rainfall, P_2 in.	3.60		
5. Land slope, s ft./ft.	0.0440		
6. $T_t = \frac{.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t hr.	0.2308	0.0000	0.0000

Shallow concentrated flow

Segment ID			
7. Surface description (Paved or Unpaved)			
8. Flow length, L ft.			
9. Watercourse slope, s ft./ft.			
10. Average velocity, V (figure 3-1) ft./sec.			
11. $T_t = \frac{L}{3600\,V}$ Compute T_t hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID			
12. Cross sectional flow area, a $ft.^2$			
13. Wetted perimeter, p_w ft.			
14. Hydraulic Radius, $r = a / p_w$ Compute r ft.			
15. Channel slope, s ft./ft.			
16. Manning's roughness coefficient, n			
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft./sec.			
17b. Input Velocity, FPS ft./sec.			
18. Flow length, L ft.			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19) hr.	0.2308	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.23 Hour
14 min

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STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-29 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	18 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	212		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0510		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1931	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	3.00		
13. Wetted perimeter, p_w	ft.	6.32		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4747		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.95		
17b. Input Velocity, FPS	ft./sec.	2.95		
18. Flow length, L	ft.	186		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0175	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2106	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.21 Hour

13 min

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STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-30 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		19 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	90		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0280		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1237	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	32.00		
13. Wetted perimeter, p_w	ft.	17.89		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.7887		
15. Channel slope, s	ft./ft.	0.0200		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	8.87		
17b. Input Velocity, FPS	ft./sec.	8.87		
18. Flow length, L	ft.	337		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0106	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1342	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.13 Hour

8.1 min

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454 South Anderson Road, Suite 3, BTC 517
Rock Hill, SC 29730 (803) 980-4970

JOB: US 21/ SC 51 Phase I Widening | SHEET 20
SUBJECT: Ditch-31 | OF 26
CALC'D BY: PRJ DATE: 7-Jul-16
CHECK'D BY: GPP DATE: 8-Jul-16

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	62		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0510		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0722	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	24.50		
13. Wetted perimeter, p_w	ft.	15.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.5655		
15. Channel slope, s	ft./ft.	0.0030		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.14		
17b. Input Velocity, FPS	ft./sec.	3.14		
18. Flow length, L	ft.	412		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0364	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1086	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.5 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		21 SHEET
	SUBJECT: Ditch-32		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF 26
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	160		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0330		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1835	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0150		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.03		
17b. Input Velocity, FPS	ft./sec.	5.03		
18. Flow length, L	ft.	701		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0387	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2222	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.22 Hour

13 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-33 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		22 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	256		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2815	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	8.00		
13. Wetted perimeter, p_w	ft.	8.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.8949		
15. Channel slope, s	ft./ft.	0.0180		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.30		
17b. Input Velocity, FPS	ft./sec.	5.30		
18. Flow length, L	ft.	531		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0278	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3093	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.31 Hour

19 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-34 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	23 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	162		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2691	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	75		
9. Watercourse slope, s	ft./ft.	0.1400		
10. Average velocity, V (figure 3-1)	ft./sec.	6.04		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0035	0.0000	0.0000

Channel flow

	Segment ID	CD	DE	
12. Cross sectional flow area, a	$ft.^2$	3.14	8.00	
13. Wetted perimeter, p_w	ft.	6.28	8.94	
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.5000	0.8949	
15. Channel slope, s	ft./ft.	0.0320	0.0090	
16. Manning's roughness coefficient, n		0.0120	0.0350	
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	13.99	3.75	
17b. Input Velocity, FPS	ft./sec.	13.99	3.75	
18. Flow length, L	ft.	222	289	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0044		0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2769	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.28 Hour

17 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-35 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		24 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	25		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0540		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0042	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	4.00		
13. Wetted perimeter, p_w	ft.	8.25		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4848		
15. Channel slope, s	ft./ft.	0.0110		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.76		
17b. Input Velocity, FPS	ft./sec.	2.76		
18. Flow length, L	ft.	140		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0141		0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0183	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.02 Hour

1.1 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-36 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	25 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	107		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1931	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.93		
17b. Input Velocity, FPS	ft./sec.	3.93		
18. Flow length, L	ft.	120		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0085		0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2016	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.20 Hour

12 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch-36 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		26 SHEET OF 26

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	59		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1300		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0477	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	4.00		
13. Wetted perimeter, p_w	ft.	8.25		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4848		
15. Channel slope, s	ft./ft.	0.0680		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	6.85		
17b. Input Velocity, FPS	ft./sec.	6.85		
18. Flow length, L	ft.	97		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0039		0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0517	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.05 Hour

3.1 min

STV	STV INC Consulting Engineers 454 South Anderson Road Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4099	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Hydrologic Data Summary CALC'D BY: PRJ DATE: 7-Jul-2016 CHK'D BY: GPP DATE: 8-Jul-2016	1 of 1

DITCH HYDROLOGIC DATA SUMMARY

Site Data				RUNOFF (Rational Method) Q = C*I*A*Cf - (Cf10 = 1.0)						
Drainage Area Number	Road Name	From Station (Upstream)	To Station (Downstream)	Runoff Coefficient 'C'	Time of Conc. 'Tc'	Rainfall Intensity 'I' (in./hr.)	Drainage Area 'A' (ac.)	Cf	Total Runoff 'Q' (c.f.s.)	
DA-5	OLDSC51 (RT)	302+74	308+00	0.63	5	6.89	2.70	1.00	11.7	
DA-6	OLDSC51 (LT)	302+75	307+32	0.35	5	6.89	0.54	1.00	1.3	
DA-7	SPRINGHILL (RT)	24+00	30+00	0.30	5	6.89	1.42	1.00	2.9	
DA-8	SPRINGHILL (LT)	24+00	30+00	0.45	5	6.89	2.05	1.00	6.4	
DA-9	FLINT (LT)	16+70	20+77	0.45	12	5.78	2.86	1.00	7.4	
DA-10	FLINT (RT)	16+70	22+50	0.63	7	6.53	1.07	1.00	4.4	
DA-12	LAKESBLVD (RT)	11+00	12+31	0.45	6	6.69	0.21	1.00	0.6	
DA-16	OLDNACL (LT)	13+27	13+58	0.51	7	6.62	4.66	1.00	15.7	
DA-18	OLDNACL (RT)	13+66	14+40	0.45	5	6.89	0.21	1.00	0.7	
DA-19	OLDNACL (RT)	10+50	13+28	0.56	9	6.22	3.38	1.00	11.8	
DA-21	GARRISONFARM (RT)	11+00	11+35	0.84	5.00	6.89	0.13	1.00	0.8	
DA-23	LAKESHORE (LT)	13+00	13+50	0.55	8.10	6.35	0.36	1.00	1.3	
DA-24	AMELIA (LT)	11+00	11+96	0.35	14.00	5.52	0.65	1.00	1.3	
DA-25	BAXTER (LT)	14+00	14+21	0.45	9.90	6.07	1.00	1.00	2.7	
DA-26	FERNFOREST (RT)	10+50	11+00	0.60	6.70	6.58	3.29	1.00	13.0	
DA-27	ANDREW (LT)	00+50	01+88	0.35	6.32	6.65	0.51	1.00	1.2	
DA-28	ANDREW (RT)	01+00	01+88	0.32	14.00	5.52	0.89	1.00	1.6	
DA-29	ANDREW (RT)	02+50	04+50	0.37	13.00	5.65	1.02	1.00	2.1	
DA-30	GOLDHILL (LT)	28+50	32+00	0.32	8.10	6.35	0.82	1.00	1.7	
DA-31	GOLDHILL (RT)	27+00	31+50	0.51	6.50	6.62	1.67	1.00	5.6	
DA-32	GOLDHILL (LT)	14+10	22+00	0.42	13.00	5.65	1.66	1.00	3.9	
DA-33	GOLDHILL (RT)	14+27	22+50	0.30	19.00	4.97	2.71	1.00	4.0	
DA-34	US 21BUSINESS (RT)	22+00	25+00	0.65	17.00	5.18	4.75	1.00	16.0	

STV	**STV INC** Consulting Engineers 454 South Anderson Road Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4099	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Hydrologic Data Summary CALC'D BY: PRJ DATE: 7-Jul-2016 CHK'D BY: GPP DATE: 8-Jul-2016	1 of 1

DITCH HYDROLOGIC DATA SUMMARY

Site Data				RUNOFF (Rational Method) Q = C*I*A*Cf - (Cf10 = 1.0)						
Drainage Area Number	Road Name	From Station (Upstream)	To Station (Downstream)	Runoff Coefficient 'C'	Time of Conc. 'Tc'	Rainfall Intensity 'I' (in./hr.)	Drainage Area 'A' (ac.)	Cf	Total Runoff 'Q' (c.f.s.)	
DA-35	ANDREW (LT)	02+60	03+50	0.45	5.00	6.89	0.14	1.00	0.4	
DA-36	EX-FLINT (LT)	10+00	11+41	0.35	12.00	5.78	0.94	1.00	1.90	
DA-37	EX-FOREST (LT)	11+69	12+32	0.30	5.00	6.89	0.24	1.00	0.50	
DA-38	US21 (LT)	0+00	17+00	D/S OF CULVERT EP5				1.00	6.22	Tail Ditch
DA-39	OLDNACL (LT)	0+00	34+00	0.35	8.60	6.27	2.75	1.00	6.03	Tail Ditch

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	1 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 302+74 To Station: 308+00 Road Name: OLDSC51 (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
302+74	642.53	2.5	303+00	642.61	2.9	11.7	1.60	0.045	0.0031	7.68	10.18	0.76	1.52	11.7	1.60	0.31	GOOD	GOOD
303+00	642.61	2.9	303+50	642.76	2.8	11.7	1.61	0.045	0.0030	7.76	10.23	0.76	1.51	11.7	1.61	0.30	GOOD	GOOD
303+50	642.76	2.8	304+00	642.91	1.8	11.7	1.61	0.045	0.0030	7.76	10.23	0.76	1.51	11.7	1.61	0.30	GOOD	GOOD
304+00	642.91	1.8	304+50	643.91	2.2	11.7	1.13	0.045	0.0200	3.81	7.16	0.53	3.07	11.7	1.13	1.41	GOOD	FIX
304+50	643.91	2.2	305+00	644.26	2.1	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD
305+00	644.26	2.1	305+50	644.61	2.0	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD
305+50	644.61	2.0	306+00	644.96	1.9	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD
306+00	644.96	1.9	306+50	645.31	2.0	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD
306+50	645.31	2.0	307+00	645.66	2.1	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD
307+00	645.66	2.1	307+50	646.01	2.1	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD
307+50	646.01	2.1	308+00	646.36	1.9	11.7	1.37	0.045	0.0070	5.65	8.72	0.65	2.07	11.7	1.37	0.60	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	2 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 302+75 To Station: 307+32 Road Name: OLDSC51 (LT)

SL= 2.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
302+75	638.63	1.4	303+00	638.92	2.0	1.3	0.55	0.045	0.0116	0.90	3.48	0.26	1.45	1.3	0.55	0.40	GOOD	GOOD
303+00	638.92	2.0	303+50	639.47	1.3	1.3	0.55	0.045	0.0110	0.92	3.52	0.26	1.42	1.3	0.55	0.38	GOOD	GOOD
303+50	639.47	1.3	304+00	640.07	3.3	1.3	0.54	0.045	0.0120	0.89	3.46	0.26	1.46	1.3	0.54	0.41	GOOD	GOOD
304+00	640.07	3.3	304+50	640.67	1.6	1.3	0.54	0.045	0.0120	0.89	3.46	0.26	1.46	1.3	0.54	0.41	GOOD	GOOD
304+50	640.67	1.6	305+00	641.02	1.7	1.3	0.60	0.045	0.0070	1.09	3.83	0.28	1.20	1.3	0.60	0.26	GOOD	GOOD
305+00	641.02	1.7	305+50	641.17	2.1	1.3	0.71	0.045	0.0030	1.49	4.49	0.33	0.87	1.3	0.71	0.13	GOOD	GOOD
305+50	641.17	2.1	306+00	641.32	2.0	1.3	0.71	0.045	0.0030	1.49	4.49	0.33	0.87	1.3	0.71	0.13	GOOD	GOOD
306+00	641.32	2.0	306+50	643.82	1.3	1.3	0.42	0.045	0.0500	0.52	2.65	0.20	2.50	1.3	0.42	1.30	GOOD	FIX
306+50	643.82	1.3	307+00	644.17	1.4	1.3	0.60	0.045	0.0070	1.09	3.83	0.28	1.20	1.3	0.60	0.26	GOOD	GOOD
307+00	644.17	1.4	307+32	644.27	1.0	1.3	0.70	0.045	0.0031	1.47	4.45	0.33	0.88	1.3	0.70	0.14	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	3 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 24+00 To Station: 30+00 Road Name: SPRINGHILL (RT)

SL= 6.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
24+00	618.54	1.3	24+50	618.36	1.3	2.9	0.82	0.045	0.0036	2.71	6.85	0.40	1.07	2.9	0.82	0.18	GOOD	GOOD
24+50	618.36	1.3	25+00	617.98	1.3	2.9	0.72	0.045	0.0076	2.05	5.95	0.34	1.42	2.9	0.72	0.34	GOOD	GOOD
25+00	617.98	1.3	25+50	617.25	1.3	2.9	0.63	0.045	0.0146	1.60	5.26	0.30	1.81	2.9	0.63	0.58	GOOD	GOOD
25+50	617.25	1.3	26+00	616.37	1.3	2.9	0.61	0.045	0.0176	1.49	5.08	0.29	1.94	2.9	0.61	0.67	GOOD	GOOD
26+00	616.37	1.3	26+50	615.50	1.3	2.9	0.61	0.045	0.0174	1.50	5.09	0.29	1.93	2.9	0.61	0.66	GOOD	GOOD
26+50	615.50	1.3	27+00	614.65	1.2	2.9	0.62	0.045	0.0170	1.51	5.12	0.30	1.92	2.9	0.62	0.65	GOOD	GOOD
27+00	614.65	1.2	27+50	613.60	1.0	2.9	0.59	0.045	0.0210	1.40	4.92	0.28	2.07	2.9	0.59	0.77	GOOD	GOOD
27+50	613.60	1.0	28+00	613.25	1.3	2.9	0.73	0.045	0.0070	2.11	6.04	0.35	1.37	2.9	0.73	0.32	GOOD	GOOD
28+00	613.25	1.3	28+50	612.33	1.3	2.9	0.61	0.045	0.0184	1.47	5.04	0.29	1.97	2.9	0.61	0.70	GOOD	GOOD
28+50	612.33	1.3	29+00	611.41	1.3	2.9	0.61	0.045	0.0184	1.47	5.04	0.29	1.97	2.9	0.61	0.70	GOOD	GOOD
29+00	611.41	1.3	29+50	610.49	1.3	2.9	0.61	0.045	0.0184	1.47	5.04	0.29	1.97	2.9	0.61	0.70	GOOD	GOOD
29+50	610.49	1.3	30+00	609.57	1.3	2.9	0.61	0.045	0.0184	1.47	5.04	0.29	1.97	2.9	0.61	0.70	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	4 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 24+00 To Station: 30+00 Road Name: SPRINGHILL (LT)

SL= 2.00 SR= 6.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
24+00	618.31	1.3	24+50	617.36	1.3	6.4	0.81	0.045	0.0190	2.63	6.74	0.39	2.44	6.4	0.81	0.96	GOOD	GOOD
24+50	617.36	1.3	25+00	616.11	1.3	6.4	0.77	0.045	0.0250	2.37	6.41	0.37	2.70	6.4	0.77	1.20	GOOD	FIX
25+00	616.11	1.3	25+50	614.91	1.3	6.4	0.78	0.045	0.0240	2.41	6.45	0.37	2.66	6.4	0.78	1.16	GOOD	FIX
25+50	614.91	1.3	26+00	613.82	1.3	6.4	0.79	0.045	0.0218	2.50	6.57	0.38	2.56	6.4	0.79	1.07	GOOD	FIX
26+00	613.82	1.3	26+50	612.72	1.3	6.4	0.79	0.045	0.0220	2.49	6.56	0.38	2.57	6.4	0.79	1.08	GOOD	FIX
26+50	612.72	1.3	27+00	611.77	1.3	6.4	0.81	0.045	0.0190	2.63	6.74	0.39	2.44	6.4	0.81	0.96	GOOD	GOOD
27+00	611.77	1.3	27+50	611.02	1.3	6.4	0.85	0.045	0.0150	2.87	7.05	0.41	2.23	6.4	0.85	0.79	GOOD	GOOD
27+50	611.02	1.3	28+00	610.48	1.3	6.4	0.90	0.045	0.0108	3.25	7.50	0.43	1.97	6.4	0.90	0.61	GOOD	GOOD
28+00	610.48	1.3	28+50	610.30	1.3	6.4	1.11	0.045	0.0036	4.90	9.21	0.53	1.31	6.4	1.11	0.25	GOOD	GOOD
28+50	610.30	1.3	29+00	609.91	1.3	6.4	0.96	0.045	0.0078	3.67	7.97	0.46	1.74	6.4	0.96	0.47	GOOD	GOOD
29+00	609.91	1.3	29+50	609.36	1.3	6.4	0.90	0.045	0.0110	3.23	7.47	0.43	1.98	6.4	0.90	0.62	GOOD	GOOD
29+50	609.36	1.3	30+00	608.67	1.3	6.4	0.86	0.045	0.0138	2.96	7.16	0.41	2.16	6.4	0.86	0.74	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	5 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 16+70 To Station: 19+50 Road Name: FLINT (LT)

SL= 2.00 SR= 6.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
16+70	608.75	1.3	17+00	608.65	1.3	7.4	1.19	0.045	0.0033	5.63	9.87	0.57	1.31	7.4	1.19	0.25	GOOD	GOOD
17+00	608.65	1.3	17+50	608.40	1.5	7.4	1.10	0.045	0.0050	4.83	9.15	0.53	1.53	7.4	1.10	0.34	GOOD	GOOD
17+50	608.40	1.5	18+00	608.15	1.7	7.4	1.10	0.045	0.0050	4.83	9.15	0.53	1.53	7.4	1.10	0.34	GOOD	GOOD
18+00	608.15	1.7	18+50	607.90	1.9	7.4	1.10	0.045	0.0050	4.83	9.15	0.53	1.53	7.4	1.10	0.34	GOOD	GOOD
18+50	607.90	1.9	19+00	607.65	1.6	7.4	1.10	0.045	0.0050	4.83	9.15	0.53	1.53	7.4	1.10	0.34	GOOD	GOOD
19+00	607.65	1.6	19+50	605.00	2.3	7.4	0.70	0.045	0.0530	1.99	5.86	0.34	3.72	7.4	0.70	2.33	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	6 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 19+50 To Station: 20+77 Road Name: FLINT (LT)

SL= 2.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
19+50	605.00	2.3	20+00	603.00	2.1	7.4	0.83	0.045	0.0400	2.08	5.30	0.39	3.55	7.4	0.83	2.08	GOOD	FIX
20+00	603.00	2.1	20+50	601.30	2.7	7.4	0.86	0.045	0.0340	2.21	5.46	0.41	3.34	7.4	0.86	1.82	GOOD	FIX
20+50	601.30	2.7	20+77	600.10	2.9	7.4	0.82	0.045	0.0444	2.00	5.19	0.39	3.70	7.4	0.82	2.27	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	7 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 16+70 To Station: 22+00 Road Name: FLINT (RT)

SL= 6.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
16+70	606.45	1.6	17+00	606.14	1.1	4.4	0.79	0.045	0.0103	2.49	6.57	0.38	1.76	4.4	0.79	0.51	GOOD	GOOD
17+00	606.14	1.1	17+50	605.90	1.4	4.4	0.91	0.045	0.0048	3.32	7.58	0.44	1.32	4.4	0.91	0.27	GOOD	GOOD
17+50	605.90	1.4	18+00	605.50	2.6	4.4	0.83	0.045	0.0080	2.74	6.89	0.40	1.60	4.4	0.83	0.41	GOOD	GOOD
18+00	605.50	2.6	18+50	605.10	2.1	4.4	0.83	0.045	0.0080	2.74	6.89	0.40	1.60	4.4	0.83	0.41	GOOD	GOOD
18+50	605.10	2.1	19+00	604.70	2.0	4.4	0.83	0.045	0.0080	2.74	6.89	0.40	1.60	4.4	0.83	0.41	GOOD	GOOD
19+00	604.70	2.0	19+50	604.30	1.3	4.4	0.83	0.045	0.0080	2.74	6.89	0.40	1.60	4.4	0.83	0.41	GOOD	GOOD
19+50	604.30	1.3	20+00	602.05	1.1	4.4	0.60	0.045	0.0450	1.44	4.98	0.29	3.06	4.4	0.60	1.68	GOOD	FIX
20+00	602.05	1.1	20+50	600.05	2.2	4.4	0.61	0.045	0.0400	1.50	5.10	0.29	2.93	4.4	0.61	1.53	GOOD	FIX
20+50	600.05	2.2	21+00	598.05	1.9	4.4	0.61	0.045	0.0400	1.50	5.10	0.29	2.93	4.4	0.61	1.53	GOOD	FIX
21+00	598.05	1.9	21+50	595.55	1.7	4.4	0.59	0.045	0.0500	1.38	4.89	0.28	3.19	4.4	0.59	1.83	GOOD	FIX
21+50	595.55	1.7	22+00	591.05	1.3	4.4	0.51	0.041	0.0900	1.04	4.24	0.24	4.24	4.4	0.51	2.86	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	8 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 22+00 To Station: 22+50 Road Name: FLINT (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
22+00	591.05	1.3	22+50	586.55	2.1	4.4	0.56	0.040	0.0900	0.95	3.58	0.27	4.63	4.4	0.56	3.16	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	9 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 11+00 To Station: 12+31 Road Name: LAKESBLVD (RT)

SL= 6.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
11+00	656.57	1.0	11+50	649.85	1.0	0.6	0.23	0.045	0.1344	0.21	1.92	0.11	2.81	0.6	0.23	1.94	GOOD	FIX
11+50	649.85	1.0	12+00	642.50	2.1	0.6	0.23	0.045	0.1470	0.21	1.89	0.11	2.90	0.6	0.23	2.09	GOOD	FIX
12+00	642.50	2.1	12+31	637.00	1.0	0.6	0.22	0.044	0.1774	0.19	1.81	0.10	3.16	0.6	0.22	2.41	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ/SCN DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	10 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 13+27 To Station: 13+58 Road Name: OLDNACL(LT)

SL= 4.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
13+27	628.01	3.1	13+50	627.61	2.8	15.7	1.15	0.045	0.0174	5.30	9.49	0.56	2.96	15.7	1.15	1.25	GOOD	FIX
13+50	627.61	2.8	13+58	627.78	2.4	15.7	1.11	0.045	0.0212	4.92	9.14	0.54	3.19	15.7	1.11	1.47	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	11 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 13+66 To Station: 14+40 Road Name: OLDNACL (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
13+66	630.04	3.3	14+00	630.48	2.1	0.7	0.43	0.045	0.0129	0.54	2.70	0.20	1.29	0.7	0.43	0.34	GOOD	GOOD
14+00	630.48	2.1	14+40	631.00	1.0	0.7	0.42	0.045	0.0130	0.54	2.70	0.20	1.29	0.7	0.42	0.34	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	12 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 10+50 To Station: 13+28 Road Name: OLDNACL (RT)

SL= 6.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
10+50	629.03	2.0	11+00	628.86	2.0	11.8	1.41	0.045	0.0034	7.93	11.71	0.68	1.49	11.8	1.41	0.30	GOOD	GOOD
11+00	628.86	2.0	11+50	628.63	2.0	11.8	1.33	0.045	0.0046	7.08	11.07	0.64	1.67	11.8	1.33	0.38	GOOD	GOOD
11+50	628.63	2.0	12+00	628.38	2.0	11.8	1.31	0.045	0.0050	6.86	10.89	0.63	1.72	11.8	1.31	0.41	GOOD	GOOD
12+00	628.38	2.0	12+50	628.20	2.0	11.8	1.39	0.045	0.0036	7.76	11.59	0.67	1.52	11.8	1.39	0.31	GOOD	GOOD
12+50	628.20	2.0	13+00	628.01	2.0	11.8	1.38	0.045	0.0038	7.60	11.47	0.66	1.55	11.8	1.38	0.33	GOOD	GOOD
13+00	628.01	2.0	13+28	627.92	2.0	11.8	1.42	0.045	0.0032	8.10	11.84	0.68	1.46	11.8	1.42	0.29	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	13 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 11+00 To Station: 11+35 Road Name: GARRISONFARM (RT)

SL= 6.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
11+00	643.38	1.0	11+35	643.79	1.0	0.8	0.41	0.045	0.0117	0.66	3.39	0.20	1.21	0.8	0.41	0.30	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	14 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 13+00 To Station: 13+50 Road Name: LAKESHORE (LT)

SL= 2.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
13+00	583.83	3.0	13+50	587.16	1.0	1.3	0.39	0.045	0.0666	0.47	2.51	0.19	2.79	1.3	0.39	1.64	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	15 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 11+00 To Station: 11+96 Road Name: AMELIA (LT)

SL= 2.00 SR= 6.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
11+00	587.63	1.0	11+50	586.38	1.0	1.3	0.42	0.045	0.0250	0.72	3.52	0.20	1.81	1.3	0.42	0.66	GOOD	GOOD
11+50	586.38	1.0	11+96	585.19	2.1	1.3	0.42	0.045	0.0259	0.71	3.50	0.20	1.84	1.3	0.42	0.68	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	16 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 14+00 To Station: 14+21 Road Name: BAXTER LN (LT)

SL= 2.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
14+00	642.50	3.8	14+21	640.86	3.1	2.7	0.50	0.044	0.0781	0.75	3.18	0.24	3.59	2.7	0.50	2.44	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	17 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 10+50 To Station: 11+00 Road Name: FERNFOREST (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
10+50	583.20	1.5	11+00	585.20	1.0	13.0	1.02	0.044	0.0400	3.10	6.47	0.48	4.19	13.0	1.02	2.54	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	18 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 00+50 To Station: 01+88 Road Name: ANDREW (LT)

SL= 2.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
00+50	613.56	1.4	01+00	612.76	1.3	1.2	0.59	0.045	0.0160	0.70	2.64	0.26	1.72	1.2	0.59	0.59	GOOD	GOOD
01+00	612.76	1.3	01+50	611.96	1.1	1.2	0.59	0.045	0.0160	0.70	2.64	0.26	1.72	1.2	0.59	0.59	GOOD	GOOD
01+50	611.96	1.1	01+88	611.35	1.7	1.2	0.59	0.045	0.0161	0.70	2.64	0.26	1.73	1.2	0.59	0.59	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	19 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 01+00 To Station: 01+88 Road Name: ANDREW (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
01+00	615.03	1.3	01+50	614.38	1.6	1.6	0.58	0.045	0.0130	1.01	3.68	0.27	1.59	1.6	0.58	0.47	GOOD	GOOD
01+50	614.38	1.6	01+88	613.89	1.4	1.6	0.58	0.045	0.0129	1.01	3.69	0.27	1.58	1.6	0.58	0.47	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	20 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 02+50 To Station: 04+50 Road Name: ANDREW (RT)

SL= 6.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
02+50	615.67	1.5	03+00	615.07	1.0	2.1	0.58	0.045	0.0120	1.35	4.84	0.28	1.55	2.1	0.58	0.44	GOOD	GOOD
03+00	615.07	1.0	03+50	613.95	1.0	2.1	0.52	0.045	0.0224	1.07	4.30	0.25	1.96	2.1	0.52	0.72	GOOD	GOOD
03+50	613.95	1.0	04+00	613.35	1.0	2.1	0.58	0.045	0.0120	1.35	4.84	0.28	1.55	2.1	0.58	0.44	GOOD	GOOD
04+00	613.35	1.0	04+50	612.77	1.2	2.1	0.59	0.045	0.0116	1.37	4.87	0.28	1.53	2.1	0.59	0.42	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	21 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 28+50 To Station: 31+50 Road Name: GOLDHILL (LT)

SL= 2.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
28+50	639.72	1.1	29+00	639.57	2.4	1.7	0.78	0.045	0.0030	1.83	4.96	0.37	0.93	1.7	0.78	0.15	GOOD	GOOD
29+00	639.57	2.4	29+50	639.42	2.7	1.7	0.78	0.045	0.0030	1.83	4.96	0.37	0.93	1.7	0.78	0.15	GOOD	GOOD
29+50	639.42	2.7	30+00	639.27	3.0	1.7	0.78	0.045	0.0030	1.83	4.96	0.37	0.93	1.7	0.78	0.15	GOOD	GOOD
30+00	639.27	3.0	30+50	639.12	3.3	1.7	0.78	0.045	0.0030	1.83	4.96	0.37	0.93	1.7	0.78	0.15	GOOD	GOOD
30+50	639.12	3.3	31+00	638.97	3.2	1.7	0.78	0.045	0.0030	1.83	4.96	0.37	0.93	1.7	0.78	0.15	GOOD	GOOD
31+00	638.97	3.2	31+50	637.22	4.7	1.7	0.49	0.045	0.0350	0.73	3.13	0.23	2.34	1.7	0.49	1.07	GOOD	FIX

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	22 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 27+00 To Station: 31+50 Road Name: GOLDHILL (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
27+00	636.53	1.0	27+50	636.38	1.0	3.0	0.97	0.045	0.0030	2.80	6.14	0.46	1.07	3.0	0.97	0.18	GOOD	GOOD
27+50	636.38	1.0	28+00	636.23	1.3	3.0	0.97	0.045	0.0030	2.80	6.14	0.46	1.07	3.0	0.97	0.18	GOOD	GOOD
28+00	636.23	1.3	28+50	636.08	1.6	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD
28+50	636.08	1.6	29+00	635.93	1.8	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD
29+00	635.93	1.8	29+50	635.78	2.1	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD
29+50	635.78	2.1	30+00	635.63	2.4	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD
30+00	635.63	2.4	30+50	635.48	2.8	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD
30+50	635.48	2.8	31+00	635.33	3.5	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD
31+00	635.33	3.5	31+50	635.18	4.1	5.6	1.22	0.045	0.0030	4.46	7.76	0.58	1.25	5.6	1.22	0.23	GOOD	GOOD

Discharge has been discretized

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^2 THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	23 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 14+10 To Station: 22+00 Road Name: GOLDHILL (LT)

SL= 2.00 SR= 4.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
14+10	620.00	1.2	14+50	622.58	1.4	3.9	0.60	0.045	0.0646	1.07	3.80	0.28	3.65	3.90	0.60	2.41	GOOD	FIX
14+50	622.58	1.4	15+00	624.15	1.5	3.9	0.69	0.045	0.0314	1.41	4.36	0.32	2.76	3.9	0.69	1.34	GOOD	FIX
15+00	624.15	1.5	15+50	625.50	1.2	3.9	0.71	0.045	0.0270	1.49	4.49	0.33	2.61	3.9	0.71	1.19	GOOD	FIX
15+50	625.50	1.2	16+00	626.73	1.2	3.9	0.72	0.045	0.0246	1.55	4.57	0.34	2.52	3.9	0.72	1.10	GOOD	FIX
16+00	626.73	1.2	16+50	628.06	1.4	3.9	0.71	0.045	0.0266	1.50	4.50	0.33	2.60	3.9	0.71	1.17	GOOD	FIX
16+50	628.06	1.4	17+00	629.18	1.3	3.9	0.73	0.045	0.0224	1.60	4.65	0.34	2.44	3.9	0.73	1.02	GOOD	FIX
17+00	629.18	1.3	17+50	630.11	1.2	3.9	0.76	0.045	0.0186	1.72	4.81	0.36	2.27	3.9	0.76	0.88	GOOD	GOOD
17+50	630.11	1.2	18+00	630.83	1.4	3.9	0.79	0.045	0.0144	1.89	5.05	0.37	2.06	3.9	0.79	0.71	GOOD	GOOD
18+00	630.83	1.4	18+50	631.41	1.5	3.9	0.83	0.045	0.0116	2.05	5.26	0.39	1.90	3.9	0.83	0.60	GOOD	GOOD
18+50	631.41	1.5	19+00	631.98	2.3	3.9	0.83	0.045	0.0114	2.06	5.27	0.39	1.89	3.9	0.83	0.59	GOOD	GOOD
19+00	631.98	2.3	19+50	632.63	2.6	3.9	0.81	0.045	0.0130	1.96	5.14	0.38	1.99	3.9	0.81	0.66	GOOD	GOOD
19+50	632.63	2.6	20+00	633.33	2.6	3.9	0.80	0.045	0.0140	1.91	5.07	0.38	2.04	3.9	0.80	0.70	GOOD	GOOD
20+00	633.33	2.6	20+50	633.59	2.6	3.9	0.96	0.045	0.0052	2.77	6.11	0.45	1.41	3.9	0.96	0.31	GOOD	GOOD
20+50	633.59	2.6	21+00	633.75	2.6	3.9	1.05	0.045	0.0032	3.32	6.69	0.50	1.17	3.9	1.05	0.21	GOOD	GOOD
21+00	633.75	2.6	21+50	633.96	2.7	3.9	1.00	0.045	0.0042	3.00	6.36	0.47	1.30	3.9	1.00	0.26	GOOD	GOOD
21+50	633.96	2.7	22+00	634.19	1.8	3.9	0.98	0.045	0.0046	2.90	6.25	0.46	1.35	3.9	0.98	0.28	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	24 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 14+27 To Station: 22+50 Road Name: GOLDHILL (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
14+27	620.26	1.8	14+50	622.40	2.0	4.0	0.54	0.040	0.0913	0.89	3.46	0.26	4.51	4.0	0.54	3.10	GOOD	FIX
14+50	622.40	2.0	15+00	624.70	1.8	4.0	0.64	0.045	0.0460	1.25	4.10	0.30	3.21	4.0	0.64	1.85	GOOD	FIX
15+00	624.70	1.8	15+50	626.05	2.0	4.0	0.71	0.045	0.0270	1.52	4.53	0.34	2.63	4.0	0.71	1.20	GOOD	FIX
15+50	626.05	2.0	16+00	626.55	3.1	4.0	0.86	0.045	0.0100	2.21	5.46	0.40	1.81	4.0	0.86	0.54	GOOD	GOOD
16+00	626.55	3.1	16+50	628.75	1.2	4.0	0.65	0.045	0.0440	1.27	4.13	0.31	3.16	4.0	0.65	1.78	GOOD	FIX
16+50	628.75	1.2	17+00	630.40	1.7	4.0	0.69	0.045	0.0330	1.41	4.36	0.32	2.83	4.0	0.69	1.41	GOOD	FIX
17+00	630.40	1.7	17+50	632.05	2.9	4.0	0.69	0.045	0.0330	1.41	4.36	0.32	2.83	4.0	0.69	1.41	GOOD	FIX
17+50	632.05	2.9	18+00	632.55	2.6	4.0	0.86	0.045	0.0100	2.21	5.46	0.40	1.81	4.0	0.86	0.54	GOOD	GOOD
18+00	632.55	2.6	18+50	633.05	3.2	4.0	0.86	0.045	0.0100	2.21	5.46	0.40	1.81	4.0	0.86	0.54	GOOD	GOOD
18+50	633.05	3.2	19+00	633.55	3.5	4.0	0.86	0.045	0.0100	2.21	5.46	0.40	1.81	4.0	0.86	0.54	GOOD	GOOD
19+00	633.55	3.5	19+50	634.05	3.4	4.0	0.86	0.045	0.0100	2.21	5.46	0.40	1.81	4.0	0.86	0.54	GOOD	GOOD
19+50	634.05	3.4	20+00	634.30	3.0	4.0	0.98	0.045	0.0050	2.86	6.21	0.46	1.40	4.0	0.98	0.30	GOOD	GOOD
20+00	634.30	3.0	20+50	634.55	2.4	4.0	0.98	0.045	0.0050	2.86	6.21	0.46	1.40	4.0	0.98	0.30	GOOD	GOOD
20+50	634.55	2.4	21+00	634.80	2.0	4.0	0.98	0.045	0.0050	2.86	6.21	0.46	1.40	4.0	0.98	0.30	GOOD	GOOD
21+00	634.80	2.0	21+50	635.05	1.7	3.0	0.88	0.045	0.0050	2.31	5.58	0.41	1.30	3.0	0.88	0.27	GOOD	GOOD
21+50	635.05	1.7	22+00	635.30	1.4	2.0	0.75	0.045	0.0050	1.70	4.79	0.36	1.17	2.0	0.75	0.24	GOOD	GOOD
22+00	635.30	1.4	22+50	635.45	1.1	1.0	0.63	0.045	0.0030	1.21	4.03	0.30	0.81	1.0	0.63	0.12	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	25 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 22+00 To Station: 25+00 Road Name: US 21 BUSINESS (RT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
22+00	622.40	2.0	25+00	620.43	2.0	16.0	1.56	0.045	0.0066	7.31	9.93	0.74	2.19	16.0	1.56	0.64	GOOD	GOOD

*** Ditch extends beyond the end of the GEOPAK chain. Stations beyond STA 23+65.54 are theoretical stations if the chain was extended

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^2 THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	26 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 02+60 To Station: 03+50 Road Name: ANDREW (LT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
02+60	611.60	0.9	03+00	610.84	0.9	0.4	0.32	0.045	0.0190	0.31	2.04	0.15	1.30	0.4	0.32	0.38	GOOD	GOOD
03+00	610.84	0.9	03+50	613.63	0.8	0.4	0.26	0.045	0.0558	0.21	1.67	0.12	1.94	0.4	0.26	0.91	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	27 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 10+00 To Station: 11+41 Road Name: EXISTING FLINT (LT)

SL= 4.00 SR= 2.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
11+41	618.27	1.0	11+00	617.31	1.0	1.9	0.55	0.045	0.0234	0.92	3.52	0.26	2.07	1.9	0.55	0.81	GOOD	GOOD
11+00	617.31	1.0	10+50	616.14	1.0	1.9	0.55	0.045	0.0234	0.92	3.52	0.26	2.07	1.9	0.55	0.81	GOOD	GOOD
10+50	616.14	1.0	10+00	614.95	1.0	1.9	0.55	0.045	0.0238	0.91	3.51	0.26	2.08	1.9	0.55	0.82	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

STV	STV Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Ditch Analysis CALC'D BY: PRJ DATE: 07-Jul-16 CHEK'D BY: GPP DATE: 08-Jul-16	28 SHEET OF 28

DITCH ANALYSIS USING MANNINGS OPEN CHANNEL FOR VEGETATIVE LININGS

For Type C Vegetation (Enter A, B, C, D, or E)

From Station: 11+69 To Station: 12+32 Road Name: EXISTING FOREST (LT)

SL= 2.00 SR= 6.00 B= 0.00

From Sta.	Ditch Elev.	Ditch Depth	To Sta.	Ditch Elev.	Ditch Depth	Q(Actual) c.f.s.	Depth ft.	Manning's n	Slope ft./ft.	Area sq. ft.	Wetted Perim.	Hyd. Rad. ft.	Velocity f.p.s.	Q(Cal.) c.f.s.	Depth ft.	Shear p.s.f.	Depth Comment	Shear Comment
11+69	587.94	0.7	12+00	586.12	0.5	0.5	0.25	0.045	0.0587	0.25	2.10	0.12	1.97	0.5	0.25	0.92	GOOD	GOOD
12+00	586.12	0.5	12+32	586.00	0.6	0.5	0.42	0.045	0.0038	0.71	3.51	0.20	0.70	0.5	0.42	0.10	GOOD	GOOD

REMARK: ALL DITCHES LINED WITH TEMPORARY EROSION CONTROL BLANKET. IF SHEAR > 1.75 LB/FT^ THEN LINING WILL BE TURF REINFORCEMENT MATTING

Appendix D

Culvert and Driveway Pipe Calculations

STV Incorporated
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730-3392
803.980.4970 www.stvinc.com

JOB:	US 21/ SC 51 Phase I Widening		1
SUBJECT:	Culvert Summary		SHEET
CALC'D BY:	PRJ/SCN	DATE: 4-Aug-21	OF
CHEK'D BY:	GPP	DATE: 5-Aug-21	2

CULVERT SUMMARY SHEET

SITE DATA					RUNOFF (Rational Method) $Q = C*I*A*C_f$ - (C_{f25} = 1.1, C_{f50} = 1.2, C_{f100} = 1.25) $Q_{500} = Q_{100} * 1.7$												PIPE DATA								RESULTS				
I.D.	Location	Upstream Building Elevation (ft)	Roadway Elevation (ft)	1' Freeboard Below Roadway Subgrade Elevation (ft)	Runoff Coefficient 'C'	Drainage Area 'A' (ac)	Time of Conc. 'T_c' (min)	Rainfall Intensity 2 Year (in/hr)	Rainfall Intensity 25 Year (in/hr)	Rainfall Intensity 50 Year (in/hr)	Rainfall Intensity 100 Year (in/hr)	Total Runoff 2 Year (cfs)	Total Runoff 25 Year (cfs)	Total Runoff 50 Year (cfs)	Total Runoff 100 Year (cfs)	Total Runoff 500 Year (cfs)	Material	Number of Barrel	Pipe Dia./ Box Height (in)	Pipe Length (ft)	Invert Up	Invert Down	Pipe Slope (ft/ft)	2 Year HW Elev (ft)	50 Year HW Elev (ft)	50 Year HW/D	100 Year Outlet Velocity (fps)	100 Year HW Elev (ft)	Flood / Overtop Probability (Year)
EP-2	US21 Sta 33+79 - 5'x5' RCBC	N/A	595.4	591.9	0.47	58.1	24	3.48	5.13	5.64	6.13	105	154	185	209	356	RCBC	1	60	229	565.47	561.95	0.015		575.01	1.91	8.36	576.24	< 0.2
XEP-2[1]	Existing EP-2 w/o extensions	N/A	595.4	591.9	0.47	58.1	24		5.13	5.64	6.13	0	154	185	209	356	RCBC	1	60	135	564.80	562.74	0.015		580.22	3.08	20.90	583.38	< 0.2
EP-3	US21 Sta 41+06 - 5'x5' RCBC	N/A	588.9	585.4	0.53	125.4	45	2.10	3.32	3.65	3.97	139	221	242	264	448	RCBC	1	60	312	568.40	565.41	0.010		574.29	1.18	14.60	574.95	< 0.2
XEP-3	Existing EP-3 w/o extensions	N/A	588.9	585.4	0.53	128.6	45		3.32	3.65	3.97	0	221	242	264	448	RCBC	1	60	125	567.32	566.12	0.010		574.29	1.39	14.60	574.95	< 0.2
CLP-4	US21 Sta 66+74 - 36" RCP	N/A	638.2	634.7	0.55	8.2	10		6.92	7.66	8.38	0	42	51	58	99	RCP	1	36	178	621.83	617.43	0.025		625.87	1.35	14.83	626.46	< 0.2
EP-5	US21 Sta 116+89 - 18" RCP	N/A	664.0	660.5	0.42	2.9	18		5.81	6.40	6.97	0	8	9	11	18	RCP	1	18	161	653.77	637.79	0.099		655.54	1.18	16.45	655.89	< 0.2
EP-6	SC51 Sta 316+23 - 6'x6' RCBC	N/A	600.7	597.3	0.32	38.5	55		3.26	3.56	3.85	0	44	53	59	101	RCBC	1	72	132	591.22	589.10	0.016		593.35	0.35	2.46	593.45	< 0.2
XEP-6[2]	Existing EP-6 w/o extensions	N/A	599.3	595.9	0.32	38.5	55		3.26	3.56	3.85	0	44	53	59	101	RCBC	1	72	30	589.35	589.26	0.003		593.64	0.71	4.68	593.78	< 0.2

1. EP-2 is approximately 3/5 filled with sediment in existing conditions and has been modeled accordingly.
2. EP-6 is approximately 1/3 filled with sediment in existing conditions, so culvert was analyzed in HY-8 as a 6' span x 4' height RCBC.

STV	STV INC Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29732 (803) 980-4970	JOB:	US 21/ SC 51 Phase I Widening		1
		SUBJECT:	Culvert Summary		SHEET
		CALC'D BY:	PRJ	DATE: 7-Jul-16	OF
		CHEK'D BY:	GPP	DATE: 8-Jul-16	1

CULVERT SUMMARY SHEET

	SITE DATA				RUNOFF Rational Method $Q = C*I*A*C_f$ - (C_{f10} = 1.0, C_{f25} = 1.1, C_{f50} = 1.2, C_{f100} = 1.25) $Q_{500} = Q_{100} * 1.7$											PIPE DATA									RESULTS				
I.D.	Location	Upstream Building Elevation (ft.)	Roadway Elevation (ft.)	1' Freeboard Below Roadway Subgrade Elevation (ft.)	Runoff Coefficient 'C'	Drainage Area 'A' (ac.)	Time of Conc. 'T_c' (min.)	Rainfall Intensity 10 Year (in./hr.)	Rainfall Intensity 25 Year (in./hr.)	Rainfall Intensity 50 Year (in./hr.)	Rainfall Intensity 100 Year (in./hr.)	Total Runoff 10 Year (c.f.s.)	Total Runoff 25 Year (c.f.s.)	Total Runoff 50 Year (c.f.s.)	Total Runoff 100 Year (c.f.s.)	Total Runoff 500 Year (c.f.s.)	Material	Number of Barrel	Pipe Diameter (in)	Pipe Length (ft.)	Invert Up	Invert Down	Pipe Slope (ft./ft.)	10 Yr. H.W. Elev. (ft.)	10 Yr. HW / D	25 Yr. H.W. Elev. (ft.)	25 Yr. HW / D	25 Yr. Outlet Vel. (f.p.s.)	100 Yr. H.W. Elev. (ft.)	Flood / Overtop Frequency (Yr.)
CLP-8	LAKESHORE - Sta. 12+86	N/A	587.42	585.36	0.55	0.36	8	6.35	7.27	8.05	8.82	1.3	1.6	1.9	2.2	3.7	RCP	1	18	65	583.83	582.00	0.028	584.39	0.37	584.46	0.42	6.23	584.57	>500
EP-9	TERRYS - Sta. 11+88 (Existing)	N/A	667.46	664.19	0.55	1.46	9	6.19	7.08	7.84	8.58	5.0	6.3	7.6	8.6	14.6	RCP	1	18	83	660.58	657.08	0.042	661.79	0.81	661.98	0.93	10.16	662.34	>500
CLP-11	GOLDHILL- Sta. 24+20	N/A	636.68	635.61	0.35	5.28	20	4.88	5.54	6.10	6.64	9.0	11.3	13.5	15.3	26.1	RCP	1	24	155	618.70	606.64	0.078	620.16	0.73	620.38	0.84	16.16	620.75	>500
CLP-12	BAXTER- Sta. 14+21	N/A	645.01	643.32	0.45	1.04	10	6.07	6.94	7.68	8.40	2.8	3.6	4.3	4.9	8.4	RCP	1	18	65	640.86	639.60	0.019	641.73	0.58	641.88	0.68	6.89	642.08	>500
CLP-13	ANDREW- Sta. 1+88	N/A	618.64	616.95	0.32	0.89	12	5.78	6.59	7.29	7.96	1.6	2.1	2.5	2.8	4.8	RCP	1	18	102	613.89	611.35	0.025	614.52	0.42	614.62	0.49	6.49	614.76	>500
CLP-14	OLD NATION RD -Sta. 17+23 (EP-531)	N/A	633.17	631.48	0.80	1.09	5	6.89	7.91	8.80	9.65	6.0	7.6	9.2	10.5	17.9	RCP	1	18	55	628.53	627.59	0.017	629.91	0.92	630.13	1.07	7.84	630.38	>500
CLP-15	GOLDHILL- Sta. 14+18	N/A	624.27	622.43	0.30	2.7	19	4.97	5.65	6.22	6.78	4	5	6	7	12	RCP	1	18	72	620.26	620.00	0.004	621.38	0.75	621.54	0.85	4.80	621.86	>500
CLP-16	OLD NATION RD -Sta. 13+28	N/A	634.09	632.30	0.62	3.7	8	6.37	7.29	8.08	8.84	15	18	22	25	43	RCP	1	24	62	627.92	627.55	0.006	630.01	1.05	630.35	1.22	6.99	631.25	>500
CLP-17	EXISTING SPRINGHILL -Sta. 23+36	N/A	619.00	617.31	0.35	1.2	15	5.40	6.15	6.79	7.41	2	3	3	4	6	RCP	1	18	109	615.60	614.95	0.006	616.32	0.48	616.52	0.61	4.52	616.69	>500

STV

STV Incorporated
Consulting Engineers
454 S Anderson Rd, Suite 3, BTC 517
Rock Hill, SC, 29730 (803) 980-4970

JOB:	US 21/ SC 51 Phase I Widening			1 SHEET
SUBJECT:	Sideline Pipe Summary			
CALC'D BY:	PRJ/SCN	DATE:	19-Apr-2021	OF
CHECK'D BY:	GPP	DATE:	19-Apr-2021	1

OPEN SYSTEM SIDELINE PIPE SUMMARY

Site Data			Runoff (Rational Method) $Q_{(10)} = C * I * A$					Pipe Data			
ID	Road Name	Station	Runoff Coefficient (C)	Drainage Area (A) (acre)	Time of Conc. (min.)	Intensity (I) (in./hr.)	Runoff (Q) (c.f.s.)	Material	Pipe Length (ft.)	Pipe Diameter (in.)	Pipe Slope (ft./ft/)
DRWY PIPE -11	FERNFOREST (RT)	10+85	0.60	2.94	7	6.62	11.68	RCP	22	24	0.005
DRWY PIPE -14	US 21 (RT)	113+67	0.50	0.20	5	6.89	0.69	RCP	45	18	0.039
DRWY PIPE -18	GOLDHILL (LT)	16+11	0.42	1.38	13	5.65	3.27	RCP	32	18	0.027
DRWY PIPE -20	GOLDHILL (RT)	19+68	0.30	1.48	16	5.29	2.35	RCP	36	18	0.009
DRWY PIPE -21	GOLDHILL (RT)	14+84	0.30	2.64	18	5.07	4.02	RCP	62	18	0.004
DRWY PIPE -25	OLDNACL(RT)	13+51	0.45	0.21	5	6.89	0.65	RCP	33	18	0.012
DRWY PIPE -26	OLDNACL(RT)	13+50	0.51	4.66	7	6.62	15.73	RCP	53	24	0.006
DRWY PIPE -27	OLDNACL(RT)	17+54	0.68	1.88	9	6.22	7.95	RCP	41	18	0.025
DRWY PIPE -28	OLDSC51(RT)	305+80	0.63	1.05	5	6.89	4.56	RCP	53	18	0.007
DRWY PIPE -32	OLDSC51(LT)	305+90	0.35	0.22	5	6.89	0.53	RCP	49	18	0.014
DRWY PIPE -36	US 21 (RT)	78+75	0.40	0.16	5	6.89	0.43	RCP	63	18	0.008
DRWY PIPE - 34	GOLDHILL (LT)	20+41	0.40	0.34	5	6.89	0.94	RCP	93	18	0.004
DRWY PIPE - 35	GOLDHILL (RT)	20+44	0.50	0.15	5	6.89	0.52	RCP	90	18	0.005

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - EP-2 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	1 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0360		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2931	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	533		
9. Watercourse slope, s	ft./ft.	0.0660		
10. Average velocity, V (figure 3-1)	ft./sec.	4.15		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0357	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	24.00		
13. Wetted perimeter, p_w	ft.	16.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.4168		
15. Channel slope, s	ft./ft.	0.0200		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	7.59		
17b. Input Velocity, FPS	ft./sec.	7.59		
18. Flow length, L	ft.	1876		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0686	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3974	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.40 Hour

24 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - EP-3 CALC'D BY: SKH/SCN DATE: 17-Jun-21 CHECK'D BY: GPP DATE: 17-Jun-21	2 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.800		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0400		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4452	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	313		
9. Watercourse slope, s	ft./ft.	0.0895		
10. Average velocity, V (figure 3-1)	ft./sec.	4.83		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0180	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	11.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.0248		
15. Channel slope, s	ft./ft.	0.0175		
16. Manning's roughness coefficient, n		0.0450		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.45		
17b. Input Velocity, FPS	ft./sec.	4.45		
18. Flow length, L	ft.	2575		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.1607	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.6239	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.62 Hour

37 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - CLP-4 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		3 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.200		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0700		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1174	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.69		
17b. Input Velocity, FPS	ft./sec.	4.69		
18. Flow length, L	ft.	838		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0497	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1671	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.17 Hour

10 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - EP-5 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	4 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	196		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0210		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2587	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC	CD	
12. Cross sectional flow area, a	$ft.^2$	1.77	6.00	
13. Wetted perimeter, p_w	ft.	4.71	12.17	
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.3758	0.4930	
15. Channel slope, s	ft./ft.	0.0120	0.0180	
16. Manning's roughness coefficient, n		0.0120	0.0350	
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	7.08	3.56	
17b. Input Velocity, FPS	ft./sec.	7.08	3.56	
18. Flow length, L	ft.	124	396	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0049	0.0309	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2635	0.0309	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.29 Hour

17.7 min

STV

STV / RWA
Consulting Engineers
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, SC 29730 (803) 980-4970

JOB: US 21/ SC 51 Phase I Widening
SUBJECT: Culvert - EP-6
CALC'D BY: SKH DATE: 7-Jul-16
CHECK'D BY: GPP DATE: 8-Jul-16

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.8126	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	176		
9. Watercourse slope, s	ft./ft.	0.0630		
10. Average velocity, V (figure 3-1)	ft./sec.	4.05		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0121	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0240		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.34		
17b. Input Velocity, FPS	ft./sec.	5.34		
18. Flow length, L	ft.	1660		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0864	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.9111	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.91 Hour

55 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - CLP-8 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	6 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	192		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1040		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1342	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1342	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.13 Hour

8 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - EP-9 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	7 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	96		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0240		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1385	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	16.00		
13. Wetted perimeter, p_w	ft.	16.49		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9703		
15. Channel slope, s	ft./ft.	0.0150		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.11		
17b. Input Velocity, FPS	ft./sec.	5.11		
18. Flow length, L	ft.	249		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0135	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1521	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.15 Hour

9 min

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - CLP-11 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	8 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3196	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	48.00		
13. Wetted perimeter, p_w	ft.	48.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9965		
15. Channel slope, s	ft./ft.	0.0600		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	10.40		
17b. Input Velocity, FPS	ft./sec.	10.40		
18. Flow length, L	ft.	320		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0085	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3281	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour

20 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - CLP-12 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	9 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	115		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0350		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1376	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	2.50		
13. Wetted perimeter, p_w	ft.	5.39		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4638		
15. Channel slope, s	ft./ft.	0.0315		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.53		
17b. Input Velocity, FPS	ft./sec.	4.53		
18. Flow length, L	ft.	434		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0266	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1643	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.16 Hour

9.9 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		10 SHEET
	SUBJECT: Culvert - CLP-13		
	CALC'D BY: SKH	DATE: 7-Jul-16	OF 14
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	216		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0440		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2080	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2080	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.21 Hour

12 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		11 SHEET
	SUBJECT: Culvert - CLP-14 (EP531)		
	CALC'D BY: SCN	DATE: 7-Apr-21	OF
	CHECK'D BY: GPP	DATE: 7-Apr-21	14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

	Path #1	Path #2	Path #3
Segment ID			
1. Surface Description (table 3-1)			
2. Manning's roughness coefficient, n (table 3-1)			
3. Flow length, L (total L ≤ 300 ft) ft.			
4. Two-year 24-hour rainfall, P_2 in.			
5. Land slope, s ft./ft.			
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr.	0.0000	0.0000	0.0000

Shallow concentrated flow

	Path #1	Path #2	Path #3
Segment ID			
7. Surface description (Paved or Unpaved)			
8. Flow length, L ft.			
9. Watercourse slope, s ft./ft.			
10. Average velocity, V (figure 3-1) ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr.	0.0000	0.0000	0.0000

Channel flow

	Path #1	Path #2	Path #3
Segment ID			
12. Cross sectional flow area, a $ft.^2$			
13. Wetted perimeter, p_w ft.			
14. Hydraulic Radius, r = a / p_w Compute r ft.			
15. Channel slope, s ft./ft.			
16. Manning's roughness coefficient, n			
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft./sec.			
17b. Input Velocity, FPS ft./sec.			
18. Flow length, L ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19) hr.	0.0000	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.00 Hour

5 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Culvert - CLP-15 CALC'D BY: SKH DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	12 SHEET OF 14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	256		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2815	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	8.00		
13. Wetted perimeter, p_w	ft.	8.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.8949		
15. Channel slope, s	ft./ft.	0.0180		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.30		
17b. Input Velocity, FPS	ft./sec.	5.30		
18. Flow length, L	ft.	531		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0278	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3093	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.31 Hour

19 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		13 SHEET
	SUBJECT: Culvert - CLP-16		
	CALC'D BY: SKH	DATE: 7-Jul-16	OF 14
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.200		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0700		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1174	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.69		
17b. Input Velocity, FPS	ft./sec.	4.69		
18. Flow length, L	ft.	339		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0201	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1375	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

8 min

STV

STV / RWA Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		14 SHEET
	SUBJECT: Culvert - CLP-17		
	CALC'D BY: SKH	DATE: 7-Jul-16	OF
	CHECK'D BY: GPP	DATE: 8-Jul-16	14

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	184		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0190		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2560	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2560	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.26 Hour

15 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51		1 SHEET
	SUBJECT: Drivewaypipe-11		
	CALC'D BY: PRJ/SCN	DATE: 19-Apr-21	OF 10
	CHECK'D BY: GPP	DATE: 19-Apr-21	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1100		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0779	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	190		
9. Watercourse slope, s	ft./ft.	0.1000		
10. Average velocity, V (figure 3-1)	ft./sec.	5.10		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0103	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	5.00		
13. Wetted perimeter, p_w	ft.	10.20		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4902		
15. Channel slope, s	ft./ft.	0.0370		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.09		
17b. Input Velocity, FPS	ft./sec.	5.09		
18. Flow length, L	ft.	379		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0207	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1089	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.5 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51		2 SHEET
	SUBJECT: Drivewaypipe-14		
	CALC'D BY: PRJ/SCN	DATE: 19-Apr-21	OF
	CHECK'D BY: GPP	DATE: 19-Apr-21	10

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	72		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0540		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0796	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	46		
9. Watercourse slope, s	ft./ft.	0.0740		
10. Average velocity, V (figure 3-1)	ft./sec.	4.39		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0029	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0825	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.08 Hour

4.9 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51		3 SHEET
	SUBJECT: Drivewaypipe-18		
	CALC'D BY: PRJ/SCN	DATE: 19-Apr-21	OF 10
	CHECK'D BY: GPP	DATE: 19-Apr-21	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	160		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0330		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1835	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0150		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.03		
17b. Input Velocity, FPS	ft./sec.	5.03		
18. Flow length, L	ft.	544		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0300	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2136	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.21 Hour

13 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51 SUBJECT: Drivewaypipe-20 CALC'D BY: PRJ/SCN DATE: 19-Apr-21 CHECK'D BY: GPP DATE: 19-Apr-21	4 SHEET OF 10

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	217		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2466	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	8.00		
13. Wetted perimeter, p_w	ft.	8.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.8949		
15. Channel slope, s	ft./ft.	0.0180		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.30		
17b. Input Velocity, FPS	ft./sec.	5.30		
18. Flow length, L	ft.	314		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0164	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2631	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.26 Hour

16 min

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51 SUBJECT: Drivewaypipe-21 CALC'D BY: PRJ/SCN DATE: 19-Apr-21 CHECK'D BY: GPP DATE: 19-Apr-21	5 SHEET OF 10

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	256		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2815	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	8.00		
13. Wetted perimeter, p_w	ft.	8.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.8949		
15. Channel slope, s	ft./ft.	0.0180		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.30		
17b. Input Velocity, FPS	ft./sec.	5.30		
18. Flow length, L	ft.	473		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0248	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3063	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.31 Hour

18 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51 SUBJECT: Drivewaypipe-25 CALC'D BY: PRJ/SCN DATE: 19-Apr-21 CHECK'D BY: GPP DATE: 19-Apr-21	6 SHEET OF 10

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	46		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0540		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0556	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.69		
17b. Input Velocity, FPS	ft./sec.	4.69		
18. Flow length, L	ft.	77		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0046	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0602	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.06 Hour

3.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51		7 SHEET
	SUBJECT: Drivewaypipe-26		
	CALC'D BY: PRJ/SCN	DATE: 19-Apr-21	OF 10
	CHECK'D BY: GPP	DATE: 19-Apr-21	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.200		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0700		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1174	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	12.65		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9486		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.69		
17b. Input Velocity, FPS	ft./sec.	4.69		
18. Flow length, L	ft.	339		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0201	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1375	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

8 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51		8 SHEET
	SUBJECT: Drivewaypipe-27		
	CALC'D BY: PRJ/SCN	DATE: 19-Apr-21	OF 10
	CHECK'D BY: GPP	DATE: 19-Apr-21	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0310		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1292	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	48		
9. Watercourse slope, s	ft./ft.	0.0430		
10. Average velocity, V (figure 3-1)	ft./sec.	3.35		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0040	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	18.75		
13. Wetted perimeter, p_w	ft.	15.81		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.1860		
15. Channel slope, s	ft./ft.	0.0160		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	6.03		
17b. Input Velocity, FPS	ft./sec.	6.03		
18. Flow length, L	ft.	342		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0157	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1489	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.15 Hour

8.9 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51 SUBJECT: Drivewaypipe-28 CALC'D BY: PRJ/SCN DATE: 19-Apr-21 CHECK'D BY: GPP DATE: 19-Apr-21		9 SHEET OF 10

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Pavement	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.011	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	74	27	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0120	0.1000	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0184	0.0284	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	4.32		
13. Wetted perimeter, p_w	ft.	7.59		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.5692		
15. Channel slope, s	ft./ft.	0.0080		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.62		
17b. Input Velocity, FPS	ft./sec.	2.62		
18. Flow length, L	ft.	186		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0198	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0381	0.0284	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.04 Hour

2.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21 NORTH PHASE AND SC 51 SUBJECT: Drivewaypipe-32 CALC'D BY: PRJ/SCN DATE: 19-Apr-21 CHECK'D BY: GPP DATE: 19-Apr-21		10 SHEET OF 10

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

	Path #1	Path #2	Path #3
Segment ID	AB		
1. Surface Description (table 3-1)	Pavement		
2. Manning's roughness coefficient, n (table 3-1)	0.011		
3. Flow length, L (total L ≤ 300 ft) ft.	57		
4. Two-year 24-hour rainfall, P_2 in.	3.60		
5. Land slope, s ft./ft.	0.0280		
6. $T_t = \frac{.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t hr.	0.0106	0.0000	0.0000

Shallow concentrated flow

Segment ID			
7. Surface description (Paved or Unpaved)			
8. Flow length, L ft.			
9. Watercourse slope, s ft./ft.			
10. Average velocity, V (figure 3-1) ft./sec.			
11. $T_t = \frac{L}{3600\,V}$ Compute T_t hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID	BC		
12. Cross sectional flow area, a $ft.^2$	3.00		
13. Wetted perimeter, p_w ft.	6.32		
14. Hydraulic Radius, $r = a / p_w$ Compute r ft.	0.4747		
15. Channel slope, s ft./ft.	0.0120		
16. Manning's roughness coefficient, n	0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft./sec.	2.84		
17b. Input Velocity, FPS ft./sec.	2.84		
18. Flow length, L ft.	155		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t hr.	0.0152	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19) hr.	0.0258	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.03 Hour

1.5 min

HY-8 Culvert Analysis Report
Existing Conditions

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 154 cfs

Design Flow: 185 cfs

Maximum Flow: 209 cfs

Table 1 - Summary of Culvert Flows at Crossing: EP-2

Headwater Elevation (ft)	Total Discharge (cfs)	XEP-2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
579.75	154.00	154.00	0.00	1
580.62	159.50	159.50	0.00	1
581.51	165.00	165.00	0.00	1
582.43	170.50	170.50	0.00	1
583.38	176.00	176.00	0.00	1
584.36	181.50	181.50	0.00	1
585.00	185.00	185.00	0.00	1
586.41	192.50	192.50	0.00	1
587.47	198.00	198.00	0.00	1
588.57	203.50	203.50	0.00	1
589.69	209.00	209.00	0.00	1
595.40	235.08	235.08	0.00	Overtopping

Rating Curve Plot for Crossing: EP-2

Table 2 - Culvert Summary Table: XEP-2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
154.00	154.00	579.75	8.914	11.953	4-FFf	2.000	2.000	2.000	2.584	15.400	7.688
159.50	159.50	580.62	9.490	12.818	4-FFf	2.000	2.000	2.000	2.618	15.950	7.756
165.00	165.00	581.51	10.085	13.711	4-FFf	2.000	2.000	2.000	2.652	16.500	7.822
170.50	170.50	582.43	10.701	14.633	4-FFf	2.000	2.000	2.000	2.684	17.050	7.887
176.00	176.00	583.38	11.337	15.584	4-FFf	2.000	2.000	2.000	2.717	17.600	7.949
181.50	181.50	584.36	11.993	16.563	4-FFf	2.000	2.000	2.000	2.748	18.150	8.011
185.00	185.00	585.00	12.422	17.201	4-FFf	2.000	2.000	2.000	2.768	18.500	8.049
192.50	192.50	586.41	13.366	18.607	4-FFf	2.000	2.000	2.000	2.809	19.250	8.129
198.00	198.00	587.47	14.083	19.672	4-FFf	2.000	2.000	2.000	2.839	19.800	8.187
203.50	203.50	588.57	14.820	20.765	4-FFf	2.000	2.000	2.000	2.869	20.350	8.243
209.00	209.00	589.69	15.577	21.887	4-FFf	2.000	2.000	2.000	2.897	20.900	8.298

****

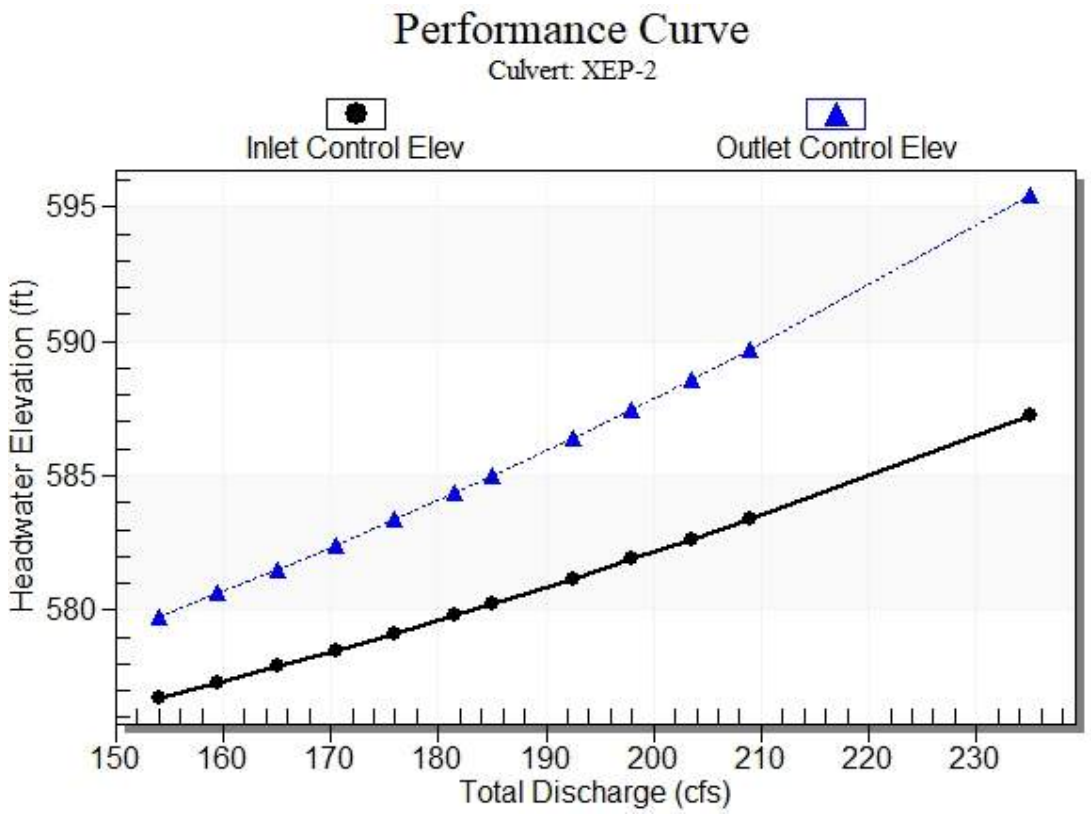
Straight Culvert

Inlet Elevation (invert): 567.80 ft, Outlet Elevation (invert): 565.74 ft

Culvert Length: 135.02 ft, Culvert Slope: 0.0153

****

Culvert Performance Curve Plot: XEP-2



Water Surface Profile Plot for Culvert: XEP-2

Site Data - XEP-2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 564.80 ft

Outlet Station: 135.00 ft

Outlet Elevation: 562.74 ft

Number of Barrels: 1

Culvert Data Summary - XEP-2

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 36.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: EP-2)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
154.00	568.32	2.58	7.69	4.03	1.19
159.50	568.36	2.62	7.76	4.08	1.19
165.00	568.39	2.65	7.82	4.14	1.20
170.50	568.42	2.68	7.89	4.19	1.20
176.00	568.46	2.72	7.95	4.24	1.20
181.50	568.49	2.75	8.01	4.29	1.20
185.00	568.51	2.77	8.05	4.32	1.21
192.50	568.55	2.81	8.13	4.38	1.21
198.00	568.58	2.84	8.19	4.43	1.21
203.50	568.61	2.87	8.24	4.48	1.21
209.00	568.64	2.90	8.30	4.52	1.21

Tailwater Channel Data - EP-2

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0250

Channel Manning's n: 0.0350

Channel Invert Elevation: 565.74 ft

Roadway Data for Crossing: EP-2

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 595.40 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 221 cfs

Design Flow: 242 cfs

Maximum Flow: 264 cfs

Table 4 - Summary of Culvert Flows at Crossing: EP-3

Headwater Elevation (ft)	Total Discharge (cfs)	EP-3 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
573.72	221.00	221.00	0.00	1
573.83	225.30	225.30	0.00	1
573.95	229.60	229.60	0.00	1
574.06	233.90	233.90	0.00	1
574.19	238.20	238.20	0.00	1
574.29	242.00	242.00	0.00	1
574.43	246.80	246.80	0.00	1
574.56	251.10	251.10	0.00	1
574.69	255.40	255.40	0.00	1
574.82	259.70	259.70	0.00	1
574.95	264.00	264.00	0.00	1
588.90	540.90	540.90	0.00	Overtopping

Rating Curve Plot for Crossing: EP-3

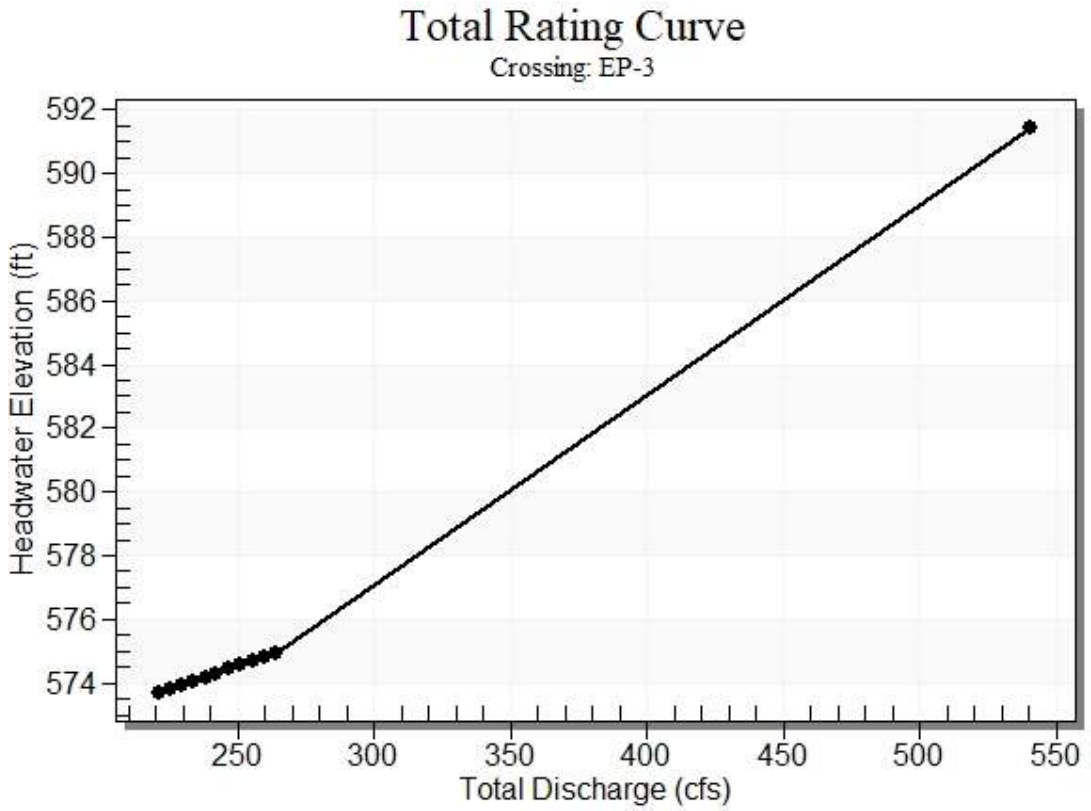


Table 5 - Culvert Summary Table: EP-3

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
221.00	221.00	573.72	6.395	5.432	5-S2n	2.887	3.929	3.157	2.326	13.999	11.194
225.30	225.30	573.83	6.510	5.543	5-S2n	2.930	3.980	3.204	2.349	14.063	11.252
229.60	229.60	573.95	6.626	5.655	5-S2n	2.973	4.031	3.251	2.372	14.127	11.310
233.90	233.90	574.06	6.745	5.769	5-S2n	3.015	4.081	3.297	2.395	14.190	11.366
238.20	238.20	574.19	6.865	5.884	5-S2n	3.058	4.131	3.343	2.417	14.252	11.422
242.00	242.00	574.29	6.973	5.987	5-S2n	3.096	4.175	3.383	2.437	14.307	11.471
246.80	246.80	574.43	7.112	6.118	5-S2n	3.143	4.230	3.434	2.462	14.375	11.532
251.10	251.10	574.56	7.238	6.238	5-S2n	3.186	4.279	3.479	2.484	14.436	11.585
255.40	255.40	574.69	7.366	6.359	5-S2n	3.228	4.327	3.525	2.506	14.492	11.638
259.70	259.70	574.82	7.497	6.481	5-S2n	3.270	4.376	3.571	2.527	14.547	11.691
264.00	264.00	574.95	7.629	6.605	5-S2n	3.312	4.424	3.616	2.548	14.601	11.742

****

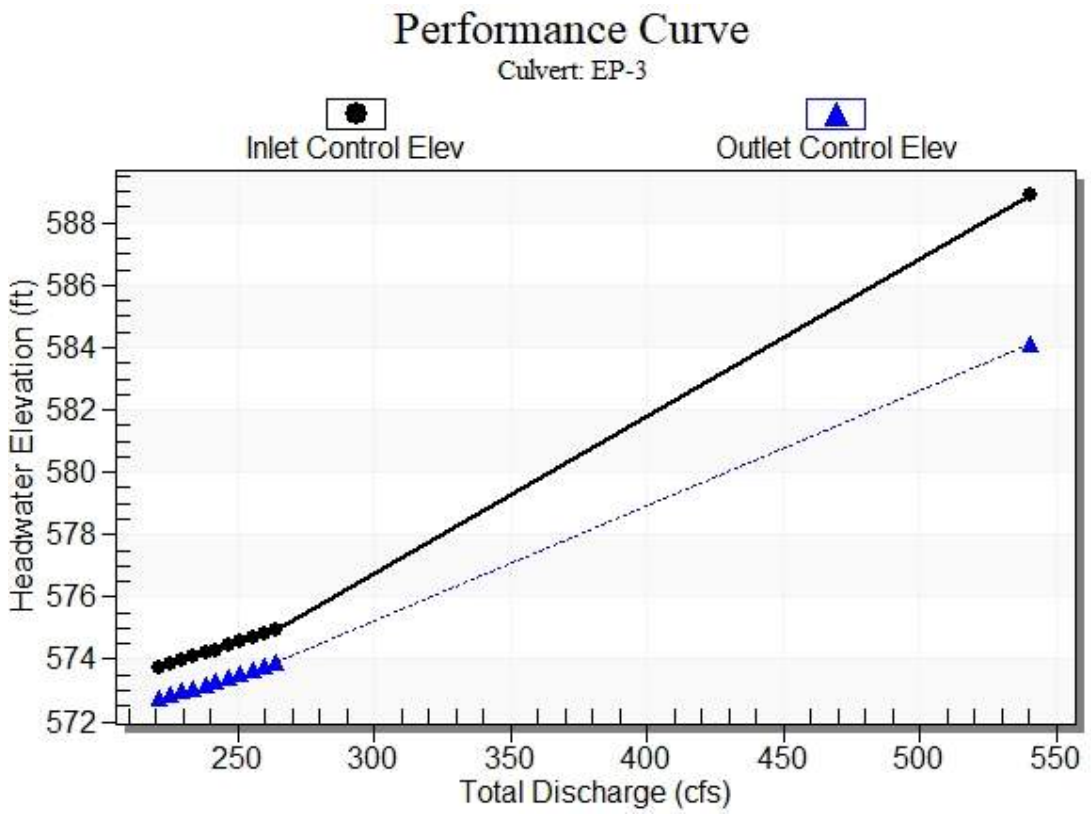
Straight Culvert

Inlet Elevation (invert): 567.32 ft, Outlet Elevation (invert): 566.12 ft

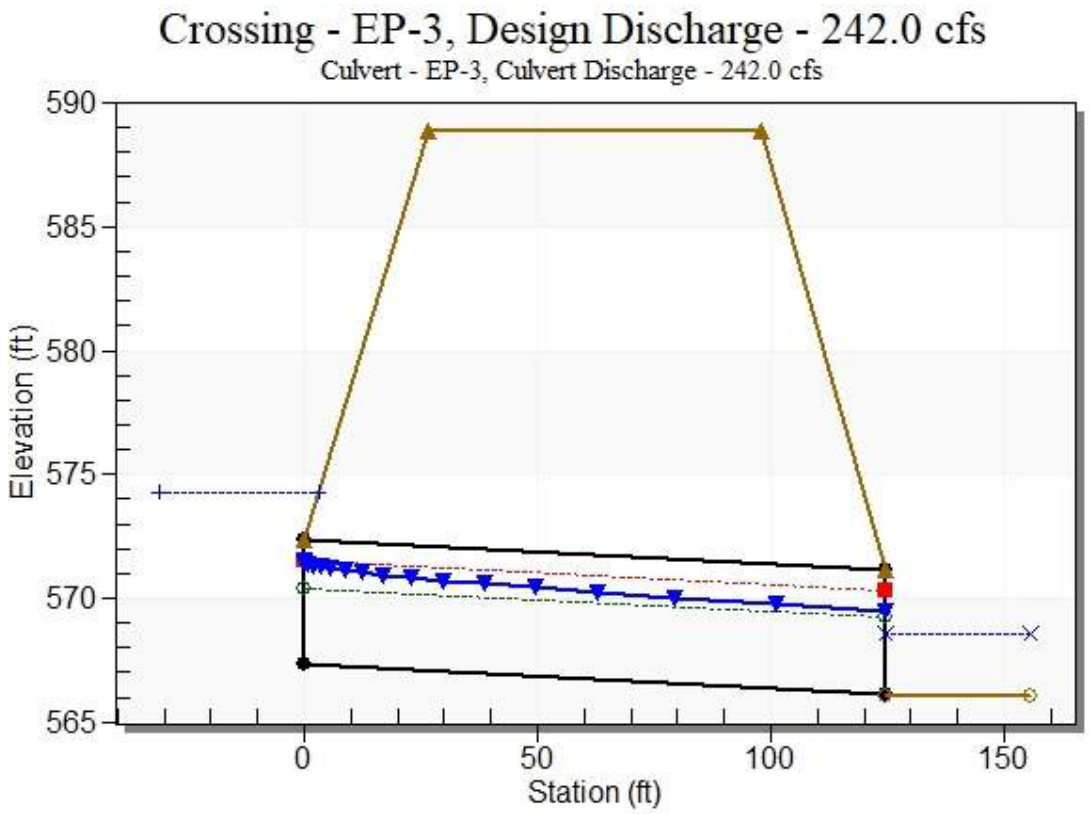
Culvert Length: 124.61 ft, Culvert Slope: 0.0096

****

Culvert Performance Curve Plot: EP-3



Water Surface Profile Plot for Culvert: EP-3



Site Data - EP-3

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 567.32 ft

Outlet Station: 124.60 ft

Outlet Elevation: 566.12 ft

Number of Barrels: 1

Culvert Data Summary - EP-3

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: EP-3)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
221.00	568.41	2.33	11.19	6.01	1.54
225.30	568.43	2.35	11.25	6.07	1.54
229.60	568.45	2.37	11.31	6.13	1.54
233.90	568.47	2.39	11.37	6.19	1.54
238.20	568.50	2.42	11.42	6.25	1.54
242.00	568.52	2.44	11.47	6.30	1.54
246.80	568.54	2.46	11.53	6.36	1.55
251.10	568.56	2.48	11.58	6.42	1.55
255.40	568.59	2.51	11.64	6.47	1.55
259.70	568.61	2.53	11.69	6.53	1.55
264.00	568.63	2.55	11.74	6.58	1.55

Tailwater Channel Data - EP-3

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0414

Channel Manning's n: 0.0350

Channel Invert Elevation: 566.08 ft

Roadway Data for Crossing: EP-3

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 588.90 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 42 cfs

Design Flow: 51 cfs

Maximum Flow: 58 cfs

Table 7 - Summary of Culvert Flows at Crossing: CLP-4-1

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-4 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
629.52	42.00	42.00	0.00	1
630.11	43.60	43.60	0.00	1
630.72	45.20	45.20	0.00	1
631.35	46.80	46.80	0.00	1
632.01	48.40	48.40	0.00	1
632.69	50.00	50.00	0.00	1
633.12	51.00	51.00	0.00	1
634.10	53.20	53.20	0.00	1
634.85	54.80	54.80	0.00	1
635.61	56.40	56.40	0.00	1
636.40	58.00	58.00	0.00	1
638.20	61.51	61.51	0.00	Overtopping

Rating Curve Plot for Crossing: CLP-4-1

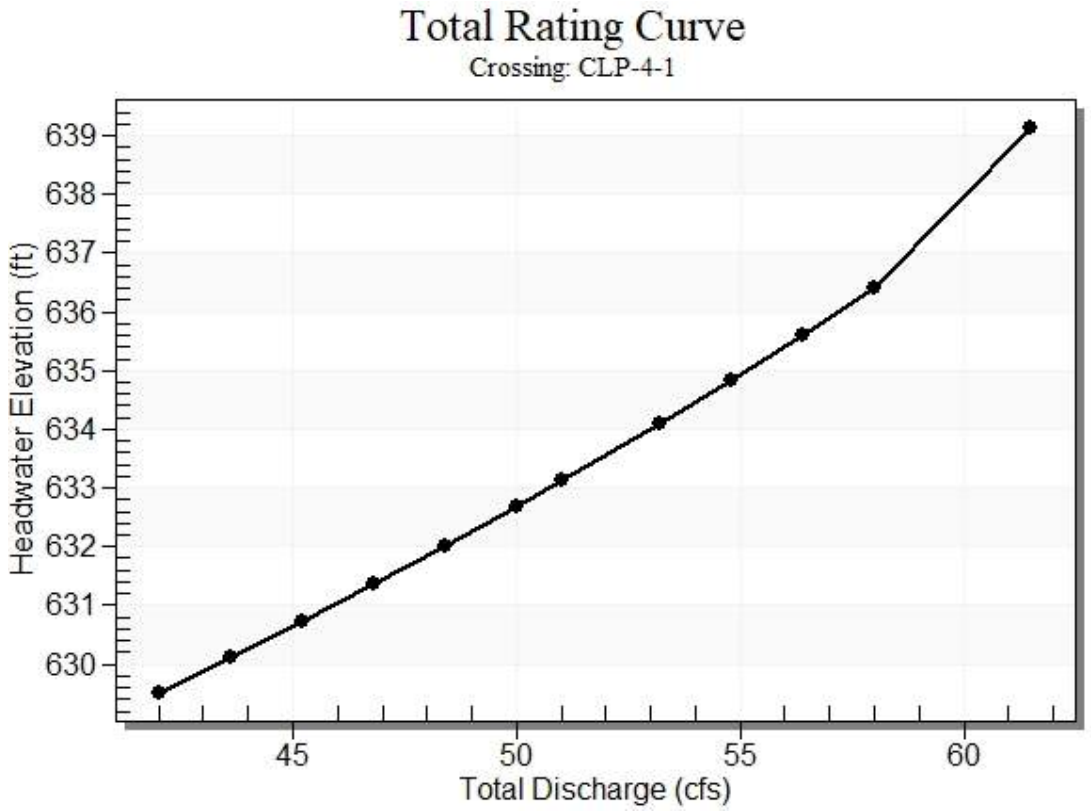


Table 8 - Culvert Summary Table: CLP-4

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
42.00	42.00	629.52	8.582	7.022	6-FFc	2.000	2.000	622.940	1.309	13.369	8.174
43.60	43.60	630.11	9.170	7.619	6-FFc	2.000	2.000	622.940	1.327	13.878	8.251
45.20	45.20	630.72	9.781	8.238	6-FFc	2.000	2.000	622.940	1.345	14.388	8.326
46.80	46.80	631.35	10.414	8.880	6-FFc	2.000	2.000	622.940	1.363	14.897	8.398
48.40	48.40	632.01	11.069	9.544	6-FFc	2.000	2.000	622.940	1.380	15.406	8.469
50.00	50.00	632.69	11.745	10.231	6-FFc	2.000	2.000	622.940	1.397	15.915	8.539
51.00	51.00	633.12	12.179	10.671	6-FFc	2.000	2.000	622.940	1.408	16.234	8.581
53.20	53.20	634.10	13.165	11.671	6-FFc	2.000	2.000	622.940	1.430	16.934	8.672
54.80	54.80	634.85	13.907	12.424	6-FFc	2.000	2.000	622.940	1.446	17.443	8.736
56.40	56.40	635.61	14.672	13.200	6-FFc	2.000	2.000	622.940	1.462	17.953	8.800
58.00	58.00	636.40	15.459	13.998	6-FFc	2.000	2.000	622.940	1.477	18.462	8.861

****

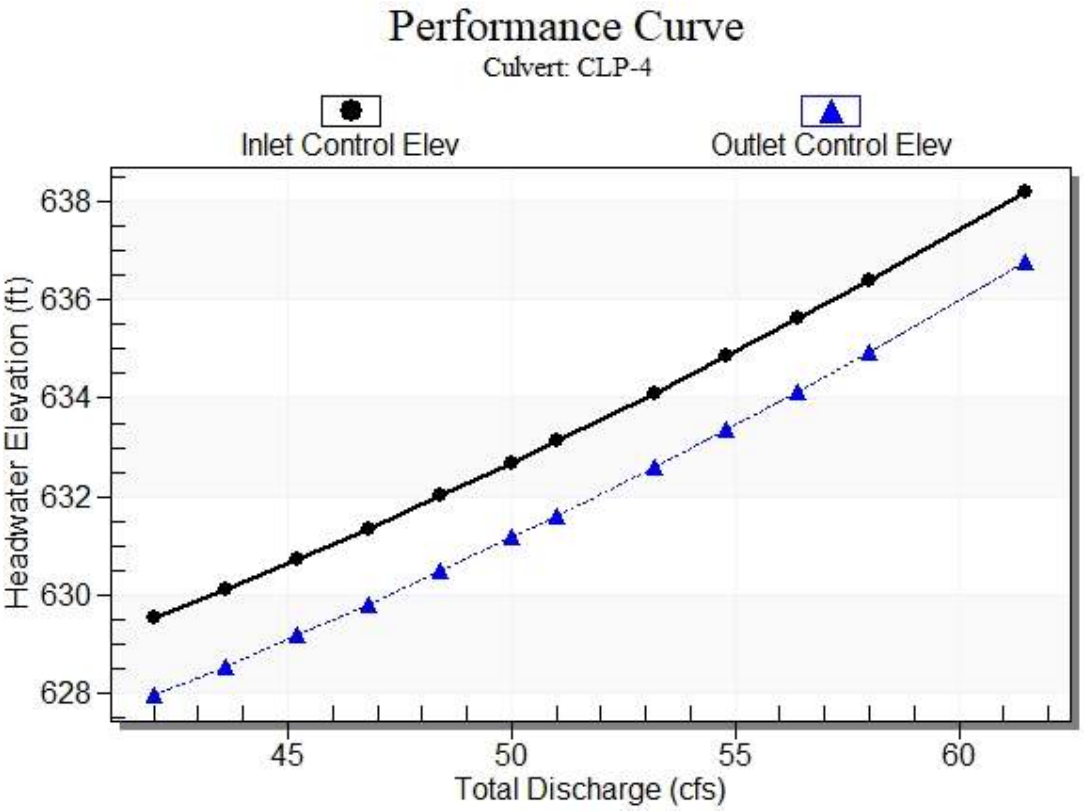
Straight Culvert

Inlet Elevation (invert): 620.94 ft, Outlet Elevation (invert): 618.27 ft

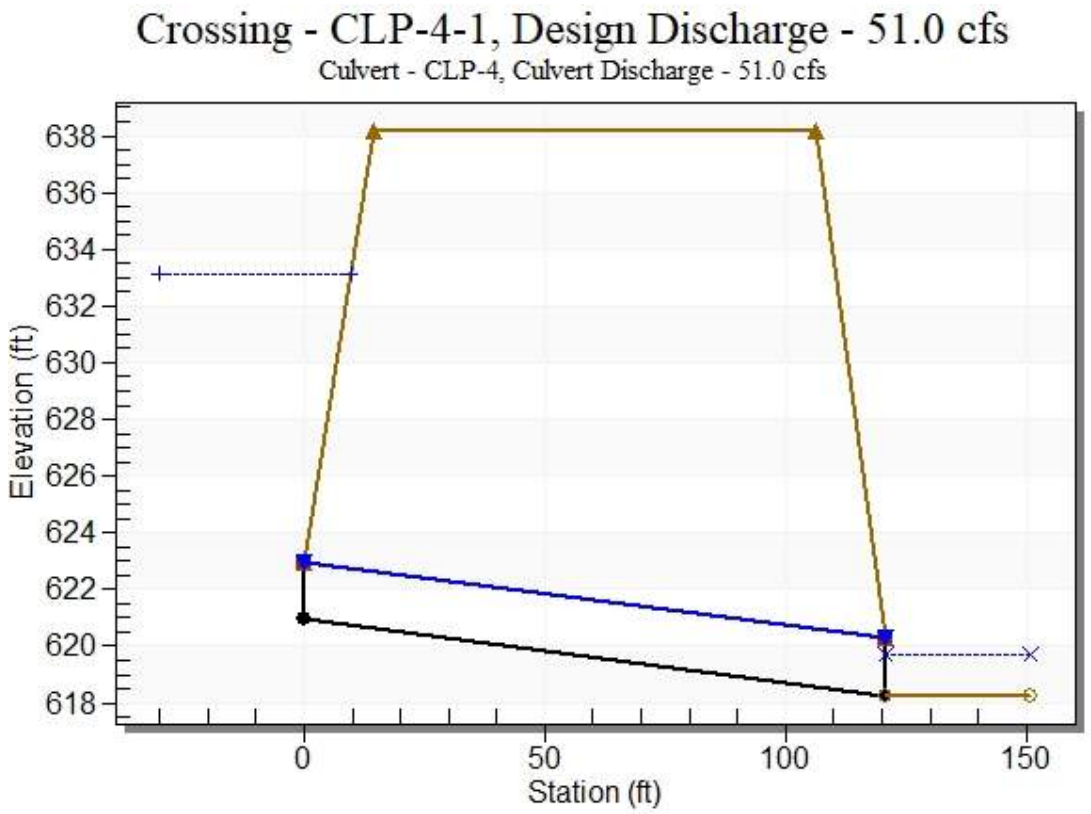
Culvert Length: 120.83 ft, Culvert Slope: 0.0221

