



Project Number 20319

Regent Parkway Sanitary Sewer Relief System

Date: June 2025

OWNER:

YORK COUNTY, ENGINEERING DEPARTMENT
PO BOX 148
6 SOUTH CONGRESS STREET
YORK, SOUTH SC 29745
(803) 684-8571
(803) 684-8596 FAX

York County Council

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Tom Audette, Vice Chair
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A. Watts Huckabee, Sr.
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York County Government
6 South Congress Street
York, SC 29745

Submitted: _____ 2025

Bidders:

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 Bidder assumes full responsibility therefore; that Bidder 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 completed; that Bidder has examined the other Contract Documents and all Addenda relating thereto, and that Bidder 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 Bid 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 York County Regent Parkway Sanitary Sewer Relief System Project is being funded in part by the SC Rural Infrastructure Authority Basic Infrastructure Program.

The Bidder further proposes and agrees to commence substantial work on this project within **14 days** of a Notice to Proceed and agrees that the Work will be substantially completed **336 days** of the Notice to Proceed, and completed and ready for final payment **366 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. Liquidated damages shall be addressed as follows:

- A. For failure to achieve Substantial Completion by the contract date: \$500.00 per consecutive calendar day.
- B. For failure to achieve Final Completion by the contract date: \$500.00 per consecutive calendar day.

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 Bond 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 Bond shall be returned to the undersigned after the Contract is signed and the Performance and Indemnity and Payment Bonds are filed.

Note:

All work performed by the Contractor as essential to the completion of the intent of the Contract Documents shall be paid in accordance with the Bid Schedule. No direct payment will be made for work performed which is not shown as a separate Bid item. The undersigned proposes the following unit prices to be utilized on the Work or Extra Work should modifications or variations incorporate these items of work into the Work.

Regent Parkway Sanitary Sewer Relief System – Bid Form

ITEM NUMBER	PAY ITEM	QUAN TITY	PAY UNIT	UNIT PRICE	AMOUNT
STARTUP AND ACQUISITION					
1	MOBILIZATION	1	LS		
2	BONDS AND INSURANCE	1	LS		
3	TRAFFIC CONTROL	1	LS		
CLEARING AND GRUBBING					
4	SELECTED CLEARING & GRUBBING	1.4	AC		
5	SELECTED REMOVAL OF MARKED TREES	62	EA		
EARTHWORK					
6	SEEDING & MULCHING	4	AC		
7	BORROW EXCAVATION	1340	CY		
8	BORE PIT EXCAVATION	900	CY		
CONCRETE AND CURB WORK					
9	CONCRETE CURB AND GUTTER (2'-6") VERTICAL FACE	147	LF		
10	CONCRETE SIDEWALK (4" UNIFORM)	725	LF		
11	INCIDENTAL MILLING	142	SY		
12	2500 LBS CONCRETE	27	CY		
13	HOT MIX ASPHALT BASE COURSE - TYPE B	18	TON		
14	HOT MIX ASPHALT INTERMEDIATE COURSE - TYPE C	18	TON		
15	HOT MIX ASPHALT SURFACE COURSE - TYPE C	35	TON		
16	LIQUID ASPHALT BINDER, PG 64-22	5	TON		
EROSION CONTROL					
17	SILT FENCE	7900	LF		
18	REPLACE/REPAIR SILT FENCE	2500	LF		
19	REMOVAL OF SILT RETAINED BY SILT FENCE	6000	LF		
20	STABILIZED CONSTRUCTION ENTRANCE	1346	SY		
21	CONCRETE WASHOUT	5	EA		
22	TREE PROTECTION FENCING	3482	LF		
23	CHECK DAMS	23	EA		
24	INLET PROTECTION	6	EA		
25	RING FILTERS	2	EA		
26	6" HDPE TEMPORARY DRIVEWAY CULVERT	85	LF		
SSWR PIPE/OTHER					
27	4' DIAMETER MANHOLE	19	EA		
28	4' DOGHOUSE MANHOLE	2	EA		
29	ABANDON 6" FORCE MAIN	460			
30	6' DIAMETER MANHOLE	1	EA		
31	6" PVC SANITARY SEWER FORCE MAIN	266	LF		
32	6' DOGHOUSE MANHOLE	1	LF		
33	16" DIP SANITARY SEWER	1713	LF		
34	16" HIGH GRADE STEEL SANITARY SEWER	50	LF		
35	26" STEEL ENCASEMENT PIPE	645	LF		
36	BORE AND JACK 26" STEEL ENCASEMENT PIPE	645	LF		
37	CONCRETE PIERS	8	EA		