****

Culvert Performance Curve Plot: CLP-4



Water Surface Profile Plot for Culvert: CLP-4



Site Data - CLP-4

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 620.94 ft

Outlet Station: 120.80 ft

Outlet Elevation: 618.27 ft

Number of Barrels: 1

Culvert Data Summary - CLP-4

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 9 - Downstream Channel Rating Curve (Crossing: CLP-4-1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
42.00	619.58	1.31	8.17	5.72	1.78
43.60	619.60	1.33	8.25	5.80	1.78
45.20	619.62	1.35	8.33	5.88	1.79
46.80	619.63	1.36	8.40	5.95	1.79
48.40	619.65	1.38	8.47	6.03	1.80
50.00	619.67	1.40	8.54	6.10	1.80
51.00	619.68	1.41	8.58	6.15	1.80
53.20	619.70	1.43	8.67	6.25	1.81
54.80	619.72	1.45	8.74	6.32	1.81
56.40	619.73	1.46	8.80	6.38	1.81
58.00	619.75	1.48	8.86	6.45	1.82

Tailwater Channel Data - CLP-4-1

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0700

Channel Manning's n: 0.0350

Channel Invert Elevation: 618.27 ft

Roadway Data for Crossing: CLP-4-1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 638.20 ft

Roadway Surface: Paved

Roadway Top Width: 92.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 44 cfs

Design Flow: 53 cfs

Maximum Flow: 59 cfs

Table 10 - Summary of Culvert Flows at Crossing: EP-6

Headwater Elevation (ft)	Total Discharge (cfs)	XEP-6 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
593.43	44.00	44.00	0.00	1
593.46	45.50	45.50	0.00	1
593.50	47.00	47.00	0.00	1
593.54	48.50	48.50	0.00	1
593.57	50.00	50.00	0.00	1
593.61	51.50	51.50	0.00	1
593.64	53.00	53.00	0.00	1
593.67	54.50	54.50	0.00	1
593.71	56.00	56.00	0.00	1
593.74	57.50	57.50	0.00	1
593.78	59.00	59.00	0.00	1
599.27	307.57	307.57	0.00	Overtopping

Rating Curve Plot for Crossing: EP-6

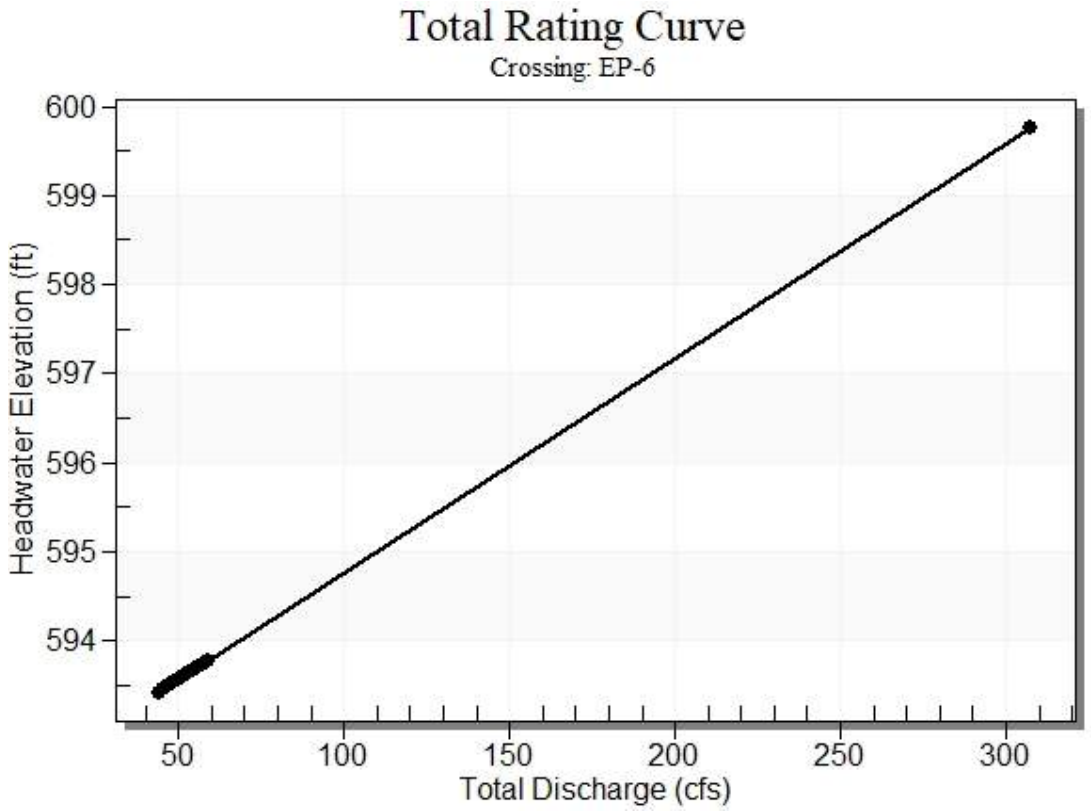


Table 11 - Culvert Summary Table: XEP-6

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
44.00	44.00	593.43	1.630	2.078	3-M1t	1.200	1.194	1.842	1.202	3.981	6.309
45.50	45.50	593.46	1.667	2.114	3-M1t	1.225	1.221	1.864	1.224	4.068	6.370
47.00	47.00	593.50	1.704	2.150	3-M1t	1.249	1.248	1.886	1.246	4.154	6.429
48.50	48.50	593.54	1.740	2.186	1-S1t	1.272	1.275	1.907	1.267	4.130	6.487
50.00	50.00	593.57	1.776	2.221	1-S1t	1.296	1.301	1.928	1.288	4.211	6.543
51.50	51.50	593.61	1.811	2.256	1-S1t	1.319	1.327	1.949	1.309	4.291	6.599
53.00	53.00	593.64	1.846	2.290	1-S1t	1.342	1.352	1.969	1.329	4.371	6.652
54.50	54.50	593.67	1.880	2.325	1-S1t	1.364	1.377	1.989	1.349	4.449	6.705
56.00	56.00	593.71	1.915	2.359	1-S1t	1.387	1.402	2.009	1.369	4.526	6.757
57.50	57.50	593.74	1.949	2.393	1-S1t	1.409	1.427	2.029	1.389	4.603	6.807
59.00	59.00	593.78	1.982	2.427	1-S1t	1.431	1.452	2.048	1.408	4.679	6.857

****

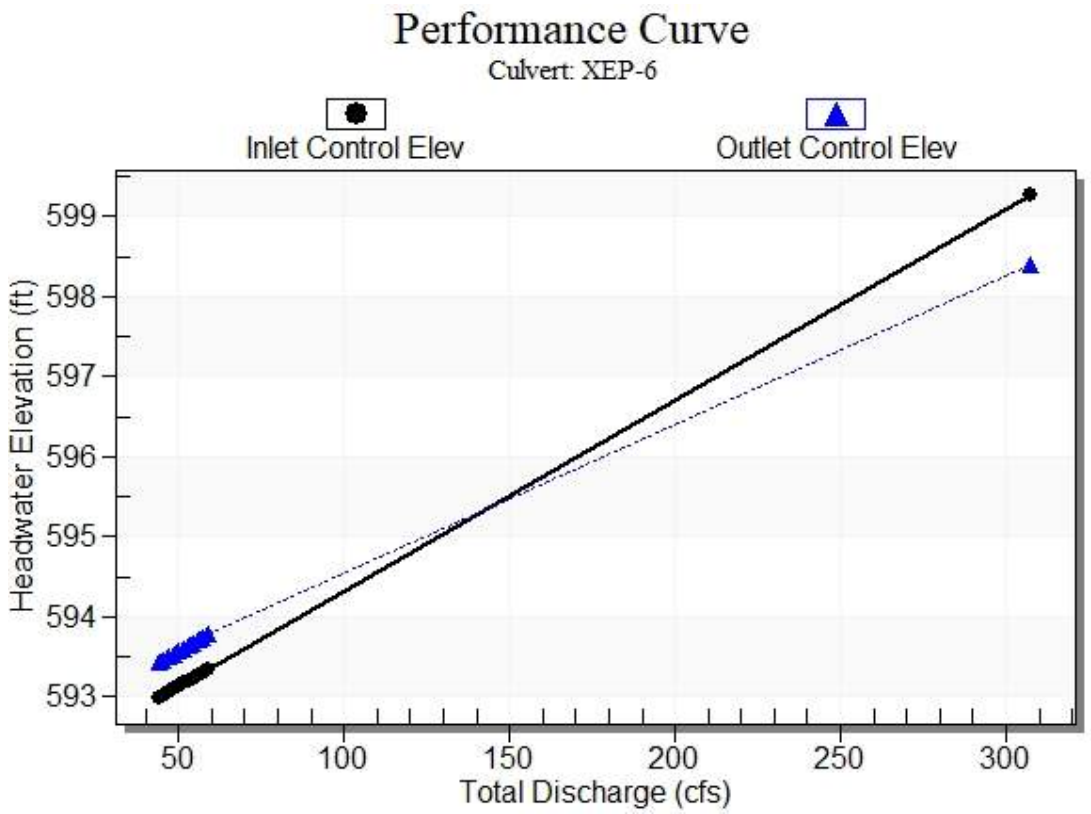
Straight Culvert

Inlet Elevation (invert): 591.35 ft, Outlet Elevation (invert): 591.26 ft

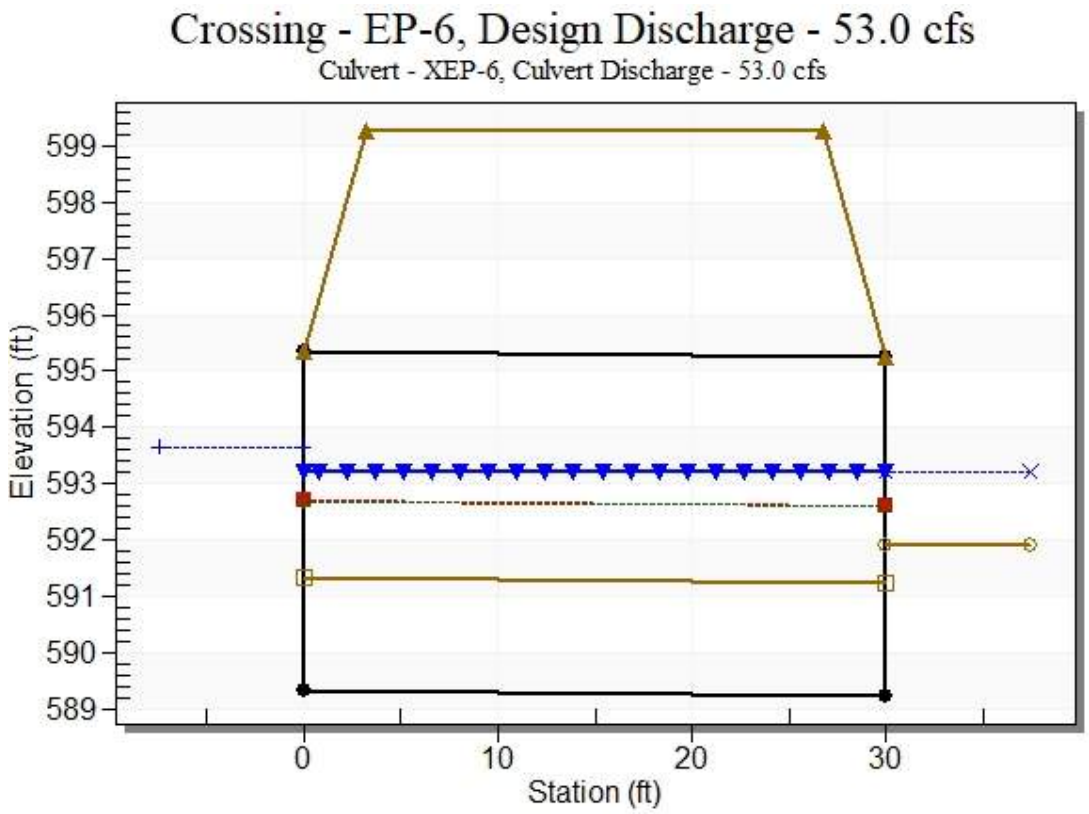
Culvert Length: 30.00 ft, Culvert Slope: 0.0030

****

Culvert Performance Curve Plot: XEP-6



Water Surface Profile Plot for Culvert: XEP-6



Site Data - XEP-6

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 589.35 ft

Outlet Station: 30.00 ft

Outlet Elevation: 589.26 ft

Number of Barrels: 1

Culvert Data Summary - XEP-6

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 24.00 in

Barrel Manning's n: 0.0130 (top and sides)

Manning's n: 0.0130 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 12 - Downstream Channel Rating Curve (Crossing: EP-6)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
44.00	593.10	1.20	6.31	2.10	1.16
45.50	593.12	1.22	6.37	2.14	1.16
47.00	593.15	1.25	6.43	2.18	1.17
48.50	593.17	1.27	6.49	2.21	1.17
50.00	593.19	1.29	6.54	2.25	1.17
51.50	593.21	1.31	6.60	2.29	1.17
53.00	593.23	1.33	6.65	2.32	1.17
54.50	593.25	1.35	6.71	2.36	1.18
56.00	593.27	1.37	6.76	2.39	1.18
57.50	593.29	1.39	6.81	2.43	1.18
59.00	593.31	1.41	6.86	2.46	1.18

Tailwater Channel Data - EP-6

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0280

Channel Manning's n: 0.0350

Channel Invert Elevation: 591.90 ft

Roadway Data for Crossing: EP-6

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 599.27 ft

Roadway Surface: Paved

Roadway Top Width: 23.50 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 8 cfs

Design Flow: 9 cfs

Maximum Flow: 11 cfs

Table 13 - Summary of Culvert Flows at Crossing: EP-5

Headwater Elevation (ft)	Total Discharge (cfs)	EP-5 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
655.38	8.00	8.00	0.00	1
655.42	8.30	8.30	0.00	1
655.47	8.60	8.60	0.00	1
655.52	8.90	8.90	0.00	1
655.53	9.00	9.00	0.00	1
655.62	9.50	9.50	0.00	1
655.67	9.80	9.80	0.00	1
655.72	10.10	10.10	0.00	1
655.78	10.40	10.40	0.00	1
655.83	10.70	10.70	0.00	1
655.89	11.00	11.00	0.00	1
664.00	32.07	32.07	0.00	Overtopping

Rating Curve Plot for Crossing: EP-5

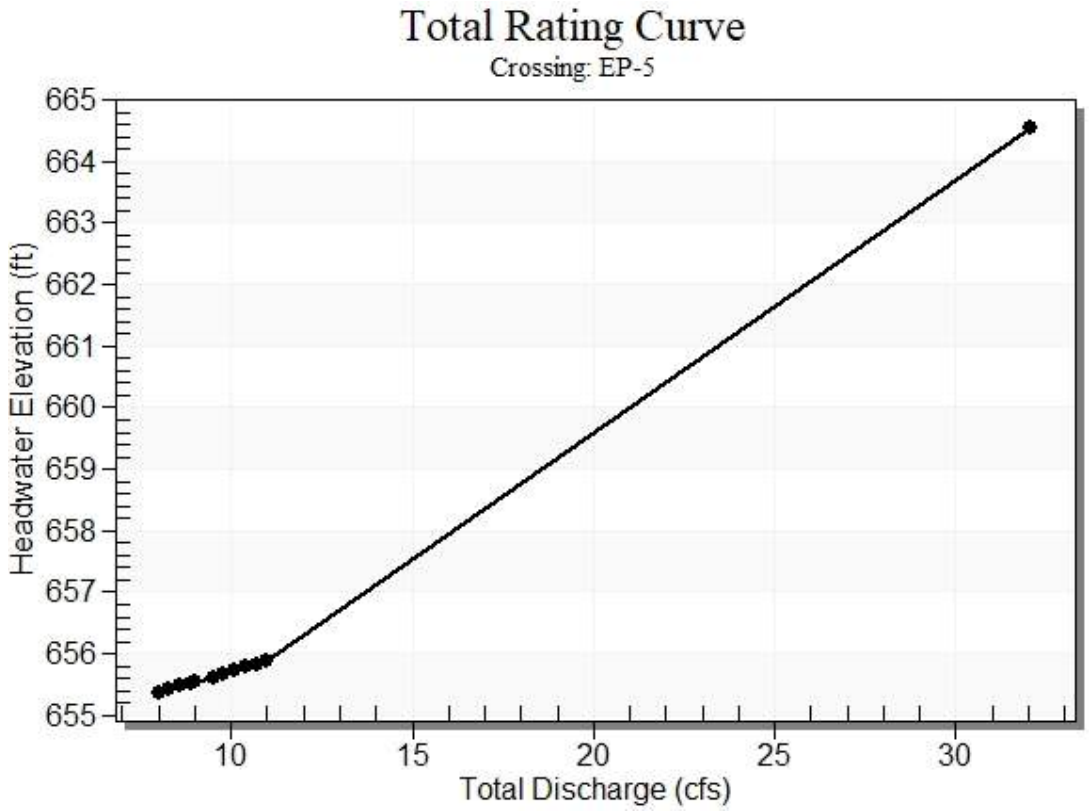


Table 14 - Culvert Summary Table: EP-5

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
8.00	8.00	655.38	1.607	0.0*	5-S2n	0.478	1.092	0.478	0.739	15.956	7.319
8.30	8.30	655.42	1.653	0.0*	5-S2n	0.487	1.112	0.487	0.750	16.129	7.387
8.60	8.60	655.47	1.700	0.0*	5-S2n	0.496	1.131	0.496	0.760	16.294	7.453
8.90	8.90	655.52	1.748	0.0*	5-S2n	0.505	1.150	0.540	0.769	15.021	7.517
9.00	9.00	655.53	1.765	0.0*	5-S2n	0.508	1.156	0.535	0.773	15.388	7.538
9.50	9.50	655.62	1.848	0.0*	5-S2n	0.523	1.189	0.523	0.788	16.736	7.641
9.80	9.80	655.67	1.900	0.0*	5-S2n	0.532	1.206	0.532	0.798	16.884	7.700
10.10	10.10	655.72	1.953	0.0*	5-S2n	0.541	1.223	0.541	0.807	17.029	7.758
10.40	10.40	655.78	2.007	0.0*	5-S2n	0.549	1.239	0.549	0.816	17.181	7.815
10.70	10.70	655.83	2.062	0.0*	5-S2n	0.558	1.255	0.593	0.824	15.901	7.871
11.00	11.00	655.89	2.119	0.0*	5-S2n	0.566	1.269	0.589	0.833	16.513	7.926

* Full Flow Headwater elevation is below inlet invert.

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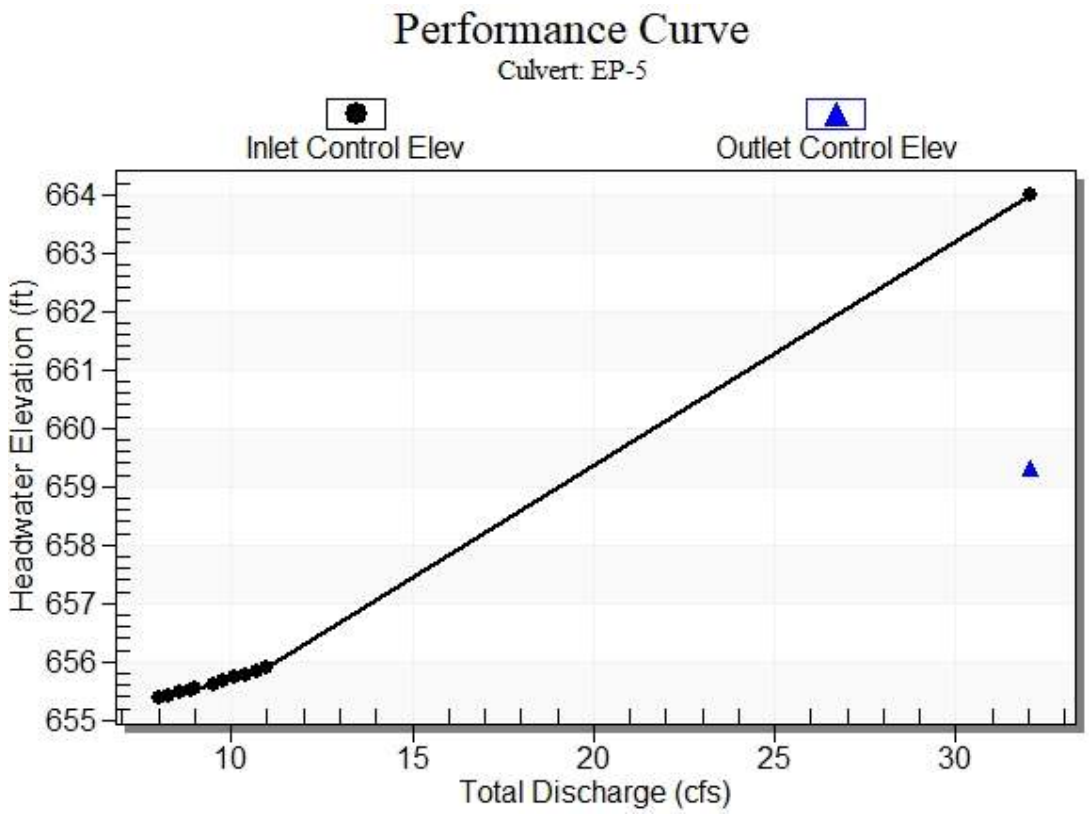
Straight Culvert

Inlet Elevation (invert): 653.77 ft, Outlet Elevation (invert): 638.90 ft

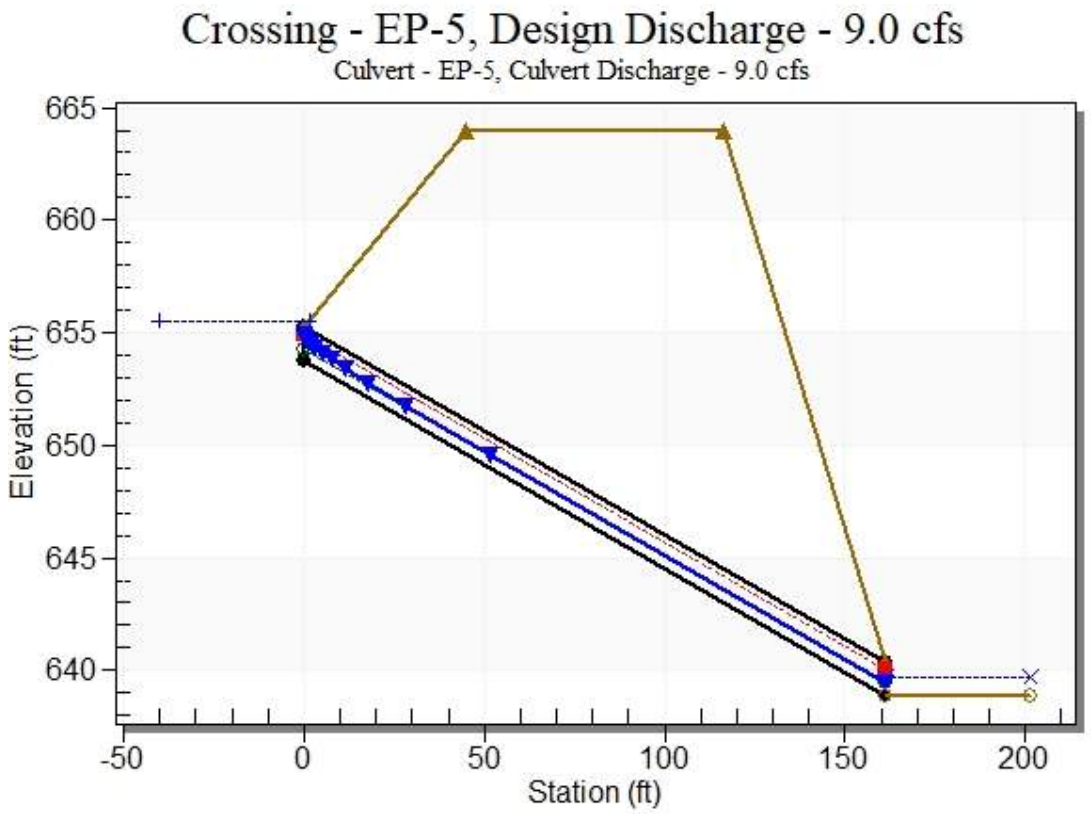
Culvert Length: 161.98 ft, Culvert Slope: 0.0922

****

Culvert Performance Curve Plot: EP-5



Water Surface Profile Plot for Culvert: EP-5



Site Data - EP-5

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 653.77 ft

Outlet Station: 161.30 ft

Outlet Elevation: 638.90 ft

Number of Barrels: 1

Culvert Data Summary - EP-5

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 15 - Downstream Channel Rating Curve (Crossing: EP-5)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.00	639.64	0.74	7.32	6.00	2.12
8.30	639.65	0.75	7.39	6.08	2.13
8.60	639.66	0.76	7.45	6.16	2.13
8.90	639.67	0.77	7.52	6.24	2.14
9.00	639.67	0.77	7.54	6.27	2.14
9.50	639.69	0.79	7.64	6.40	2.14
9.80	639.70	0.80	7.70	6.47	2.15
10.10	639.71	0.81	7.76	6.54	2.15
10.40	639.72	0.82	7.82	6.62	2.16
10.70	639.72	0.82	7.87	6.69	2.16
11.00	639.73	0.83	7.93	6.76	2.16

Tailwater Channel Data - EP-5

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.1300

Channel Manning's n: 0.0350

Channel Invert Elevation: 638.90 ft

Roadway Data for Crossing: EP-5

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 664.00 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 6.3 cfs

Maximum Flow: 8.6 cfs

Table 16 - Summary of Culvert Flows at Crossing: EP9

Headwater Elevation (ft)	Total Discharge (cfs)	EP-9 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
661.34	5.00	5.00	0.00	1
661.40	5.36	5.36	0.00	1
661.45	5.72	5.72	0.00	1
661.50	6.08	6.08	0.00	1
661.53	6.30	6.30	0.00	1
661.60	6.80	6.80	0.00	1
661.66	7.16	7.16	0.00	1
661.71	7.52	7.52	0.00	1
661.77	7.88	7.88	0.00	1
661.83	8.24	8.24	0.00	1
661.89	8.60	8.60	0.00	1
667.46	24.51	24.51	0.00	Overtopping

Rating Curve Plot for Crossing: EP9

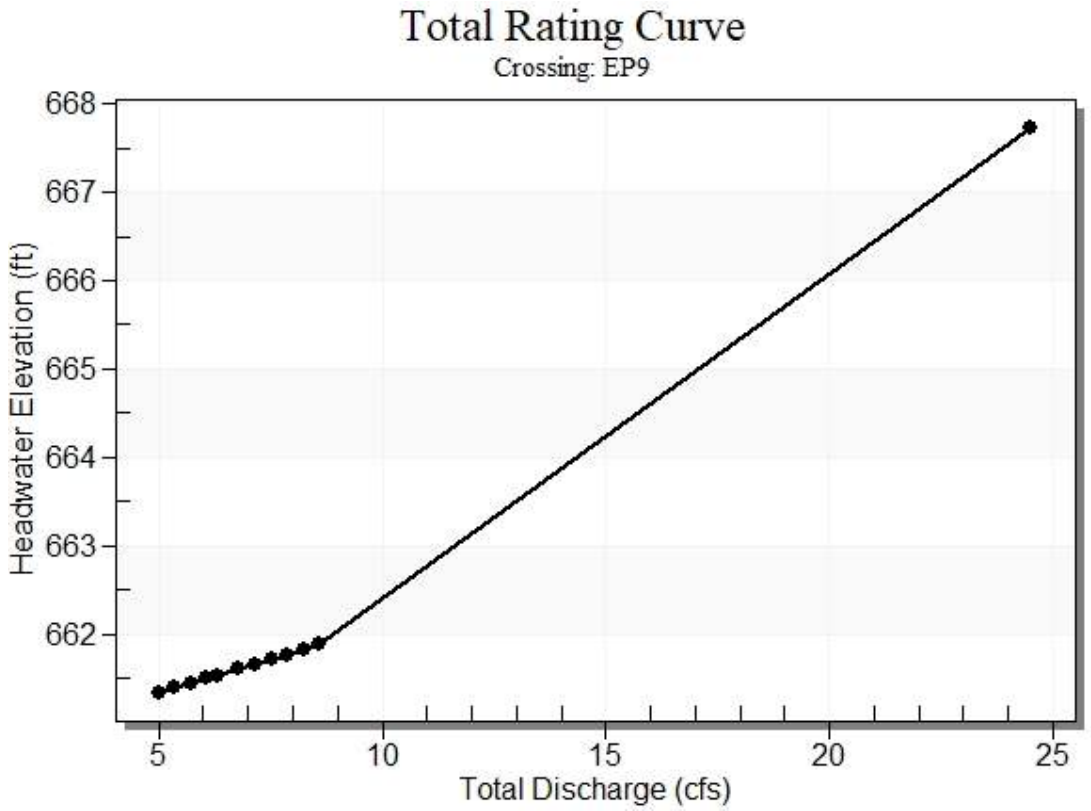


Table 17 - Culvert Summary Table: EP-9

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	661.34	1.214	0.0*	1-S2n	0.459	0.856	0.482	0.489	9.849	3.488
5.36	5.36	661.40	1.266	0.0*	1-S2n	0.475	0.889	0.500	0.502	10.042	3.550
5.72	5.72	661.45	1.317	0.0*	1-S2n	0.492	0.919	0.492	0.514	10.964	3.608
6.08	6.08	661.50	1.368	0.0*	1-S2n	0.508	0.948	0.508	0.526	11.165	3.663
6.30	6.30	661.53	1.400	0.0*	1-S2n	0.518	0.965	0.560	0.533	10.112	3.696
6.80	6.80	661.60	1.472	0.0*	1-S2n	0.539	1.007	0.575	0.548	10.556	3.767
7.16	7.16	661.66	1.526	0.0*	5-S2n	0.555	1.033	0.555	0.559	11.650	3.816
7.52	7.52	661.71	1.581	0.0*	5-S2n	0.570	1.059	0.570	0.570	11.810	3.863
7.88	7.88	661.77	1.637	0.0*	5-S2n	0.584	1.084	0.630	0.580	10.804	3.909
8.24	8.24	661.83	1.696	0.0*	5-S2n	0.599	1.108	0.647	0.589	10.926	3.953
8.60	8.60	661.89	1.756	0.0*	5-S2n	0.613	1.131	0.661	0.599	11.085	3.995

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 660.13 ft, Outlet Elevation (invert): 657.08 ft

Culvert Length: 72.46 ft, Culvert Slope: 0.0421

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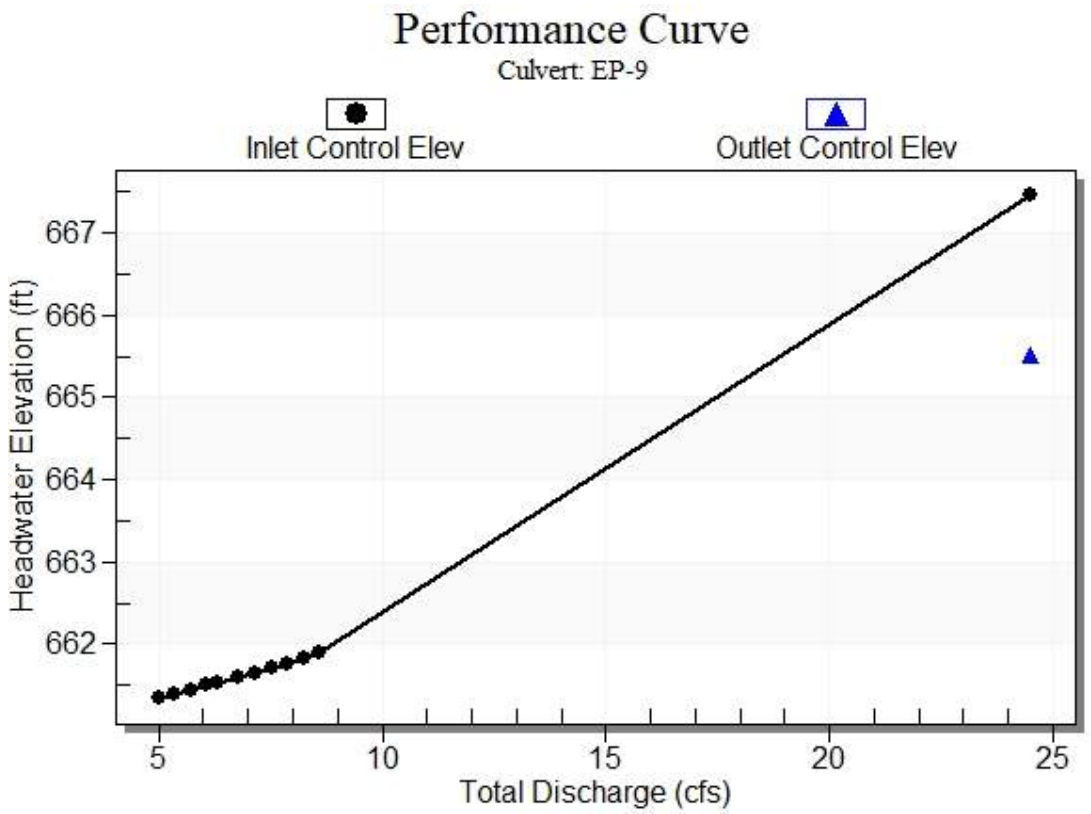
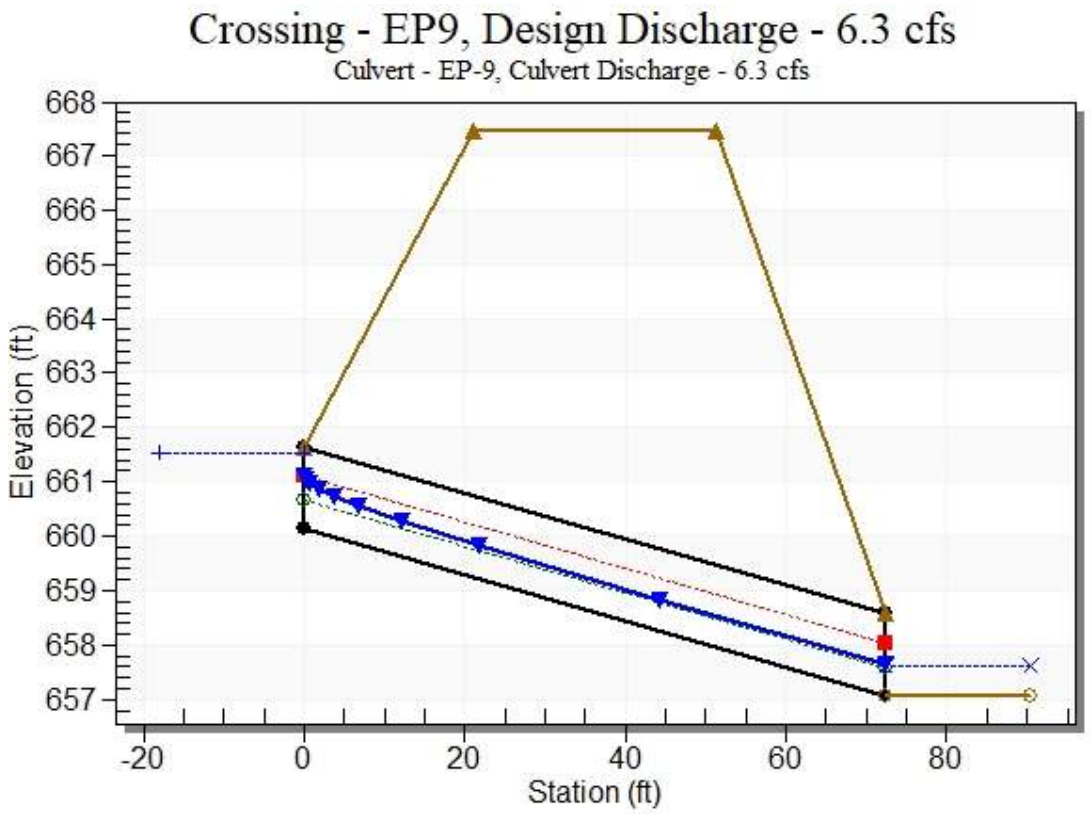
Culvert Performance Curve Plot: EP-9



Water Surface Profile Plot for Culvert: EP-9



Site Data - EP-9

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 660.13 ft

Outlet Station: 72.40 ft

Outlet Elevation: 657.08 ft

Number of Barrels: 1

Culvert Data Summary - EP-9

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 18 - Downstream Channel Rating Curve (Crossing: EP9)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	657.57	0.49	3.49	1.37	1.24
5.36	657.58	0.50	3.55	1.41	1.25
5.72	657.59	0.51	3.61	1.44	1.25
6.08	657.61	0.53	3.66	1.48	1.26
6.30	657.61	0.53	3.70	1.50	1.26
6.80	657.63	0.55	3.77	1.54	1.27
7.16	657.64	0.56	3.82	1.57	1.27
7.52	657.65	0.57	3.86	1.60	1.28
7.88	657.66	0.58	3.91	1.63	1.28
8.24	657.67	0.59	3.95	1.66	1.28
8.60	657.68	0.60	3.99	1.68	1.29

Tailwater Channel Data - EP9

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0450

Channel Manning's n: 0.0350

Channel Invert Elevation: 657.08 ft

Roadway Data for Crossing: EP9

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 667.46 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2.8 cfs

Design Flow: 3.6 cfs

Maximum Flow: 4.9 cfs

Table 19 - Summary of Culvert Flows at Crossing: CLP12

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
642.68	2.80	2.80	0.00	1
642.73	3.01	3.01	0.00	1
642.77	3.22	3.22	0.00	1
642.81	3.43	3.43	0.00	1
642.84	3.60	3.60	0.00	1
642.88	3.85	3.85	0.00	1
642.92	4.06	4.06	0.00	1
642.96	4.27	4.27	0.00	1
643.00	4.48	4.48	0.00	1
643.04	4.69	4.69	0.00	1
643.08	4.90	4.90	0.00	1
645.01	11.58	11.58	0.00	Overtopping

Rating Curve Plot for Crossing: CLP12

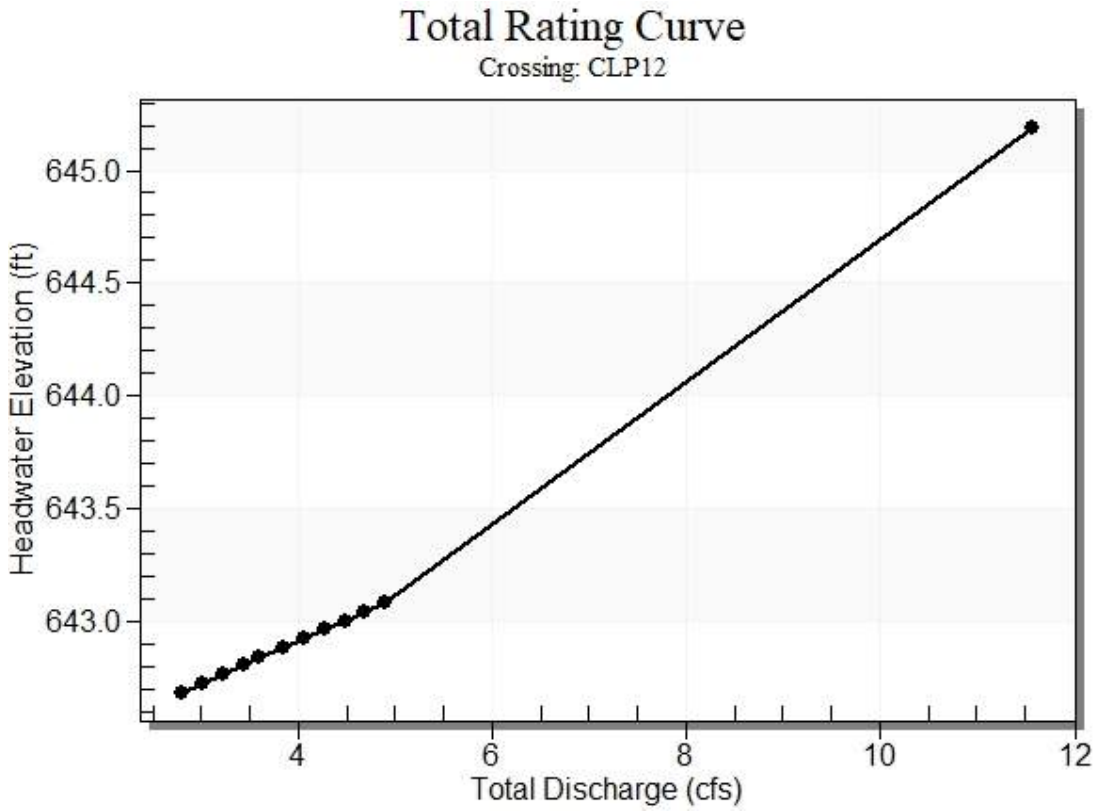


Table 20 - Culvert Summary Table: CLP-12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.80	2.80	642.68	0.954	0.0*	1-S2n	0.443	0.670	0.482	0.436	6.204	4.921
3.01	3.01	642.73	0.995	0.371	1-S2n	0.460	0.695	0.503	0.447	6.302	5.011
3.22	3.22	642.77	1.036	0.417	1-S2n	0.477	0.718	0.523	0.459	6.403	5.096
3.43	3.43	642.81	1.075	0.468	1-S2n	0.494	0.745	0.543	0.470	6.493	5.177
3.60	3.60	642.84	1.107	0.507	1-S2n	0.507	0.763	0.558	0.479	6.571	5.240
3.85	3.85	642.88	1.153	0.565	1-S2n	0.527	0.789	0.581	0.491	6.674	5.329
4.06	4.06	642.92	1.192	0.615	1-S2n	0.543	0.811	0.599	0.501	6.754	5.400
4.27	4.27	642.96	1.231	0.669	1-S2n	0.558	0.835	0.618	0.510	6.834	5.468
4.48	4.48	643.00	1.270	0.721	5-S2n	0.574	0.855	0.636	0.519	6.911	5.534
4.69	4.69	643.04	1.310	0.775	5-S2n	0.589	0.875	0.654	0.528	6.988	5.598
4.90	4.90	643.08	1.351	0.829	5-S2n	0.605	0.895	0.672	0.537	7.062	5.660

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 641.73 ft, Outlet Elevation (invert): 641.25 ft

Culvert Length: 24.00 ft, Culvert Slope: 0.0200

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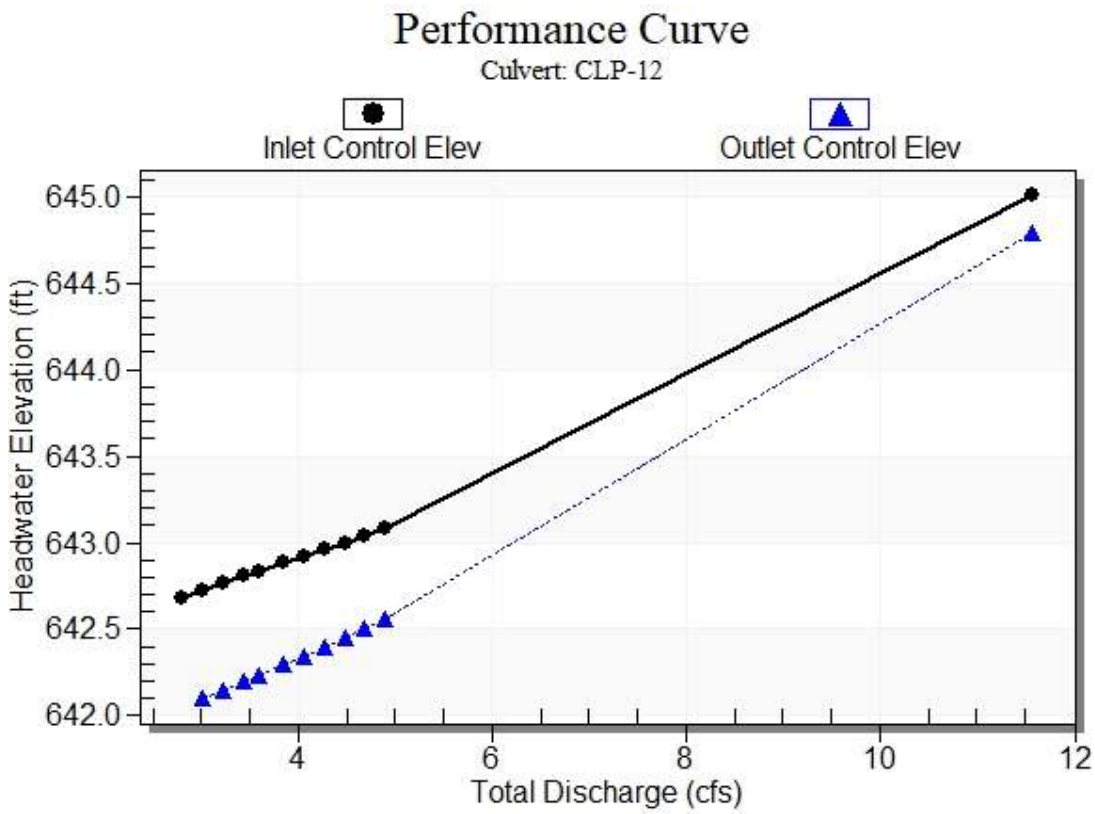
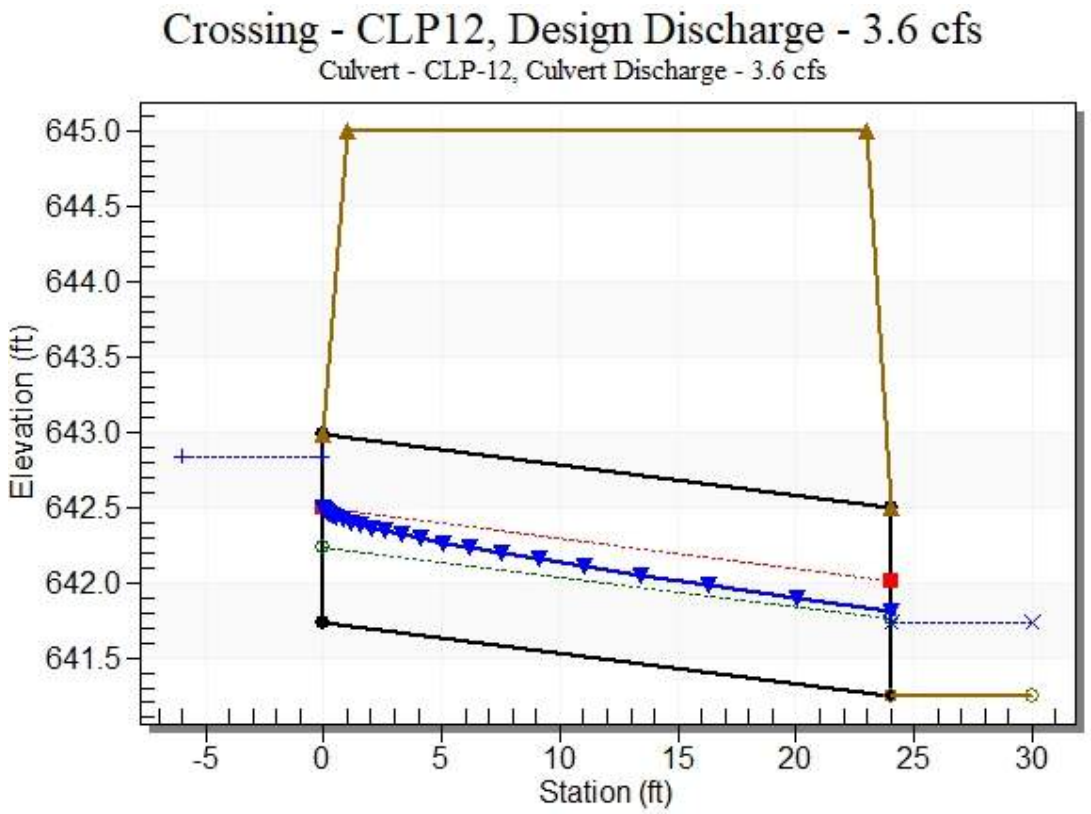
Culvert Performance Curve Plot: CLP-12



Water Surface Profile Plot for Culvert: CLP-12



Site Data - CLP-12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 641.73 ft

Outlet Station: 24.00 ft

Outlet Elevation: 641.25 ft

Number of Barrels: 1

Culvert Data Summary - CLP-12

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 21 - Downstream Channel Rating Curve (Crossing: CLP12)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.80	641.69	0.44	4.92	2.99	1.86
3.01	641.70	0.45	5.01	3.07	1.87
3.22	641.71	0.46	5.10	3.15	1.87
3.43	641.72	0.47	5.18	3.23	1.88
3.60	641.73	0.48	5.24	3.28	1.89
3.85	641.74	0.49	5.33	3.37	1.90
4.06	641.75	0.50	5.40	3.44	1.90
4.27	641.76	0.51	5.47	3.50	1.91
4.48	641.77	0.52	5.53	3.57	1.91
4.69	641.78	0.53	5.60	3.63	1.92
4.90	641.79	0.54	5.66	3.69	1.92

Tailwater Channel Data - CLP12

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.1100

Channel Manning's n: 0.0350

Channel Invert Elevation: 641.25 ft

Roadway Data for Crossing: CLP12

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 645.01 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1.6 cfs

Design Flow: 2.1 cfs

Maximum Flow: 2.8 cfs

Table 22 - Summary of Culvert Flows at Crossing: CLP13

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-13 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
614.54	1.60	1.60	0.00	1
614.58	1.72	1.72	0.00	1
614.61	1.84	1.84	0.00	1
614.64	1.96	1.96	0.00	1
614.66	2.08	2.08	0.00	1
614.67	2.10	2.10	0.00	1
614.72	2.32	2.32	0.00	1
614.74	2.44	2.44	0.00	1
614.77	2.56	2.56	0.00	1
614.79	2.68	2.68	0.00	1
614.82	2.80	2.80	0.00	1
618.64	14.63	14.63	0.00	Overtopping

Rating Curve Plot for Crossing: CLP13

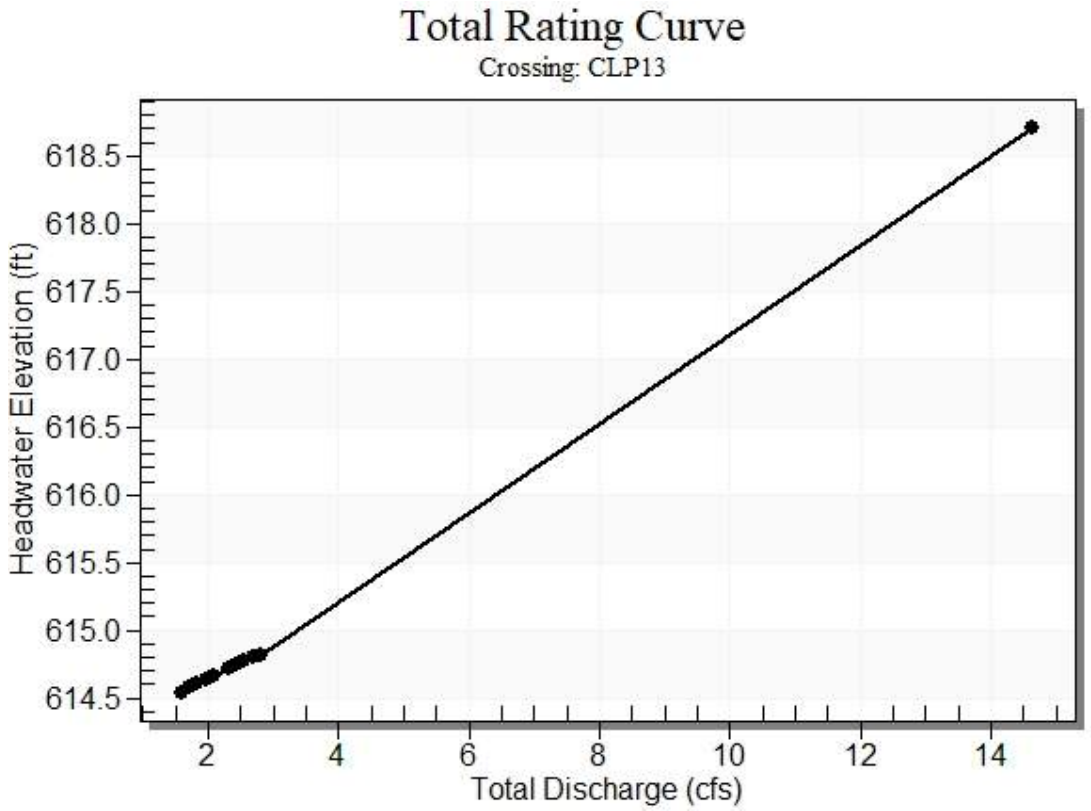


Table 23 - Culvert Summary Table: CLP-13

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.60	1.60	614.54	0.664	0.0*	1-S2n	0.270	0.499	0.285	0.426	7.369	2.202
1.72	1.72	614.58	0.696	0.0*	1-S2n	0.280	0.519	0.295	0.438	7.571	2.242
1.84	1.84	614.61	0.726	0.0*	1-S2n	0.289	0.539	0.305	0.449	7.732	2.280
1.96	1.96	614.64	0.756	0.0*	1-S2n	0.298	0.557	0.316	0.460	7.793	2.316
2.08	2.08	614.66	0.784	0.0*	1-S2n	0.308	0.575	0.327	0.470	7.906	2.351
2.10	2.10	614.67	0.789	0.0*	1-S2n	0.309	0.578	0.328	0.472	7.929	2.357
2.32	2.32	614.72	0.838	0.0*	1-S2n	0.325	0.609	0.346	0.490	8.106	2.416
2.44	2.44	614.74	0.864	0.0*	1-S2n	0.334	0.625	0.357	0.499	8.191	2.447
2.56	2.56	614.77	0.890	0.0*	1-S2n	0.342	0.641	0.367	0.508	8.279	2.476
2.68	2.68	614.79	0.914	0.0*	1-S2n	0.350	0.656	0.377	0.517	8.319	2.505
2.80	2.80	614.82	0.939	0.0*	1-S2n	0.358	0.670	0.385	0.526	8.425	2.532

* Full Flow Headwater elevation is below inlet invert.

****

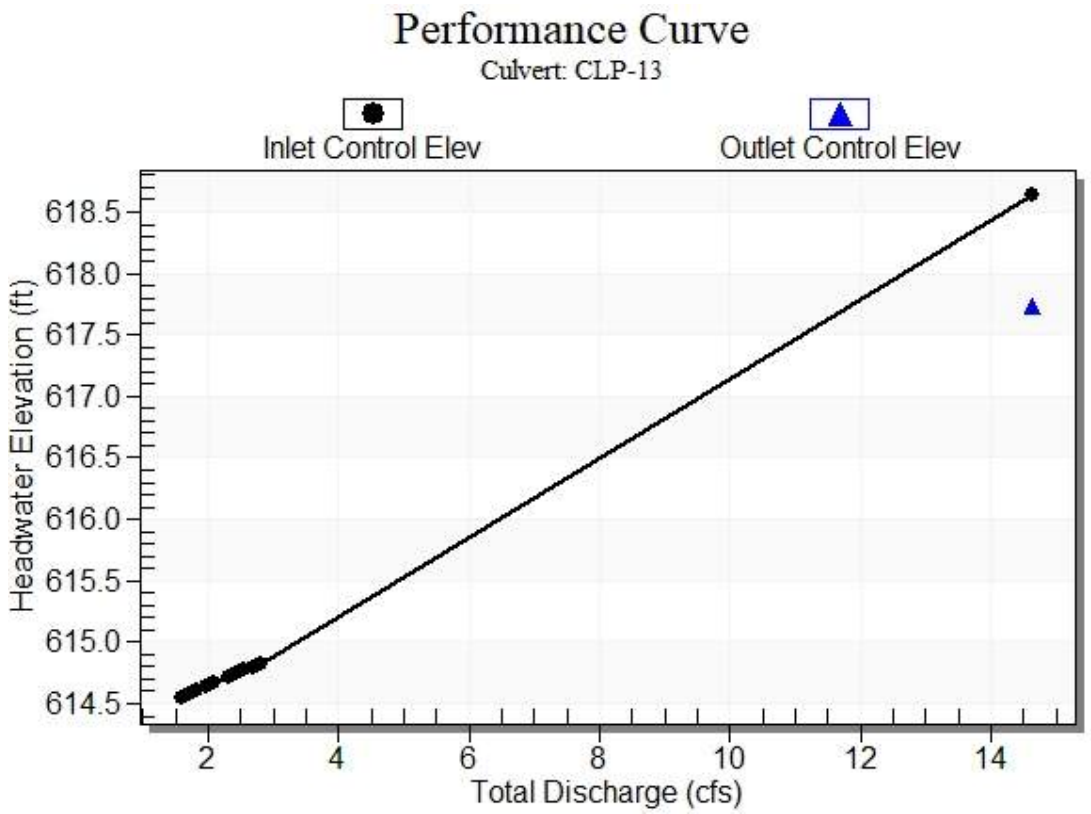
Straight Culvert

Inlet Elevation (invert): 613.88 ft, Outlet Elevation (invert): 612.35 ft

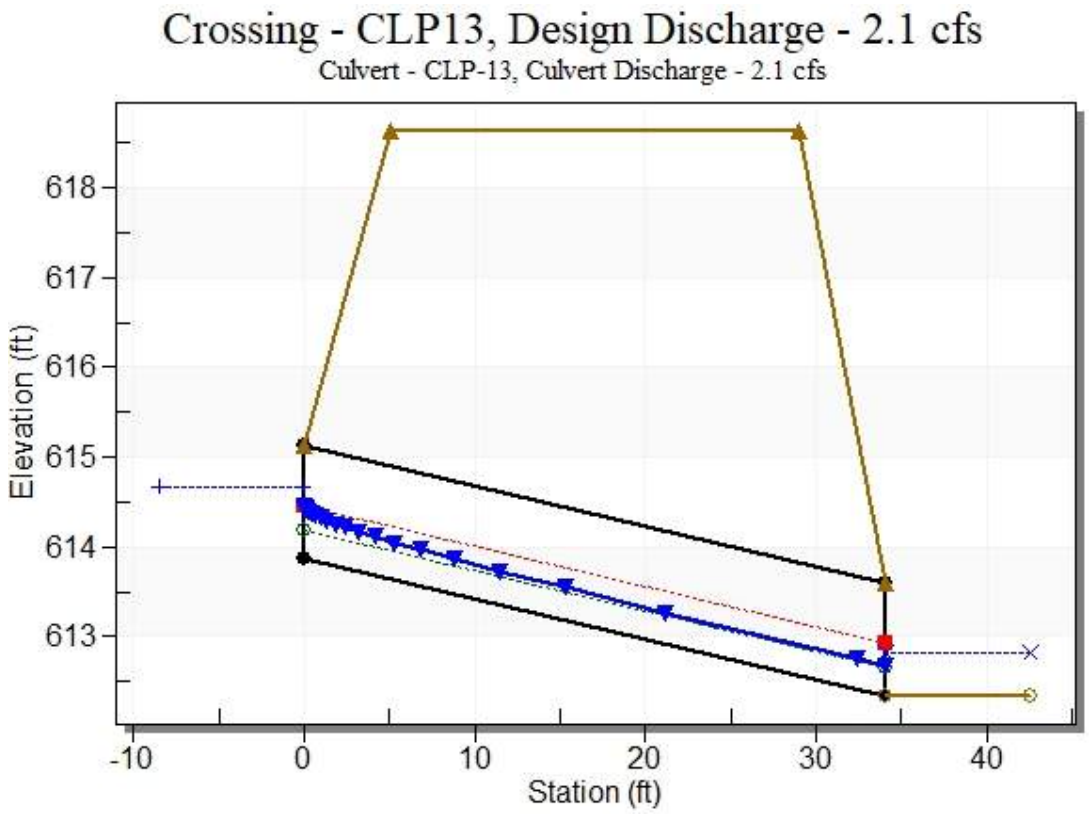
Culvert Length: 34.13 ft, Culvert Slope: 0.0449

****

Culvert Performance Curve Plot: CLP-13



Water Surface Profile Plot for Culvert: CLP-13



Site Data - CLP-13

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 613.88 ft

Outlet Station: 34.10 ft

Outlet Elevation: 612.35 ft

Number of Barrels: 1

Culvert Data Summary - CLP-13

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 24 - Downstream Channel Rating Curve (Crossing: CLP13)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.60	612.78	0.43	2.20	0.59	0.84
1.72	612.79	0.44	2.24	0.60	0.84
1.84	612.80	0.45	2.28	0.62	0.85
1.96	612.81	0.46	2.32	0.63	0.85
2.08	612.82	0.47	2.35	0.65	0.85
2.10	612.82	0.47	2.36	0.65	0.85
2.32	612.84	0.49	2.42	0.67	0.86
2.44	612.85	0.50	2.45	0.69	0.86
2.56	612.86	0.51	2.48	0.70	0.87
2.68	612.87	0.52	2.50	0.71	0.87
2.80	612.88	0.53	2.53	0.72	0.87

Tailwater Channel Data - CLP13

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0220

Channel Manning's n: 0.0350

Channel Invert Elevation: 612.35 ft

Roadway Data for Crossing: CLP13

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 618.64 ft

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

Table 1 - Summary of Culvert Flows at Crossing: CLP16

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CLP-16 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
630.01	10-Year	15.00	15.00	0.00	1
630.35	25-Year	18.00	18.00	0.00	1
630.77	50-Year	22.00	22.00	0.00	1
631.25	100-Year	25.00	25.00	0.00	1
634.09	Overtopping	39.47	39.47	0.00	Overtopping

Rating Curve Plot for Crossing: CLP16

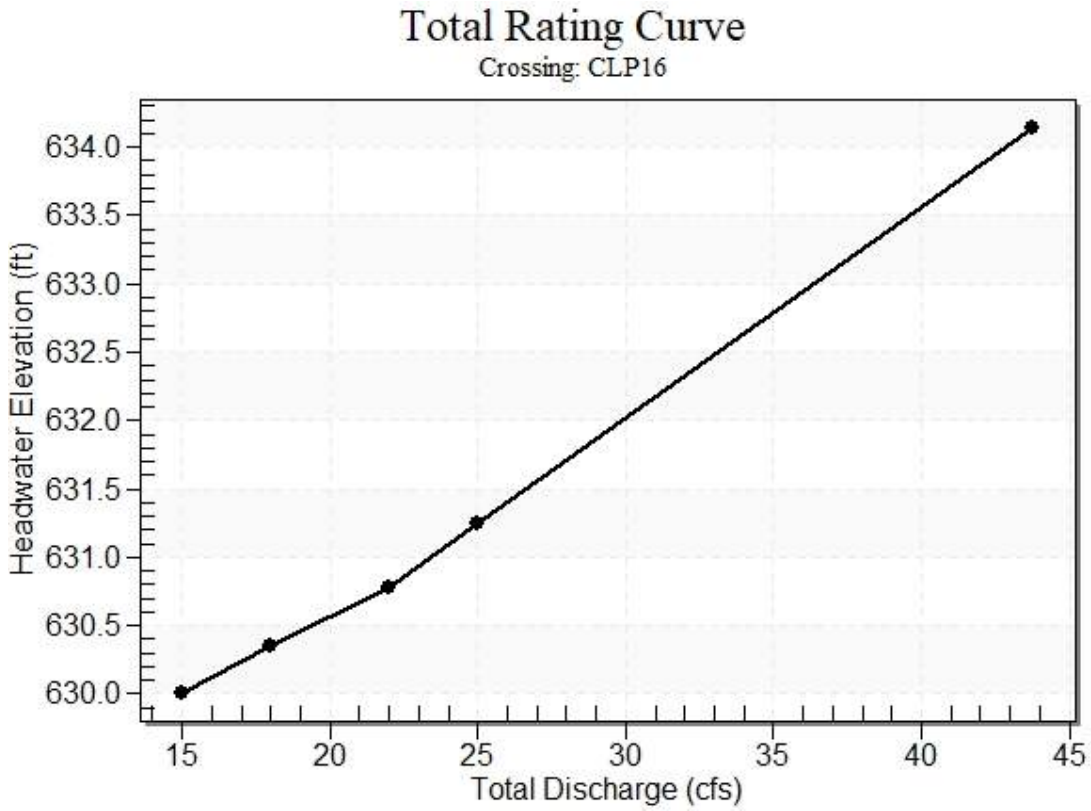


Table 2 - Culvert Summary Table: CLP-16

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10-Year	15.00	15.00	630.01	2.092	1.682	5-S2n	1.342	1.396	1.344	0.919	6.683	2.963
25-Year	18.00	18.00	630.35	2.389	2.435	7-M2c	1.555	1.528	1.528	0.984	6.988	3.101
50-Year	22.00	22.00	630.77	2.840	2.853	7-M2c	2.000	1.675	1.675	1.060	7.830	3.261
100-Year	25.00	25.00	631.25	3.226	3.330	7-M2c	2.000	1.762	1.762	1.112	8.532	3.367

****

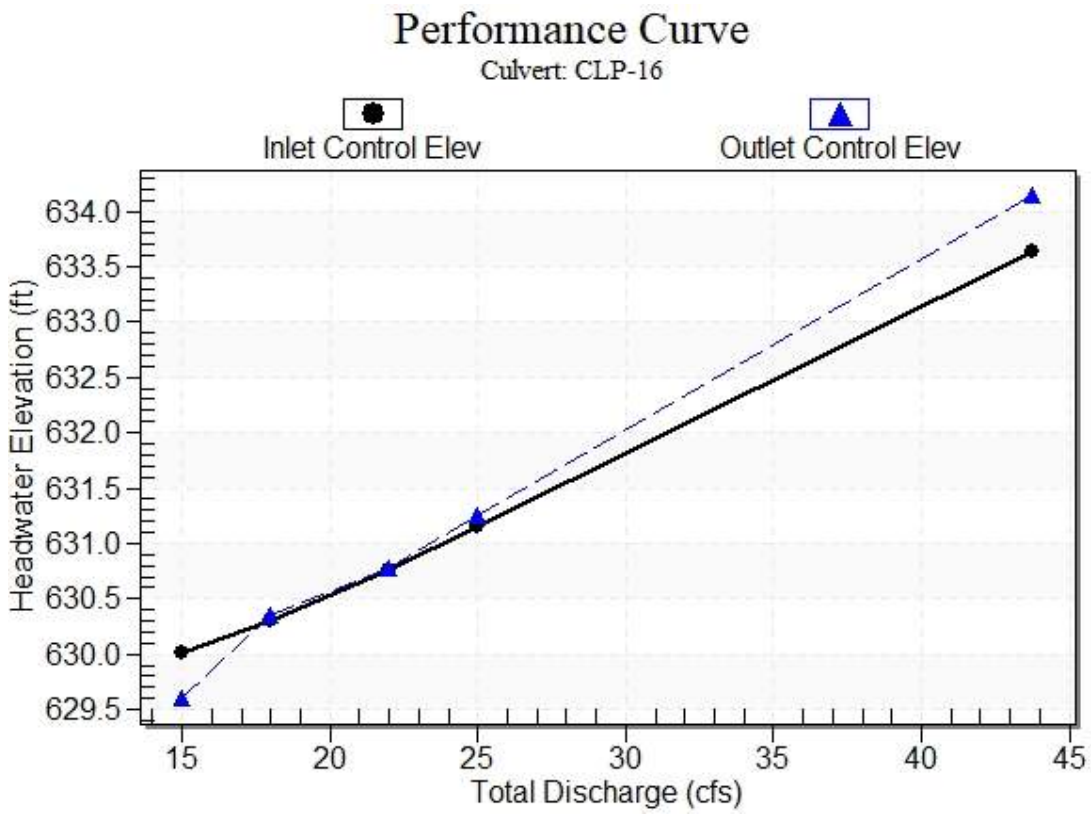
Straight Culvert

Inlet Elevation (invert): 627.92 ft, Outlet Elevation (invert): 627.55 ft

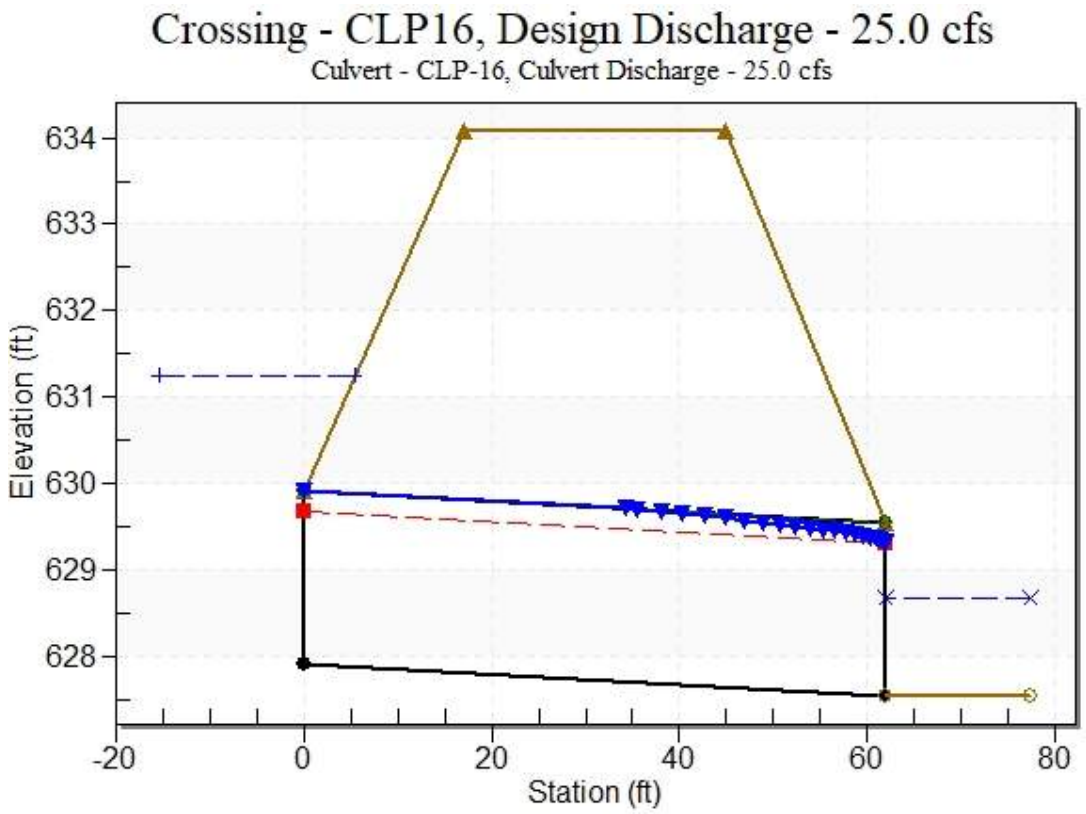
Culvert Length: 62.00 ft, Culvert Slope: 0.0060

****

Culvert Performance Curve Plot: CLP-16



Water Surface Profile Plot for Culvert: CLP-16



Site Data - CLP-16

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 627.92 ft

Outlet Station: 62.00 ft

Outlet Elevation: 627.55 ft

Number of Barrels: 1

Culvert Data Summary - CLP-16

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: CLP16)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
15.00	628.47	0.92	2.96	0.80	0.77
18.00	628.53	0.98	3.10	0.86	0.78
22.00	628.61	1.06	3.26	0.93	0.79
25.00	628.66	1.11	3.37	0.97	0.80

Tailwater Channel Data - CLP16

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0140

Channel Manning's n: 0.0350

Channel Invert Elevation: 627.55 ft

Roadway Data for Crossing: CLP16

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 634.09 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 221 cfs

Design Flow: 242 cfs

Maximum Flow: 264 cfs

Table 28 - Summary of Culvert Flows at Crossing: XEP-3

Headwater Elevation (ft)	Total Discharge (cfs)	XEP-3 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
573.72	221.00	221.00	0.00	1
573.83	225.30	225.30	0.00	1
573.95	229.60	229.60	0.00	1
574.06	233.90	233.90	0.00	1
574.19	238.20	238.20	0.00	1
574.29	242.00	242.00	0.00	1
574.43	246.80	246.80	0.00	1
574.56	251.10	251.10	0.00	1
574.69	255.40	255.40	0.00	1
574.82	259.70	259.70	0.00	1
574.95	264.00	264.00	0.00	1
588.90	540.90	540.90	0.00	Overtopping

Rating Curve Plot for Crossing: XEP-3

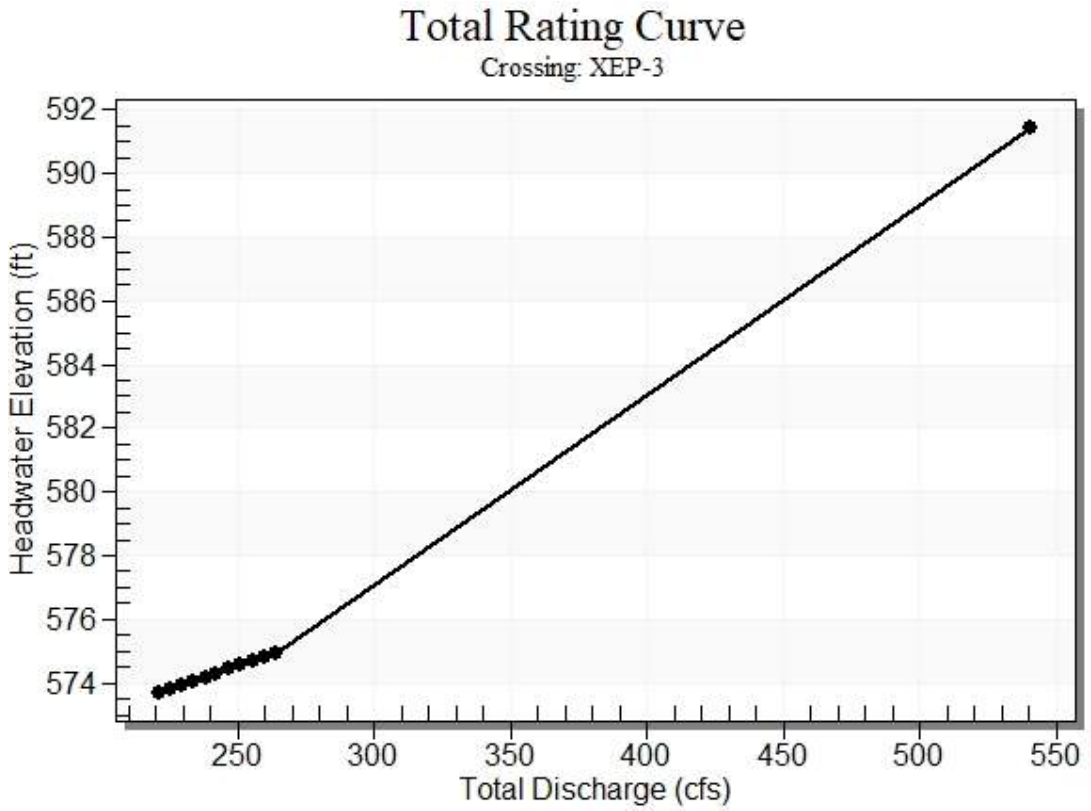


Table 29 - Culvert Summary Table: XEP-3

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
221.00	221.00	573.72	6.395	5.432	5-S2n	2.887	3.929	3.157	2.326	13.999	11.194
225.30	225.30	573.83	6.510	5.543	5-S2n	2.930	3.980	3.204	2.349	14.063	11.252
229.60	229.60	573.95	6.626	5.655	5-S2n	2.973	4.031	3.251	2.372	14.127	11.310
233.90	233.90	574.06	6.745	5.769	5-S2n	3.015	4.081	3.297	2.395	14.190	11.366
238.20	238.20	574.19	6.865	5.884	5-S2n	3.058	4.131	3.343	2.417	14.252	11.422
242.00	242.00	574.29	6.973	5.987	5-S2n	3.096	4.175	3.383	2.437	14.307	11.471
246.80	246.80	574.43	7.112	6.118	5-S2n	3.143	4.230	3.434	2.462	14.375	11.532
251.10	251.10	574.56	7.238	6.238	5-S2n	3.186	4.279	3.479	2.484	14.436	11.585
255.40	255.40	574.69	7.366	6.359	5-S2n	3.228	4.327	3.525	2.506	14.492	11.638
259.70	259.70	574.82	7.497	6.481	5-S2n	3.270	4.376	3.571	2.527	14.547	11.691
264.00	264.00	574.95	7.629	6.605	5-S2n	3.312	4.424	3.616	2.548	14.601	11.742

****

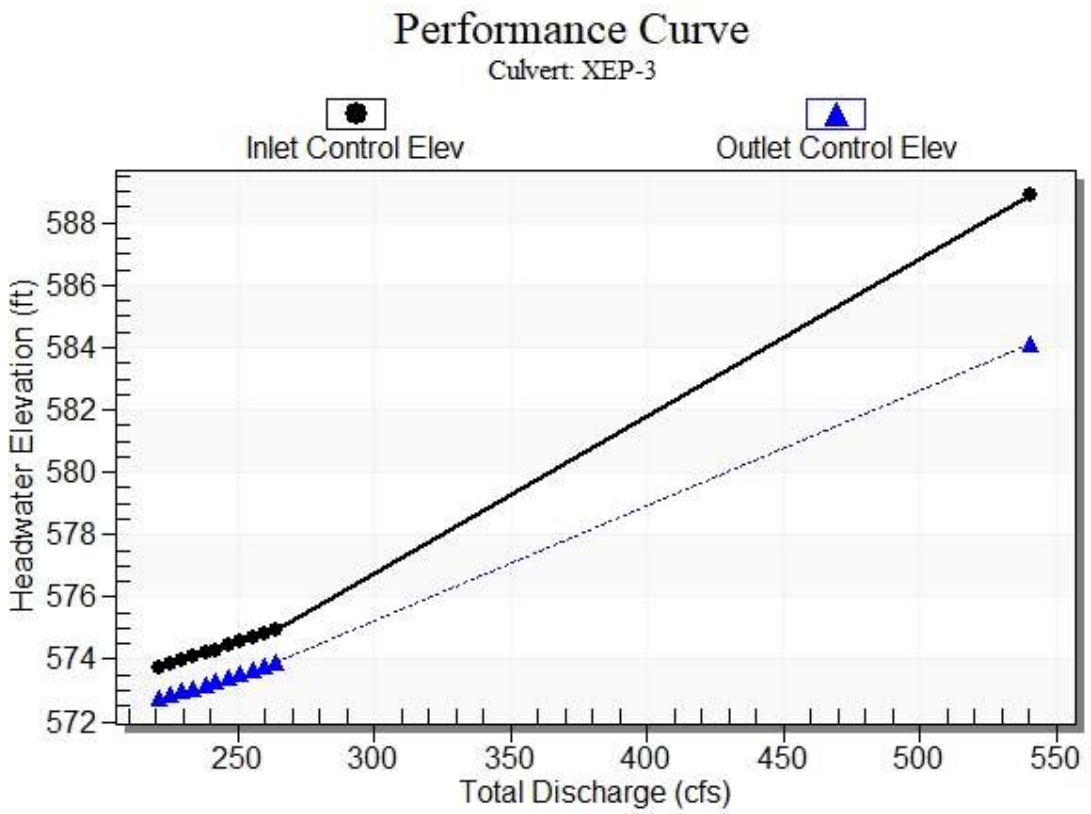
Straight Culvert

Inlet Elevation (invert): 567.32 ft, Outlet Elevation (invert): 566.12 ft

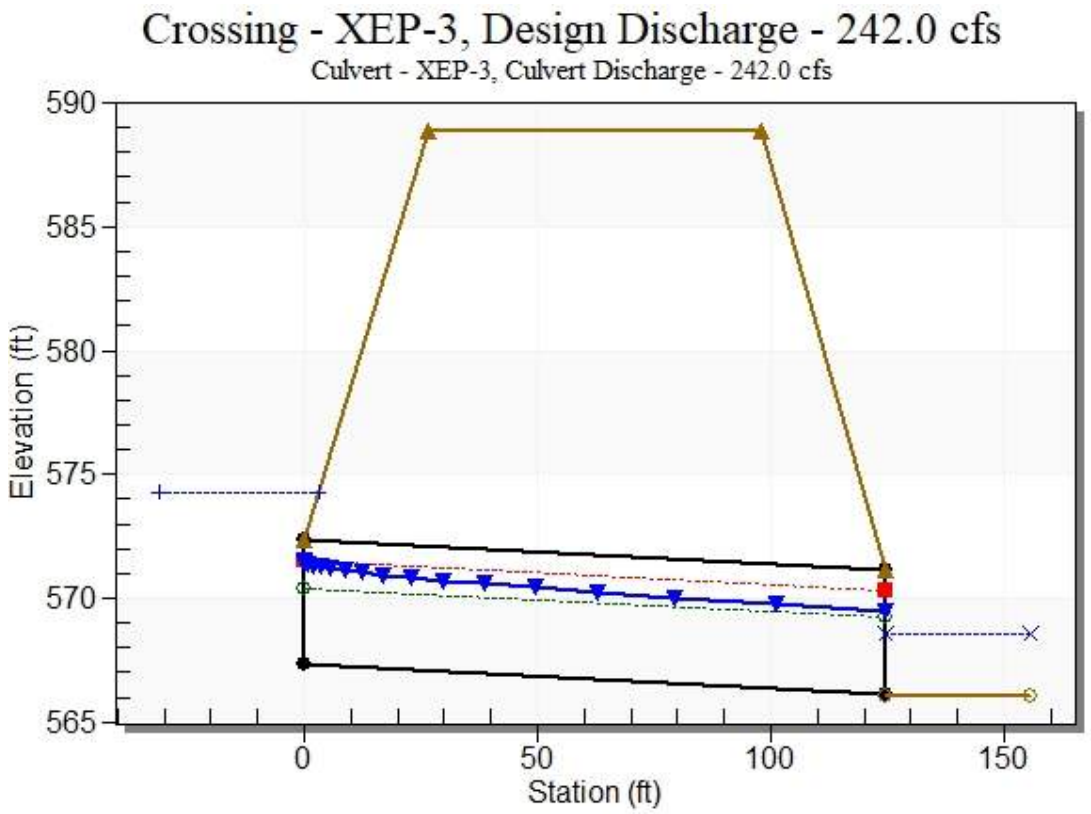
Culvert Length: 124.61 ft, Culvert Slope: 0.0096

****

Culvert Performance Curve Plot: XEP-3



Water Surface Profile Plot for Culvert: XEP-3



Site Data - XEP-3

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 567.32 ft

Outlet Station: 124.60 ft

Outlet Elevation: 566.12 ft

Number of Barrels: 1

Culvert Data Summary - XEP-3

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 30 - Downstream Channel Rating Curve (Crossing: XEP-3)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
221.00	568.41	2.33	11.19	6.01	1.54
225.30	568.43	2.35	11.25	6.07	1.54
229.60	568.45	2.37	11.31	6.13	1.54
233.90	568.47	2.39	11.37	6.19	1.54
238.20	568.50	2.42	11.42	6.25	1.54
242.00	568.52	2.44	11.47	6.30	1.54
246.80	568.54	2.46	11.53	6.36	1.55
251.10	568.56	2.48	11.58	6.42	1.55
255.40	568.59	2.51	11.64	6.47	1.55
259.70	568.61	2.53	11.69	6.53	1.55
264.00	568.63	2.55	11.74	6.58	1.55

Tailwater Channel Data - XEP-3

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0414

Channel Manning's n: 0.0350

Channel Invert Elevation: 566.08 ft

Roadway Data for Crossing: XEP-3

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 588.90 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

HY-8 Culvert Analysis Report
Proposed Conditions

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 154 cfs

Design Flow: 185 cfs

Maximum Flow: 209 cfs

Table 1 - Summary of Culvert Flows at Crossing: EP-2

Headwater Elevation (ft)	Total Discharge (cfs)	EP-2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
573.47	154.00	154.00	0.00	1
573.73	159.50	159.50	0.00	1
574.01	165.00	165.00	0.00	1
574.28	170.50	170.50	0.00	1
574.55	176.00	176.00	0.00	1
574.83	181.50	181.50	0.00	1
575.01	185.00	185.00	0.00	1
575.39	192.50	192.50	0.00	1
575.67	198.00	198.00	0.00	1
575.96	203.50	203.50	0.00	1
576.24	209.00	209.00	0.00	1
595.40	517.14	517.14	0.00	Overtopping

Rating Curve Plot for Crossing: EP-2

Table 2 - Culvert Summary Table: EP-2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
154.00	154.00	573.47	4.842	7.995	5-FFf	0.000	0.000	5.000	6.679	6.160	7.685
159.50	159.50	573.73	4.972	8.265	5-FFf	0.000	0.000	5.000	6.892	6.380	7.714
165.00	165.00	574.01	5.102	8.536	5-FFf	0.000	0.000	5.000	7.104	6.600	7.742
170.50	170.50	574.28	5.231	8.809	5-FFf	0.000	0.000	5.000	7.316	6.820	7.768
176.00	176.00	574.55	5.362	9.084	5-FFf	0.000	0.000	5.000	7.528	7.040	7.793
181.50	181.50	574.83	5.493	9.361	5-FFf	0.000	0.000	5.000	7.740	7.260	7.817
185.00	185.00	575.01	5.577	9.538	5-FFf	0.000	0.000	5.000	7.874	7.400	7.831
192.50	192.50	575.39	5.757	9.920	5-FFf	0.000	0.000	5.000	8.163	7.700	7.861
198.00	198.00	575.67	5.891	10.203	5-FFf	0.000	0.000	5.000	8.374	7.920	7.882
203.50	203.50	575.96	6.026	10.487	5-FFf	0.000	0.000	5.000	8.585	8.140	7.901
209.00	209.00	576.24	6.162	10.774	5-FFf	0.000	0.000	5.000	8.796	8.360	7.920

****

Double Broken-back Culvert

Inlet Elevation (invert): 565.47 ft,

Upper Break Elevation (invert): 564.80 ft,

Lower Break Elevation (invert): 562.74 ft,

Culvert Length: 228.96 ft,

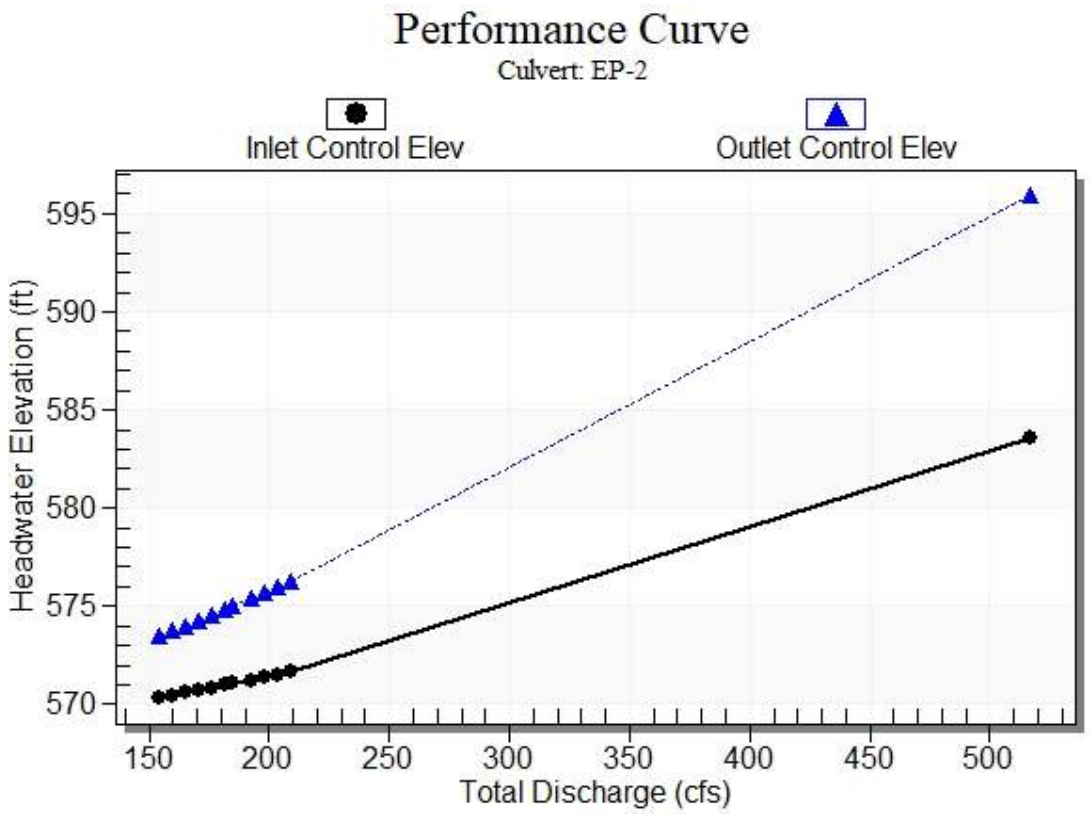
Upper Culvert Section Slope: 0.0155

Steep Culvert Section Slope: 0.0153

Runout Culvert Section Slope: 0.0154

****

Culvert Performance Curve Plot: EP-2



Water Surface Profile Plot for Culvert: EP-2

Site Data - EP-2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 565.47 ft

Upper Break Station: 43.09 ft

Upper Break Elevation: 564.80 ft

Lower Break Station: 177.65 ft

Lower Break Elevation: 562.74 ft

Outlet Station: 228.93 ft

Outlet Elevation: 561.95 ft

Number of Barrels: 1

Culvert Data Summary - EP-2

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 5.00 ft

Upper & Middle Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper & Middle Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Double Broken-back

Inlet Configuration: 1:1 Bevel (45º flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: EP-2)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
154.00	572.68	6.68	7.69	10.42	0.52
159.50	572.89	6.89	7.71	10.75	0.52
165.00	573.10	7.10	7.74	11.08	0.51
170.50	573.32	7.32	7.77	11.41	0.51
176.00	573.53	7.53	7.79	11.74	0.50
181.50	573.74	7.74	7.82	12.07	0.50
185.00	573.87	7.87	7.83	12.28	0.49
192.50	574.16	8.16	7.86	12.73	0.48
198.00	574.37	8.37	7.88	13.06	0.48
203.50	574.59	8.59	7.90	13.39	0.48
209.00	574.80	8.80	7.92	13.72	0.47

Tailwater Channel Data - EP-2

Tailwater Channel Option: Rectangular Channel

Bottom Width: 3.00 ft

Channel Slope: 0.0250

Channel Manning's n: 0.0350

Channel Invert Elevation: 566.00 ft

Roadway Data for Crossing: EP-2

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 595.40 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 204 cfs

Design Flow: 244 cfs

Maximum Flow: 276 cfs

Table 4 - Summary of Culvert Flows at Crossing: EP-3

Headwater Elevation (ft)	Total Discharge (cfs)	EP-3 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
574.36	204.00	204.00	0.00	1
574.54	211.20	211.20	0.00	1
574.73	218.40	218.40	0.00	1
574.92	225.60	225.60	0.00	1
575.11	232.80	232.80	0.00	1
575.32	240.00	240.00	0.00	1
575.43	244.00	244.00	0.00	1
575.74	254.40	254.40	0.00	1
575.96	261.60	261.60	0.00	1
576.18	268.80	268.80	0.00	1
576.41	276.00	276.00	0.00	1
588.90	525.38	525.38	0.00	Overtopping