Base Bid Subtotal (Use Words)

\$

Total Bid (Use Words)

\$

Acknowledgement of Addenda

If any Addenda are issued, Bidder hereby acknowledges receipt of all Addenda through and including:

Addenda: #1 ☐ #2 ☐ #3 ☐ #4 ☐ #5 ☐

Bid Bond

Attached hereto is a cashier's check on the Bank of

Or Bid Bond for the sum of

Made payable to **York County Government** (Owner)

Contractor's Classifications and Subclassifications

SC Contractor's License Number(s):

Classification(s) and Limits:

Subclassifications (s) & Limits

List of Subcontractor(s)

Subcontractor(s)

Signature Page - OFFERORS MUST COMPLETE AND SIGN THE FORM BELOW

The submittal must be signed by an authorized representative of the Offeror accepting all terms and conditions contained in this document and any addenda. Modifying the terms and conditions of this solicitation may result in your response being rejected.

COMPANY NAME

FEDERAL TAX ID NUMBER

COMPANY ADDRESS

CITY, STATE, ZIP+4

PAYMENT/REMITTANCE ADDRESS

CITY, STATE, ZIP+4

EMAIL ADDRESS

COMPANY TELEPHONE

PRINT NAME

TITLE

AUTHORIZED SIGNATURE

DATE

Minority Status

- ☐ Not Minority Owned
- ☐ African American Male
- ☐ Caucasian Female
- ☐ African American Female
- ☐ Aleut
- ☐ Eskimo
- ☐ East Indian
- ☐ Native American
- ☐ Asian
- ☐ Other (Please Explain)

► Go to www.irs.gov/FormW9 for instructions and the latest information.

Print or type.
See Specific Instructions on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.	
2 Business name/disregarded entity name, if different from above	
3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only one of the following seven boxes. ☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate ☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____ Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is not disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner. ☐ Other (see instructions) ► _____	4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3): Exempt payee code (if any) _____ Exemption from FATCA reporting code (if any) _____ <i>(Applies to accounts maintained outside the U.S.)</i>
5 Address (number, street, and apt. or suite no.) See instructions.	Requester's name and address (optional)
6 City, state, and ZIP code	
7 List account number(s) here (optional)	

Part I	Taxpayer Identification Number (TIN)
---------------	---

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN*, later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			-			-					
--	--	--	---	--	--	---	--	--	--	--	--

or

Employer identification number

			-							
--	--	--	---	--	--	--	--	--	--	--

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here	Signature of U.S. person ▶		Date ▶	

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to www.irs.gov/FormW9.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)

- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, later.

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 _____, **20**____, for:

Regent Parkway Sanitary Sewer Relief System

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., 20____, 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 _____, 20____, A.D.

(Attach Power of Attorney
to original Bid Bond)

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:

PROJECT DESCRIPTION

The Owner has considered the Bid submitted by you for the above described work in response to its Advertisement for Bids dated 2025 and Information for Bidders.

You are hereby notified that your Bid has been accepted for items in the amount of
spell out amount _____).

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: County Engineer

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged

By: _____

Title: _____

This _____ day of _____, 20_____.

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:

Regent Parkway Sanitary Sewer Relief System

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 **366 Calendar** days after commencement date fixed in the Notice to Proceed.

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.

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 *Five Hundred Dollars (\$500.00)* 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 *Five Hundred Dollars (\$500.00)* 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. 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 ten percent (10%) 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

NOTICE TO PROCEED

Date: _____

To: _____

Project:

Regent Parkway Sanitary Sewer Relief System

You are hereby notified to commence work in accordance with the Agreement dated _____ on or before _____, and you are to complete the work within 366 consecutive calendar days thereafter. The date of completion of all work is therefore _____.

On behalf of the

YORK COUNTY GOVERNMENT

By: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged by _____, this the ____ day of _____, **20**____.

By: _____

Title: _____

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 _____, 20____,
entered into a Contract with Owner for:

Regent Parkway Sanitary Sewer Relief System

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 one (1) year 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) year 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 (1) year. 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.