Rating Curve Plot for Crossing: EP-3

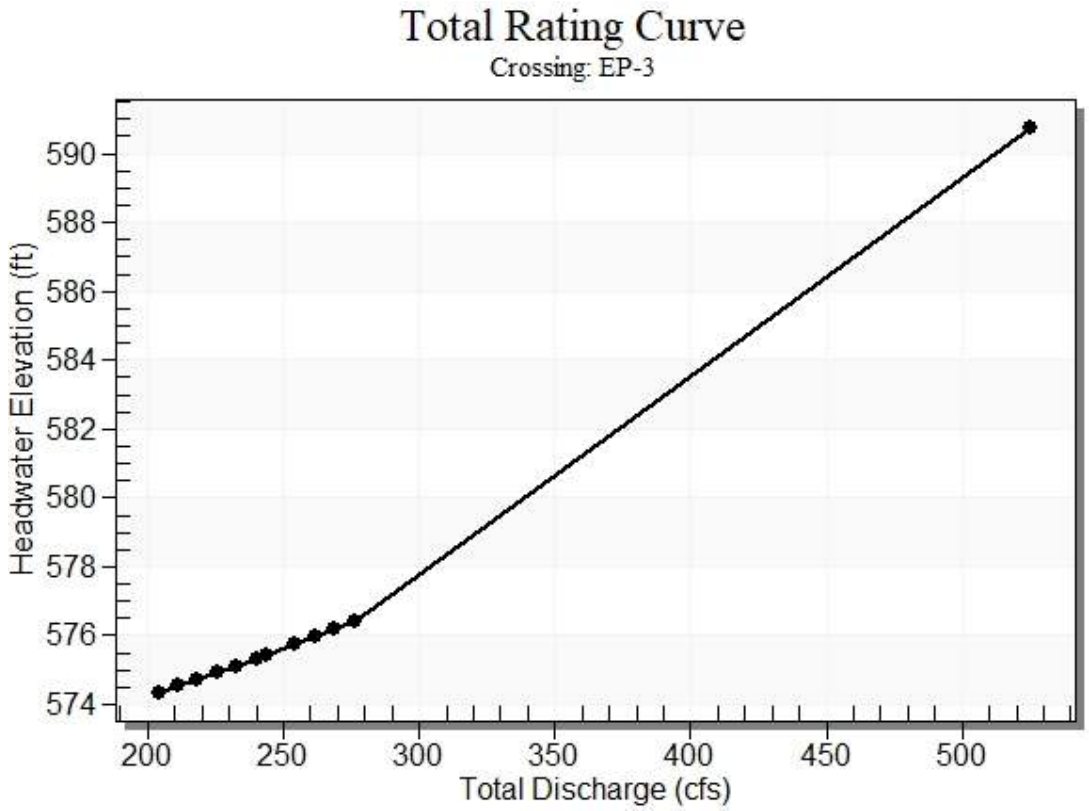


Table 5 - Culvert Summary Table: EP-3

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
204.00	204.00	574.36	5.958	2.369	5-S2n	0.000	0.000	2.901	2.231	14.332	10.954
211.20	211.20	574.54	6.140	2.499	5-S2n	0.000	0.000	2.942	2.272	14.448	11.057
218.40	218.40	574.73	6.327	2.634	5-S2n	0.000	0.000	2.982	2.312	14.561	11.158
225.60	225.60	574.92	6.518	2.772	5-S2n	0.000	0.000	3.021	2.351	14.669	11.256
232.80	232.80	575.11	6.715	2.916	5-S2n	0.000	0.000	3.059	2.389	14.774	11.352
240.00	240.00	575.32	6.916	3.064	5-S2n	0.000	0.000	3.108	2.427	14.875	11.446
244.00	244.00	575.43	7.031	3.148	5-S2n	0.000	0.000	3.148	2.448	14.930	11.496
254.40	254.40	575.74	7.336	3.373	5-S2n	0.000	0.000	3.251	2.501	15.070	11.626
261.60	261.60	575.96	7.555	3.534	5-S2n	0.000	0.000	3.323	2.537	15.163	11.713
268.80	268.80	576.18	7.780	3.700	5-S2n	0.000	0.000	3.394	2.572	15.254	11.798
276.00	276.00	576.41	8.012	3.871	5-S2n	0.000	0.000	3.465	2.607	15.343	11.882

****

Double Broken-back Culvert

Inlet Elevation (invert): 568.40 ft,

Upper Break Elevation (invert): 567.32 ft,

Lower Break Elevation (invert): 566.12 ft,

Culvert Length: 312.22 ft,

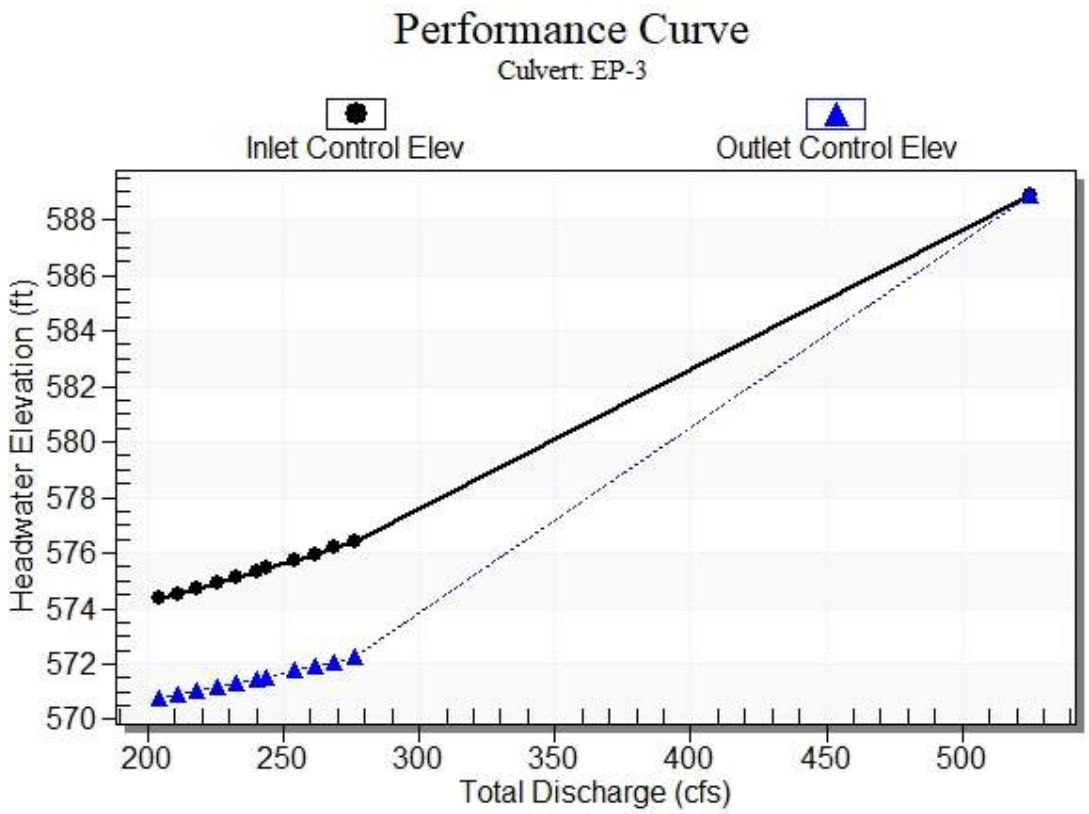
Upper Culvert Section Slope: 0.0096

Steep Culvert Section Slope: 0.0097

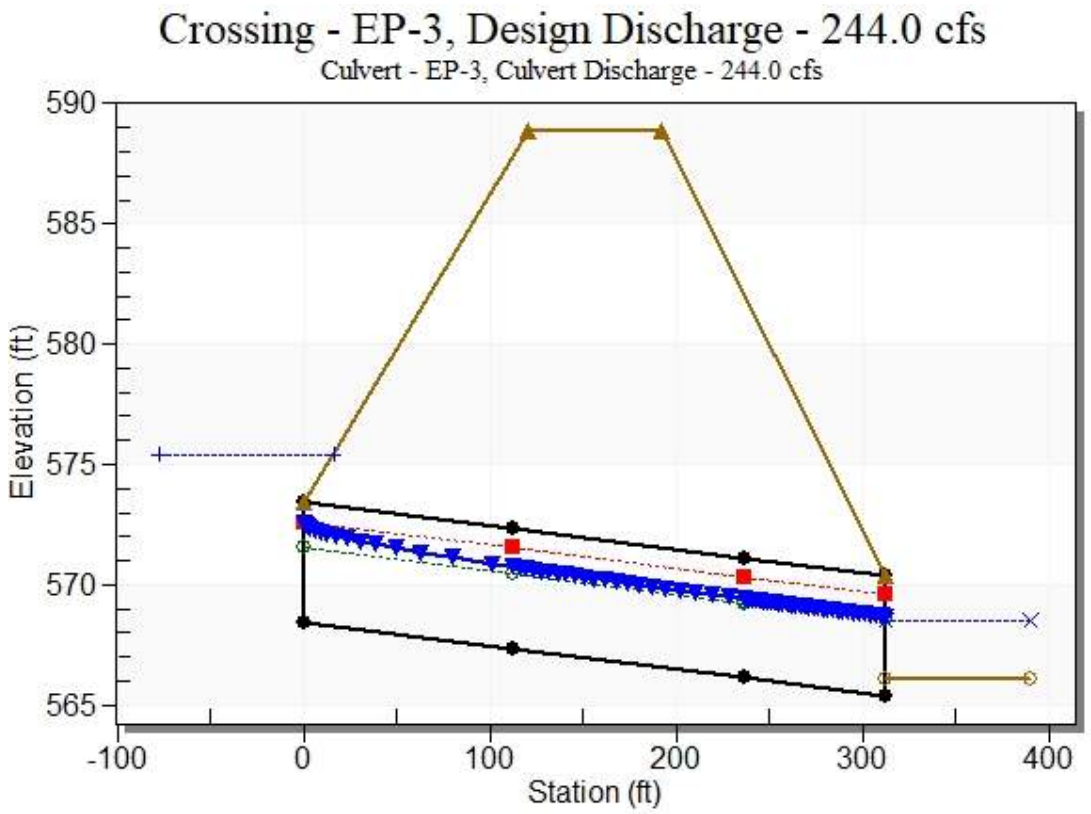
Runout Culvert Section Slope: 0.0094

****

Culvert Performance Curve Plot: EP-3



Water Surface Profile Plot for Culvert: EP-3



Site Data - EP-3

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 568.40 ft

Upper Break Station: 112.33 ft

Upper Break Elevation: 567.32 ft

Lower Break Station: 236.51 ft

Lower Break Elevation: 566.12 ft

Outlet Station: 312.21 ft

Outlet Elevation: 565.41 ft

Number of Barrels: 1

Culvert Data Summary - EP-3

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 5.00 ft

Upper & Middle Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper & Middle Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Double Broken-back

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: EP-3)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
204.00	568.31	2.23	10.95	5.76	1.53
211.20	568.35	2.27	11.06	5.87	1.53
218.40	568.39	2.31	11.16	5.97	1.54
225.60	568.43	2.35	11.26	6.07	1.54
232.80	568.47	2.39	11.35	6.17	1.54
240.00	568.51	2.43	11.45	6.27	1.54
244.00	568.53	2.45	11.50	6.32	1.54
254.40	568.58	2.50	11.63	6.46	1.55
261.60	568.62	2.54	11.71	6.55	1.55
268.80	568.65	2.57	11.80	6.64	1.55
276.00	568.69	2.61	11.88	6.73	1.56

Tailwater Channel Data - EP-3

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0414

Channel Manning's n: 0.0350

Channel Invert Elevation: 566.08 ft

Roadway Data for Crossing: EP-3

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 588.90 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 42 cfs

Design Flow: 51 cfs

Maximum Flow: 58 cfs

Table 7 - Summary of Culvert Flows at Crossing: CLP-4-1

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-4 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
625.22	42.00	42.00	0.00	1
625.33	43.60	43.60	0.00	1
625.44	45.20	45.20	0.00	1
625.56	46.80	46.80	0.00	1
625.67	48.40	48.40	0.00	1
625.79	50.00	50.00	0.00	1
625.87	51.00	51.00	0.00	1
626.05	53.20	53.20	0.00	1
626.18	54.80	54.80	0.00	1
626.32	56.40	56.40	0.00	1
626.46	58.00	58.00	0.00	1
638.20	132.38	132.38	0.00	Overtopping

Rating Curve Plot for Crossing: CLP-4-1

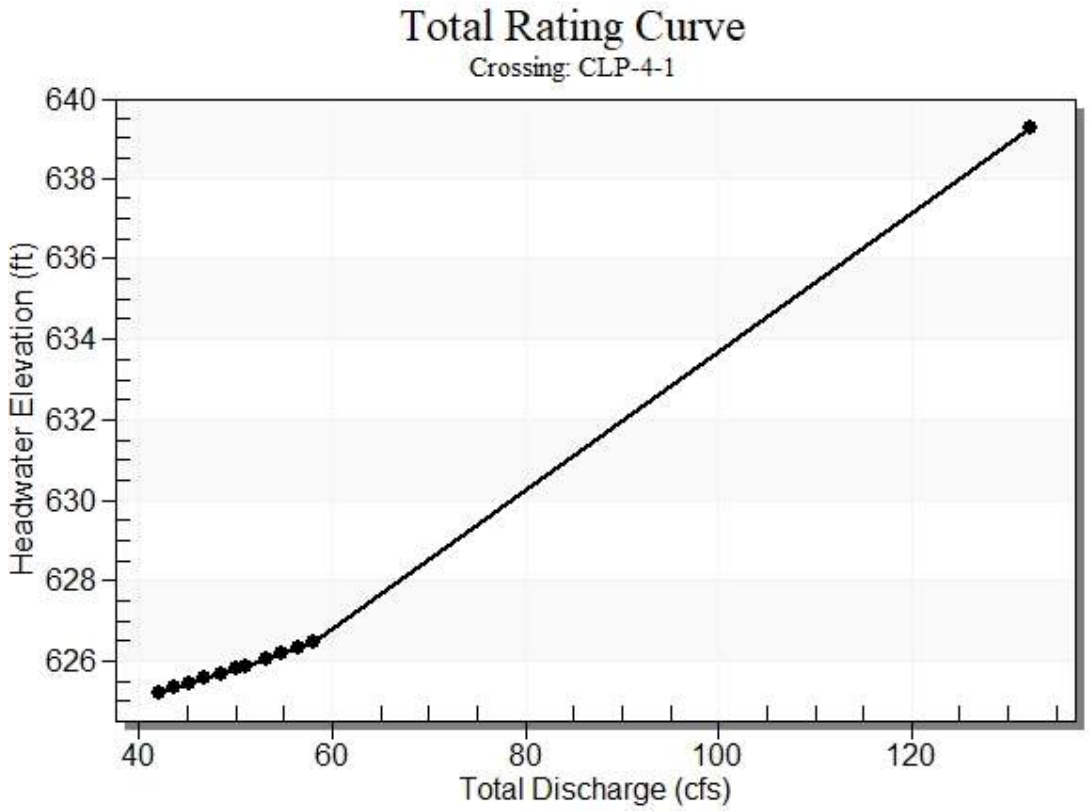


Table 8 - Culvert Summary Table: CLP-4

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
42.00	42.00	625.22	3.395	0.0*	5-S2n	1.229	2.109	1.304	1.309	13.767	8.174
43.60	43.60	625.33	3.502	0.0*	5-S2n	1.255	2.149	1.335	1.327	13.862	8.251
45.20	45.20	625.44	3.612	0.0*	5-S2n	1.280	2.188	1.363	1.345	13.989	8.326
46.80	46.80	625.56	3.726	0.0*	5-S2n	1.306	2.225	1.389	1.363	14.137	8.398
48.40	48.40	625.67	3.843	0.118	5-S2n	1.331	2.262	1.413	1.380	14.294	8.469
50.00	50.00	625.79	3.964	0.262	5-S2n	1.356	2.298	1.445	1.397	14.358	8.539
51.00	51.00	625.87	4.042	0.355	5-S2n	1.371	2.320	1.463	1.408	14.406	8.581
53.20	53.20	626.05	4.218	0.563	5-S2n	1.405	2.367	1.503	1.430	14.532	8.672
54.80	54.80	626.18	4.352	0.718	5-S2n	1.429	2.400	1.530	1.446	14.631	8.736
56.40	56.40	626.32	4.489	0.878	5-S2n	1.454	2.432	1.557	1.462	14.732	8.800
58.00	58.00	626.46	4.632	1.040	5-S2n	1.478	2.463	1.584	1.477	14.833	8.861

* Full Flow Headwater elevation is below inlet invert.

****

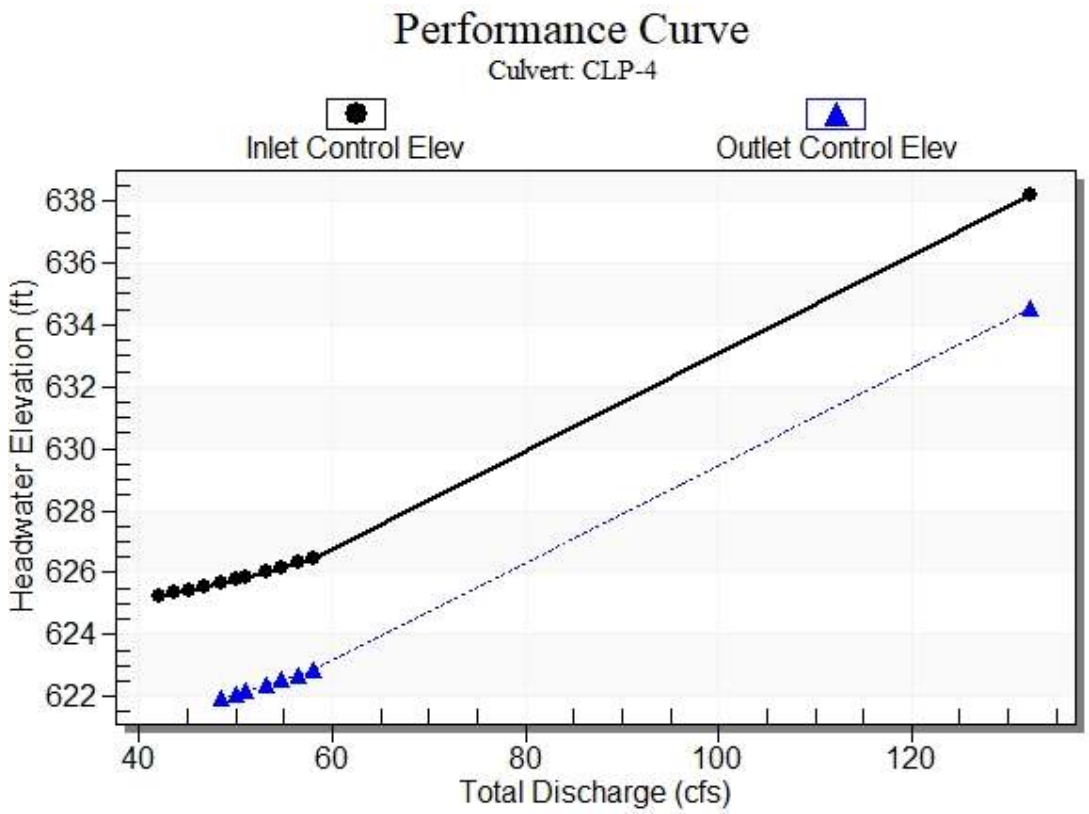
Straight Culvert

Inlet Elevation (invert): 621.83 ft, Outlet Elevation (invert): 617.43 ft

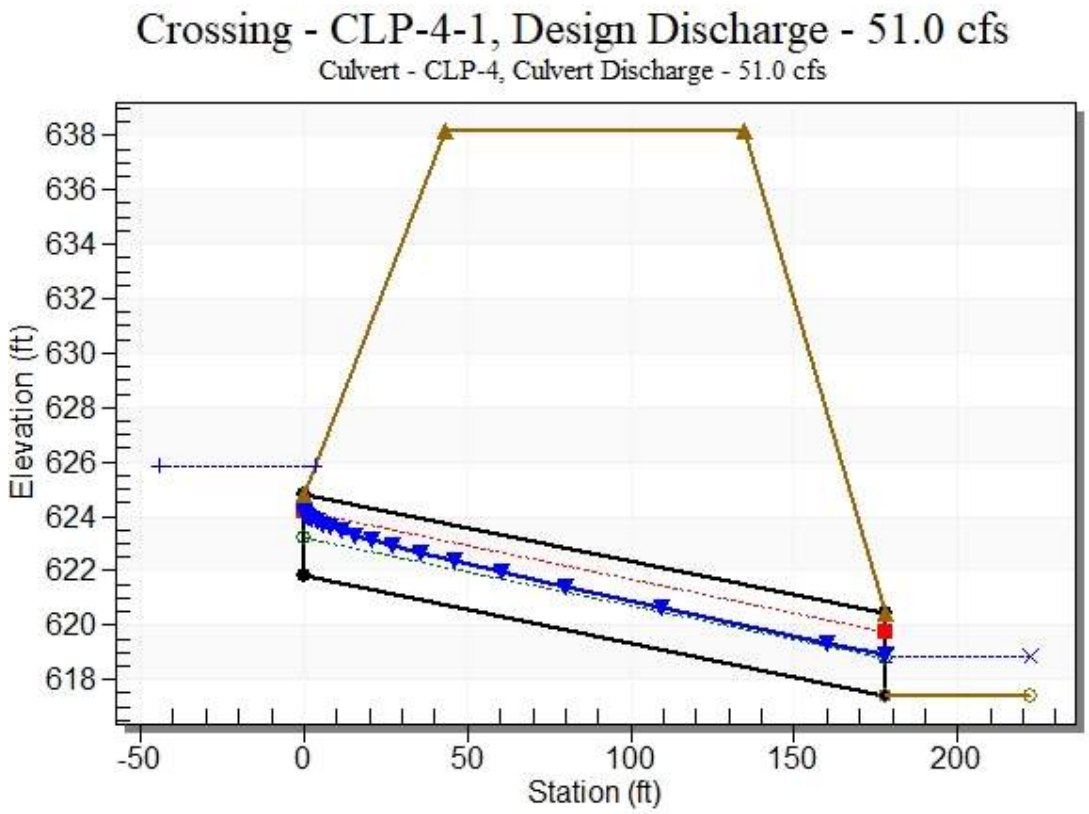
Culvert Length: 178.05 ft, Culvert Slope: 0.0247

****

Culvert Performance Curve Plot: CLP-4



Water Surface Profile Plot for Culvert: CLP-4



Site Data - CLP-4

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 621.83 ft

Outlet Station: 178.00 ft

Outlet Elevation: 617.43 ft

Number of Barrels: 1

Culvert Data Summary - CLP-4

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 9 - Downstream Channel Rating Curve (Crossing: CLP-4-1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
42.00	618.74	1.31	8.17	5.72	1.78
43.60	618.76	1.33	8.25	5.80	1.78
45.20	618.78	1.35	8.33	5.88	1.79
46.80	618.79	1.36	8.40	5.95	1.79
48.40	618.81	1.38	8.47	6.03	1.80
50.00	618.83	1.40	8.54	6.10	1.80
51.00	618.84	1.41	8.58	6.15	1.80
53.20	618.86	1.43	8.67	6.25	1.81
54.80	618.88	1.45	8.74	6.32	1.81
56.40	618.89	1.46	8.80	6.38	1.81
58.00	618.91	1.48	8.86	6.45	1.82

Tailwater Channel Data - CLP-4-1

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0700

Channel Manning's n: 0.0350

Channel Invert Elevation: 617.43 ft

Roadway Data for Crossing: CLP-4-1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 638.20 ft

Roadway Surface: Paved

Roadway Top Width: 92.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 44 cfs

Design Flow: 53 cfs

Maximum Flow: 59 cfs

Table 10 - Summary of Culvert Flows at Crossing: EP-6

Headwater Elevation (ft)	Total Discharge (cfs)	EP-6 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
593.18	44.00	44.00	0.00	1
593.21	45.50	45.50	0.00	1
593.24	47.00	47.00	0.00	1
593.26	48.50	48.50	0.00	1
593.29	50.00	50.00	0.00	1
593.32	51.50	51.50	0.00	1
593.35	53.00	53.00	0.00	1
593.37	54.50	54.50	0.00	1
593.40	56.00	56.00	0.00	1
593.43	57.50	57.50	0.00	1
593.45	59.00	59.00	0.00	1
600.70	321.80	321.80	0.00	Overtopping

Rating Curve Plot for Crossing: EP-6

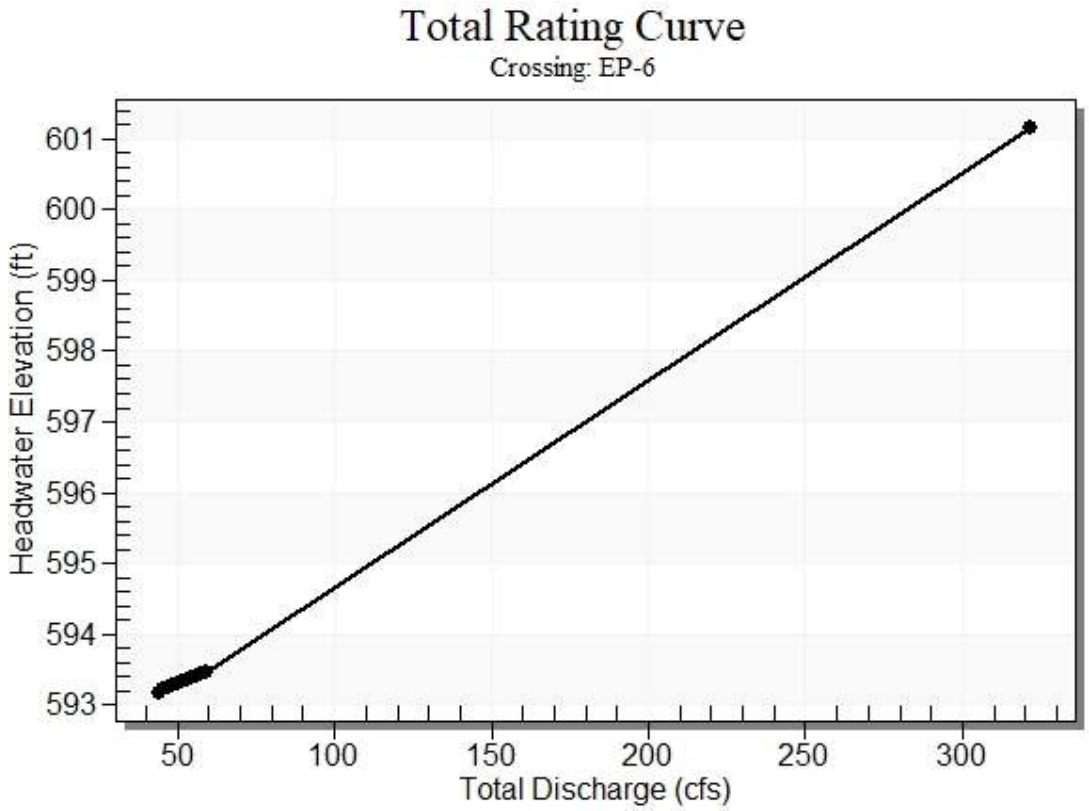


Table 11 - Culvert Summary Table: EP-6

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
44.00	44.00	593.18	1.796	1.962	5-FFf	0.000	1.186	4.000	1.202	1.833	6.309
45.50	45.50	593.21	1.836	1.990	5-FFf	0.000	1.213	4.000	1.224	1.896	6.370
47.00	47.00	593.24	1.876	2.017	5-FFf	0.000	1.240	4.000	1.246	1.958	6.429
48.50	48.50	593.26	1.916	2.045	5-FFf	0.000	1.266	4.000	1.267	2.021	6.487
50.00	50.00	593.29	1.956	2.072	5-FFf	0.000	1.292	4.000	1.288	2.083	6.543
51.50	51.50	593.32	1.994	2.099	5-FFf	0.000	1.318	4.000	1.309	2.146	6.599
53.00	53.00	593.35	2.035	2.126	5-FFf	0.000	1.318	4.000	1.329	2.208	6.652
54.50	54.50	593.37	2.075	2.153	5-FFf	0.000	1.318	4.000	1.349	2.271	6.705
56.00	56.00	593.40	2.115	2.180	5-FFf	0.000	1.318	4.000	1.369	2.333	6.757
57.50	57.50	593.43	2.154	2.207	5-FFf	0.000	1.318	4.000	1.389	2.396	6.807
59.00	59.00	593.45	2.193	2.233	5-FFf	0.000	1.318	4.000	1.408	2.458	6.857

****

Double Broken-back Culvert

Inlet Elevation (invert): 591.22 ft,

Upper Break Elevation (invert): 589.35 ft,

Lower Break Elevation (invert): 589.26 ft,

Culvert Length: 131.92 ft,

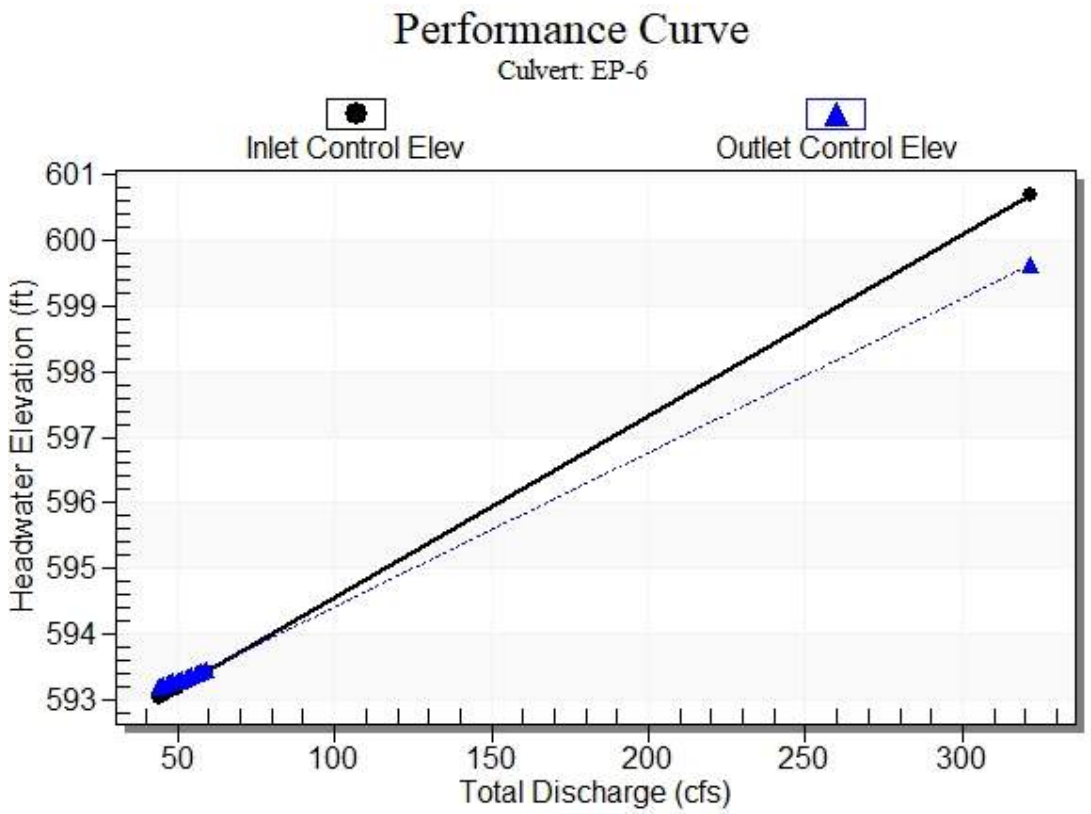
Upper Culvert Section Slope: 0.0377

Steep Culvert Section Slope: 0.0030

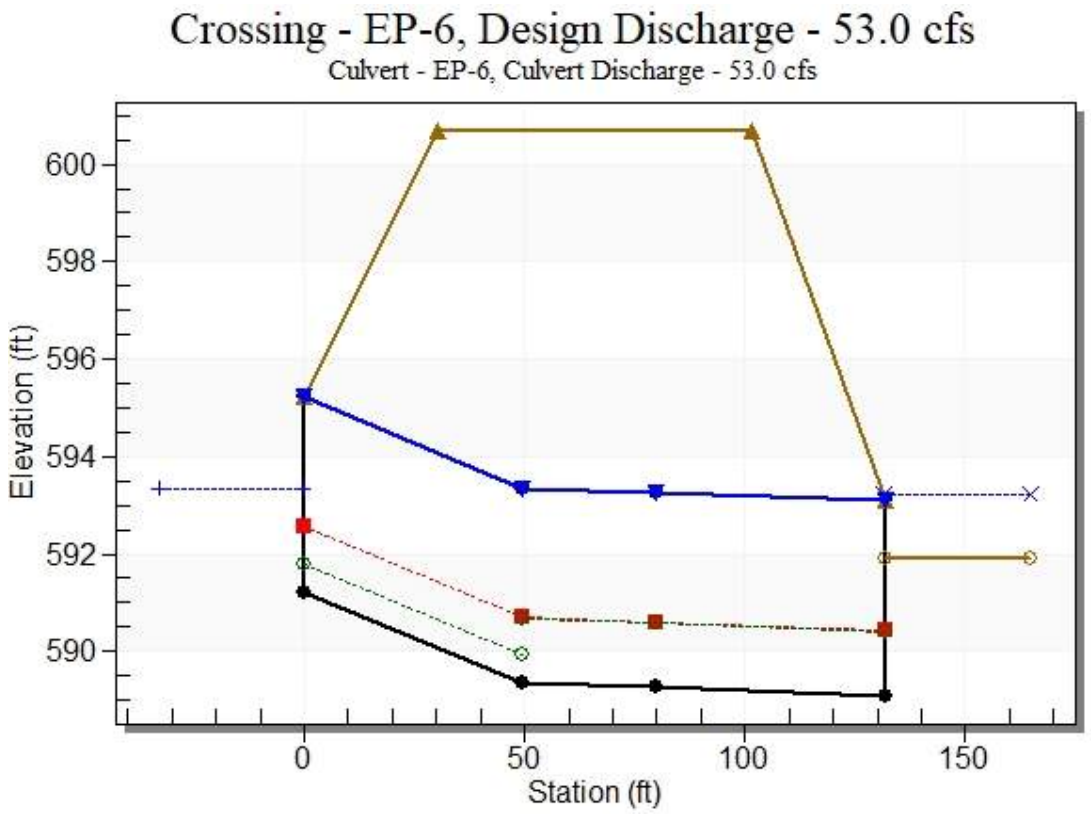
Runout Culvert Section Slope: 0.0031

****

Culvert Performance Curve Plot: EP-6



Water Surface Profile Plot for Culvert: EP-6



Site Data - EP-6

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 591.22 ft

Upper Break Station: 49.60 ft

Upper Break Elevation: 589.35 ft

Lower Break Station: 79.70 ft

Lower Break Elevation: 589.26 ft

Outlet Station: 131.90 ft

Outlet Elevation: 589.10 ft

Number of Barrels: 1

Culvert Data Summary - EP-6

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 4.00 ft

Upper & Middle Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper & Middle Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Double Broken-back

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: None

Table 12 - Downstream Channel Rating Curve (Crossing: EP-6)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
44.00	593.10	1.20	6.31	2.10	1.16
45.50	593.12	1.22	6.37	2.14	1.16
47.00	593.15	1.25	6.43	2.18	1.17
48.50	593.17	1.27	6.49	2.21	1.17
50.00	593.19	1.29	6.54	2.25	1.17
51.50	593.21	1.31	6.60	2.29	1.17
53.00	593.23	1.33	6.65	2.32	1.17
54.50	593.25	1.35	6.71	2.36	1.18
56.00	593.27	1.37	6.76	2.39	1.18
57.50	593.29	1.39	6.81	2.43	1.18
59.00	593.31	1.41	6.86	2.46	1.18

Tailwater Channel Data - EP-6

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 1.50 (_:1)

Channel Slope: 0.0280

Channel Manning's n: 0.0350

Channel Invert Elevation: 591.90 ft

Roadway Data for Crossing: EP-6

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 600.70 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 8 cfs

Design Flow: 9 cfs

Maximum Flow: 11 cfs

Table 13 - Summary of Culvert Flows at Crossing: EP-5

Headwater Elevation (ft)	Total Discharge (cfs)	EP-5 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
655.38	8.00	8.00	0.00	1
655.42	8.30	8.30	0.00	1
655.47	8.60	8.60	0.00	1
655.52	8.90	8.90	0.00	1
655.54	9.00	9.00	0.00	1
655.62	9.50	9.50	0.00	1
655.67	9.80	9.80	0.00	1
655.72	10.10	10.10	0.00	1
655.78	10.40	10.40	0.00	1
655.83	10.70	10.70	0.00	1
655.89	11.00	11.00	0.00	1
664.00	32.07	32.07	0.00	Overtopping

Rating Curve Plot for Crossing: EP-5

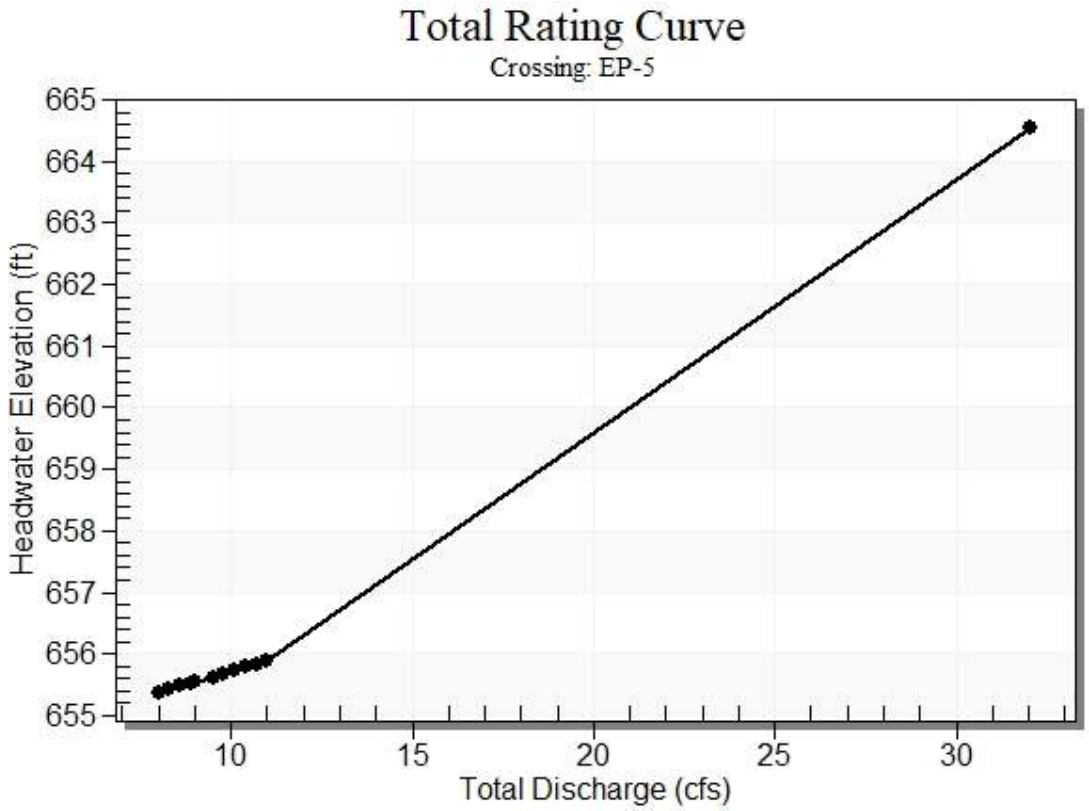


Table 14 - Culvert Summary Table: EP-5

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
8.00	8.00	655.38	1.608	0.0*	5-S2n	0.479	1.092	0.479	0.739	15.903	7.319
8.30	8.30	655.42	1.654	0.0*	5-S2n	0.488	1.112	0.488	0.750	16.075	7.387
8.60	8.60	655.47	1.701	0.0*	5-S2n	0.498	1.131	0.498	0.760	16.238	7.453
8.90	8.90	655.52	1.749	0.0*	5-S2n	0.507	1.150	0.544	0.769	14.874	7.517
9.00	9.00	655.54	1.765	0.0*	5-S2n	0.510	1.156	0.538	0.773	15.275	7.538
9.50	9.50	655.62	1.849	0.0*	5-S2n	0.524	1.189	0.524	0.788	16.679	7.641
9.80	9.80	655.67	1.900	0.0*	5-S2n	0.533	1.206	0.533	0.798	16.826	7.700
10.10	10.10	655.72	1.953	0.0*	5-S2n	0.542	1.223	0.542	0.807	16.973	7.758
10.40	10.40	655.78	2.007	0.0*	5-S2n	0.551	1.239	0.551	0.816	17.085	7.815
10.70	10.70	655.83	2.063	0.0*	5-S2n	0.559	1.255	0.597	0.824	15.778	7.871
11.00	11.00	655.89	2.120	0.0*	5-S2n	0.567	1.269	0.590	0.833	16.452	7.926

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 653.77 ft, Outlet Elevation (invert): 637.79 ft

Culvert Length: 175.73 ft, Culvert Slope: 0.0913

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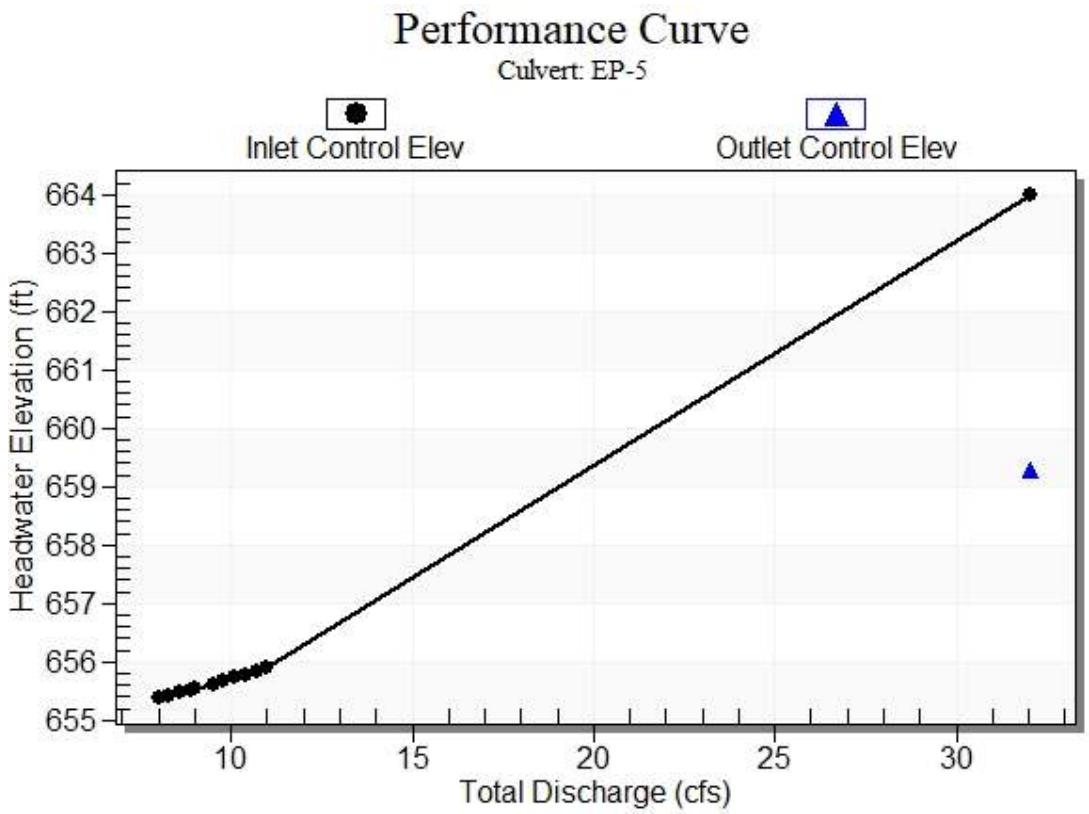
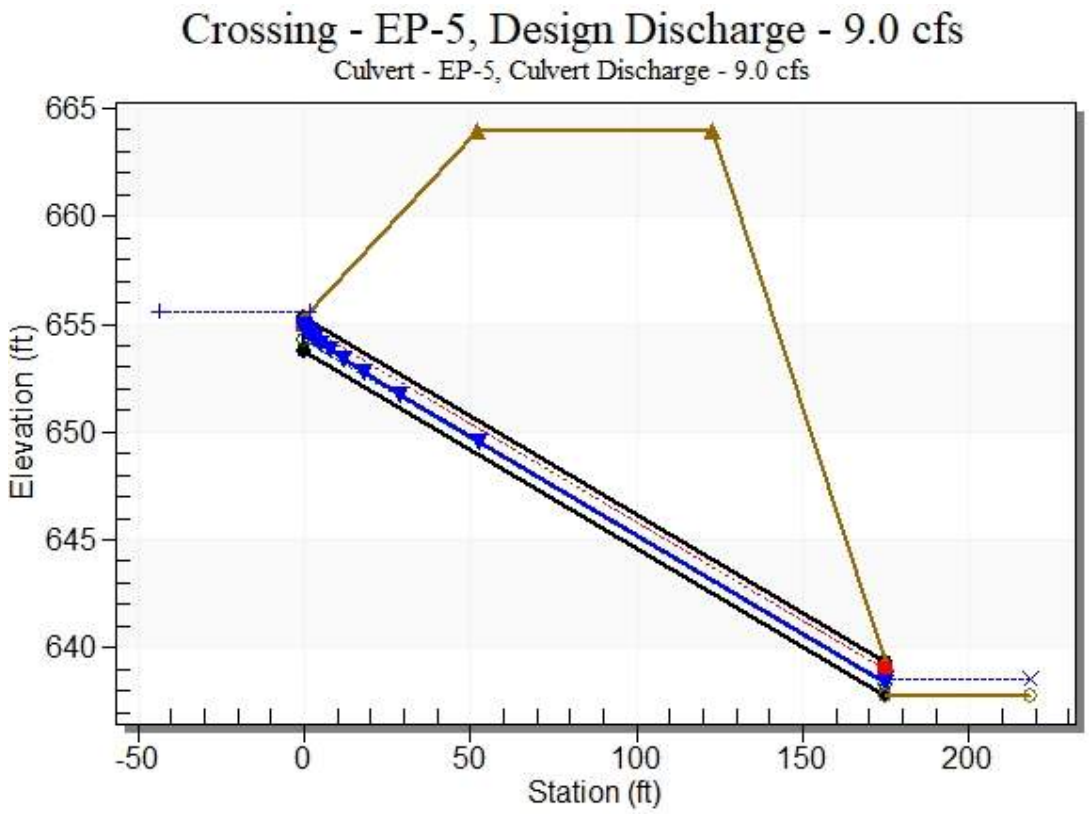
Culvert Performance Curve Plot: EP-5



Water Surface Profile Plot for Culvert: EP-5



Site Data - EP-5

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 653.77 ft

Outlet Station: 175.00 ft

Outlet Elevation: 637.79 ft

Number of Barrels: 1

Culvert Data Summary - EP-5

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 15 - Downstream Channel Rating Curve (Crossing: EP-5)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.00	638.53	0.74	7.32	6.00	2.12
8.30	638.54	0.75	7.39	6.08	2.13
8.60	638.55	0.76	7.45	6.16	2.13
8.90	638.56	0.77	7.52	6.24	2.14
9.00	638.56	0.77	7.54	6.27	2.14
9.50	638.58	0.79	7.64	6.40	2.14
9.80	638.59	0.80	7.70	6.47	2.15
10.10	638.60	0.81	7.76	6.54	2.15
10.40	638.61	0.82	7.82	6.62	2.16
10.70	638.61	0.82	7.87	6.69	2.16
11.00	638.62	0.83	7.93	6.76	2.16

Tailwater Channel Data - EP-5

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.1300

Channel Manning's n: 0.0350

Channel Invert Elevation: 637.79 ft

Roadway Data for Crossing: EP-5

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 664.00 ft

Roadway Surface: Paved

Roadway Top Width: 71.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 16 - Summary of Culvert Flows at Crossing: CLP8

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CLP-8 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
584.39	10-Year	1.30	1.30	0.00	1
584.46	25-Year	1.60	1.60	0.00	1
584.52	50-Year	1.90	1.90	0.00	1
584.57	100-Year	2.20	2.20	0.00	1
587.42	Overtopping	17.08	17.08	0.00	Overtopping

Rating Curve Plot for Crossing: CLP8

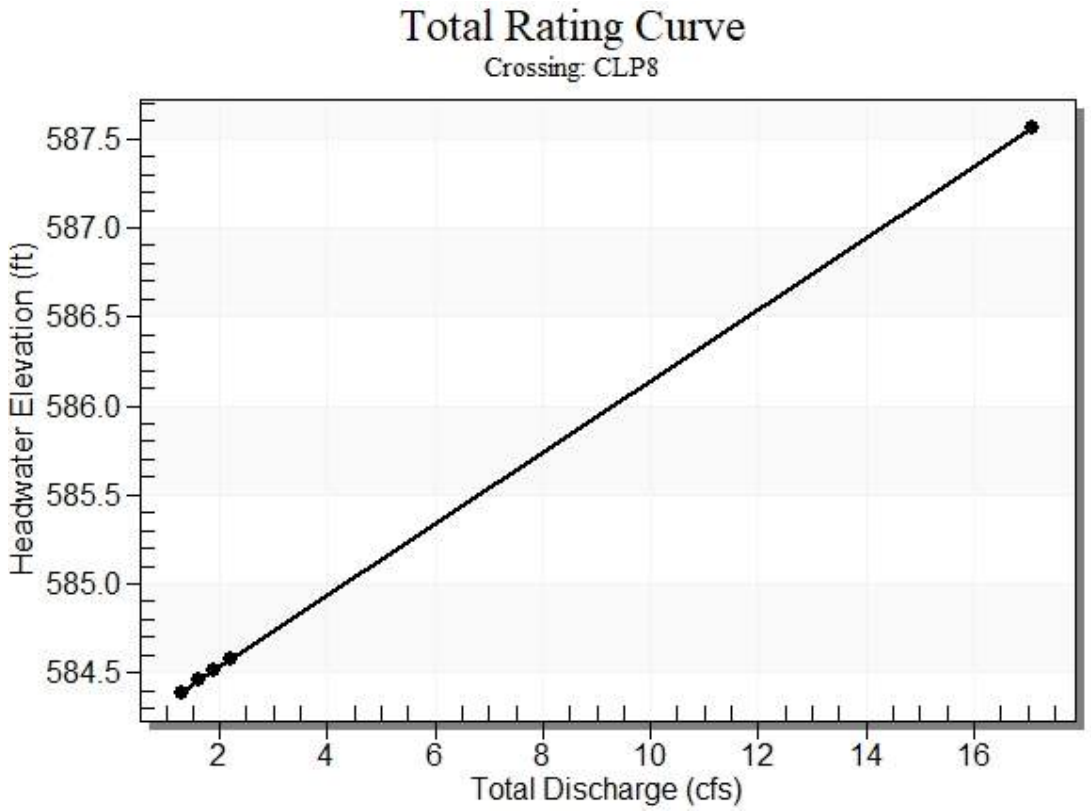


Table 17 - Culvert Summary Table: CLP-8

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10-Year	1.30	1.30	584.39	0.562	0.0*	1-S2n	0.257	0.424	0.269	0.000	5.905	0.000
25-Year	1.60	1.60	584.46	0.627	0.0*	1-S2n	0.285	0.470	0.298	0.000	6.235	0.000
50-Year	1.90	1.90	584.52	0.686	0.0*	1-S2n	0.311	0.516	0.324	0.000	6.540	0.000
100-Year	2.20	2.20	584.57	0.742	0.0*	1-S2n	0.334	0.555	0.349	0.000	6.847	0.000

* Full Flow Headwater elevation is below inlet invert.

****

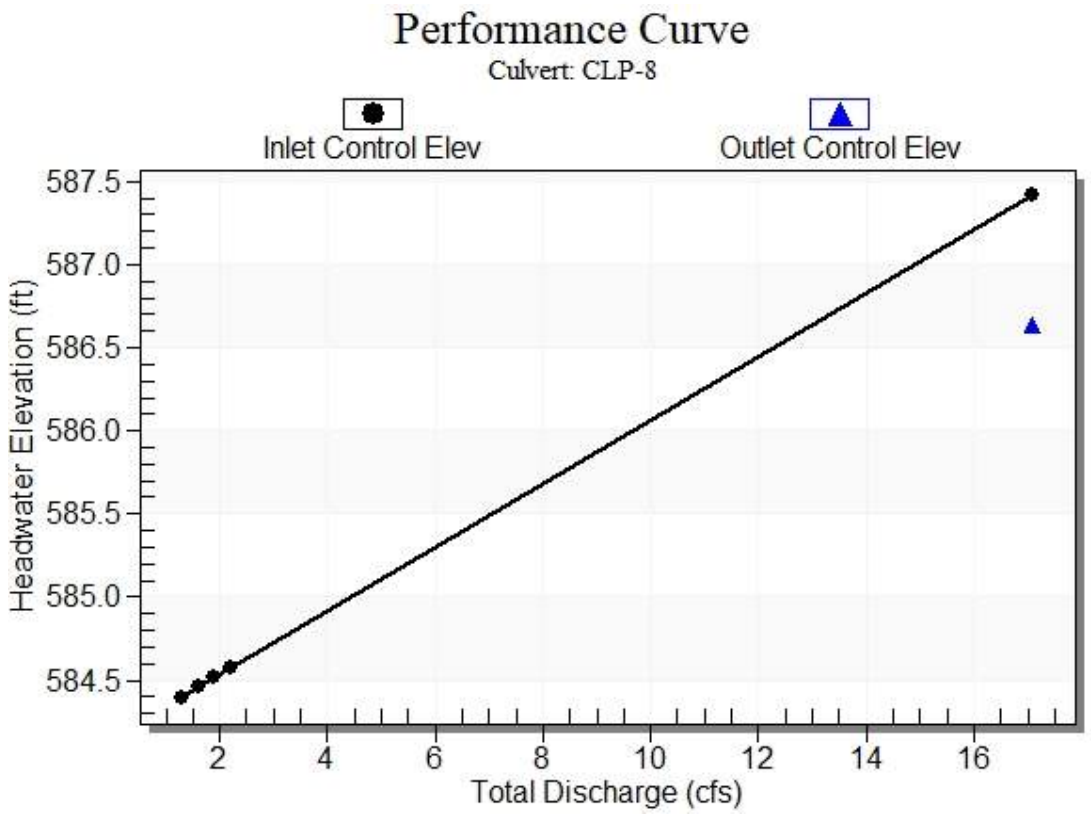
Straight Culvert

Inlet Elevation (invert): 583.83 ft, Outlet Elevation (invert): 582.00 ft

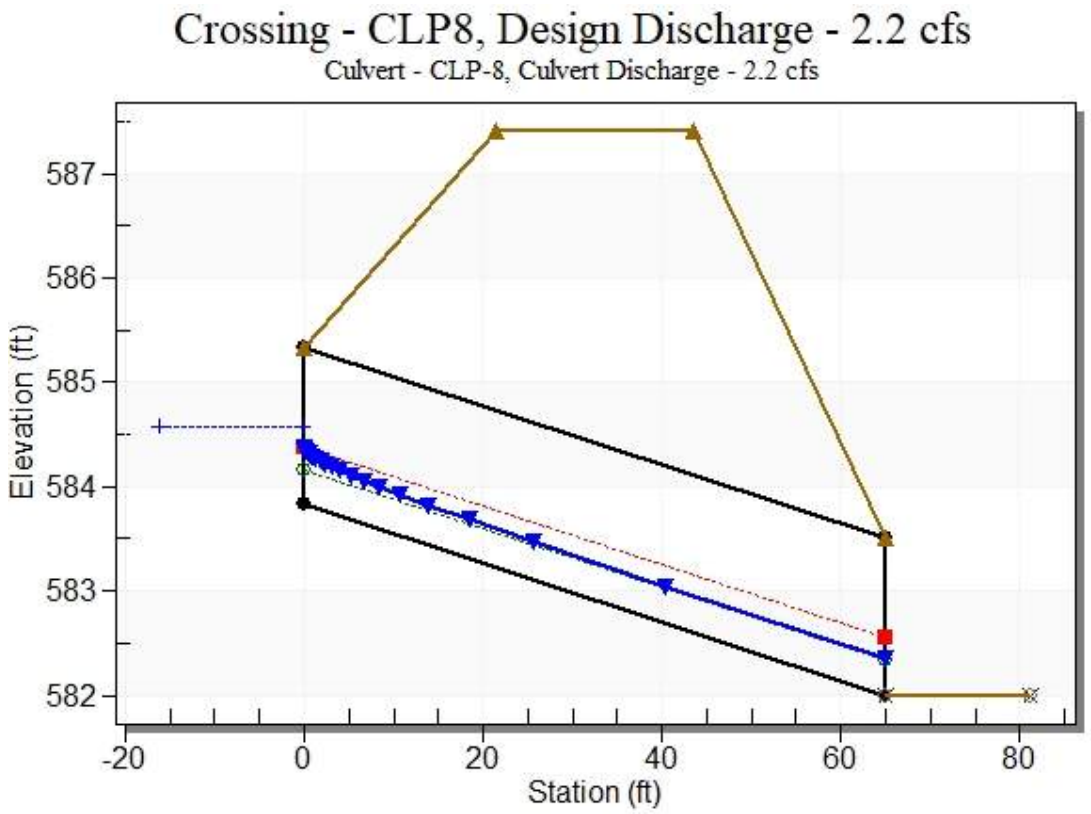
Culvert Length: 65.03 ft, Culvert Slope: 0.0282

****

Culvert Performance Curve Plot: CLP-8



Water Surface Profile Plot for Culvert: CLP-8



Site Data - CLP-8

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 583.83 ft

Outlet Station: 65.00 ft

Outlet Elevation: 582.00 ft

Number of Barrels: 1

Culvert Data Summary - CLP-8

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 18 - Downstream Channel Rating Curve (Crossing: CLP8)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.30	582.00	0.00
1.60	582.00	0.00
1.90	582.00	0.00
2.20	582.00	0.00

Tailwater Channel Data - CLP8

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 582.00 ft

Roadway Data for Crossing: CLP8

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 587.42 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 6.3 cfs

Maximum Flow: 8.6 cfs

Table 19 - Summary of Culvert Flows at Crossing: EP9

Headwater Elevation (ft)	Total Discharge (cfs)	EP-9 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
661.79	5.00	5.00	0.00	1
661.85	5.36	5.36	0.00	1
661.90	5.72	5.72	0.00	1
661.95	6.08	6.08	0.00	1
661.98	6.30	6.30	0.00	1
662.05	6.80	6.80	0.00	1
662.11	7.16	7.16	0.00	1
662.16	7.52	7.52	0.00	1
662.22	7.88	7.88	0.00	1
662.28	8.24	8.24	0.00	1
662.34	8.60	8.60	0.00	1
667.46	23.66	23.66	0.00	Overtopping

Rating Curve Plot for Crossing: EP9

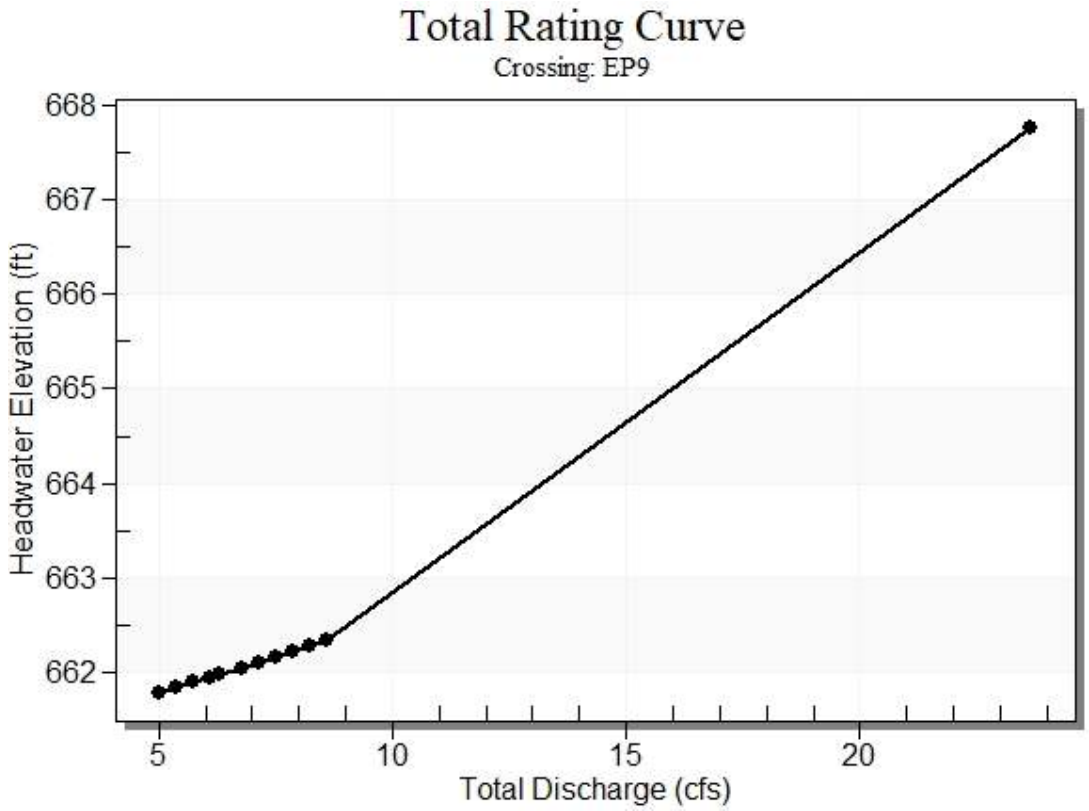


Table 20 - Culvert Summary Table: EP-9

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	661.79	1.214	0.0*	1-S2n	0.458	0.856	0.480	0.489	9.897	3.488
5.36	5.36	661.85	1.266	0.0*	1-S2n	0.475	0.889	0.499	0.502	10.087	3.550
5.72	5.72	661.90	1.317	0.0*	1-S2n	0.492	0.919	0.492	0.514	10.968	3.608
6.08	6.08	661.95	1.368	0.0*	1-S2n	0.508	0.948	0.508	0.526	11.169	3.663
6.30	6.30	661.98	1.399	0.0*	1-S2n	0.518	0.965	0.558	0.533	10.159	3.696
6.80	6.80	662.05	1.472	0.0*	1-S2n	0.539	1.007	0.565	0.548	10.788	3.767
7.16	7.16	662.11	1.526	0.0*	5-S2n	0.554	1.033	0.554	0.559	11.654	3.816
7.52	7.52	662.16	1.580	0.0*	5-S2n	0.569	1.059	0.569	0.570	11.815	3.863
7.88	7.88	662.22	1.637	0.0*	5-S2n	0.584	1.084	0.628	0.580	10.850	3.909
8.24	8.24	662.28	1.696	0.0*	5-S2n	0.599	1.108	0.642	0.589	11.038	3.953
8.60	8.60	662.34	1.756	0.0*	5-S2n	0.613	1.131	0.653	0.599	11.258	3.995

* Full Flow Headwater elevation is below inlet invert.

****

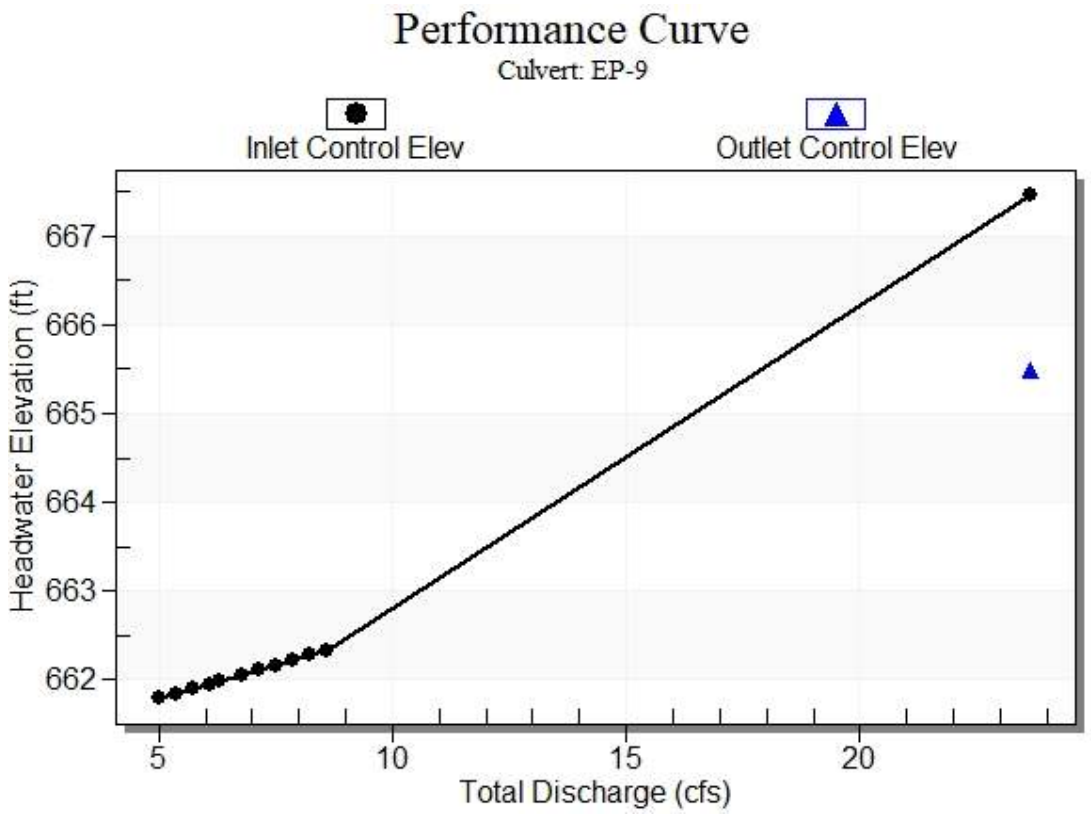
Straight Culvert

Inlet Elevation (invert): 660.58 ft, Outlet Elevation (invert): 657.08 ft

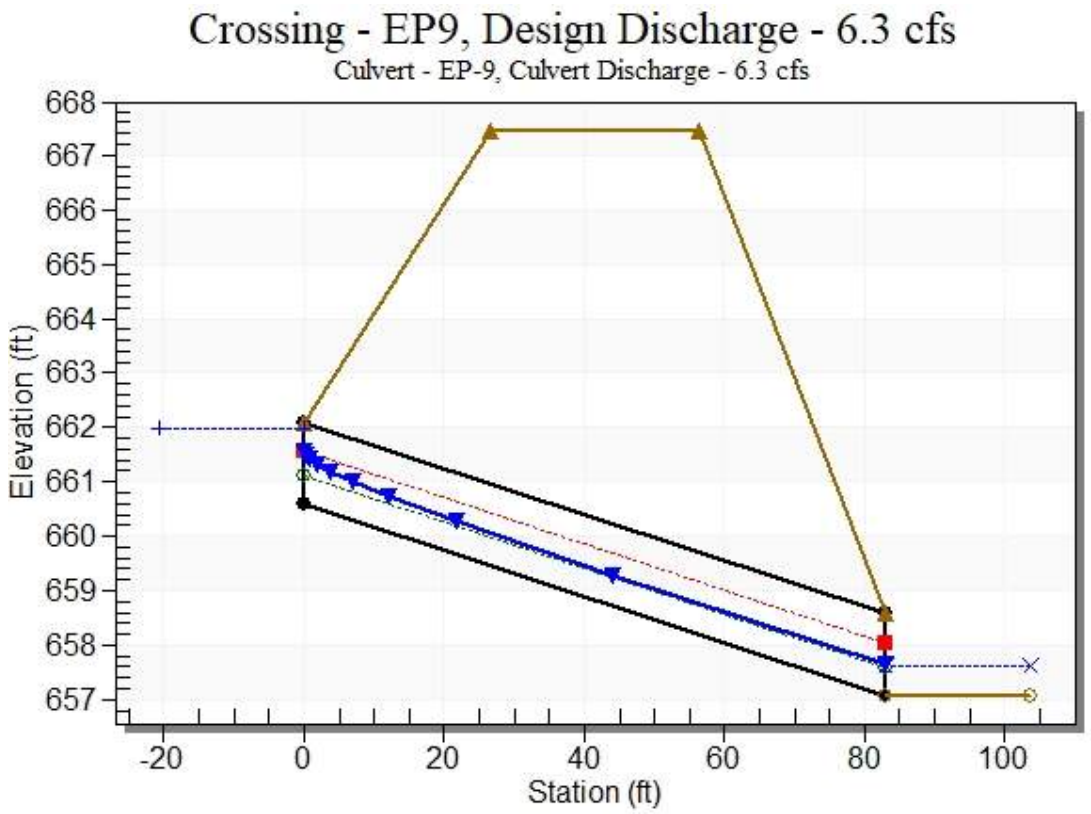
Culvert Length: 83.07 ft, Culvert Slope: 0.0422

****

Culvert Performance Curve Plot: EP-9



Water Surface Profile Plot for Culvert: EP-9



Site Data - EP-9

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 660.58 ft

Outlet Station: 83.00 ft

Outlet Elevation: 657.08 ft

Number of Barrels: 1

Culvert Data Summary - EP-9

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 21 - Downstream Channel Rating Curve (Crossing: EP9)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	657.57	0.49	3.49	1.37	1.24
5.36	657.58	0.50	3.55	1.41	1.25
5.72	657.59	0.51	3.61	1.44	1.25
6.08	657.61	0.53	3.66	1.48	1.26
6.30	657.61	0.53	3.70	1.50	1.26
6.80	657.63	0.55	3.77	1.54	1.27
7.16	657.64	0.56	3.82	1.57	1.27
7.52	657.65	0.57	3.86	1.60	1.28
7.88	657.66	0.58	3.91	1.63	1.28
8.24	657.67	0.59	3.95	1.66	1.28
8.60	657.68	0.60	3.99	1.68	1.29

Tailwater Channel Data - EP9

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0450

Channel Manning's n: 0.0350

Channel Invert Elevation: 657.08 ft

Roadway Data for Crossing: EP9

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 667.46 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9 cfs

Design Flow: 11.3 cfs

Maximum Flow: 15.3 cfs

Table 22 - Summary of Culvert Flows at Crossing: CLP11

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-11 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
620.16	9.00	9.00	0.00	1
620.22	9.63	9.63	0.00	1
620.28	10.26	10.26	0.00	1
620.34	10.89	10.89	0.00	1
620.38	11.30	11.30	0.00	1
620.46	12.15	12.15	0.00	1
620.52	12.78	12.78	0.00	1
620.57	13.41	13.41	0.00	1
620.63	14.04	14.04	0.00	1
620.69	14.67	14.67	0.00	1
620.75	15.30	15.30	0.00	1
636.68	76.18	76.18	0.00	Overtopping

Rating Curve Plot for Crossing: CLP11

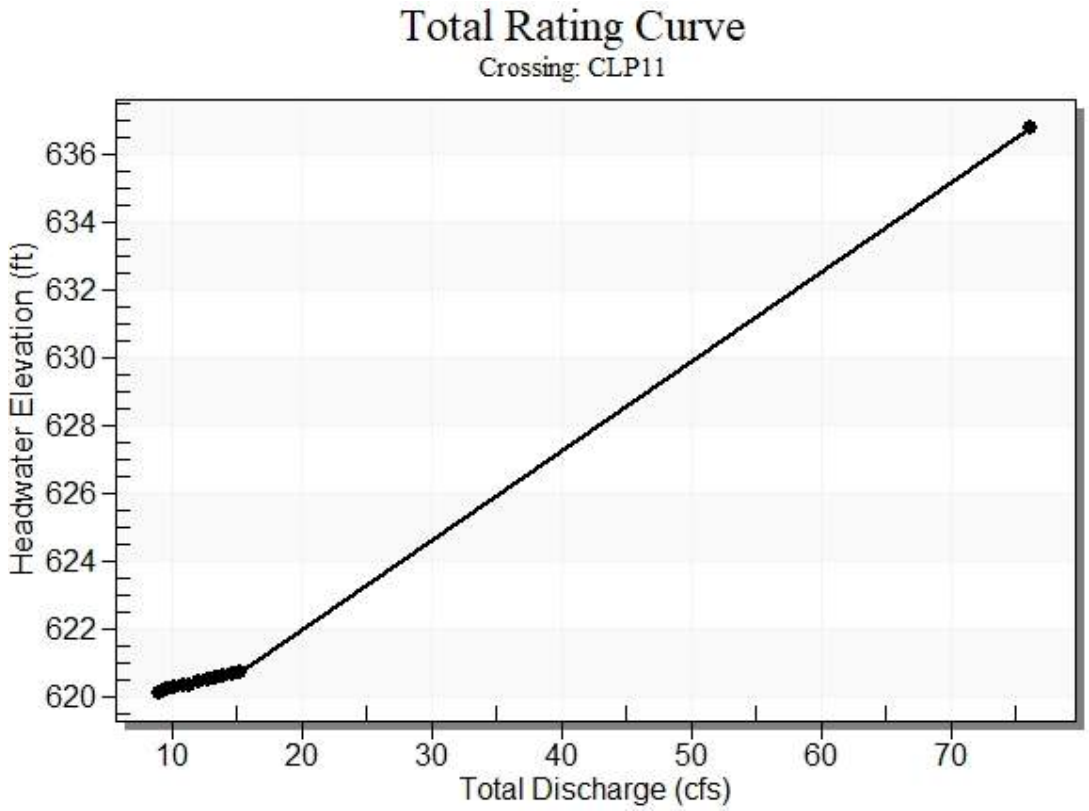


Table 23 - Culvert Summary Table: CLP-11

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
9.00	9.00	620.16	1.462	0.0*	1-S2n	0.477	1.069	0.517	0.403	13.466	4.607
9.63	9.63	620.22	1.524	0.0*	1-S2n	0.493	1.105	0.493	0.414	15.459	4.686
10.26	10.26	620.28	1.583	0.0*	1-S2n	0.510	1.144	0.510	0.424	15.757	4.761
10.89	10.89	620.34	1.642	0.0*	1-S2n	0.525	1.180	0.541	0.433	15.314	4.832
11.30	11.30	620.38	1.680	0.0*	1-S2n	0.535	1.202	0.535	0.439	16.159	4.877
12.15	12.15	620.46	1.758	0.0*	1-S2n	0.555	1.247	0.555	0.452	16.516	4.966
12.78	12.78	620.52	1.815	0.0*	1-S2n	0.570	1.283	0.570	0.460	16.703	5.030
13.41	13.41	620.57	1.873	0.0*	1-S2n	0.584	1.315	0.584	0.469	16.953	5.090
14.04	14.04	620.63	1.931	0.0*	1-S2n	0.598	1.346	0.639	0.477	15.692	5.149
14.67	14.67	620.69	1.989	0.0*	1-S2n	0.612	1.376	0.629	0.485	16.740	5.206
15.30	15.30	620.75	2.049	0.0*	5-S2n	0.626	1.406	0.626	0.492	17.578	5.261

* Full Flow Headwater elevation is below inlet invert.

****

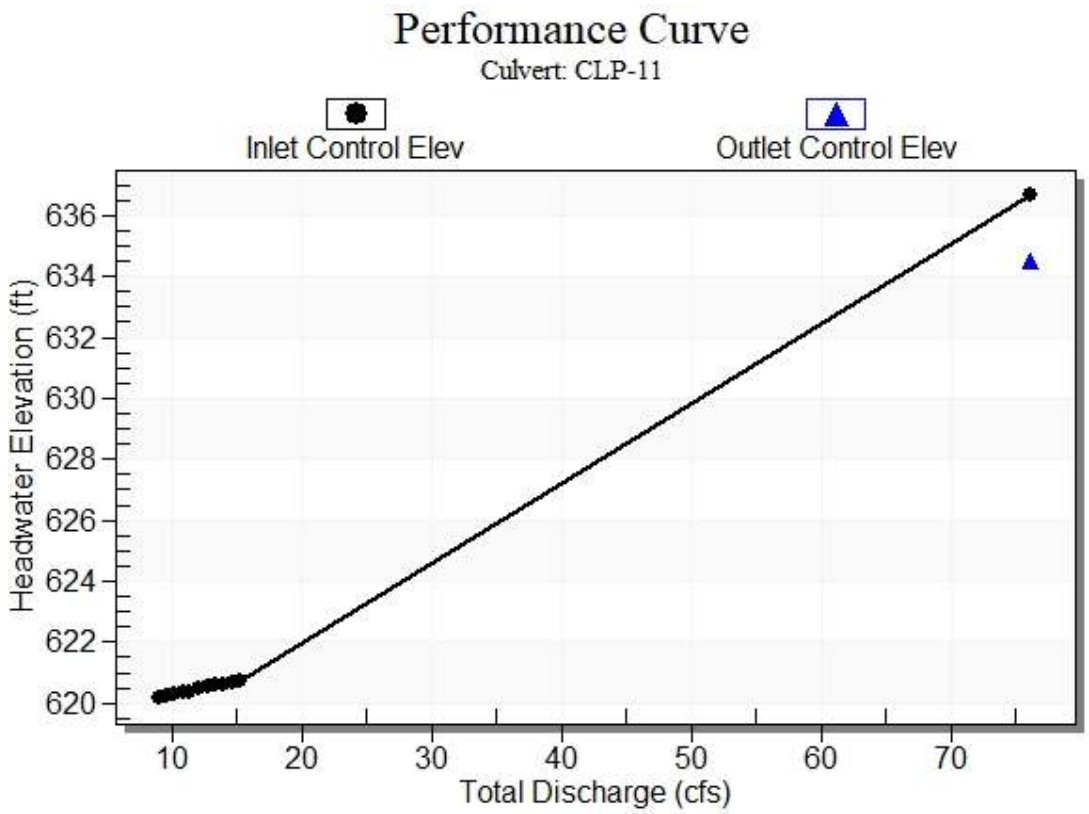
Straight Culvert

Inlet Elevation (invert): 618.70 ft, Outlet Elevation (invert): 606.64 ft

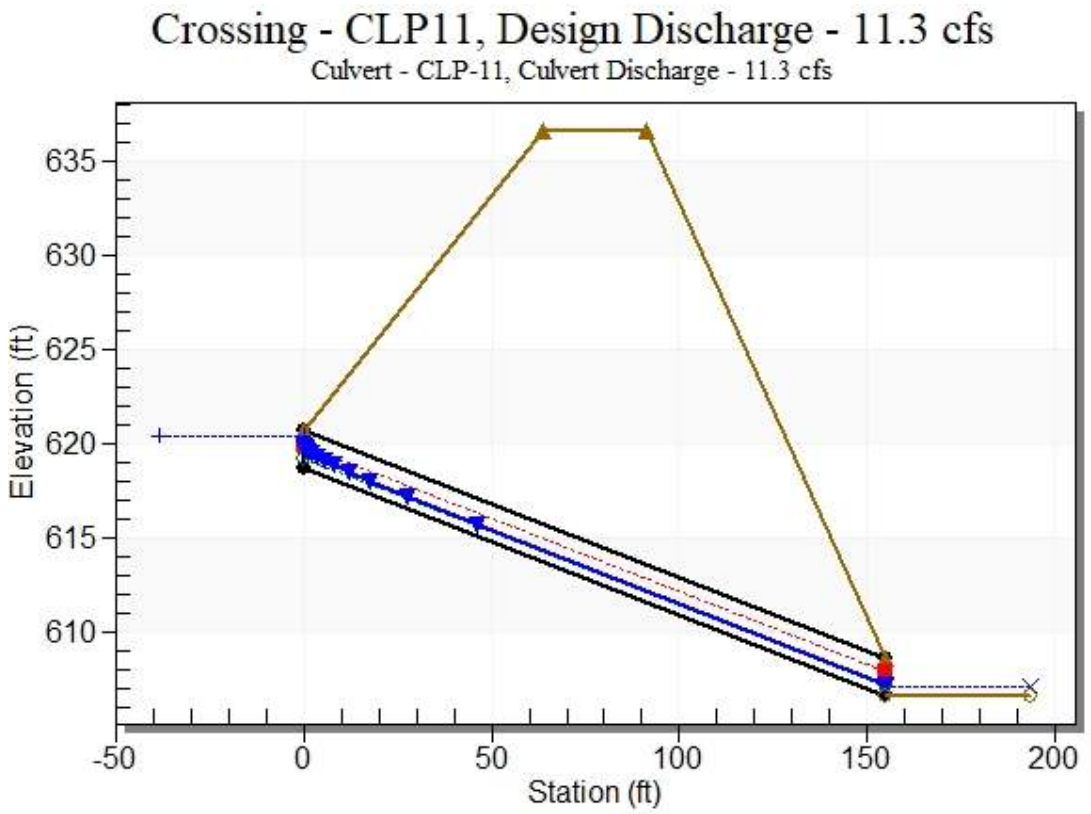
Culvert Length: 155.47 ft, Culvert Slope: 0.0778

****

Culvert Performance Curve Plot: CLP-11



Water Surface Profile Plot for Culvert: CLP-11



Site Data - CLP-11

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 618.70 ft

Outlet Station: 155.00 ft

Outlet Elevation: 606.64 ft

Number of Barrels: 1

Culvert Data Summary - CLP-11

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 24 - Downstream Channel Rating Curve (Crossing: CLP11)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
9.00	607.04	0.40	4.61	2.52	1.81
9.63	607.05	0.41	4.69	2.58	1.82
10.26	607.06	0.42	4.76	2.64	1.82
10.89	607.07	0.43	4.83	2.70	1.83
11.30	607.08	0.44	4.88	2.74	1.83
12.15	607.09	0.45	4.97	2.82	1.84
12.78	607.10	0.46	5.03	2.87	1.85
13.41	607.11	0.47	5.09	2.92	1.85
14.04	607.12	0.48	5.15	2.97	1.86
14.67	607.12	0.48	5.21	3.02	1.86
15.30	607.13	0.49	5.26	3.07	1.87

Tailwater Channel Data - CLP11

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 12.00 (_:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0350

Channel Invert Elevation: 606.64 ft

Roadway Data for Crossing: CLP11

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 636.68 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2.8 cfs

Design Flow: 3.6 cfs

Maximum Flow: 4.9 cfs

Table 25 - Summary of Culvert Flows at Crossing: CLP12

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
641.73	2.80	2.80	0.00	1
641.77	3.01	3.01	0.00	1
641.81	3.22	3.22	0.00	1
641.85	3.43	3.43	0.00	1
641.88	3.60	3.60	0.00	1
641.92	3.85	3.85	0.00	1
641.95	4.06	4.06	0.00	1
641.98	4.27	4.27	0.00	1
642.01	4.48	4.48	0.00	1
642.05	4.69	4.69	0.00	1
642.08	4.90	4.90	0.00	1
645.01	18.91	18.91	0.00	Overtopping

Rating Curve Plot for Crossing: CLP12

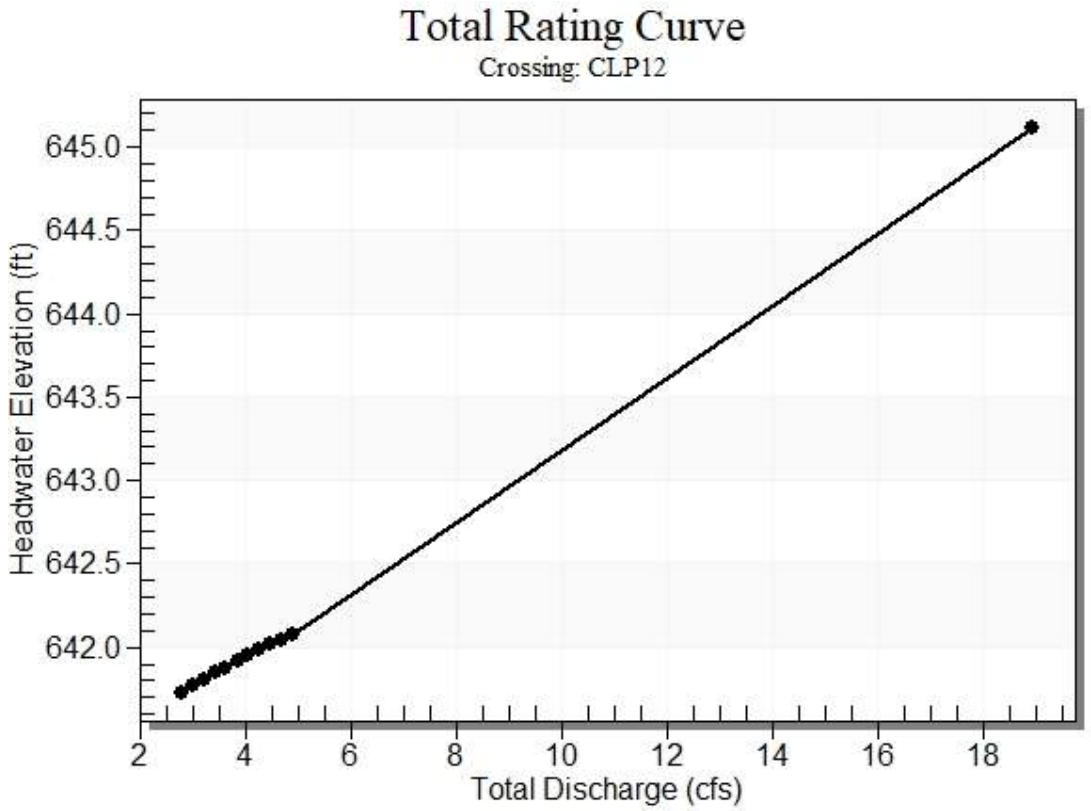


Table 26 - Culvert Summary Table: CLP-12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.80	2.80	641.73	0.871	0.0*	1-S2n	0.415	0.634	0.415	0.436	6.794	4.921
3.01	3.01	641.77	0.911	0.0*	1-S2n	0.431	0.659	0.431	0.447	6.949	5.011
3.22	3.22	641.81	0.949	0.0*	1-S2n	0.446	0.683	0.446	0.459	7.060	5.096
3.43	3.43	641.85	0.986	0.0*	1-S2n	0.461	0.706	0.481	0.470	6.785	5.177
3.60	3.60	641.88	1.015	0.0*	1-S2n	0.473	0.725	0.493	0.479	6.890	5.240
3.85	3.85	641.92	1.057	0.0*	1-S2n	0.490	0.750	0.511	0.491	7.018	5.329
4.06	4.06	641.95	1.090	0.0*	1-S2n	0.504	0.771	0.525	0.501	7.126	5.400
4.27	4.27	641.98	1.123	0.0*	1-S2n	0.517	0.791	0.540	0.510	7.215	5.468
4.48	4.48	642.01	1.155	0.0*	1-S2n	0.531	0.810	0.555	0.519	7.287	5.534
4.69	4.69	642.05	1.186	0.0*	1-S2n	0.544	0.829	0.569	0.528	7.370	5.598
4.90	4.90	642.08	1.217	0.0*	1-S2n	0.557	0.847	0.584	0.537	7.451	5.660

* Full Flow Headwater elevation is below inlet invert.

****

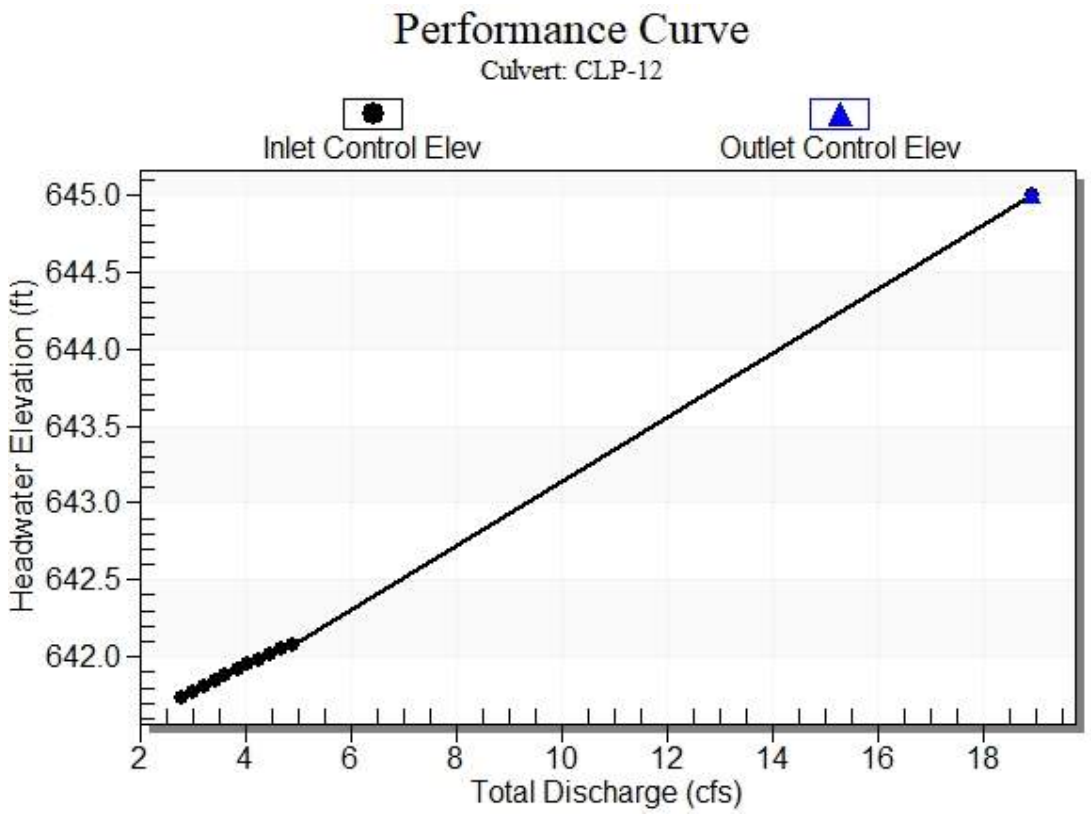
Straight Culvert

Inlet Elevation (invert): 640.86 ft, Outlet Elevation (invert): 639.60 ft

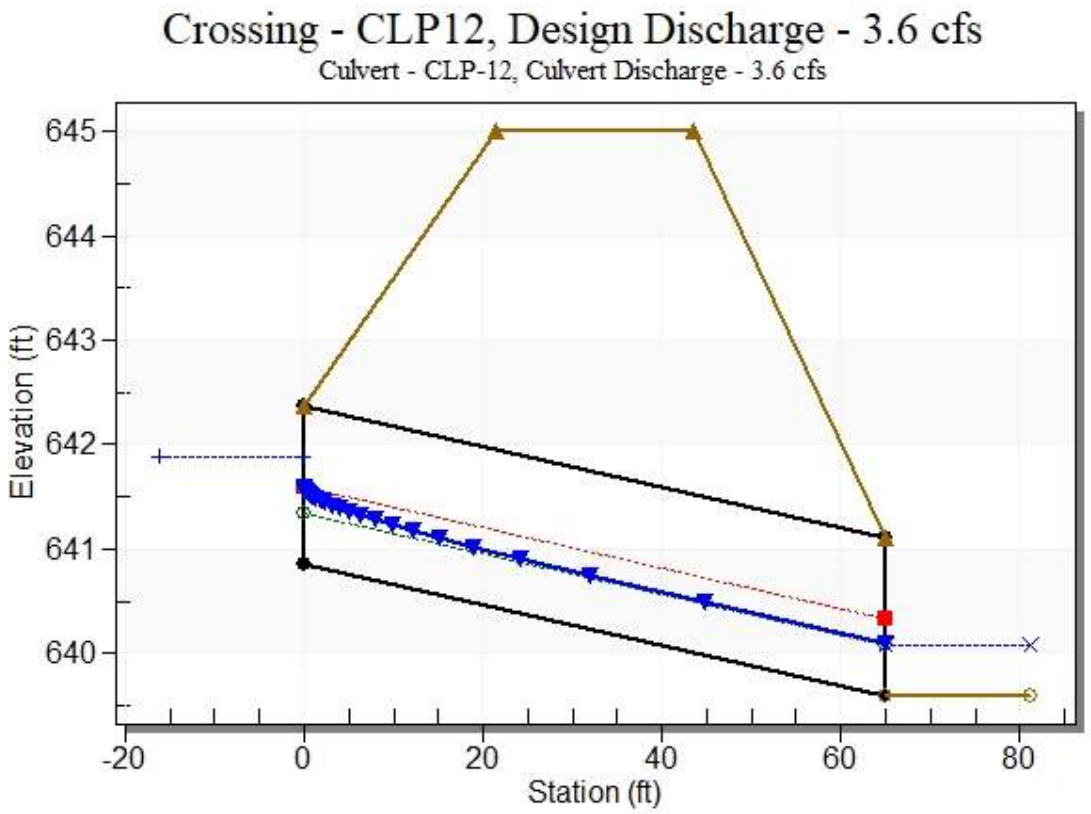
Culvert Length: 65.01 ft, Culvert Slope: 0.0194

****

Culvert Performance Curve Plot: CLP-12



Water Surface Profile Plot for Culvert: CLP-12



Site Data - CLP-12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 640.86 ft

Outlet Station: 65.00 ft

Outlet Elevation: 639.60 ft

Number of Barrels: 1

Culvert Data Summary - CLP-12

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 27 - Downstream Channel Rating Curve (Crossing: CLP12)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.80	640.04	0.44	4.92	2.99	1.86
3.01	640.05	0.45	5.01	3.07	1.87
3.22	640.06	0.46	5.10	3.15	1.87
3.43	640.07	0.47	5.18	3.23	1.88
3.60	640.08	0.48	5.24	3.28	1.89
3.85	640.09	0.49	5.33	3.37	1.90
4.06	640.10	0.50	5.40	3.44	1.90
4.27	640.11	0.51	5.47	3.50	1.91
4.48	640.12	0.52	5.53	3.57	1.91
4.69	640.13	0.53	5.60	3.63	1.92
4.90	640.14	0.54	5.66	3.69	1.92

Tailwater Channel Data - CLP12

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.1100

Channel Manning's n: 0.0350

Channel Invert Elevation: 639.60 ft

Roadway Data for Crossing: CLP12

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 645.01 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1.6 cfs

Design Flow: 2.1 cfs

Maximum Flow: 2.8 cfs

Table 28 - Summary of Culvert Flows at Crossing: CLP13

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-13 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
614.52	1.60	1.60	0.00	1
614.54	1.72	1.72	0.00	1
614.57	1.84	1.84	0.00	1
614.59	1.96	1.96	0.00	1
614.61	2.08	2.08	0.00	1
614.62	2.10	2.10	0.00	1
614.66	2.32	2.32	0.00	1
614.68	2.44	2.44	0.00	1
614.71	2.56	2.56	0.00	1
614.73	2.68	2.68	0.00	1
614.76	2.80	2.80	0.00	1
618.64	20.48	20.48	0.00	Overtopping

Rating Curve Plot for Crossing: CLP13

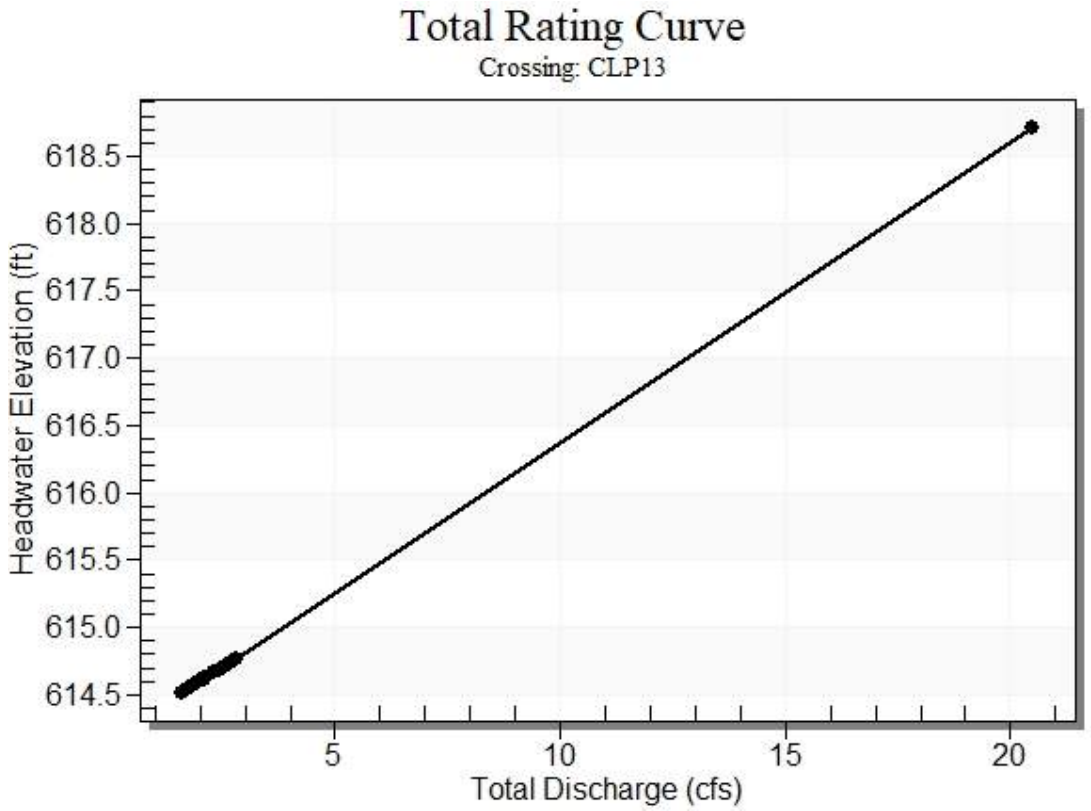


Table 29 - Culvert Summary Table: CLP-13

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.60	1.60	614.52	0.629	0.0*	1-S2n	0.294	0.470	0.294	0.426	6.342	2.202
1.72	1.72	614.54	0.652	0.0*	1-S2n	0.305	0.489	0.317	0.438	6.160	2.242
1.84	1.84	614.57	0.677	0.0*	1-S2n	0.315	0.507	0.315	0.449	6.642	2.280
1.96	1.96	614.59	0.700	0.0*	1-S2n	0.325	0.525	0.339	0.460	6.333	2.316
2.08	2.08	614.61	0.723	0.0*	1-S2n	0.335	0.542	0.349	0.470	6.469	2.351
2.10	2.10	614.62	0.727	0.0*	1-S2n	0.337	0.544	0.351	0.472	6.493	2.357
2.32	2.32	614.66	0.769	0.0*	1-S2n	0.354	0.572	0.369	0.490	6.649	2.416
2.44	2.44	614.68	0.795	0.0*	1-S2n	0.363	0.588	0.378	0.499	6.752	2.447
2.56	2.56	614.71	0.819	0.0*	1-S2n	0.372	0.604	0.387	0.508	6.861	2.476
2.68	2.68	614.73	0.843	0.0*	1-S2n	0.381	0.619	0.396	0.517	6.976	2.505
2.80	2.80	614.76	0.867	0.0*	1-S2n	0.390	0.634	0.401	0.526	7.111	2.532

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

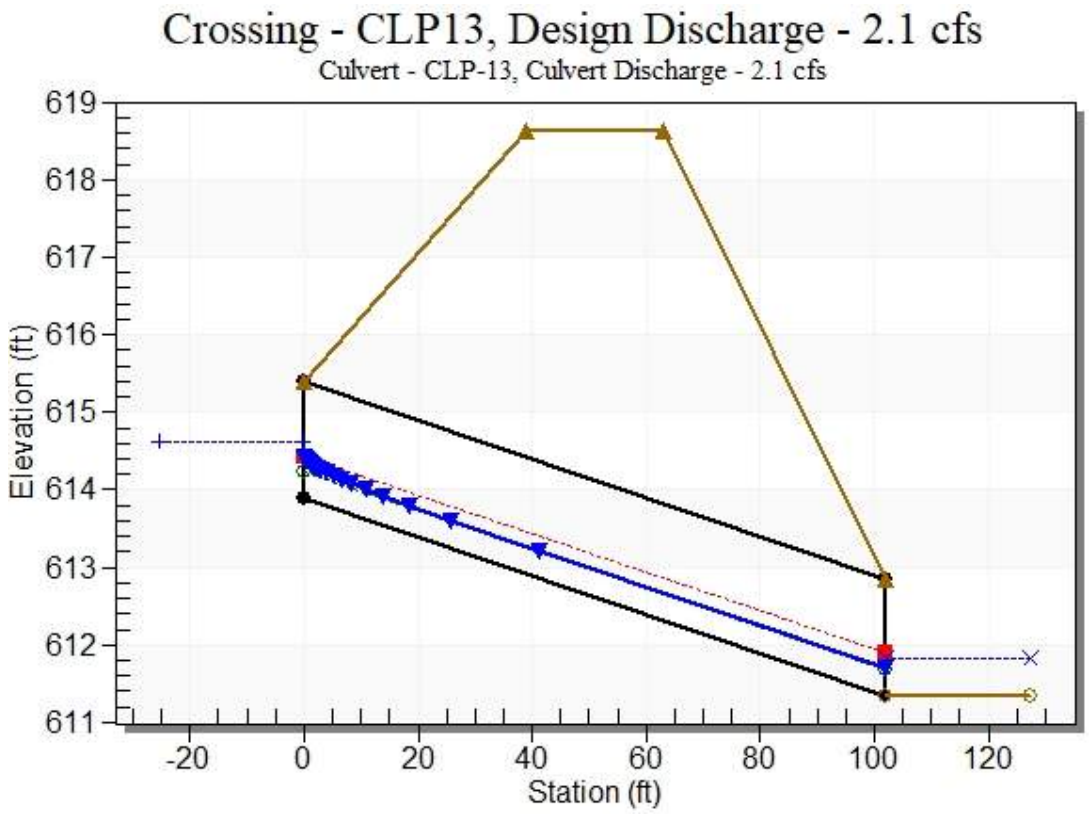
Inlet Elevation (invert): 613.89 ft, Outlet Elevation (invert): 611.35 ft

Culvert Length: 102.03 ft, Culvert Slope: 0.0249

****

Culvert Performance Curve Plot: CLP-13

Water Surface Profile Plot for Culvert: CLP-13



Site Data - CLP-13

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 613.89 ft

Outlet Station: 102.00 ft

Outlet Elevation: 611.35 ft

Number of Barrels: 1

Culvert Data Summary - CLP-13

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 30 - Downstream Channel Rating Curve (Crossing: CLP13)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.60	611.78	0.43	2.20	0.59	0.84
1.72	611.79	0.44	2.24	0.60	0.84
1.84	611.80	0.45	2.28	0.62	0.85
1.96	611.81	0.46	2.32	0.63	0.85
2.08	611.82	0.47	2.35	0.65	0.85
2.10	611.82	0.47	2.36	0.65	0.85
2.32	611.84	0.49	2.42	0.67	0.86
2.44	611.85	0.50	2.45	0.69	0.86
2.56	611.86	0.51	2.48	0.70	0.87
2.68	611.87	0.52	2.50	0.71	0.87
2.80	611.88	0.53	2.53	0.72	0.87

Tailwater Channel Data - CLP13

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0220

Channel Manning's n: 0.0350

Channel Invert Elevation: 611.35 ft

Roadway Data for Crossing: CLP13

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 618.64 ft

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 4 cfs

Design Flow: 5 cfs

Maximum Flow: 7 cfs

Table 31 - Summary of Culvert Flows at Crossing: CLP15

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-15 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
621.38	4.00	4.00	0.00	1
621.43	4.30	4.30	0.00	1
621.48	4.60	4.60	0.00	1
621.53	4.90	4.90	0.00	1
621.54	5.00	5.00	0.00	1
621.62	5.50	5.50	0.00	1
621.67	5.80	5.80	0.00	1
621.71	6.10	6.10	0.00	1
621.76	6.40	6.40	0.00	1
621.81	6.70	6.70	0.00	1
621.86	7.00	7.00	0.00	1
624.27	15.61	15.61	0.00	Overtopping

Rating Curve Plot for Crossing: CLP15

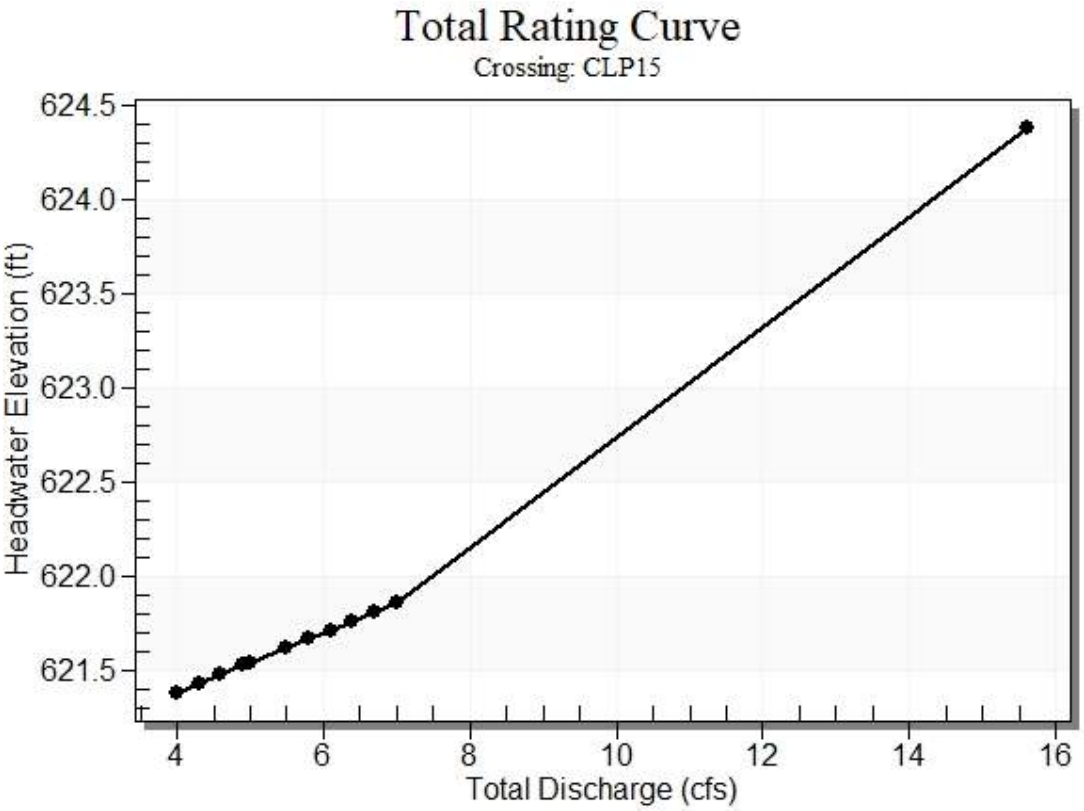


Table 32 - Culvert Summary Table: CLP-15

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
4.00	4.00	621.38	1.093	1.125	2-M2c	0.802	0.765	0.765	0.432	4.414	6.135
4.30	4.30	621.43	1.139	1.173	2-M2c	0.839	0.794	0.794	0.443	4.531	6.247
4.60	4.60	621.48	1.185	1.220	2-M2c	0.877	0.821	0.821	0.455	4.647	6.354
4.90	4.90	621.53	1.229	1.266	2-M2c	0.914	0.847	0.847	0.466	4.763	6.455
5.00	5.00	621.54	1.244	1.282	2-M2c	0.927	0.856	0.856	0.469	4.801	6.487
5.50	5.50	621.62	1.315	1.359	2-M2c	0.991	0.901	0.901	0.486	4.960	6.644
5.80	5.80	621.67	1.357	1.405	2-M2c	1.032	0.926	0.926	0.496	5.067	6.733
6.10	6.10	621.71	1.399	1.453	2-M2c	1.074	0.949	0.949	0.506	5.173	6.818
6.40	6.40	621.76	1.442	1.501	7-M2c	1.120	0.972	0.972	0.515	5.280	6.900
6.70	6.70	621.81	1.484	1.551	7-M2c	1.170	0.999	0.999	0.524	5.359	6.980
7.00	7.00	621.86	1.527	1.599	7-M2c	1.500	1.021	1.021	0.532	5.461	7.057

****

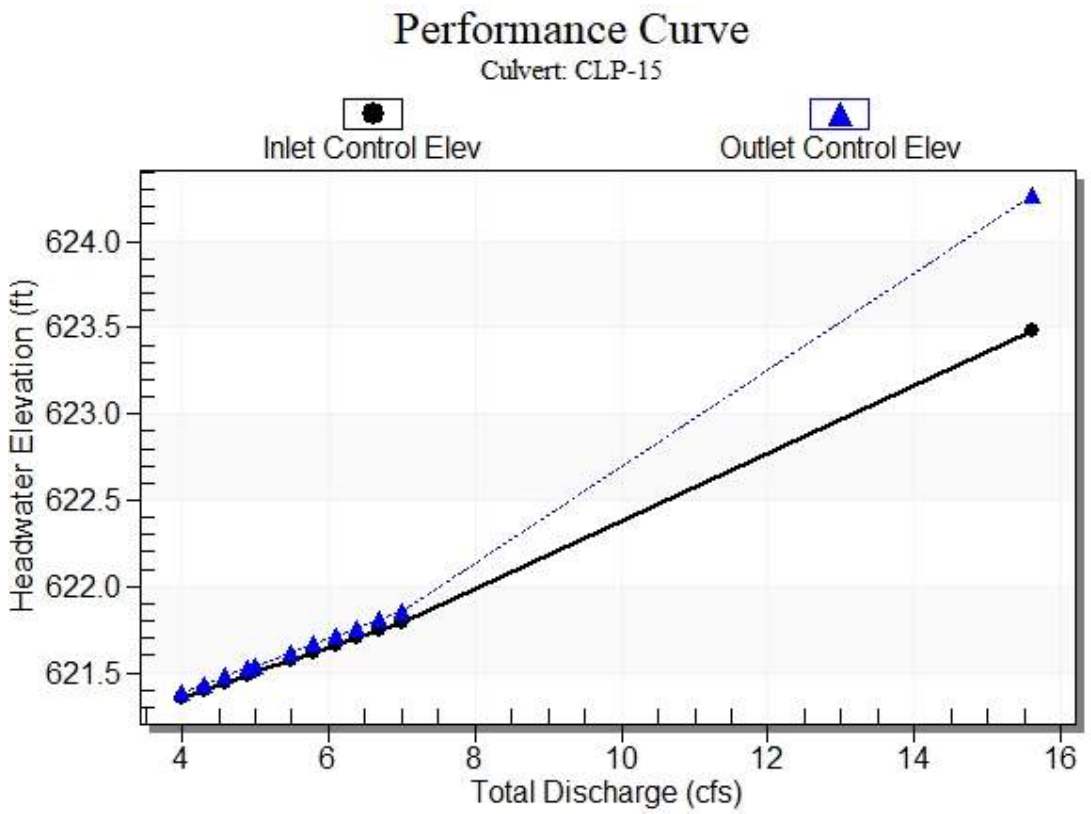
Straight Culvert

Inlet Elevation (invert): 620.26 ft, Outlet Elevation (invert): 620.00 ft

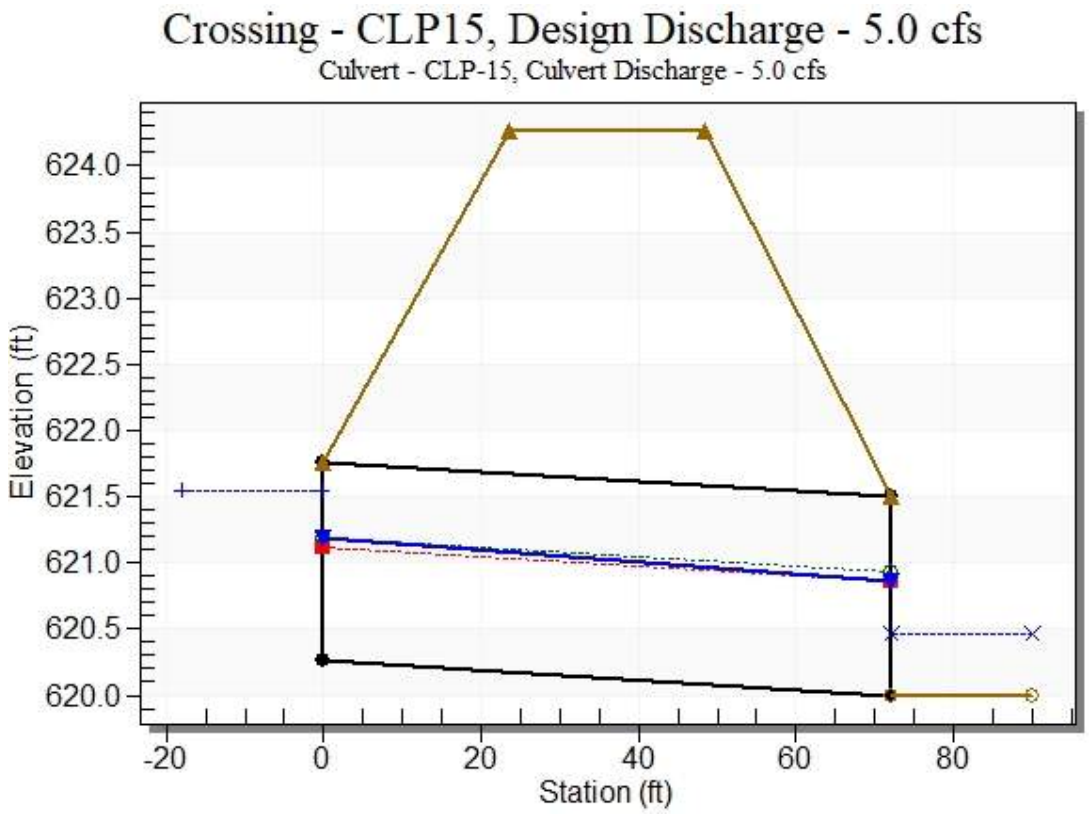
Culvert Length: 72.00 ft, Culvert Slope: 0.0036

****

Culvert Performance Curve Plot: CLP-15



Water Surface Profile Plot for Culvert: CLP-15



Site Data - CLP-15

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 620.26 ft

Outlet Station: 72.00 ft

Outlet Elevation: 620.00 ft

Number of Barrels: 1

Culvert Data Summary - CLP-15

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 33 - Downstream Channel Rating Curve (Crossing: CLP15)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
4.00	620.43	0.43	6.14	4.58	2.33
4.30	620.44	0.44	6.25	4.70	2.34
4.60	620.45	0.45	6.35	4.82	2.35
4.90	620.47	0.47	6.45	4.94	2.36
5.00	620.47	0.47	6.49	4.98	2.36
5.50	620.49	0.49	6.64	5.16	2.37
5.80	620.50	0.50	6.73	5.26	2.38
6.10	620.51	0.51	6.82	5.36	2.39
6.40	620.51	0.51	6.90	5.46	2.40
6.70	620.52	0.52	6.98	5.56	2.40
7.00	620.53	0.53	7.06	5.65	2.41

Tailwater Channel Data - CLP15

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.50 (_:1)

Channel Slope: 0.1700

Channel Manning's n: 0.0350

Channel Invert Elevation: 620.00 ft

Roadway Data for Crossing: CLP15

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 624.27 ft

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 34 - Summary of Culvert Flows at Crossing: CLP16

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CLP-16 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
630.55	10-Year	15.00	15.00	0.00	1
630.85	25-Year	18.00	18.00	0.00	1
631.30	50-Year	22.00	22.00	0.00	1
631.70	100-Year	25.00	25.00	0.00	1
634.09	Overtopping	37.50	37.50	0.00	Overtopping

Rating Curve Plot for Crossing: CLP16

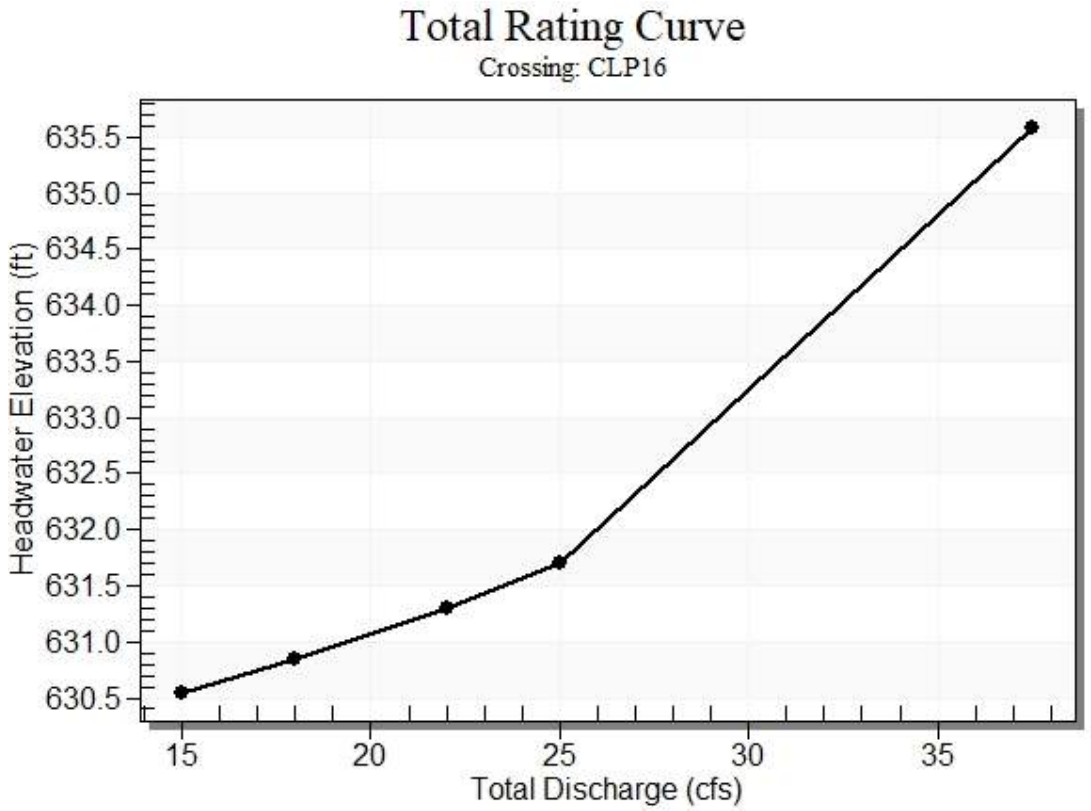


Table 35 - Culvert Summary Table: CLP-16

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10-Year	15.00	15.00	630.55	2.091	0.469	5-S2n	1.221	1.392	1.262	0.919	6.966	2.963
25-Year	18.00	18.00	630.85	2.388	2.257	5-S2n	1.393	1.526	1.436	0.984	7.256	3.101
50-Year	22.00	22.00	631.30	2.839	2.812	7-M2c	2.000	1.674	1.674	1.060	7.834	3.261
100-Year	25.00	25.00	631.70	3.224	3.235	7-M2c	2.000	1.761	1.761	1.112	8.533	3.367

****

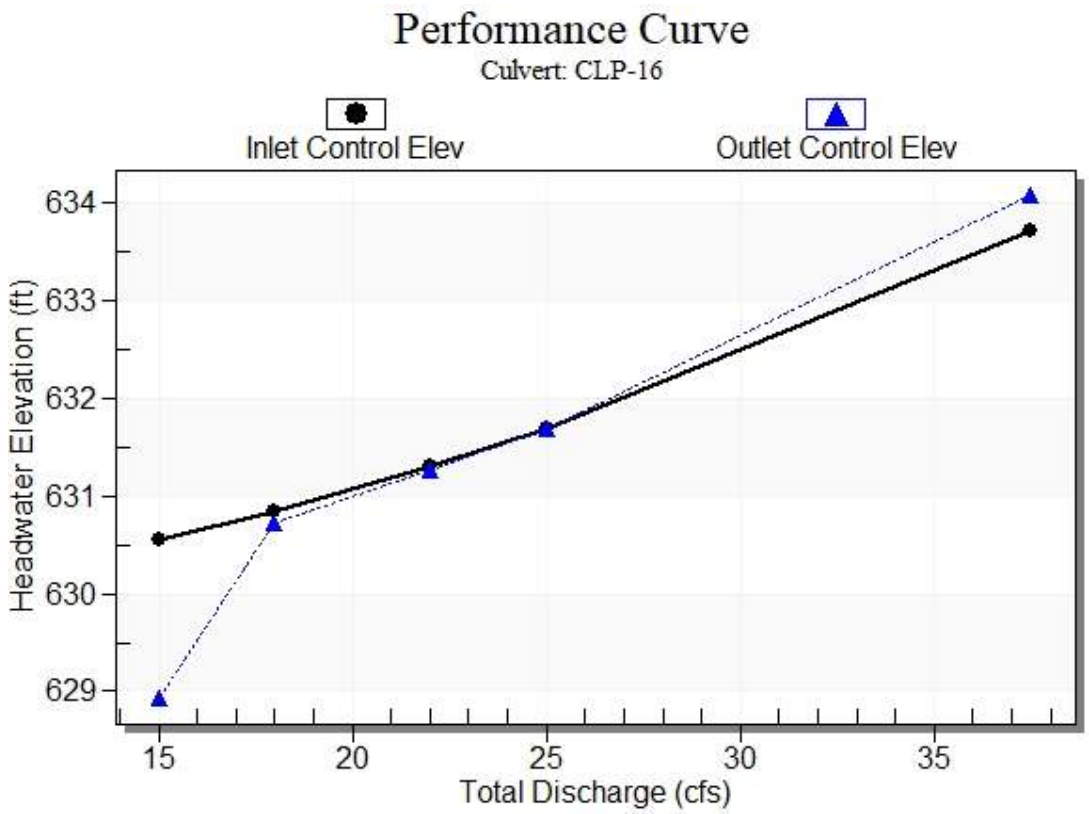
Straight Culvert

Inlet Elevation (invert): 628.46 ft, Outlet Elevation (invert): 628.01 ft

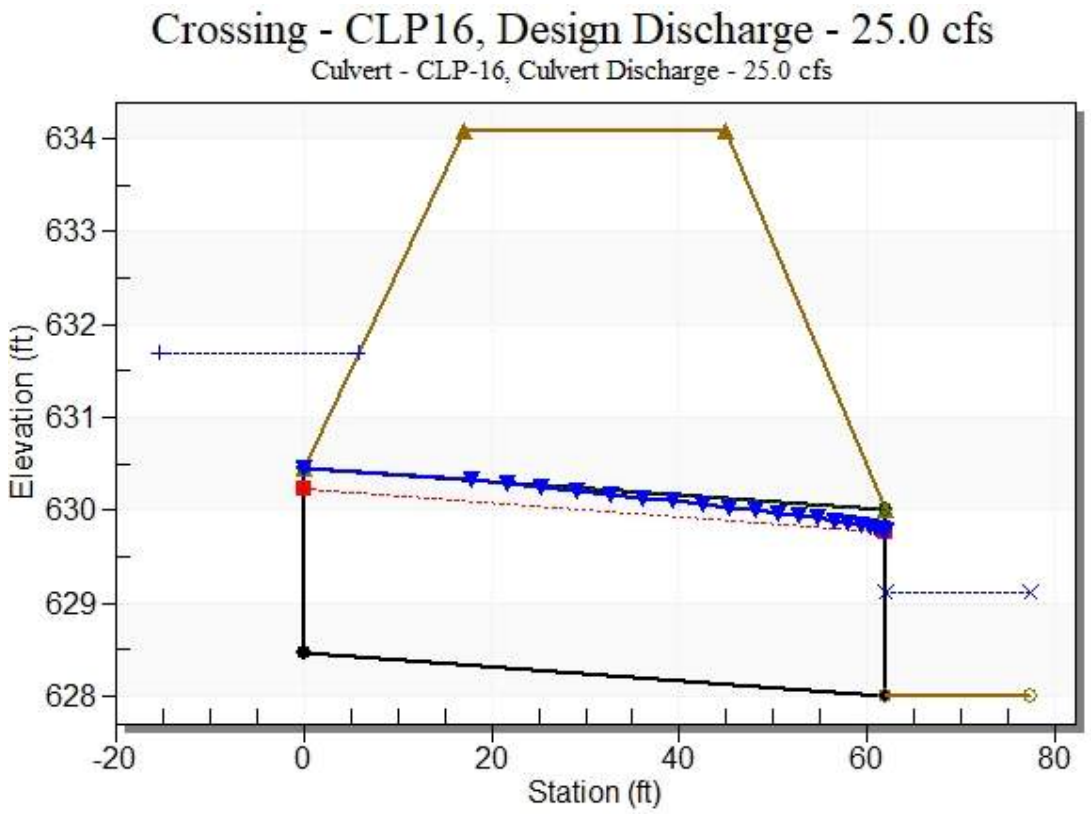
Culvert Length: 62.00 ft, Culvert Slope: 0.0073

****

Culvert Performance Curve Plot: CLP-16



Water Surface Profile Plot for Culvert: CLP-16



Site Data - CLP-16

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 628.46 ft

Outlet Station: 62.00 ft

Outlet Elevation: 628.01 ft

Number of Barrels: 1

Culvert Data Summary - CLP-16

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 36 - Downstream Channel Rating Curve (Crossing: CLP16)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
15.00	628.93	0.92	2.96	0.80	0.77
18.00	628.99	0.98	3.10	0.86	0.78
22.00	629.07	1.06	3.26	0.93	0.79
25.00	629.12	1.11	3.37	0.97	0.80

Tailwater Channel Data - CLP16

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0140

Channel Manning's n: 0.0350

Channel Invert Elevation: 628.01 ft

Roadway Data for Crossing: CLP16

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 634.09 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2 cfs

Design Flow: 3 cfs

Maximum Flow: 4 cfs

Table 37 - Summary of Culvert Flows at Crossing: CLP17

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-17 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
616.32	2.00	2.00	0.00	1
616.36	2.20	2.20	0.00	1
616.40	2.40	2.40	0.00	1
616.44	2.60	2.60	0.00	1
616.48	2.80	2.80	0.00	1
616.52	3.00	3.00	0.00	1
616.56	3.20	3.20	0.00	1
616.59	3.40	3.40	0.00	1
616.63	3.60	3.60	0.00	1
616.66	3.80	3.80	0.00	1
616.69	4.00	4.00	0.00	1
619.00	13.49	13.49	0.00	Overtopping

Rating Curve Plot for Crossing: CLP17

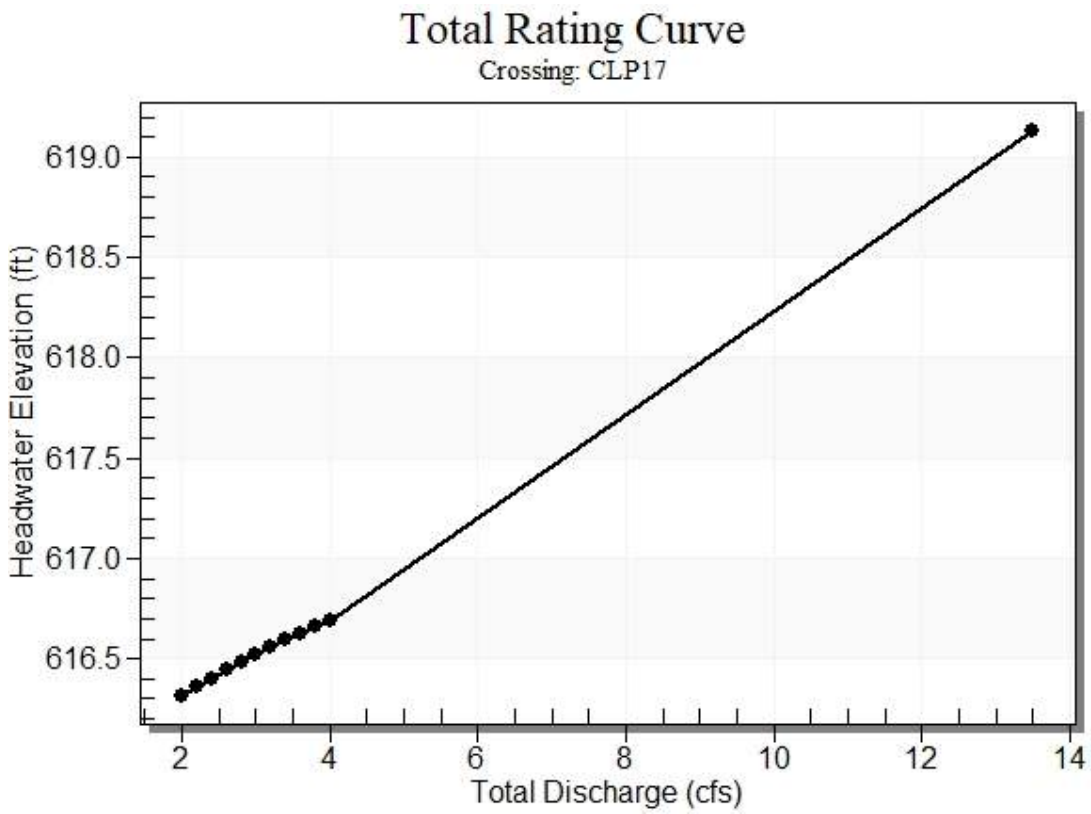


Table 38 - Culvert Summary Table: CLP-17

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.00	2.00	616.32	0.719	0.0*	1-S2n	0.473	0.530	0.473	0.444	4.037	1.690
2.20	2.20	616.36	0.757	0.0*	1-S2n	0.498	0.555	0.512	0.460	4.005	1.731
2.40	2.40	616.40	0.800	0.015	1-S2n	0.521	0.582	0.521	0.476	4.248	1.769
2.60	2.60	616.44	0.842	0.056	1-S2n	0.544	0.609	0.544	0.490	4.347	1.805
2.80	2.80	616.48	0.881	0.096	1-S2n	0.566	0.634	0.566	0.504	4.431	1.838
3.00	3.00	616.52	0.919	0.137	1-S2n	0.588	0.658	0.588	0.517	4.518	1.870
3.20	3.20	616.56	0.956	0.178	1-S2n	0.609	0.681	0.609	0.530	4.592	1.901
3.40	3.40	616.59	0.991	0.219	1-S2n	0.630	0.703	0.647	0.542	4.506	1.930
3.60	3.60	616.63	1.025	0.260	1-S2n	0.651	0.725	0.670	0.554	4.556	1.958
3.80	3.80	616.66	1.058	0.302	1-S2n	0.671	0.745	0.671	0.565	4.801	1.984
4.00	4.00	616.69	1.091	0.344	1-S2n	0.691	0.765	0.691	0.576	4.865	2.010

* Full Flow Headwater elevation is below inlet invert.

****

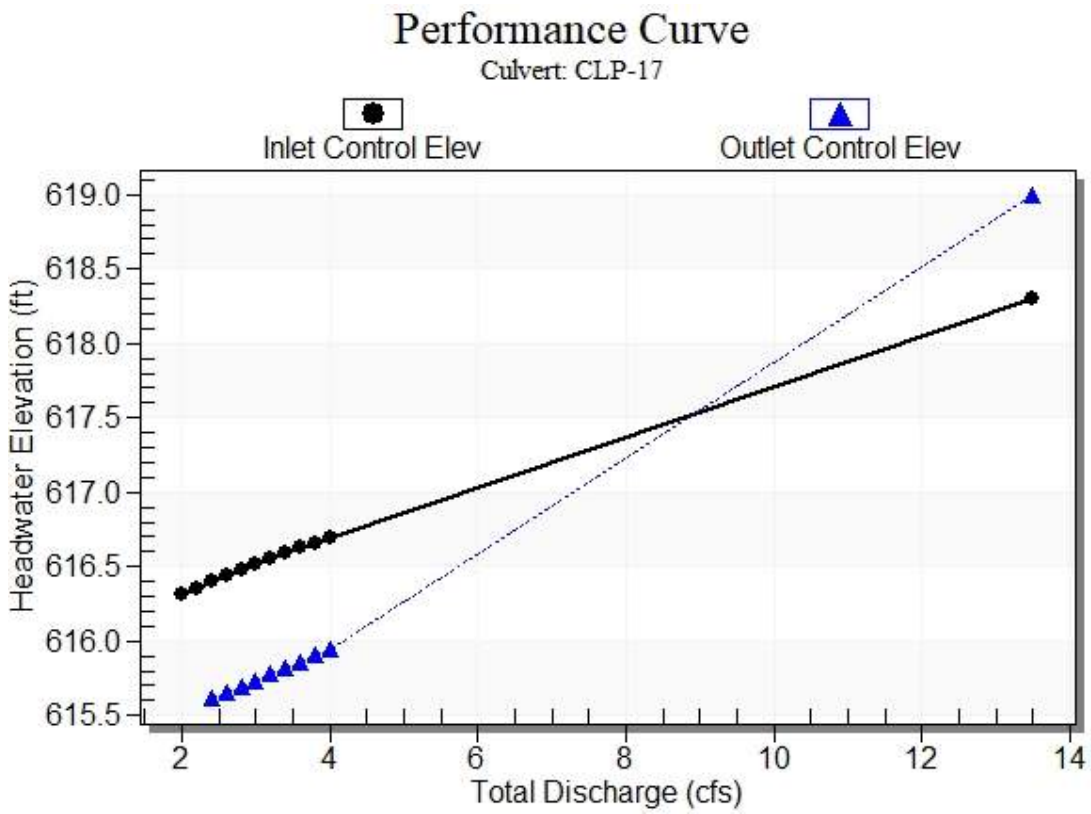
Straight Culvert

Inlet Elevation (invert): 615.60 ft, Outlet Elevation (invert): 614.95 ft

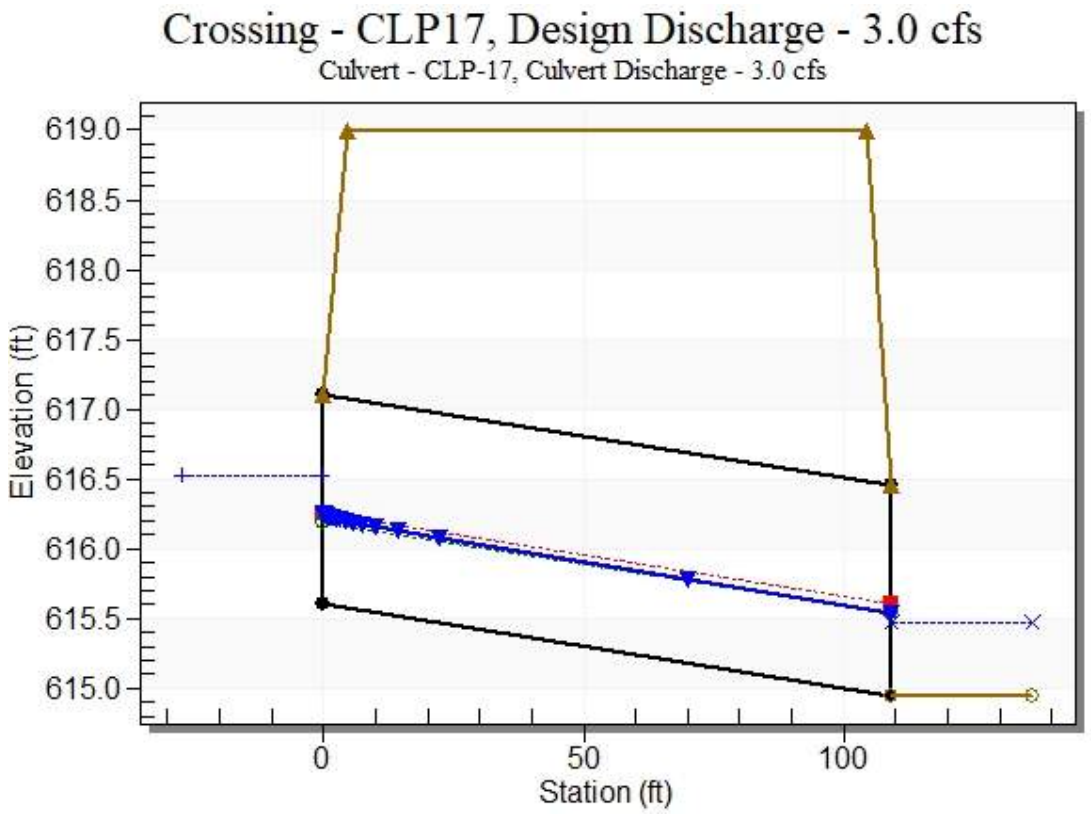
Culvert Length: 109.00 ft, Culvert Slope: 0.0060

****

Culvert Performance Curve Plot: CLP-17



Water Surface Profile Plot for Culvert: CLP-17



Site Data - CLP-17

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 615.60 ft

Outlet Station: 109.00 ft

Outlet Elevation: 614.95 ft

Number of Barrels: 1

Culvert Data Summary - CLP-17

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 39 - Downstream Channel Rating Curve (Crossing: CLP17)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.00	615.39	0.44	1.69	0.33	0.63
2.20	615.41	0.46	1.73	0.34	0.64
2.40	615.43	0.48	1.77	0.36	0.64
2.60	615.44	0.49	1.80	0.37	0.64
2.80	615.45	0.50	1.84	0.38	0.65
3.00	615.47	0.52	1.87	0.39	0.65
3.20	615.48	0.53	1.90	0.40	0.65
3.40	615.49	0.54	1.93	0.41	0.65
3.60	615.50	0.55	1.96	0.41	0.66
3.80	615.51	0.56	1.98	0.42	0.66
4.00	615.53	0.58	2.01	0.43	0.66

Tailwater Channel Data - CLP17

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0120

Channel Manning's n: 0.0350

Channel Invert Elevation: 614.95 ft

Roadway Data for Crossing: CLP17

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 619.00 ft

Roadway Surface: Paved

Roadway Top Width: 100.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 6 cfs

Design Flow: 7.6 cfs

Maximum Flow: 9.2 cfs

Table 40 - Summary of Culvert Flows at Crossing: CLP14

Headwater Elevation (ft)	Total Discharge (cfs)	CLP-14 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
629.91	6.00	6.00	0.00	1
629.95	6.32	6.32	0.00	1
630.00	6.64	6.64	0.00	1
630.04	6.96	6.96	0.00	1
630.09	7.28	7.28	0.00	1
630.13	7.60	7.60	0.00	1
630.18	7.92	7.92	0.00	1
630.23	8.24	8.24	0.00	1
630.28	8.56	8.56	0.00	1
630.33	8.88	8.88	0.00	1
630.38	9.20	9.20	0.00	1
633.17	19.98	19.98	0.00	Overtopping

Rating Curve Plot for Crossing: CLP14

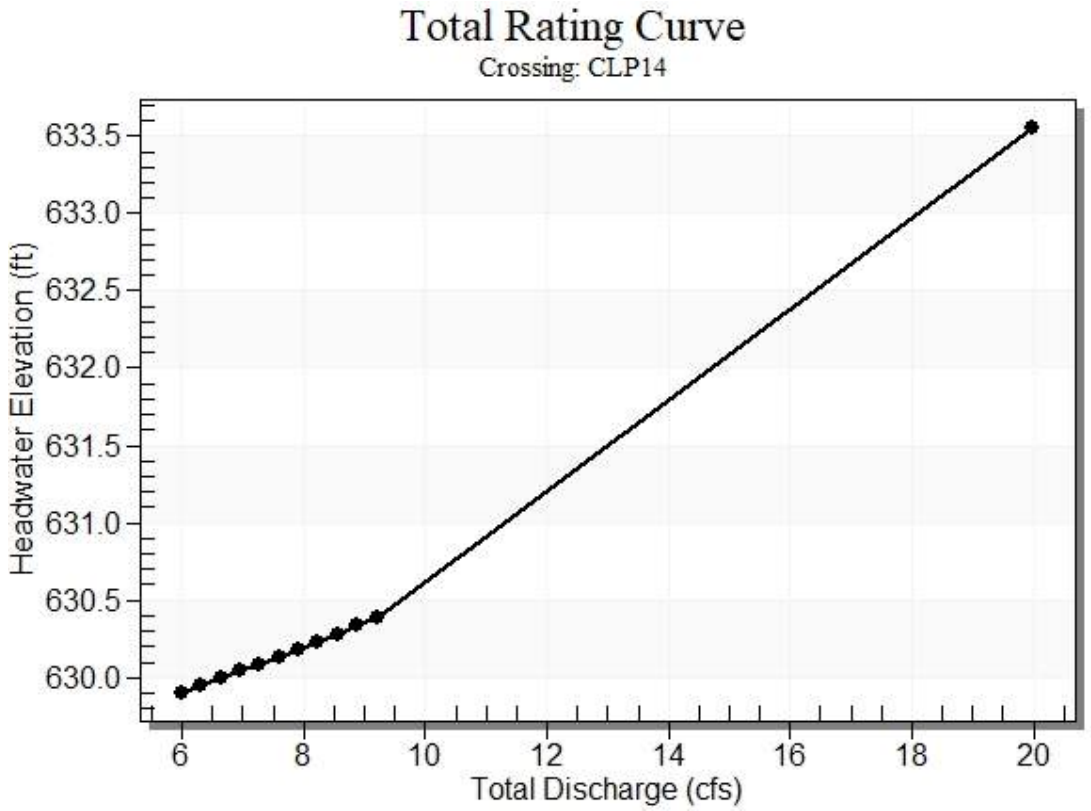


Table 41 - Culvert Summary Table: CLP-14

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
6.00	6.00	629.91	1.375	0.370	1-S2n	0.646	0.942	0.683	0.691	7.411	2.093
6.32	6.32	629.95	1.420	0.435	1-S2n	0.666	0.966	0.704	0.705	7.501	2.120
6.64	6.64	630.00	1.465	0.505	1-S2n	0.685	0.995	0.725	0.718	7.591	2.146
6.96	6.96	630.04	1.511	0.574	5-S2n	0.704	1.019	0.746	0.731	7.678	2.172
7.28	7.28	630.09	1.557	0.644	5-S2n	0.722	1.042	0.766	0.743	7.762	2.196
7.60	7.60	630.13	1.604	0.715	5-S2n	0.741	1.064	0.786	0.755	7.844	2.220
7.92	7.92	630.18	1.652	0.788	5-S2n	0.759	1.087	0.806	0.767	7.923	2.243
8.24	8.24	630.23	1.701	0.862	5-S2n	0.778	1.108	0.826	0.779	8.001	2.265
8.56	8.56	630.28	1.750	1.123	5-S2n	0.796	1.129	0.846	0.790	8.074	2.287
8.88	8.88	630.33	1.802	1.190	5-S2n	0.814	1.149	0.866	0.801	8.145	2.308
9.20	9.20	630.38	1.854	1.259	5-S2n	0.832	1.168	0.885	0.811	8.212	2.329

****

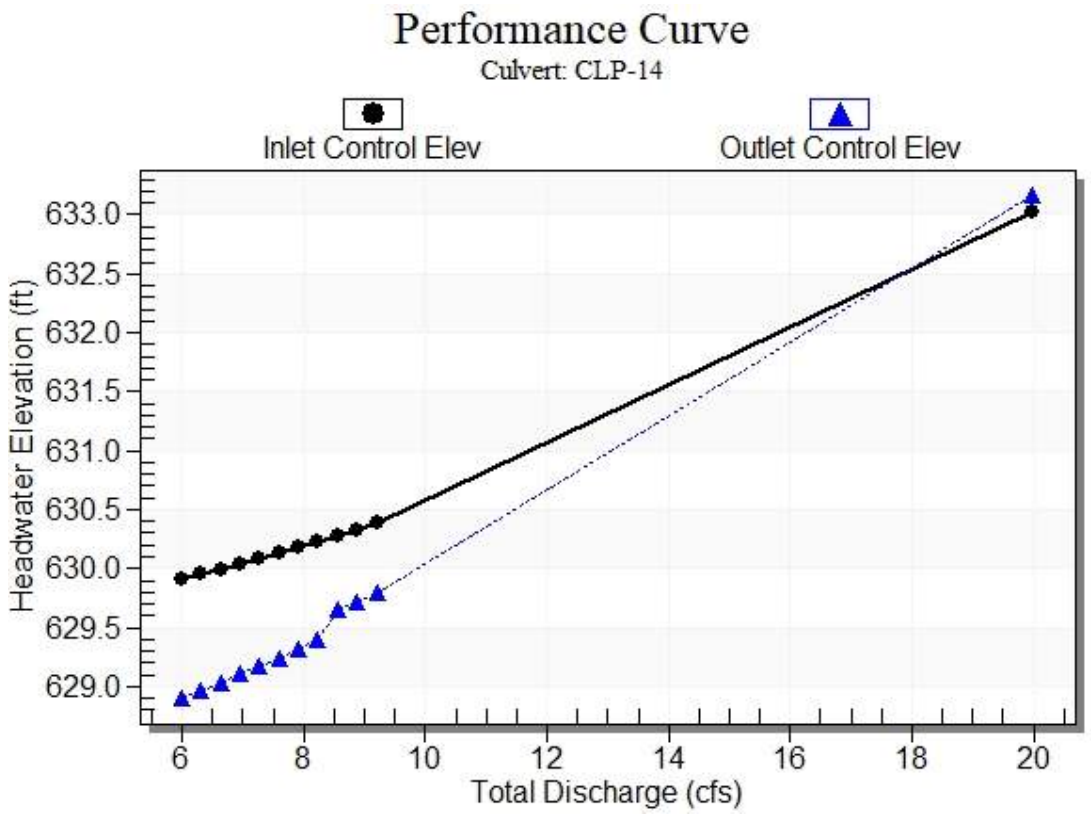
Straight Culvert

Inlet Elevation (invert): 628.53 ft, Outlet Elevation (invert): 627.59 ft

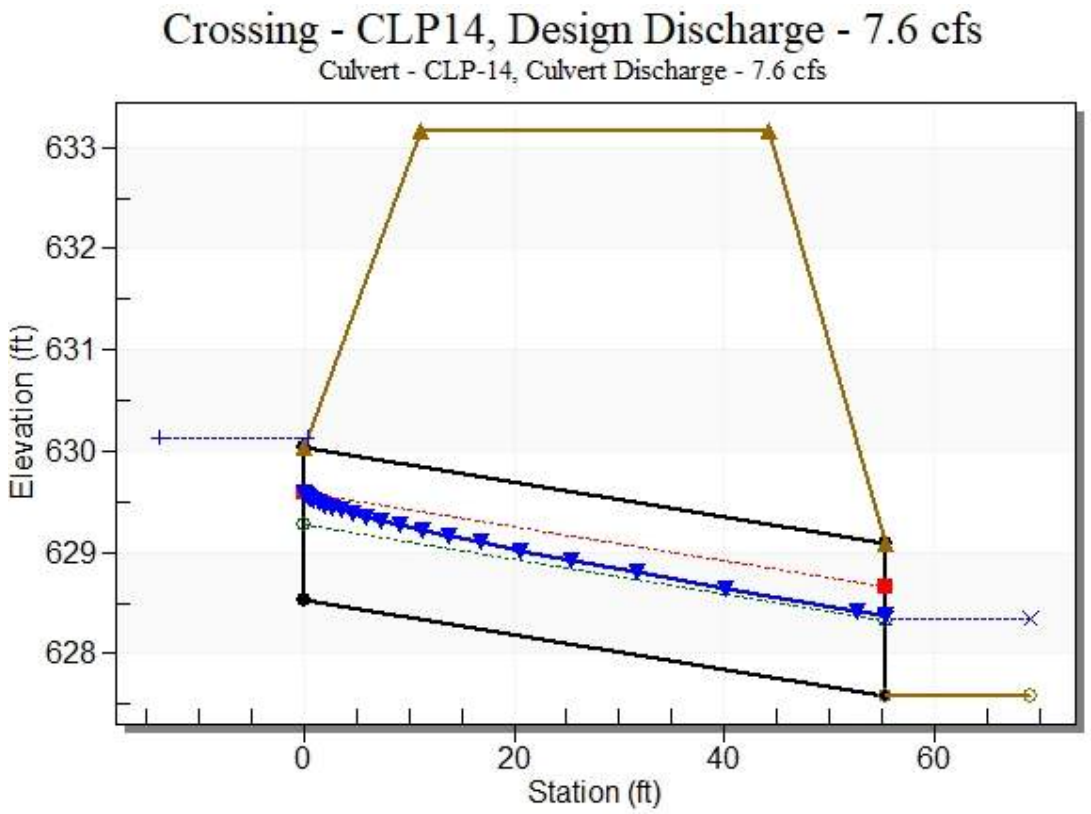
Culvert Length: 55.41 ft, Culvert Slope: 0.0170

****

Culvert Performance Curve Plot: CLP-14



Water Surface Profile Plot for Culvert: CLP-14



Site Data - CLP-14

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 628.53 ft

Outlet Station: 55.40 ft

Outlet Elevation: 627.59 ft

Number of Barrels: 1

Culvert Data Summary - CLP-14

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1.5:1)

Inlet Depression: None

Table 42 - Downstream Channel Rating Curve (Crossing: CLP14)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
6.00	628.28	0.69	2.09	0.44	0.63
6.32	628.29	0.70	2.12	0.45	0.63
6.64	628.31	0.72	2.15	0.46	0.63
6.96	628.32	0.73	2.17	0.47	0.63
7.28	628.33	0.74	2.20	0.47	0.63
7.60	628.35	0.76	2.22	0.48	0.64
7.92	628.36	0.77	2.24	0.49	0.64
8.24	628.37	0.78	2.27	0.50	0.64
8.56	628.38	0.79	2.29	0.50	0.64
8.88	628.39	0.80	2.31	0.51	0.64
9.20	628.40	0.81	2.33	0.52	0.64

Tailwater Channel Data - CLP14

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0102

Channel Manning's n: 0.0350

Channel Invert Elevation: 627.59 ft

Roadway Data for Crossing: CLP14

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 633.17 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

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Rock Hill, South Carolina 29730-3392
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JOB:	2515776 - US21/SC51 Widening		SHEET
SUBJECT:	Culvert Scour		1
CALC'D BY:	GPP	DATE: 22-Sep-21	OF
CHECK'D BY:		DATE:	1

CULVERT SCOUR AT PIPE EXIT PER HEC-14 SECTION 5.2

Station	D (in)	S (ft/ft)	drop height (ft)	Q (cfs)	PI	S_v (lb/ft^2)	α_u	ρ	C_h	C_s	V (ft/sec)	τ_c	S_{nm} (lb/ft^2)	h_s (depth, ft)	W_s (width, ft)	L_s (length, ft)	V_s (volume, ft^3)	L_m (point of max scour, ft)
33+80	60	0.015	0	185	38	530	180	1.94	1.00	1.00	9.43	9.02	19.1	5.78	24.86	72.49	701.23	29.00
41+06	60	0.01	0	242	18	530	180	1.94	1.00	1.00	12.33	5.84	50.5	6.88	29.33	99.91	1731.92	39.96

NOTES:

1. Shear (S_v) input from project RGER Table 4-3. Plasticity Index (PI) inputs from nearest sampling location where PL/LL was laboratory tested.
2. Scour will be mitigated by rip rap outlet protection. See rip rap calculations in Appendix F
3. Potential for inlet scour will be mitigated by headwall structures

KCI TECHNOLOGIES
ISO 9001:2015 CERTIFIED
ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
3014 Southcross Boulevard • Rock Hill, SC 29730 • Phone 803-980-6025 • Fax 803-980-6055

Existing Culvert Assessment
US-21 / SC-51 Widening
Fort Mill, South Carolina

Submitted By:
KCI Technologies
3014 Southcross Blvd.
Rock Hill, South Carolina 29730

Assessment date: January 14, 2022

Prepared by: David Speer, P.E.

Culvert @ Sta. 33+79 US 21

The culvert was constructed as part of SCDOT File No. 46.240 with a plans date December 19, 1940 at approximately Station 319+28.8. It is a 5'x5' single reinforced concrete box culvert with a length of approximately 132 feet with approximately 25 feet of fill above the culvert. The culvert details were not included in the project files on SCDOT's Plans Online. The assessment of the west end of the culvert is in a sump and is almost 100% submerged under water and soil. Only the head wall was visible during the site visit (see figure 1). The east end of the culvert was approximately 90% filled with water and soil. The inside of the culvert was inaccessible (see figure 2).

The visible concrete was competent and no signs of deterioration were present. Additionally, there were no cracks shown in the roadway above or any disturbances in the slopes above the culvert. This indicates that the culvert is intact and its structure has not been compromised. Based on these observations and the fact that the structure has been in place for many years with no disturbance in the roadway above, KCI recommends that the existing culvert be left in place and extended.

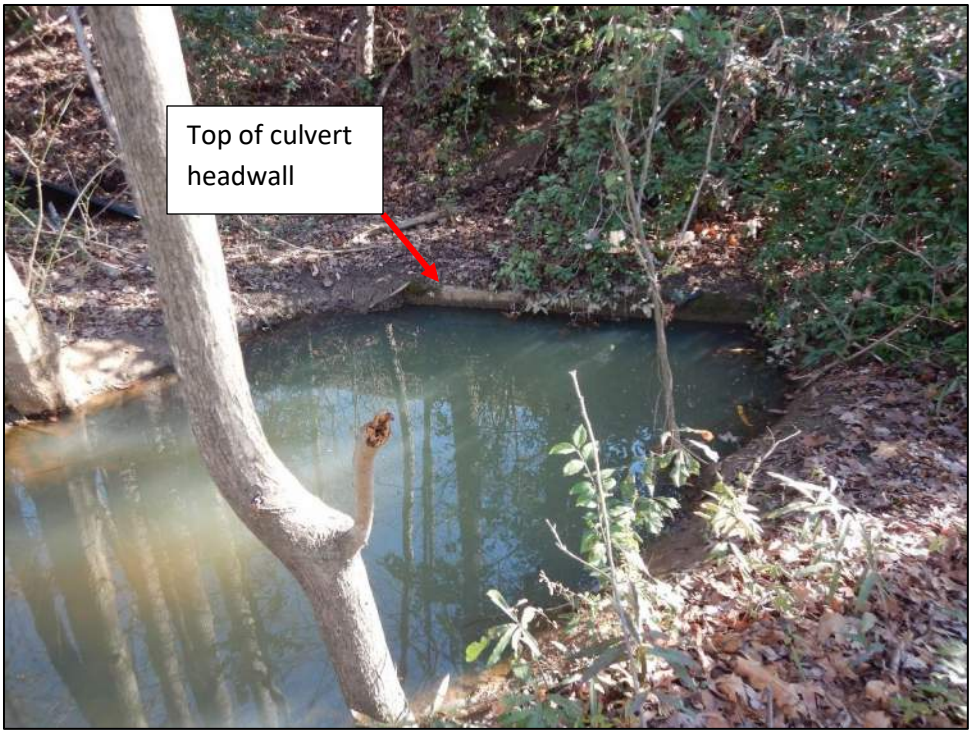

Figure 1: West end of culvert @ sta. 33+79



Figure 2: East end of culvert @ sta. 33+79

Culvert @ Sta. 41+06 US 21

The culvert was constructed as part of SCDOT File No. 46.240 with a plans date December 19, 1940, at approximately Station 326+57.1. It is a 5'x5' single reinforced concrete box culvert with a length of approximately 122 feet with approximately 17 feet of fill above the culvert. The culvert details were not included in the project files on SCDOT's Plans Online. The west end of the culvert did not show any signs of deterioration (see figure 3). On the interior of the culvert, the bottom of the top slab and inside face of the walls did not show any signs of deterioration or water intrusion. The east end of the culvert was inaccessible due to very steep slope and the presence of thick brush.

No signs of significant deterioration were observed during the structural assessment. The pavement and ground above and around the culvert did not show signs of cracking or settlement. Based on these observations, KCI recommends that the existing culvert be left in place and extended.



Figure 3:West End Culvert @ Sta. 41+06

Culvert @ Sta. 316+23 SC 51

The culvert was constructed as part of Federal Aid Project 216 (REOP) with a plans date July 18, 1927, at approximately Station 316+31. It is a 6'x6' single reinforced concrete box culvert with a length of approximately 30 feet with approximately 4 feet of fill above the culvert The original plans show a 6'x8' opening, however during a site visit conducted on May 30, 2019, it was determined that the culvert was a 6'x6' (see figures 4-6). The south end of the culvert did not show any signs of deterioration (see figure 7). Additionally, the north end of the culvert did not show any signs of deterioration (see figure 8). On the interior of the culvert, the bottom of the top slab and inside face of the walls did not show any signs of deterioration or water intrusion (see figure 8-9).

No signs of significant deterioration were observed during the structural assessment. The pavement and ground above and around the culvert did not show signs of cracking or settlement. Based on these observations, KCI recommends that the existing culvert be left in place and extended.



Figure 4: Measuring width of south end of culvert @ sta. 316+23



Figure 5: Measuring to top of soil at south end of culvert @ sta. 316+23



Figure 6: Measuring depth of soil at south end of culvert @ sta. 316+23



Figure 7: South end of culvert @ sta. 316+23



Figure 8: North end of culvert @ sta. 316+23



Figure 9: Inside of culvert @ sta. 316+23

CONCLUSION

Based on the condition of all three of the culverts during the site visits, KCI recommends that these culverts are suitable to be left in place and to have extensions added to the ends to facilitate the widening of the supported roadways.

Appendix E

Pre vs Post Calculations

STV Incorporated
454 South Anderson Road, Suite 3
Rock Hill, South Carolina 29730-3392
803 980 4970 o 803 980 4099 f

JOB:	US21/SC51 Phase I Widening			1
SUBJECT:	Outfalls 1,2 & 3 Comparison			SHEET
CALC'D BY:	GPP	DATE:	22-Dec-2023	OF
CHECK'D BY:	SCN	DATE:	22-Dec-2023	1

PRE VS. POST OUTFALL COMPARISON

GIVEN:

Outfall Location: Road Name **US 21**

Analysis Point **Outfalls 1, 2 and 3**

Outfall 1						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 2 has been redirected to Outfall 1.
Pre (Existing) Discharge (cfs):	40.0	75.0	96.0	115.0	131.0	
Post (Proposed) Discharge (cfs):	86.0	145.0	182.0	211.0	242.0	

Outfall 2						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 2 has been redirected to Outfall 1.
Pre (Existing) Discharge (cfs):	45.0	108.0	153.0	192.0	233.0	
Post (Proposed) Discharge (cfs):	30.0	84.0	121.0	154.0	188.0	

Outfall 3						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 3 has been redirected to Outfall 6.
Pre (Existing) Discharge (cfs):	106.0	220.0	293.0	354.0	420.0	
Post (Proposed) Discharge (cfs):	112.0	227.0	299.0	360.0	425.0	

Outfall 6						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 3 has been redirected to Outfall 6. Post discharges include new Outfalls 6a and 6b.
Pre (Existing) Discharge (cfs):	24.0	45.0	59.0	69.0	81.0	
Post (Proposed) Discharge (cfs):	18.0	35.0	45.0	54.0	63.0	

Forest Lake (Outfall 2 + 3)						Notes
	2yr	10yr	25yr	50yr	100yr	Based on redirecting Outfall 2 and Outfall 3 areas, overall discharge to Forest Lake has been reduced.
Pre (Existing) Discharge (cfs):	151.0	328.0	446.0	546.0	653.0	
Post (Proposed) Discharge (cfs):	142.0	311.0	420.0	514.0	613.0	
Difference (cfs):	-9.0	-17.0	-26.0	-32.0	-40.0	
Δ %:	-6.0	-5.2	-5.8	-5.9	-6.1	

REMARKS:

To reduce overall peak discharges to Forest Lake, areas from Outfalls 2 and 3 have been reallocated to adjacent Outfalls 1 and 6 respectively. Please see the accompanying exhibits to see the new pipe system alignments used to accomplish this approach.

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 2			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	50		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0030		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1910	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.	0.0660		
10. Average velocity, V (figure 3-1)	ft./sec.	4.15		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	6.75		
13. Wetted perimeter, p_w	ft.	9.49		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7113		
15. Channel slope, s	ft./ft.	0.0030		
16. Manning's roughness coefficient, n		0.0450		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	1.45		
17b. Input Velocity, FPS	ft./sec.	1.45		
18. Flow length, L	ft.	755		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.1451	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3361	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.34 Hour
20 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 2			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			4.1	252.5
B	Woods	55			0.5	27.5
B	Impervious	98			11.6	1136.8
B	Inudstrial	88				
				Totals ==>	16.2	1416.8

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1416.8}{16.2} = 87.2$ Use CN ====> **87**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	2.20	3.68	4.59	5.32	6.08

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

STV Incorporated 331 East Main Street, Suite 200 Rock Hill, South Carolina 29730 803 207 2025 www.stvinc.com	JOB:	US21 SC51 Widening			SHEET 3
	SUBJECT:	Outfall 2			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.025 mi^2 (acres/640)

Runoff curve number..... CN = 87 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.3 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.299	0.299	0.299	0.299	0.299
5. Compute I_a/P		0.08	0.06	0.05	0.04	0.04
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	725	800	825	850	850
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	2.20	3.68	4.59	5.32	6.08
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	40	75	96	115	131

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 1			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	57		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0184		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0126	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)		paved		
8. Flow length, L	ft.	75		
9. Watercourse slope, s	ft./ft.	0.0100		
10. Average velocity, V (figure 3-1)	ft./sec.	2.03		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0102	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	1.77		
13. Wetted perimeter, p_w	ft.	4.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.3758		
15. Channel slope, s	ft./ft.	0.0423		
16. Manning's roughness coefficient, n		0.0120		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	13.30		
17b. Input Velocity, FPS	ft./sec.	13.30		
18. Flow length, L	ft.	728		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0152	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0380	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.04 Hour
2 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 1			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			5.4	328.2
B	Woods	55			0.3	14.9
B	Impervious	98			9.9	967.3
B	Inudstrial	88			10.4	915.2
				Totals ==>	25.9	2225.5

* Use only one CN source per line

CN (weighted) = total product / total area = 2225.5 / 25.9 = 85.9 Use CN ====> **86**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	2.12	3.58	4.49	5.21	5.96

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

STV Incorporated	JOB:	US21 SC51 Widening			SHEET
331 East Main Street, Suite 200	SUBJECT:	Outfall 1			3
Rock Hill, South Carolina 29730	CALC'D BY:	GPP	DATE:	8-Dec-23	OF
803 207 2025 www.stvinc.com	CHECK'D BY:	SCN	DATE:	8-Dec-23	3

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.041 mi^2 (acres/640)

Runoff curve number..... CN = 86 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.0 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.326	0.326	0.326	0.326	0.326
5. Compute I_a/P		0.09	0.06	0.05	0.05	0.04
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	1000	1000	1000	1000	1000
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	2.12	3.58	4.49	5.21	5.96
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	86	145	182	211	242

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 2			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0360		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2964	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	533		
9. Watercourse slope, s	ft./ft.	0.0660		
10. Average velocity, V (figure 3-1)	ft./sec.	4.15		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0357	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	24.00		
13. Wetted perimeter, p_w	ft.	16.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.4168		
15. Channel slope, s	ft./ft.	0.0210		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	7.78		
17b. Input Velocity, FPS	ft./sec.	7.78		
18. Flow length, L	ft.	2051		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0732	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4053	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.41 Hour
24 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			2.4	148.8
B	Residential 1/3 ac	72			16.3	1171.4
B	Pasture	61			31.6	1927.0
B	Woods	55			12.0	658.9
B	Impervious	98			5.6	552.7
B	Urban Business	92			1.5	139.3
				Totals ==>	69.4	4598.2

* Use only one CN source per line

CN (weighted) = total product / total area = 4598.2 / 69.4 = 66.2 Use CN ====> **66**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.81	1.81	2.50	3.08	3.70

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.108 mi^2 (acres/640)

Runoff curve number..... CN = 66 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.4 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.030	1.030	1.030	1.030	1.030
5. Compute I_a/P		0.29	0.20	0.17	0.15	0.14
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	510	550	565	575	580
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.81	1.81	2.50	3.08	3.70
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	45	108	153	192	233

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JOB:	US21 SC51 Widening			SHEET 1
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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0360		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2964	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		paved		
8. Flow length, L	ft.	533		
9. Watercourse slope, s	ft./ft.	0.0660		
10. Average velocity, V (figure 3-1)	ft./sec.	5.22		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0284	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	24.00		
13. Wetted perimeter, p_w	ft.	16.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.4168		
15. Channel slope, s	ft./ft.	0.0210		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	7.78		
17b. Input Velocity, FPS	ft./sec.	7.78		
18. Flow length, L	ft.	2051		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0732	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3980	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.40 Hour
24 min

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JOB:	US21 SC51 Widening			SHEET 2
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.9	53.7
B	Residential 1/3 ac	72			16.0	1149.8
B	Pasture	61			28.2	1719.6
B	Woods	55			12.0	658.9
B	Impervious	98			1.5	149.9
B	Urban business	92			1.5	138.9
				Totals ==>	60.1	3870.9

* Use only one CN source per line

CN (weighted) = total product / total area = 3870.9 / 60.1 = 64.5 Use CN ====> 64

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.72	1.66	2.32	2.88	3.48

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.094 mi^2 (acres/640)

Runoff curve number..... CN = 64 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.4 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.125	1.125	1.125	1.125	1.125
5. Compute I_a/P		0.32	0.22	0.19	0.16	0.15
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	475	540	555	570	575
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.72	1.66	2.32	2.88	3.48
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	32	84	121	154	188

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JOB:	US21 SC51 Widening			SHEET 1
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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.800		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0410		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4458	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	313		
9. Watercourse slope, s	ft./ft.	0.0895		
10. Average velocity, V (figure 3-1)	ft./sec.	4.83		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0180	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	11.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.0248		
15. Channel slope, s	ft./ft.	0.0175		
16. Manning's roughness coefficient, n		0.0450		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.45		
17b. Input Velocity, FPS	ft./sec.	4.45		
18. Flow length, L	ft.	2575		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.1607	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.6245	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.75 Hour
45 min

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SUBJECT:	Outfall 2			
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			19.2	1169.4
B	Cultivated land	75			8.5	634.5
B	Residential 1/3 ac	72			38.1	2746.1
B	Woods	55			14.5	797.0
B	Impervious	98			10.6	1035.9
B	Residentail multi-family	85			37.7	3207.9
				Totals ==>	128.6	9590.7

* Use only one CN source per line

CN (weighted) = total product / total area = 9590.7 / 128.6 = 74.6 Use CN ====> 75

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.32	2.55	3.35	4.01	4.70

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 2			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.201 mi^2 (acres/640)

Runoff curve number..... CN = 75 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.8 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.667	0.667	0.667	0.667	0.667
5. Compute I_a/P		0.19	0.13	0.11	0.10	0.09
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	400	430	435	440	445
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.32	2.55	3.35	4.01	4.70
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	106	220	293	354	420

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.800		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0410		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4458	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	313		
9. Watercourse slope, s	ft./ft.	0.0895		
10. Average velocity, V (figure 3-1)	ft./sec.	4.83		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0180	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	12.00		
13. Wetted perimeter, p_w	ft.	11.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.0248		
15. Channel slope, s	ft./ft.	0.0175		
16. Manning's roughness coefficient, n		0.0450		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.45		
17b. Input Velocity, FPS	ft./sec.	4.45		
18. Flow length, L	ft.	2575		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.1607	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.6245	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.75 Hour
45 min

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SUBJECT:	Outfall 3			OF 3
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CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			13.4	816.2
B	Cultivated land	75			0.0	0.0
B	Woods	55			13.1	721.6
B	Residential 1/3 ac	72			38.1	2746.1
B	Impervious	98			17.0	1669.9
B	Residential multi-family	85			43.7	3712.0
				Totals ==>	125.4	9665.7

* Use only one CN source per line

CN (weighted) = total product / total area = 9665.7 / 125.4 = 77.1 Use CN ====> **77**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.45	2.72	3.55	4.22	4.93

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 3			
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.196 mi^2 (acres/640)

Runoff curve number..... CN = 77 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.8 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.597	0.597	0.597	0.597	0.597
5. Compute I_a/P		0.17	0.12	0.10	0.09	0.08
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	395	425	430	435	440
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.45	2.72	3.55	4.22	4.93
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	112	227	299	360	425

STV Incorporated	JOB:	US21 SC51 Widening		SHEET
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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	77		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0210		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1239	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	16.00		
13. Wetted perimeter, p_w	ft.	16.49		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9703		
15. Channel slope, s	ft./ft.	0.0330		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	7.58		
17b. Input Velocity, FPS	ft./sec.	7.58		
18. Flow length, L	ft.	709		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0260	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1499	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.1499 Hour

9 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			2.6	157.4
B	Woods	55			0.8	44.0
B	Impervious	98			0.5	48.0
B	Inudstrial	88				
				Totals ==>	3.9	249.4

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{249.4}{3.9} = 64.4$ Use CN ====> **64**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.72	1.66	2.32	2.88	3.48

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.006 mi^2 (acres/640)

Runoff curve number..... CN = 64 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.1 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.125	1.125	1.125	1.125	1.125
5. Compute I_a/P		0.32	0.22	0.19	0.16	0.15
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	780	830	855	875	880
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.72	1.66	2.32	2.88	3.48
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	3	8	12	15	19

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	159		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0400		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1710	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	8.00		
13. Wetted perimeter, p_w	ft.	8.94		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.8949		
15. Channel slope, s	ft./ft.	0.0180		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.30		
17b. Input Velocity, FPS	ft./sec.	5.30		
18. Flow length, L	ft.	592		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0310	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2020	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.20 Hour
12 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			2.9	176.3
B	Woods	55			0.8	44.0
B	Impervious	98			0.7	65.7
B	Inudstrial	88				
				Totals ==>	4.4	286.0

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{286.0}{4.4} = 65.6$ Use CN ====> **66**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.81	1.81	2.50	3.08	3.70

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.007 mi^2 (acres/640)

Runoff curve number..... CN = 66 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.030	1.030	1.030	1.030	1.030
5. Compute I_a/P		0.29	0.20	0.17	0.15	0.14
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	720	760	775	780	785
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.81	1.81	2.50	3.08	3.70
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	4	9	13	16	20

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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3232	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	48.00		
13. Wetted perimeter, p_w	ft.	48.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9965		
15. Channel slope, s	ft./ft.	0.0860		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	12.46		
17b. Input Velocity, FPS	ft./sec.	12.46		
18. Flow length, L	ft.	467		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0104	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3336	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour
20 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.2	70.2
B	Woods	55			3.8	209.6
B	Impervious	98			0.0	3.9
B	Dirt Road	82			0.2	14.8
				Totals ==>	5.2	298.4

* Use only one CN source per line

CN (weighted) = total product / total area = 298.4 / 5.2 = 57.6 Use CN ====> 58

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.46	1.24	1.81	2.30	2.84

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.008 mi^2 (acres/640)

Runoff curve number..... CN = 58 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.3 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.448	1.448	1.448	1.448	1.448
5. Compute I_a/P		0.41	0.28	0.24	0.21	0.19
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	435	560	580	595	605
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.46	1.24	1.81	2.30	2.84
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	2	6	8	11	14

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3232	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	48.00		
13. Wetted perimeter, p_w	ft.	48.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.9965		
15. Channel slope, s	ft./ft.	0.0860		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	12.46		
17b. Input Velocity, FPS	ft./sec.	12.46		
18. Flow length, L	ft.	467		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0104	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3336	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour
20 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.8	108.0
B	Woods	55			3.3	181.5
B	Impervious	98			0.2	22.5
B	Dirt Road	82			0.2	13.9
				Totals ==>	5.5	326.0

* Use only one CN source per line

CN (weighted) = total product / total area = 326.0 / 5.5 = 59.6 Use CN ====> 60

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.54	1.37	1.97	2.49	3.05

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.009 mi^2 (acres/640)

Runoff curve number..... CN = 60 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.3 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.333	1.333	1.333	1.333	1.333
5. Compute I_a/P		0.38	0.26	0.22	0.19	0.17
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	465	570	585	605	610
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.54	1.37	1.97	2.49	3.05
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	2	7	10	13	16

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 6			
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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	192		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0270		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2327	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	48.13		
13. Wetted perimeter, p_w	ft.	23.85		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	2.0180		
15. Channel slope, s	ft./ft.	0.0270		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	11.17		
17b. Input Velocity, FPS	ft./sec.	11.17		
18. Flow length, L	ft.	683		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0170	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2497	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.25 Hour

15 min

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SUBJECT:	Outfall 6			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			2.6	156.2
B	Woods	55			2.1	113.9
B	Impervious	98			1.9	186.2
B	Urban business	92			6.1	562.1
				Totals ==>	12.6	1018.3

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1018.3}{12.6} = 80.6$ Use CN ====> **81**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.72	3.09	3.96	4.66	5.38

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 6			
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	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.020 mi^2 (acres/640)

Runoff curve number..... CN = 81 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.469	0.469	0.469	0.469	0.469
5. Compute I_a/P		0.13	0.09	0.08	0.07	0.06
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	715	745	750	755	760
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.72	3.09	3.96	4.66	5.38
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	24	45	59	69	81

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.280		
3. Flow length, L (total L ≤ 300 ft)	ft.	237		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0370		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4000	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	254		
9. Watercourse slope, s	ft./ft.	0.0190		
10. Average velocity, V (figure 3-1)	ft./sec.	2.22		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0317	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	4.91		
13. Wetted perimeter, p_w	ft.	7.85		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.6255		
15. Channel slope, s	ft./ft.	0.0099		
16. Manning's roughness coefficient, n		0.0120		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	9.04		
17b. Input Velocity, FPS	ft./sec.	9.04		
18. Flow length, L	ft.	740		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0227	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4545	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.45 Hour
27 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			2.6	156.2
B	Woods	55			2.1	113.9
B	Impervious	98			1.9	186.2
B	Urban business	92			6.1	562.1
				Totals ==>	12.6	1018.3

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1018.3}{12.6} = 80.6$ Use CN ====> **81**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.72	3.09	3.96	4.66	5.38

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.020 mi^2 (acres/640)

Runoff curve number..... CN = 81 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.5 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.469	0.469	0.469	0.469	0.469
5. Compute I_a/P		0.13	0.09	0.08	0.07	0.06
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	540	575	580	585	590
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.72	3.09	3.96	4.66	5.38
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	18	35	45	54	63

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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	72		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0370		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0936	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	7.68		
13. Wetted perimeter, p_w	ft.	10.12		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7589		
15. Channel slope, s	ft./ft.	0.0120		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.88		
17b. Input Velocity, FPS	ft./sec.	3.88		
18. Flow length, L	ft.	283		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0203	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1139	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

7 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.9	54.9
B	Woods	55				
B	Impervious	98			1.2	121.5
B	Urban business	92			1.2	108.6
				Totals ==>	3.3	285.0

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{285.0}{3.3} = 85.8$ Use CN ====> **86**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	2.12	3.58	4.49	5.21	5.96

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 7		
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.005 mi^2 (acres/640)

Runoff curve number..... CN = 86 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.1 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.326	0.326	0.326	0.326	0.326
5. Compute I_a/P		0.09	0.06	0.05	0.05	0.04
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	980	985	990	990	992
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	2.12	3.58	4.49	5.21	5.96
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	11	18	23	27	31

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	72		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0370		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0936	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	7.68		
13. Wetted perimeter, p_w	ft.	10.12		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7589		
15. Channel slope, s	ft./ft.	0.0120		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.88		
17b. Input Velocity, FPS	ft./sec.	3.88		
18. Flow length, L	ft.	283		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0203	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1139	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour
7 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.0	59.2
B	Woods	55				
B	Impervious	98			0.7	68.6
B	Urban business	92			1.0	93.8
				Totals ==>	2.7	221.6

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{221.6}{2.7} = 82.4$ Use CN ====> **82**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.80	3.19	4.06	4.77	5.50

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.004 mi^2 (acres/640)

Runoff curve number..... CN = 82 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.1 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.439	0.439	0.439	0.439	0.439
5. Compute I_a/P		0.12	0.09	0.07	0.06	0.06
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	965	985	990	993	993
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.80	3.19	4.06	4.77	5.50
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	7	13	17	20	23

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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	115		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0350		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1392	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	3.00		
13. Wetted perimeter, p_w	ft.	6.32		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4747		
15. Channel slope, s	ft./ft.	0.0290		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.41		
17b. Input Velocity, FPS	ft./sec.	4.41		
18. Flow length, L	ft.	454		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0286	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1678	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.17 Hour

10 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.4	26.2
B	Woods	55			0.4	20.9
B	Impervious	98			0.2	22.5
B	Urban business	92				
				Totals ==>	1.0	69.7

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{69.7}{1.0} = 67.0$ Use CN ====> **67**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.86	1.89	2.59	3.18	3.81

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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331 East Main Street, Suite 200	SUBJECT:	Outfall 8			3
Rock Hill, South Carolina 29730	CALC'D BY:	GPP	DATE:	8-Dec-23	OF
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.002 mi^2 (acres/640)

Runoff curve number..... CN = 67 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.985	0.985	0.985	0.985	0.985
5. Compute I_a/P		0.28	0.19	0.16	0.14	0.13
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	775	820	825	830	835
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.86	1.89	2.59	3.18	3.81
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	3	3	4	5

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	115		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0350		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1392	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	2.50		
13. Wetted perimeter, p_w	ft.	5.39		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4638		
15. Channel slope, s	ft./ft.	0.0345		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.74		
17b. Input Velocity, FPS	ft./sec.	4.74		
18. Flow length, L	ft.	454		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0266	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1658	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.17 Hour

10 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.4	26.2
B	Woods	55			0.4	20.9
B	Impervious	98			0.0	2.0
B	Dirt Road	82			0.2	17.2
				Totals ==>	1.0	66.3

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{66.3}{1.0} = 63.8$ Use CN ====> **64**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.72	1.66	2.32	2.88	3.48

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.002 mi^2 (acres/640)

Runoff curve number..... CN = 64 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.125	1.125	1.125	1.125	1.125
5. Compute I_a/P		0.32	0.22	0.19	0.16	0.15
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	750	805	815	820	825
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.72	1.66	2.32	2.88	3.48
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	2	3	4	5

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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0464	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	438		
9. Watercourse slope, s	ft./ft.	0.0240		
10. Average velocity, V (figure 3-1)	ft./sec.	3.15		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0386	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	6.00		
13. Wetted perimeter, p_w	ft.	12.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4930		
15. Channel slope, s	ft./ft.	0.0400		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.31		
17b. Input Velocity, FPS	ft./sec.	5.31		
18. Flow length, L	ft.	373		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0195	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1045	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

6 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.8	108.6
B	Woods	55				
B	Impervious	98			1.6	153.9
B	Urban business	92				
				Totals ==>	3.4	262.4

* Use only one CN source per line

CN (weighted) = total product / total area = 262.4 / 3.4 = 78.3 Use CN ====> 78

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.51	2.81	3.65	4.33	5.04

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.005 mi^2 (acres/640)

Runoff curve number..... CN = 78 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.1 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.564	0.564	0.564	0.564	0.564
5. Compute I_a/P		0.16	0.11	0.09	0.08	0.07
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	985	995	1000	1000	1000
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.51	2.81	3.65	4.33	5.04
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	8	15	19	23	26

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	91		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0330		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0146	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	265		
9. Watercourse slope, s	ft./ft.	0.0190		
10. Average velocity, V (figure 3-1)	ft./sec.	2.80		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0263	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	1.77		
13. Wetted perimeter, p_w	ft.	4.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.3758		
15. Channel slope, s	ft./ft.	0.0220		
16. Manning's roughness coefficient, n		0.0120		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	9.59		
17b. Input Velocity, FPS	ft./sec.	9.59		
18. Flow length, L	ft.	189		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0055	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0464	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.05 Hour

3 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.8	108.6
B	Woods	55				
B	Impervious	98			1.6	153.9
B	Dirt Road	82				
				Totals ==>	3.4	262.4

* Use only one CN source per line

CN (weighted) = total product / total area = 262.4 / 3.4 = 78.3 Use CN ====> 78

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.51	2.81	3.65	4.33	5.04

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.005 mi^2 (acres/640)

Runoff curve number..... CN = 78 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.0 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.564	0.564	0.564	0.564	0.564
5. Compute I_a/P		0.16	0.11	0.09	0.08	0.07
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	970	990	1000	1000	1000
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.51	2.81	3.65	4.33	5.04
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	8	15	19	23	26

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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.350		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0420		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.5489	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	447		
9. Watercourse slope, s	ft./ft.	0.0470		
10. Average velocity, V (figure 3-1)	ft./sec.	3.50		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0355	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	5.00		
13. Wetted perimeter, p_w	ft.	10.20		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4902		
15. Channel slope, s	ft./ft.	0.0550		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	6.21		
17b. Input Velocity, FPS	ft./sec.	6.21		
18. Flow length, L	ft.	523		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0234	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.6078	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.61 Hour

36 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			3.3	203.1
B	Woods	55			12.4	682.0
B	Impervious	98			1.5	143.1
B	Urban business	92			1.8	162.8
				Totals ==>	19.0	1191.1

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1191.1}{19.0} = 62.8$ Use CN ====> **63**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.67	1.59	2.23	2.78	3.37

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.030 mi^2 (acres/640)

Runoff curve number..... CN = 63 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.6 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.175	1.175	1.175	1.175	1.175
5. Compute I_a/P		0.33	0.23	0.19	0.17	0.15
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	365	425	435	445	455
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.67	1.59	2.23	2.78	3.37
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	7	20	29	37	45

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 10			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.350		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0420		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.5489	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	447		
9. Watercourse slope, s	ft./ft.	0.0470		
10. Average velocity, V (figure 3-1)	ft./sec.	3.50		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0355	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	5.00		
13. Wetted perimeter, p_w	ft.	10.20		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4902		
15. Channel slope, s	ft./ft.	0.0550		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	6.21		
17b. Input Velocity, FPS	ft./sec.	6.21		
18. Flow length, L	ft.	523		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0234	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.6078	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.61 Hour
36 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 10			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			2.9	175.1
B	Woods	55			12.4	682.0
B	Impervious	98			2.5	245.0
B	Urban business	92			1.8	162.8
				Totals ==>	19.5	1264.9

* Use only one CN source per line

CN (weighted) = total product / total area = 1264.9 / 19.5 = 64.7 Use CN ====> 65

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.76	1.73	2.41	2.98	3.59

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

STV Incorporated	JOB:	US21 SC51 Widening			SHEET
331 East Main Street, Suite 200	SUBJECT:	Outfall 10			3
Rock Hill, South Carolina 29730	CALC'D BY:	GPP	DATE:	8-Dec-23	OF
803 207 2025 www.stvinc.com	CHECK'D BY:	SCN	DATE:	8-Dec-23	3

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.031 mi^2 (acres/640)

Runoff curve number..... CN = 65 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.6 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.077	1.077	1.077	1.077	1.077
5. Compute I_a/P		0.31	0.21	0.18	0.16	0.14
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	380	425	440	445	455
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.76	1.73	2.41	2.98	3.59
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	9	22	32	40	50

STV Incorporated	JOB:	US21 SC51 Widening		SHEET
331 Eat Main Street, Suite 200	SUBJECT:	Outfall 11		1
Rock Hill, South Carolina 29730	CALC'D BY:	GPP	DATE: 8-Dec-23	OF
803 207 2025 www.stvinc.com	CHECK'D BY:	GPP	DATE: 8-Dec-23	3

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.240		
3. Flow length, L (total L ≤ 300 ft)	ft.	109		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0241		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2255	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	680.00		
13. Wetted perimeter, p_w	ft.	129.66		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	5.2445		
15. Channel slope, s	ft./ft.	0.0370		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	24.72		
17b. Input Velocity, FPS	ft./sec.	24.72		
18. Flow length, L	ft.	2053		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0231	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2486	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.25 Hour