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 _____, 20____, 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 _____, 20____, 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 _____, 20____, entered
into a Contract with OWNER for:

Regent Parkway Sanitary Sewer Relief System

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 _____, 20____, 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

WITNESS:

SURETY:

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 _____, 20____, A.D.

(Attach Power of Attorney)

Notary Public
State of South Carolina-at-Large

My Commission Expires: _____

END OF SECTION

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

<u>Forms of Coverage</u>	<u>Policy Number</u>	<u>Expiration Date</u>
*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 nonowned 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	_____	_____

<u>Types of Coverage</u>	<u>Forms of Coverage</u>	<u>Minimum Limits of Liability</u>	
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: Regent Parkway Sanitary Sewer Relief System Project Number: _____

Purchase Order 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		6		11		16	
2		7		12		17	
3		8		13		18	
4		9		14		19	
5		10		15		20	

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: _____ Notarized: _____

Signed By: _____ My Commission expires: _____

Date: _____ Affix seal:

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	\$ 0	Original Durations	0 Days
Previous Change Orders (Add/Deduct)	\$ 0	Previous Change Order (Add/Deduct)	0 Days
This Change Order (Add/Deduct)	\$ 0	This Change Order (Add/Deduct)	0 Days
Revised Contract Amount	\$ 0	Revised Contract Time	0 Days
REVISED CONTRACT COMPLETION DATE IS:			

OWNER	CONTRACTOR	ENGINEER

Attest

**RELEASE AND WAIVER OF CLAIM
BY PRIME CONTRACTOR**

Know all men by these presents that the undersigned, _____ of _____ 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 **Regent Parkway Sanitary Sewer Relief System** located in York, 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: _____

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, Information 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, Information 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.

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.

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 condition's 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. *OWNER* - 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. *Special 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 ensure 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 ensure 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 two 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, its 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, and watchmen and take all necessary precautions for the protection of the work and the safety of the public.

25. PUBLIC CONVENIENCE

25.1. The CONTRACTOR shall at all times so conduct his work as to ensure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to ensure 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 ensure 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 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 ensure 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 10 percent to be retained 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.

END OF SECTION

SECTION 012200 – UNIT PRICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS

Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes.

The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 UNIT PRICE SCHEDULE

A. 6" PVC Sanitary Sewer Force Main (SDR 35)

6" PVC Sanitary Sewer Force (SDR 35) will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for PVC Gravity sewer construction shall be full compensation for providing all materials, equipment and labor, necessary to construct PVC gravity sewer complete, in place, including but not limited to: earth excavation, trenching, furnishing and installing SDR 35 PVC force main sewer pipe with stone bedding, properly disposing of unsuitable soils off-site, hauling in suitable backfill material from

off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe, taps into existing force main, bends, backfilling with suitable material and consolidating backfill, cleaning up the construction area, and related work.

B. 6" HDPE Temporary Driveway Culvert

6" HDPE Temporary Driveway Culvert will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for 6" HDPE Temporary Driveway Culvert construction shall be full compensation for providing all materials, equipment and labor, necessary to construct temporary HDPE driveway culvert complete, in place, including but not limited to: earth excavation, trenching, furnishing and installing HDPE pipe with stone bedding, properly disposing of unsuitable soils off-site, hauling in suitable backfill material from off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe, backfilling with suitable material and consolidating backfill, cleaning up the construction area, removal and disposal of temporary driveway culvert materials after approval by Owner and Engineer, and related work.

C. 8" Ductile Iron Sanitary Sewer (PC 350)

8" Ductile Iron Sanitary Sewer Pressure Class 350 will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for ductile iron gravity sewer construction shall be full compensation for providing all materials, equipment and labor, necessary to construct ductile iron gravity sewer complete, in place, including but not limited to: earth excavation, trenching, furnishing and installing PC 350 ductile iron gravity sewer pipe, properly disposing of unsuitable soils off-site, hauling in suitable backfill material from off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe, backfilling with suitable material and consolidating backfill, cleaning up the construction area, and related work.

D. 8" PVC Sanitary Sewer (SDR 35)

8" PVC Sanitary Sewer (SDR 35) will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for PVC Gravity sewer construction shall be full compensation for providing all materials, equipment and labor, necessary to construct PVC gravity sewer complete, in place, including but not limited to: earth excavation, trenching, furnishing and installing SDR 35 PVC gravity sewer pipe with stone bedding, properly disposing of unsuitable soils off-site, hauling in suitable backfill material from off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe, backfilling with suitable material and consolidating backfill, cleaning up the construction area, and related work.

E. 16" Ductile Iron Sanitary Sewer (PC 350)

16" Ductile Iron Sanitary Sewer Pressure Class 350 will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for ductile iron gravity sewer construction shall be full compensation for providing all materials, equipment and labor, necessary to construct ductile iron gravity sewer complete, in place, including but not limited to: earth excavation, trenching, furnishing and installing PC 350 ductile iron gravity sewer

pipe, properly disposing of unsuitable soils off-site, hauling in suitable backfill material from off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe, backfilling with suitable material and consolidating backfill, cleaning up the construction area, and related work.

F. 16" High Grade Steel Sanitary Sewer (PC 350)

16" High Grade Steel Sanitary Sewer will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for high grade steel gravity sewer construction shall be full compensation for providing all materials, equipment and labor, necessary to construct ductile iron gravity sewer complete, in place, including but not limited to: earth excavation, trenching, furnishing and installing high grade steel gravity sewer pipe, properly disposing of unsuitable soils off-site, hauling in suitable backfill material from off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe, backfilling with suitable material and consolidating backfill, cleaning up the construction area, and related work.

G. Bore and Jack 26" Steel Encasement Pipe

Bore and Jack 26" Steel Encasement Pipe will be measured for payment on the basis of horizontal linear foot (LF) distances.

Payment for bore and jack 26" steel encasement pipe construction shall be full compensation for providing all materials, equipment and labor, necessary to bore and jack encasement pipe complete, in place, including but not limited to: boring, jacking, properly disposing of unsuitable materials off-site, hauling in suitable backfill material from off-site if needed, furnishing and installing any and all stabilization stone necessary to support the pipe ends, furnishing and installing any supports needed for ductile iron gravity sewer encased pipe, backfilling ends with suitable material and consolidating backfill, cleaning up the construction area, and related work

H. 4' Diameter Manhole

4' Diameter Manholes will be measured for payment on the basis of actual count of each (EA) 4' diameter manhole installed.

Payment for 4' diameter manholes shall be full compensation for providing all labor, equipment and material necessary to install manholes complete and in place, including but not limited to: construction staking (after initial construction staking), earth excavation, furnishing and installing precast concrete manhole (complete with steps, standard frames, covers), undercutting unsuitable soils, properly disposing of unsuitable soils off-site, over excavating and furnishing and placing stabilization stone where excavation bottom material is unsuitable for support of manhole, hauling in suitable backfill material if unavailable on site, constructing pipe inverts, making watertight connections to influent and effluent pipes, constructing up to 9-1/2" high brick chimney as necessary to reach grade, grouting around frames, backfilling with suitable material, consolidating backfill, cleaning up the construction area, and related work.

I. 4' Diameter Doghouse Manhole

Doghouse Manholes will be measured for payment on the basis of actual count of each (EA) 4' diameter manhole installed.

Payment for 4' diameter manholes shall be full compensation for providing all labor, equipment and material necessary to install manholes complete and in place, including but not limited to: construction staking (after initial construction staking), earth excavation, furnishing and installing precast concrete manholes (complete with steps, standard frames, covers), undercutting unsuitable soils, properly disposing of unsuitable soils off-site, over excavating and furnishing and placing stabilization stone where excavation bottom material is unsuitable for support of manhole, hauling in suitable backfill material if unavailable on site, constructing pipe inverts, making watertight connections to influent and effluent pipes, constructing up to 9-1/2" high brick chimney as necessary to reach grade, grouting around frames, backfilling with suitable material, consolidating backfill, cleaning up the construction area, and related work.

J. 5' Diameter Doghouse Manhole

5' Diameter Doghouse Manholes will be measured for payment on the basis of actual count of each (EA) 5' diameter manhole installed.

Payment for 5' diameter manholes shall be full compensation for providing all labor, equipment and material necessary to install manholes complete and in place, including but not limited to: construction staking (after initial construction staking), earth excavation, furnishing and installing precast concrete manholes (complete with steps, standard frames, covers), undercutting unsuitable soils, properly disposing of unsuitable soils off-site, over excavating and furnishing and placing stabilization stone where excavation bottom material is unsuitable for support of manhole, hauling in suitable backfill material if unavailable on site, constructing pipe inverts, making watertight connections to influent and effluent pipes, constructing up to 9-1/2" high brick chimney as necessary to reach grade, grouting around frames, backfilling with suitable material, consolidating backfill, cleaning up the construction area, and related work.