15 min

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SUBJECT:	Outfall 11			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			33.8	2061.2
B	Woods	55			7.6	417.5
B	Impervious	98			9.3	913.4
B	Urban business	92			14.6	1346.9
				Totals ==>	65.3	4738.9

* Use only one CN source per line

CN (weighted) = total product / total area = 4738.9 / 65.3 = 72.5 Use CN ====> 73

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.19	2.37	3.16	3.80	4.47

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 11			
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.102 mi^2 (acres/640)

Runoff curve number..... CN = 73 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.740	0.740	0.740	0.740	0.740
5. Compute I_a/P		0.21	0.14	0.12	0.11	0.10
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	680	728	730	732	735
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.19	2.37	3.16	3.80	4.47
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	83	177	235	284	336

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SUBJECT:	Outfall 11			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.240		
3. Flow length, L (total L ≤ 300 ft)	ft.	109		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0241		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2255	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	384.00		
13. Wetted perimeter, p_w	ft.	124.00		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	3.0968		
15. Channel slope, s	ft./ft.	0.0336		
16. Manning's roughness coefficient, n		0.0250		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	23.21		
17b. Input Velocity, FPS	ft./sec.	23.21		
18. Flow length, L	ft.	2311		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0277	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2531	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.25 Hour

15 min

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SUBJECT:	Outfall 11			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			33.5	2042.3
B	Woods	55			7.8	431.2
B	Impervious	98			11.4	1115.2
B	Urban business	92			15.1	1387.4
				Totals ==>	67.8	4976.1

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4976.1}{67.8} = 73.4$ Use CN ====> **73**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.19	2.37	3.16	3.80	4.47

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 11			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.106 mi^2 (acres/640)

Runoff curve number..... CN = 73 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.3 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.740	0.740	0.740	0.740	0.740
5. Compute I_a/P		0.21	0.14	0.12	0.11	0.10
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	680	725	728	731	735
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.19	2.37	3.16	3.80	4.47
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	86	182	243	294	348

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 14			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.8218	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	176		
9. Watercourse slope, s	ft./ft.	0.0630		
10. Average velocity, V (figure 3-1)	ft./sec.	4.05		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0121	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0240		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.34		
17b. Input Velocity, FPS	ft./sec.	5.34		
18. Flow length, L	ft.	1777		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0925	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.9264	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.93 Hour
56 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 14			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			6.5	395.9
B	Woods	55			36.5	2006.4
B	Impervious	98			2.9	285.2
B	Urban business	92			23.0	2113.2
				Totals ==>	68.9	4800.7

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4800.7}{68.9} = 69.7$ Use CN ====> 70

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.02	2.13	2.87	3.49	4.14

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 14			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.108 mi^2 (acres/640)

Runoff curve number..... CN = 70 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.9 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.857	0.857	0.857	0.857	0.857
5. Compute I_a/P		0.24	0.17	0.14	0.13	0.11
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	330	360	370	375	380
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.02	2.13	2.87	3.49	4.14
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	36	82	114	141	169

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 14			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.8218	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	176		
9. Watercourse slope, s	ft./ft.	0.0630		
10. Average velocity, V (figure 3-1)	ft./sec.	4.05		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0121	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0240		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.34		
17b. Input Velocity, FPS	ft./sec.	5.34		
18. Flow length, L	ft.	1777		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0925	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.9264	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.93 Hour
56 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 14			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			3.2	197.0
B	Woods	55			32.3	1778.2
B	Impervious	98			12.3	1208.3
B	Urban business	92			22.4	2064.5
				Totals ==>	70.3	5248.0

* Use only one CN source per line

CN (weighted) = total product / total area = 5248.0 / 70.3 = 74.6 Use CN ====> 75

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.32	2.55	3.35	4.01	4.70

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 14			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.110 mi^2 (acres/640)

Runoff curve number..... CN = 75 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.9 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.667	0.667	0.667	0.667	0.667
5. Compute I_a/P		0.19	0.13	0.11	0.10	0.09
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	345	365	375	380	385
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.32	2.55	3.35	4.01	4.70
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	50	102	138	167	199

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TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	25		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0514	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	155		
9. Watercourse slope, s	ft./ft.	0.0190		
10. Average velocity, V (figure 3-1)	ft./sec.	2.22		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0194	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	6.00		
13. Wetted perimeter, p_w	ft.	12.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4930		
15. Channel slope, s	ft./ft.	0.0350		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.97		
17b. Input Velocity, FPS	ft./sec.	4.97		
18. Flow length, L	ft.	513		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0287	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0994	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

6 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.5	28.1
B	Woods	55			0.2	9.4
B	Impervious	98			0.2	19.6
B	Urban business	92				
				Totals ==>	0.8	57.0

* Use only one CN source per line

CN (weighted) = total product / total area = 57.0 / 0.8 = 68.7 Use CN ====> 69

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.97	2.05	2.78	3.38	4.03

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.001 mi^2 (acres/640)

Runoff curve number..... CN = 69 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.1 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.899	0.899	0.899	0.899	0.899
5. Compute I_a/P		0.26	0.18	0.15	0.13	0.12
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	965	980	985	990	995
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.97	2.05	2.78	3.38	4.03
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	3	4	4	5

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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	36		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0090		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0946	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	18.00		
13. Wetted perimeter, p_w	ft.	13.42		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.3413		
15. Channel slope, s	ft./ft.	0.0250		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	8.19		
17b. Input Velocity, FPS	ft./sec.	8.19		
18. Flow length, L	ft.	478		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0162	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1109	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.11 Hour
7 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 15			
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.4	23.2
B	Woods	55				
B	Impervious	98			0.4	41.2
B	Urban business	92				
				Totals ==>	0.8	64.3

* Use only one CN source per line

CN (weighted) = total product / total area = 64.3 / 0.8 = 80.4 Use CN ====> 80

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.65	3.00	3.85	4.55	5.27

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 15			
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.001 mi^2 (acres/640)

Runoff curve number..... CN = 80 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.1 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.500	0.500	0.500	0.500	0.500
5. Compute I_a/P		0.14	0.10	0.08	0.07	0.07
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	960	980	983	985	987
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.65	3.00	3.85	4.55	5.27
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	2	4	5	6	7

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 16			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	174		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0120		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2975	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	211		
9. Watercourse slope, s	ft./ft.	0.0050		
10. Average velocity, V (figure 3-1)	ft./sec.	1.44		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0408	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	6.00		
13. Wetted perimeter, p_w	ft.	12.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4930		
15. Channel slope, s	ft./ft.	0.0220		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.94		
17b. Input Velocity, FPS	ft./sec.	3.94		
18. Flow length, L	ft.	1160		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0818	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4200	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.42 Hour
25 min

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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.7	39.7
B	Woods	55				
B	Impervious	98			0.6	61.7
B	Urban business	92			1.2	105.8
				Totals ==>	2.4	207.2

* Use only one CN source per line

CN (weighted) = total product / total area = 207.2 / 2.4 = 85.3 Use CN ====> 85

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	2.03	3.48	4.38	5.10	5.85

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 16			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.004 mi^2 (acres/640)

Runoff curve number..... CN = 85 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.4 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.353	0.353	0.353	0.353	0.353
5. Compute I_a/P		0.10	0.07	0.06	0.05	0.05
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	580	590	595	600	600
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	2.03	3.48	4.38	5.10	5.85
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	4	8	10	12	13

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JOB:	US21 SC51 Widening			SHEET 1
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CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	81		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1563	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	217		
9. Watercourse slope, s	ft./ft.	0.0270		
10. Average velocity, V (figure 3-1)	ft./sec.	2.65		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0227	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	50.00		
13. Wetted perimeter, p_w	ft.	22.36		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	2.2361		
15. Channel slope, s	ft./ft.	0.0250		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	11.51		
17b. Input Velocity, FPS	ft./sec.	11.51		
18. Flow length, L	ft.	521		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0126	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1916	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.19 Hour
11 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 16			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.6	95.2
B	Woods	55				
B	Impervious	98			0.1	8.8
B	Urban business	92				
				Totals ==>	1.7	104.0

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{104.0}{1.7} = 63.0$ Use CN ====> **63**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.67	1.59	2.23	2.78	3.37

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 16			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.003 mi^2 (acres/640)

Runoff curve number..... CN = 63 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.175	1.175	1.175	1.175	1.175
5. Compute I_a/P		0.33	0.23	0.19	0.17	0.15
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	680	750	775	782	790
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.67	1.59	2.23	2.78	3.37
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	3	4	6	7

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 17			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	229		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0440		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2204	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	1.77		
13. Wetted perimeter, p_w	ft.	4.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.3758		
15. Channel slope, s	ft./ft.	0.0400		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.43		
17b. Input Velocity, FPS	ft./sec.	4.43		
18. Flow length, L	ft.	103		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0065	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2268	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.23 Hour
14 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 17			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.5	93.9
B	Woods	55				
B	Impervious	98			0.3	31.4
B	Urban business	92				
				Totals ==>	1.9	125.3

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{125.3}{1.9} = 67.4$ Use CN ====> **67**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.86	1.89	2.59	3.18	3.81

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 17			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.003 mi^2 (acres/640)

Runoff curve number..... CN = 67 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.985	0.985	0.985	0.985	0.985
5. Compute I_a/P		0.28	0.19	0.16	0.14	0.13
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	670	705	720	730	735
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.86	1.89	2.59	3.18	3.81
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	2	4	5	7	8

STV Incorporated	JOB:	US21 SC51 Widening		SHEET
331 Eat Main Street, Suite 200	SUBJECT:	Outfall 17		1
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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	229		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0440		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2204	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	1.77		
13. Wetted perimeter, p_w	ft.	4.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.3758		
15. Channel slope, s	ft./ft.	0.0400		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.43		
17b. Input Velocity, FPS	ft./sec.	4.43		
18. Flow length, L	ft.	103		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0065	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2268	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.23 Hour

14 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 17			
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.3	78.1
B	Woods	55				
B	Impervious	98			0.1	10.8
B	Urban business	92				
				Totals ==>	1.4	88.9

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{88.9}{1.4} = 63.9$ Use CN ====> **64**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.72	1.66	2.32	2.88	3.48

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 17			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.002 mi^2 (acres/640)

Runoff curve number..... CN = 64 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	1.125	1.125	1.125	1.125	1.125
5. Compute I_a/P		0.32	0.22	0.19	0.16	0.15
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	650	700	715	735	740
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.72	1.66	2.32	2.88	3.48
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	3	4	5	6

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 18			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	212		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0510		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1953	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	3.00		
13. Wetted perimeter, p_w	ft.	6.32		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4747		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.95		
17b. Input Velocity, FPS	ft./sec.	2.95		
18. Flow length, L	ft.	186		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0175	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2128	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.21 Hour

13 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 18			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.5	28.7
B		55				
B	Impervious	98			0.1	5.9
B	Residential 1/3 ac	72			0.5	36.0
				Totals ==>	1.0	70.6

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{70.6}{1.0} = 68.5$ Use CN ====> **68**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.91	1.97	2.68	3.28	3.92

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 18			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.002 mi^2 (acres/640)

Runoff curve number..... CN = 68 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.941	0.941	0.941	0.941	0.941
5. Compute I_a/P		0.27	0.18	0.15	0.14	0.12
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	720	745	770	775	780
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.91	1.97	2.68	3.28	3.92
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	2	3	4	5

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JOB:	US21 SC51 Widening			SHEET 1
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CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
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TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	212		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0510		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1953	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	3.00		
13. Wetted perimeter, p_w	ft.	6.32		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4747		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	2.95		
17b. Input Velocity, FPS	ft./sec.	2.95		
18. Flow length, L	ft.	186		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0175	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2128	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.21 Hour
13 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 18			OF 3
CALC'D BY:	GPP	DATE:	8-Dec-23	
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			0.5	28.7
B	Woods	55				
B	Impervious	98			0.1	5.9
B	Residential 1/3 ac	72			0.5	36.0
				Totals ==>	1.0	70.6

* Use only one CN source per line

CN (weighted) = total product / total area = 70.6 / 1.0 = 68.5 Use CN ====> **68**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.91	1.97	2.68	3.28	3.92

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 18			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.002 mi^2 (acres/640)

Runoff curve number..... CN = 68 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.941	0.941	0.941	0.941	0.941
5. Compute I_a/P		0.27	0.18	0.15	0.14	0.12
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	705	745	760	765	775
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.91	1.97	2.68	3.28	3.92
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	1	2	3	4	5

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 19			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	153		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2599	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	6.00		
13. Wetted perimeter, p_w	ft.	12.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4930		
15. Channel slope, s	ft./ft.	0.0340		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.90		
17b. Input Velocity, FPS	ft./sec.	4.90		
18. Flow length, L	ft.	1169		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0663	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3262	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour
20 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 19			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			9.8	597.8
B	Woods	55			0.4	23.1
B	Impervious	98			4.9	483.1
B	Cultivated land	78			7.5	582.7
				Totals ==>	22.6	1686.7

* Use only one CN source per line

CN (weighted) = total product / total area = 1686.7 / 22.6 = 74.6 Use CN ====> 75

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.32	2.55	3.35	4.01	4.70

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

STV Incorporated	JOB:	US21 SC51 Widening			SHEET
331 East Main Street, Suite 200	SUBJECT:	Outfall 19			3
Rock Hill, South Carolina 29730	CALC'D BY:	GPP	DATE:	8-Dec-23	OF
803 207 2025 www.stvinc.com	CHECK'D BY:	SCN	DATE:	8-Dec-23	3

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.035 mi^2 (acres/640)

Runoff curve number..... CN = 75 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.3 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.667	0.667	0.667	0.667	0.667
5. Compute I_a/P		0.19	0.13	0.11	0.10	0.09
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	605	630	645	655	660
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.32	2.55	3.35	4.01	4.70
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	28	57	76	93	110

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JOB:	US21 SC51 Widening			SHEET	1
SUBJECT:	Outfall 19				
CALC'D BY:	GPP	DATE:	8-Dec-23	OF	3
CHECK'D BY:	SCN	DATE:	8-Dec-23		

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	153		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2599	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	6.00		
13. Wetted perimeter, p_w	ft.	12.17		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4930		
15. Channel slope, s	ft./ft.	0.0340		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.90		
17b. Input Velocity, FPS	ft./sec.	4.90		
18. Flow length, L	ft.	1169		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0663	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3262	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour
20 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 19			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			7.4	453.2
B	Woods	55				
B	Impervious	98			5.3	514.5
B	Residential 1/3 ac	72				
				Totals ==>	12.7	967.7

* Use only one CN source per line

CN (weighted) = total product / total area = 967.7 / 12.7 = 76.3 Use CN ====> 76

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.38	2.63	3.45	4.12	4.81

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 19			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.020 mi^2 (acres/640)

Runoff curve number..... CN = 76 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.3 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.632	0.632	0.632	0.632	0.632
5. Compute I_a/P		0.18	0.12	0.10	0.09	0.08
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	610	627	655	660	665
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.38	2.63	3.45	4.12	4.81
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	17	33	45	54	63

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 20			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	GPP	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☑ Present ☐ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	107		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1953	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.93		
17b. Input Velocity, FPS	ft./sec.	3.93		
18. Flow length, L	ft.	120		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0085	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2038	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.20 Hour

12 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 20			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☑ Present ☐ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.5	93.9
B	Woods	55				
B	Impervious	98			0.2	22.5
B	Cultivated land	78			0.4	27.3
				Totals ==>	2.1	143.8

* Use only one CN source per line

CN (weighted) = total product / total area = 143.8 / 2.1 = 67.8 Use CN ====> **68**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	0.91	1.97	2.68	3.28	3.92

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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	SUBJECT:	Outfall 20			
	CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
	CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☑ Present ☐ Developed

1. Data

Drainage area..... A_m = 0.003 mi^2 (acres/640)

Runoff curve number..... CN = 68 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.941	0.941	0.941	0.941	0.941
5. Compute I_a/P		0.27	0.18	0.15	0.14	0.12
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	720	760	777	780	790
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	0.91	1.97	2.68	3.28	3.92
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	2	5	7	8	10

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JOB:	US21 SC51 Widening			SHEET 1
SUBJECT:	Outfall 20			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

TIME OF CONCENTRATION (T_C)

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	107		
4. Two-year 24-hour rainfall, P_2	in.	3.52		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1953	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	9.00		
13. Wetted perimeter, p_w	ft.	12.37		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.7276		
15. Channel slope, s	ft./ft.	0.0130		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.93		
17b. Input Velocity, FPS	ft./sec.	3.93		
18. Flow length, L	ft.	120		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0085	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2038	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.20 Hour
12 min

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JOB:	US21 SC51 Widening			SHEET 2
SUBJECT:	Outfall 20			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

RUNOFF CURVE NUMBER AND RUNOFF

Check one: ☐ Present ☑ Developed

Runoff Curve Number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Figure 2-3	CN* Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
B	Grass	61			1.6	98.2
B	Woods	55				
B	Impervious	98			0.5	48.0
B	Residential 1/3 ac	72				
				Totals ==>	2.1	146.2

* Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{146.2}{2.1} = 69.6$ Use CN ====> **70**

Runoff

	Storm # 1	Storm # 2	Storm # 3	Storm # 4	Storm # 5
Frequency.....yr	2	10	25	50	100
Rainfall, P (24-hour)..... in	3.52	5.12	6.08	6.84	7.62
Runoff, Q..... in	1.02	2.13	2.87	3.49	4.14

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

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JOB:	US21 SC51 Widening			SHEET 3
SUBJECT:	Outfall 19			
CALC'D BY:	GPP	DATE:	8-Dec-23	OF 3
CHECK'D BY:	SCN	DATE:	8-Dec-23	

GRAPHICAL PEAK DISCHARGE METHOD

Check one: ☐ Present ☑ Developed

1. Data

Drainage area..... A_m = 0.003 mi^2 (acres/640)

Runoff curve number..... CN = 70 (From CN & Runoff worksheet)

Time of concentration..... T_c = 0.2 hr (From T_c worksheet)

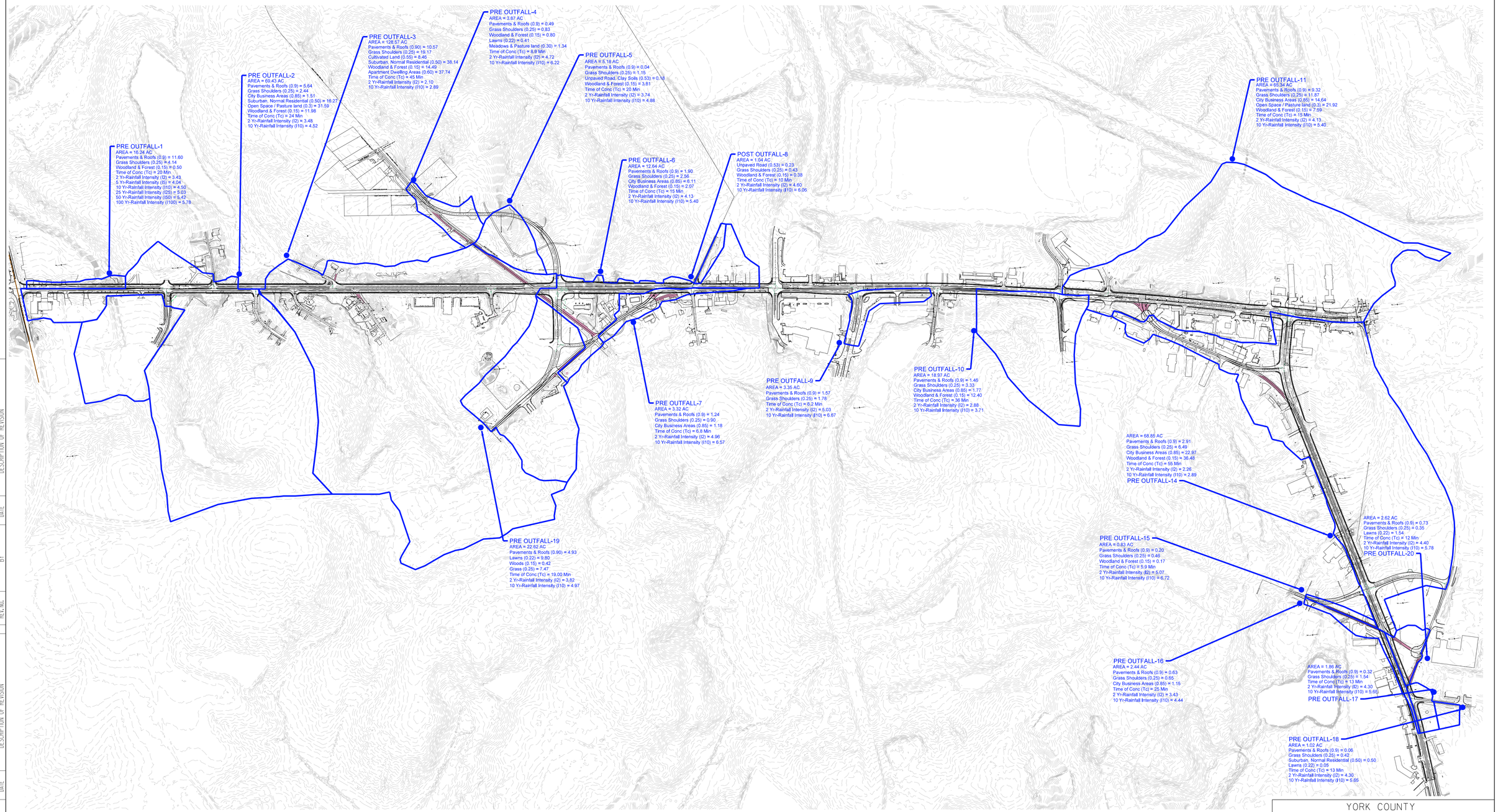
Rainfall distribution..... = II (I, IA, II, III)

Pond and swamp areas spread thoroughout watershed..... = 0.0 percent of A_m (0) acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3	Storm #4	Storm #5
2. Frequency	yr	2	10	25	50	100
3. Rainfall, P (24-hour)	in	3.52	5.12	6.08	6.84	7.62
4. Initial abstraction, I_a ..... (Use CN with table 4-1)	in	0.857	0.857	0.857	0.857	0.857
5. Compute I_a/P		0.24	0.17	0.14	0.13	0.11
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	730	770	780	785	800
7. Runoff, Q ..... (From CN & Runoff worksheet)	in	1.02	2.13	2.87	3.49	4.14
8. Pond and swamp adjustment factor, F_p ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.00	1.00	1.00	1.00	1.00
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	ft^3/s	2	5	7	9	11

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

SOUTH CAROLINA
STV INCORPORATED
NO. C0338
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 21220
GUY PARIS PETERS

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 5
ROCK HILL, SOUTH CAROLINA 29730

400 0 400 800

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
DRAINAGE AREA – PRE

FIGURE 8A

norlega
t:\Projects\256776\256776.000\90_CAD Models and Sheets\04_CT_Transportation\Hydro\Design\Pre vs_Post Analysis\256776 DA-PRE.dgn
8/4/2021

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	II149-004	US 21	

POST OUTFALL-1
AREA = 25.95 AC
Pavements & Roofs (0.9) = 9.63
Grass Shoulders (0.25) = 5.38
Woodland & Forest (0.15) = 0.27
City Business (0.85) = 10.14
Residential (0.50) = 0.53
Time of Conc (Tc) = 20 Min
2 Yr-Rainfall Intensity (I2) = 3.43
5 Yr-Rainfall Intensity (I5) = 4.04
10 Yr-Rainfall Intensity (I10) = 4.50
25 Yr-Rainfall Intensity (I25) = 5.03
50 Yr-Rainfall Intensity (I50) =5.42
100 Yr-Rainfall Intensity (I100) = 5.78

POST OUTFALL-2
AREA = 60.06 AC
Pavements & Roofs (0.9) = 1.53
Grass Shoulders (0.25) = 0.88
City Business Areas (0.85) = 1.51
Suburban, Normal Residential (0.50) = 15.97
Open Space /Pasture (0.3) = 28.19
Woodland & Forest (0.15) = 11.98
Time of Conc (Tc) = 24 Min
2 Yr-Rainfall Intensity (I2) = 3.10
5 Yr-Rainfall Intensity (I5) = 3.68
10 Yr-Rainfall Intensity (I10) = 4.10
25 Yr-Rainfall Intensity (I25) = 4.61
50 Yr-Rainfall Intensity (I50) = 4.98
100 Yr-Rainfall Intensity (I100) = 5.33

POST OUTFALL-3
AREA = 125.35 AC
Pavements & Roofs (0.90) = 17.04
Grass Shoulders (0.25) = 13.38
Suburban, Normal Residential (0.50) = 38.14
Woodland & Forest (0.15) = 13.12
Apartment Dwelling Areas (0.60) = 43.67
Time of Conc (Tc) = 45 Min
2 Yr-Rainfall Intensity (I2) = 2.10
5 Yr-Rainfall Intensity (I5) = 2.55
10 Yr-Rainfall Intensity (I10) = 2.89
25 Yr-Rainfall Intensity (I25) = 3.32
50 Yr-Rainfall Intensity (I50) = 3.65
100 Yr-Rainfall Intensity (I100) = 3.97

POST OUTFALL-4
AREA = 4.36 AC
Pavements & Roofs (0.9) = 0.87
Grass Shoulders (0.25) = 1.42
Woodland & Forest (0.15) = 0.80
Lawns (0.22) = 0.41
Meadows & Pasture land (0.30) = 1.06
Time of Conc (Tc) = 12 Min
2 Yr-Rainfall Intensity (I2) = 4.40
10 Yr-Rainfall Intensity (I10) = 5.78

POST OUTFALL-5
AREA = 5.47 AC
Pavements & Roofs (0.9) = 0.23
Grass Shoulders (0.25) = 1.77
Unpaved Road, Clay Soils (0.53) = 0.17
Woodland & Forest (0.15) = 3.30
Time of Conc (Tc) = 20 Min
2 Yr-Rainfall Intensity (I2) = 3.74
10 Yr-Rainfall Intensity (I10) = 4.88

POST OUTFALL-6
AREA = 11.94 AC
Pavements & Roofs (0.9) = 2.21
Grass Shoulders (0.25) = 4.36
City Business Areas (0.85) = 2.60
Woodland & Forest (0.15) = 0.34
Lawns (0.22) = 0.90
Time of Conc (Tc) = 12 Min
2 Yr-Rainfall Intensity (I2) = 3.96
5 Yr-Rainfall Intensity (I5) = 4.64
10 Yr-Rainfall Intensity (I10) = 5.15
25 Yr-Rainfall Intensity (I25) = 5.73
50 Yr-Rainfall Intensity (I50) = 6.15
100 Yr-Rainfall Intensity (I100) = 6.53

POST OUTFALL-6a
AREA = 2.16 AC
Pavements & Roofs (0.9) = 1.86
Grass Shoulders (0.25) = 0.19
Woodland & Forest (0.15) = 0.11
Time of Conc (Tc) = 5 Min
2 Yr-Rainfall Intensity (I2) = 5.19
10 Yr-Rainfall Intensity (I10) = 6.89

POST OUTFALL-6b
AREA = 11.51 AC
Pavements & Roofs (0.9) = 7.41
Grass Shoulders (0.25) = 1.29
City Business Areas (0.85) = 2.05
Woodland & Forest (0.15) = 0.76
Time of Conc (Tc) = 27 Min
2 Yr-Rainfall Intensity (I2) = 3.31
10 Yr-Rainfall Intensity (I10) = 4.29

POST OUTFALL-8
AREA = 1.05 AC
Pavements & Roofs (0.9) = 0.02
Unpaved Road (0.53) = 0.21
Grass Shoulders (0.25) = 0.43
Woodland & Forest (0.15) = 0.38
Time of Conc (Tc) = 10 Min
2 Yr-Rainfall Intensity (I2) = 4.60
10 Yr-Rainfall Intensity (I10) = 6.06

POST OUTFALL-7
AREA = 2.66 AC
Pavements & Roofs (0.9) = 0.70
Grass Shoulders (0.25) = 0.94
City Business Areas (0.85) = 1.02
Time of Conc (Tc) = 6.8 Min
2 Yr-Rainfall Intensity (I2) = 4.96
10 Yr-Rainfall Intensity (I10) = 6.57

POST OUTFALL-9
AREA = 2.73 AC
Pavements & Roofs (0.9) = 1.23
Grass Shoulders (0.25) = 1.50
Time of Conc (Tc) = 5.0 Min
2 Yr-Rainfall Intensity (I2) = 5.19
10 Yr-Rainfall Intensity (I10) = 6.89

POST OUTFALL-10
AREA = 19.54 AC
Pavements & Roofs (0.9) = 2.50
Grass Shoulders (0.25) = 2.87
City Business Areas (0.85) = 1.77
Woodland & Forest (0.15) = 12.40
Time of Conc (Tc) = 36 Min
2 Yr-Rainfall Intensity (I2) = 2.88
10 Yr-Rainfall Intensity (I10) = 3.71

POST OUTFALL-11
AREA = 67.82 AC
Pavements & Roofs (0.9) = 11.38
Grass Shoulders (0.25) = 12.88
City Business Areas (0.85) = 15.08
Open Space /Pasture (0.3) = 20.64
Woodland & Forest (0.15) = 7.84
Time of Conc (Tc) = 15 Min
2 Yr-Rainfall Intensity (I2) = 4.13
10 Yr-Rainfall Intensity (I10) = 5.40

AREA = 70.33 AC
Pavements & Roofs (0.9) = 12.33
Grass Shoulders (0.25) = 3.23
City Business Areas (0.85) = 22.44
Woodland & Forest (0.15) = 32.33
Time of Conc (Tc) = 55 Min
2 Yr-Rainfall Intensity (I2) = 2.26
10 Yr-Rainfall Intensity (I10) = 2.89

POST OUTFALL-14

POST OUTFALL-15
AREA = 0.80 AC
Pavements & Roofs (0.9) = 0.42
Grass Shoulders (0.25) = 0.38
Time of Conc (Tc) = 6.5 Min
2 Yr-Rainfall Intensity (I2) = 4.98
10 Yr-Rainfall Intensity (I10) = 6.60

AREA = 2.10 AC
Pavements & Roofs (0.9) = 0.49
Grass Shoulders (0.25) = 0.10
Lawns (0.22) = 1.51
Time of Conc (Tc) = 12 Min
2 Yr-Rainfall Intensity (I2) = 4.40
10 Yr-Rainfall Intensity (I10) = 5.78

POST OUTFALL-20

POST OUTFALL-16
AREA = 1.66 AC
Pavements & Roofs (0.9) = 0.09
Grass Shoulders (0.25) = 1.56
Time of Conc (Tc) = 11 Min
2 Yr-Rainfall Intensity (I2) = 4.50
10 Yr-Rainfall Intensity (I10) = 5.91

AREA = 1.39 AC
Pavements & Roofs (0.9) = 0.11
Grass Shoulders (0.25) = 1.28
Time of Conc (Tc) = 13 Min
2 Yr-Rainfall Intensity (I2) = 4.30
10 Yr-Rainfall Intensity (I10) = 5.65

POST OUTFALL-17

POST OUTFALL-18
AREA = 1.02 AC
Pavements & Roofs (0.9) = 0.06
Grass Shoulders (0.25) = 0.42
Suburban, Normal Residential (0.50) = 0.50
Lawns (0.22) = 0.05
Time of Conc (Tc) = 13 Min
2 Yr-Rainfall Intensity (I2) = 4.30
10 Yr-Rainfall Intensity (I10) = 5.65

POST OUTFALL-19
AREA = 12.68 AC
Pavement (0.90) = 6.37
Grass Shoulder (0.25) = 0.77
Lawns (0.22) = 7.07
Time of Conc (Tc) = 19.0 Min
2 Yr-Rainfall Intensity (I2) = 3.82
10 Yr-Rainfall Intensity (I10) = 4.97

400 0 400 800

FIGURE 8B
12–21–20 Update

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51 DRAINAGE AREA – POST

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 5
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED NO. C0338 — CERTIFICATE OF AUTHORIZATION
SOUTH CAROLINA — No. 21220 — LICENSED PROFESSIONAL ENGINEER — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
1			
2			
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norlega
t:\Projects\256776\256776.000\90_CAD Models and Sheets\04_Transportation\Hydro\Design\Pre vs. Post Analysis\256776 DA-POST.dgn
8/4/2021

STV Incorporated
454 South Anderson Road, Suite 3
Rock Hill, South Carolina 29730-3392
803 980 4970 o 803 980 4099 f

JOB:	US21/SC51 Phase I Widening			1
SUBJECT:	Outfalls 1,2 & 3 Comparison			SHEET
CALC'D BY:	GPP	DATE:	22-Dec-2023	OF
CHECK'D BY:	SCN	DATE:	22-Dec-2023	1

PRE VS. POST OUTFALL COMPARISON

GIVEN:

Outfall Location: Road Name **US 21**

Analysis Point **Outfalls 1, 2 and 3**

Outfall 1						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 2 has been redirected to Outfall 1.
Pre (Existing) Discharge (cfs):	40.0	75.0	96.0	115.0	131.0	
Post (Proposed) Discharge (cfs):	86.0	145.0	182.0	211.0	242.0	

Outfall 2						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 2 has been redirected to Outfall 1.
Pre (Existing) Discharge (cfs):	45.0	108.0	153.0	192.0	233.0	
Post (Proposed) Discharge (cfs):	30.0	84.0	121.0	154.0	188.0	

Outfall 3						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 3 has been redirected to Outfall 6.
Pre (Existing) Discharge (cfs):	106.0	220.0	293.0	354.0	420.0	
Post (Proposed) Discharge (cfs):	112.0	227.0	299.0	360.0	425.0	

Outfall 6						Notes
	2yr	10yr	25yr	50yr	100yr	Area from Outfall 3 has been redirected to Outfall 6. Post discharges include new Outfalls 6a and 6b.
Pre (Existing) Discharge (cfs):	24.0	45.0	59.0	69.0	81.0	
Post (Proposed) Discharge (cfs):	18.0	35.0	45.0	54.0	63.0	

Forest Lake (Outfall 2 + 3)						Notes
	2yr	10yr	25yr	50yr	100yr	Based on redirecting Outfall 2 and Outfall 3 areas, overall discharge to Forest Lake has been reduced.
Pre (Existing) Discharge (cfs):	151.0	328.0	446.0	546.0	653.0	
Post (Proposed) Discharge (cfs):	142.0	311.0	420.0	514.0	613.0	
Difference (cfs):	-9.0	-17.0	-26.0	-32.0	-40.0	
Δ %:	-6.0	-5.2	-5.8	-5.9	-6.1	

REMARKS:

To reduce overall peak discharges to Forest Lake, areas from Outfalls 2 and 3 have been reallocated to adjacent Outfalls 1 and 6 respectively. Please see the accompanying exhibits to see the new pipe system alignments used to accomplish this approach.

Peters, Guy P.

From: Bostic, Tameika L. <BosticTL@scdot.org>
Sent: Thursday, November 12, 2020 1:33 PM
To: Carlsten, Christopher E.; Peters, Guy P.
Cc: Hamilton, Patrick
Subject: US-21/SC-51 Widening (0042332) Dam Impacts
Attachments: D3645_Inundation_Mapbook.pdf; D3645 Crest.jpg; D3645Aux.jpg; D3645Primary Outfall.jpg; US 21 Forest Lake.JPG

This e-mail is from outside STV

Gentlemen:

Happy Thursday and hope you are doing well. For the project in the subject line, DHEC has alerted us to a concern with the Lake Forest Dam, which is located approximately 2200 ft from the existing ROW of US-21. I have attached several items to this email concerning the property. Please see the exert from the original email below regarding this issue.

I wanted to make you aware of a concern that was initially raised by a dam owner we are currently working with in York County. Based on the current condition of the dam, the Department shares their concerns with the likely increase in runoff from the widening of US21 from 2 lanes to 5 lanes and potential impacts to the dam. The dam is known to us as Forest Lake (D3645). There are several homes located below the dam; therefore, it is classified as High Hazard based on potential loss of life which may result from failure of the dam.

As shown in the screen grab from SCDOT's project viewer, Lake Forest Dam is located approximately 2200 feet from the existing right-of-way of US21. DHEC Dam Safety has been trying to work with the dam's owner to address significant deficiencies in the primary outlet control structure and auxiliary spillway. It appears from our inspections that the primary is not functioning, which has resulted in increased flows through the auxiliary. These continuous flows have now resulted in head cutting of the earthen spillway, which has progressed since December 2019. The owner is currently working to install interim measures to lower the water level; and, we will be increasing our compliance/enforcement activities to have them engage a professional engineer to work on a plan for repair.

As SCDOT's engineers and consultants work on the design for widening of US21, the department would ask that particular attention be paid and consideration be made for the lack of capacity at Forest Lake Dam. Section 72-425.D(4)(a)(1) of the Standards for Stormwater Management and Sediment Reduction Regulations requires such an analysis and is critical given the potential impacts from failure of this dam due to hydrologic loadings in its present condition.

If SCDOT needs any of the data we have on this dam (inspections, etc,), please don't hesitate to let us know. Included are a few photos from a routine monitoring visit in July, as well as the DSS Wise Lite Inundation Mapbook our staff developed. We would welcome discussing this issue with you as the project is further developed.

Thank you ☺

"Make your dreams happen."

Tameika L. Bostic, EIT
Assistant Program Manager – Midlands
SCDOT
955 Park St. – Room 418
Columbia, SC 29201
(o) 803-737-0457

Peters, Guy P.

From: Sheri A. Williamson
Sent: Thursday, April 18, 2013 3:35 PM
To: Guy P. Peters; Christopher T. Carbuto
Subject: FW: Forest Lake Community and Surrounding Construction

Just want to keep you in the loop.

From: Leazer, Phil [mailto:phil.leazer@yorkcountygov.com]
Sent: Thursday, April 18, 2013 3:34 PM
To: Johnson Michael
Cc: Sheri A. Williamson; Moss, Steven; Hamilton, Patrick
Subject: FW: Forest Lake Community and Surrounding Construction

FYI…..

From: Markle, Korey [HDS] [mailto:Korey.Markle@hdsupply.com]
Sent: Thursday, April 18, 2013 3:22 PM
To: Leazer, Phil
Subject: RE: Forest Lake Community and Surrounding Construction

Phil,

Thank you very much for the reply. I understand Pennies For Progress and the York County Stormwater Department are aware of our situation. It is comforting to hear that the Design Engineer will consider the drainage basin in its highway design. I did not want to come across as being upset, I just wanted the county to realize we are here, and we don't want to be forgotten when the time comes. I believe our discharge pipe through the dam is 15". A short site visit will make obvious the amount of property that feeds our lake. It is very concerning to say the least.

We are having a neighborhood meeting soon and I will include some of this information to the residents. Just that the county is aware of the growth impact to our lake. I will not go into the future highway plans.

Your reply was very timely and I sincerely appreciate your attention to this. Feel free to contact me anytime concerning this or any other issues that affect our community.

Thank you,

Korey Markle
Account Manager
HD Supply Waterworks
901 Crafters Lane
Pineville NC 28134
704-507-6356 office
704-393-8893 fax
704-507-6356 mobile

From: Leazer, Phil [mailto:phil.leazer@yorkcountygov.com]
Sent: Thursday, April 18, 2013 3:03 PM
To: Markle, Korey [HDS]; 'korey.markle@gmail.com'
Cc: Johnson Michael; Sheri A. Williamson (Sheri.Williamson@stvinc.com); Moss, Steven; Culver, Jennifer
Subject: RE: Forest Lake Community and Surrounding Construction
Importance: High

Dear Mr. Markle,

My name is Phil Leazer and I work for the York County Engineering Department. I have been assigned to the Pennies for Progress Program, York County's large-scale roadway improvement program. We are in receipt of an email you sent to Councilman Michael Johnson regarding the Forest Lake Community and would like to offer the following:

First let me start by apologizing to both you and Councilman Johnson. We have been a little overwhelmed here in this office of late and are woefully behind on responding to emails. We apologize for the delay in getting back to you on this very important issue.

You are very much correct, the York County Pennies for Progress Program is beginning to look at the possibility of widening US 21 from the Captain Steve's restaurant at Springfield Parkway north to SC 51. We have started to gather very preliminary information along this corridor that we will use to develop a concept plan for this work. (Concept plan being nothing more than what kind of roadway facility is needed along this corridor.) Once this concept plan is complete, we will then have a better idea of what areas a widened roadway may impact.

We have already been in discussions with the York County Stormwater Department about the Forest Lake Area even before your email. We too share the same concerns as you and want to make sure what we may end up doing on US 21 does not negatively affect downstream and probably more importantly the 15 acres lake that defines your neighborhood. As soon as we got your email, we contacted the engineering design firm that we have working on this project and let them know we need to coordinate with the Forest Lake Development as we move beyond the concept plan stage of this project. With your permission we will add you to our list of property owners to coordinate with to make sure we get you all the information you need to feel more comfortable with the project.

Again, I apologize for the delay in getting back to you on this issue.

If you have any questions or comments, or would like to discuss this any further, please do not hesitate to contact me at any of the outlets below.

Thanks you for giving us the opportunity to answer your questions and bring you in on this project.

Phil Leazer
York County Engineering
Pennies for Progress Division
(803) 818-5763 office direct
(803) 684-8571 Engineering Offices
Phil.leazer@yorkcountygov.com

From: Johnson Michael
Sent: Monday, April 08, 2013 2:28 PM
To: Leazer, Phil; Pettine, David
Subject: Fwd: Forest Lake Community and Surrounding Construction

Gentleman:

Received this today. Would appreciate some feedback so I can advise him properly.

Michael Johnson
District One

Sent from my iPad

Begin forwarded message:

From: "Markle, Korey [HDS]" <Korey.Markle@hdsupply.com>
Date: April 8, 2013, 10:20:17 AM EDT
To: "michael.johnson@yorkcountygov.com" <michael.johnson@yorkcountygov.com>
Cc: Wendy Markle <markles@comporium.net>, "Markle, Korey [HDS]" <Korey.Markle@hdsupply.com>, Dale Stickney <dstick_2@hotmail.com>, "rmccurry@besc.com" <rmccurry@besc.com>
Subject: Forest Lake Community and Surrounding Construction

Mr. Johnson,

I need your help. I am the President of the Forest Lake Community Club. Our subdivision is located just north of Captain Steve's Fish Camp on the west side of Hwy 21 By-Pass at the intersection of Gold Hill Rd. We are experiencing drainage problems caused by new and recent development, and now we see signs of future development coming. We need the County's help in fixing drainage problems that are a direct result from this upstream development. I don't know the State laws, but I understand one cannot discharge rainfall runoff onto adjacent properties resulting in damage to that property. We feel this is what the County has allowed to happen to us.

Our neighborhood has a 15 acre lake. It is fed by a pipe that comes under Hwy 21. Since the construction of the Apartment buildings on the corner of Gold Hill Rd and Hwy 21 on the east side, we have experienced a huge increase in the amount of water coming into our lake. This development's erosion run off has contaminated our lake's water with silt and literally filled-in the upper end of the lake. On top of that, the increased run off from the complex's impervious area has over taxed the lake's existing drainage system. We now experience conditions that exceed our lakes drainage system capabilities. This additional volume bypasses the lakes outlet drainage system, thus relying on the emergency overflow around the dam. This situation is fine for emergencies, but we are now experiencing these "emergencies" nearly every rainfall. Before the complex was built, I had only seen an overflow condition once in over ten years. This upstream development is the cause and will eventually cause the dam to fail.

Recently we have seen surveyors and underground locations marking the right-of-way of Hwy 21. This is done for engineering purposes when future developments are being designed. If this is for a highway widening, or any other development increasing impervious area, the impact on the lake will become exponential. I find it unacceptable that we (Forest Lake) have not been contacted by any local Government Department about any of these projects, we only see the surveyors flagging trees and running their control, even on our private property. I understand how a drainage system works and how it can impact existing downstream infrastructure. If Hwy 21 is improved to something similar to Gold Hill Rd, the impact to our dam would be catastrophic. A quick look at Google Maps will show there are 6 or more houses located directly behind and downstream of this dam. The results of a dam breach are unthinkable.

It is incomprehensible that York County's Engineering and Zoning Departments did not consider the impact of this, and the future development, would and will have on the existing creeks and eco systems down-stream, especially when they immediately feed a lake. I am all for growth and future development

in York County. And I would love to see Hwy 21 By-Pass improved, and any other development projects scheduled for this area. But we need to make sure our lake's discharge drainage system is included in the scope of such projects, because we are directly impacted by them.

I feel this could be a long hard fight for us, so we must have the support of our local representatives, most importantly you. If you would like to discuss this or even come make a site visit, we would love to have you. Feel free to contact me anytime.

Respectfully,

Korey Markle
495 Forest Way Drive
Fort Mill SC 29715
803-548-6047 home
704-507-6356 mobile
markles@comporium.net
korey.markle@gmail.com

Please consider the environment before printing this e-mail.

Appendix F

Erosion and Sediment Control Calculations

South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS
US 21	22+45	LT	STEELE CREEK	CATAWBA RIVER
US 21	34+56	LT	STEELE CREEK	CATAWBA RIVER
US 21	39+49	LT	STEELE CREEK	CATAWBA RIVER
US 21	66+89	LT	STEELE CREEK	CATAWBA RIVER
US 21	67+96	LT	STEELE CREEK	CATAWBA RIVER
US 21	73+45	LT	STEELE CREEK	CATAWBA RIVER
US 21	116+69	LT	STEELE CREEK	CATAWBA RIVER
US 21	122+69	LT	STEELE CREEK	CATAWBA RIVER
US 21	123+75	LT	STEELE CREEK	CATAWBA RIVER
US 21	34+07	RT	STEELE CREEK	CATAWBA RIVER
US 21	41+34	RT	STEELE CREEK	CATAWBA RIVER
US 21	42+54	RT	STEELE CREEK	CATAWBA RIVER
US 21	101+25	RT	SUGAR CREEK	CATAWBA RIVER
US 21 BUSSINESS	22+04	RT	STEELE CREEK	CATAWBA RIVER
OLDNACL	17+23	RT	SUGAR CREEK	CATAWBA RIVER
OLDNACL	13+25	LT	STEELE CREEK	CATAWBA RIVER
FLINTHILL	12+43	RT	SUGAR CREEK	CATAWBA RIVER

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE
US 21	10+00	137+14	FINE	BLUE RIDGE
SC 51	295+62	342+91	FINE	BLUE RIDGE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
US 21	15+00	17+50	LT	2.5		2		0.155
US 21	17+50	21+00	LT	5		2		0.435
US 21	21+00	23+50	LT	19		2		1.180
US 21	23+50	31+50	LT	3		2		0.596
US 21	31+50	36+00	LT	17.5		2		1.957
US 21	36+00	37+50	LT	10		2		0.373
US 21	37+50	42+00	LT	16		2		1.789
US21	44+00	45+00	LT	2		2		0.050
US21	45+00	46+00	LT	16			2.0	0.398
US21	46+00	50+00	LT	28			2.0	2.783
US21	50+00	53+50	LT	22			2.0	1.913
US21	54+00	57+50	LT	7		2		0.609
US21	58+00	59+50	LT	3		2		0.112
US21	60+00	60+50	LT	2		2		0.025
US21	64+50	66+00	LT	3.5		2		0.130
							TOTAL	**12.503**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)
FLINT	19+00	19+50	LT	2.3	6	2		1	0.106		
FLINT	19+50	20+77	LT	2.9	4	2		1	0.260		
FLINT	21+00	22+00	RT	1.3	6	2		1	0.120		
FLINT	22+00	22+50	RT	2.1	4	2		1	0.074		
US21	18+20	18+50	LT	1	4	2		1	0.021		
FERNFOREST	10+50	11+00	RT	1.2	4	2		1	0.042		
US21	21+00	21+50	LT	1	2	2		2		0.025	
LAKESBLVD	11+00	12+31	RT	0.5	6	2		1	0.061		
BAXTER	14+00	14+21	LT	1	4	2		1	0.015		
GARRISON	11+00	12+00	LT	1	6	2		1	0.092		
GOLDHILL	14+11	14+50	LT	0.6	4	2		1	0.017		
GOLDHILL	14+27	15+00	RT	1	4	2		1	0.052		
GOLDHILL	16+00	16+50	RT	1	4	2		1	0.035		
OLD NACL	18+00	19+50	LT	0.7	4	2		1	0.074		
LAKESHORE	13+00	13+50	LT	0.4	4	2		1	0.014		
								TOTALS	**0.984**	**0.025**	

SEDIMENT TUBES IN DITCHES

ROAD / ROUTE	STATION TO STATION		SIDE	AVERAGE LENGTH	SPACING (FT)	TOTAL	COMMENTS
US 21	15+00	15+25	LT	10	25	20	
US 21	15+88	17+62	LT	10	80	40	
US 21	18+02	18+42	LT	10	75	20	
US 21	19+19	19+95	LT	10	150	20	
US 21	20+25	21+96	LT	10	25	80	
US 21	24+13	27+13	LT	10	150	30	
US 21	28+79	31+42	LT	10	150	30	
US21	41+00	42+00	LT	10	25	40	
US21	43+50	44+25	LT	10	25	40	
US21	53+95	54+25	LT	10	30	20	
US21	54+97	55+27	LT	10	30	20	
US21	56+12	57+33	LT	10	30	50	
US21	58+00	59+50	LT	10	75	30	
US21	105+50	107+75	LT	10	120	20	
US21	110+00	111+50	LT	10	150	10	
US 21	19+18	20+11	RT	10	100	20	
US21	38+00	38+50	RT	10	50	20	
US21	40+11	41+34	RT	10	25	60	
US21	50+86	53+86	RT	10	150	30	
US21	64+00	64+42	RT	10	50	10	
US21	65+46	66+50	RT	10	30	40	
US21	66+87	67+13	RT	10	25	20	
US21	134+28	135+50	RT	10	150	20	
AMELIA	10+90	11+48	LT	10	30	30	
FERNFOREST	10+54	10+72	RT	10	30	10	
FERNFOREST	10+94	11+20	RT	10	30	10	
LAKESHORE	13+00	13+50	LT	10	25	20	
EX-FOREST	11+16	12+75	LT	10	40	50	
OLD-NACL	10+50	13+28	RT	10	150	30	
OLD-NACL	13+66	14+40	RT	10	100	20	
OLD-NACL	15+42	17+00	RT	10	150	20	
OLD-NACL	17+44	20+20	RT	10	150	20	
OLD-NACL	15+45	16+95	LT	10	150	10	
EX-GOLDHILL	32+31	32+82	LT	10	50	30	
EX-GOLDHILL	33+86	35+23	RT	10	130	20	
EX-GOLDHILL	22+75	23+64	RT	10	90	10	
GOLDHILL-REALIGN	14+50	18+00	RT	10	60	70	
GOLDHILL-REALIGN	19+50	21+00	RT	10	150	20	
GOLDHILL-REALIGN	27+00	31+35	RT	10	150	40	
GOLDHILL-REALIGN	14+22	14+52	LT	10	25	20	
GOLDHILL-REALIGN	15+16	15+99	LT	10	60	20	
GOLDHILL-REALIGN	17+37	22+01	LT	10	150	40	
Baxter	14+22	14+40	LT	10	25	20	
GARRISONFARM	11+04	11+39	RT	10	25	20	
GARRISONFARM	11+22	11+50	LT	10	25	20	
Lakes BLVD	11+00	12+46	RT	10	25	60	
Lakes BLVD	10+84	11+62	LT	10	25	50	
TERRYS	11+47	11+97	RT	10	50	10	
					TOTAL	**1350FT**	

SEDIMENT DAM

NO	ROAD / ROUTE	STATION	SIDE	DRAINED OR NOT DRAINED	LENGTH OF SILT BASIN	WIDTH OF SILT BASIN	DAM HEIGHT	SIDE SLOPE OF SILT BASIN	SPILLWAY BOTTOM WIDTH	DAM BOTTOM WIDTH	RIP RAP CLASS	TOTAL STORAGE VOLUME	SEDIMENT STORAGE HEIGHT	OUTFALL CHANNEL WIDTH	OUTFALL CHANNEL DEPTH	OUTFALL CHANNEL LENGTH
4	OLDUS21BUS	14+25	LT	DRAINED	120	4	4	3	12	4	B	284	0.75	N/A	N/A	N/A
5	OLDSC51	304+35	LT	DRAINED	90	15	4	3	12	4	B	307	0.75	N/A	N/A	N/A
6	SC 51	314+80	RT	DRAINED	175	20	3	3	14	7	B	506	0.75	N/A	N/A	N/A

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South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	OUTFALL DITCH SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS
ANDREW	01+95	LT	MCCULLOUGH BRANCH	CATAWBA RIVER
FLINT	23+05	RT	SUGAR CREEK	CATAWBA RIVER
EXIST. SPRINGHILL	23+53	LT	MCCULLOUGH BRANCH	CATAWBA RIVER
GOLDHILL REALIGN	23+92	LT	STEELE CREEK	CATAWBA RIVER
GOLDHILL REALIGN	14+07	LT	STEELE CREEK	CATAWBA RIVER
SC 51	316+33	RT	SUGAR CREEK	CATAWBA RIVER

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
US21	66+00	68+00	LT	18		2		0.894
US-21	68+50	69+00	LT	1.5		2		0.019
US-21	69+00	70+00	LT	1		2		0.025
US-21	70+00	72+00	LT	5.5		2		0.273
US-21	72+50	74+50	LT	15		2		0.745
US-21	76+50	82+00	LT	2.5		2		0.342
US-21	84+00	85+50	LT	4			2.0	0.149
US-21	85+50	95+00	LT	3.75			2.0	0.885
US-21	96+50	107+50	LT	4.7		2		1.284
US-21	109+00	112+00	LT	4.7		2		0.350
US-21	113+50	128+00	LT	24		2		8.646
US-21	128+00	117+00	LT	2		2		0.547
US-21	117+50	118+50	LT	11		2		0.273
US-21	120+00	124+50	LT	25		2		2.795
US-21	125+00	134+00	LT	3		2		0.671
							TOTAL	17.899

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)
								TOTALS			

SEDIMENT TUBES IN DITCHES

ROAD / ROUTE	STATION TO STATION		SIDE	AVERAGE LENGTH	SPACING (FT)	TOTAL	COMMENTS
ANDREW	00+54	01+82	LT	10	100	20	
ANDREW	01+06	01+72	RT	10	150	20	
ANDREW	02+49	05+23	RT	10	60	50	
US21 (Tail Ditch)	135+20	135+30	LT	10	50	20	
US21 (Tail Ditch)	134+32	135+49	RT	10	150	20	
SC51	306+99	307+72	LT	10	50	20	
SC51	308+61	309+62	LT	10	90	20	
SC51	310+36	310+99	LT	10	150	10	
SC51	336+88	340+00	LT	10	150	30	
SC51	303+41	308+75	RT	10	75	90	
SC51	308+95	310+25	RT	10	45	30	
FLINT2	16+70	22+50	RT	10	80	80	
FLINT2	16+67	21+53	LT	10	80	70	
EX-FLINT	15+10	19+71	LT	10	75	70	
EX-FLINT	14+86	16+94	RT	10	150	30	
EX-FLINT	16+94	19+04	RT	10	120	30	
EX-FLINT	10+94	11+40	LT	10	150	10	
EX-FLINT	11+21	11+91	RT	10	150	10	
EX-FLINT	16+36	18+82	RT	10	50	60	
SPRINGHILL	23+97	29+97	LT	10	150	50	
SPRINGHILL	24+00	30+00	RT	10	150	50	
EX-SPRINGHILL	14+82	16+06	RT	10	150	10	
EX-SPRINGHILL	22+57	22+76	RT	10	150	10	
EX-SPRINGHILL	16+33	17+81	LT	10	150	20	
EX-SPRINGHILL	18+98	19+89	LT	10	150	10	
EX-SPRINGHILL	20+86	23+50	LT	10	150	20	
EX-SPRINGHILL	23+90	24+47	LT	10	150	10	
					TOTAL	870FT	

SEDIMENT DAM

NO	ROAD / ROUTE	STATION	SIDE	DRAINED OR NOT DRAINED	LENGTH OF SILT BASIN	WIDTH OF SILT BASIN	DAM HEIGHT	SIDE SLOPE OF SILT BASIN	SPILLWAY BOTTOM WIDTH	DAM BOTTOM WIDTH	RIP RAP CLASS	TOTAL STORAGE VOLUME	SEDIMENT STORAGE HEIGHT	OUTFALL CHANNEL WIDTH	OUTFALL CHANNEL DEPTH	OUTFALL CHANNEL LENGTH

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South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	OUTFALL DITCH SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
US 21	15+50	24+50	RT	1		2		0.224
US 21	24+50	27+50	RT	3		2		0.224
US-21	29+00	30+00	RT	1.75		2		0.043
US-21	30+00	31+00	RT	23			2.0	0.571
US-21	31+00	33+00	RT	1.5		2		0.075
US-21	33+00	35+00	RT	17		2		0.845
US-21	35+00	35+50	RT	7.5		2		0.093
US-21	36+50	39+00	RT	1.8		2		0.112
US-21	40+00	45+00	RT	17.8		2		2.211
US-21	45+00	45+50	RT	4		2		0.050
US-21	46+50	49+00	RT	2.4		2		0.149
US-21	49+00	55+00	RT	8.7		2		1.297
US-21	55+00	57+00	RT	11.5		2		0.571
US-21	58+00	59+00	RT	5		2		0.124
US-21	59+00	62+00	RT	2.5		2		0.186
							TOTAL	**6.775**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)

South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
US-21	64+00	67+50	RT	8		2		0.696
US-21	67+50	78+00	RT	4.2		2		1.096
US-21	78+00	80+00	RT	9.5		2		0.472
US-21	80+00	82+00	RT	4.75		2		0.236
US-21	83+50	89+00	RT	5		2		0.683
US-21	91+00	95+50	RT	1.75		2		0.196
US-21	95+50	97+00	RT	4.3		2		0.160
US-21	98+00	107+50	RT	5.75		2		1.357
US-21	109+50	116+00	RT	1.6		2		0.258
US-21	116+50	122+00	RT	6.75		2		0.922
US-21	122+50	124+50	RT	10		2		0.497
US-21	124+50	128+50	RT	3.6		2		0.358
US-21	130+00	130+50	RT	1		2		0.012
OLD SC-51	302+50	303+00	LT	2.2		4		0.050
OLD SC-51	303+00	307+50	LT	3.75		4	2.0	1.192
							TOTAL	**8.186**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)

SCDOT
South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
OLD SC-51	307+50	308+15	LT	1		6		0.044
OLD SC-51	308+15	308+30	LT	1		4		0.007
OLD SC-51	315+50	316+00	LT	2		6		0.068
OLD SC-51	302+50	303+00	RT	1		2		0.012
OLD SC-51	303+00	308+50	RT	1.4		4	2.0	0.544
OLD SC-51	315+50	316+00	RT	1.2		6		0.041
OLD SC-51	316+00	316+16	RT	1		50		0.089
SPRINGHILL	23+51	30+00	LT	1		6	2.0	0.600
SPRINGHILL	23+51	30+00	LT	2.1			2.0	0.339
SPRINGHILL	23+51	30+50	RT	1		6	2.0	0.646
SPRINGHILL	28+50	30+20	RT	1.2			2.0	0.051
FLINT2	16+51	19+00	LT	2.1		6	2.0	0.484
FLINT2	20+77	21+00	LT	1.9		4	2.0	0.031
FLINT2	21+00	22+00	LT	3.1		6		0.210
FLINT2	22+00	23+00	LT	3.1		4		0.142
							TOTAL	**3.306**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)

SCDOT
South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
FLINT2	16+50	17+00	RT	1.5		4		0.034
FLINT2	17+00	21+00	RT	1.5		6	2.0	0.555
FERN FOREST	11+00	11+50	RT	1		6		0.034
FERN FOREST	11+00	12+00	LT	1		4		0.046
LAKESBLVD	11+00	12+00	LT	1		6	2.0	0.097
TERRYS	11+50	12+00	LT	2		4	1.0	0.062
TERRYS	11+50	12+00	RT	2		4	1.0	0.062
GARRISONFARM	11+00	12+00	RT	1.5		6	2.0	0.139
GARRISONFARM	11+00	11+50	LT	1.5		6	2.0	0.069
AMELIA	10+50	12+00	LT	1		4	2.0	0.106
AMELIA	10+50	12+00	LT	2			2.0	0.075
AMELIA	10+50	11+80	RT	1		6		0.088
AMELIA	11+80	12+00	RT	1		12		0.027
BAXTER	14+21	14+50	LT	3		4	2.0	0.061
BAXTER	14+50	14+79	LT	1.8		4	1.0	0.029
							TOTAL	**1.482**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)
								TOTALS			

SEDIMENT TUBES IN DITCHES

ROAD / ROUTE	STATION TO STATION		SIDE	AVERAGE LENGTH	SPACING (FT)	TOTAL	COMMENTS

South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	OUTFALL DITCH SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
BAXTER	14+00	14+50	RT	2		6		0.068
BAXTER	14+50	14+79	RT	2.5		4		0.033
ANDREW	00+50	01+50	LT	0.75		2	2.0	0.037
ANDREW	00+50	01+50	LT	3.75		2		0.093
ANDREW	01+50	02+00	LT	0.75		4	2.0	0.026
ANDREW	01+50	02+50	LT	3		4		0.137
ANDREW	02+50	03+00	LT	2.5		6		0.084
ANDREW	03+00	03+50	LT	1		4	2.0	0.035
ANDREW	03+00	03+50	LT	2.2		4		0.050
ANDREW	03+50	03+90	LT	1		4		0.018
ANDREW	00+50	01+00	RT	2		6		0.068
ANDREW	01+00	01+50	RT	0.75		2	2.0	0.019
ANDREW	01+00	01+50	RT	2.8		2		0.035
ANDREW	01+50	02+00	RT	1		6	2.0	0.046
ANDREW	01+50	02+50	RT	2		6		0.135
							TOTAL	**0.886**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)

South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
ANDREW	02+50	03+90	RT	1.3		6	2.0	0.168
ANDREW	03+50	03+90	RT	1.5			2.0	0.015
GARRISON	11+00	12+00	RT	1.5		6	2.0	0.139
GOLDHILL-REALIGN	14+00	14+50	LT	2		4		0.046
GOLDHILL-REALIGN	14+50	19+00	LT	1.85		4	2.0	0.588
GOLDHILL-REALIGN	14+50	19+00	LT	1.1		4		0.227
GOLDHILL-REALIGN	19+00	22+50	LT	5		4	2.0	1.237
GOLDHILL-REALIGN	22+50	23+00	LT	10		4		0.229
GOLDHILL-REALIGN	23+00	25+50	LT	25		2		1.553
GOLDHILL-REALIGN	25+50	26+50	LT	10		4		0.458
GOLDHILL-REALIGN	26+50	27+00	LT	2.9		6		0.098
GOLDHILL-REALIGN	27+00	28+50	LT	10		4		0.687
GOLDHILL-REALIGN	28+50	32+00	LT	3.6		4	2.0	0.890
GOLDHILL-REALIGN	28+50	32+00	LT	5.2			2.0	0.452
GOLDHILL-REALIGN	32+00	32+39	LT	5.5		2		0.053
							TOTAL	**6.840**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)
								TOTALS			

SEDIMENT TUBES IN DITCHES

ROAD / ROUTE	STATION TO STATION		SIDE	AVERAGE LENGTH	SPACING (FT)	TOTAL	COMMENTS
					TOTAL	0FT	

SEDIMENT DAM

NO	ROAD / ROUTE	STATION	SIDE	DRAINED OR NOT DRAINED	LENGTH OF SILT BASIN	WIDTH OF SILT BASIN	DAM HEIGHT	SIDE SLOPE OF SILT BASIN	SPILLWAY BOTTOM WIDTH	DAM BOTTOM WIDTH	RIP RAP CLASS	TOTAL STORAGE VOLUME	SEDIMENT STORAGE HEIGHT	OUTFALL CHANNEL WIDTH	OUTFALL CHANNEL DEPTH	OUTFALL CHANNEL LENGTH

8/4/2021
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South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
GOLDHILL-REALIGN	15+50	16+00	RT	3		4	2.0	0.106
GOLDHILL-REALIGN	16+50	19+00	RT	4		4		0.458
GOLDHILL-REALIGN	20+50	22+50	RT	3			2.0	0.149
GOLDHILL-REALIGN	23+00	23+50	RT	3.1		6		0.105
GOLDHILL-REALIGN	23+50	24+00	RT	6.7		4		0.153
GOLDHILL-REALIGN	24+00	26+00	RT	19.5		2		0.969
GOLDHILL-REALIGN	26+00	26+50	RT	5		4		0.115
GOLDHILL-REALIGN	26+50	27+00	RT	1		6		0.034
GOLDHILL-REALIGN	27+00	32+00	RT	4		4	2.0	1.413
GOLDHILL-REALIGN	28+50	32+00	RT	9			2.0	0.783
GOLDHILL-REALIGN	32+00	32+39	RT	7.1		2		0.069
EX FLINT	10+00	11+50	LT	1		4	2.0	0.106
EX FLINT	11+50	12+50	LT	1		2	6.0	0.092
OLD US-21 BUS	11+00	15+00	LT	5		6		1.352
OLD US-21 BUS	16+00	17+00	LT	5.7		4		0.261
							TOTAL	6.165

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)

South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH STATION	OUTFALL DITCH SIDE	NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1 FRONT	SLOPES x : 1 BACK	MSY
OLD US-21 BUS	17+00	20+50	LT	4.9		6		1.159
OLD US-21 BUS	11+00	15+00	RT	2.2		6		0.595
OLD US-21 BUS	16+00	21+92	RT	4		6		1.600
OLD US-21 BUS	21+92	24+80	RT	1.9		2	2	0.272
OLD NACL	10+50	11+00	LT	2.1		4		0.048
OLD NACL	11+00	13+50	LT	1.9		6		0.321
OLD NACL	13+50	14+50	LT	0.75		6	2	0.069
OLD NACL	19+50	19+98	LT	1.7		4	2	0.058
OLD NACL	10+50	11+00	RT	2.5		4		0.057
OLD NACL	11+00	12+00	RT	2.6		6		0.176
OLD NACL	12+00	13+00	RT	3.2		6	2	0.296
OLD NACL	13+00	13+50	RT	2.8		4	2	0.099
OLD NACL	13+50	13+97	RT	1		6	2	0.043
OLD NACL	13+97	14+50	RT	1.6		4	2	0.060
OLD NACL	18+00	19+98	RT	2.55		4	2	0.357
							TOTAL	**5.210**

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1) FRONT	SLOPES (x : 1) BACK	DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)
								TOTALS			

SEDIMENT TUBES IN DITCHES

ROAD / ROUTE	STATION TO STATION		SIDE	AVERAGE LENGTH	SPACING (FT)	TOTAL	COMMENTS
						TOTAL	0FT

SEDIMENT DAM

NO	ROAD / ROUTE	STATION	SIDE	DRAINED OR NOT DRAINED	LENGTH OF SILT BASIN	WIDTH OF SILT BASIN	DAM HEIGHT	SIDE SLOPE OF SILT BASIN	SPILLWAY BOTTOM WIDTH	DAM BOTTOM WIDTH	RIP RAP CLASS	TOTAL STORAGE VOLUME	SEDIMENT STORAGE HEIGHT	OUTFALL CHANNEL WIDTH	OUTFALL CHANNEL DEPTH	OUTFALL CHANNEL LENGTH

8/4/2021
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SCDOT
South Carolina Department of Transportation

EROSION CONTROL DATA SHEET

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROUTE/ROAD NO.	SHEET NO.
3	S.C.	YORK	0042332	US21	

RECEIVING WATERS

ROAD / ROUTE	OUTFALL DITCH		NAME OF RECEIVING WATERS	NAME OF ULTIMATE RECEIVING WATERS
	STATION	SIDE		

SOIL TYPES

ROAD / ROUTE	STATION TO STATION		SOIL PARTICLE SIZE (COARSE / FINE)	ZONE

TEMPORARY EROSION CONTROL BLANKET

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF BLANKET (FT)	DITCH BOTTOM WIDTH (FT)	SLOPES x : 1		MSY
						FRONT	BACK	
US21 (Tail Ditch)	00+00	00+77	LT	3		4	2	0.163
LAKESHORE	13+00	13+50	LT	3.76			2	0.047
LAKESHORE	13+50	14+13	LT	1.3		6	2	0.076
LAKESHORE	12+70	13+00	RT	1		6		0.020
							TOTAL	0.306

TURF REINFORCED MATTING (TRM)

ROAD / ROUTE	STATION TO STATION		SIDE	DEPTH OF MAT (FT)	SLOPES (x : 1)		DITCH BOTTOM WIDTH (FT)	TYPE	TYPE 1 (MSY)	TYPE 2 (MSY)	TYPE 3 (MSY)
					FRONT	BACK					

SEDIMENT DAMS ARE DESIGNED PER SCDOT STANDARD DRAWING 815-405-01

STV Incorporated	JOB: US 21 & SC 51		7
Consulting Engineers	SUBJECT: Sediment Dam/Basin Design		SHEET
454 S Anderson Rd, Suite 3, BTC 517	CALC'D BY: PRJ	DATE: 26-Jul-16	OF
Rock Hill, SC, 29730 (803) 980-4970	CHECK'D BY: SCN	DATE: 10-Feb-17	10

Sediment Dam/Basin Design

Sediment Dam 4

Location: OLDUS21BUSINESS Sta. 14+25 Lt		
Total Drainage Area	5.05	AC
Total Disturbed Area	0.64	AC
Region	Upper State	
Sediment Storage Rate*	15.40	CY/Disturbed Acre
Sediment Storage Volume	10	CY
Runoff Storage Volume*	269	CY
Class of Sediment Dam Riprap	Class B	
Spillway Width	12	FT
Spillway Depth	1 ft	
Spillway Side Slope	2:1	
Rock Dam Height	4.0	FT
Rock Dam Bottom width	4.0	FT
Sediment Storage Height	0.75	FT
Length of Basin	**120**	**FT**
Width of Basin	**4**	**FT**
Upstream and Downstream slope of placed Riprap	2:1	
Required Storage Volume	279	CY
Provided Storage Volume	**284**	**CY**

* SCDOT Stormwater Quality Design Manual Appendix B

Total Storage Volume

TRAPEZOIDAL CHANNEL	
BOTTOM WIDTH (FT)	4.00
DEPTH (FT)	4.00
SLOPE (?H:1V)	3.00
Length (FT)	120.00
AREA (SQ FT)	64.00
Volume (CY)	284.4

STV Incorporated
Consulting Engineers
454 S Anderson Rd, Suite 3, BTC 517
Rock Hill, SC, 29730 (803) 980-4970

JOB:	US 21 & SC 51			8
SUBJECT:	Sediment Dam/Basin Design			SHEET
CALC'D BY:	PRJ	DATE:	26-Jul-16	OF
CHECK'D BY:	SCN	DATE:	10-Feb-17	10

Sediment Dam/Basin Design

Sediment Dam 5

Location: OLDSC51 Sta. 304+35 Lt		
Total Drainage Area	5.00	AC
Total Disturbed Area	1.25	AC
Region	Upper State	
Sediment Storage Rate*	15.40	CY/Disturbed Acre
Sediment Storage Volume	19	CY
Runoff Storage Volume*	277	CY
Class of Sediment Dam Riprap	Class B	
Spillway Width	12	FT
Spillway Depth	1 ft	
Spillway Side Slope	2:1	
Rock Dam Height	4.0	FT
Rock Dam Bottom width	4.0	FT
Sediment Storage Height	0.75	FT
Length of Basin	**90**	**FT**
Width of Basin	**15**	**FT**
Upstream and Downstream slope of placed Riprap	2:1	
Required Storage Volume	296	CY
Provided Storage Volume	**307**	**CY**

* SCDOT Stormwater Quality Design Manual Appendix B

Total Storage Volume

TRAPEZOIDAL CHANNEL	
BOTTOM WIDTH (FT)	15.00
DEPTH (FT)	4.00
SLOPE (?H:1V)	2.00
Length (FT)	90.00
AREA (SQ FT)	92.00
Volume (CY)	306.7

STV Incorporated
Consulting Engineers
454 S Anderson Rd, Suite 3, BTC 517
Rock Hill, SC, 29730 (803) 980-4970

JOB:	US 21 & SC 51			9
SUBJECT:	Sediment Dam/Basin Design			SHEET
CALC'D BY:	PRJ	DATE:	26-Jul-16	OF
CHECK'D BY:	SCN	DATE:	10-Feb-17	10

Sediment Dam/Basin Design

Sediment Dam 6

Location: SC 51 Sta. 314+80 Rt		
Total Drainage Area	8.01	AC
Total Disturbed Area	1.43	AC
Region	Upper State	
Sediment Storage Rate*	15.40	CY/Disturbed Acre
Sediment Storage Volume	22	CY
Runoff Storage Volume*	424	CY
Class of Sediment Dam Riprap	Class B	
Spillway Width	14	FT
Spillway Depth	1 ft	
Spillway Side Slope	2:1	
Rock Dam Height	3.0	FT
Rock Dam Bottom width	7.0	FT
Sediment Storage Height	0.75	FT
Length of Basin	**175**	**FT**
Width of Basin	**20**	**FT**
Upstream and Downstream slope of placed Riprap	2:1	
Required Storage Volume	446	CY
Provided Storage Volume	**506**	**CY**

* SCDOT Stormwater Quality Design Manual Appendix B

Total Storage Volume

TRAPEZOIDAL CHANNEL	
BOTTOM WIDTH (FT)	20.00
DEPTH (FT)	3.00
SLOPE (?H:1V)	2.00
Length (FT)	175.00
AREA (SQ FT)	78.00
Volume (CY)	505.6

Hydraulic Analysis Report
Culvert Outfalls

Project Data

Project Title:

Designer:

Project Date: Monday, June 06, 2016

Project Units: U.S. Customary Units

Notes:

Riprap Analysis: Culvert EP-2

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 154 cfs

Culvert Diameter: 5 ft

Normal Depth in Culvert: 1.85 ft

Tailwater Depth: 6.68 ft

If tailwater is unknown, use 0.4D

flow is subcritical

Result Parameters

Tailwater Depth Used in Computations: 6.68 ft

Culvert Diameter Used in Computations: 5 ft

Computed D50: 3.42899 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 20 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 28.3333 ft

No channel used in calculations

Riprap Analysis: Culvert EP-3

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 204 cfs

Culvert Diameter: 5 ft

Normal Depth in Culvert: 2.72 ft

Tailwater Depth: 2.23 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 2.23 ft

Culvert Diameter Used in Computations: 5 ft

Computed D50: 14.9434 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS IV

Riprap Class Order: 4

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 30 in

d85: 21 in

d50: 15.5 in

d15: 10.5 in

Layout Recommendations

Apron Length: 30 ft

Apron Depth: 2.84167 ft

Apron Width (at end): 35 ft

No channel used in calculations

Riprap Analysis: Culvert CLP-4

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 42 cfs

Culvert Diameter: 3 ft

Normal Depth in Culvert: 1.23 ft

Tailwater Depth: 1.31 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 1.31 ft

Culvert Diameter Used in Computations: 3 ft

Computed D50: 6.11093 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 12 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 17 ft

No channel used in calculations

Riprap Analysis: Culvert EP-5

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 8 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.48 ft

Tailwater Depth: 0.74 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 0.74 ft

Culvert Diameter Used in Computations: 1.5 ft

Computed D50: 2.9875 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 8.5 ft

No channel used in calculations

Riprap Analysis: Culvert EP-6

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 44 cfs

Culvert Diameter: 4 ft

Normal Depth in Culvert: 0.51 ft

Tailwater Depth: 1.2 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 1.6 ft

Culvert Diameter Used in Computations: 4 ft

Computed D50: 3.62753 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 16 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 22.6667 ft

No channel used in calculations

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection EP-2 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	1 SHEET OF 4

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 33+79 EP-2 Road Name US 21

From Charts - Length (L_a) = 65 ft.

Width 1 (W_1) = 3 * D_o = 15.0 ft. Pipe Size (D_o) = 60 "

Width 2 (W_2) = 40 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 3566.1 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 222.88 Tons, use ===> **223 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 239.62 s.y., use ===> **240 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection EP-3 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	2 SHEET OF 4

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 41+06 EP-3 Road Name US 21

From Charts - Length (L_a) = 32 ft.

Width 1 (W_1) = 3 * D_o = 15.0 ft. Pipe Size (D_o) = 60 "

Width 2 (W_2) = 35 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 2160.0 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 135.00 Tons, use ===> **135 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 123.09 s.y., use ===> **124 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-4 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	SHEET 3 OF 4

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 66+74 CLP-4 Road Name US 21

From Charts - Length (L_a) = 14 ft.

Width 1 (W_1) = 3 * D_o = 9.0 ft. Pipe Size (D_o) = 36 "

Width 2 (W_2) = 17 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 363.1 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 22.69 Tons, use ===> **23 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 32.19 s.y., use ===> **33 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Since we are combining the rip rap for use Type C riprap

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection EP-6 CALC'D BY: PRJ/SCN DATE: 19-Oct-20 CHECK'D BY: SCN DATE: 19-Oct-20	SHEET 4 OF 4

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 316+23 EP-6 Road Name SC 51

From Charts - Length (L_a) = 16 ft.

Width 1 (W_1) = 3 * D_o = 12.0 ft. Pipe Size (D_o) = 48 "

Width 2 (W_2) = 24 ft.

Flows for culvert and two incoming 42" RCP's added together

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 777.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 48.60 Tons, use ===> **49 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 52.40 s.y., use ===> **53 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

Hydraulic Analysis Report
Side Road Outfalls Protection

Project Data

Project Title:

Designer:

Project Date: Friday, June 24, 2016

Project Units: U.S. Customary Units

Notes:

Riprap Analysis: CLP-8

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 1.6 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.29 ft

Tailwater Depth: 0 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 0.6 ft

Culvert Diameter Used in Computations: 1.5 ft

Computed D50: 0.430951 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 8.5 ft

No channel used in calculations

Riprap Analysis: EP-9

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 6.3 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.52 ft

Tailwater Depth: 0.53 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.53 ft

Culvert Diameter Used in Computations: 1.01 ft

Computed D50: 5.13993 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 7.03 ft

No channel used in calculations

Riprap Analysis: CLP-11

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 11.3 cfs

Culvert Diameter: 2 ft

Normal Depth in Culvert: 0.53 ft

Tailwater Depth: 0.44 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.506 ft

Culvert Diameter Used in Computations: 1.265 ft

Computed D50: 8.69043 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS II

Riprap Class Order: 2

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 18 in

d85: 13 in

d50: 9.5 in

d15: 7 in

Layout Recommendations

Apron Length: 8 ft

Apron Depth: 2.6125 ft

Apron Width (at end): 9.12833 ft

No channel used in calculations

Riprap Analysis: CLP-12

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 3.6 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.47 ft

Tailwater Depth: 0.48 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.48 ft

Culvert Diameter Used in Computations: 0.985 ft

Computed D50: 2.78263 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 6.955 ft

No channel used in calculations

Riprap Analysis: CLP-13

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 2.1 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.34 ft

Tailwater Depth: 0.47 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.47 ft

Culvert Diameter Used in Computations: 0.92 ft

Computed D50: 1.51712 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 6.76 ft

No channel used in calculations

Riprap Analysis: CLP-14

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 7.6 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.74 ft

Tailwater Depth: 0.76 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.76 ft

Culvert Diameter Used in Computations: 1.12 ft

Computed D50: 4.01041 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 7.36 ft

No channel used in calculations

Riprap Analysis: CLP-15

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 5 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.93 ft

Tailwater Depth: 0.47 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.486 ft

Culvert Diameter Used in Computations: 1.215 ft

Computed D50: 3.21931 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 7.645 ft

No channel used in calculations

Riprap Analysis: CLP-16

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 15 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 1.252 ft

Tailwater Depth: 0.8 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.8 ft

Culvert Diameter Used in Computations: 1.376 ft

Computed D50: 7.16828 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS II

Riprap Class Order: 2

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 18 in

d85: 13 in

d50: 9.5 in

d15: 7 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 2.6125 ft

Apron Width (at end): 8.128 ft

No channel used in calculations

Riprap Analysis: CLP-17

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 3 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.59 ft

Tailwater Depth: 0.52 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.52 ft

Culvert Diameter Used in Computations: 1.045 ft

Computed D50: 1.86156 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 7.135 ft

No channel used in calculations

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-8 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	1 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 12+86 CLP-8 Road Name LAKESHORE

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 9 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 161.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 10.10 Tons, use ===> **11 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 17.31 s.y., use ===> **18 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection EP-9 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	2 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 11+88 EP-9 Road Name TERRYS

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-11 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	3 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 24+20 CLP-11 Road Name GOLDHILL

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 10 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 216.0 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 13.50 Tons, use ===> **14 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 19.69 s.y., use ===> **20 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-12 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	4 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 14+21 CLP-12 Road Name BAXTER

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-13 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	SHEET 5 OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 1+88 CLP-13 Road Name ANDREW

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-14 CALC'D BY: SCN DATE: 7-Apr-21 CHECK'D BY: GPP DATE: 7-Apr-21	6 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 17+23 Road Name OLD NATION ROAD

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-15 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	7 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 14+18 CLP-15 Road Name GOLDHILL

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-16 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 27-Apr-17	8 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 13+28 CLP-16 Road Name OLD NATION ROAD

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 139.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 8.73 Tons, use ===> **9 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 15.31 s.y., use ===> **16 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection CLP-17 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 27-Apr-17	9 SHEET OF 9

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 23+39 CLP-17 Road Name EXISTING SPRINGHILL

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

Hydraulic Analysis Report
System Outfalls Protection

Project Data

Project Title:

Designer:

Project Date: Monday, June 06, 2016

Project Units: U.S. Customary Units

Notes:

Riprap Analysis: outlet 1

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 18.448 cfs

Culvert Diameter: 2.5 ft

Normal Depth in Culvert: 0.62 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 1.56 ft

Computed D50: 6.39206 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 10 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 11.3467 ft

No channel used in calculations

Riprap Analysis: outlet 2

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 10.677 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 1.5 ft

Tailwater Depth: 0.6 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.6 ft

Culvert Diameter Used in Computations: 1.5 ft

Computed D50: 5.4142 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 8.5 ft

No channel used in calculations

Riprap Analysis: outlet 3

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 18.824 cfs

Culvert Diameter: 2.5 ft

Normal Depth in Culvert: 0.7 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 1.6 ft

Computed D50: 6.34839 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 10 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 11.4667 ft

No channel used in calculations

Riprap Analysis: outlet 4

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 10.198 cfs

Culvert Diameter: 2 ft

Normal Depth in Culvert: 0.92 ft

Tailwater Depth: 0.8 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.8 ft

Culvert Diameter Used in Computations: 1.46 ft

Computed D50: 3.95975 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 8 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 9.71333 ft

No channel used in calculations

Riprap Analysis: outlet 5

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 10.443 cfs

Culvert Diameter: 2 ft

Normal Depth in Culvert: 0.67 ft

Tailwater Depth: 0.8 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.8 ft

Culvert Diameter Used in Computations: 1.335 ft

Computed D50: 4.60514 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 8 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 9.33833 ft

No channel used in calculations

Riprap Analysis: outfall-EXOP-532

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 3.671 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.45 ft

Tailwater Depth: 0.6 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.6 ft

Culvert Diameter Used in Computations: 0.975 ft

Computed D50: 2.31613 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 6.925 ft

No channel used in calculations

Riprap Analysis: outlet 7

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 33.4 cfs

Culvert Diameter: 3 ft

Normal Depth in Culvert: 1.447 ft

Tailwater Depth: 1.2 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1.2 ft

Culvert Diameter Used in Computations: 2.2235 ft

Computed D50: 7.32778 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS II

Riprap Class Order: 2

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 18 in

d85: 13 in

d50: 9.5 in

d15: 7 in

Layout Recommendations

Apron Length: 12 ft

Apron Depth: 2.6125 ft

Apron Width (at end): 14.6705 ft

No channel used in calculations

Riprap Analysis: outlet 9

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 45.864 cfs

Culvert Diameter: 3.5 ft

Normal Depth in Culvert: 0.89 ft

Tailwater Depth: 1.4 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1.4 ft

Culvert Diameter Used in Computations: 2.195 ft

Computed D50: 9.75281 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS III

Riprap Class Order: 3

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 24 in

d85: 17 in

d50: 12.5 in

d15: 9 in

Layout Recommendations

Apron Length: 14 ft

Apron Depth: 3.4375 ft

Apron Width (at end): 15.9183 ft

No channel used in calculations

Riprap Analysis: outlet 10

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 32.9 cfs

Culvert Diameter: 3.5 ft

Normal Depth in Culvert: 0.92 ft

Tailwater Depth: 1.4 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1.4 ft

Culvert Diameter Used in Computations: 2.21 ft

Computed D50: 6.20609 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 14 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 15.9633 ft

No channel used in calculations

Riprap Analysis: outlet 4a

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 12.967 cfs

Culvert Diameter: 2 ft

Normal Depth in Culvert: 0.85 ft

Tailwater Depth: 0.8 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.8 ft

Culvert Diameter Used in Computations: 1.425 ft

Computed D50: 5.63401 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 8 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 9.60833 ft

No channel used in calculations

Riprap Analysis: outlet 4b

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 32.096 cfs

Culvert Diameter: 2.5 ft

Normal Depth in Culvert: 0.862 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 1.681 ft

Computed D50: 12.1074 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS III

Riprap Class Order: 3

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 24 in

d85: 17 in

d50: 12.5 in

d15: 9 in

Layout Recommendations

Apron Length: 12.5 ft

Apron Depth: 2.5 ft

Apron Width (at end): 13.3763 ft

No channel used in calculations

Riprap Analysis: outlet 12

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 4.133 cfs

Culvert Diameter: 2.5 ft

Normal Depth in Culvert: 0.33 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 1.415 ft

Computed D50: 0.990573 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 10 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 10.9117 ft

No channel used in calculations

Riprap Analysis: outlet 14

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 15.528 cfs

Culvert Diameter: 2.5 ft

Normal Depth in Culvert: 1.25 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 1.875 ft

Computed D50: 3.97521 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 10 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 12.2917 ft

No channel used in calculations

Riprap Analysis: outfall 13

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 9.351 cfs

Culvert Diameter: 2.5 ft

Normal Depth in Culvert: 0.56 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 1.53 ft

Computed D50: 2.65112 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 10 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 11.2567 ft

No channel used in calculations

Riprap Analysis: outlet 4c

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 10.476 cfs

Culvert Diameter: 2 ft

Normal Depth in Culvert: 2 ft

Tailwater Depth: 0.8 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.8 ft

Culvert Diameter Used in Computations: 2 ft

Computed D50: 2.69777 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 8 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 11.3333 ft

No channel used in calculations

Riprap Analysis: outlet 15

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 7.4 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.78 ft

Tailwater Depth: 0.6 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 0.6 ft

Culvert Diameter Used in Computations: 1.5 ft

Computed D50: 3.32081 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 8.5 ft

No channel used in calculations

Riprap Analysis: outlet 20

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 0.769 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.26 ft

Tailwater Depth: 1 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 1 ft

Culvert Diameter Used in Computations: 0.88 ft

Computed D50: 0.198213 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 6.64 ft

No channel used in calculations

Riprap Analysis: outlet 16

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 1.211 cfs

Culvert Diameter: 1.5 ft

Normal Depth in Culvert: 0.32 ft

Tailwater Depth: 0.6 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.6 ft

Culvert Diameter Used in Computations: 0.91 ft

Computed D50: 0.578798 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 6 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 6.73 ft

No channel used in calculations

Riprap Analysis: outlet OP-39

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 40 cfs

Culvert Diameter: 3 ft

Normal Depth in Culvert: 1.7 ft

Tailwater Depth: 2.1 ft

If tailwater is unknown, use 0.4D

flow is sbcritical

Result Parameters

Tailwater Depth Used in Computations: 2.1 ft

Culvert Diameter Used in Computations: 3 ft

Computed D50: 3.57196 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 12 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 17 ft

No channel used in calculations

Riprap Analysis: outlet OP-41

Notes:

Input Parameters

Riprap Type: Culvert Outlet Protection

Flow: 7.268 cfs

Culvert Diameter: 2 ft

Normal Depth in Culvert: 0.47 ft

Tailwater Depth: 0.8 ft

If tailwater is unknown, use 0.4D

flow is supercritical

Result Parameters

Tailwater Depth Used in Computations: 0.8 ft

Culvert Diameter Used in Computations: 1.235 ft

Computed D50: 3.151 in

Riprap Class

Riprap shape should be angular

Riprap Class Name: CLASS I

Riprap Class Order: 1

The following values are an 'average' of the size fraction range for the selected riprap class.

d100: 12 in

d85: 9 in

d50: 6.5 in

d15: 4.5 in

Layout Recommendations

Apron Length: 8 ft

Apron Depth: 1.89583 ft

Apron Width (at end): 9.03833 ft

No channel used in calculations

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-1 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	1 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 41+29 Road Name US 21 (RT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 7.5 ft. Pipe Size (D_o) = 30 "

Width 2 (W_2) = 12 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 233.4 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 14.59 Tons, use ===> **15 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 22.64 s.y., use ===> **23 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-2 CALC'D BY: PRJ DATE: 12-Feb-18 CHECK'D BY: SCN DATE: 13-Feb-18	SHEET 2 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 42+75 Road Name US 21 (RT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 9 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 161.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 10.10 Tons, use ===> **11 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 17.31 s.y., use ===> **18 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-3 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	3 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 40+82 Road Name US 21 (LT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 7.5 ft. Pipe Size (D_o) = 30 "

Width 2 (W_2) = 15 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 269.3 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 16.83 Tons, use ===> **17 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 25.31 s.y., use ===> **26 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-4 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	4 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 66+75 Road Name US 21 (LT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 10 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 191.5 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 11.97 Tons, use ===> **12 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 19.53 s.y., use ===> **20 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-4a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 27-Apr-17	5 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 67+99 Road Name US 21 (LT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 10 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 159.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 9.98 Tons, use ===> **10 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 16.87 s.y., use ===> **17 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-4b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	6 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 73+45 Road Name US 21 (LT)

From Charts - Length (L_a) = 15 ft.

Width 1 (W_1) = 3 * D_o = 7.5 ft. Pipe Size (D_o) = 30 "

Width 2 (W_2) = 14 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 435.4 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 27.21 Tons, use ===> **28 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 33.37 s.y., use ===> **34 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-5 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	SHEET 7 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 101+29 Road Name US 21 (RT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 10 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 191.5 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 11.97 Tons, use ===> **12 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 19.53 s.y., use ===> **20 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-7 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	8 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 123+79 Road Name US 21 (LT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 9.0 ft. Pipe Size (D_o) = 36 "

Width 2 (W_2) = 14 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 372.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 23.29 Tons, use ===> **24 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 29.43 s.y., use ===> **30 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-9 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	9 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 316+19 Road Name SC 51 (RT)

From Charts - Length (L_a) = 20 ft.

Width 1 (W_1) = 3 * D_o = 10.5 ft. Pipe Size (D_o) = 42 "

Width 2 (W_2) = 20 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 823.5 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 51.47 Tons, use ===> **52 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 55.04 s.y., use ===> **56 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-10 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 24-Apr-17	SHEET 10 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 316+30 Road Name SC 51 (RT)

From Charts - Length (L_a) = 16 ft.

Width 1 (W_1) = 3 * D_o = 10.5 ft. Pipe Size (D_o) = 42 "

Width 2 (W_2) = 18 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 615.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 38.48 Tons, use ===> **39 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 43.48 s.y., use ===> **44 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-12 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 27-Apr-17	11 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 34+10 Road Name US 21 (RT)

From Charts - Length (L_a) = 15 ft.