K. 6' Diameter Manhole

6' Diameter Manholes will be measured for payment on the basis of actual count of each (EA) 6' diameter manhole installed.

Payment for 6' diameter manholes shall be full compensation for providing all labor, equipment and material necessary to install manholes complete and in place, including but not limited to: construction staking (after initial construction staking), earth excavation, furnishing and installing precast concrete manhole (complete with steps, standard frames, covers), undercutting unsuitable soils, properly disposing of unsuitable soils off-site, over excavating and furnishing and placing stabilization stone where excavation bottom material is unsuitable for support of manhole, hauling in suitable backfill material if unavailable on site, constructing pipe inverts, making watertight connections to influent and effluent pipes, constructing up to 9-1/2" high brick chimney as necessary to reach grade, grouting around frames, backfilling with suitable material, consolidating backfill, cleaning up the construction area, and related work.

L. 6' Diameter Doghouse Manhole

6' Diameter Doghouse Manholes will be measured for payment on the basis of actual count of each (EA) 6' diameter manhole installed.

Payment for 6' diameter manholes shall be full compensation for providing all labor, equipment and material necessary to install manholes complete and in place, including but not limited to: construction staking (after initial construction staking), earth excavation, furnishing and installing precast concrete

manholes (complete with steps, standard frames, covers), undercutting unsuitable soils, properly disposing of unsuitable soils off-site, over excavating and furnishing and placing stabilization stone where excavation bottom material is unsuitable for support of manhole, hauling in suitable backfill material if unavailable on site, constructing pipe inverts, making watertight connections to influent and effluent pipes, constructing up to 9-1/2" high brick chimney as necessary to reach grade, grouting around frames, backfilling with suitable material, consolidating backfill, cleaning up the construction area, and related work.

M. Concrete Trench Plug

Concrete Trench Plugs will be measured for payment on the basis of actual count of each (EA) concrete trench plug installed.

Payment for concrete trench plugs shall be full compensation for providing all labor, equipment and material necessary to install trench plugs complete and in place as shown on the Construction Drawings and Details, including but not limited to: earth excavation, undercutting unsuitable soils, properly disposing of unsuitable soils off-site, over excavating and furnishing and placing stabilization stone where excavation bottom material is unsuitable for support of trench plug, constructing concrete forms, placing concrete, curing concrete, removing and properly disposing of concrete forms, hauling in suitable backfill material if unavailable on site, protecting proposed sewer line during construction of trench plug, backfilling with suitable material, consolidating backfill, cleaning up the construction area, and related work.

N. Concrete Curb and Gutter (1'-6") Vertical Face

Concrete curb and gutter will be measured for payment on the basis of horizontal lineal foot (LF) distances installed and properly maintained.

Payment for concrete curb and gutter shall be full compensation for providing all labor, equipment and material necessary to install curb and gutter complete and in place in the locations shown per the Construction Drawings and Details.

O. Concrete Curb and Gutter (2'-6") Vertical Face

Concrete curb and gutter will be measured for payment on the basis of horizontal lineal foot (LF) distances installed and properly maintained.

Payment for concrete curb and gutter shall be full compensation for providing all labor, equipment and material necessary to install curb and gutter complete and in place in the locations shown per the Construction Drawings and Details.

P. Concrete Sidewalk (4" Uniform)

Concrete sidewalk will be measured for payment on the basis of square yards (SY) installed and properly maintained.

Payment for concrete sidewalk shall be full compensation for providing all labor, equipment and material necessary to install sidewalk complete and in place in the locations shown per the Construction Drawings and Details.

Q. Incidental Milling

Incidental Milling will be measured for payment on the basis per square yard (SY) required for proper removal.

Payment for incidental milling shall be full compensation for providing all labor, equipment and material necessary to mill existing asphalt in the locations shown per the Construction Drawings and Details or as directed.

R. Asphalt Base Course – Type B

Asphalt Base Course will be measured for payment on the basis per ton (TON) required for proper installation.

Payment for asphalt base course shall be full compensation for providing all labor, equipment and material necessary to install asphalt base course complete and in place in the locations shown per the Construction Drawings and Details.