Width 1 (W_1) = 3 * D_o = 7.5 ft. Pipe Size (D_o) = 30 "

Width 2 (W_2) = 18 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 381.5 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 23.85 Tons, use ===> **24 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 33.55 s.y., use ===> **34 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-14 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: SCN DATE: 27-Apr-17	SHEET 12 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 12+44 Road Name FLINT HILL ROAD (RT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 7.5 ft. Pipe Size (D_o) = 30 "

Width 2 (W_2) = 15 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 269.3 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 16.83 Tons, use ===> **17 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 25.31 s.y., use ===> **26 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated	JOB: US 21/ SC 51 Phase I Widening			13
Consulting Engineers	SUBJECT: Outlet Protection Outfall-13			SHEET
454 S Anderson Rd, Suite 3, BTC 517	CALC'D BY: PRJ	DATE:	7-Sep-19	OF
Rock Hill, SC, 29730	CHECK'D BY: SCN	DATE:	10-Sep-19	20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 21+92 Road Name US 21B (RT)

From Charts - Length (L_a) = 12 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 15 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 251.4 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 15.71 Tons, use ===> **16 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 23.98 s.y., use ===> **24 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-4c CALC'D BY: SCN DATE: 25-Mar-21 CHECK'D BY: GPP DATE: 25-Mar-21	14 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 17+00 Road Name US 21B (LT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 12 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 179.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 11.22 Tons, use ===> **12 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 18.42 s.y., use ===> **19 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-15 CALC'D BY: PRJ DATE: 7-Sep-19 CHECK'D BY: SCN DATE: 10-Sep-19	15 SHEET OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 21+48 Road Name FLINT HILL ROAD (LT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 10 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 144.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 9.04 Tons, use ===> **10 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 15.70 s.y., use ===> **16 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-17 CALC'D BY: PRJ DATE: 7-Sep-19 CHECK'D BY: SCN DATE: 10-Sep-19	SHEET 16 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 18+67 Road Name OLDNACL (RT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-16 CALC'D BY: PRJ DATE: 7-Sep-19 CHECK'D BY: SCN DATE: 10-Sep-19	SHEET 17 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 18+61 Road Name GOLDHILL REALIGNMENT (RT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall-17 CALC'D BY: SCN DATE: 6-Apr-21 CHECK'D BY: GPP DATE:	SHEET 18 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 17+21 Road Name OLDNACL (RT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 4.5 ft. Pipe Size (D_o) = 18 "

Width 2 (W_2) = 8 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 124.7 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 7.79 Tons, use ===> **8 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 14.15 s.y., use ===> **15 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall OP-39 CALC'D BY: SCN DATE: 6-Apr-21 CHECK'D BY: GPP DATE:	SHEET 19 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 22+00 Road Name US 21 (LT)

From Charts - Length (L_a) = 48 ft.

Width 1 (W_1) = 3 * D_o = 9.0 ft. Pipe Size (D_o) = 36 "

Width 2 (W_2) = 17 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class C (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 1.30 ft. d_{max} = 1.80 ft.

Thickness (T) = 1.5 * d_{max} = 2.70 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 1684.8 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 105.30 Tons, use ===> **106 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 105.93 s.y., use ===> **106 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

STV

STV Incorporated Consulting Engineers 454 S Anderson Rd, Suite 3, BTC 517 Rock Hill, SC, 29730	JOB: US 21/ SC 51 Phase I Widening SUBJECT: Outlet Protection Outfall OP-41 CALC'D BY: SCN DATE: 6-Apr-21 CHECK'D BY: GPP DATE:	SHEET 20 OF 20

DETERMINE RIP RAP APRON QUANTITY

GIVEN:

Outlet Protection for Pipe @ Sta. 33+65 Road Name US 21 (LT)

From Charts - Length (L_a) = 10 ft.

Width 1 (W_1) = 3 * D_o = 6.0 ft. Pipe Size (D_o) = 24 "

Width 2 (W_2) = 10 ft.

SOLUTION:

From Riprap Apron Design Charts Determine d_{50} Riprap Size

SCDOT Riprap Class B (Round up to match SCDOT riprap class - see Table #1 below)

d_{50} = 0.75 ft. d_{max} = 1.33 ft.

Thickness (T) = 1.5 * d_{max} = 2.00 ft.

Volume of Riprap = L_a * 0.5(W_1 + W_2) * T = 159.6 c.f.

Weight of Riprap = Vol. * (125 lbs./c.f.) / (2000 lbs./ton) = 9.98 Tons, use ===> **10 TONS**

DETERMINE GEOTEXTILE QUANTITY, TYPE, AND CLASS

SOLUTION:

Quantity of Geotextile

[L_a * 0.5(W_1 + W_2) + T(2L_a + W_1 + W_2)] / (9 s.f./s.y.) = 16.87 s.y., use ===> **17 SY**

SCDOT Geotextile Type C (see "Map of Recommended Geotextiles for Erosion Control")

SCDOT Geotextile Class 2 (In most cases will be Class 2; see SCDOT 2007 Specs., p.829)

Riprap Class	d_{50} Rock Size (ft.)	d_{max} (ft.)
A	0.50	0.75
B	0.75	1.33
C	1.30	1.80
D	1.80	2.25
E	2.25	2.85
F	2.85	3.60

TABLE #1: Riprap Class (From SCDOT 2007 Specs., P.825-826)

Appendix G

Closed Drainage System Calculations

Region 3 US 21 use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comment
SYSTEM-1								
HIGH POINT								
CB-103	36+63.16	17	2.08	1.23	0.06	2614	12600	
CB-200a	38+80.00	17	2.08	1.23	0.21	9148	12600	
CB-200	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-201	41+20.00	17	2.08	0.99	0.15	6534	11600	
SYSTEM-2								
HIGH POINT								
CB-236	61+30.53	17	2.78	0.99	0.22	9583	17000	
CB-210	60+00.00	17	2.78	1.95	0.17	7405	21500	
CB-215	57+82.29	17	2.08	2.83	0.24	10454	16600	
CB-208	56+40.00	17	2.08	2.83	0.14	6098	16600	
CB-206	53+00.00	17	2.08	2.83	0.33	14375	16600	
CB-204a	48+23.84	17	2.08	2.83	0.17	7405	16600	
CB-204	49+90.97	17	2.08	2.83	0.30	13068	16600	
CB-216	46+42.36	17	2.08	2.83	0.19	8276	16600	
CB-202	45+00.00	17	2.08	2.83	0.14	6098	16600	
CB-212	42+58.15	17	2.08	2.30	0.24	10454	15800	
SYSTEM-3								
HIGH POINT								
CB-242a	62+11.09	17	2.08	0.83	0.14	6098	10700	
CB-211a	61+52.44	17	2.08	0.83	0.17	7405	10700	
CB-211b	60+79.19	17	2.08	1.37	0.23	10019	13000	
CB-211	60+00.07	17	2.08	1.95	0.24	10454	15100	
CB-209	57+68.00	17	2.08	2.83	0.21	9148	16600	
CB-207a	54+60.75	17	2.08	2.83	0.31	13504	16600	
CB-207b	53+56.08	17	2.08	2.83	0.35	15246	16600	
CB-207	53+00.00	17	2.08	2.83	0.31	13504	16600	
CB-207c	52+43.61	17	2.08	2.83	0.38	16553	16600	
CB-207d	51+74.81	17	2.08	2.83	0.37	16117	16600	
CB-205a	51+00.00	17	2.08	2.83	0.38	16553	16600	
CB-205b	50+36.05	17	2.08	2.83	0.37	16117	16600	
CB-205c	49+68.70	17	2.08	2.83	0.37	16117	16600	
CB-205	49+00.00	17	2.08	2.83	0.37	16117	16600	
CB-241a	48+23.94	17	2.08	2.83	0.37	16117	16600	
CB-241b	47+55.73	17	2.08	2.83	0.31	13504	16600	
CB-241	46+98.66	17	2.08	2.83	0.28	12197	16600	
CB-203a	46+20.99	17	2.08	2.83	0.35	15246	16600	
CB-203b	45+59.72	17	2.08	2.83	0.27	11761	16600	
CB-203	45+00.00	17	2.08	2.83	0.24	10454	16600	
CB-213	43+66.03	17	2.08	2.83	0.14	6098	16600	
CB-214b	41+80.48	17	2.08	1.56	0.23	10019	13800	
CB-214a	40+94.84	17	2.08	0.76	0.09	3877	10150	
HIGH POINT								
CB-016	3590.89	17	2.08	1.22	0.25	10890	12450	
CB-017	3788.88	17	2.08	1.22	0.21	9147.6	12450	
CB-018	3950.28	17	2.08	0.612	0.17	7405.2	9100	
CB-019	Analysed as Weir no spread for Type 18 structure							LOW POINT

Region 3 US 21 use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comment
SYSTEM-4								
HIGH POINT								
CB-501	64+34.17	17	2.78	1.24	0.23	10019	18800	
CB-501a	65+43.56	17	2.78	1.29	0.24	10454	18950	
CB-502	66+60.31	17	2.78	1.10	0.10	4543	12000	
CB-502b	67+38.91	17	2.08	0.65	0.15	6347	9400	
CB-502a	68+07.79	17	2.08	0.27	0.08	3485	6000	
CB-503	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-506	78+44.69	17	2.08	0.96	0.18	7841	11300	
CB-506a	77+67.03	17	2.08	1.76	0.33	14375	14400	
CB-506b	77+41.16	17	2.08	1.76	0.33	14375	14400	
CB-506c	76+83.36	17	2.08	1.76	0.33	13496	14400	
CB-516	76+18.94	17	2.08	1.76	0.32	14268	14400	
CB-505	73+50.05	17	2.08	1.76	0.23	10019	14400	
CB-519	73+46.91	1	2.08	1.76	0.02	871	14400	
CB-504	70+95.56	17	2.08	1.76	0.31	13504	14400	
CB-504a	69+81.72	17	2.08	0.69	0.15	6534	9600	
HIGH POINT								
CB-600a	80+39.01	17	2.08	1.22	0.26	11326	11800	
CB-600b	80+85.61	17	2.08	1.22	0.26	11326	11800	
CB-600c	81+54.29	17	2.08	1.22	0.26	11326	11800	
CB-600	81+86.06	17	2.08	1.22	0.26	11326	11800	
CB-601a	83+53.82	17	2.78	1.22	0.25	10890	18400	
CB-601	84+00.00	17	2.78	1.22	0.11	4792	18400	
CB-602	85+40.95	17	2.78	1.22	0.25	10890	18400	
CB-602b	86+17.84	17	2.78	1.22	0.24	10454		CB-1 for driveway
CB-602a	87+11.67	17	2.78	1.22	0.27	11761	18400	
CB-603	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-700	96+56.84	17	2.08	2.18	0.13	5663	15400	
CB-606	94+26.36	17	2.08	2.18	0.33	14375	15400	
CB-605	92+23.33	17	2.08	2.18	0.27	11761	15400	
CB-604	90+63.18	17	2.08	2.18	0.35	15351	15400	
CB-604b	89+04.61	17	2.08	1.94	0.32	13743	15200	
CB-604a	88+26.64	17	2.08	0.99	0.10	4356	11600	
HIGH POINT								
CB-507	65+33.59	17	2.08	1.29	0.18	7841	12600	
CB-508	67+82.31	17	2.08	1.29	0.21	9148	12600	
CB-517	66+66.09	1	2.08	1.06	0.09	3920	11800	
CB-518	Analysed as Weir no spread for Type 1 structure							LOW POINT
CB-509	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-515	78+35.29	17	2.08	1.01	0.19	8276	11600	
CB-514	77+22.99	17	2.08	1.69	0.10	4356	14200	
CB-513	75+87.00	17	2.08	1.76	0.14	6098	14400	
CB-512	74+52.95	17	2.08	1.76	0.13	5663	14400	
CB-512a	73+48.38	17	2.08	1.76	0.10	4356	14400	
CB-511	71+80.59	17	2.08	1.76	0.18	7841	14400	
CB-510	69+11.94	17	2.08	1.76	0.25	10890	14400	

Region 3 US 21 use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comment
HIGH POINT								
CB-607	81+86.94	17	2.08	1.08	0.23	10019	11700	
CB-608	84+03.98	17	2.08	1.22	0.24	10454	12500	
CB-609	85+43.35	17	2.08	1.22	0.13	5663	12500	
CB-609a	87+04.94	17	2.78	0.49	0.19	8276	12100	
CB-610	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-706	96+60.71	17	2.08	2.18	0.18	7841	15400	
CB-614	94+25.20	17	2.08	2.18	0.22	9583	15400	
CB-613	92+92.33	17	2.08	2.18	0.12	5227	15400	
CB-618	92+88.49	1	2.08	2.18	0.07	3049	14600	
CB-617	90+90.46	1	2.08	2.18	0.06	2614	14600	
CB-612	91+77.48	17	2.08	2.18	0.10	4356	15400	
CB-611	88+86.76	17	2.78	1.72	0.34	14810	20800	
CB-611a	87+96.05	17	2.78	0.62	0.12	5227	13500	
SYSTEM-5								
HIGH POINT								
CB-701a	98+95.10	17	2.08	0.25	0.10	4356	5800	
CB-702A	99+43.78	1	2.08	0.25	0.04	1742	5750	
CB-701	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-703	103+64.98	17	2.08	1.37	0.14	6098	13000	
CB-702	101+74.45	17	2.08	0.72	0.19	8276	9800	
CB-701b	100+19.63	17	2.08	0.72	0.15	6534	9800	
HIGH POINT								
CB-707a	99+23.94	17	2.08	0.15	0.11	4792	5400	
CB-707	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-710a	105+41.74	17	2.08	1.06	0.15	6534	11800	
CB-709	103+64.98	17	2.08	1.37	0.17	7405	13000	
CB-708	101+74.44	17	2.08	0.72	0.19	8276	9800	
CB-707b	100+19.74	17	2.08	0.72	0.15	6534	9800	
SYSTEM-6								
HIGH POINT								
CB-705	107+00.00	17	2.08	1.13	0.24	10454	11900	
CB-704	105+15.00	17	2.08	1.13	0.19	8276	11900	
CB-704A	105+14.82	1	2.08	1.13	0.03	1307	13500	
HIGH POINT								
CB-710	107+01.38	17	2.08	1.06	0.22	9583	11800	
HIGH POINT								
CB-800	110+06.87	17	2.08	0.28	0.13	5663	9200	
CB-801	112+02.34	17	2.08	0.84	0.22	9583	10800	
CB-802	114+60.32	17	2.08	1.36	0.25	10890	12900	
CB-803	116+62.72	17	2.08	1.36	0.20	8712	12900	
CB-804	118+90.51	17	2.08	1.36	0.23	10019	12900	
CB-805	121+90.86	17	2.08	1.36	0.29	12632	12900	
CB-806	124+15.74	17	2.08	1.36	0.22	9583	12900	
CB-806A	125+11.07	17	2.08	1.36	0.09	3920	12900	
CB-900	126+68.43	17	2.08	1.36	0.16	6970	12900	
CB-901	129+10.41	17	2.08	1.21	0.26	11326	12400	
CB-902	131+10.22	17	2.08	1.21	0.22	9583	12400	
CB-903	134+07.56	17	3.73	1.21	0.43	18731	26635	

Region 3 US 21 use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comment
HIGH POINT								
CB-801b	110+68.52	1	2.08	0.45	0.02	784	7700	
CB-807	110+64.12	17	2.08	0.44	0.14	6098	7600	
CB801a	112+61.39	1	2.08	1.00	0.01	566	11600	
CB-808	113+55.50	17	2.08	1.28	0.25	10890	12500	
CB-809	115+55.41	17	2.08	1.36	0.21	9148	12900	
CB-816	116+57.13	17	2.08	1.36	0.10	4356	12900	
CB-810	117+90.10	17	2.08	1.36	0.13	5663	12900	
CB-811	119+76.21	17	2.08	1.36	0.18	7841	12900	
CB-812	121+91.10	17	2.08	1.36	0.21	9148	12900	
CB-813	123+92.67	17	2.08	1.36	0.20	8712	12900	
CB-904	125+41.49	17	2.78	1.36	0.18	7841	12900	
CB-905a	127+04.57	17	2.78	1.36	0.24	10454	12900	
CB-905	128+12.11	17	2.78	1.31	0.29	12632	18800	
CB-906a	130+02.51	17	2.78	1.21	0.28	12197	18000	
CB-906	130+79.23	17	1.30	1.21	0.10	4356	5400	
CB-907	Structure is on the super							Super
HIGH POINT								
CB-908	130+80.44	1	1.28	1.21	0.05	2178	5400	
CB-909	132+82.58	1	2.59	1.21	0.19	8276	12400	
CB-910	134+08.82	1	3.73	1.21	0.12	5227	17250	
SYSTEM-12								
HIGH POINT								
CB-036	16+57.52	1	2.08	1.13	0.01	536	10900	
CB-041	15+59.81	1	2.08	0.81	0.01	222	10400	
CB-020	15+57.34	17	2.08	0.80	0.06	2614	10200	
CB-021	16+38.76	17	2.08	1.07	0.07	3093	11600	
CB-024	17+52.20	17	2.08	1.28	0.25	11814	12500	
CB-025	18+36.29	17	2.08	1.25	0.24	10454	12700	
CB-026	21+80.00	17	2.08	1.16	0.18	7671	12100	
CB-028	20+26.34	17	2.08	1.16	0.20	8712	12100	
CB-027	21+80.00	17	2.08	1.16	0.17	7475	12100	
CB-030	22+44.17	17	2.08	1.16	0.13	5772	12100	
CB-032	24+32.75	17	2.08	1.16	0.25	10890	12100	
CB-033	26+41.38	17	2.08	1.16	0.27	11761	12100	
CB-034	27+39.01	17	2.08	1.16	0.14	6098	12100	
CB-035	10+74.44	17	1.32	3.95	0.07	3049	17700	
CB-113a	10+76.57	17	2.08	4.02	0.10	4356	17800	
CB-113b	28+68.31	17	2.08	1.23	0.14	6098	12600	
CB-113	29+44.43	17	2.08	1.23	0.13	5663	12600	
CB-108	30+25.05	17	2.08	1.23	0.11	4792	12600	
CB-109	31+65.69	17	2.08	1.23	0.24	10454	12600	
CB-110	33+12.03	17	2.08	1.23	0.15	6534	12600	
CB-110a	34+07.30	17	2.08	1.23	0.10	4487	12600	
CB-111	35+31.25	17	2.08	1.23	0.13	5663	12600	
CB-105	29+73.25	1	2.08	1.23	0.02	697	12400	
CB-106	31+68.11	1	2.08	1.23	0.02	784	12400	
SYSTEM-17								
HIGH POINT								
CB-005	24+65.36	17	2.08	1.16	0.24	10454	12100	
CB-006	27+28.70	17	2.08	1.16	0.25	10890	12100	
CB-037	27+34.46	1	2.08	1.16	0.03	1220	11000	
CB-010	28+55.79	17	2.08	1.22	0.18	7841	12450	
CB-012	29+66.01	17	2.08	1.22	0.11	4792	12450	
CB-013	31+55.14	17	2.08	1.22	0.19	8276	12450	
CB-015	33+62.35	17	2.08	1.22	0.22	9583	12450	

Region 3 US 21 use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comment
SYSTEM-18								
HIGH POINT								
CB-001	15+74.17	17	2.08	0.86	0.17	7405	10800	
CB-002	18+27.13	17	2.08	1.26	0.26	11326	12400	
CB-003	20+24.53	17	2.08	1.16	0.21	9148	12100	
CB-004	22+42.02	17	2.08	1.16	0.12	5258	12100	

Region 3 US 21 BUSINESS use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comments
SYSTEM-13								
HIGH POINT								
CB-235	11+05.26	17	1.87	2.07	0.11	4792	15400	
CB-234	12+82.12	17	1.15	0.92	0.18	7841	11200	
HIGH POINT								
CB-230	11+33.55	17	2.08	2.07	0.18	7841	15400	
CB-229	12+81.99	17	2.08	0.92	0.21	9148	11200	
CB-229a	13+49.63	17	2.08	0.46	0.09	3920	7800	
CB-232	13+94.67	17	2.08	0.46	0.16	6970	7800	
CB-228	14+50.31	17	2.09	0.46	0.12	5227	7800	
CB-227a	15+87.77	17	3.68	0.46	0.30	13068	20500	
CB-227	17+00.87	17	3.68	0.46	0.20	8712	20500	
CB-244	18+29.94	17	3.68	0.46	0.46	20038	20500	
CB-226	19+51.28	17	3.68	0.46	0.17	7405	20500	
CB-246	20+27.32	17	2.08	0.63	0.09	3920	9200	

Region 3 REGENT PARKWAY use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comments
SYSTEM-12								
HIGH POINT								
CB-620	13+80.45	17	3.15	1.80	0.39	16988	21200	
CB-622	Structure is on the super							Super

Region 3 FLINT HILL use Cross drain 2.08%

Structure No.	STA	Structure Type	Cross Slope (%)	Road Grade (%)	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart (SF)	Comments
SYSTEM-14								
HIGH POINT								
CB-1405	13+20.52	17	2.08	1.41	0.05	2178	13400	
CB-1403	Analysed as Weir no spread for Type 1 structure							LOW POINT
CB-1404	Analysed as Weir no spread for Type 1 structure							LOW POINT

Region 3 SC 51

Structure No.	STA	Structure Type	Cross Slope	Road Grade	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart	Comments
SYSTEM-9								
HIGH POINT								
CB-911a	297+08.12	17	2.78	0.44	0.26	11326	11400	
CB-911	297+74.63	17	2.78	0.44	0.26	11326	11400	
CB-1001b	298+42.91	17	2.78	0.44	0.25	10890	11400	
CB-1001a	299+27.96	17	3.08	0.44	0.26	11326	11400	
CB-1001	299+85.62	17	3.85	0.44	0.44	19166	20000	
CB-1002	301+71.67	17	3.85	1.51	0.69	30056	34000	
CB-1003a	302+96.06	17	3.06	2.71	0.60	26136	53000	
CB-1003	303+72.96	17	2.78	3.33	0.37	16117	24000	
CB-1004a	304+20.09	17	2.78	3.33	0.36	15682	24000	
CB-1004b	304+55.31	17	2.78	3.33	0.39	16988	24000	
CB-1004c	304+97.43	17	2.78	3.33	0.35	15246	24000	
CB-1004d	305+23.79	17	2.78	3.33	0.33	14375	24000	
CB-1004	305+50.79	17	2.78	3.33	0.39	16988	17200	
CB-1005	307+76.52	17	2.08	3.33	0.39	16988	17200	
CB-1006	309+58.17	17	2.08	3.33	0.19	8276	17200	
CB-1007	310+98.52	17	2.08	3.33	0.14	6098	17200	
CB-1007a	311+92.95	17	2.08	3.33	0.23	10019	17200	
CB-1008	313+10.11	17	2.08	3.33	0.37	16117	17200	
CB-1101	314+87.71	17	2.08	1.93	0.28	12197	15100	
CB-1102	315+93.54	17	2.08	0.67	0.10	4356	9600	
HIGH POINT								
CB-1017	306+02.33	17	1.82	3.33	0.11	4792	17200	
CB-1018	308+61.04	17	2.08	3.33	0.27	11761	17200	
CB-1019	310+23.24	17	2.08	3.33	0.16	6970	17200	
CB-1020	311+76.22	17	2.08	3.33	0.16	6970	17200	
CB-1103	314+09.29	17	2.08	2.86	0.24	10454	16600	
CB-1104	315+93.54	17	2.08	0.67	0.19	8276	9600	
SYSTEM-10								
HIGH POINT								
CB-1111	326+65.26	17	2.08	0.72	0.18	7841	9800	
CB-1110	324+97.51	17	2.08	1.50	0.22	9583	13800	
CB-1109a	323+75.00	17	2.08	1.96	0.31	13678	15200	
CB-1109	322+82.00	17	2.08	2.50	0.37	16117	16200	
CB-1108	321+10.79	17	2.08	2.50	0.20	8712	16200	
CB-1107	319+59.80	17	2.08	2.50	0.32	13839	16200	
CB-1106a	317+91.34	17	2.08	1.68	0.21	9148	14400	
CB-1106	316+85.81	17	2.08	0.43	0.08	3485	7500	
CB-1105	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-1200b	328+73.25	17	2.00	0.26	0.06	2614	5400	
CB-1200a	329+54.84	17	1.11	0.31	0.08	3485	5400	
HIGH POINT								
CB-1203	337+47.23	17	1.55	1.10	0.08	3485	5400	
CB-1204	340+00.33	17	2.08	1.30	0.26	11326	12900	

Region 3 SC 51

Structure No.	STA	Structure Type	Cross Slope	Road Grade	Drain Area (Ac)	Drain Area (SF)	Drain Area per Chart	Comments
HIGH POINT								
CB-1117	326+64.70	17	2.08	0.72	0.17	7405	9800	
CB-1116	324+97.51	17	2.08	1.50	0.17	7405	13800	
CB-1115	322+67.71	17	2.08	2.50	0.22	9583	16200	
CB-1114	320+97.47	17	2.08	2.50	0.19	8276	16200	
CB-1113	319+54.64	17	2.08	2.50	0.08	3485	16200	
CB-1112	316+85.81	17	2.08	0.43	0.17	7405	7500	
CB-1112a	318+04.58	17	2.08	1.84	0.19	8276	15000	
HIGH POINT								
CB-1205a	329+27.63	17	2.08	0.31	0.12	5227	6400	
HIGH POINT								
CB-1207a	334+91.69	17	2.45	0.58	0.20	8712	13200	
CB-1207	333+65.70	17	2.45	1.38	0.26	11326	18500	
CB-1206b	333+09.21	17	2.45	1.49	0.12	5227	19900	
CB-1206a	332+23.39	17	2.45	1.03	0.17	7405	17200	
CB-1206	331+46.13	17	2.08	0.61	0.18	7841	9100	
CB-1205	Analysed as Weir no spread for Type 18 structure							LOW POINT
HIGH POINT								
CB-1216	336+46.40	17	2.08	0.42	0.14	6098	7400	
CB-1208	337+47.30	17	2.08	1.06	0.13	5663	11800	
CB-1209	339+33.50	17	2.08	1.30	0.19	8276	12900	

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GEOPAK Output Tables

GEOPAK Output Type: **Area**

Area ID	Tc Used	Discharge	Intensity	Composite c value	Composite Area	Notes
CB-001	5	1.09	7.76	0.83	0.17	
CB-002	5	1.63	7.76	0.81	0.26	
CB-003	5	1.47	7.76	0.90	0.21	
CB-004	5	0.84	7.76	0.90	0.12	
CB-005	5	1.19	7.76	0.90	0.17	
CB-006	5	1.53	7.76	0.79	0.25	
CB-008	5	0.52	7.76	0.74	0.09	
CB-009	5	0.44	7.76	0.71	0.08	
CB-010	5	1.15	7.76	0.82	0.18	
CB-012	5	0.70	7.76	0.82	0.11	
CB-013	5	1.18	7.76	0.80	0.19	
CB-015	5	1.42	7.76	0.83	0.22	
CB-016	5	1.53	7.76	0.79	0.25	
CB-017	5	1.29	7.76	0.79	0.21	
CB-018	5	1.04	7.76	0.79	0.17	
CB-019	5	0.86	7.76	0.79	0.14	
CB-020	5	0.35	7.76	0.75	0.06	
CB-021	5	0.45	7.76	0.81	0.07	
CB-024	5	1.67	7.76	0.86	0.25	
CB-025	5	1.49	7.76	0.80	0.24	
CB-026	5	1.26	7.76	0.90	0.18	
CB-027	5	1.19	7.76	0.90	0.17	
CB-028	5	1.33	7.76	0.86	0.20	
CB-030	5	0.93	7.76	0.90	0.13	
CB-032	5	1.26	7.76	0.90	0.18	
CB-033	5	1.57	7.76	0.75	0.27	
CB-034	5	0.74	7.76	0.68	0.14	
CB-035	5	0.36	7.76	0.67	0.07	
CB-036	5	0.14	7.76	0.90	0.02	
CB-037	5	0.20	7.76	0.90	0.03	
CB-103	5	0.42	7.76	0.90	0.06	
CB-105	5	0.11	7.76	0.90	0.02	
CB-106	5	0.13	7.76	0.90	0.02	
CB-108	5	0.56	7.76	0.66	0.11	
CB-109	5	1.17	7.76	0.63	0.24	
CB-110	5	1.04	7.76	0.90	0.15	
CB-111	5	0.91	7.76	0.90	0.13	
CB-113	5	0.61	7.76	0.60	0.13	
CB-200	5	1.89	7.76	0.90	0.27	
CB-201	5	1.05	7.76	0.90	0.15	
CB-202	5	0.98	7.76	0.90	0.14	
CB-203	6	0.76	7.49	0.42	0.24	
CB-204	5	2.10	7.76	0.90	0.30	
CB-205	13	0.83	5.61	0.40	0.37	
CB-206	5	2.30	7.76	0.90	0.33	
CB-207	20	0.59	4.60	0.41	0.31	
CB-208	5	0.98	7.76	0.90	0.14	
CB-209	5	1.47	7.76	0.90	0.21	
CB-210	5	1.19	7.76	0.90	0.17	
CB-211	7	0.80	6.98	0.48	0.24	
CB-212	5	1.68	7.76	0.90	0.24	

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GEOPAK Output Tables

GEOPAK Output Type: **Area**

Area ID	Tc Used	Discharge	Intensity	Composite c value	Composite Area	Notes
CB-213	5	0.98	7.76	0.90	0.14	
CB-215	5	1.68	7.76	0.90	0.24	
CB-216	5	1.33	7.76	0.90	0.19	
CB-226	5	1.06	7.76	0.80	0.17	
CB-227	5	1.40	7.76	0.90	0.20	
CB-228	5	0.65	7.76	0.70	0.12	
CB-229	5	1.03	7.76	0.63	0.21	
CB-230	5	1.17	7.76	0.84	0.18	
CB-232	5	0.87	7.76	0.70	0.16	
CB-233	5	0.91	7.76	0.90	0.13	
CB-234	5	1.06	7.76	0.76	0.18	
CB-235	5	0.71	7.76	0.83	0.11	
CB-236	5	1.54	7.76	0.90	0.22	
CB-241	7	1.13	7.18	0.56	0.28	
CB-244	5	3.03	7.76	0.85	0.46	
CB-246	5	0.63	7.76	0.90	0.09	
CB-501	14	0.87	5.43	0.70	0.23	
CB-502	5	0.70	7.76	0.90	0.10	
CB-503	5	1.89	7.76	0.90	0.27	
CB-504	5	1.95	7.76	0.81	0.31	
CB-505	5	1.61	7.76	0.90	0.23	
CB-506	5	1.26	7.76	0.90	0.18	
CB-507	5	1.26	7.76	0.90	0.18	
CB-508	5	1.47	7.76	0.90	0.21	
CB-509	5	0.77	7.76	0.90	0.11	
CB-510	5	0.91	7.76	0.90	0.13	
CB-511	5	1.26	7.76	0.90	0.18	
CB-512	5	0.91	7.76	0.90	0.13	
CB-513	5	0.98	7.76	0.90	0.14	
CB-514	5	0.70	7.76	0.90	0.10	
CB-515	5	1.33	7.76	0.90	0.19	
CB-516	7	1.75	7.18	0.74	0.33	
CB-517	5	0.63	7.76	0.90	0.09	
CB-518	5	0.35	7.76	0.90	0.05	
CB-519	5	0.14	7.76	0.90	0.02	
CB-520	5	0.13	7.76	0.90	0.02	
CB-521	5	0.24	7.76	0.90	0.04	
CB-524	5	0.21	7.76	0.90	0.03	
CB-600	12	0.68	5.80	0.45	0.26	
CB-601	5	0.77	7.76	0.90	0.11	
CB-602	5	1.21	7.76	0.60	0.26	
CB-603	5	0.77	7.76	0.90	0.11	
CB-604	6	1.32	7.35	0.53	0.34	
CB-605	5	1.89	7.76	0.90	0.27	
CB-606	5	2.30	7.76	0.90	0.33	
CB-607	5	1.61	7.76	0.90	0.23	
CB-608	5	1.68	7.76	0.90	0.24	
CB-609	5	0.91	7.76	0.90	0.13	
CB-610	5	0.70	7.76	0.90	0.10	
CB-611	5	2.37	7.76	0.90	0.34	
CB-612	5	0.70	7.76	0.90	0.10	

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GEOPAK Output Tables

GEOPAK Output Type: **Area**

Area ID	Tc Used	Discharge	Intensity	Composite c value	Composite Area	Notes
CB-613	5	0.84	7.76	0.90	0.12	
CB-614	5	1.54	7.76	0.90	0.22	
CB-617	5	0.42	7.76	0.90	0.06	
CB-618	5	0.49	7.76	0.90	0.07	
CB-620	5	2.36	7.76	0.78	0.39	
CB-622	5	0.19	7.76	0.40	0.06	
CB-700	5	0.91	7.76	0.90	0.13	
CB-701	5	0.98	7.76	0.90	0.14	
CB-702	5	1.33	7.76	0.90	0.19	
CB-703	5	1.01	7.76	0.90	0.14	
CB-704	5	1.12	7.76	0.90	0.16	
CB-705	5	1.61	7.76	0.90	0.23	
CB-706	5	1.47	7.76	0.90	0.21	
CB-707	5	0.77	7.76	0.90	0.11	
CB-708	5	1.33	7.76	0.90	0.19	
CB-709	5	1.19	7.76	0.90	0.17	
CB-710	5	1.54	7.76	0.90	0.22	
CB-800	5	0.91	7.76	0.90	0.13	
CB-801	5	1.54	7.76	0.90	0.22	
CB-802	5	1.75	7.76	0.90	0.25	
CB-803	5	1.40	7.76	0.90	0.20	
CB-804	5	1.61	7.76	0.90	0.23	
CB-805	5	2.03	7.76	0.90	0.29	
CB-806	5	1.54	7.76	0.90	0.22	
CB-807	5	0.98	7.76	0.90	0.14	
CB-808	5	1.75	7.76	0.90	0.25	
CB-809	5	1.47	7.76	0.90	0.21	
CB-810	5	0.91	7.76	0.90	0.13	
CB-811	5	1.26	7.76	0.90	0.18	
CB-812	5	1.47	7.76	0.90	0.21	
CB-813	5	1.40	7.76	0.90	0.20	
CB-816	5	0.70	7.76	0.90	0.10	
CB-900	5	1.12	7.76	0.90	0.16	
CB-901	5	1.82	7.76	0.90	0.26	
CB-902	5	1.54	7.76	0.90	0.22	
CB-903	5	3.00	7.76	0.90	0.43	
CB-904	5	1.26	7.76	0.90	0.18	
CB-905	5	1.94	7.76	0.86	0.29	
CB-906	5	0.70	7.76	0.90	0.10	
CB-907	5	0.42	7.76	0.90	0.06	
CB-908	5	0.35	7.76	0.90	0.05	
CB-909	5	1.33	7.76	0.90	0.19	
CB-910	5	0.84	7.76	0.90	0.12	
CB-911	5	2.31	7.76	0.85	0.35	
DI-007	5	2.54	7.76	0.39	0.84	
DI-011	5	1.03	7.76	0.34	0.39	
DI-014	5	4.84	7.76	0.38	1.64	
DI-022	5	2.35	7.76	0.55	0.55	
DI-023	5	0.42	7.76	0.70	0.08	
DI-026	5	2.68	7.76	0.69	0.50	
DI-027	5	5.54	7.76	0.60	1.19	

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GEOPAK Output Tables

GEOPAK Output Type: **Area**

Area ID	Tc Used	Discharge	Intensity	Composite c value	Composite Area	Notes
DI-029	5	3.56	7.76	0.90	0.51	
DI-100	7	13.91	7.05	0.60	3.29	
DI-219	11	2.28	6.00	0.21	1.81	
DI-220	8	1.17	6.66	0.20	0.88	
DI-221	11	1.44	6.00	0.25	0.96	
DI-222	17	1.00	4.98	0.25	0.80	
DI-239	5	7.97	7.76	0.65	1.58	
DI-525	5	0.77	7.76	0.68	0.15	
DI-714	8	0.29	6.83	0.20	0.21	
DI-715	10	0.17	6.23	0.20	0.14	
DI-913	5	0.73	7.76	0.85	0.11	
DI-914	5	1.06	7.76	0.85	0.16	
CB-1001	8	2.69	6.86	0.80	0.49	
CB-1002	9	2.30	6.53	0.56	0.63	
CB-1003	15	0.81	5.27	0.45	0.34	
CB-1004	27	0.54	3.95	0.35	0.39	
CB-1005	26	0.64	4.03	0.41	0.39	
CB-1006	5	1.33	7.76	0.90	0.19	
CB-1007	5	0.98	7.76	0.90	0.14	
CB-1008	20	1.06	4.60	0.62	0.37	
CB-1017	5	0.77	7.76	0.90	0.11	
CB-1018	5	1.89	7.76	0.90	0.27	
CB-1019	5	1.12	7.76	0.90	0.16	
CB-1020	5	1.12	7.76	0.90	0.16	
CB-1101	10	1.10	6.23	0.63	0.28	
CB-1102	5	0.70	7.76	0.90	0.10	
CB-1103	5	1.68	7.76	0.90	0.24	
CB-1104	5	1.33	7.76	0.90	0.19	
CB-1105	5	0.56	7.76	0.90	0.08	
CB-1106	5	0.98	7.76	0.90	0.14	
CB-1107	5	2.23	7.76	0.90	0.32	
CB-1108	5	1.40	7.76	0.90	0.20	
CB-1109	18	1.57	4.84	0.90	0.36	
CB-110a	5	0.72	7.76	0.90	0.10	
CB-1110	5	1.54	7.76	0.90	0.22	
CB-1111	5	1.26	7.76	0.90	0.18	
CB-1112	5	0.84	7.76	0.90	0.12	
CB-1113	5	1.05	7.76	0.90	0.15	
CB-1114	5	1.33	7.76	0.90	0.19	
CB-1115	5	1.54	7.76	0.90	0.22	
CB-1116	5	1.19	7.76	0.90	0.17	
CB-1117	5	1.19	7.76	0.90	0.17	
CB-113a	5	0.60	7.76	0.77	0.10	
CB-113b	5	1.21	7.76	0.74	0.21	
CB-1203	5	0.56	7.76	0.90	0.08	
CB-1204	5	1.82	7.76	0.90	0.26	
CB-1205	5	2.79	7.76	0.90	0.40	
CB-1206	5	1.26	7.76	0.90	0.18	
CB-1207	5	1.82	7.76	0.90	0.26	
CB-1208	5	0.91	7.76	0.90	0.13	
CB-1209	5	1.33	7.76	0.90	0.19	

STV	STV Inc. Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, South Carolina 29730-3392	JOB: US 21 / SC 51 Improvements SUBJECT: GEOPAK Output Tables CALC'D BY: SCN DATE: 30-Mar-22 CHEK'D BY: GPP DATE: 31-Mar-22	SHEET OF 6

GEOPAK Output Tables

GEOPAK Output Type: **Area**

Area ID	Tc Used	Discharge	Intensity	Composite c value	Composite Area	Notes
CB-1216	5	0.98	7.76	0.90	0.14	
CB-1403	5	1.23	7.76	0.66	0.24	
CB-1405	5	0.26	7.76	0.66	0.05	
CB-200a	5	2.51	7.76	0.90	0.36	
CB-203a	10	0.92	6.25	0.42	0.35	
CB-203b	5	0.88	7.76	0.42	0.27	
CB-204a	5	1.19	7.76	0.90	0.17	
CB-205a	17	0.76	4.98	0.40	0.38	
CB-205b	13	0.83	5.61	0.40	0.37	
CB-205c	13	0.83	5.61	0.40	0.37	
CB-207a	5	2.16	7.76	0.90	0.31	
CB-207b	22	0.63	4.39	0.41	0.35	
CB-207c	20	0.72	4.60	0.41	0.38	
CB-207d	18	0.73	4.84	0.41	0.37	
CB-211a	6	0.60	7.38	0.48	0.17	
CB-211b	7	0.77	6.98	0.48	0.23	
CB-214a	5	0.59	7.76	0.85	0.09	
CB-214b	5	1.52	7.76	0.85	0.23	
CB-227a	5	1.98	7.76	0.85	0.30	
CB-229a	5	0.47	7.76	0.67	0.09	
CB-241a	6	1.54	7.42	0.56	0.37	
CB-241b	5	1.35	7.76	0.56	0.31	
CB-242a	6	0.50	7.38	0.48	0.14	
CB-501a	11	0.98	6.00	0.68	0.24	
CB-502a	5	0.56	7.76	0.90	0.08	
CB-502b	5	1.05	7.76	0.90	0.15	
CB-504a	5	1.02	7.76	0.88	0.15	
CB-506a	26	0.98	4.03	0.74	0.33	
CB-506b	25	1.00	4.11	0.74	0.33	
CB-506c	7	1.75	7.18	0.74	0.33	
CB-512a	5	0.70	7.76	0.90	0.10	
CB-600a	11	0.70	6.00	0.45	0.26	
CB-600b	13	0.66	5.61	0.45	0.26	
CB-600c	11	0.70	6.00	0.45	0.26	
CB-601a	5	1.75	7.76	0.90	0.25	
CB-602a	9	1.03	6.37	0.60	0.27	
CB-602b	5	1.02	7.76	0.60	0.22	
CB-604a	5	0.70	7.76	0.90	0.10	
CB-604b	6	1.29	7.38	0.53	0.33	
CB-609a	5	1.33	7.76	0.90	0.19	
CB-611a	5	0.84	7.76	0.90	0.12	
CB-701a	5	0.70	7.76	0.90	0.10	
CB-701b	5	1.05	7.76	0.90	0.15	
CB-702a	5	0.28	7.76	0.90	0.04	
CB-704a	5	0.21	7.76	0.90	0.03	
CB-707a	5	0.56	7.76	0.90	0.08	
CB-707b	5	1.05	7.76	0.90	0.15	
CB-710a	5	1.05	7.76	0.90	0.15	
CB-801a	5	0.09	7.76	0.90	0.01	
CB-801b	5	0.13	7.76	0.90	0.02	
CB-806A	5	0.63	7.76	0.90	0.09	

STV	**STV Inc.** Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, South Carolina 29730-3392	JOB: US 21 / SC 51 Improvements SUBJECT: GEOPAK Output Tables CALC'D BY: SCN DATE: 30-Mar-22 CHEK'D BY: GPP DATE: 31-Mar-22	SHEET OF 6

GEOPAK Output Tables

GEOPAK Output Type: **Area**

Area ID	Tc Used	Discharge	Intensity	Composite c value	Composite Area	Notes
CB-905a	5	1.68	7.76	0.90	0.24	
CB-906a	5	1.96	7.76	0.90	0.28	
CB-911a	5	2.11	7.76	0.85	0.32	
DI-1021	9	0.47	6.53	0.30	0.24	
DI-1022	20	6.29	4.60	0.52	2.63	
DI-1023	5	8.61	7.76	0.59	1.88	
DI-1024	14	1.90	5.43	0.46	0.76	
DI-1025	11	1.12	6.00	0.30	0.62	
DI-1026	9	2.72	6.58	0.30	1.38	
DI-1027	29	0.87	3.80	0.30	0.76	
DI-1404	5	1.30	7.76	0.73	0.23	
DI-1406	5	5.54	7.76	0.85	0.84	
DI-1601	5	1.21	7.76	0.40	0.39	
DI-228a	5	0.19	7.76	0.22	0.11	
DI-245a	16	0.47	5.12	0.22	0.42	
DI-506d	29	4.89	3.80	0.70	1.84	
DI-507A	5	0.45	7.76	0.45	0.13	
DI-603a	11	0.87	6.00	0.52	0.28	
DI-604C	7	1.55	6.95	0.62	0.36	
DI-700a	19	0.55	4.72	0.30	0.39	
DI-904A	5	0.28	7.76	0.45	0.08	
DI-907A	7	3.80	6.95	0.68	0.80	
ECB-623	5	2.09	7.76	0.84	0.32	
OEP-242	7	6.14	7.21	0.51	1.67	
OEP-524	8	1.76	6.72	0.32	0.82	
CB-1001a	5	2.86	7.76	0.80	0.46	
CB-1001b	5	1.55	7.76	0.80	0.25	
CB-1003a	19	1.36	4.72	0.45	0.64	
CB-1004a	24	0.53	4.20	0.35	0.36	
CB-1004b	27	0.54	3.95	0.35	0.39	
CB-1004c	28	0.47	3.87	0.35	0.35	
CB-1004d	25	0.47	4.11	0.35	0.33	
CB-1007a	20	0.66	4.60	0.62	0.23	
CB-1106a	5	1.47	7.76	0.90	0.21	
CB-1109a	8	1.75	6.72	0.90	0.29	
CB-1112a	5	1.05	7.76	0.90	0.15	
CB-1200a	5	0.56	7.76	0.90	0.08	
CB-1200b	5	0.42	7.76	0.90	0.06	
CB-1205a	5	0.84	7.76	0.90	0.12	
CB-1206a	5	1.19	7.76	0.90	0.17	
CB-1206b	5	0.84	7.76	0.90	0.12	
CB-1207a	5	1.40	7.76	0.90	0.20	
DI-1112b	5	0.38	7.76	0.35	0.14	
ECB-1401	8	1.76	6.72	0.32	0.82	
ECB-1402	5	2.46	7.76	0.72	0.44	
EXIP-531	5	3.66	7.76	0.86	0.55	
OEP-1407	14	8.23	5.43	0.75	2.02	

STV	STV Inc. Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, South Carolina 29730-3392	JOB: S-160 Widening SUBJECT: GEOPAK Output Tables CALC'D BY: SCN DATE: 30-Mar-22 CHEK'D BY: GPP DATE: 31-Mar-22	SHEET OF 8

GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
OP-39	OP	US21FP	22+00.00	575.07	0.00	0.00	0.00	
OP-41	OP	US21FP	33+64.94	570.23	0.00	0.00	0.00	
CB-001	C.B. TYPE 17	US21FP	15+74.17	616.19	5.99	6.41	1.15	
CB-002	C.B. TYPE 17	US21FP	18+27.13	613.23	4.50	7.64	2.53	
CB-003	C.B. TYPE 17	US21FP	20+24.53	610.86	4.50	8.24	3.73	
CB-004	C.B. TYPE 17	US21FP	23+09.00	607.67	17.38	7.79	33.69	
CB-005	C.B. TYPE 17	US21FP	24+65.36	605.76	12.13	6.97	8.27	
CB-006	C.B. TYPE 17	US21FP	27+28.70	602.72	8.38	6.12	7.48	
CB-008	EX CATCH BASIN	US21FP	27+75.18	602.38	4.46	5.00	0.52	
CB-009	EX CATCH BASIN	US21FP	28+07.41	602.39	4.54	5.31	0.94	
CB-010	C.B. TYPE 17	US21FP	28+55.79	601.21	5.60	5.65	3.71	
CB-012	C.B. TYPE 17	US21FP	29+66.01	599.85	3.67	5.00	0.70	
CB-013	C.B. TYPE 17	US21FP	31+55.14	597.53	5.00	5.03	6.01	
CB-015	C.B. TYPE 17	US21FP	33+62.35	594.98	9.12	5.38	7.29	
CB-016	C.B. TYPE 17	US21FP	35+90.89	592.17	4.50	5.00	1.53	
CB-017	C.B. TYPE 17	US21FP	37+88.88	589.74	4.50	5.68	2.72	
CB-018	C.B. TYPE 17	US21FP	39+50.28	587.96	11.07	24.59	18.83	
CB-019	C.B. TYPE 18	US21FP	40+14.96	587.76	8.23	24.48	16.81	
CB-020	C.B. TYPE 17	US21FP	15+57.34	616.33	5.98	5.02	2.69	
CB-021	C.B. TYPE 1	US21FP	16+35.64	615.20	5.26	5.32	3.50	
CB-024	C.B. TYPE 17	US21FP	17+55.50	614.18	5.31	5.82	7.59	
CB-025	C.B. TYPE 17	US21FP	18+33.00	613.12	5.69	5.99	14.22	
CB-026	C.B. TYPE 17	US21FP	21+98.00	610.84	21.16	8.74	37.11	
CB-027	C.B. TYPE 17	US21FP	21+98.00	610.84	6.82	6.76	19.30	
CB-028	C.B. TYPE 17	US21FP	20+26.34	610.84	5.00	6.43	18.48	
CB-030	C.B. TYPE 17	US21FP	23+09.00	607.66	16.71	7.61	25.17	
CB-032	C.B. TYPE 17	US21FP	24+32.75	606.14	12.57	7.16	5.89	
CB-033	C.B. TYPE 17	US21FP	26+41.38	603.73	9.33	6.36	4.94	
CB-034	C.B. TYPE 17	US21FP	27+39.01	602.60	7.81	5.97	3.53	
CB-035	C.B. TYPE 17	MERCANTILE_FP	10+74.44	602.99	4.33	5.00	0.36	
CB-036	C.B. TYPE 1	US21FP	16+57.52	615.50	4.50	5.00	0.14	
CB-037	C.B. TYPE 1	US21FP	27+34.46	602.79	4.50	5.00	0.20	
CB-041	C.B. TYPE 1	US21FP	15+59.81	616.45	5.94	5.00	0.14	
CB-103	C.B. TYPE 17	US21FP	36+63.16	591.28	4.50	5.00	0.42	
CB-105	C.B. TYPE 1	US21FP	29+73.25	599.95	4.50	5.00	0.11	
CB-106	C.B. TYPE 1	US21FP	31+68.11	597.51	4.50	6.46	0.22	
CB-108	C.B. TYPE 17	US21FP	30+25.05	599.13	4.50	5.00	0.56	
CB-109	C.B. TYPE 17	US21FP	31+65.69	597.40	4.61	6.83	1.81	
CB-110	C.B. TYPE 17	US21FP	33+12.03	595.60	6.01	7.22	2.72	
CB-111	C.B. TYPE 17	US21FP	35+31.25	592.91	4.50	5.00	0.91	
CB-113	C.B. TYPE 17	US21FP	29+44.43	600.12	4.07	5.00	0.61	
CB-200	C.B. TYPE 18	US21FP	40+14.96	587.76	8.35	7.46	17.91	
CB-201	C.B. TYPE 17	US21FP	41+10.00	588.28	12.70	7.73	18.63	
CB-202	C.B. TYPE 17	US21FP	45+00.00	597.26	9.12	7.43	9.39	
CB-203	C.B. TYPE 17	US21FP	45+00.00	597.26	5.00	23.62	13.96	
CB-204	C.B. TYPE 17	US21FP	49+90.97	611.18	4.65	6.68	6.50	
CB-205	C.B. TYPE 17	US21FP	49+00.00	608.60	5.00	23.03	10.28	
CB-206	C.B. TYPE 17	US21FP	53+00.00	619.95	4.67	6.10	4.69	

GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
CB-207	C.B. TYPE 17	US21FP	53+00.00	619.94	7.77	22.22	6.53	
CB-208	C.B. TYPE 17	US21FP	56+40.00	629.59	4.69	5.36	2.61	
CB-209	C.B. TYPE 17	US21FP	57+68.00	632.22	6.12	17.07	1.93	
CB-210	C.B. TYPE 17	US21FP	59+99.98	638.92	4.00	5.00	1.16	
CB-211	C.B. TYPE 17	US21FP	60+00.07	639.25	4.00	7.20	0.80	
CB-212	C.B. TYPE 17	US21FP	42+58.15	590.55	12.07	7.77	10.73	
CB-213	C.B. TYPE 17	US21FP	43+73.72	593.46	6.49	23.77	14.44	
CB-215	C.B. TYPE 17	US21FP	57+82.29	633.62	4.70	5.00	1.68	
CB-216	C.B. TYPE 17	US21FP	46+42.36	601.30	4.50	7.26	8.59	
CB-226	C.B. TYPE 17	US21B_FP	19+51.28	633.20	4.08	5.51	3.99	
CB-227	C.B. TYPE 17	US21B_FP	17+00.87	633.58	4.23	8.17	10.33	
CB-228	C.B. TYPE 17	US21B_FP	14+50.31	635.72	4.46	7.56	7.68	
CB-229	C.B. TYPE 17	US21B_FP	12+81.99	636.58	4.08	7.00	5.94	
CB-230	C.B. TYPE 17	US21B_FP	11+33.55	638.89	5.54	6.44	3.55	
CB-232	C.B. TYPE 17	US21B_FP	13+94.67	635.98	3.94	7.38	7.01	
CB-233	C.B. TYPE 17	US21B_FP	21+74.00	631.54	8.54	16.31	9.35	
CB-234	C.B. TYPE 17	US21B_FP	12+82.12	636.89	4.08	5.70	1.67	
CB-235	C.B. TYPE 17	US21B_FP	11+05.26	639.70	4.08	5.00	0.69	
CB-236	C.B. TYPE 17	US21FP	61+30.53	640.79	6.53	5.67	2.57	
CB-241	C.B. TYPE 17	US21FP	46+98.66	602.89	5.00	23.34	12.51	
CB-244	C.B. TYPE 17	US21B_FP	18+29.94	633.64	4.08	5.00	3.03	
CB-246	C.B. TYPE 17	US21B_FP	20+27.32	633.21	4.82	16.10	8.81	
CB-501	C.B. TYPE 17	US21FP	64+34.17	640.34	7.27	14.00	8.96	
CB-502	C.B. TYPE 17	US21FP	66+30.00	637.88	10.58	14.37	10.22	
CB-503	C.B. TYPE 18	US21FP	68+57.16	636.73	8.53	8.02	11.89	
CB-504	C.B. TYPE 17	US21FP	70+95.56	638.31	4.50	5.00	1.95	
CB-505	C.B. TYPE 17	US21FP	73+50.05	642.69	10.89	30.20	31.73	
CB-506	C.B. TYPE 17	US21FP	78+44.69	650.92	15.53	29.02	16.18	
CB-507	C.B. TYPE 17	US21FP	65+33.59	639.40	5.01	5.00	2.56	
CB-508	C.B. TYPE 17	US21FP	67+72.45	636.93	7.55	7.57	5.09	
CB-509	C.B. TYPE 18	US21FP	68+57.11	636.73	8.15	7.80	7.73	
CB-510	C.B. TYPE 17	US21FP	70+35.00	637.11	4.61	5.57	2.10	
CB-511	C.B. TYPE 17	US21FP	71+80.59	639.63	5.63	5.00	1.26	
CB-512	C.B. TYPE 17	US21FP	74+52.95	644.55	10.80	12.04	16.22	
CB-513	C.B. TYPE 17	US21FP	75+87.00	646.92	12.25	11.59	13.54	
CB-514	C.B. TYPE 17	US21FP	77+22.99	649.31	14.21	11.14	13.01	
CB-515	C.B. TYPE 17	US21FP	78+35.29	650.83	15.38	10.76	12.64	
CB-516	C.B. TYPE 17	US21FP	76+18.94	647.48	12.81	29.70	19.64	
CB-517	C.B. TYPE 1	US21FP	66+66.09	637.98	4.02	5.00	0.63	
CB-518	C.B. TYPE 1	US21FP	68+57.21	636.95	4.65	6.89	0.66	
CB-519	C.B. TYPE 1	US21FP	73+46.91	642.90	3.90	5.00	0.14	
CB-520	C.B. TYPE 1	US21FP	71+15.09	638.59	4.00	5.00	0.13	
CB-521	C.B. TYPE 1	US21FP	69+70.49	636.60	3.75	6.06	0.35	
CB-522	C.B. TYPE 17	US21FP	68+89.00	636.76	5.76	6.13	2.15	
CB-523	C.B. TYPE 1	US21FP	74+50.28	644.73	6.23	5.00	0.14	
CB-524	C.B. TYPE 1	US21FP	67+75.12	637.15	5.24	7.40	1.39	
CB-600	C.B. TYPE 17	US21FP	81+86.06	650.73	13.75	13.01	13.79	
CB-601	C.B. TYPE 17	US21FP	84+00.00	647.80	10.15	12.28	12.17	

GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
CB-602	C.B. TYPE 17	US21FP	85+35.30	646.09	8.04	11.83	11.78	
CB-603	C.B. TYPE 18	US21FP	87+45.15	644.51	5.79	11.09	9.39	
CB-604	C.B. TYPE 17	US21FP	90+57.75	649.42	4.50	6.79	5.96	
CB-605	C.B. TYPE 17	US21FP	92+23.33	652.92	4.50	6.45	4.75	
CB-606	C.B. TYPE 17	US21FP	94+26.36	657.36	4.50	5.98	3.06	
CB-607	C.B. TYPE 17	US21FP	81+86.94	650.72	14.17	9.55	12.14	
CB-608	C.B. TYPE 17	US21FP	84+03.98	648.09	10.95	8.80	11.16	
CB-609	C.B. TYPE 17	US21FP	85+43.35	646.38	8.80	8.31	9.95	
CB-610	C.B. TYPE 18	US21FP	87+45.29	644.17	5.94	7.61	8.27	
CB-611	C.B. TYPE 17	US21FP	88+86.76	645.33	5.50	7.21	7.03	
CB-612	C.B. TYPE 17	US21FP	91+77.48	651.92	10.10	6.32	5.10	
CB-613	C.B. TYPE 17	US21FP	92+92.33	654.43	11.10	5.87	3.68	
CB-614	C.B. TYPE 17	US21FP	94+25.20	657.34	4.50	5.67	2.90	
CB-617	C.B. TYPE 1	US21FP	90+90.46	650.04	3.25	5.00	0.42	
CB-618	C.B. TYPE 1	US21FP	92+88.49	654.57	4.00	5.00	0.49	
CB-619	C.B. TYPE 1	US21FP	91+74.81	652.08	5.69	5.60	0.88	
CB-620	C.B. TYPE 17	REGENTPKWY_FP	13+80.45	641.57	4.50	5.00	2.36	
CB-622	C.B. TYPE 17	REGENTPKWY_FP	13+80.45	641.44	4.50	5.06	2.54	
CB-700	C.B. TYPE 17	US21FP	97+01.50	662.40	4.69	5.00	0.91	
CB-701	C.B. TYPE 18	US21FP	99+39.32	664.19	4.80	5.30	1.88	
CB-702	C.B. TYPE 17	US21FP	101+74.45	664.99	6.63	6.32	4.89	
CB-703	C.B. TYPE 17	US21FP	103+64.98	667.03	4.50	5.00	0.99	
CB-704	C.B. TYPE 17	US21FP	105+15.00	669.03	5.14	7.82	1.41	
CB-705	C.B. TYPE 17	US21FP	107+00.00	670.63	7.31	10.06	3.92	
CB-706	C.B. TYPE 17	US21FP	96+60.71	662.49	4.50	5.00	1.47	
CB-707	C.B. TYPE 18	US21FP	99+66.85	664.18	4.80	5.21	1.28	
CB-708	C.B. TYPE 17	US21FP	101+74.44	664.97	7.52	6.61	10.19	
CB-709	C.B. TYPE 17	US21FP	103+64.98	667.03	4.50	5.67	2.11	
CB-710	C.B. TYPE 17	US21FP	107+01.38	670.64	5.16	5.00	1.50	
CB-800	C.B. TYPE 17	US21FP	110+06.87	670.80	8.42	11.45	4.41	
CB-801	C.B. TYPE 17	US21FP	112+02.34	670.01	8.23	12.29	5.39	
CB-802	C.B. TYPE 17	US21FP	114+60.32	667.01	6.01	13.36	6.43	
CB-803	C.B. TYPE 17	US21FP	116+62.72	664.26	6.07	13.84	10.80	
CB-804	C.B. TYPE 17	US21FP	118+90.51	661.16	5.00	14.39	11.70	
CB-805	C.B. TYPE 17	US21FP	121+90.86	657.08	11.93	14.80	17.30	
CB-806	C.B. TYPE 17	US21FP	124+15.74	654.02	10.10	15.35	18.03	
CB-807	C.B. TYPE 17	US21FP	110+64.12	670.92	6.46	7.92	1.02	
CB-808	C.B. TYPE 17	US21FP	113+73.10	668.42	4.92	9.85	2.32	
CB-809	C.B. TYPE 17	US21FP	115+55.41	665.72	4.50	10.43	3.40	
CB-810	C.B. TYPE 17	US21FP	117+90.10	662.53	4.50	5.00	0.89	
CB-811	C.B. TYPE 17	US21FP	119+06.67	660.00	4.50	5.39	2.07	
CB-812	C.B. TYPE 17	US21FP	121+91.10	657.07	11.19	7.34	5.74	
CB-813	C.B. TYPE 17	US21FP	123+85.58	654.17	7.67	6.39	2.68	
CB-816	C.B. TYPE 17	US21FP	116+57.13	664.33	4.92	10.69	3.90	
CB-900	C.B. TYPE 17	US21FP	126+68.43	650.52	18.32	11.59	16.80	
CB-901	C.B. TYPE 17	US21FP	129+10.41	647.28	14.34	10.83	15.86	
CB-902	C.B. TYPE 17	US21FP	130+98.13	644.85	11.27	10.25	14.79	
CB-903	C.B. TYPE 17	US21FP	134+07.56	640.52	5.50	9.24	13.28	

GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
CB-904	C.B. TYPE 17	US21FP	125+41.49	651.98	4.50	5.49	1.46	
CB-905	C.B. TYPE 17	US21FP	128+02.93	648.19	4.25	5.00	1.89	
CB-906	C.B. TYPE 17	US21FP	130+79.23	645.13	6.07	7.99	8.93	
CB-907	C.B. TYPE 17	US21FP	134+04.64	643.82	5.90	5.00	0.41	
CB-908	C.B. TYPE 1	US21FP	130+80.44	645.47	6.54	8.15	9.16	
CB-909	C.B. TYPE 1	US21FP	132+82.58	643.53	5.83	8.88	9.98	
CB-910	C.B. TYPE 1	US21FP	134+08.82	641.97	5.69	9.15	10.89	
CB-911	C.B. TYPE 17	SC51FP	297+74.63	645.33	4.50	5.31	4.25	
DI-007	D.I. 24"X36"	US21FP	27+28.87	601.50	6.47	5.00	2.54	
DI-011	D.I. 24"X36"	US21FP	28+55.89	600.00	3.65	5.55	1.93	
DI-014	D.I. 24"X36"	US21FP	31+55.07	597.10	3.20	5.00	4.84	
DI-022	D.I. 24"X36"	US21FP	15+57.47	616.00	4.94	5.00	2.35	
DI-023	D.I. 24"X36"	US21FP	16+39.28	615.00	4.27	5.00	0.42	
DI-026	D.I. 24"X36"	US21FP	17+52.48	613.00	3.20	5.00	2.68	
DI-027	D.I. 24"X36"	US21FP	18+36.68	611.20	3.20	5.00	5.54	
DI-029	D.I. 24"X36"	US21FP	20+26.31	610.00	3.20	5.00	3.56	
DI-100	D.I. 24"X36"	US21FP	38+80.33	585.07	5.67	7.00	13.91	
DI-219	D.I. 24"X36"	US21FP	55+72.42	619.56	3.20	11.00	2.28	
DI-220	D.I. 24"X36"	US21FP	54+55.47	616.44	3.20	11.27	3.31	
DI-221	D.I. 24"X36"	US21FP	43+25.00	588.50	4.50	11.00	1.44	
DI-222	D.I. 24"X24"	US21FP	57+61.61	630.77	4.50	17.00	1.00	
DI-239	D.I. 24"X36"	US21B_FP	19+58.07	634.83	3.20	5.00	7.97	
DI-522	D.I. 24"X24"	GARRISONFARM_FP	10+99.77	643.38	3.48	0.00	2.10	
DI-523	D.I. 24"X24"	GARRISONFARM_FP	11+15.21	643.42	3.38	0.00	1.30	
DI-525	D.I. 24"X36"	OLDNAT_FP-2	19+00.80	634.50	3.80	5.00	0.77	
DI-714	D.I. 24"X24"	US21FP	105+10.03	667.17	3.20	7.70	0.28	
DI-715	D.I. 24"X24"	US21FP	106+94.47	668.26	4.01	10.00	0.17	
DI-913	D.I. 24"X24"	US21FP	126+68.09	648.03	13.34	5.00	0.71	
DI-914	D.I. 24"X24"	US21FP	131+10.10	641.70	5.51	5.00	1.03	
MH-038	M.H.	US21FP	22+00.00	591.30	15.69	8.78	37.05	
MH-040	M.H.	US21FP	33+64.60	582.17	10.56	5.43	7.27	
MH-042	M.H.	US21FP	28+45.03	601.51	4.45	5.50	0.93	
MH-045	M.H.	US21FP	127+06.80	650.06	4.85	5.00	1.64	
MH-050	M.H.	US21FP	128+05.23	648.60	4.91	5.34	3.47	
MH-055	M.H.	US21FP	130+05.18	646.20	4.81	5.90	5.20	
MH-060	M.H.	US21FP	130+81.90	645.55	6.45	7.95	8.35	
MH-214	M.H.	US21FP	39+50.00	582.92	16.40	24.61	18.83	
MH-243	M.H.	US21FP	62+07.70	646.44	11.72	6.82	6.05	
MH-244	M.H.	US21FP	62+00.00	641.48	7.60	5.97	2.54	
MH-245	M.H.	US21FP	11+00.00	639.89	6.36	6.29	2.50	
MH-526	M.H.	US21FP	63+80.35	645.50	8.62	8.40	1.74	
MH-530	M.H.	US21FP	66+67.50	635.00	17.69	14.41	10.21	
CB-1001	C.B. TYPE 17	SC51FP	299+91.75	643.68	4.50	7.60	10.26	
CB-1002	C.B. TYPE 17	SC51FP	301+71.67	642.27	4.50	8.80	12.01	
CB-1003	C.B. TYPE 17	SC51FP	303+72.96	637.98	4.50	8.80	14.82	
CB-1004	C.B. TYPE 17	SC51FP	305+50.79	632.35	4.60	8.80	18.88	
CB-1005	C.B. TYPE 17	SC51FP	307+76.52	624.91	6.26	11.00	19.40	
CB-1006	C.B. TYPE 17	SC51FP	309+58.17	618.87	5.00	11.00	22.83	

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GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
CB-1007	C.B. TYPE 17	SC51FP	310+98.52	614.21	5.00	29.00	15.76	
CB-1008	C.B. TYPE 17	SC51FP	313+10.11	607.17	5.00	29.31	17.04	
CB-1017	C.B. TYPE 17	SC51FP	306+02.33	630.87	8.81	20.37	24.81	
CB-1018	C.B. TYPE 17	SC51FP	308+61.04	622.10	7.44	20.69	27.34	
CB-1019	C.B. TYPE 17	SC51FP	310+23.24	616.71	6.50	20.89	27.91	
CB-1020	C.B. TYPE 17	SC51FP	311+76.22	611.62	6.50	21.07	28.47	
CB-1101	C.B. TYPE 17	SC51FP	314+87.71	602.09	5.00	29.54	17.62	
CB-1102	C.B. TYPE 17	SC51FP	315+93.54	600.72	5.78	29.73	17.89	
CB-1103	C.B. TYPE 17	SC51FP	314+09.29	603.97	6.50	21.33	29.32	
CB-1104	C.B. TYPE 17	SC51FP	315+93.54	600.72	7.23	29.88	45.14	
CB-1105	C.B. TYPE 18	SC51FP	316+49.87	600.53	4.50	5.00	0.55	
CB-1106	C.B. TYPE 17	SC51FP	316+85.81	600.60	5.76	19.26	18.13	
CB-1107	C.B. TYPE 17	SC51FP	318+94.00	604.14	5.93	18.88	16.42	
CB-1108	C.B. TYPE 17	SC51FP	321+10.79	609.41	6.31	18.56	15.14	
CB-1109	C.B. TYPE 17	SC51FP	322+82.00	613.50	6.00	18.00	5.07	
CB-110a	C.B. TYPE 17	US21FP	34+07.30	594.43	11.80	7.38	4.15	
CB-1110	C.B. TYPE 17	SC51FP	324+97.51	617.75	4.50	7.59	3.26	
CB-1111	C.B. TYPE 17	SC51FP	326+65.26	619.68	4.64	7.02	1.98	
CB-1112	C.B. TYPE 17	SC51FP	316+85.81	600.60	7.98	19.38	32.39	
CB-1113	C.B. TYPE 17	SC51FP	320+20.00	605.39	5.00	12.33	15.89	
CB-1114	C.B. TYPE 17	SC51FP	320+97.47	609.13	4.51	12.24	15.17	
CB-1115	C.B. TYPE 17	SC51FP	322+67.71	613.32	5.10	11.98	14.34	
CB-1116	C.B. TYPE 17	SC51FP	324+97.51	618.00	7.66	11.48	13.44	
CB-1117	C.B. TYPE 17	SC51FP	326+64.70	619.85	8.99	10.92	12.81	
CB-113a	C.B. TYPE 17	MERCANTILE_FP	10+76.57	602.91	4.50	5.00	0.60	
CB-113b	C.B. TYPE 17	US21FP	28+68.31	601.05	5.76	5.37	2.36	
CB-1203	C.B. TYPE 17	SC51FP	337+47.23	623.60	4.60	5.00	0.55	
CB-1204	C.B. TYPE 17	SC51FP	340+00.33	620.21	3.75	5.00	1.77	
CB-1205	C.B. TYPE 18	SC51FP	330+32.92	619.93	7.94	9.66	11.82	
CB-1206	C.B. TYPE 17	SC51FP	331+46.13	620.27	7.94	9.27	9.75	
CB-1207	C.B. TYPE 17	SC51FP	333+65.70	622.72	9.70	8.48	7.33	
CB-1208	C.B. TYPE 17	SC51FP	337+47.30	623.45	8.74	6.86	4.12	
CB-1209	C.B. TYPE 17	SC51FP	339+33.50	621.08	5.62	6.09	3.43	
CB-1210	C.B. TYPE 17	SC51FP	339+33.50	620.57	4.57	5.81	2.23	
CB-1216	C.B. TYPE 17	SC51FP	336+46.40	624.20	9.82	7.32	4.89	
CB-1403	C.B. TYPE 18	FLINTHILL_FP	12+49.83	667.43	5.39	14.78	15.90	
CB-1405	C.B. TYPE 17	FLINTHILL_FP	13+20.52	667.93	5.09	14.58	12.07	
CB-200a	C.B. TYPE 17	US21FP	38+80.00	588.62	9.30	7.06	16.53	
CB-203a	C.B. TYPE 17	US21FP	46+20.99	600.69	5.00	23.45	13.10	
CB-203b	C.B. TYPE 17	US21FP	45+59.72	598.95	5.00	23.54	13.55	
CB-204a	C.B. TYPE 17	US21FP	48+23.84	606.44	4.50	6.97	7.49	
CB-205a	C.B. TYPE 17	US21FP	51+00.00	614.27	5.00	22.72	8.44	
CB-205b	C.B. TYPE 17	US21FP	50+36.05	612.46	5.00	22.82	9.06	
CB-205c	C.B. TYPE 17	US21FP	49+68.70	610.55	5.00	22.93	9.67	
CB-207a	C.B. TYPE 17	US21FP	54+60.75	624.50	11.83	17.71	5.97	
CB-207b	C.B. TYPE 17	US21FP	53+56.08	621.54	9.19	22.00	6.00	
CB-207c	C.B. TYPE 17	US21FP	52+43.61	618.35	6.48	22.40	7.18	
CB-207d	C.B. TYPE 17	US21FP	51+74.81	616.40	5.00	22.59	7.80	

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GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
CB-211a	C.B. TYPE 17	US21FP	61+52.44	641.30	6.79	8.01	2.07	
CB-211b	C.B. TYPE 17	US21FP	60+79.19	640.52	5.66	7.66	1.54	
CB-214a	C.B. TYPE 17	US21FP	40+94.84	588.06	7.37	24.35	16.39	
CB-214b	C.B. TYPE 17	US21FP	41+80.48	589.05	6.95	24.21	16.13	
CB-221a	C.B. TYPE 16	US21FP	43+16.75	590.51	7.71	23.83	15.44	
CB-227a	C.B. TYPE 17	US21B_FP	15+87.77	634.60	4.30	7.91	9.25	
CB-229a	C.B. TYPE 17	US21B_FP	13+49.63	636.18	3.91	7.23	6.29	
CB-241a	C.B. TYPE 17	US21FP	48+23.94	606.45	5.00	23.15	11.14	
CB-241b	C.B. TYPE 17	US21FP	47+55.73	604.51	5.00	23.25	11.86	
CB-242a	C.B. TYPE 17	US21FP	62+11.09	641.63	7.42	8.26	8.18	
CB-501a	C.B. TYPE 17	US21FP	65+43.56	638.93	7.43	14.26	9.77	
CB-502a	C.B. TYPE 17	US21FP	68+07.79	636.80	11.07	8.07	12.35	
CB-502b	C.B. TYPE 17	US21FP	67+38.95	637.00	14.63	8.15	13.21	
CB-504a	C.B. TYPE 17	US21FP	69+81.72	637.16	4.50	5.39	2.91	
CB-506a	C.B. TYPE 17	US21FP	77+67.03	650.00	14.85	29.26	17.03	
CB-506b	C.B. TYPE 17	US21FP	77+41.16	649.61	14.55	29.34	17.93	
CB-506c	C.B. TYPE 17	US21FP	77+02.00	648.41	13.48	29.45	18.81	
CB-512a	C.B. TYPE 17	US21FP	73+48.38	642.67	9.73	12.27	16.62	
CB-600a	C.B. TYPE 17	US21FP	80+39.01	651.67	15.17	13.50	15.51	
CB-600b	C.B. TYPE 17	US21FP	80+85.61	651.51	14.85	13.34	14.94	
CB-600c	C.B. TYPE 17	US21FP	81+54.29	651.04	14.18	13.13	14.39	
CB-601a	C.B. TYPE 17	US21FP	83+53.82	648.37	10.87	12.43	13.39	
CB-602a	C.B. TYPE 17	US21FP	86+94.96	644.51	5.93	11.26	10.30	
CB-602b	C.B. TYPE 1	US21FP	86+26.18	645.26	6.91	11.51	10.99	
CB-604a	C.B. TYPE 17	US21FP	88+26.64	644.87	4.78	7.32	9.21	
CB-604b	C.B. TYPE 17	US21FP	89+04.61	645.97	4.50	7.08	7.11	
CB-609a	C.B. TYPE 17	US21FP	86+94.96	644.29	6.20	7.79	9.37	
CB-611a	C.B. TYPE 17	US21FP	87+96.05	644.30	5.91	7.43	7.71	
CB-701a	C.B. TYPE 17	US21FP	98+95.10	664.27	4.50	5.00	0.68	
CB-701b	C.B. TYPE 17	US21FP	100+19.63	664.23	5.25	5.64	2.84	
CB-702a	C.B. TYPE 1	US21FP	99+43.78	664.51	4.69	5.00	0.27	
CB-704a	C.B. TYPE 1	US21FP	105+14.82	669.20	5.00	5.00	0.20	
CB-707a	C.B. TYPE 17	US21FP	99+29.42	664.21	4.50	5.00	0.55	
CB-707b	C.B. TYPE 17	US21FP	100+19.74	664.23	5.12	5.46	2.27	
CB-710a	C.B. TYPE 17	US21FP	105+41.74	669.32	4.50	5.00	1.02	
CB-801a	C.B. TYPE 1	US21FP	112+61.39	669.66	4.52	5.00	0.09	
CB-801b	C.B. TYPE 1	US21FP	110+68.52	671.09	6.53	7.55	0.19	
CB-806A	C.B. TYPE 17	US21FP	125+11.07	652.72	21.50	15.53	33.17	
CB-905a	C.B. TYPE 17	US21FP	127+04.57	649.71	4.13	5.00	1.64	
CB-906a	C.B. TYPE 17	US21FP	130+02.51	645.89	4.14	5.00	1.91	
CB-911a	C.B. TYPE 17	SC51FP	297+08.12	645.62	4.50	5.00	2.06	
DI-1021	D.I. 24"X24"	SC51FP	302+40.19	639.00	6.01	8.80	13.46	
DI-1022	D.I. 24"X36"	SC51FP	303+78.00	634.00	6.00	20.00	19.48	
DI-1023	D.I. 24"X36"	SC51FP	306+05.30	628.61	6.50	20.32	24.38	
DI-1024	D.I. 24"X36"	SC51FP	308+63.79	621.20	4.50	14.00	1.86	
DI-1025	D.I. 24"X24"	SC51FP	307+73.76	623.70	4.50	11.00	1.09	
DI-1026	D.I. 24"X24"	SC51FP	309+60.46	619.00	4.50	8.60	2.66	
DI-1027	D.I. 24"X24"	SC51FP	311+00.81	614.72	4.50	29.00	0.85	

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GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
DI-1028	D.I. 24"X36"	SC51FP	300+19.89	642.53	3.75	0.00	11.70	
DI-1029	D.I. 24"X36"	SC51FP	301+17.29	638.63	5.25	0.00	13.00	
DI-1120	D.I. 24"X36"	SPRINGHILL_FP	30+02.16	609.57	6.13	18.36	14.32	
DI-1121	D.I. 24"X36"	SPRINGHILL_FP	30+02.38	608.67	4.78	18.09	11.46	
DI-1404	D.I. 24"X36"	FLINTHILL_FP	12+49.83	666.65	4.84	14.92	16.73	
DI-1406	D.I. 24"X36"	FLINTHILL_FP	14+10.14	668.43	5.00	14.33	11.98	
DI-1601	D.I. 24"X24"	GH-REAL_FP	19+22.16	641.94	2.92	5.00	1.21	
DI-228a	D.I. 24"X24"	21TOCLTPRO	14+52.04	634.42	2.50	5.00	0.18	
DI-245a	D.I. 24"X36"	US21B_FP	20+32.54	633.40	3.20	5.00	8.69	
DI-506d	D.I. 24"X36"	US21FP	78+43.32	643.93	6.58	29.00	4.89	
DI-507A	D.I. 24"X24"	US21FP	64+42.38	637.87	3.00	0.00	1.30	
DI-603a	D.I. 24"X36"	US21FP	87+59.95	643.93	4.50	11.00	0.87	
DI-604C	D.I. 24"X24"	US21FP	88+21.09	644.34	3.15	7.30	1.55	
DI-904A	D.I. 24"X24"	US21FP	125+97.40	650.90	3.20	5.00	0.27	
DI-907A	D.I. 24"X36"	US21FP	132+22.53	643.00	3.00	7.30	3.71	
ECB-623	EX CATCH BASIN	REGENTPKWY_FP	13+81.67	640.10	5.10	5.14	4.60	
MH-040a	M.H.	US21FP	33+64.74	589.64	11.57	5.41	7.28	
MH-109a	M.H.	US21FP	34+09.98	586.44	9.35	7.41	4.14	
MH-212a	M.H.	US21FP	42+75.00	585.72	17.01	7.81	10.71	
MH-503a	M.H.	US21FP	67+09.01	634.75	16.80	8.15	13.21	
MH-505a	M.H.	US21FP	73+44.77	635.51	6.60	30.20	31.73	
MH-805a	M.H.	US21FP	124+66.18	622.00	11.86	16.00	32.73	
MH-805b	M.H.	US21FP	124+29.87	612.00	7.47	16.05	32.68	
MH-913A	M.H.	US21FP	125+01.95	644.00	17.56	15.76	32.95	
OEP-242	DUMMY JOINT	US21FP	62+53.40	635.18	0.00	6.50	6.14	
OEP-524	DUMMY JOINT	US21FP	63+66.77	637.22	0.00	8.10	1.76	
CB-1001a	C.B. TYPE 17	SC51FP	299+27.96	644.32	4.50	5.79	8.29	
CB-1001b	C.B. TYPE 17	SC51FP	298+42.91	645.03	4.50	5.57	5.67	
CB-1003a	C.B. TYPE 17	SC51FP	302+96.06	640.01	4.50	8.80	13.84	
CB-1004a	C.B. TYPE 17	SC51FP	304+20.09	636.44	4.50	8.80	15.62	
CB-1004b	C.B. TYPE 17	SC51FP	304+55.31	635.44	4.50	8.80	16.49	
CB-1004c	C.B. TYPE 17	SC51FP	304+97.43	634.03	4.50	8.80	17.27	
CB-1004d	C.B. TYPE 17	SC51FP	305+23.79	633.21	4.50	8.80	18.01	
CB-1007a	C.B. TYPE 17	SC51FP	311+92.95	611.07	5.00	29.16	16.24	
CB-1106a	C.B. TYPE 17	SC51FP	317+35.81	600.99	4.49	19.19	17.24	
CB-1109a	C.B. TYPE 17	SC51FP	323+75.00	616.07	4.50	8.10	4.90	
CB-1112a	C.B. TYPE 17	SC51FP	318+50.00	602.90	5.26	12.61	16.49	
CB-1200a	C.B. TYPE 17	SC51FP	329+54.84	620.45	4.50	5.00	0.55	
CB-1200b	C.B. TYPE 17	SC51FP	328+73.25	620.36	4.67	5.62	0.93	
CB-1205a	C.B. TYPE 17	SC51FP	329+27.63	620.17	8.50	10.01	12.32	
CB-1206a	C.B. TYPE 17	SC51FP	332+23.39	620.79	8.21	8.99	8.83	
CB-1206b	C.B. TYPE 17	SC51FP	333+09.21	621.87	9.03	8.68	7.96	
CB-1207a	C.B. TYPE 17	SC51FP	334+91.69	623.95	10.04	7.97	5.94	
DI-1112b	D.I. 24"X24"	US21FP	133+85.18	597.87	3.20	5.00	0.37	
ECB-1401	EX CATCH BASIN	US21FP	110+29.13	668.11	2.70	8.10	1.76	
ECB-1402	EX CATCH BASIN	FLINTHILL_FP	12+10.95	667.58	3.50	8.81	3.78	
EDI-1501	EXISTING D.I.	FLINT2_FP	20+76.94	600.10	5.27	0.00	7.40	
EDI-531A	EXISTING D.I.	OLDNAT_FP-2	17+22.80	632.45	3.92	5.01	3.67	

STV	STV Inc. Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, South Carolina 29730-3392	JOB: S-160 Widening SUBJECT: GEOPAK Output Tables CALC'D BY: SCN DATE: 30-Mar-22 CHEK'D BY: GPP DATE: 31-Mar-22	SHEET OF 8

GEOPAK Output Tables

GEOPAK Output Type: **Node**

Node ID	Node Library Item	Node Ref. PGL	Node Station	Node Elevation	Node Depth	Node Tc Used	Node Cuml. Dis.	Notes
EXIP-531	DUMMY JOINT	OLDNAT_FP-2	17+18.02	632.00	1.81	5.00	3.66	
EXOP-532	OP	OLDNAT_FP-2	17+20.56	627.59	0.00	0.00	0.00	
OEP-1407	DUMMY JOINT	FLINTHILL_FP	16+31.39	671.47	0.00	14.00	8.23	
Outlet-1	OP	US21FP	41+50.00	575.00	0.00	0.00	0.00	
Outlet-2	OP	US21FP	42+75.00	568.50	0.00	0.00	0.00	
Outlet-3	OP	US21FP	39+50.00	566.37	0.00	0.00	0.00	
Outlet-4	OP	US21FP	66+74.23	617.00	0.00	0.00	0.00	
Outlet-5	OP	US21FP	101+28.50	653.00	0.00	0.00	0.00	
Outlet-7	OP	US21FP	123+89.32	604.00	0.00	0.00	0.00	
Outfall-9	OP	SC51FP	316+18.59	590.10	0.00	0.00	0.00	
Outlet-10	OP	SC51FP	316+29.60	590.10	0.00	0.00	0.00	
Outlet-12	OP	US21FP	34+09.92	575.58	0.00	0.00	0.00	
Outlet-14	OP	FLINTHILL_FP	12+44.07	661.38	0.00	0.00	0.00	
Outlet-15	OP	FLINT2_FP	21+47.87	596.00	2.32	0.00	0.00	
Outlet-16	OP	GH-REAL_FP	18+60.68	640.00	2.00	0.00	0.00	
Outlet-4a	OP	US21FP	67+14.45	617.43	0.00	0.00	0.00	
Outlet-4b	OP	US21FP	73+44.85	627.40	0.00	0.00	0.00	
Outlet-4c	OP	US21FP	16+91.00	629.03	0.00	0.00	0.00	
outlet-20	OP	OLDNAT_FP-2	18+67.18	629.90	0.00	0.00	0.00	
Outfall-11	OP	REGENTPKWY_FP	15+10.93	637.78	4.84	0.00	0.00	
Outfall-13	OP	21TOCLTPRO	22+00.00	622.46	0.00	0.00	0.00	
W/MH- 62	M.H.	REGENTPKWY_FI	15+10.02	637.77	4.52	0.00	0.00	
W/MH- 62	M.H.	REGENTPKWY	15+10.02	637.77	4.52	0.00	0.00	

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CHEK'D BY: GPP DATE: 31-Mar-22

GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
EP-043	CB-009	MH-042	Circular	Concrete	1	15	46.18	1.12	0.94	597.85	599.10	598.29	2.41	597.31	598.56	597.61	4.13
EP-044	CB-008	CB-009	Circular	Concrete	1	15	32.23	0.16	0.52	597.92	599.17	598.32	1.52	597.87	599.12	598.29	1.41
EP-531	EXIP-531	EDI-531A	Circular	Plastic	1	12	5.71	2.8	3.66	630.19	631.19	631.71	4.66	630.03	631.03	630.69	6.63
NP-001	CB-001	CB-002	Circular	Concrete	1	18	248.96	0.58	1.15	610.20	611.70	610.72	2.14	608.73	610.23	609.10	3.42
NP-002	CB-002	CB-003	Circular	Concrete	1	18	193.4	1.2	2.53	608.73	610.23	609.35	3.67	606.36	607.86	606.82	5.52
NP-003	CB-003	CB-026	Circular	Concrete	1	18	169.47	0.99	3.73	606.36	607.86	607.11	4.20	604.64	606.14	605.23	5.75
NP-004	CB-026	MH-038	Circular	Concrete	1	36	47.45	8.64	37.11	589.68	592.68	592.33	5.61	585.25	588.25	586.26	17.75
NP-005	CB-006	CB-005	Circular	Concrete	1	18	259.34	0.51	7.48	594.96	596.46	596.46	4.23	593.63	595.13	594.76	5.22
NP-006	CB-010	CB-006	Circular	Concrete	1	18	123.09	0.51	3.71	595.61	597.11	596.68	2.74	594.96	596.46	596.46	2.1
NP-007	DI-007	CB-006	Circular	Concrete	1	18	7.52	6.00	2.54	595.03	596.53	596.47	1.46	594.34	595.84	596.46	1.44
NP-008	CB-005	CB-004	Circular	Concrete	1	18	152.36	1.19	8.27	593.64	595.14	594.76	5.82	591.78	593.28	592.68	7.5
NP-010	CB-012	CB-010	Circular	Concrete	1	18	106.22	0.52	0.70	596.18	597.68	596.68	1.36	595.61	597.11	596.68	0.52
NP-011	DI-011	CB-010	Circular	Concrete	1	18	8.27	6	1.93	596.35	597.85	597.02	2.52	595.61	597.11	595.92	7.47
NP-013	CB-013	CB-015	Circular	Concrete	1	24	203.21	3.22	6.01	592.53	594.53	593.63	3.41	585.86	587.86	586.36	9.79
NP-014	DI-014	CB-013	Circular	Concrete	1	18	14.84	4.62	4.84	593.9	595.4	595.17	3.02	593.03	594.53	593.55	8.79
NP-015	CB-015	MH-040a	Circular	Concrete	1	24	16.56	6.00	7.29	585.86	587.86	587.10	3.59	584.64	586.64	585.20	10.15
NP-016	CB-016	CB-017	Circular	Concrete	1	18	193.99	1.23	1.53	587.67	589.17	588.29	2.23	585.24	586.74	585.59	4.82
NP-017	CB-017	CB-018	Circular	Concrete	1	18	157.40	1.10	2.72	585.24	586.74	585.88	3.77	583.46	584.96	583.95	5.47
NP-018	CB-019	CB-018	Circular	Concrete	1	30	58.01	1.5	16.81	579.53	582.03	580.92	6	578.6	581.1	579.61	9.05
NP-019	CB-214a	CB-019	Circular	Concrete	1	30	73.22	1.50	16.39	580.69	583.19	582.06	5.95	579.53	582.03	580.51	9.19
NP-020	CB-020	CB-021	Circular	Concrete	1	18	71.64	0.54	2.69	610.35	611.85	611.14	2.84	609.94	611.44	610.52	4.24
NP-021	CB-021	CB-024	Circular	Concrete	1	18	122.53	0.45	3.50	609.94	611.44	610.81	3.31	609.37	610.87	610.17	3.70
NP-022	DI-022	CB-020	Circular	Concrete	1	18	7.91	6	2.35	611.06	612.56	611.88	2.39	610.35	611.85	610.69	7.67
NP-023	DI-023	CB-021	Circular	Concrete	1	18	11.50	5.13	0.42	610.73	612.23	611.02	1.80	609.94	611.44	610.08	5.26
NP-024	CB-024	CB-025	Circular	Concrete	1	24	81.5	1.69	7.59	608.87	610.87	610.17	3.53	607.43	609.43	608.1	8.15
NP-025	CB-025	CB-028	Circular	Concrete	1	24	193.34	0.80	14.22	607.43	609.43	609.28	4.68	605.84	607.84	607.01	7.42
NP-026	DI-026	CB-024	Circular	Concrete	1	18	9.71	3.12	2.68	609.8	611.3	610.69	2.47	609.37	610.87	609.79	6.59
NP-027	DI-027	CB-025	Circular	Concrete	1	18	11.30	0.48	5.54	608.00	609.50	609.39	3.24	607.93	609.43	609.28	3.30
NP-028	CB-028	CB-027	Circular	Concrete	1	24	167.66	1.06	18.48	605.84	607.84	607.81	5.9	604.02	606.02	605.3	8.74
NP-029	DI-029	CB-028	Circular	Concrete	1	18	9.14	3.50	3.56	606.80	608.30	607.86	2.68	606.34	607.84	607.81	2.03
NP-030	CB-032	CB-030	Circular	Concrete	1	18	119.75	0.4	5.89	593.57	595.07	594.61	4.52	593.07	594.57	594.01	5.07
NP-032	CB-033	CB-032	Circular	Concrete	1	18	204.63	0.40	4.94	594.40	595.90	595.33	4.30	593.57	595.07	594.61	3.79
NP-033	CB-034	CB-033	Circular	Concrete	1	18	93.64	0.4	3.53	594.79	596.29	595.71	3.1	594.4	595.9	595.33	3.07
NP-034	CB-113b	CB-034	Circular	Concrete	1	18	125.30	0.40	2.36	595.31	596.81	596.10	2.49	594.79	596.29	595.71	2.08
NP-035	CB-035	CB-034	Circular	Concrete	1	18	44.31	1.16	0.36	598.66	600.16	598.93	1.73	598.1	599.6	598.28	3.08