S. Asphalt Intermediate Course – Type C

Asphalt Intermediate Course will be measured for payment on the basis per ton (TON) required for proper installation.

Payment for asphalt intermediate course shall be full compensation for providing all labor, equipment and material necessary to install asphalt intermediate course complete and in place in the locations shown per the Construction Drawings and Details.

T. Asphalt Surface Course – Type C

Asphalt Surface Course will be measured for payment on the basis per ton (TON) required for proper installation.

Payment for asphalt surface course shall be full compensation for providing all labor, equipment and material necessary to install asphalt surface course complete and in place in the locations shown per the Construction Drawings and Details.

U. Liquid Asphalt Binder

Liquid Asphalt Binder will be measured for payment on the basis per ton (TON) required for proper installation.

Payment for liquid asphalt binder shall be full compensation for providing all labor, equipment and material relating to asphalt binder necessary to install asphalt in place in the locations shown per the Construction Drawings and Details

V. Mobilization (General Construction & ~~Tunneling~~)

Mobilization will be measured for payment on a lump sum (LS) basis.

Payment for mobilization shall be full compensation for all costs associated with project start-up, moving men and equipment to and from the project site and for any other start-up related overhead costs.

W. Bonds and Insurance

Bonds and Insurance will be measured for payment on a lump sum (LS) basis.

Payment for bonds and insurance shall be full compensation for all costs associated with bonds and insurance for project start-up.

X. Trench Rock Excavation (Allowance)

Trench Rock Excavation will be measured for payment on a cubic yard (CY) basis of trench rock measured in-place prior to removal.

Payment for trench rock excavation shall be full compensation for providing all labor, equipment and material necessary for excavation of trench rock within the limits of the trench as indicated on the Construction Drawings and Details. Trench rock shall be measured by the Engineer prior to removal.

Y. Stabilized Construction Entrance

Stabilized Construction Entrances will be measured for payment on the basis of actual count of each (EA) stabilized entrance installed and properly maintained.

Payment for stabilized construction entrances shall be full compensation for providing all labor, equipment and material necessary to install and maintain the construction entrances during the construction period in the locations shown per the Construction Drawings and Details, including removing and disposing of entrance materials after approval by Owner and Engineer.

Z. Concrete Washout

Concrete Washout will be measured for payment on the basis of actual count of each (EA) concrete washout installed and properly maintained.

Payment for concrete washouts shall be full compensation for providing all labor, equipment and material necessary to install and maintain the concrete washouts during the construction period in the locations shown per the Construction Drawings and Details, including removing and disposing of washout materials after approval by Owner and Engineer.

AA. Temporary Silt Fence

Temporary Silt Fence will be measured for payment on the basis of horizontal lineal foot (LF) distances installed and properly maintained.

Payment for temporary sediment fence shall be full compensation for providing all labor, equipment and material necessary to install sediment fence complete and in place in the locations shown per the Construction Drawings and Details, including but not limited to: excavation for sediment fence, furnishing and installing fence posts, wire fence reinforcement and sediment fence fabric, inspecting and maintaining silt fence until stabilization has been achieved, and removing and disposing of fence materials after approval by Owner and Engineer.

BB. Remove and Repair Silt Fence

Remove and Repair Silt Fence will be measured for payment on the basis of horizontal lineal foot (LF) distances of silt fence properly removed and repaired.

Payment for remove and repair silt fence shall be full compensation for providing all labor, equipment and material necessary to remove and repair silt fence including but not limited to: furnishing and installing fence posts, wire fence reinforcement and sediment fence fabric, inspecting and maintaining silt fence until stabilization has been achieved, and removing and disposing of fence materials after approval by Owner and Engineer.

CC. Removal of Silt Retained by Silt Fence

Removal of Silt Retained by Silt Fence will be measured for payment on the basis of horizontal lineal foot (LF) distances of silt fence from which silt has been properly removed.

Payment for removal of silt retained by silt fence shall be full compensation for providing all labor, equipment and material necessary to remove silt from silt fence line, including but not limited to: removing and disposing of silt.

DD. Temporary Rock Check Dam

Temporary Rock Check Dams will be measured for payment on the basis of actual count of each (EA) rock check dam installed and properly maintained.

Payment for temporary rock check dams shall be full compensation for providing all labor, equipment and material necessary to install and maintain rock check dams during the construction period in the locations shown per the Construction Drawings and Details, including but not limited to: earth excavation, installing stone riprap, washed stone and non-woven geotextile fabric, inspecting and maintaining check dams until stabilization has been achieved, and removing and disposing of check dam materials after approval by Owner and Engineer.

EE. Temporary Tree Protection Fence

Temporary Tree Protection Fence will be measured for payment on the basis of horizontal lineal foot (LF) distances installed and properly maintained.

Payment for temporary tree protection fence shall be full compensation for providing all labor, equipment and material necessary to install tree protection fence complete and in place in the locations shown per the Construction Drawings and Details, including but not limited to: excavation for tree protection fence, furnishing and installing fence posts, wire fence reinforcement and fence fabric, inspecting and maintaining tree protection fence until stabilization has been achieved, and removing and disposing of fence materials after approval by Owner and Engineer.

FF. Temporary Inlet Protection

Temporary Inlet Protection will be measured for payment on the basis of actual count of each (EA) inlet protection installed and properly maintained.

Payment for temporary inlet protection shall be full compensation for providing all labor, equipment and material necessary to install and maintain inlet protection during the construction period in the locations

shown per the Construction Drawings and Details, including but not limited to: earth excavation, installation, materials, inspecting and maintaining inlet protection, and removing and disposing of inlet protection materials after approval by Owner and Engineer.

GG. Temporary Ring Filter

Temporary Ring Filters will be measured for payment on the basis of actual count of each (EA) temporary ring filter installed and properly maintained.

Payment for temporary ring filters shall be full compensation for providing all labor, equipment and material necessary to install and maintain ring filters during the construction period in the locations shown per the Construction Drawings and Details, including but not limited to: earth excavation, installation, materials, inspecting and maintaining check dams until stabilization has been achieved, and removing and disposing of ring filter materials after approval by Owner and Engineer.

HH. Erosion Control Blanket

Erosion Control Blanket will be measured for payment on a square foot (SF) basis as measured by ground coverage.

Payment for erosion control blankets (North American Green or approved equal) shall be full compensation for providing all labor, equipment and materials necessary to install the blanket in the locations as shown on the Construction Drawings in accordance with the manufacturer's installation guidelines. Payment shall include maintaining the erosion control blanket until a substantial stand of grass has been established and the threat of sediment runoff no longer exists.

II. Temporary Stream Crossing

Temporary Stream Crossing will be measured for payment on the basis of actual count of each (EA) temporary stream crossing installed.

Payment for temporary stream crossings shall include providing all labor, equipment, and materials necessary to the temporary stream crossing in locations shown per the Construction Drawings and Details, including but not limited to: providing and maintaining bypass pumping as required, installing temporary rock check dams including sand bags and plastic sheeting, excavation, dewatering, removing temporary measures once the stream crossing has been completed, restoring and protecting the channel banks, and maintaining bank stabilization measures until a vegetative cover is established and the ground surface stabilized.

JJ. Standard Seeding/Stabilization

Standard Seeding/Stabilization will be measured for payment on a per acre (AC) basis.

Payment for standard seeding/stabilization shall be full compensation for providing all materials, equipment and labor necessary to restore and stabilize disturbed surfaces within the project area which are not within delineated wetlands, including but not limited to: preparing soil for seeding; providing and applying lime, superphosphate, fertilizer and grass seed to prepared soil; providing and applying mulch; providing and applying liquid asphalt to bond and anchor mulch; and maintaining seeded areas until a substantial stand of grass has been established and the threat of sediment runoff no longer exists.

KK. Site Clearing and Grubbing

Site Clearing and Grubbing will be measured for payment on a per acre (AC) basis.

Payment for site clearing and grubbing shall be full compensation for providing all materials, equipment and labor necessary to remove trees, shrubs, brush, stumps and other vegetation within the limits shown on the Construction Drawings including but not limited to: chipping and grinding of vegetation for mulching or composting on-site, removing all dead trees, limbs, and brush within the project limits, removing all debris, junk and trash from the site.

LL. Removal of Marked Trees.

Removal of Marked Trees will be measured for payment on the basis of actual count of each (EA) tree properly removed.

Payment for Removal of Marked Trees shall be full compensation for removing trees and stumps marked for removal on the Construction Drawings and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, Specifications, and other terms of the contract.