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-036	CB-036	CB-041	Circular	Concrete	1	18	93.72	0.50	0.14	611.00	612.50	611.18	1.13	610.51	612.01	610.73	0.90
NP-037	CB-037	CB-034	Circular	Concrete	1	18	39.7	0.43	0.2	598.29	599.79	598.49	1.35	598.1	599.6	598.27	1.81
NP-038	MH-038	OP-39	Circular	Concrete	1	36	54.73	0.95	37.05	575.61	578.61	577.60	7.45	575.07	578.07	576.71	9.38
NP-040	MH-040	OP-41	Circular	Concrete	1	24	21.22	6	7.27	571.61	573.61	572.57	4.89	570.23	572.23	570.78	10.41
NP-041	CB-041	CB-001	Circular	Concrete	1	18	42.56	0.45	0.14	610.51	612.01	610.73	0.90	610.30	611.80	610.72	0.35
NP-042	MH-042	DI-011	Circular	Concrete	1	18	9.54	1.94	0.93	597.06	598.56	597.48	2.33	596.8	598.3	597.06	4.56
NP-043	CB-030	CB-004	Circular	Concrete	1	36	72.00	0.46	25.17	590.95	593.95	593.15	4.54	590.60	593.60	592.86	4.40
NP-103	CB-103	CB-200a	Circular	Concrete	1	18	212.84	2.98	0.42	586.78	588.28	587.06	1.8	580.31	581.81	580.46	4.49
NP-105	CB-105	CB-106	Circular	Concrete	1	18	191.05	1.25	0.11	595.45	596.95	595.62	0.98	593.01	594.51	593.48	0.24
NP-106	CB-106	CB-109	Circular	Concrete	1	18	40	0.5	0.22	593.01	594.51	593.48	0.47	592.79	594.29	593.48	0.28
NP-108	CB-108	CB-109	Circular	Concrete	1	18	136.64	1.31	0.56	594.63	596.13	594.96	1.93	592.79	594.29	593.00	3.68
NP-109	CB-109	CB-110	Circular	Concrete	1	18	142.34	2.19	1.81	592.79	594.29	593.48	2.3	589.59	591.09	589.92	6.21
NP-110	CB-110a	MH-109a	Circular	Concrete	1	30	20.33	7.00	4.15	582.63	585.13	583.50	2.74	580.94	583.44	581.29	9.86
NP-111	CB-111	CB-110a	Circular	Concrete	1	18	119.95	3.86	0.91	588.41	589.91	588.85	2.08	583.63	585.13	583.84	6.19
NP-200	CB-200	CB-201	Circular	Concrete	1	24	88.37	0.44	17.91	579.41	581.41	581.17	6.11	579.00	581.00	580.52	6.97
NP-201	CB-201	Outlet-1	Circular	Concrete	1	24	58.25	0.96	18.63	575.58	577.58	577.51	5.99	575	577	576.35	8.28
NP-202	CB-202	CB-212	Circular	Concrete	1	18	237.85	3.94	9.39	588.14	589.64	589.33	6.22	578.60	580.10	579.27	12.19
NP-203	CB-203	CB-213	Circular	Concrete	1	24	122.28	4.19	13.96	592.26	594.26	593.61	6.19	586.97	588.97	587.7	13.36
NP-204	CB-204	CB-204a	Circular	Concrete	1	18	163.13	2.75	6.50	606.53	608.03	607.54	5.15	601.94	603.44	602.55	9.67
NP-205	CB-205	CB-241a	Circular	Concrete	1	24	72.06	2.83	10.28	603.6	605.6	604.75	5.48	601.45	603.45	602.16	10.37
NP-206	CB-206	CB-204	Circular	Concrete	1	18	305.03	2.83	4.69	615.28	616.78	616.14	4.51	606.53	608.03	607.04	8.95
NP-207	CB-207	CB-207c	Circular	Concrete	1	24	52.39	0.54	6.53	612.17	614.17	613.08	4.69	611.87	613.87	612.7	5.25
NP-208	CB-208	CB-206	Circular	Concrete	1	18	336.00	2.83	2.61	624.90	626.40	625.53	3.73	615.28	616.78	615.65	7.57
NP-209	CB-209	CB-207a	Circular	Concrete	1	18	303.25	4.21	1.93	626.1	627.6	626.77	2.52	613.17	614.67	613.47	7.99
NP-212	CB-212	MH-212a	Circular	Concrete	1	18	31.13	4.26	10.73	578.48	579.98	580.25	6.07	576.99	578.49	577.79	11.16
NP-213	CB-213	CB-221a	Circular	Concrete	1	24	51.66	6.58	14.44	586.97	588.97	588.49	5.64	583.3	585.3	584.01	14.42
NP-214	MH-214	Outlet-3	Circular	Concrete	1	30	31.27	0.45	18.83	566.52	569.02	568.07	5.89	566.37	568.87	567.81	6.44
NP-215	CB-215	CB-208	Circular	Concrete	1	18	138.29	2.83	1.68	628.92	630.42	629.58	2.25	624.9	626.4	625.2	6.66
NP-216	CB-216	CB-202	Circular	Concrete	1	18	138.36	6.08	8.59	596.80	598.30	597.95	5.92	588.14	589.64	588.71	13.88
NP-219	DI-219	DI-220	Circular	Concrete	1	18	112.96	2.67	2.28	616.36	617.86	617.16	2.38	613.24	614.74	613.6	7.12
NP-220	DI-220	CB-207a	Circular	Concrete	1	18	18.04	0.30	3.31	613.24	614.74	614.16	2.92	613.17	614.67	613.87	4.14
NP-221	DI-221	CB-221a	Circular	Concrete	1	18	10.65	1.35	1.44	584	585.5	584.59	2.21	583.8	585.3	584.15	4.58
NP-222	DI-222	CB-209	Circular	Concrete	1	18	12.92	1.00	1.00	626.27	627.77	626.75	2.05	626.10	627.60	626.77	1.30
NP-226	CB-226	CB-246	Circular	Concrete	1	18	69.13	0.32	3.99	629.12	630.62	630.01	3.66	628.89	630.39	629.65	4.41
NP-227	CB-227a	CB-227	Circular	Concrete	1	24	102.91	0.90	9.25	630.31	632.31	631.47	4.91	629.35	631.35	630.23	6.93

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-228	CB-228	CB-227a	Circular	Concrete	1	18	126.05	0.74	7.68	631.26	632.76	632.48	4.98	630.3	631.8	631.3	6.13
NP-229	CB-229	CB-229a	Circular	Concrete	1	18	63.52	0.50	5.94	632.61	634.11	633.87	3.75	632.27	633.77	633.27	4.74
NP-230	CB-230	CB-229	Circular	Concrete	1	18	144.59	0.5	3.55	633.35	634.85	634.12	3.91	632.61	634.11	633.31	4.4
NP-232	CB-232	CB-228	Circular	Concrete	1	18	51.65	0.50	7.01	632.04	633.54	633.13	5.12	631.76	633.26	632.79	5.45
NP-233	CB-233	Outfall-13	Circular	Concrete	1	30	38.81	1.51	9.35	623.07	625.57	624.31	3.87	622.46	624.96	623.2	7.6
NP-234	CB-234	CB-229	Circular	Concrete	1	18	68.73	0.43	1.67	632.81	634.31	633.90	1.22	632.50	634.00	633.87	0.99
NP-235	CB-235	CB-234	Circular	Concrete	1	18	172.87	1.59	0.69	635.62	637.12	635.99	2	632.81	634.31	633.03	4.19
NP-236	CB-210	CB-236	Circular	Concrete	1	18	126.58	0.51	1.16	634.92	636.42	635.44	2.15	634.26	635.76	634.65	3.23
NP-237	CB-236	MH-244	Circular	Concrete	1	18	68.57	0.52	2.57	634.26	635.76	634.89	3.63	633.88	635.38	634.46	4.1
NP-238	MH-244	MH-245	Circular	Concrete	1	18	71.76	0.46	2.54	633.88	635.38	634.57	3.19	633.53	635.03	634.12	3.94
NP-239	DI-239	DI-245a	Circular	Concrete	1	18	73.34	1.85	7.97	631.63	633.13	633.45	4.51	630.2	631.7	630.98	8.6
NP-240	CB-242a	CB-501	Circular	Concrete	1	18	224.81	0.50	8.18	634.21	635.71	635.83	4.63	633.07	634.57	634.38	4.99
NP-241	CB-241	CB-203a	Circular	Concrete	1	24	73.67	2.83	12.51	597.89	599.89	599.17	5.9	595.69	597.69	596.48	10.88
NP-242	OEP-242	MH-243	Circular	Concrete	1	18	92.83	0.49	6.14	635.18	636.68	636.67	3.48	634.72	636.22	635.96	3.94
NP-243	MH-243	CB-242a	Circular	Concrete	1	18	14.63	0.5	6.05	634.72	636.22	635.96	3.88	634.63	636.13	635.83	4
NP-244	CB-244	CB-226	Circular	Concrete	1	18	111.61	0.38	3.03	629.56	631.06	630.52	2.55	629.12	630.62	630.01	2.78
NP-245	CB-246	CB-233	Circular	Concrete	1	24	142.68	3.67	8.81	628.39	630.39	629.62	4.36	623	625	623.59	11.38
NP-501	CB-501	CB-501a	Circular	Concrete	1	18	105.39	0.98	8.96	633.07	634.57	634.38	5.47	632.00	633.50	633.01	7.06
NP-502	CB-502	MH-530	Circular	Concrete	1	24	34.82	6.21	10.22	627.45	629.45	628.93	4.11	625.05	627.05	625.67	12.39
NP-503	CB-503	CB-502a	Circular	Concrete	1	24	42.71	5.29	11.89	628.20	630.20	629.91	4.16	625.73	627.73	626.42	12.46
NP-504	CB-504	CB-504a	Circular	Concrete	1	18	109.84	1.01	1.95	633.81	635.31	634.53	2.31	632.66	634.16	633.08	4.83
NP-505	MH-505a	Outlet-4b	Circular	Concrete	1	30	17.02	8.00	31.73	628.91	631.41	630.93	7.45	627.40	629.90	628.60	13.62
NP-506	CB-506	CB-506a	Circular	Concrete	1	30	73.66	0.32	16.18	635.39	637.89	636.88	5.33	635.15	637.65	636.69	5.07
NP-507	CB-507	CB-508	Circular	Concrete	1	18	234.86	0.82	2.56	634.39	635.89	635.17	2.75	632.43	633.93	632.94	4.84
NP-508	CB-508	CB-509	Circular	Concrete	1	24	77.99	0.98	5.09	629.38	631.38	630.41	3.11	628.58	630.58	629.21	6.06
NP-509	CB-524	CB-508	Circular	Concrete	1	18	29.00	0.45	1.39	631.91	633.41	632.50	2.15	631.76	633.26	632.19	3.27
NP-510	CB-510	CB-522	Circular	Concrete	1	18	142	0.68	2.1	632.5	634	633.06	3.5	631.5	633	631.98	4.3
NP-511	CB-511	CB-510	Circular	Concrete	1	18	141.59	1.03	1.26	634.00	635.50	634.54	2.17	632.50	634.00	632.83	4.28
NP-512	CB-512	CB-512a	Circular	Concrete	1	30	100.52	0.77	16.22	633.75	636.25	635.2	5.48	632.94	635.44	634.07	7.52
NP-513	CB-513	CB-512	Circular	Concrete	1	24	130.05	0.31	13.54	634.67	636.67	636.24	5.12	634.25	636.25	635.58	6.13
NP-514	CB-514	CB-513	Circular	Concrete	1	24	131.98	0.32	13.01	635.1	637.1	636.66	4.96	634.67	636.67	636.24	4.92
NP-515	CB-515	CB-514	Circular	Concrete	1	24	108.30	0.31	12.64	635.45	637.45	636.99	4.88	635.10	637.10	636.66	4.82
NP-516	CB-516	CB-505	Circular	Concrete	1	30	264.83	1.07	19.64	634.67	637.17	636.18	6.32	631.8	634.3	632.94	8.97
NP-517	CB-517	CB-524	Circular	Concrete	1	18	105.03	0.74	0.63	633.96	635.46	634.31	1.97	633.15	634.65	633.41	3.12
NP-518	CB-509	CB-503	Circular	Concrete	1	24	84	0.91	7.73	629	631	630.34	3.45	628.2	630.2	629	6.62

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-519	CB-512a	CB-505	Circular	Concrete	1	30	76.36	1.42	16.62	632.94	635.44	634.71	4.47	631.80	634.30	632.80	9.09
NP-520	CB-520	CB-521	Circular	Concrete	1	18	140.6	1.2	0.13	634.59	636.09	634.77	1.06	632.85	634.35	633.07	0.77
NP-521	CB-521	CB-518	Circular	Concrete	1	18	109.30	0.49	0.35	632.85	634.35	633.07	2.16	632.30	633.80	632.61	1.33
NP-522	CB-522	CB-509	Circular	Concrete	1	24	25.22	1.71	2.15	631	633	631.52	3.29	630.5	632.5	630.86	5.56
NP-524	OEP-524	MH-526	Circular	Concrete	1	18	63.65	0.52	1.76	637.22	638.72	637.90	2.27	636.88	638.38	637.35	3.69
NP-525	DI-525	outlet-20	Circular	Concrete	1	18	75.8	1.03	0.77	630.7	632.2	631.1	2.04	629.9	631.4	630.16	3.69
NP-526	MH-526	CB-501	Circular	Concrete	1	18	58.25	5.58	1.74	636.88	638.38	637.47	2.66	633.41	634.91	633.67	8.52
NP-527	DI-523	DI-522	Circular	Concrete	1	18	34.33	0.37	1.3	640.04	641.54	640.6	2.18	639.9	641.4	640.53	1.86
NP-528	DI-522	CB-512	Circular	Concrete	1	18	83.38	4.85	2.10	639.90	641.40	640.53	3.01	635.66	637.16	635.95	8.59
NP-529	CB-518	CB-524	Circular	Concrete	1	18	78.09	0.48	0.66	632.3	633.8	632.61	2.48	631.91	633.41	632.2	2.68
NP-530	MH-530	Outlet-4	Circular	Concrete	1	24	31.50	0.92	10.21	617.31	619.31	618.71	4.35	617.00	619.00	617.96	6.85
NP-600	CB-600	CB-600c	Circular	Concrete	1	24	33.1	0.33	13.79	636.98	638.98	638.78	4.64	636.86	638.86	638.66	4.62
NP-601	CB-601	CB-601a	Circular	Concrete	1	24	42.18	0.33	12.17	637.65	639.65	639.33	4.33	637.50	639.50	639.23	4.20
NP-602	CB-602	CB-601	Circular	Concrete	1	24	125.97	0.31	11.78	638.05	640.05	639.61	4.48	637.65	639.65	639.33	4.19
NP-603	CB-603	CB-602a	Circular	Concrete	1	24	43.57	0.30	9.39	638.72	640.72	640.04	4.28	638.58	640.58	639.96	4.07
NP-604	CB-604	CB-604b	Circular	Concrete	1	18	149.21	2.25	5.96	644.92	646.42	645.88	5	641.47	642.97	642.08	8.78
NP-605	CB-605	CB-604	Circular	Concrete	1	18	161.58	2.11	4.75	648.42	649.92	649.28	4.55	644.92	646.42	645.47	8.08
NP-606	CB-606	CB-605	Circular	Concrete	1	18	199.03	2.19	3.06	652.86	654.36	653.55	3.86	648.42	649.92	648.85	7.24
NP-607	CB-607	CB-515	Circular	Concrete	1	24	352.99	0.31	12.14	636.55	638.55	638.03	4.87	635.45	637.45	636.99	4.69
NP-608	CB-608	CB-607	Circular	Concrete	1	24	213.03	0.31	11.16	637.23	639.23	638.62	4.8	636.55	638.55	638.03	4.47
NP-609	CB-609	CB-608	Circular	Concrete	1	24	135.14	0.32	9.95	637.58	639.58	638.90	4.51	637.14	639.14	638.62	4.00
NP-610	CB-610	CB-609a	Circular	Concrete	1	24	43.87	0.29	8.27	638.23	640.23	639.41	4.29	638.09	640.09	639.3	4.16
NP-611	CB-611	CB-611a	Circular	Concrete	1	18	86.73	1.04	7.03	639.83	641.33	640.90	5.22	638.89	640.39	639.74	6.84
NP-612	CB-612	CB-611	Circular	Concrete	1	18	287.01	0.68	5.1	641.82	643.32	642.91	3.68	639.83	641.33	640.62	5.44
NP-613	CB-613	CB-612	Circular	Concrete	1	18	110.86	0.45	3.68	643.33	644.83	644.08	4.18	642.82	644.32	643.55	4.29
NP-614	CB-614	CB-613	Circular	Concrete	1	18	128.86	7.15	2.9	652.84	654.34	653.51	3.83	643.33	644.83	643.65	10.84
NP-617	CB-617	CB-619	Circular	Concrete	1	18	80.35	0.47	0.42	646.79	648.29	647.07	1.80	646.39	647.89	646.85	0.91
NP-618	CB-619	CB-612	Circular	Concrete	1	18	28.5	1.2	0.88	646.39	647.89	646.85	1.9	646	647.5	646.27	4.05
NP-619	CB-618	CB-619	Circular	Concrete	1	18	109.68	2.19	0.49	650.57	652.07	650.88	1.87	648.08	649.58	648.26	4.20
NP-620	CB-620	CB-622	Circular	Concrete	1	18	13.3	0.75	2.36	637.07	638.57	637.89	2.4	636.94	638.44	637.45	4.45
NP-622	CB-622	ECB-623	Circular	Concrete	1	18	39.77	4.64	2.54	636.94	638.44	637.55	3.74	635.00	636.50	635.33	8.66
NP-623	ECB-623	Outfall-11	Circular	Concrete	1	18	129.4	1.59	4.6	635	636.5	636.08	3.38	632.94	634.44	633.52	7.21
NP-700	CB-700	CB-606	Circular	Concrete	1	18	271.81	1.76	0.91	657.71	659.21	658.15	2.08	652.86	654.36	653.11	4.69
NP-701	CB-701	CB-701b	Circular	Concrete	1	18	73.91	0.53	1.88	659.39	660.89	660.08	2.34	658.98	660.48	659.47	3.78
NP-702	CB-702	CB-708	Circular	Concrete	1	18	77.72	0.50	4.89	658.36	659.86	659.54	3.29	657.95	659.45	658.80	4.75

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-703	CB-703	CB-702	Circular	Concrete	1	18	186.54	2.19	0.99	662.53	664.03	663	2.11	658.36	659.86	658.61	5.2
NP-704	CB-704	CB-705	Circular	Concrete	1	18	181.00	0.31	1.41	663.89	665.39	664.53	1.97	663.32	664.82	664.39	1.06
NP-706	CB-706	CB-614	Circular	Concrete	1	18	230.96	2.19	1.47	657.99	659.49	658.59	2.21	652.84	654.34	653.14	5.85
NP-707	CB-707	CB-707b	Circular	Concrete	1	18	46.05	0.54	1.28	659.38	660.88	659.82	2.99	659.11	660.61	659.50	3.44
NP-708	CB-708	Outlet-5	Circular	Concrete	1	24	143.36	3.06	10.19	657.45	659.45	658.99	3.93	653	655	653.67	11.09
NP-709	CB-709	CB-708	Circular	Concrete	1	18	186.43	2.41	2.11	662.53	664.03	663.10	3.45	657.95	659.45	658.30	6.74
NP-710	CB-710	CB-705	Circular	Concrete	1	18	72.01	2.84	1.5	665.48	666.98	666.09	2.22	663.32	664.82	663.61	6.43
NP-714	DI-714	CB-704	Circular	Concrete	1	18	11.18	0.50	0.28	663.97	665.47	664.53	0.46	663.89	665.39	664.53	0.39
NP-715	DI-715	CB-705	Circular	Concrete	1	18	11.42	6	0.17	664.25	665.75	664.44	1.26	663.32	664.82	664.39	0.13
NP-800	CB-800	CB-801	Circular	Concrete	1	18	192.03	0.31	4.41	662.38	663.88	663.33	3.73	661.78	663.28	662.86	3.22
NP-801	CB-801	CB-802	Circular	Concrete	1	18	249.09	0.3	5.39	661.78	663.28	662.86	3.94	661	662.5	662	4.33
NP-802	CB-802	CB-803	Circular	Concrete	1	18	198.92	1.14	6.43	661.00	662.50	662.00	5.16	658.69	660.19	659.47	6.97
NP-803	CB-803	CB-804	Circular	Concrete	1	24	229.72	0.87	10.8	658.19	660.19	659.68	4.32	656.16	658.16	657.13	7.17
NP-804	CB-804	CB-805	Circular	Concrete	1	24	296.41	3.50	11.70	656.16	658.16	657.40	5.72	645.64	647.64	646.33	12.19
NP-806	CB-805	CB-806	Circular	Concrete	1	30	220.89	0.55	17.3	645.15	647.65	646.86	4.82	643.92	646.42	645.21	6.78
NP-807	CB-807	CB-808	Circular	Concrete	1	18	299.18	0.32	1.02	664.46	665.96	664.95	2.02	663.50	665.00	664.10	1.56
NP-808	CB-808	CB-809	Circular	Concrete	1	18	183.17	1.22	2.32	663.5	665	664.1	3.55	661.22	662.72	661.66	5.41
NP-809	CB-809	CB-816	Circular	Concrete	1	18	97.46	1.37	3.40	661.22	662.72	661.94	4.06	659.83	661.33	660.35	6.28
NP-810	CB-810	CB-811	Circular	Concrete	1	18	112.27	2.18	0.89	658.03	659.53	658.47	2.08	655.5	657	655.73	5.03
NP-811	CB-811	CB-812	Circular	Concrete	1	18	285.73	2.97	2.07	655.50	657.00	656.06	3.44	646.90	648.40	647.23	7.21
NP-812	CB-812	CB-805	Circular	Concrete	1	24	72	0.3	5.74	645.88	647.88	647.1	2.87	645.65	647.65	646.86	2.88
NP-813	CB-813	CB-812	Circular	Concrete	1	24	190.34	0.32	2.68	646.50	648.50	647.16	2.99	645.88	647.88	647.10	1.34
NP-816	CB-816	CB-803	Circular	Concrete	1	18	72	0.95	3.9	659.41	660.91	660.38	3.22	658.69	660.19	659.31	5.7
NP-900	CB-900	CB-806A	Circular	Concrete	1	30	153.33	0.31	16.80	632.20	634.70	634.04	4.33	631.72	634.22	633.83	3.80
NP-901	CB-902	CB-901	Circular	Concrete	1	30	183.72	0.34	14.79	633.58	636.08	634.94	5.42	632.95	635.45	634.44	4.84
NP-902	CB-903	CB-902	Circular	Concrete	1	24	300.37	0.31	13.28	635.02	637.02	636.88	4.36	634.08	636.08	635.39	6.08
NP-903	CB-901	CB-900	Circular	Concrete	1	30	238.07	0.3	15.86	632.94	635.44	634.44	5.15	632.2	634.7	634.04	4.08
NP-904	CB-904	CB-813	Circular	Concrete	1	18	152.27	0.31	1.46	647.48	648.98	648.00	2.67	647.00	648.50	647.45	3.24
NP-905	MH-050	MH-055	Circular	Concrete	1	18	196.28	1.15	3.47	643.69	645.19	644.63	2.96	641.39	642.89	641.94	5.95
NP-906	CB-906	CB-908	Circular	Concrete	1	24	39.03	0.30	8.93	639.06	641.06	640.44	3.88	638.93	640.93	640.37	3.69
NP-907	CB-907	CB-910	Circular	Concrete	1	18	39.09	2.39	0.41	637.92	639.42	638.2	1.79	636.89	638.39	637.05	4.13
NP-908	CB-908	CB-909	Circular	Concrete	1	24	198.12	0.30	9.16	638.93	640.93	640.37	3.79	638.33	640.33	639.41	5.29
NP-909	CB-909	CB-910	Circular	Concrete	1	24	123.04	1.12	9.98	637.7	639.7	638.86	5.26	636.28	638.28	637.15	7.66
NP-910	CB-910	CB-903	Circular	Concrete	1	24	47.89	2.43	10.89	636.28	638.28	637.84	4.14	635.02	637.02	635.80	9.58
NP-911	CB-911	CB-1001b	Circular	Concrete	1	18	64.28	0.44	4.25	640.83	642.33	641.66	4.24	640.53	642.03	641.47	3.65

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-913	DI-913	CB-900	Circular	Concrete	1	18	11.14	6.00	0.71	634.69	636.19	635.07	2.01	633.78	635.28	633.95	6.34
NP-914	DI-914	CB-902	Circular	Concrete	1	18	18.01	4.8	1.03	636.19	637.69	636.67	2.12	635.13	636.63	635.35	6.65
NP-915	MH-060	CB-906	Circular	Concrete	1	24	8.17	0.33	8.35	639.10	641.10	640.62	3.25	639.06	641.06	640.44	3.62
NP-916	CB-906a	MH-055	Circular	Concrete	1	18	7.94	3.06	1.91	641.75	643.25	642.47	2.26	641.39	642.89	642.52	1.34
NP-917	CB-905	MH-050	Circular	Concrete	1	18	5.56	2.66	1.89	643.94	645.44	644.65	2.30	643.69	645.19	644.63	1.62
NP-918	CB-905a	MH-045	Circular	Concrete	1	18	8.11	3.1	1.64	645.58	647.08	646.23	2.25	645.21	646.71	645.53	5.85
EP-1401	ECB-1401	ECB-1402	Circular	Plastic	1	15	175.57	0.67	1.76	665.41	666.66	666.15	2.31	664.23	665.48	664.71	4.10
EP-1501	EDI-1501	Outlet-15	Circular	Concrete	1	18	77.73	1.48	7.4	594.83	596.33	596.54	4.19	593.68	595.18	594.47	7.82
EP-531a	EDI-531A	EXOP-532	Circular	Concrete	1	18	41.19	2.28	3.67	628.53	630.03	629.48	3.12	627.59	629.09	628.08	7.36
NP-003a	CB-004	CB-026	Circular	Concrete	1	36	107	0.49	33.69	590.29	593.29	592.86	5.22	589.75	592.75	592.33	5.2
NP-028a	CB-027	CB-030	Circular	Concrete	1	24	107.00	1.25	19.30	604.02	606.02	605.61	7.22	602.63	604.63	603.88	9.30
NP-040a	MH-040a	MH-040	Circular	Concrete	1	24	11.35	6	7.28	578.07	580.07	579.04	4.84	577.17	579.17	577.76	9.48
NP-1001	CB-1001	CB-1002	Circular	Concrete	1	18	171.58	0.80	10.26	639.18	640.68	640.50	6.23	637.77	639.27	639.00	6.60
NP-1002	CB-1002	CB-1003a	Circular	Concrete	1	18	113.8	1.92	12.01	637.77	639.27	639.2	6.9	635.51	637.01	636.5	9.71
NP-1003	CB-1003	CB-1004a	Circular	Concrete	1	18	43.33	3.25	14.82	633.48	634.98	634.91	8.52	631.94	633.44	632.97	11.51
NP-1004	CB-1004	CB-1005	Circular	Concrete	1	18	216.24	3.91	18.88	627.75	629.25	629.29	10.68	619.15	620.65	620.2	14.2
NP-1005	CB-1005	CB-1006	Circular	Concrete	1	24	182.98	2.56	19.40	618.65	620.65	620.23	7.27	613.87	615.87	614.87	12.31
NP-1006	CB-1006	CB-1007	Circular	Concrete	1	24	136.35	3.32	22.83	613.87	615.87	615.96	7.27	609.21	611.21	610.25	13.86
NP-1007	CB-1007	CB-1007a	Circular	Concrete	1	24	90.43	3.33	15.76	609.21	611.21	610.64	6.55	606.07	608.07	606.92	12.34
NP-1008	CB-1008	CB-1101	Circular	Concrete	1	24	173.59	2.86	17.04	602.17	604.17	603.66	6.77	597.09	599.09	597.99	12.41
NP-1017	CB-1017	CB-1018	Circular	Concrete	1	42	254.71	2.86	24.81	622.06	625.56	624.00	4.53	614.66	618.16	615.53	13.27
NP-1018	CB-1018	CB-1019	Circular	Concrete	1	42	158.2	2.74	27.34	614.66	618.16	616.43	5.61	610.21	613.71	611.15	13.14
NP-1019	CB-1019	CB-1020	Circular	Concrete	1	42	148.98	3.33	27.91	610.21	613.71	611.84	6.35	605.12	608.62	606.03	14.10
NP-1020	CB-1020	CB-1103	Circular	Concrete	1	42	229.06	3.28	28.47	605.12	608.62	606.77	6.39	597.47	600.97	598.37	14.45
NP-1021	DI-1021	DI-1022	Circular	Concrete	1	36	139.91	3.46	13.46	632.99	635.99	634.17	5.18	628.00	631.00	628.65	12.00
NP-1022	DI-1022	DI-1023	Circular	Concrete	1	36	223.51	2.37	19.48	628	631	629.46	5.69	622.61	625.61	623.46	11.76
NP-1023	DI-1023	CB-1017	Circular	Concrete	1	42	12.49	0.30	24.38	622.11	625.61	624.24	3.97	622.06	625.56	624.00	4.45
NP-1024	DI-1024	CB-1018	Circular	Concrete	1	18	9.75	0.3	1.86	616.7	618.2	617.4	2.29	616.66	618.16	617.17	3.48
NP-1025	DI-1025	CB-1005	Circular	Concrete	1	18	13.45	0.30	1.09	619.20	620.70	620.23	0.84	619.15	620.65	620.23	0.80
NP-1026	DI-1026	CB-1006	Circular	Concrete	1	18	9.45	0.97	2.66	614.5	616	615.96	1.52	614.37	615.87	615.96	1.51
NP-1027	DI-1027	CB-1007	Circular	Concrete	1	18	9.43	3.80	0.85	610.22	611.72	610.64	2.06	609.71	611.21	609.92	5.54
NP-1028	DI-1028	DI-1029	Circular	Concrete	1	18	100.86	3.72	11.7	638.78	640.28	641.51	6.62	634.88	636.38	635.68	12.29
NP-1029	DI-1029	DI-1021	Circular	Concrete	1	36	127.58	0.30	13.00	633.38	636.38	634.73	4.21	632.99	635.99	634.17	5.00
NP-109a	MH-109a	Outlet-12	Circular	Concrete	1	30	23.39	6	4.14	577.09	579.59	577.76	3.92	575.58	578.08	575.94	9.4
NP-1101	CB-1101	CB-1102	Circular	Concrete	1	24	101.84	1.29	17.62	597.09	599.09	598.61	6.89	595.72	597.72	596.89	9.20

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CHEK'D BY: GPP DATE: 31-Mar-22
SHEET
OF 10

GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-1102	CB-1102	CB-1104	Circular	Concrete	1	24	72	0.95	17.89	594.94	596.94	596.99	5.69	594.22	596.22	595.53	8.21
NP-1103	CB-1103	CB-1104	Circular	Concrete	1	42	180.25	2.16	29.32	597.47	600.97	599.15	6.44	593.49	596.99	594.52	12.39
NP-1104	CB-1104	Outfall-9	Circular	Concrete	1	42	37	8.7	45.14	593.49	596.99	596.23	5.59	590.1	593.6	591.23	16.87
NP-1105	CB-1105	CB-1106	Circular	Concrete	1	18	29.27	0.34	0.55	596.03	597.53	596.94	0.49	595.92	597.42	596.94	0.43
NP-1106	CB-1106	CB-1112	Circular	Concrete	1	24	72	1.7	18.13	594.84	596.84	596.94	5.77	593.55	595.55	594.68	9.94
NP-1107	CB-1107	CB-1106a	Circular	Concrete	1	24	154.19	1.08	16.42	598.21	600.21	599.68	6.63	596.50	598.50	597.67	8.58
NP-1108	CB-1108	CB-1107	Circular	Concrete	1	24	212.79	2.26	15.14	603.1	605.1	604.84	5.21	598.21	600.21	599.11	11.09
NP-1109	CB-1109	DI-1121	Circular	Concrete	1	18	56.17	5.17	5.07	607.50	609.00	608.55	3.83	604.39	605.89	604.85	10.94
NP-1110	CB-1110	CB-1109a	Circular	Concrete	1	18	118.51	1.37	3.26	613.25	614.75	613.96	3.97	611.57	613.07	612.08	6.22
NP-1111	CB-1111	CB-1110	Circular	Concrete	1	18	164.00	1.07	1.98	615.04	616.54	615.59	3.39	613.25	614.75	613.67	4.95
NP-1112	CB-1112	Outlet-10	Circular	Concrete	1	42	60.39	4.04	32.39	592.62	596.12	594.77	5.24	590.1	593.6	591.13	13.73
NP-1113	CB-1113	CB-1112a	Circular	Concrete	1	24	166.00	1.62	15.89	600.39	602.39	601.83	6.55	597.64	599.64	598.66	9.89
NP-1114	CB-1114	CB-1113	Circular	Concrete	1	24	73.47	5.46	15.17	604.62	606.62	606.03	6.4	600.39	602.39	601.13	14.3
NP-1115	CB-1115	CB-1114	Circular	Concrete	1	24	166.25	2.11	14.34	608.22	610.22	609.59	6.24	604.62	606.62	605.51	10.64
NP-1116	CB-1116	CB-1115	Circular	Concrete	1	24	225.8	0.92	13.44	610.34	612.34	611.67	6.08	608.22	610.22	609.31	7.72
NP-1117	CB-1117	CB-1116	Circular	Concrete	1	24	163.19	0.31	12.81	610.86	612.86	612.38	4.99	610.34	612.34	611.67	5.80
NP-111a	CB-110	CB-110a	Circular	Concrete	1	18	91.27	6.25	2.72	589.59	591.09	590.23	3.79	583.63	585.13	583.94	10.13
NP-1120	DI-1120	CB-1108	Circular	Concrete	1	24	68.83	0.47	14.32	603.44	605.44	605.26	4.77	603.10	605.10	604.84	4.93
NP-1121	DI-1121	DI-1120	Circular	Concrete	1	24	89.22	0.48	11.46	603.89	605.89	605.55	4.1	603.44	605.44	605.26	3.81
NP-113a	CB-113a	CB-113b	Circular	Concrete	1	18	56.21	2.26	0.60	598.41	599.91	598.75	1.95	597.05	598.55	597.24	4.53
NP-113b	CB-113	CB-113b	Circular	Concrete	1	18	72.11	1	0.61	596.05	597.55	596.4	1.96	595.29	596.79	595.53	3.42
NP-1202	CB-1203	CB-1210	Circular	Concrete	1	18	182.27	1.53	0.55	619.00	620.50	619.33	1.92	616.15	617.65	616.35	3.86
NP-1203	CB-1210	CB-1209	Circular	Concrete	1	18	72	0.71	2.23	616	617.5	616.74	2.56	615.46	616.96	615.95	4.41
NP-1204	CB-1204	CB-1210	Circular	Concrete	1	18	62.83	0.46	1.77	616.46	617.96	617.14	2.27	616.15	617.65	616.64	3.54
NP-1205	CB-1205	CB-1205a	Circular	Concrete	1	24	98.62	0.31	11.82	611.99	613.99	613.46	4.77	611.67	613.67	613.18	4.66
NP-1206	CB-1206	CB-1205	Circular	Concrete	1	24	106.07	0.31	9.75	612.33	614.33	613.67	4.39	611.99	613.99	613.46	3.93
NP-1207	CB-1207	CB-1206b	Circular	Concrete	1	24	51.74	0.32	7.33	613.02	615.02	614.09	4.3	612.84	614.84	613.97	4
NP-1208	CB-1208	CB-1216	Circular	Concrete	1	18	102.23	0.31	4.12	614.71	616.21	615.62	3.68	614.38	615.88	615.40	3.22
NP-1209	CB-1209	CB-1208	Circular	Concrete	1	18	182.2	0.4	3.43	615.46	616.96	616.38	3.02	614.71	616.21	615.62	3.06
NP-1216	CB-1216	CB-1207a	Circular	Concrete	1	18	149.77	0.31	4.89	614.38	615.88	615.40	3.82	613.91	615.41	615.05	3.37
NP-1402	ECB-1402	CB-1403	Circular	Concrete	1	18	48.96	2.26	3.78	664.08	665.58	664.9	3.8	662.93	664.43	663.42	7.51
NP-1403	CB-1403	DI-1404	Circular	Concrete	1	30	40.00	0.30	15.90	662.04	664.54	663.85	4.18	661.91	664.41	663.26	5.90
NP-1404	DI-1404	Outlet-14	Circular	Concrete	1	30	83.01	0.51	16.73	661.81	664.31	663.23	5.83	661.38	663.88	662.67	6.52
NP-1405	CB-1405	CB-1403	Circular	Concrete	1	24	64.03	0.44	12.07	662.84	664.84	664.17	5.46	662.54	664.54	663.85	5.54
NP-1406	DI-1406	CB-1405	Circular	Concrete	1	24	88.79	0.54	11.98	663.43	665.43	664.74	5.5	662.93	664.93	664.12	6.13

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-1407	OEP-1407	DI-1406	Circular	Concrete	1	18	219.40	3.41	8.23	671.47	672.97	673.34	4.66	663.93	665.43	664.58	11.13
NP-1601	DI-1601	Outlet-16	Circular	Concrete	1	18	89.04	1.12	1.21	639.02	640.52	639.55	2.16	638	639.5	638.32	4.35
NP-200a	CB-200a	CB-200	Circular	Concrete	1	24	128.29	0.31	16.53	579.82	581.82	582.11	5.26	579.41	581.41	581.17	5.63
NP-200b	DI-100	CB-200a	Circular	Concrete	1	24	17.05	0.44	13.91	579.4	581.4	582.17	4.43	579.32	581.32	582.11	4.43
NP-203a	CB-203a	CB-203b	Circular	Concrete	1	24	57.27	2.84	13.10	595.69	597.69	597.00	6.02	593.95	595.95	594.78	10.71
NP-203b	CB-203b	CB-203	Circular	Concrete	1	24	55.72	2.83	13.55	593.95	595.95	595.28	6.11	592.26	594.26	593.11	10.73
NP-204a	CB-204a	CB-216	Circular	Concrete	1	18	177.48	2.83	7.49	601.94	603.44	603.01	5.54	596.80	598.30	597.45	10.16
NP-205a	CB-205a	CB-205b	Circular	Concrete	1	24	59.95	2.83	8.44	609.27	611.27	610.31	5.1	607.46	609.46	608.1	9.75
NP-205b	CB-205b	CB-205c	Circular	Concrete	1	24	63.35	2.84	9.06	607.46	609.46	608.54	5.23	605.55	607.55	606.21	9.97
NP-205c	CB-205c	CB-205	Circular	Concrete	1	24	64.7	2.84	9.67	605.55	607.55	606.67	5.36	603.6	605.6	604.29	10.14
NP-207a	CB-207a	CB-207b	Circular	Concrete	1	24	100.66	0.31	5.97	612.67	614.67	613.84	3.15	612.35	614.35	613.27	4.24
NP-207b	CB-207b	CB-207	Circular	Concrete	1	24	52.08	0.32	6	612.35	614.35	613.27	4.26	612.17	614.17	613.08	4.31
NP-207c	CB-207c	CB-207d	Circular	Concrete	1	24	64.80	0.68	7.18	611.87	613.87	612.82	4.83	611.40	613.40	612.23	5.84
NP-207d	CB-207d	CB-205a	Circular	Concrete	1	24	70.81	2.85	7.8	611.4	613.4	612.4	4.97	609.27	611.27	609.87	9.74
NP-211a	CB-211b	CB-211a	Circular	Concrete	1	18	69.27	0.48	1.54	634.86	636.36	635.85	1.25	634.51	636.01	635.84	0.93
NP-211b	CB-211	CB-211b	Circular	Concrete	1	18	75.14	0.49	0.8	635.25	636.75	635.85	1.22	634.86	636.36	635.85	0.65
NP-212a	MH-212a	Outlet-2	Circular	Concrete	1	18	41.93	0.48	10.71	568.71	570.21	570.49	6.06	568.50	570.00	569.76	6.78
NP-214a	CB-018	MH-214	Circular	Concrete	1	30	16.21	4.84	18.83	576.89	579.39	578.82	4.62	575.92	578.42	576.88	10.88
NP-214b	CB-214b	CB-214a	Circular	Concrete	1	30	81.64	1.65	16.13	582.10	584.60	583.51	5.65	580.69	583.19	581.63	9.51
NP-221a	CB-221a	CB-214b	Circular	Concrete	1	30	138.73	0.49	15.44	582.8	585.3	584.23	5.33	582.1	584.6	583.35	6.31
NP-227a	CB-227	Outlet-4c	Circular	Concrete	1	24	105.73	0.30	10.33	629.35	631.35	630.91	3.93	629.03	631.03	630.18	5.52
NP-228a	DI-228a	CB-228	Circular	Concrete	1	18	10.1	1.14	0.18	631.92	633.42	632.48	0.3	631.76	633.26	632.48	0.22
NP-229a	CB-229a	CB-232	Circular	Concrete	1	18	41.03	0.51	6.29	632.27	633.77	633.27	5.03	632.04	633.54	633.13	4.59
NP-238a	MH-245	CB-230	Circular	Concrete	1	18	33.26	0.49	2.5	633.53	635.03	634.23	3.1	633.35	634.85	633.93	3.99
NP-241a	CB-241a	CB-241b	Circular	Concrete	1	24	64.21	2.84	11.14	601.45	603.45	602.65	5.63	599.51	601.51	600.25	10.48
NP-241b	CB-241b	CB-241	Circular	Concrete	1	24	53.07	2.84	11.86	599.51	601.51	600.75	5.78	597.89	599.89	598.67	10.38
NP-242a	CB-211a	CB-242a	Circular	Concrete	1	18	54.66	0.51	2.07	634.51	636.01	635.84	1.25	634.21	635.71	635.83	1.17
NP-245a	DI-245a	CB-246	Circular	Concrete	1	18	54.15	2.26	8.69	630.2	631.7	631.74	4.92	628.89	630.39	629.68	9.22
NP-501a	CB-501a	CB-502	Circular	Concrete	1	24	82.45	4.86	9.77	631.50	633.50	632.65	5.20	627.30	629.30	627.89	12.59
NP-502a	CB-502b	MH-503a	Circular	Concrete	1	24	34.71	1.76	13.21	622.37	624.37	623.85	5.3	621.69	623.69	622.66	8.78
NP-502b	CB-502a	CB-502b	Circular	Concrete	1	24	64.83	4.88	12.35	625.73	627.73	627.03	5.73	622.37	624.37	623.06	12.95
NP-503a	MH-503a	Outlet-4a	Circular	Concrete	1	24	31.19	1.57	13.21	617.95	619.95	619.62	4.72	617.43	619.43	618.43	8.38
NP-504a	CB-504a	CB-503	Circular	Concrete	1	18	117.89	1.61	2.91	632.66	634.16	633.32	3.87	630.70	632.20	631.16	6.38
NP-505a	CB-505	MH-505a	Circular	Concrete	1	30	18.54	8	31.73	631.8	634.3	634.48	6.46	630.01	632.51	631.17	14.15
NP-506a	CB-506a	CB-506b	Circular	Concrete	1	30	21.87	0.35	17.03	635.15	637.65	636.69	5.34	635.06	637.56	636.64	5.19

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GEOPAK Output Tables

GEOPAK Output Type: **Link**

Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
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NP-506b	CB-506b	CB-506c	Circular	Concrete	1	30	35.16	0.33	17.93	635.06	637.56	636.64	5.47	634.93	637.43	636.54	5.36
NP-506c	CB-506c	CB-516	Circular	Concrete	1	30	79.06	0.32	18.81	634.93	637.43	636.54	5.62	634.67	637.17	636.18	6.05
NP-506d	DI-506d	CB-506	Circular	Concrete	1	18	11.95	6	4.89	637.35	638.85	638.63	3.04	636.39	637.89	636.9	9.25
NP-507a	DI-507A	CB-507	Circular	Concrete	1	18	88.73	0.52	1.30	634.87	636.37	635.43	2.18	634.39	635.89	634.80	3.39
NP-512a	CB-519	CB-523	Circular	Concrete	1	18	99.38	0.48	0.14	639	640.5	639.18	1.13	638.5	640	638.67	1.29
NP-512b	CB-523	CB-512	Circular	Concrete	1	18	40.00	0.68	0.14	638.50	640.00	638.67	1.29	638.20	639.70	638.29	3.07
NP-600a	CB-600a	CB-506	Circular	Concrete	1	24	195.65	0.31	15.51	636.5	638.5	638.32	5.18	635.89	637.89	637.31	6.5
NP-600b	CB-600b	CB-600a	Circular	Concrete	1	24	42.59	0.33	14.94	636.66	638.66	638.47	4.99	636.50	638.50	638.32	4.99
NP-600c	CB-600c	CB-600b	Circular	Concrete	1	24	59.35	0.32	14.39	636.86	638.86	638.66	4.83	636.66	638.66	638.47	4.8
NP-601a	CB-601a	CB-600	Circular	Concrete	1	24	164.20	0.31	13.39	637.50	639.50	639.23	4.63	636.98	638.98	638.78	4.50
NP-602a	CB-602a	CB-602b	Circular	Concrete	1	24	67.73	0.32	10.3	638.58	640.58	639.96	4.46	638.35	640.35	639.81	4.2
NP-602b	CB-602b	CB-602	Circular	Concrete	1	24	89.59	0.32	10.99	638.35	640.35	639.81	4.48	638.05	640.05	639.61	4.18
NP-603a	DI-603a	CB-603	Circular	Concrete	1	18	16.52	1	0.87	639.43	640.93	640.03	1.31	639.22	640.72	640.04	0.89
NP-604a	CB-604a	CB-603	Circular	Concrete	1	18	74.61	1.10	9.21	640.09	641.59	641.59	5.21	639.22	640.72	640.22	7.40
NP-604b	CB-604b	CB-604a	Circular	Concrete	1	18	73.99	1.77	7.11	641.47	642.97	642.52	5.36	640.09	641.59	640.83	8.25
NP-604c	DI-604C	CB-604a	Circular	Concrete	1	18	7.86	9.28	1.55	641.19	642.69	641.81	2.23	640.09	641.59	640.33	8.33
NP-609a	CB-609a	CB-609	Circular	Concrete	1	24	148.07	0.34	9.37	638.09	640.09	639.3	4.72	637.58	639.58	638.9	4.25
NP-611a	CB-611a	CB-610	Circular	Concrete	1	24	44.11	0.33	7.71	638.39	640.39	639.51	4.26	638.23	640.23	639.41	4.00
NP-623a	JB W/MH- 623a	Outfall-11	Circular	Concrete	1	18	3.26	6	0	633.25	634.75	634.54	0	632.94	634.44	634.54	0
NP-701a	CB-701a	CB-701	Circular	Concrete	1	18	37.69	0.92	0.68	659.77	661.27	660.14	2.00	659.39	660.89	659.64	3.43
NP-701b	CB-701b	CB-702	Circular	Concrete	1	18	151.41	0.4	2.84	658.98	660.48	659.66	3.66	658.36	659.86	659.54	1.91
NP-702a	CB-702a	CB-701	Circular	Concrete	1	18	42.78	0.92	0.27	659.82	661.32	660.07	1.44	659.39	660.89	660.08	0.34
NP-704a	CB-704a	CB-704	Circular	Concrete	1	18	30.82	0.89	0.2	664.2	665.7	664.53	0.72	663.89	665.39	664.53	0.28
NP-705a	CB-705	CB-800	Circular	Concrete	1	18	308.43	0.30	3.92	663.32	664.82	664.39	2.93	662.38	663.88	663.33	3.32
NP-707a	CB-707a	CB-707	Circular	Concrete	1	18	35.97	0.83	0.55	659.71	661.21	660.04	1.92	659.38	660.88	659.61	3.09
NP-707b	CB-707b	CB-708	Circular	Concrete	1	18	150.31	0.75	2.27	659.11	660.61	659.69	3.55	657.95	659.45	658.44	4.52
NP-710a	CB-710a	CB-709	Circular	Concrete	1	18	172.76	1.3	1.02	664.82	666.32	665.3	2.12	662.53	664.03	662.81	4.38
NP-801a	CB-801a	CB-801b	Circular	Concrete	1	18	188.86	0.30	0.09	665.14	666.64	665.30	0.84	664.56	666.06	664.95	0.24
NP-801b	CB-801b	CB-807	Circular	Concrete	1	18	31.14	0.3	0.19	664.56	666.06	664.95	0.51	664.46	665.96	664.95	0.37
NP-806a	CB-806	CB-806A	Circular	Concrete	1	30	91.32	1.00	18.03	643.92	646.42	645.36	6.14	642.97	645.47	644.10	8.36
NP-900a	CB-806A	MH-913A	Circular	Concrete	1	36	84.42	0.32	33.17	631.22	634.22	633.83	5.09	630.94	633.94	632.81	7.16
NP-903a	MH-805a	MH-805b	Circular	Concrete	1	36	50.33	5.56	32.73	610.14	613.14	612.34	5.89	607.14	610.14	608.18	15.08
NP-903b	MH-805b	Outlet-7	Circular	Concrete	1	36	52.93	0.97	32.68	604.53	607.53	606.39	7.12	604	607	605.52	9.1
NP-904a	DI-904A	CB-904	Circular	Concrete	1	18	52.93	0.39	0.27	647.70	649.20	648.01	1.06	647.48	648.98	648.00	0.50
NP-905a	MH-045	MH-050	Circular	Concrete	1	18	94.76	1.54	1.64	645.21	646.71	645.81	2.47	643.69	645.19	644.04	5.33

STV Inc.
Consulting Engineers
454 South Anderson Road, Suite 3, BTC 517
Rock Hill, South Carolina 29730-3392

JOB: S-160 Widening
SUBJECT: GEOPAK Output Tables
CALC'D BY: SCN DATE: 30-Mar-22
CHEK'D BY: GPP DATE: 31-Mar-22

GEOPAK Output Tables

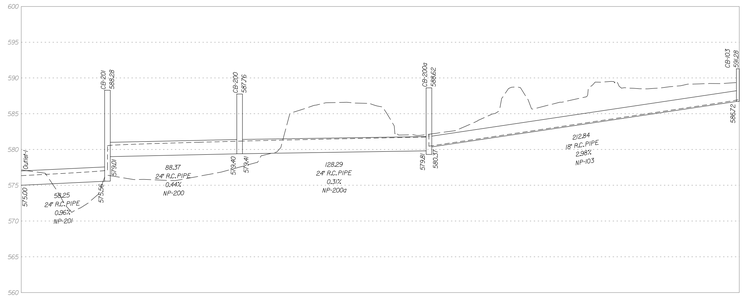
GEOPAK Output Type: **Link**

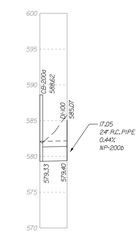
Link	Upstream	Downstream			Number	Rise	Actual			Upstream				Downstream			
ID	Node	Node	Shape	Material	of Barrels	(in)	Length	Slope	Discharge	Invert	Soffit	HGL	Velocity	Invert	Soffit	HGL	Velocity
NP-906a	MH-055	MH-060	Circular	Concrete	1	18	73.05	2.38	5.20	641.39	642.89	642.52	3.65	639.56	641.06	640.13	8.50
NP-907a	DI-907A	MH-060	Circular	Concrete	1	18	139.33	0.31	3.71	640	641.5	641.08	2.72	639.56	641.06	640.62	2.77
NP-911a	CB-911a	CB-911	Circular	Concrete	1	18	62.51	0.44	2.06	641.12	642.62	641.87	2.33	640.83	642.33	641.37	3.61
NP-913a	MH-913A	MH-805a	Circular	Concrete	1	36	267.99	6	32.95	626.44	629.44	628.31	7.13	610.14	613.14	611.02	19.02
NP-1001a	CB-1001a	CB-1001	Circular	Concrete	1	18	51.11	1.16	8.29	639.82	641.32	640.99	5.61	639.18	640.68	640.10	7.30
NP-1001b	CB-1001b	CB-1001a	Circular	Concrete	1	18	78.88	0.86	5.67	640.53	642.03	641.47	4.87	639.82	641.32	640.61	6.05
NP-1003a	CB-1003a	CB-1003	Circular	Concrete	1	18	70.38	2.73	13.84	635.51	637.01	636.99	7.86	633.48	634.98	634.48	11.12
NP-1004a	CB-1004a	CB-1004b	Circular	Concrete	1	18	31.29	2.83	15.62	631.94	633.44	633.4	8.92	630.94	632.44	632.07	10.93
NP-1004b	CB-1004b	CB-1004c	Circular	Concrete	1	18	38.20	3.34	16.49	630.94	632.44	632.39	9.44	629.53	631.03	630.63	11.82
NP-1004c	CB-1004c	CB-1004d	Circular	Concrete	1	18	22.41	3.1	17.27	629.53	631.03	630.99	9.86	628.71	630.21	629.92	11.34
NP-1004d	CB-1004d	CB-1004	Circular	Concrete	1	18	23.05	3.55	18.01	628.71	630.21	630.17	10.25	627.75	629.25	628.95	11.93
NP-1007a	CB-1007a	CB-1008	Circular	Concrete	1	24	113.17	3.33	16.24	606.07	608.07	607.53	6.62	602.17	604.17	603.03	12.67
NP-1106a	CB-1106a	CB-1106	Circular	Concrete	1	24	46.00	2.16	17.24	596.50	598.50	598.00	6.80	595.42	597.42	596.48	10.18
NP-1109a	CB-1109a	CB-1109	Circular	Concrete	1	18	89	4.38	4.9	611.57	613.07	612.44	4.61	607.5	609	607.97	10.48
NP-1112a	CB-1112a	CB-1112	Circular	Concrete	1	24	160.19	2.14	16.49	597.64	599.64	599.11	6.67	594.12	596.12	595.08	11.04
NP-1112b	DI-1112b	CB-1112	Circular	Concrete	1	18	11.57	0.3	0.37	594.67	596.17	594.94	1.74	594.62	596.12	594.86	2.13
NP-1200a	CB-1200a	CB-1200b	Circular	Concrete	1	18	77.59	0.31	0.55	615.95	617.45	616.28	1.92	615.69	617.19	616.09	1.44
NP-1200b	CB-1200b	CB-1111	Circular	Concrete	1	18	209.29	0.31	0.93	615.69	617.19	616.09	2.45	615.04	616.54	615.59	1.58
NP-1205a	CB-1205a	CB-1117	Circular	Concrete	1	24	264.27	0.30	12.32	611.67	613.67	613.18	4.86	610.86	612.86	612.38	4.80
NP-1206a	CB-1206a	CB-1206	Circular	Concrete	1	24	72.23	0.32	8.83	612.58	614.58	613.81	4.34	612.33	614.33	613.67	3.97
NP-1206b	CB-1206b	CB-1206a	Circular	Concrete	1	24	80.67	0.31	7.96	612.84	614.84	613.97	4.34	612.58	614.58	613.81	3.91
NP-1207a	CB-1207a	CB-1207	Circular	Concrete	1	18	120.31	0.31	5.94	613.91	615.41	615.05	4.1	613.52	615.02	614.46	5.09
NP-1207a	CB-1207a	CB-1207	Circular	Concrete	1	18	120.31	0.31	6.09	613.91	615.41	615.08	4.12	613.52	615.02	614.47	5.14

SYSTEM–1

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	





SCALE: H: 1"=50' V: 1"=10'

LEGEND

- - - - - EXISTING GRADE
——— STORM DRAINAGE PIPE
- - - - - - - - - HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3			
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REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
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STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
STV INCORPORATED NO. C03318

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 21220
GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
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3			
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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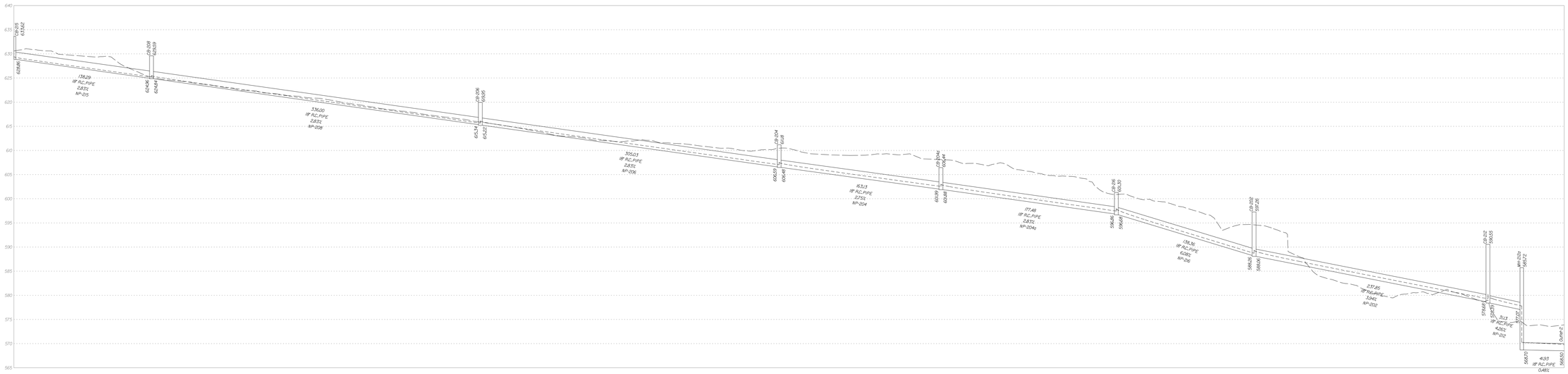
7/13/2022

SYSTEM–2

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED NO. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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7/13/2022

SYSTEM–3

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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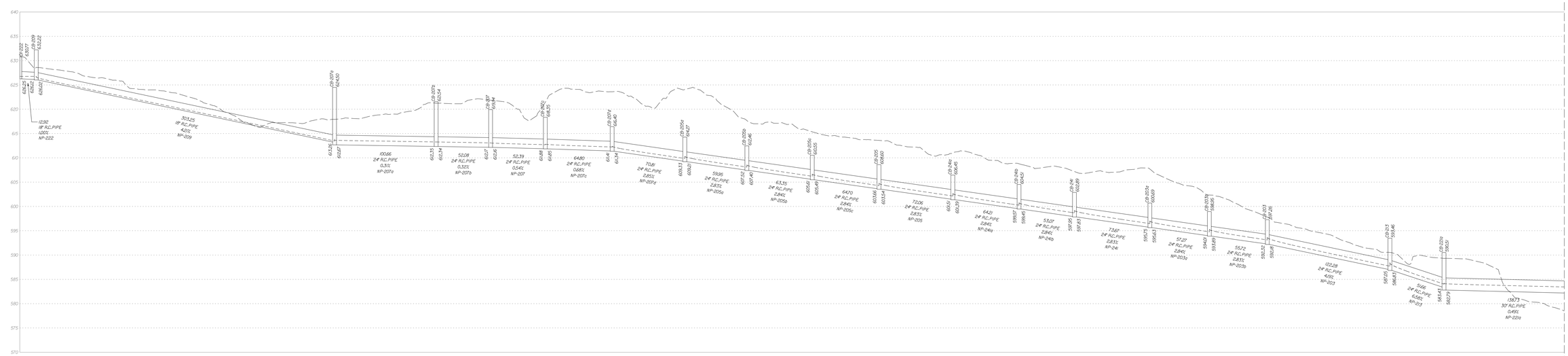

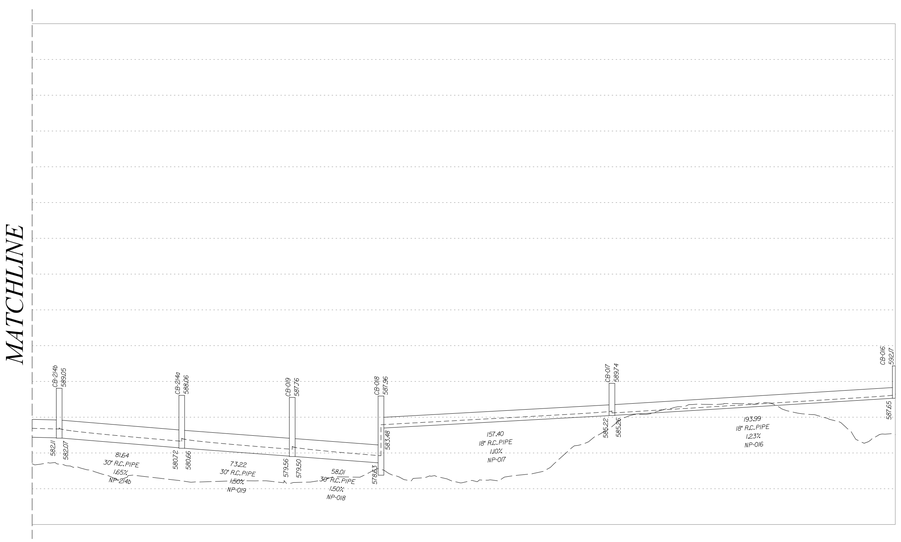

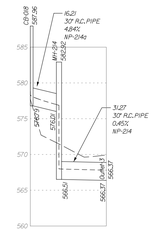

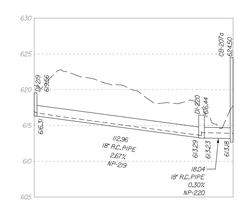

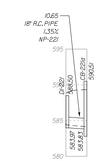

SCALE: H: 1"=50' V: 1"=10'

LEGEND

- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA STV INCORPORATED NO. C03318 CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 21220 GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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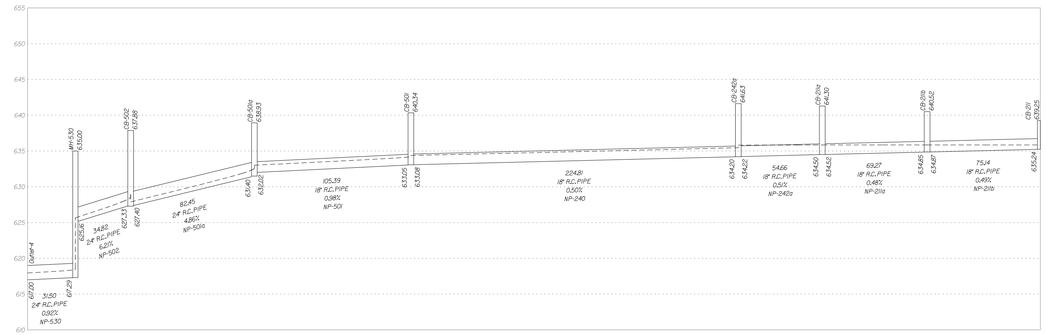
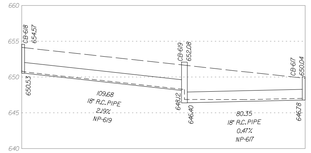
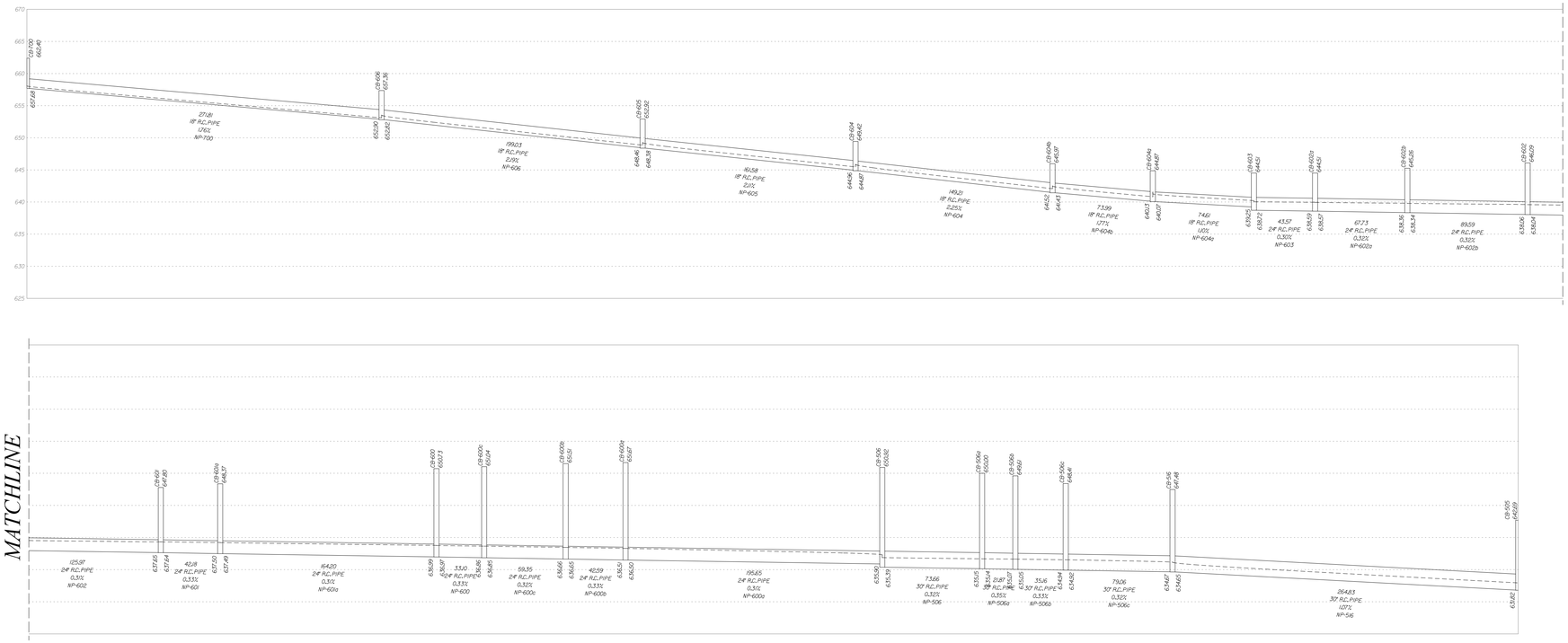
7/13/2022

SYSTEM–4

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	III49-004	US 21	







SCALE: H: 1"=50' V: 1"=10'

LEGEND

——— EXISTING GRADE

——— STORM DRAINAGE PIPE

- - - - - - - - - - HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED No. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — No. 21220 — LICENSED PROFESSIONAL ENGINEER — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51 CLOSED SYSTEM DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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7/13/2022

SYSTEM–4A

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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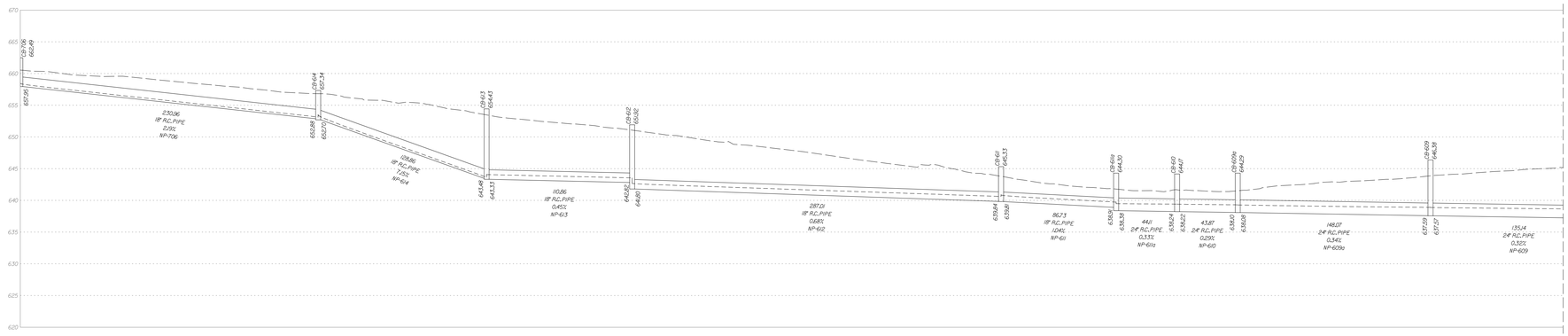
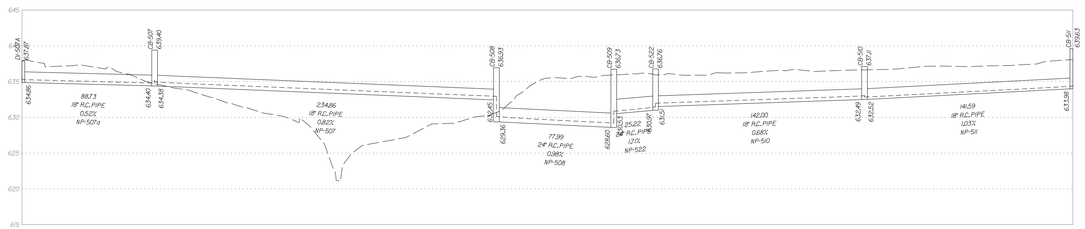
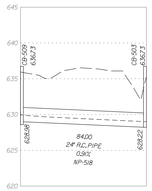
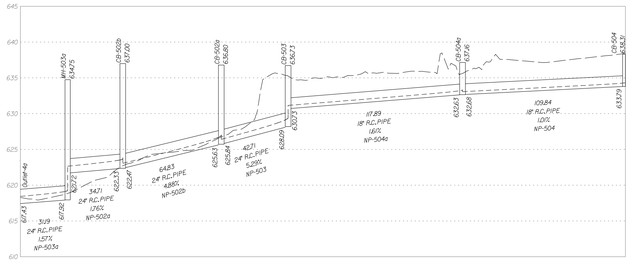




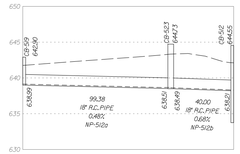




SYSTEM–4B

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	III49-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED No. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — No. 21220 — LICENSED PROFESSIONAL ENGINEER — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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7/13/2022

SYSTEM–5

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
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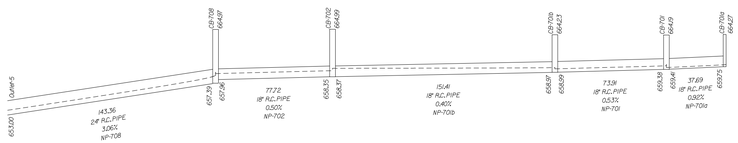

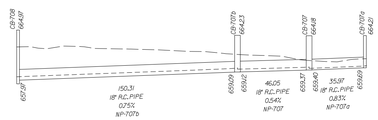

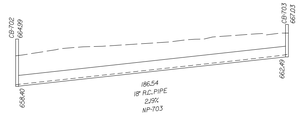

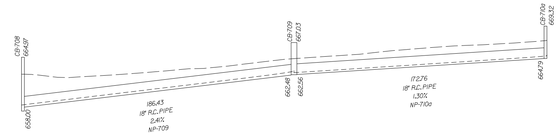

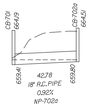

SCALE: H: 1"=50' V: 1"=10'

LEGEND

EXISTING GRADE

STORM DRAINAGE PIPE

HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
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STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED No. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE RTE. DWG. NO.

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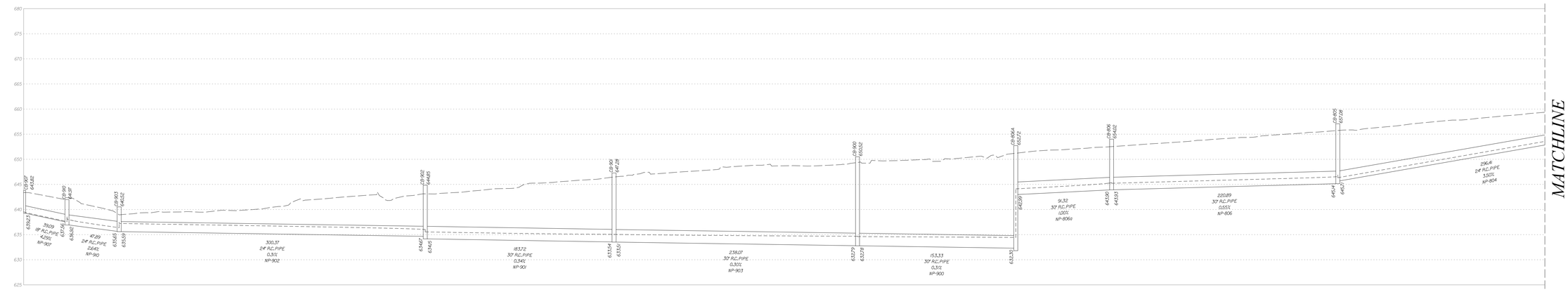
7/13/2022

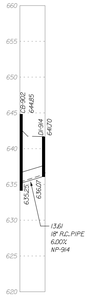
SYSTEM-6

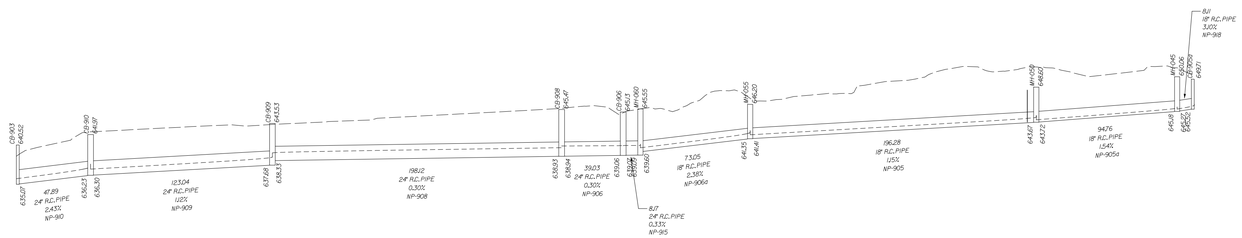
FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	11149-004	US 21	

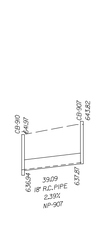


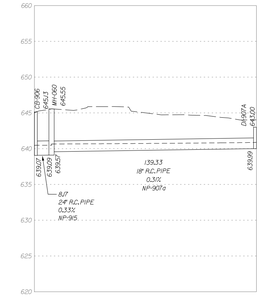
SYSTEM-8

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	11149-004	US 21	









SCALE: H: 1"=50' V: 1"=10'

LEGEND

——— EXISTING GRADE

——— STORM DRAINAGE PIPE

---------- HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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SOUTH CAROLINA — No. 21220 — LICENSED PROFESSIONAL ENGINEER — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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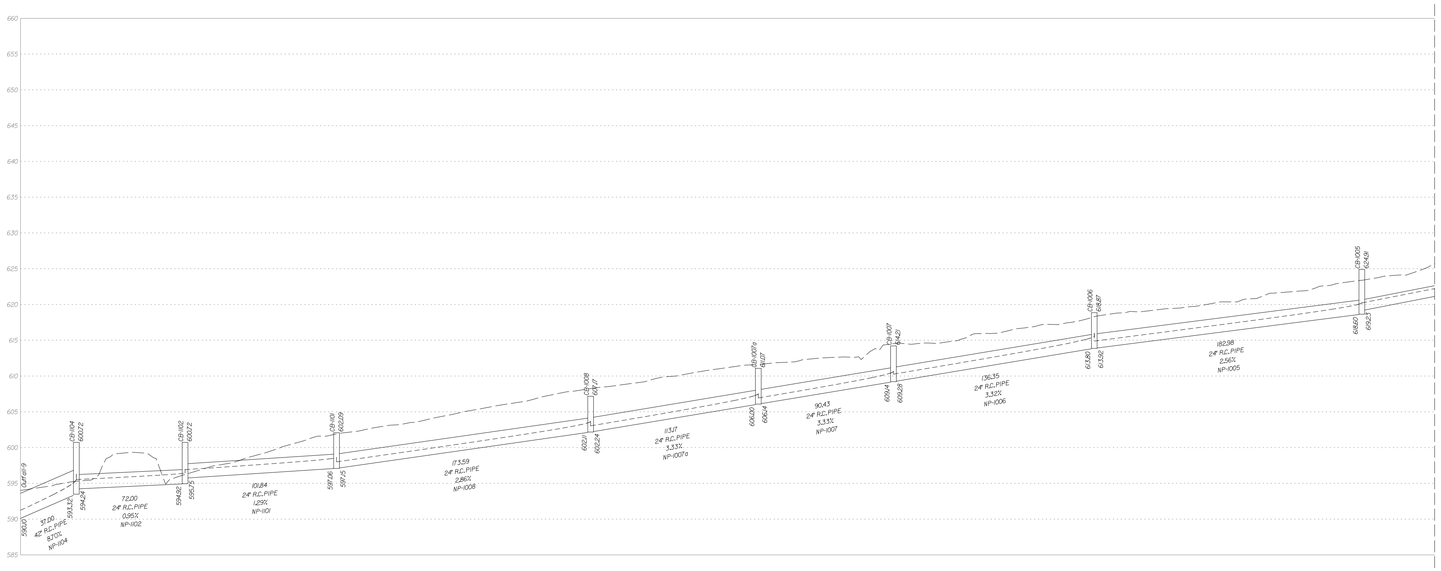
7/13/2022

SYSTEM-9

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	1I149-004	US 21	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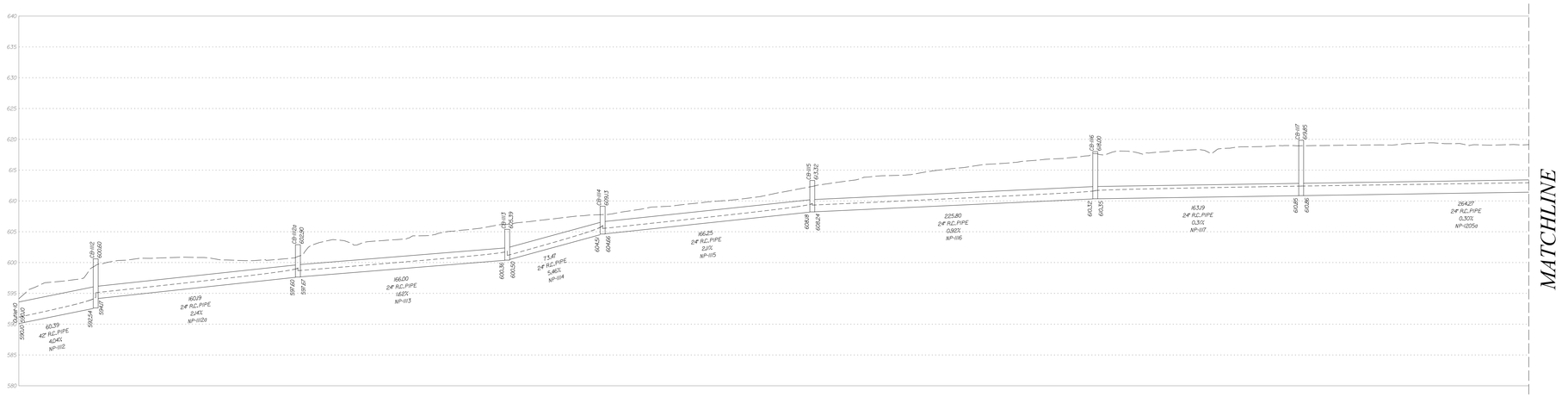
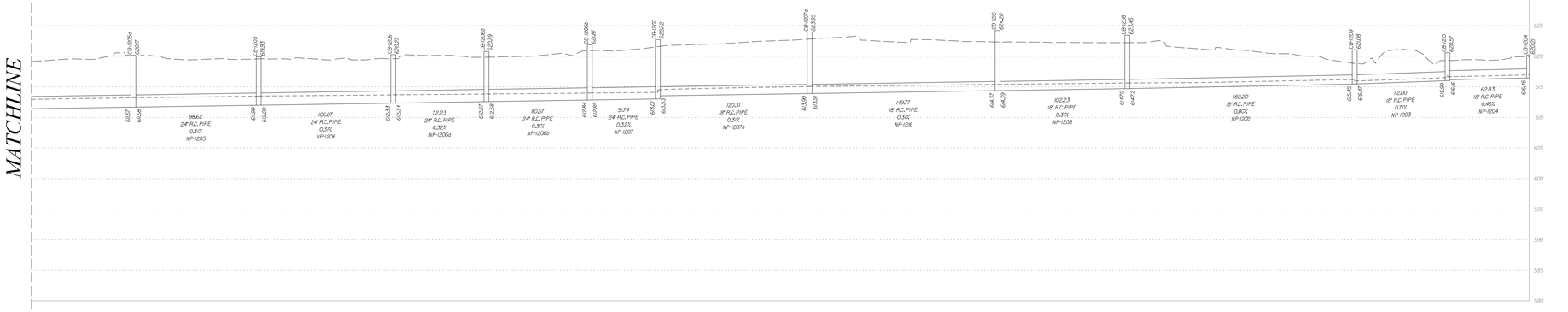
SYSTEM–10

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1I149-004	US 21	





SCALE: H: 1"=50' V: 1"=10'

LEGEND
- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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STV Incorporated
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SOUTH CAROLINA — No. 21220 — LICENSED PROFESSIONAL ENGINEER — GUY PARIS PETERS

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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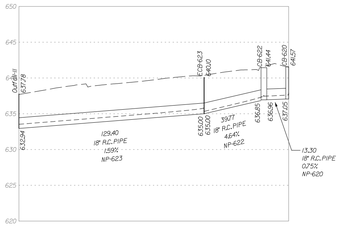
SYSTEM–11

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	III49-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

EXISTING GRADE

STORM DRAINAGE PIPE

HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 5
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED NO. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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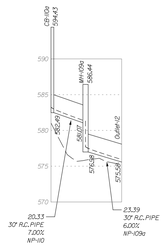
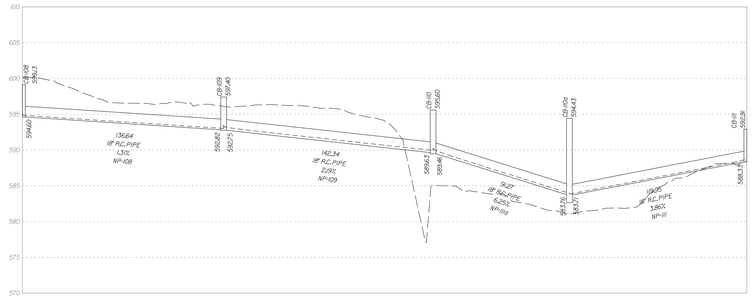
7/13/2022

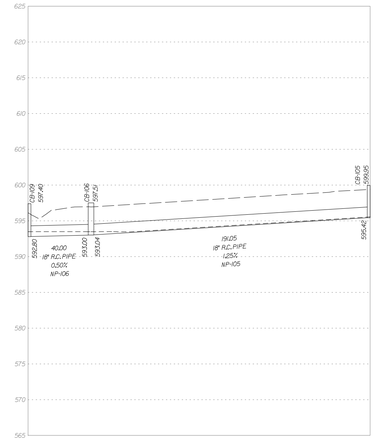
SYSTEM–12

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	







SCALE: H: 1"=50' V: 1"=10'

LEGEND

- – – – – – EXISTING GRADE
- ——— STORM DRAINAGE PIPE
- - - - - - - - - HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
STV INCORPORATED NO. C03318

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 21220 GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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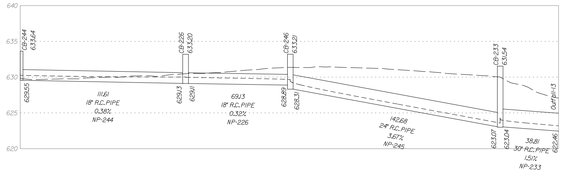
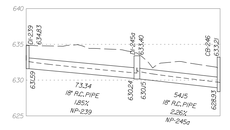
7/13/2022

SYSTEM–13

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	III49-004	US 21	





SCALE: H: 1"=50' V: 1"=10'

LEGEND

- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA — STV INCORPORATED NO. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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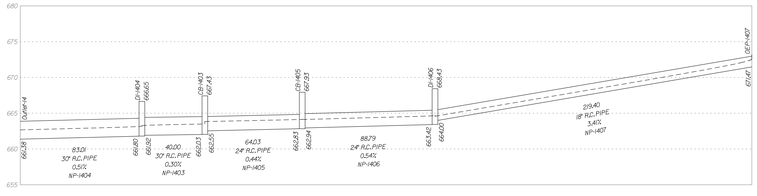
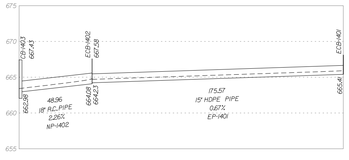
7/13/2022

SYSTEM-14

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	111149-004	US 21	





SCALE: H: 1"=50' V: 1"=10'

LEGEND
- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
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SOUTH CAROLINA — STV INCORPORATED NO. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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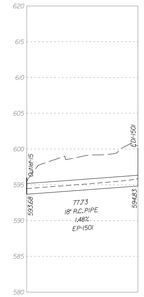
7/13/2022

SYSTEM–15

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

- - - - - - EXISTING GRADE
——— STORM DRAINAGE PIPE
- - - - - - - - - HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
STV INCORPORATED NO. C03318

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 21220 GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE RTE. DWG. NO.

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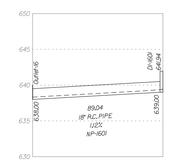
SYSTEM–16

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

- – – – – – EXISTING GRADE
- ———— STORM DRAINAGE PIPE
- - - - - - - - - HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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STV Incorporated
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SOUTH CAROLINA
STV INCORPORATED
NO. C03318
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 21220
GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE RTE. DWG. NO.

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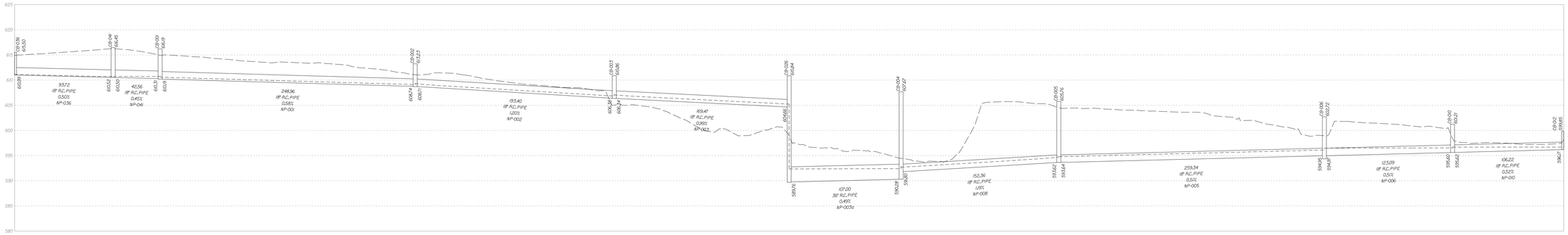
7/13/2022

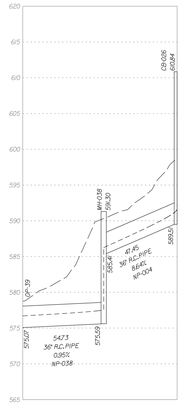
SYSTEM–17

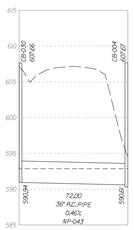
FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	









SCALE: H: 1"=50' V: 1"=10'

LEGEND
- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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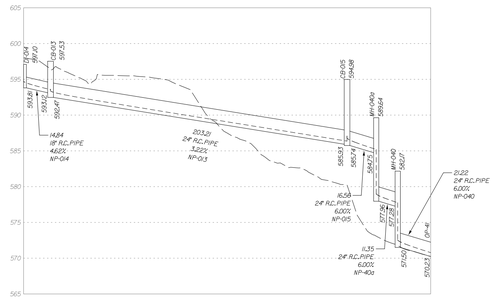
7/13/2022

SYSTEM–18

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	III49-004	US 21	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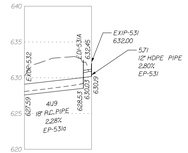
SYSTEM–19

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	III49-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
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STV Incorporated
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SOUTH CAROLINA — STV INCORPORATED NO. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

marlegas
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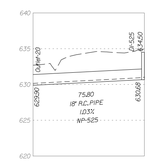
7/13/2022

SYSTEM–20

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	



SCALE: H: 1"=50' V: 1"=10'

LEGEND

- – – – – – EXISTING GRADE
- ———— STORM DRAINAGE PIPE
- - - - - - - - - HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
3			
2			
1			

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

SOUTH CAROLINA
STV INCORPORATED
NO. C03318
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 21220
GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE RTE. DWG. NO.

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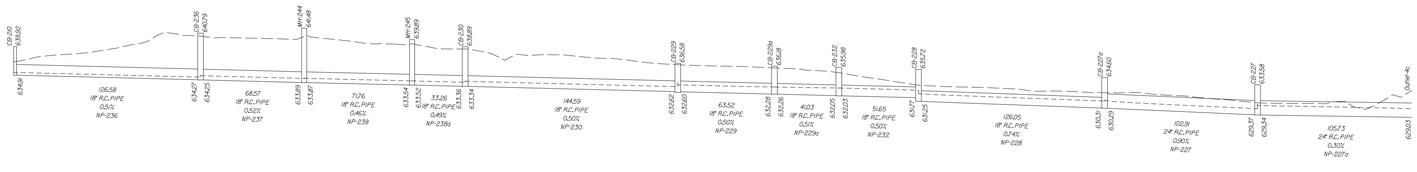
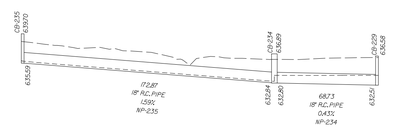
7/13/2022

SYSTEM–21

FINAL R/W PLANS FOR REVIEW ONLY	FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
	3	S.C.	YORK	0042332	1149-004	US 21	





SCALE: H: 1"=50' V: 1"=10'

LEGEND
- EXISTING GRADE
- STORM DRAINAGE PIPE
- HYDRAULIC GRADE LINE

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
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3			
2			
1			

STV Incorporated
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454 S. ANDERSON ROAD, SUITE 3
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SOUTH CAROLINA — STV INCORPORATED NO. C03318 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
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YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
CLOSED SYSTEM
DRAINAGE PROFILE

SCALE | RTE. | DWG. NO.

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1/13/2022

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-100 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	1 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1100		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0779	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	190		
9. Watercourse slope, s	ft./ft.	0.1000		
10. Average velocity, V (figure 3-1)	ft./sec.	5.10		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0103	0.0000	0.0000

Channel flow

Segment ID		CD		
12. Cross sectional flow area, a	$ft.^2$	5.00		
13. Wetted perimeter, p_w	ft.	10.20		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4902		
15. Channel slope, s	ft./ft.	0.0370		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.09		
17b. Input Velocity, FPS	ft./sec.	5.09		
18. Flow length, L	ft.	417		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0228	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1109	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.7 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-221 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	2 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Wood	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.400	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	124	152	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.1300	0.0860	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1896	0.1201	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1896	0.1201	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.19 Hour

11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening	3 SHEET
	SUBJECT: CB-203	
	CALC'D BY: PRJ DATE: 7-Jul-16	OF
	CHECK'D BY: GPP DATE: 8-Jul-16	73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	86		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.2100		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0928	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	34		
9. Watercourse slope, s	ft./ft.	0.0430		
10. Average velocity, V (figure 3-1)	ft./sec.	4.22		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0022	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0950	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.09 Hour

5.7 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-203b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	4 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	57		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1600		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0744	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	56		
9. Watercourse slope, s	ft./ft.	0.2100		
10. Average velocity, V (figure 3-1)	ft./sec.	7.39		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0021	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0765	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.08 Hour

4.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-203a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	5 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	144		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1400		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1648	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1648	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.16 Hour

9.9 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-241 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	6 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	106		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.2100		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1096	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1096	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-241b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	7 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	80		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.2900		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0769	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0769	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.08 Hour

4.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-241a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	8 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.200		
3. Flow length, L (total L ≤ 300 ft)	ft.	72		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0600		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0960	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	65		
9. Watercourse slope, s	ft./ft.	0.3200		
10. Average velocity, V (figure 3-1)	ft./sec.	9.13		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0020	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0980	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

5.9 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-205 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	9 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	197		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1350		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2148	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2148	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.21 Hour

13 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-205c CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	10 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	210		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1400		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2228	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2228	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.22 Hour

13 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-205b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	11 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	203		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1400		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2169	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2169	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.22 Hour

13 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-205a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	12 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	201		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2881	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2881	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.29 Hour

17 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-207d CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		13 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	207		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1200		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2949	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2949	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.29 Hour

18 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-207c CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	14 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	175		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0650		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3295	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC	CD	
7. Surface description (Paved or Unpaved)		Upaved	Paved	
8. Flow length, L	ft.	61	17	
9. Watercourse slope, s	ft./ft.	0.2900	0.0550	
10. Average velocity, V (figure 3-1)	ft./sec.	10.95	4.77	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0015	0.0010	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3311	0.0010	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour

20 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-207 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	15 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	153		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0470		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3369	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Upaved		
8. Flow length, L	ft.	81		
9. Watercourse slope, s	ft./ft.	0.2140		
10. Average velocity, V (figure 3-1)	ft./sec.	9.40		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0024	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3393	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.34 Hour

20 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-207b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		16 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.400		
3. Flow length, L (total L ≤ 300 ft)	ft.	248		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.1020		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3637	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3637	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.36 Hour

22 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-220 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		17 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1327	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Upaved		
8. Flow length, L	ft.	63		
9. Watercourse slope, s	ft./ft.	0.0530		
10. Average velocity, V (figure 3-1)	ft./sec.	4.68		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0037	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	18.00		
13. Wetted perimeter, p_w	ft.	13.42		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	1.3413		
15. Channel slope, s	ft./ft.	0.1900		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	22.57		
17b. Input Velocity, FPS	ft./sec.	22.57		
18. Flow length, L	ft.	124		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0015	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1380	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

8.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-219 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	18 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

	Path #1	Path #2	Path #3
Segment ID	AB		
1. Surface Description (table 3-1)	Grass		
2. Manning's roughness coefficient, n (table 3-1)	0.150		
3. Flow length, L (total L ≤ 300 ft) ft.	155		
4. Two-year 24-hour rainfall, P_2 in.	3.60		
5. Land slope, s ft./ft.	0.0310		
6. $T_t = \frac{.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t hr.	0.1835	0.0000	0.0000

Shallow concentrated flow

Segment ID	BC		
7. Surface description (Paved or Unpaved)	Upaved		
8. Flow length, L ft.	97		
9. Watercourse slope, s ft./ft.	0.0810		
10. Average velocity, V (figure 3-1) ft./sec.	5.79		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t hr.	0.0047	0.0000	0.0000

Channel flow

Segment ID	CD		
12. Cross sectional flow area, a $ft.^2$	36.75		
13. Wetted perimeter, p_w ft.	22.14		
14. Hydraulic Radius, $r = a / p_w$ Compute r ft.	1.6599		
15. Channel slope, s ft./ft.	0.1900		
16. Manning's roughness coefficient, n	0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft./sec.	26.01		
17b. Input Velocity, FPS ft./sec.	26.01		
18. Flow length, L ft.	70		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t hr.	0.0007	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19) hr.	0.1889	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) 0.19 Hour
11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		19 SHEET
	SUBJECT: DI-222		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF
	CHECK'D BY: GPP	DATE: 8-Jul-16	73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Grass	Wood	
2. Manning's roughness coefficient, n (table 3-1)		0.150	0.400	
3. Flow length, L (total L ≤ 300 ft)	ft.	58	135	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0660	0.0540	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0618	0.2883	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0618	0.2883	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.29 Hour

17 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-211 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	20 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	112		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0610		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1079	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1079	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.5 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-211b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		21 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	101		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0400		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1176	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	22		
9. Watercourse slope, s	ft./ft.	0.0090		
10. Average velocity, V (figure 3-1)	ft./sec.	1.93		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0032	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1208	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.12 Hour

7.2 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-211a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	22 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	94		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0570		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0964	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	18		
9. Watercourse slope, s	ft./ft.	0.0050		
10. Average velocity, V (figure 3-1)	ft./sec.	1.44		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0035	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0999	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-501 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		23 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	53		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0110		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2049	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	47		
9. Watercourse slope, s	ft./ft.	0.0010		
10. Average velocity, V (figure 3-1)	ft./sec.	0.64		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0203	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2252	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.23 Hour

14 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-501a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	24 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	114		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0660		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1847	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1847	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.18 Hour

11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-503 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	25 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	30		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0290		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0882	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC	CD	
7. Surface description (Paved or Unpaved)		Unpaved	Paved	
8. Flow length, L	ft.	22	56	
9. Watercourse slope, s	ft./ft.	0.0430	0.0016	
10. Average velocity, V (figure 3-1)	ft./sec.	3.35	0.81	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0018	0.0191	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0900	0.0191	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.09 Hour

5.4 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-516 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	26 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Woods	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.250	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	67	284	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0570	0.0340	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1106	0.0355	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1106	0.0355	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-506c CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		27 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Woods	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.250	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	44	260	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0280	0.0260	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1050	0.0368	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1050	0.0368	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.11 Hour

6.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-506b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		28 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.280		
3. Flow length, L (total L ≤ 300 ft)	ft.	200		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0280		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3860	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	317		
9. Watercourse slope, s	ft./ft.	0.0270		
10. Average velocity, V (figure 3-1)	ft./sec.	3.34		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0264	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4124	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.41 Hour

25 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-506a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	29 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Woods		
2. Manning's roughness coefficient, n (table 3-1)		0.280		
3. Flow length, L (total L ≤ 300 ft)	ft.	237		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0370		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3955	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	280		
9. Watercourse slope, s	ft./ft.	0.0190		
10. Average velocity, V (figure 3-1)	ft./sec.	2.22		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0350	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4305	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.43 Hour

26 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-600a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		30 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	180		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0430		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1814	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1814	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.18 Hour

11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-600b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	31 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Wood	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.300	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	90	126	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0270	0.0430	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2185	0.1364	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2185	0.1364	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.22 Hour

13 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		32 SHEET
	SUBJECT: CB-600c		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF 73
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Wood	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.300	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	74	118	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0320	0.0460	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1746	0.1260	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		CD		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	43		
9. Watercourse slope, s	ft./ft.	0.1000		
10. Average velocity, V (figure 3-1)	ft./sec.	6.43		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0019	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1764	0.1260	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.18 Hour

11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		33 SHEET
	SUBJECT: CB-600		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF
	CHECK'D BY: GPP	DATE: 8-Jul-16	73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Woods	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.300	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	78	102	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0280	0.0360	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1921	0.1236	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1921	0.1236	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.19 Hour

12 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-602b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		34 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	46		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0630		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0523	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	80		
9. Watercourse slope, s	ft./ft.	0.0260		
10. Average velocity, V (figure 3-1)	ft./sec.	3.28		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0068	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0591	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.06 Hour

3.5 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-602a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		35 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	79		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0610		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1421	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	128		
9. Watercourse slope, s	ft./ft.	0.0150		
10. Average velocity, V (figure 3-1)	ft./sec.	2.49		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0143	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1564	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.16 Hour

9.4 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-603 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		36 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB	BC	
1. Surface Description (table 3-1)		Wood	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.250	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	90	44	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0630	0.0170	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1346	0.0105	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1346	0.0105	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.13 Hour

8.1 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		37 SHEET
	SUBJECT: DI-603a		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF
	CHECK'D BY: GPP	DATE: 8-Jul-16	73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Wood	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.250	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	113	35	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0440	0.0480	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1864	0.0058	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1864	0.0058	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.19 Hour

11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-604c CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		38 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Grass	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.150	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	138	52	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0680	0.0120	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1221	0.0138	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1221	0.0138	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.12 Hour

7.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening	39 SHEET
	SUBJECT: CB-604b	
	CALC'D BY: PRJ DATE: 7-Jul-16	OF
	CHECK'D BY: GPP DATE: 8-Jul-16	73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	94		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0660		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0909	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	111		
9. Watercourse slope, s	ft./ft.	0.0320		
10. Average velocity, V (figure 3-1)	ft./sec.	3.64		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0085	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0994	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening		40 SHEET
	SUBJECT: CB-604		
	CALC'D BY: PRJ	DATE: 7-Jul-16	OF 73
	CHECK'D BY: GPP	DATE: 8-Jul-16	

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	98		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0540		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1018	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1018	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.10 Hour

6.1 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-700a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		41 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	145		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0070		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3154	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3154	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.32 Hour

19 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-714 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	42 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.200		
3. Flow length, L (total L ≤ 300 ft)	ft.	58		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0230		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1185	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	117		
9. Watercourse slope, s	ft./ft.	0.0370		
10. Average velocity, V (figure 3-1)	ft./sec.	3.10		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0105	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1290	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.13 Hour

7.7 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-715 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	43 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	98		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0600		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1700	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1700	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.17 Hour

10 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-905 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	44 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	73		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0590		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0096	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	19		
9. Watercourse slope, s	ft./ft.	0.0140		
10. Average velocity, V (figure 3-1)	ft./sec.	2.41		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0022	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0118	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.01 Hour

0.7 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-911 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		45 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	100		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0305		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0161	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0161	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.02 Hour

1 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1001 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	46 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Grass	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.150	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	79	102	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0200	0.0370	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1275	0.0151	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1275	0.0151	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.13 Hour

7.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1002 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		47 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Grass	Wood	
2. Manning's roughness coefficient, n (table 3-1)		0.150	0.300	
3. Flow length, L (total L ≤ 300 ft)	ft.	32	101	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0310	0.0930	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0519	0.1461	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0519	0.1461	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.15 Hour

8.8 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1003a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	48 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	203		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0570		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3107	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3107	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.31 Hour

19 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1003 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		49 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	120		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0380		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2399	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	126		
9. Watercourse slope, s	ft./ft.	0.0780		
10. Average velocity, V (figure 3-1)	ft./sec.	4.51		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0078	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2477	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.25 Hour

15 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1004a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	50 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	271		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0532		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4024	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4024	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.40 Hour

24 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1004b CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		51 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	299		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0500		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4463	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4463	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.45 Hour

27 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1004c CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		52 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	299		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0440		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4697	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	30		
9. Watercourse slope, s	ft./ft.	0.0720		
10. Average velocity, V (figure 3-1)	ft./sec.	4.33		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0019	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4716	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.47 Hour

28 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1004d CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		53 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0580		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4217	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4217	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.42 Hour

25 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1004 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		54 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0490		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4511	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	45		
9. Watercourse slope, s	ft./ft.	0.0400		
10. Average velocity, V (figure 3-1)	ft./sec.	3.23		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0039	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4550	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.45 Hour

27 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1005 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		55 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	289		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0540		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4211	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Paved		
8. Flow length, L	ft.	146		
9. Watercourse slope, s	ft./ft.	0.0530		
10. Average velocity, V (figure 3-1)	ft./sec.	4.68		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0087	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4298	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.43 Hour

26 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1025 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	56 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	98		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0710		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1589	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	370		
9. Watercourse slope, s	ft./ft.	0.0630		
10. Average velocity, V (figure 3-1)	ft./sec.	4.05		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0254	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1843	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.18 Hour

11 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1026 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		57 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	46		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0430		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1060	0.0000	0.0000

Shallow concentrated flow

		Path #1	Path #2	Path #3
Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	514		
9. Watercourse slope, s	ft./ft.	0.0560		
10. Average velocity, V (figure 3-1)	ft./sec.	3.82		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0374	0.0000	0.0000

Channel flow

		Path #1	Path #2	Path #3
Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1434	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

8.6 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1027 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		58 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.300		
3. Flow length, L (total L ≤ 300 ft)	ft.	300		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0430		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4753	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	175		
9. Watercourse slope, s	ft./ft.	0.0416		
10. Average velocity, V (figure 3-1)	ft./sec.	3.29		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0148	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.4901	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.49 Hour

29 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1007a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		59 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Wood	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.300	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	202	72	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0480	0.0330	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3315	0.0120	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3315	0.0120	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour

20 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1008 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	60 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Wood	Pavement	
2. Manning's roughness coefficient, n (table 3-1)		0.300	0.011	
3. Flow length, L (total L ≤ 300 ft)	ft.	203	172	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0470	0.0270	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3356	0.0261	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3356	0.0261	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.34 Hour

20 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1101 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	61 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	170		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0430		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1733	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1733	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.17 Hour

10 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1021 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	62 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	112		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0280		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.1473	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.1473	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.15 Hour

8.8 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1022 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	63 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	215		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0160		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.3105	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	84		
9. Watercourse slope, s	ft./ft.	0.0280		
10. Average velocity, V (figure 3-1)	ft./sec.	2.70		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0086	0.0000	0.0000

Channel flow

	Segment ID	CD		
12. Cross sectional flow area, a	$ft.^2$	4.00		
13. Wetted perimeter, p_w	ft.	8.25		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4848		
15. Channel slope, s	ft./ft.	0.0210		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	3.81		
17b. Input Velocity, FPS	ft./sec.	3.81		
18. Flow length, L	ft.	188		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0137	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.3329	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.33 Hour

20 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1023 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		64 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Pavement		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	227		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0420		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0273	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	233		
9. Watercourse slope, s	ft./ft.	0.0310		
10. Average velocity, V (figure 3-1)	ft./sec.	2.84		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0228	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0500	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.05 Hour

3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1024 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		65 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB	BC	
1. Surface Description (table 3-1)		Pavement	Wood	
2. Manning's roughness coefficient, n (table 3-1)		0.011	0.250	
3. Flow length, L (total L ≤ 300 ft)	ft.	82	164	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0730	0.0540	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0097	0.2313	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0097	0.2313	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.23 Hour

14 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1107 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	66 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Wood		
2. Manning's roughness coefficient, n (table 3-1)		0.200		
3. Flow length, L (total L ≤ 300 ft)	ft.	240		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0120		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.4789	0.0000	0.0000

Shallow concentrated flow

	Segment ID	BC	CD	
7. Surface description (Paved or Unpaved)		Unpaved	Paved	
8. Flow length, L	ft.	566	85	
9. Watercourse slope, s	ft./ft.	0.0220	0.0350	
10. Average velocity, V (figure 3-1)	ft./sec.	2.39	3.80	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0657	0.0062	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.5446	0.0062	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.54 Hour

33 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1109 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		67 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	219		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0190		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2942	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2942	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.29 Hour

18 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: CB-1109a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	68 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB	BC	
1. Surface Description (table 3-1)		Pavement	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.011	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	168	95	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0090	0.0250	
6. $T_t = \frac{.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr.	0.0397	0.1352	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, $r = a / p_w$ Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0397	0.1352	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

8.1 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-239 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		69 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Concrete		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	204		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0086		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0472	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID		BC		
12. Cross sectional flow area, a	$ft.^2$	1.77		
13. Wetted perimeter, p_w	ft.	4.71		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.3758		
15. Channel slope, s	ft./ft.	0.0680		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	5.78		
17b. Input Velocity, FPS	ft./sec.	5.78		
18. Flow length, L	ft.	162		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0078	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0550	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.05 Hour

3.3 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-245a CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		70 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	162		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0130		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2691	0.0000	0.0000

Shallow concentrated flow

Segment ID		BC		
7. Surface description (Paved or Unpaved)		Unpaved		
8. Flow length, L	ft.	75		
9. Watercourse slope, s	ft./ft.	0.1400		
10. Average velocity, V (figure 3-1)	ft./sec.	6.04		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0035	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2725	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.27 Hour

16 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: OEP-1407 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		71 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB		
1. Surface Description (table 3-1)		Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.150		
3. Flow length, L (total L ≤ 300 ft)	ft.	181		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0330		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.2026	0.0000	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID	BC		
12. Cross sectional flow area, a	$ft.^2$	4.00		
13. Wetted perimeter, p_w	ft.	8.25		
14. Hydraulic Radius, r = a / p_w Compute r	ft.	0.4848		
15. Channel slope, s	ft./ft.	0.0300		
16. Manning's roughness coefficient, n		0.0350		
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.	4.55		
17b. Input Velocity, FPS	ft./sec.	4.55		
18. Flow length, L	ft.	418		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0255	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.2281	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.23 Hour

14 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1406 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16		72 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
Segment ID		AB		
1. Surface Description (table 3-1)		Concrete		
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft.	248		
4. Two-year 24-hour rainfall, P_2	in.	3.60		
5. Land slope, s	ft./ft.	0.0170		
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0420	0.0000	0.0000

Shallow concentrated flow

Segment ID				
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

Segment ID				
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0420	0.0000	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.04 Hour

2.5 min

STV

STV Consulting Engineers 454 South Anderson Road, Suite 3, BTC 517 Rock Hill, SC 29730 (803) 980-4970	JOB: US 21/ SC 51 Phase I Widening SUBJECT: DI-1406 CALC'D BY: PRJ DATE: 7-Jul-16 CHECK'D BY: GPP DATE: 8-Jul-16	73 SHEET OF 73

TIME OF CONCENTRATION (T_C) - POST DEVELOPMENT

Check One: ☐ Present ☑ Developed

Note: Space for as many as three segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow

		Path #1	Path #2	Path #3
	Segment ID	AB	BC	
1. Surface Description (table 3-1)		Pavement	Grass	
2. Manning's roughness coefficient, n (table 3-1)		0.011	0.150	
3. Flow length, L (total L ≤ 300 ft)	ft.	150	86	
4. Two-year 24-hour rainfall, P_2	in.	3.60	3.60	
5. Land slope, s	ft./ft.	0.0250	0.0200	
6. $T_t = \frac{.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr.	0.0241	0.1365	0.0000

Shallow concentrated flow

	Segment ID			
7. Surface description (Paved or Unpaved)				
8. Flow length, L	ft.			
9. Watercourse slope, s	ft./ft.			
10. Average velocity, V (figure 3-1)	ft./sec.			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000

Channel flow

	Segment ID			
12. Cross sectional flow area, a	$ft.^2$			
13. Wetted perimeter, p_w	ft.			
14. Hydraulic Radius, r = a / p_w Compute r	ft.			
15. Channel slope, s	ft./ft.			
16. Manning's roughness coefficient, n				
17a. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft./sec.			
17b. Input Velocity, FPS	ft./sec.			
18. Flow length, L	ft.			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr.	0.0000	0.0000	0.0000
20. Total, T_c (add T_t in steps 6, 11, and 19)	hr.	0.0241	0.1365	0.0000

21. Watershed Total, T_c (maximum, Path #1, #2, or #3) ..... 0.14 Hour

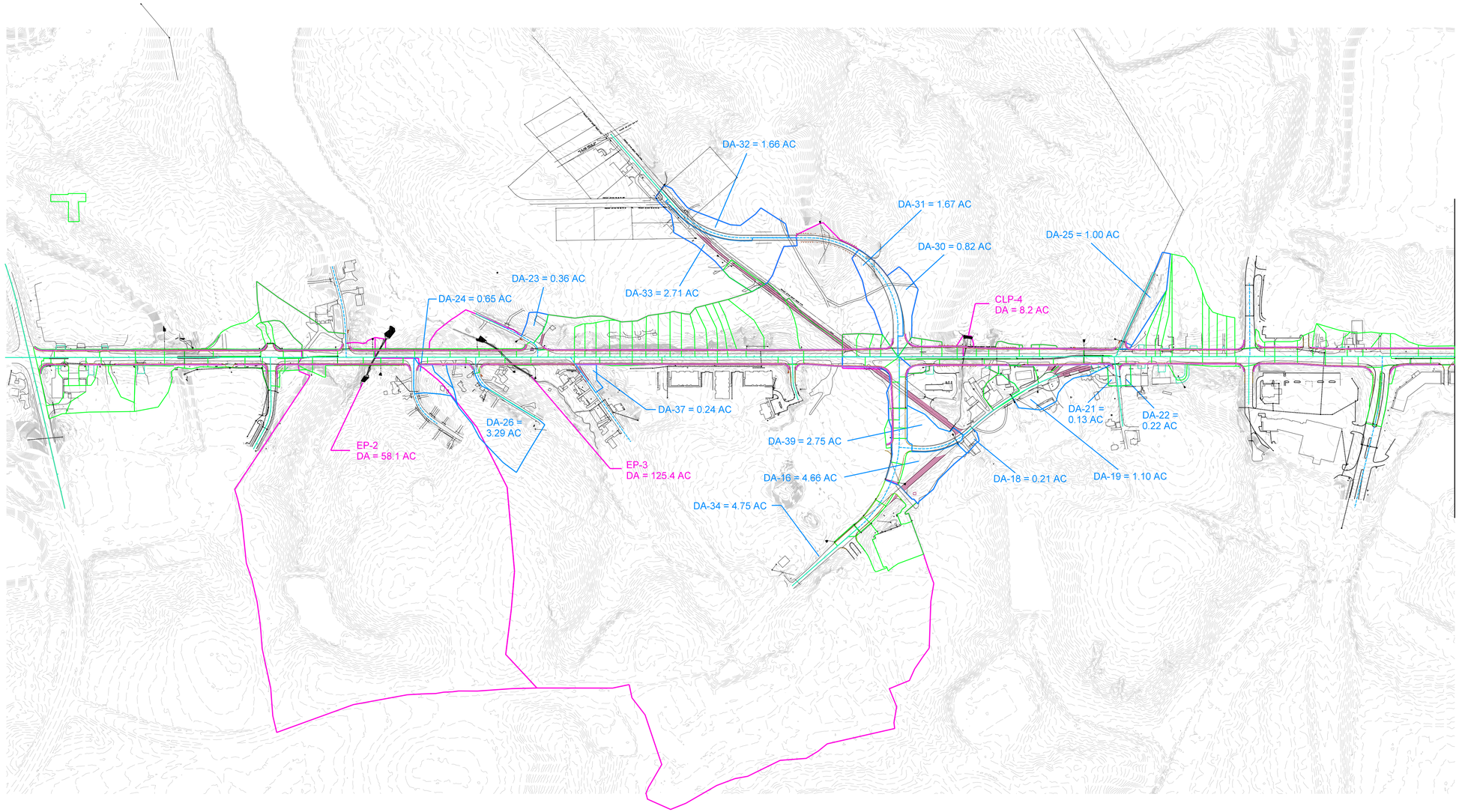
8.2 min

Appendix H

Drainage Area Maps

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

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3/3/2022

SOUTH CAROLINA — STV INCORPORATED NO. C0338 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

LEGEND
- DA DITCH
- DA CULVERT
- DA SYSTEM

300 0 300 600

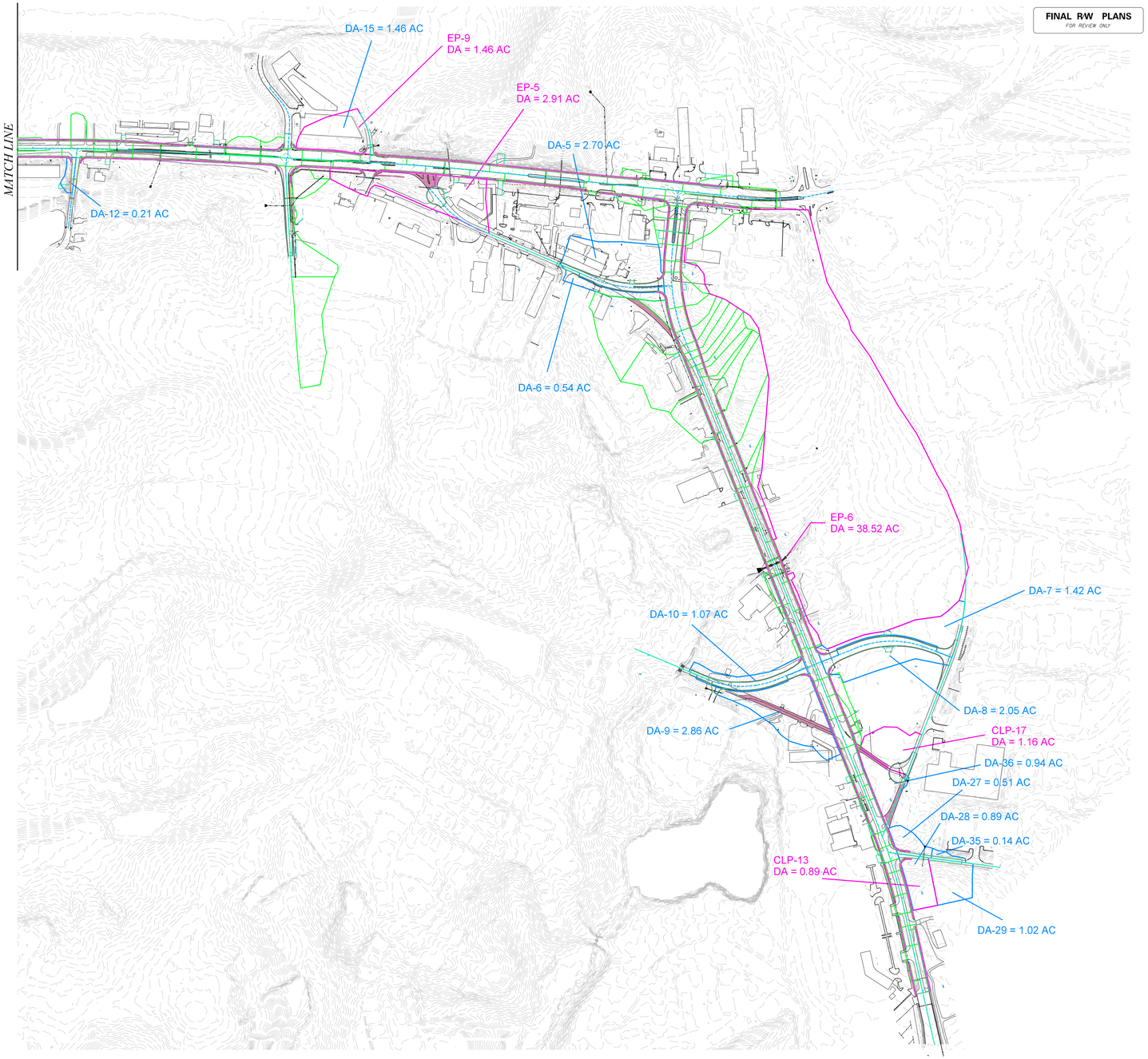
FIGURE 7A

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
DRAINAGE AREA MAP (1 OF 2)

FINAL R/W PLANS
FOR REVIEW ONLY

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	



REV. NO.	BY	DATE	DESCRIPTION OF REVISION
6			
5			
4			
3			
2			
1			

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7/31/2022

SOUTH CAROLINA — STV INCORPORATED NO. C0338 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — LICENSED PROFESSIONAL ENGINEER — No. 21220 — GUY PARIS PETERS

STV Incorporated
ROCK HILL BUSINESS TECHNOLOGY CENTER, BTC 517
454 S. ANDERSON ROAD, SUITE 3
ROCK HILL, SOUTH CAROLINA 29730

LEGEND
DA DITCH
DA CULVERT
DA SYSTEM

300 0 300 600

FIGURE 7B

YORK COUNTY
SOUTH CAROLINA

US 21 NORTH PHASE 1 & SC 51
DRAINAGE AREA MAP (2 OF 2)

Appendix F

Inspection Log and Reports

SWPPP Inspection Log

Name of Construction Site	Location of Construction Site

Date of Inspection	Inspector Name	Does Inspection Report require maintenance of installed BMPs?	
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No

SWPPP Inspection Log (Continued)			
Date of Inspection	**Inspector Name**	**Does Inspection Report require maintenance of installed BMPs?**	
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No

Appendix G

Rainfall Log and Reports

SWPPP Rainfall Records (January - June)										Year:	
January	Rainfall	February	Rainfall	March	Rainfall	April	Rainfall	May	Rainfall	June	Rainfall
1		1		1		1		1		1	
2		2		2		2		2		2	
3		3		3		3		3		3	
4		4		4		4		4		4	
5		5		5		5		5		5	
6		6		6		6		6		6	
7		7		7		7		7		7	
8		8		8		8		8		8	
9		9		9		9		9		9	
10		10		10		10		10		10	
11		11		11		11		11		11	
12		12		12		12		12		12	
13		13		13		13		13		13	
14		14		14		14		14		14	
15		15		15		15		15		15	
16		16		16		16		16		16	
17		17		17		17		17		17	
18		18		18		18		18		18	
19		19		19		19		19		19	
20		20		20		20		20		20	
21		21		21		21		21		21	
22		22		22		22		22		22	
23		23		23		23		23		23	
24		24		24		24		24		24	
25		25		25		25		25		25	
26		26		26		26		26		26	
27		27		27		27		27		27	
28		28		28		28		28		28	
29		29		29		29		29		29	
30				30		30		30		30	
31				31				31			

SWPPP Rainfall Records (July - December)										Year:	
July	Rainfall	August	Rainfall	September	Rainfall	October	Rainfall	November	Rainfall	December	Rainfall
1		1		1		1		1		1	
2		2		2		2		2		2	
3		3		3		3		3		3	
4		4		4		4		4		4	
5		5		5		5		5		5	
6		6		6		6		6		6	
7		7		7		7		7		7	
8		8		8		8		8		8	
9		9		9		9		9		9	
10		10		10		10		10		10	
11		11		11		11		11		11	
12		12		12		12		12		12	
13		13		13		13		13		13	
14		14		14		14		14		14	
15		15		15		15		15		15	
16		16		16		16		16		16	
17		17		17		17		17		17	
18		18		18		18		18		18	
19		19		19		19		19		19	
20		20		20		20		20		20	
21		21		21		21		21		21	
22		22		22		22		22		22	
23		23		23		23		23		23	
24		24		24		24		24		24	
25		25		25		25		25		25	
26		26		26		26		26		26	
27		27		27		27		27		27	
28		28		28		28		28		28	
29		29		29		29		29		29	
30		30		30		30		30		30	
31		31				31				31	

Appendix H

Additional Site Logs and Records

SWPPP Pre-Construction Conference Attendance Log

Date & Time	Description/Outline and Name of the Presenter of SWPPP and Site Requirements

Name	Company	Signature

SWPPP Pre-Construction Conference Attendance Log (Continued)

Name	Company	Signature

SWPPP Contractor & Sub-Contractor Log

Name of Construction Site	Location of Construction Site

Company/Individual Name		Work Responsibilities
1.)		
Start Date:		
Completion Date:		
2.)		
Start Date:		
Completion Date:		
3.)		
Start Date:		
Completion Date:		
4.)		
Start Date:		
Completion Date:		
5.)		
Start Date:		
Completion Date:		
6.)		
Start Date:		
Completion Date:		
7.)		
Start Date:		
Completion Date:		
8.)		
Start Date:		
Completion Date:		
9.)		
Start Date:		
Completion Date:		
10.)		
Start Date:		
Completion Date:		

SWPPP Contractor & Sub-Contractor Log (Continued)		
11.)		
Start Date:		
Completion Date:		
12.)		
Start Date:		
Completion Date:		
13.)		
Start Date:		
Completion Date:		
14.)		
Start Date:		
Completion Date:		
15.)		
Start Date:		
Completion Date:		
16.)		
Start Date:		
Completion Date:		
17.)		
Start Date:		
Completion Date:		
18.)		
Start Date:		
Completion Date:		
19.)		
Start Date:		
Completion Date:		
20.)		
Start Date:		
Completion Date:		
21.)		
Start Date:		
Completion Date:		

SWPPP Modification Log

Name of Construction Site	Location of Construction Site

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

SWPPP Modification Log (Continued)

Name of Construction Site	Location of Construction Site

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

Type of Modification	Description of Modification	Location of Modification
☐ Major ☐ Minor Start Date: Completion Date:		
Reason for Modifications:	Approved/Implemented By:	

SWPPP Soil Stabilization Log

Name of Construction Site	Location of Construction Site

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

SWPPP Modification Log (Continued)

Name of Construction Site	Location of Construction Site

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Type of Stabilization	Description of Stabilization	Location of Stabilization
☐ Final ☐ Temporary		
Initiate Date:		
Completion Date:		
Additional work proposed for this area:	Inspection Frequency for Stabilized Area:	

Appendix I

Construction General Permit SCR100000

A copy of the NPDES General Permit for Stormwater Discharges from Construction Activities (SCR100000) can be found at the following address:

http://www.scdhec.gov/environment/water/swater/docs/CGP-permit.pdf

Appendix J

Sediment and Erosion Control Plan Set

Plans are provided as a separate volume and are not bound with the remainder of the SWPPP.

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

August 2, 2023

Division 10

York County Pennies for Progress
6 Congress Street, PO Box 148
York, SC 29745

SUBJECT: Non-Utility Encroachment Contract – Mecklenburg County – US-21 and SC-51 Improvements – US-21 (Carowinds Blvd) from SC-460 (Springfield Pkwy) to 700 ft. south of S-48 (Springhill Farm Rd) & SC-51 (Pineville-Rock Hill Rd) from US-21 (Carowinds Blvd) to the NC state line.

Encroachment Number: E102-060-23-00572

To Whom It May Concern:

A review of the subject encroachment has been completed by the appropriate staff agencies of the Division of Highways. Plans for construction at the above referenced location have been approved for construction at this time and are subject to the attached special provisions.

This encroachment involves roadway improvements and pavement markings along US-21 (Carowinds Blvd) and SC-51 (Pineville-Rock Hill Rd).
Please contact our District Office at (980) 523-0000 should additional information be needed.

Cordially,

Brett D. Canipe/KHB/JTL

Brett D. Canipe, PE
Division Engineer

BDC/KHB
Enclosure
cc: Mr. Felix Obregon, District Engineer
Mr. Dwight Hill, County Maintenance Engineer (Letter Only)
File

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
DIVISION 10 DISTRICT 2 OFFICE
7605 DISTRICT DRIVE
CHARLOTTE, NC 28213

Telephone: (980) 523-0000
Fax: (704) 598-1758
Customer Service: 1-877-368-4968

Website: www.ncdot.gov

Location:
7605 DISTRICT DRIVE
CHARLOTTE, NC 28213

ROUTE NC 51 / SC 51 (Pineville-Rock Hill Rd) PROJECT US 21 and SC 51 Improvements STATE OF NORTH CAROLINA COUNTY OF Mecklenburg

DEPARTMENT OF TRANSPORTATION

-AND-

York County Pennies For Progress
6 Congress Street, Post Office Box 148
York, SC 29745

RIGHT OF WAY ENCROACHMENT AGREEMENT FOR CURB AND GUTTER, PAVEMENT WIDENING AND STORM DRAINAGE

THIS AGREEMENT, made and entered into this the 2nd day of Aug , 20 23 , by and between the Department of Transportation, party of the first part; and York County Pennies for Progress party of the second part,

WITNESSETH

THAT WHEREAS, the party of the second part desires to encroach on the right of way of the public road designated as Route(s) NC Highway 51 (Pineville-Rock Hill Rd) , located at the North Carolina / South Carolina border

with the construction and/or erection of: roadway improvements

WHEREAS, it is to the material advantage of the party of the second part to effect this encroachment, and the party of the first part in the exercise of authority conferred upon it by statute, is willing to permit the encroachment within the limits of the right of way as indicated, subject to the conditions of this agreement;

NOW, THEREFORE, IT IS AGREED that the party of the first part hereby grants to the party of the second part the right and privilege to make this encroachment as shown on attached plan sheet(s), specifications and special provisions which are made a part hereof upon the following conditions, to wit:

That the said party of the second part binds and obligates himself to install the encroaching facility in such safe and proper condition that it will not interfere with or endanger travel upon said highway.

That the party of the second part agrees to provide during construction proper signs, signal lights, flagmen and other warning devices for the protection of traffic in conformance with the latest Manual on Uniform Traffic Control Devices for Streets and Highways and Amendments or Supplements thereto. Information as to the above rules and regulations may be obtained from the Division Engineer of the party of the first part.

That the party of the second part hereby agrees to indemnify and save harmless the party of the first part from all damages and claims for damage that may arise by reason of the installation and maintenance of this encroachment.

It is clearly understood by the party of the second part that the party of the first part will assume no responsibility for any damage that may be caused to such facilities, within the highway rights of way limits, in carrying out its construction.

That the party of the second part agrees to restore all areas disturbed during construction to the satisfaction of the Division Engineer of the party of the first part. The party of the second part agrees to exercise every reasonable precaution during construction and maintenance to prevent eroding of soil; silting or pollution of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces or other property; or pollution of the air. There shall be compliance with applicable rules and regulations of the North Carolina Division of Environmental Management, North Carolina Sedimentation Control Commission, and with ordinances and regulations of various counties, municipalities and other official agencies relating to pollution prevention and control. When any construction operation disturbs the ground surface and existing ground cover, the party of the second part agrees to remove and replace the sod or otherwise reestablish the grass cover to meet the satisfaction of the Division Engineer of the party of the first part.

That the party of the second part agrees to assume the actual cost of any inspection of the work considered to be necessary by the Division Engineer of the party of the first part.

That the party of the second part agrees to have available at the encroaching site, at all times during construction, a copy of this agreement showing evidence of approval by the party of the first part. The party of the first part reserves the right to stop all work unless evidence of approval can be shown.

Provided the work contained in this agreement is being performed on a completed highway open to traffic; the party of the second part agrees to give written notice to the Division Engineer of the party of the first part when all work contained herein has been completed. Unless specifically requested by the party of the first part, written notice of completion of work on highway projects under construction will not be required.

That in the case of noncompliance with the terms of this agreement by the party of the second part, the party of the first part reserves the right to stop all work until the facility has been brought into compliance or removed from the right of way at no cost to the party of the first part.

That it is agreed by both parties that this agreement shall become void if actual construction of the work contemplated herein is not begun within one (1) year from the date of authorization by the party of the first part unless written waiver is secured by the party of the second part from the party of the first part.

R/W (161B) : Party of the Second Part certifies that this agreement is true and accurate copy of the form

R/W (161B) incorporating all revisions to date.

IN WITNESS WHEREOF, each of the parties to this agreement has caused the same to be executed the day and year first above written.

DEPARTMENT OF TRANSPORTATION

DocuSigned by:

BY: Brett D. Canipe, PE/KHB

DIVISION ENGINEER

F6B8E4EDA41A4E8...

ATTEST OR WITNESS:

Assistant County Engineer

Second Party

INSTRUCTIONS

When the applicant is a corporation or a municipality, this agreement must have the corporate seal and be attested by the corporation secretary or by the empowered city official, unless a waiver of corporate seal and attestation by the secretary or by the empowered City official is on file in the Raleigh office of the State Utilities Manager. In the space provided in this agreement for execution, the name of the corporation or municipality shall be typed above the name, and title of all persons signing the agreement should be typed directly below their signature.

When the applicant is not a corporation, then his signature must be witnessed by one person. The address should be included in this agreement and the names of all persons signing the agreement should be typed directly below their signature.

This agreement must be accompanied, in the form of an attachment, by plans or drawings showing the following applicable information:

1. All roadways and ramps.
2. Right of way lines and where applicable, the control of access lines.
3. Location of the proposed encroachment.
4. Length and type of encroachment.
5. Location by highway survey station number. If station number cannot be obtained, location should be shown by distance from some identifiable point, such as a bridge, road, intersection, etc. (To assist in preparation of the encroachment plan, the Department's roadway plans may be seen at the various Highway Division Offices, or at the Raleigh office.)
6. Drainage structures or bridges if affected by encroachment.
7. Typical section indicating the pavement design and width, and the slopes, widths and details for either a curb and gutter or a shoulder and ditch section, whichever is applicable.
8. Horizontal alignment indicating general curve data, where applicable.
9. Vertical alignment indicated by percent grade, P.I. station and vertical curve length, where applicable.
10. Amount of material to be removed and/or placed on NCDOT right of way, if applicable.
11. Cross-sections of all grading operations, indicating slope ratio and reference by station where applicable.
12. All pertinent drainage structures proposed. Include all hydraulic data, pipe sizes, structure details and other related information.
13. Erosion and sediment control.
14. Any special provisions or specifications as to the performance of the work or the method of construction that may be required by the Department must be shown on a separate sheet attached to encroachment agreement provided that such information cannot be shown on plans or drawings.
15. The Department's Division Engineer should be given notice by the applicant prior to actual starting of installation included in this agreement.
16. Method of handling traffic during construction where applicable.
17. Scale of plans, north arrow, etc.

NCDOT PRECONSTRUCTION MEETING REQUEST FORM

Date: _____

Prior to beginning any work inside NCDOT ROW, this form must be completed and submitted to the inspectors listed below. Please allow 2-3 business days for a response by the appropriate inspector. Please note that this form must be completed and submitted to NCDOT prior to the pre-construction meeting.

Please submit this form to the following NCDOT Inspectors:

Elijah Hager- (980)250-08680 (ebhager1@ncdot.gov)

Carl Valente- (980) 323-0614 (cvalente@ncdot.gov)

Permit number: D102-060-23-00572

Project Name: US-21 and SC-51 Improvements

Construction start date: _____

Approximate ending date: _____

Requested Date & time: _____

Contractor's Information:

- **Name:** _____
- **Email:** _____
- **Phone Number:** _____

City/Town Inspector's Information:

- **Name:** _____
- **Email:** _____
- **Phone Number:** _____
- **City/Town:** _____

SPECIAL PROVISIONS

R/W 16.1B

ENCROACHING PARTY

E102-060-23-00572

Pre-Construction

Contact Offices & Outside Agency issues/contacts/info

1. Approval may be rescinded upon failure to follow any of the provisions in this permit and may be considered a violation of the encroachment agreement.

2. The encroachment applicant shall have one (1) year from the approval date as shown on the cover letter to begin construction. If work is not started within this one (1) year time period, the Encroachment Contract will become VOID, thus requiring written authorization from the District Engineer's office to proceed with construction.

3. The Encroaching party or their contractor shall provide the following notices prior to construction activity within the NCDOT Right of Way:
   - Three (3) business days advance phone call at telephone (980) 523-0000 or email to ebhager1@ncdot.gov and cvalente@ncdot.gov to the District Engineer's office.
   - If the construction falls within the limits of an NCDOT managed construction project, five (5) business days advance phone call to the Resident Engineer, Mr. Jon Hinson at (980) 523-0160 or email to jchinson@ncdot.gov.

   Failure to provide these notifications prior to beginning construction is subject to the Division Engineer's discretion to cease construction activity for this encroachment. NCDOT reserves the right to cease any construction or maintenance work associated with this installation by the encroaching party until the construction or maintenance meets the satisfaction of the Division Engineer or their representative.

4. The approval is subject to the project being constructed as shown on the approved plan and any attached revisions to the approved plans must be approved through **Kimberly Boik or Felix Obregon** with the NCDOT District Office.

5. Prior to beginning work, it is the requirement of the Encroaching Party to contact the appropriate Utility Companies involved and make arrangements to adjust or relocate any utilities that conflict with the proposed work.

6. It shall be the responsibility of the encroaching party to determine the location of utilities within the encroachment area. NCGS § 87-115 through § 87-130 of the Underground Utility Safety and Damage Prevention Act requires underground utilities to be located by calling 811 prior to construction. The encroaching party shall be responsible for notifying other utility owners and providing protection and safeguards to prevent damage or interruption to existing facilities and maintain access to them.

7. The encroaching party shall notify the appropriate municipal office prior to beginning any work within the municipality's limits of jurisdiction.

8. Excavation within 1000 feet of a signalized intersection will require notification by the encroaching party to NC-811 at telephone number 811 no less than one week prior to beginning work. All traffic signal or detection cables must be located prior to excavation by calling 811. Cost to replace or repair NCDOT signs, signals, pavement markings or associated equipment and facilities shall be the responsibility of the encroaching party.

9. This agreement does not authorize installations within nor encroachment onto railroad rights of way. Permits for installations within railroad right of way must be obtained from the railroad and are the responsibility of the encroaching party.

10. At the option of the District Engineer, a preconstruction meeting including representatives of NCDOT, the encroaching party, contractors, and municipality, if applicable, shall be required. A pre-construction conference held between a municipality (or other facility owner) and a contractor without the presence of NCDOT personnel with subsequent construction commencing may be subject to NCDOT personnel ceasing any work on NCDOT right-of-way related to this encroachment until such meeting is held. Contact the District office to schedule.

11. At the discretion of the District Engineer, a NOTIFICATION FOR UTILITY / NON-UTILITY ENCROACHMENT WITHIN NCDOT R/W form (See corresponding attachment) with the scheduled pre-construction meeting and associated construction schedule details must be completed and submitted to the District Engineer's office a minimum of one week prior to construction.

12. At the discretion of the District Engineer, the encroaching party (not the utility contractor) shall make arrangements to have a qualified inspector, under the supervision of a Professional Engineer registered in North Carolina, on site at all times during construction. The registered Professional Engineer shall be required to submit a signed and PE sealed certification that the utility was installed in accordance with the encroachment agreement.

Legal & Right-of-Way Issues

13. This approval and associated plans and supporting documents shall not be interpreted to allow any design change or change in the intent of the design by the Owner, Design Engineer, or any of their representatives. Any revisions or changes to these approved plans or intent for construction must be obtained in writing from the Division Engineer's office or their representative prior to construction or during construction if an issue arises during construction to warrant changes.

14. NCDOT does not guarantee the right of way on this road, nor will it be responsible for any claim for damages brought about by any property owner by reason of this installation. It is the responsibility of the encroaching party to verify the right of way.

15. Encroaching party shall be responsible for obtaining all necessary permanent and/or temporary construction, drainage, utility and/or sight distance easements.

16. All Right of Way and easements necessary for construction and maintenance shall be dedicated to NCDOT with proof of dedication furnished to the District Engineer prior to beginning work.

17. No commercial advertising shall be allowed within NCDOT Right of Way.

18. The encroaching party shall obtain proper approval from all affected pole owners prior to attachment to any pole.

19. The installation within the Control of Access fence shall not adversely affect the design, construction, maintenance, stability, traffic safety or operation of the controlled access highway, and the utility must be serviced without access from the through-traffic roadways or ramps.

20. No permission is given through the NCDOT permitting process to install items on NON-NCDOT maintained streets, private property, or railroad property.

21. Prior to the approval of any privately maintained facility within NCDOT right of way which the State of North Carolina is not the fee simple owner, written permission that each and every property owner affected by the installation shall be provided to NCDOT by the encroaching party.

Work Zone Traffic

22. WORK ZONE TRAFFIC CONTROL QUALIFICATIONS AND TRAINING PROGRAM

    All personnel performing any activity inside the highway right of way are required to be familiar with the NCDOT Maintenance / Utility Traffic Control Guidelines (MUTCG). No specific training course or test is required for qualification in the Maintenance /Utility Traffic Control Guidelines (MUTCG).

    All flagging, spotting, or operating Automated Flagger Assist Devices (AFAD) inside the highway right of way requires qualified and trained Work Zone Flaggers. Training for this certification is provided by NCDOT approved training resources and by private entities that have been pre-approved to train themselves.

    All personnel involved with the installation of Work Zone Traffic Control devices inside the highway right of way are required to be qualified and trained Work Zone Installers. Training for this certification is provided by NCDOT approved training resources and by private entities that have been pre-approved to train themselves.

    All personnel in charge of overseeing work zone Temporary Traffic Control operations and installations inside the highway right of way are required to be qualified and trained Work Zone Supervisors. Training for this certification is provided by NCDOT approved training resources and by private entities that have been pre-approved to train themselves.

    For questions and/or additional information regarding this training program please refer to https://connect.ncdot.gov/projects/WZTC/Pages/Training.aspx or call the NCDOT Work Zone Traffic Control Section (919) 814-5000.

23. The party of the second part shall employ traffic control measures that are in accordance with the prevailing federal, state, local, and NCDOT policies, standards, and procedures. These policies, standards, and procedures include, but are not limited to the following:
    - Manual on Uniform Traffic Control Devices (MUTCD) – North Carolina has adopted the MUTCD to provide basic principles and guidelines for traffic control device design, application, installation, and maintenance. North Carolina uses the MUTCD as a minimum requirement where higher supplemental standards specific to North Carolina are not established. Use fundamental principles and best practices of MUTCD (Part 6, Temporary Traffic Control).
    - NCDOT Maintenance / Utility Traffic Control Guidelines – This document enhances the fundamental principles and best practices established in MUTCD Part 6, Temporary Traffic Control, incorporating NCDOT-specific standards and details. It also covers important safety knowledge for a wide range of work zone job responsibilities.
    - *NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures* and amendments or supplements thereto. When there is no guidance provided in the *NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures*, comply with the *Manual on Uniform Traffic Control Devices for Streets and Highways* and amendments or supplements thereto. Information as to the above rules and regulations may be obtained from the NCDOT Division Engineer.

24. If the Traffic Control Supervisor determines that portable concrete barrier (PCB) is required to shield a hazard within the clear zone, then PCB shall be designed and sealed by a licensed North Carolina Professional Engineer. PCB plans and design calculations shall be submitted to the District Engineer for review and approval prior to installation.

25. Ingress and egress shall be maintained to all businesses and dwellings affected by the project. Special attention shall be paid to police, EMS and fire stations, fire hydrants, secondary schools, and hospitals.

26. Traffic shall always be maintained. All lanes of traffic are to be open during the hours of 6:00 A.M. to 9:00 A.M. and from 4:00 P.M. to 6:00 P.M. Monday through Friday, during any time of inclement weather, **or as directed by the District Engineer per the approval letter**. Any violation of these hours will result in ceasing any further construction by the Encroaching Party or their contractor.

27. If the construction is within 1000 feet of a school location or on a designated bus route, the construction shall be coordinated with the school start and end times to avoid traffic delays.

28. Work hours may be modified by the District Engineer or designee if installation causes traffic problems. If nighttime or weekend work is allowed or required, all signs must be retro-reflective, and a work zone lighting plan must be submitted for approval prior to construction.

29. Two-way traffic shall be maintained at all times unless designated by the District Engineer. Traffic shall not be rerouted or detoured without the prior written approval from the District Engineer. No utility work will be allowed on state holidays from 7:00 PM the night before through 9:00 AM the day prior to, following or during local events without prior approval from the District Engineer. If the construction is within 1000 feet of a school location or on a designated bus route, the construction shall be coordinated with the school start and end times to avoid traffic delays.

30. **ADDITIONAL NCDOT HOLIDAY LANE CLOSING RESTRICTIONS** are as follows:
    - **New Year's:** From 4pm, Dec. 31, until 9am, Jan. 2. If New Year's Day is on a Friday, Saturday, Sunday or Monday, then until 9am the following Tuesday.
    - **Easter:** From 4pm, Thursday before the holiday until 6pm the Monday after holiday.
    - **Memorial Day:** From 4pm, Friday, until 9am Tuesday.
    - **Independence Day:** From 4pm on the day before holiday, until 9am on the day after. If the holiday lands on a Friday, Saturday, Sunday or Monday, then there will be no lane closures from 4pm on the Thursday before until 9am the Tuesday after.
    - **Labor Day:** From the hours of 4pm, Friday until 9am Tuesday.
    - **Thanksgiving:** From 4pm, Tuesday until 9am Monday.
    - **Christmas:** From 4pm the Friday before the week of Christmas Day, until 9am the following Tuesday after the week of Christmas Day.

31. No lane closures shall be allowed on days or times in which special events are occurring in the area which may include but not be limited to CIAA and ACC Tournaments, NASCAR races, soccer games, stadium events, college graduations, move-ins and sporting events, plus Panthers, Knights and Hornets games. The time restrictions, including the requirement to perform work within the roadway at night, will be adjusted by the Engineer or Inspector for that project. Further restrictions may also be required depending on the size and location of the event.

32. Work requiring lane or shoulder closures shall not be performed on both sides of the road simultaneously within the same area.

33. Any work requiring equipment or personnel within 5 feet of the edge of any travel lane of an undivided facility and within 10 feet of the edge of any travel lane of a divided facility shall require a lane closure with appropriate tapers per current *NCDOT Roadway Standard Drawings or MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES*.

34. At the discretion of the District Engineer, a traffic control plan shall be developed and submitted under the seal and signature of a Licensed North Carolina Professional Engineer prior to construction. The plan shall be specific to the site and adequately detailed. Issues such as the proximity to intersections shall be addressed.

35. Temporary and final pavement markings are the responsibility of the encroaching party. Final pavement markings and sign plans shall be submitted with the encroachment request to the Division Traffic Engineer prior to construction. Final pavement markings shall be thermoplastic unless otherwise directed by the Division Traffic Engineer or District Engineer.

36. Any pavement markings that are damaged or obliterated shall be restored by the encroaching party at no expense to NCDOT.

37. Sidewalk closures shall be installed as necessary. Pedestrian traffic shall be detoured around these closures and shall be signed appropriately and in accordance with The American with Disabilities Act Accessibility Guidelines. The encroaching party must adhere to the guidelines for accommodating pedestrians in encroachment work zones as described in the NCDOT Pedestrian Work Zone Accommodations Training found at https://www.youtube.com/watch?v=AOuYa5IW3dg&feature=youtu.be

Roadside Environmental

38. The encroaching party shall comply with all applicable Federal, State and local environmental regulations and shall obtain all necessary Federal, State and local environmental permits, including but not limited to, those related to sediment control, stormwater, wetland, streams, endangered species and historical sites. Additional information can be obtained by contacting the NCDOT Roadside Environmental Engineer regarding the North Carolina Natural Heritage Program or the United States Fish and Wildlife Services. Contact the Division Roadside Environmental Engineer's Office at (704) 244-8260.

39. It is the responsibility of the encroaching party to secure any needed environmental permits and/or authorizations prior to beginning construction. Permit authorizations from the US Army Corps of Engineers Asheville Regulatory Field Office, (828) 271-7980, and the NC Division of Water Quality Mooresville Regional Office, (704) 663-1699, are required for any stream or wetland impacts. If you, or your representative, determine that no permits or authorizations are needed, attach a letter of verification to the encroachment application stating such.

40. When surface area in excess of one acre will be disturbed, the Encroacher shall submit a Sediment and Erosion Control Plan which has been approved by the appropriate regulatory agency or authority prior to beginning any work on the Right of Way. Failure to provide this information shall be grounds for suspension of operations. Proper temporary and permanent measures shall be used to control erosion and sedimentation in accordance with the approved sediment and erosion control plan.

41. The Verification of Compliance with Environmental Regulations (VCER-1) form is required for all non-utility encroachment agreements or any utility encroachments when land disturbance within NCDOT right of way exceeds 1 acre. The VCER-1 form must be PE sealed by a NC registered professional engineer who has verified that all appropriate environmental permits (if applicable) have been obtained and all applicable environmental regulations have been followed.

42. All erosion control devices and measures shall be constructed, installed, maintained, and removed by the Encroacher in accordance with all applicable Federal, State, and Local laws, regulations, ordinances, and policies. Permanent vegetation shall be established on all disturbed areas in accordance with the recommendations of the Division Roadside Environmental Engineer. All areas disturbed (shoulders, ditches, removed accesses, etc.) shall be graded and seeded in accordance with the latest *NCDOT Standards Specifications for Roads and Structures* and within 15 calendar days with an approved NCDOT seed mixture (all lawn type areas shall be maintained and reseeded as such). Seeding rates per acre shall be applied according to the Division Roadside Environmental Engineer. Any plant or vegetation in the NCDOT planted sites that is destroyed or damaged as a result of this encroachment shall be replaced with plants of like kind or similar shape.

43. No trees within NCDOT shall be cut without authorization from the Division Roadside Environmental Engineer. An inventory of trees measuring greater than 4 caliper inches (measured 6" above the ground) is required when trees within C/A right of way will be impacted by the encroachment installation. Mitigation is required and will be determined by the Division Roadside Environmental Engineer's Office.

44. Prior to installation, the Encroaching Party shall contact the District Engineer to discuss any environmental issues associated with the installation to address concerns related to the root system of trees impacted by boring or non-utility construction of sidewalk, roadway widening, etc.

45. The applicant is responsible for identifying project impacts to waters of the United States (wetlands, intermittent streams, perennial streams and ponds) located within the NCDOT right-of-way. The discharge of dredged or fill material into waters of the United States requires authorization from the United States Army Corps of Engineers

(USACE) and certification from the North Carolina Division of Water Quality (NCDWQ). The applicant is required to obtain pertinent permits or certification from these regulatory agencies if construction of the project impacts waters of the United States within the NCDOT right-of-way. The applicant is responsible for complying with any river or stream Riparian Buffer Rule as regulated by the NCDWQ. The Rule regulates activity within a 50-foot buffer along perennial streams, intermittent streams and ponds. Additional information can be obtained by contacting the NCDWQ or the USACE.

46. The contractor shall not begin the construction until after the traffic control and erosion control devices have been installed to the satisfaction of the Division Engineer or their agent.

47. The contractor shall perform all monitoring and record keeping and any required maintenance of erosion and sediment control measures to maintain compliance with stormwater regulations.

48. It should be noted that there are federally protected plant species found within the Department of Transportation rights of way. While the department makes every effort to assure that these roadside populations are identified by posting "Do Not Mow" signs, it is the responsibility of the encroaching party to assure that these populations remain undisturbed. Assistance with threatened and endangered species issues can be obtained through the US Fish and Wildlife Service Asheville Field Office, (828) 258-3939.

Construction

General

49. An executed copy of the encroachment agreement, provisions and approved plans shall be present at the construction site at all times. If safety or traffic conditions warrant such an action, NCDOT reserves the right to further limit, restrict or suspend operations within the right of way.

50. The Encroaching Party and/or their Contractor shall comply with all OSHA requirements. If OSHA visits the work area associated with this encroachment, the District Office shall be notified by the encroaching party immediately if any violations are cited.

51. All materials and workmanship shall conform to the *NCDOT Standards and Specifications for Roads and Structures*.

52. Strict compliance with the *Policies and Procedures for Accommodating Utilities on Highway Rights of Way* manual shall be required.

53. Any REVISIONS marked in RED on the attached non-PE sealed plans shall be incorporated into and made part of the approved encroachment agreement.

54. The attached plans reflect the corrections and revisions as coordinated with the NCDOT Encroachment Review Unit of the District Office.

55. All disturbed areas are to be fully restored to current NCDOT minimum roadway standards or as directed by the Division Engineer or their representative. Disturbed areas within NCDOT Right-of-Way include, but not limited to, any excavation areas, pavement removal, drainage or other features.

56. Any pavement, curb and gutter, handicap ramps, or concrete sidewalk replacement/repair required due to this installation shall be the responsibility of the encroaching party and shall be completely restored within 7-days of final construction. All repairs or replacements shall be in accordance with the requirements of and to the satisfaction of the District Engineer.

57. The encroaching party shall notify the Division Engineer or their representative immediately in the event any drainage structure is blocked, disturbed or damaged. All drainage structures disturbed, damaged or blocked shall be restored to its original condition as directed by the Division Engineer or their representative.

58. Unless specified otherwise, during non-working hours, equipment shall be located away from the job site or parked as close to the right of way line as possible and be properly barricaded in order not to have any equipment obstruction within the Clear Recovery Area. Also, during non-working hours, no parking or material storage shall be allowed along the shoulders of any state-maintained roadway.

59. Guardrail removed or damaged during construction shall be replaced or repaired to its original condition, meeting current NCDOT standards or as directed by the Division Engineer or their representative.

60. The resetting of the Control of Access fence shall be in accordance with the applicable NCDOT standard and as directed by the Division Engineer or their representative.

61. Right of Way monuments disturbed during construction shall be referenced by a registered Land Surveyor and reset after construction.

62. All Traffic signs moved during construction shall be reinstalled as soon as possible to the satisfaction of the Division Engineer or their representative.

63. Any utility markers, cabinets, pedestals, meter bases and services for meter reading required shall be as close to the Right of Way line as possible. If it is not feasible to install at or near Right of Way line, then written approval shall be obtained from NCDOT prior to installation.

64. All driveways disturbed during construction shall be returned to a state comparable with the condition of the driveways prior to construction.

65. If the approved method of construction is unsuccessful and other means are required, prior approval must be obtained through the District Engineer before construction may continue.

Engineering

66. All traffic control, asphalt mixes, structures, construction, workmanship and construction methods, and materials shall be in compliance with the most-recent versions of the following resources: *ASTM Standards*, *Manual on Uniform Traffic Control Devices, NCDOT Utilities Accommodations Manual, NCDOT Standard Specifications for Roads and Structures, NCDOT Roadway Standard Drawings,* NCDOT *Asphalt Quality Management System* manual, **and the approved plans.**

67. Prior approval for any blasting must be obtained from the Division Engineer or their representative.

Location within R/W

68. All utility access points, such as manholes, vaults, handholes, splice boxes and junction boxes shall be located as close to the right of way line as possible and shall not be placed in the ditch line, side slopes of the ditches or in the pavement. All manholes, handholes, splice boxes, junction boxes and vaults and covers shall be flush with the ground when located within the vehicle clear zone. Slack loops for telecommunications in industry standard housing units shall be buried a minimum of 18 inches when buried or meet minimum NCDOT vertical and horizontal clearances when installed aerially.

69. Fire Hydrants shall be of the breakaway type. Hydrants shall be placed near the right of way line. In curb and gutter sections with written approval from the District, the hydrants may be placed at 6' behind the back of the curb or minimum 2' back of sidewalk.

70. Luminaire and/or utility poles and guy wires shall be set as close to the Right of Way line as practical and outside the Clear Zone in accordance with the latest version of the AASHTO Roadside Design Guide (See corresponding attachment) or made breakaway in accordance with the requirements of NCHRP Report 350. Any relocation of the utility poles from the original design due to Clear Zone requirements shall require a re-submittal for the utility design.

71. Luminaire and/or utility poles shall be set a minimum of 5'-6" behind face of any guardrail or otherwise sufficiently protected. However, standard placement may be reduced to 3'-6" behind face of guardrail when posts are spaced 3'-1 ½", or where speed limit is less than 55 MPH..

Excavation

72. Excavation material shall not be placed on pavement.

73. Trenching, bore pits and/or other excavations shall not be left open or unsafe overnight.

74. It is the responsibility of the encroaching party or their contractor to prevent any mud/dirt from tracking onto the roadway. Any dirt which may collect on the roadway pavement from equipment and/or truck traffic on site shall be immediately removed to avoid any unsafe traffic conditions.

Paving

75. The paving of this roadway shall be in accordance with the latest version of NCDOT Standard Specifications, Sections 610, 1012 and 1020. The Contractor shall follow all procedures of the Quality Management System (QMS) for asphalt pavement - Maintenance Version (see https://connect.ncdot.gov/resources/Materials/MaterialsResources/2018%20QMS%20Asphalt%20Manual.pdf). The Contractor must adhere to all testing requirements and quality control requirements specified. The Contractor shall contact the NCDOT Division QA Supervisor prior to producing plant mix and make the Supervisor aware that the mix is being produced for a future NCDOT road. Contact the District Engineer to determine the NCDOT Division QA Supervisor. Only NCDOT approved mix designs will be acceptable. A Quality Control Plan shall be submitted (as Directed by the District Engineer) to the District Engineer's Office prior to asphalt production utilizing form QMS-MV1. Failing mixes and/or densities are subject to penalties including monetary payments or removal and replacement. To minimize traffic queuing in construction areas, the possibility of traffic detours may be considered when working on high traffic routes even if traffic control is used. The District Engineer may require traffic detours.

76. "Potholing" pavement cores to expose existing utilities shall be made with an 18" diameter keyhole pavement core. Pavement core locations shall not be placed in the wheel path whenever possible. Vacuum excavation shall be utilized to expose underground utilities. Pavement cores shall be repaired within the same working day. The pavement core shall be retained and reused to fill the core hole.

    The excavation shall be backfilled and compacted with select material to the bottom of the existing pavement structure or as indicated by the District Engineer. The retained core shall be placed in the hole and secured with a waterproof, mechanical joint. If the pavement core is damaged and cannot be re-used, the core may be replaced with the surface mix, S9.5C. The asphalt patch shall match the thickness of the existing asphalt or four inches, whichever is greater. All materials must be listed on the NCDOT Approved Products List (APL) found at: https://apps.ncdot.gov/vendor/approvedproducts/.

77. The minimum pavement design for pavement repair shall be according to NCDOT Standard Drawing 654.01 (https://connect.ncdot.gov/resources/Specifications/2018StandardRdwyDrawings/Division%2006%20Asphalt%20Bases%20and%20Pavements.pdf) and shall include a mechanical overlay extent to be a minimum of 25 feet each side of the pavement repair area OR as directed by the District Engineer.

78. Pavement cuts shall be repaired the same day the cuts are made unless an asphalt patch cannot be accomplished the same day due to material availability or time restrictions. When the asphalt patch is not feasible, the following apply:
    - The pavement cut shall be filled to the surface with ABC stone or Flowable Fill per NCDOT's Standards and Specifications.
    - Once the cut is filled, a minimum ¾-inch steel plate shall be placed and pinned to prevent moving. Plates shall be designed large enough to span a minimum of 1-foot on all sides on the pavement cut.
    - When flowable fill is used, it shall cure for 24 hours prior to any asphalt material placement. Flowable fill bleed water shall not be present during paving operations. Paving shall not cause damage (shoving, distortion, pumping, etc.) to the flowable fill.
    - Install and leave "BUMP" signs according to MUTCD until the steel plate has been removed. Once the flowable fill has cured, remove the steel plate, and mill/fill according to the directions of the District Engineer.
    - All pavement cuts must be sealed with NCDOT approved sealant to prevent future pavement separation or cracking.

79. Any pavement damaged because of settlement of the pavement or damaged by equipment used to perform encroachment work, shall be re-surfaced to the satisfaction of the District Engineer. This may include the removal of pavement and a 50' mechanical overlay. All pavement work and pavement markings (temporary and final) are the responsibility of the Encroaching Party.

Post Construction

Close out/ Inspection

80. The Encroaching party shall notify the District Engineer's office within 2 business days after construction is complete. The District Engineer may perform a construction inspection. Any deficiencies may be noted and reported to the encroaching party to make immediate repairs or resolve any issues to restore the right-of-way to a similar condition prior to construction, including pavement, signage, traffic signals, pavement markings, drainage, structures/pipes, or other highway design features.

81. At the discretion of the District Engineer, a final inspection report may be provided to the encroaching party upon satisfactory completion of the work.

82. A written acknowledgement of the completed work by the District Engineer's office begins the one-year warranty period associated with the performance bond.

83. If the actual construction differs from the approved plans associated with this encroachment, a copy of "as-built" plans shall be submitted to the District Engineer's office in a PDF format and in a current ESRI GIS format within 4 weeks of construction.

Complete restoration including fertilizing, seeding, and mulching of all areas disturbed during construction will follow within a maximum of fifteen (15) working days of the initial disturbing activity.

Grass cover to be established on all disturbed areas in accordance with recommendations of the Division Roadside Environmental engineer.

August 1 – June 1	May 1 – September 1
100# KY 31 TALL FESCUE	100# KY 31 TALL FESCUE
OR ALTA TALL FESCUE	OR ALTA TALL FESCUE
15# ALTA TALL FESCUE	15# KENIBLUE BLUGRASS
15# RELIANT HARD FESCUE	15# RELIANT HARD FESCUE
500# FERTILIZER	25# KOBE OR KOREAN LESPEDEZA
400# LIMESTONE	500# FERTILIZER
	400# LIMESTONE

On cut and fill slopes 2:1 or steeper add 25# Rye Grain November 1 through March 1.

On cut and fill slopes 2:1 or steeper add 30# Sericea Lespedeza January 1 through December 1.

Fertilizer shall be 10-20-20 analysis. Upon written approval of the Engineer, a difference analysis of fertilizer may be used provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis.

River Birches will not be planted near storm or sanitary sewers as roots will intrude at pipe joints.

VERIFICATION OF COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

(Check Appropriate Box)

☐ Permits from the N.C. Department of Environment and Natural Resources and the U.S. Army Corp of Engineers are not required for this project. However, all applicable federal and state regulations have been followed.

☐ The required permits from the ~~N.C.~~ S.C. Department of ~~Environment and Natural Resources~~ Health and Environmental Control and the U.S. Army Corp of Engineers have been obtained for this project. Copies of permits and Completion Certificates are attached.

☐ All applicable NPDES Stormwater Permit requirements have been met for this project. (The applicant should contact the N.C. Division of Water Quality in Raleigh to determine if a stormwater permit is required.)

☐ The project is in compliance with all applicable sedimentation and erosion control laws and regulations.

Project Name: US21 and SC51 Improvements

Township: _____ County: York SC at Mecklenburg NC

Project Engineer: STV Incorporated Phone No.: 704 314 5374

Project Contact: Guy P. Peters, PE, CFM



Applicant's Name: Guy P. Peters, PE, CFM

Date Submitted: 17 February 2023

Form VCER-1
June 1, 2006

Water Supply Construction Permit
Bureau of Water

S.C. Department of Health and Environmental Control

Permission is Hereby Granted To: **FERN FOREST RURAL WATER CO**
141 AMELIA DR
FORT MILL SC 29715

for the construction of a distribution system in accordance with the construction plans, specifications, design calculations and the SCDHEC Construction Permit Application signed by Andrew S Vane, Professional Engineer, S.C. Registration Number: 19911.

Project Name: **FERN FOREST WATER SYSTEM IMPROVEMENTS**

County: York

Location: US HIGHWAY 21 BETWEEN FERN FOREST COURT AND FOREST DRIVE, FORT MILL, SC

Project Description: Relocating approximately 565 LF-3"PVC water line in areas of conflict with proposed storm drainage system along US Hwy 21.

Service By: Water will be provided by the Fern Forest MHP (System Number: 4660001).

Special Conditions:
1. All construction and materials for this project must conform to the Standard Specifications for York County.

In accepting this permit, the owner agrees to the admission of properly authorized persons at all reasonable hours for the purpose of sampling and inspection.

NOTE: This is a permit for construction only and does not constitute State Department of Health and Environmental Control approval, temporary or otherwise, to place the system in operation. No written approval shall be issued to place a drinking water project into operation until approval is obtained to place any associated wastewater project into operation. An Approval to Place in Operation is required and can be obtained following the completion of construction by contacting the LANCASTER EQC OFFICE at 803-285-7461. Additional permits may be required prior to construction (e.g., stormwater).

Permit Number: **37283-WS**
Date of Issue: **January 09, 2024**
Expiration Date: Construction must be completed and the Approval to Place in Operation granted prior to **January 09, 2027** or this permit will expire.

Douglas B. Kinard P.E, Director
Drinking Water and Recreational Waters Protection Division

MPM

DocuSign Envelope ID: 07A4EDAB-A0CE-42DA-9AD2-FC4228FA490B

SHEET NO.	TOTAL SHEETS
UCI	4

York County south carolina

Pennies for Progress

PROPOSED PLANS FOR

YORK COUNTY, SOUTH CAROLINA
US 21 NORTH PHASE 1 & SC 51
YORK COUNTY PROJECT ID # 11149–004
PROJECT ID # 0042332
US 21 FROM SC 460 (SPRINGFIELD PKWY) TO 700' SOUTH OF S–48 (SPRINGHILL FARM RD) & SC 51 FROM US 21 TO THE NC STATE LINE

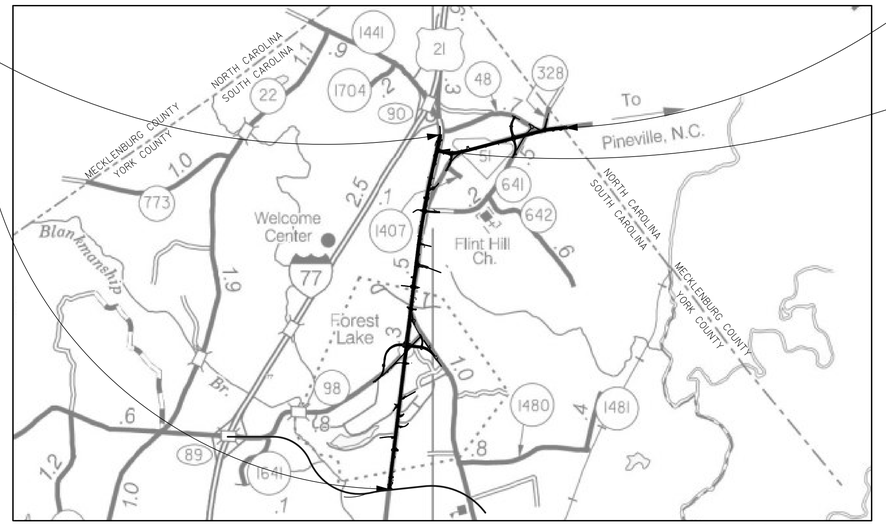
FERN FOREST WATER LINE RELOCATION PLANS

SURVEY STA. 134+33.25 END
PROJECT ID 0042332
US 21

SURVEY STA. 14+78.91 BEGIN
PROJECT ID 0042332
US 21

SURVEY STA. 340+10.00 END
PROJECT ID 0042332
SC 51

SURVEY STA. 296+15.72 BEGIN
PROJECT ID 0042332
SC 51



YORK COUNTY MAP

-N-

LAYOUT
SCALE 1INCH = 2,300 FEET

dhec

DRINKING WATER AND RECREATIONAL WATER PROTECTION
WATER AND SEWER CONSTRUCTION ONLY
(Subject to any provisions which may appear in the construction permit)

Final written approval for operation must be obtained from DHEC after completion of construction.

Approved for:

Water Permit 37283-WS
Wastewater Permit
Date 1/09/2024
Reviewer Maia Milenkova

SHEET INDEX

COVER	UC–1
WATER AND SEWER NOTES	UC–2
TESTING AND INSPECTION NOTES	UC–2
WATER PLAN	UC–3

CONSULTING ENGINEERING FIRM

SOUTH CAROLINA — STV INCORPORATED NO. C0338 — CERTIFICATE OF AUTHORIZATION

STV 100 Years

STV Incorporated
1969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

ENGINEER OF RECORD

SOUTH CAROLINA — PROFESSIONAL ENGINEER — ANDREW S. YANG

DocuSigned by: Andrew S. Yang — 1/9/2024

FOR CONSTRUCTION : _____ _____
STV Incorporated DATE

DocuSign Envelope ID: 07A4EDAB-A0CE-42DA-9AD2-FC4228FA490B

FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	1149-004	US 21	UC-2

STV 100 Years
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

WATER/SEWER GENERAL NOTES

1. FIRE HYDRANTS SHALL BE YORK COUNTY STANDARD.
2. ALL WATER MAIN VALVES MUST OPEN COUNTERCLOCKWISE IN CONFORMANCE WITH YORK COUNTY STANDARDS.
3. BLOCKING SHALL BE INSTALLED AT ALL BENDS, TEES, VALVES, REDUCERS, BLOW-OFFS, AND HYDRANT LOCATIONS, UNLESS ALTERNATIVES ARE SHOWN ON DETAILS.
4. WATER MAINS LESS THAN 4 INCH IN DIAMETER SHALL BE PVC ASTM D2241 SDR 13.5, CLASS 315. ALL MAINS 4 INCH TO 12 INCH SHALL BE AWWA C-900 PRESSURE CLASS 200 PVC SDR14. FITTINGS LESS THAN 4 INCH SHALL BE SLIP JOINT PVC PER SPECIFICATIONS. PVC PIPING SHALL BE INSTALLED WITH APPROVED COPPER LOCATING WIRE.
5. ASBESTOS CEMENT PIPE SHALL NOT BE USED IN POTABLE WATER SYSTEMS.
6. DIP SHALL BE IN ACCORDANCE WITH AWWA C150/A21.50 & AWWA C151/A21.51
7. NO FLUSHING DEVICE SHALL BE DIRECTLY CONNECTED TO ANY SEWER SYSTEM.
8. CHAMBERS, PITS OR MANHOLES CONTAINING VALVES, BLOW-OFFS, METERS, AIR RELIEF VALVES OR OTHER SUCH APPURTENANCES TO A POTABLE WATER DISTRIBUTION SYSTEM, SHALL NOT BE CONNECTED DIRECTLY TO ANY STORM DRAIN OR SANITARY SEWER.
9. INSTALLATION OF WATER MAINS AND APPURTENANCES SHALL BE CONDUCTED IN ACCORDANCE SECTION C OF THE AWWA STANDARDS AND/OR MANUFACTURER?S RECOMMENDED INSTALLATION PROCEDURES.
10. A CONTINUOUS AND UNIFORM BEDDING SHALL BE PROVIDED IN THE TRENCH FOR ALL BURIED PIPE. BACK-FILL MATERIAL SHALL BE TAMPED IN LAYERS AROUND THE PIPE AND TO A SUFFICIENT HEIGHT ABOVE THE PIPE TO ADEQUATELY SUPPORT AND PROTECT THE PIPE. STONES, OTHER THAN CRUSHED BEDDING, SHALL NOT COME INTO CONTACT WITH THE PIPE AND SHALL NOT BE WITHIN SIX (6) INCHES OF THE PIPE.
11. ALL WATER MAINS SHALL MEET THE YORK COUNTY WATER SPECIFICATIONS FOR PIPE WARNING TAPE AND TRACING WIRE. REFER TO YORK COUNTY WATER & SEWER STANDARDS TECHNICAL SPECIFICATIONS SECTION 33 05 05, SECTION 2.2 FOR PROPER INSTALLATION.
12. A "W" MUST BE ETCHED INTO THE CURBING SHOWING THE LOCATION OF WATER METERS.
13. A "V" MUST BE ETCHED INTO THE CURBING SHOWING THE LOCATION OF VALVES.
14. VALVES CANNOT BE LOCATED IN SIDEWALKS, CURBING, DIRVEWAYS, OR ASPHALT AREAS.
15. REFER TO YORK COUNTY STANDARD SPECIFICATIONS AND DETAILS REGARDING SERVICE LINE MATERIAL.
16. ALL SERVICE LINES REQUIRE INDIVIDUAL CONNECTIONS TO THE MAIN. MULTIPLE SERVICE LINES INTERCONNECTING WILL NOT BE ALLOWED.
17. WATER MAINS WHICH HAVE BEEN PREVIOUSLY USED FOR CONVEYING POTABLE WATER MAY BE REUSED PROVIDED THEY MEET APPLICABLE CRITERIA FROM AWWA SECTION C, ANSI/NSF 61 AND ASTM D1785 OR D2241. THE MAINS MUST BE THOROUGHLY CLEANED AND RESTORED PRACTICALLY TO THEIR ORIGINAL CONDITION.
18. THERMOPLASTIC PIPE SHALL NOT BE USED ABOVE GRADE.
19. NATURAL RUBBER OR OTHER MATERIAL WHICH WILL SUPPORT MICROBIOLOGICAL GROWTH MAY NOT BE USED FOR ANY GASKETS, O-RINGS, AND OTHER PRODUECTS USED FOR JOINTING PIPES, SETTING METERS OR VALVES, OR OTHER APPURTENANCES WHICH WILL EXPOSE THE MATERIAL TO THE WATER.
20. LUBRICANTS WHICH WILL SUPPORT MICROBIOLOGICAL GROWTH SHALL NOT BE USED FOR SLIP-ON JOINTS.
21. THE USE OF VEGETABLE SHORTENING TO LUBRICATE JOINTS IS PROHIBITED.
22. THE USE OF SOLVENT-WELD PVC PIPE AND FITTINGS IN WATER MAINS 4 INCHES AND LARGER IS PROHIBITED.
23. AT NO TIME SHALL A POTABLE WATER LINE PASS THROUGH OR COME INTO CONTACT WITH ANY PART OF A SEWER MANHOLE.
24. AIR RELIEF VALVES SHALL BE PROVIED IN ACCORDANCE WITH SOUND ENGINEERING PRACTICE AT HIGH POINTS IN WATER MAINS AS REQUIRED. AUTOMATIC AIR RELIEF VALVES SHALL NOT BE USED IN SITUATIONS WHERE FLOODING OF THE INSTALLATION MANHOLE OR CHAMBER MAY OCCUR.
25. BLOW-OFFS SHOULD NOT BE DIRECTED TOWARDS ROADS OR SO THAT THE WATER FROM THE BLOW-OFF FLOWS INTO CREEKS, STREAMS, ETC... DIRECT BLOW-OFFS AT STREAM CROSSINGS AWAY FROM THE STREAM.
26. USE DIP WITH MECHANICAL JOINTS FOR ANY LINES BEING INSTALLED IN ROCK.
27. ANY PIPE, SOLDER, OR FLUX WHICH IS USED IN THE INSTALLATION OR REPAIR OF ANY PUBLIC WATER SYSTEM, USED IN ANY PLUMBING WHICH PROVIDES WATER THROUGH CONNECTION TO A PUBLIC WATER SYSTEM, FOR HUMAN CONSUMPTION, SHALL BE LEAD FREE. LEAD FREE, FOR SOLDER AND FLUX, MEAN THOSE CONTAINING NOT MORE THAN 0.2% LEAD. LEAD FREE, FOR PIPES AND PIPE FITTINGS, AS THOSE CONTAINING NOT MORE THAN 8.0% LEAD. LEADED JOINTS NECESSARY FOR THE REPAIR OF CIP SHALL BE EXEMPT FROM THE ABOVE.
28. THERE SHALL BE NO CONNECTION BETWEEN THE DISTRIBUTIONS SYSTEM AND ANY PIPES, PUMPS, HYDRANTS, OR TANKS WHEREBY UNSAFE WATER OR OTHER CONTAMINATION MATERIALS MAY BE DISCHARGED OR DRAWN INTO THE SYSTEM. NO BY-PASSES SHALL BE ALLOWED, UNLESS THE BYPASS IS ALSO EQUIPPED WITH AN EQUAL, APPROVED BACK-FLOW DEVICE.
29. REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLIES SHALL NOT BE INSTALLED IN ANY AREA LOCATION SUBJECT TO POSSIBLE FLOODING.
30. ALL PIPING UP TO THE INLET OF THE BACKFLOW PREVENTION DEVICE MUST BE SUITABLE FOR POTABLE WATER. THE PIPE MUST BE AWWA OR NSF APPROVED. BLACK STEEL PIPE CANNOT BE USED ON THE INLET SIDE OF THE DEVICE.
31. FIRE LINE SPRINKLERS AND DEDICATED FIRE LINES, EXCEPT THOSE IN THE HIGH HAZARD CATEGORY, SHALL BE PROTECTED BY AN APPROVED DOUBLE CHECK VALVE ASSEMBLY.

PROJECT SPECIFIC NOTES

1. CONTRACTOR SHALL COORDINATE ALL SHUT-DOWNS AND TIE-INS WITH FERN FOREST RURAL WATER ASSOCIATION. CONTACT DOTTIE CARTER AT 803-548-0398 A MINIMUM OF 1 WEEK IN ADVANCE.
2. EXISTING FERN FOREST WATER SYSTEM VALVES TO BE OPERATED BY FERN FOREST RURAL WATER ASSOCIATION ONLY.
3. CONTRACTOR MAY NEED TO SCHEDULE SHUTDOWN WORK DURING LOW DEMAND PERIODS INCLUDING NIGHT WORK.

SOUTH CAROLINA
STV INCORPORATED NO. C0338
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
PROFESSIONAL ENGINEER
Docusigned by: Andrew S. Vine
7A9EE7290AE2471...
8/2024
ANDREW S. VINE

SEQUENCE OF CONSTRUCTION

1. INSTALL PROPOSED 3" PVC WATER LINE WHERE INDICATED ON PLANS TO A POINT JUST SHORT OF TIE-INS.
2. PRESSURE TEST, FLUSH AND CHLORINATE AND PREPARE FOR FINAL CONNECTION PER SCDHEC REQUIREMENTS.
3. MINIMIZE SHUT DOWN TIME TO A SINGLE 4 HOUR PERIOD, COORDINATED WITH FERN FOREST RURAL WATER ASSOCIATION
4. SHUT DOWN EXISTING 3" PVC WATER LINES ON FERN FOREST CT AND FOREST DRIVE AND COMPLETE TIE-IN.
5. PLACE NEW 3" PVC WATER MAIN INTO OPERATION.

TESTING/INSPECTION NOTES

1. NOTIFY THE ENGINEER OF RECORD AND YORK COUNTY AT LEAST 48 HOURS BEFORE STARTING CONSTRUCTION OF SEWER AND WATER FACILITIES. THE ENGINEER SHALL PERIODICALLY INSPECT THE PROGRESS OF INSTALLATION AND SHALL COMPLETE A FINAL WATER AND SEWER INSPECTION. THE ENGINEER OF RECORD AND YORK COUNTY SHALL WITNESS PRESSURE TESTING OF THE WATER SYSTEM, AND AIR AND MANDREL TESTING OF THE SEWER SYSTEM. THE CONTRACTOR SHALL FURNISH, SECURE, AND PROVIDE ALL NECESSARY TESTING MATERIALS, EQUIPMENT, PROCEDURES AND CERTIFIED LABORATORY TEST RESULTS FOR USE WITH ENGINEERS FINAL CERTIFICATION OF COMPLETION.
2. WATER MAINS AND SEWER FORCE MAINS MUST BE HYDROSTATICALLY TESTED PER YORK COUNTY SPECIFICATIONS AND UNDER THE SUPERVISION OF A YORK COUNTY INSPECTOR AND THE ENGINEER OF RECORD.
3. DISINFECT WATER LINES AND PROVIDE ACCEPTABLE BACTERIOLOGICAL TEST FROM A CERTIFIED TESTING LABORATORY FOR USE WITH THE ENGINEERS CERTIFICATION OF COMPLETION. A MINIMUM OF TWO (2) SAMPLES, COLLECTED AT LEAST TWENTY-FOUR (24) HOURS APART, ARE TO BE TAKEN FROM EACH SAMPLING SITE FOR TOTAL COLIFORM ANALYSIS AND TOTAL CHLORINE RESIDUAL. THE NUMBER OF TEST SITES MUST INCLUDE ALL DEAD-END LINES AND SHALL BE COLLECTED A MINIMUM OF EVERY 1,200 LINEAR FEET.
4. SECURE FINAL OPERATIONAL APPROVAL FROM YORK COUNTY AND SCDHEC PRIOR TO ACTIVATION OF THE SYSTEM.

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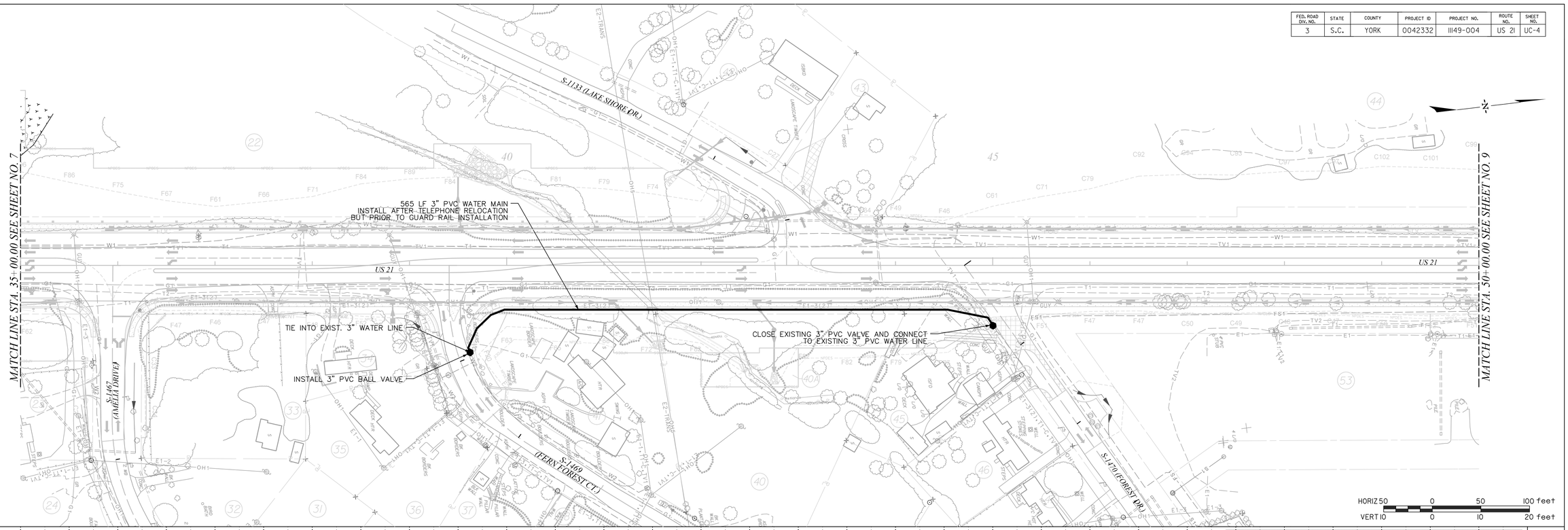
FED. ROAD DIV. NO.	STATE	COUNTY	PROJECT ID	PROJECT NO.	ROUTE NO.	SHEET NO.
3	S.C.	YORK	0042332	11149-004	US 21	UC-4



STV 100 Years
STV Incorporated
4969 CENTRE POINTE DRIVE
SUITE 102
NORTH CHARLESTON, SOUTH CAROLINA 29418

US 21 (N HWY 21 BYPASS)

NO PROFILE

SOUTH CAROLINA PROFESSIONAL ENGINEER
DocuSigned by: Andrew S. Vane
7/8/2024
ANDREW S. VANE

SOUTH CAROLINA STV INCORPORATED NO. C03338 CERTIFICATE OF AUTHORIZATION

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PROLINE.DGN

Water Supply Construction Permit
Bureau of Water

S.C. Department of Health and Environmental Control

Permission is Hereby Granted To: **YORK COUNTY UTILITIES**
6 S CONGRESS ST
YORK SC 29745

for the construction of a distribution system in accordance with the construction plans, specifications, design calculations and the SCDHEC Construction Permit Application signed by Andrew S Vane, Professional Engineer, S.C. Registration Number: 19911.

Project Name: **US21 NORTH PHASE 1& SC51**

County: York

Location: US 21 FROM SC 460 TO 700 LF SOUTH OF S-48 (SPRINGHILL FARM RD) SC51 FROM US21 TO NC STATE LINE

Project Description: Installation of approximately 258LF of 8" water line, 5,282LF of 12" water line, 886LF of 24" water line, 7 water meter relocations and 12 fire hydrant relocations in areas of conflict with newly proposed storm drainage system/structures.

Service By: Water will be provided by the York County Public Works (System Number: 4620002).

Special Conditions:
1. All construction and materials for this project must conform to the Standard Specifications for YORK COUNTY.

In accepting this permit, the owner agrees to the admission of properly authorized persons at all reasonable hours for the purpose of sampling and inspection.

NOTE: This is a permit for construction only and does not constitute State Department of Health and Environmental Control approval, temporary or otherwise, to place the system in operation. No written approval shall be issued to place a drinking water project into operation until approval is obtained to place any associated wastewater project into operation. An Approval to Place in Operation is required and can be obtained following the completion of construction by contacting the LANCASTER EQC OFFICE at 803-285-7461. Additional permits may be required prior to construction (e.g., stormwater).

Permit Number: **37404-WS**
Date of Issue: **February 28, 2024**
Expiration Date: Construction must be completed and the Approval to Place in Operation granted prior to **February 28, 2027** or this permit will expire.

Douglas B. Kinard P.E, Director
Drinking Water and Recreational Waters Protection Division

MPM(c)

dhec
Healthy People. Healthy Communities.

S.C. Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201 (803) 898-3432 www.scdhec.gov

Wastewater Construction Permit
Bureau of Water

PROJECT NAME: US21 North Phase 1 & SC 51	COUNTY: York
LOCATION: US 21 FROM SC 460 TO 700 LF SOUTH OF S-48 (SPRINGHILL FARM RD) SC51 FROM US21 TO NC STATE LINE.	

PERMISSION IS HEREBY GRANTED TO: York County Utilities
6 CONGRESS ST S
YORK, SC 29745

For the construction of a sanitary sewer system in accordance with the construction plans, specifications, design calculations and the Construction Permit Application signed by Andrew Vane, Registered Professional Engineer, S.C Registration Number: 19911.

Project Description: Approximately 501LF of 8" force mains, 874LF of 8" gravity sewers and 9 x 4ft diameter manholes. No pump station modifications and no increase in existing permitted flows.

TREATMENT FACILITY: The wastewater will be discharged to the ROCK HILL MANCHESTER CREEK - SC0020443 at a design flow rate of 0 GPD.

STANDARD CONDITION:

NOTE: In accepting this permit, the owner agrees to the admission of properly authorized persons at all reasonable hours for the purpose of sampling and inspection. This is a permit for construction only and does not constitute DHEC approval, temporary or otherwise, to place the system in operation. An Approval to Place in Operation is required and can be obtained following the completion of construction by contacting the Midlands EA Lancaster at 803-285-7461. Additional permits may be required prior to construction (e.g., Stormwater).

SPECIAL CONDITIONS:

- All construction/materials for this project must conform to the Standard Specifications for YORK COUNTY SEWER SPECS - SS-02164.

PERMIT NUMBER:	WW045648
ISSUANCE DATE:	February 28, 2024
EXPIRATION DATES:	Construction must be completed and the Approval to Place in Operation granted prior to February 28, 2027 or this permit will expire.

Douglas B. Kinard, P.E., Director
Drinking Water and Recreational Waters Protection Division