MM. Sewer By-Pass Pumping

Sewer By-Pass Pumping will be measured for payment on the basis of lump sum (LS) for each area required to be by-pass pumped.

Payment for sewer by-pass pumping shall be full compensation for providing all labor, equipment, power and material necessary to divert sewer flows in areas as indicated on the Construction Drawings, including but not limited to: designing temporary pumping system, furnishing and installing temporary plugs in manholes to be by-passed, providing primary and standby sewage pumps capable of handling peak sewer flows of the effluent sewer, furnishing and installing temporary pipeline for conveyance of by-passed sewer, furnishing and installing on-site power for pumping system, providing adequate standby equipment available for immediate operation and use in the event of an emergency or breakdown, performing leakage and pressure tests of the pumping discharge piping prior to actual operation, inspecting and maintaining the pumping system throughout its operation, removal of pumping system and equipment upon approval of the Engineer, and other related work.

NN. Trench Dewatering

Trench Dewatering will be measured for payment on the basis of lump sum (LS) for the project.

Payment for trench dewatering shall be full compensation for providing all labor, equipment, power and material necessary to prevent surface water and subsurface or ground water from entering excavations, including but not limited to: designing dewatering system, protecting existing structures and utilities from settlement, lateral movement, undermining or washout as a result of dewatering operations, furnishing, installing, testing, and operating dewatering system which may include wells, well points, pump equipment, standby power, standby pumps, filter material, and other appurtenances, grading for control of surface water, properly disposing of water removed by dewatering, controlling sediment runoff, continuous monitoring and inspection of dewatering system, recording water levels, removing system from the project site upon completion of dewatering operations, plugging or filling of wells, and other related work.

OO. Sewer Line and Manhole Testing

Sewer Line and Manhole Testing will be measured for payment on a lump sum (LS) basis.

Payment for sewer line and manhole testing shall be full compensation for providing all labor, equipment, materials, and any other cost associated with the testing of the sanitary sewer lines and manholes, including: pressure tests, manhole leakage tests and deflection tests in accordance with the Specifications.

PP. Construction Staking

Construction Staking will be measured for payment on a lump sum (LS) basis.

Payment for construction staking shall be full compensation for providing all labor, equipment, materials, and any other cost associated with the surveying required to properly construct the project. Payment for construction staking includes, but not limited to: setting up baseline site control; staking demolition and clearing limits; staking the alignment/location of manholes; ~~staking entry and exit shafts for bore pits~~; and setting grades (where applicable).

QQ. As-Built Survey

As-Built Survey will be measured for payment on a lump sum (LS) basis.

Payment for as-built survey shall be full compensation for providing all labor, equipment, materials, and any other cost associated with the surveying required to provide a certified survey showing dimensions, locations, angles and elevations of the sanitary sewer construction and other required site work. Survey shall be certified by a South Carolina Professional Land Surveyor. Contractor shall coordinate and furnish record drawings as required by the Specifications.

RR. Fine Grading

Fine Grading will be measured for payment in a lump sum (LS) basis.

Payment for fine grading is determined using the contract unit bid price for the pay item. Payment is full compensation for grading and forming the subgrade as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the contract.

SS. Bore Pit Excavation

Bore Pit Excavation will be measured for payment in a cubic yard (CY) basis.

Payment for bore pit excavation is full compensation for performing the earthwork prescribed and, if applicable, includes excavating of material; forming and compacting embankments; disposing of surplus or unsuitable material; stripping, preparing, and compacting of subgrade and shoulders; de-watering bore pits (when necessary), and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to satisfactorily complete the work accordance with the Plans, the Specifications, and other terms of the contract.

TT. Borrow Excavation

Borrow Excavation will be measured for payment in a cubic yard (CY) basis.

Payment for borrow excavation is full compensation for performing the earthwork prescribed and, if applicable, includes excavating of material; forming and compacting embankments; disposing of surplus or unsuitable material; stripping, preparing, and compacting of subgrade and shoulders; de-watering borrow pits (when necessary), terracing borrow pits; removing and resetting of guide signs, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to satisfactorily complete the work accordance with the Plans, the Specifications, and other terms of the contract.

UU. Concrete Piers

Concrete piers will be measured for payment on the basis of each (EA) concrete pier installed and properly maintained.

Payment for concrete piers shall be full compensation for providing all labor, equipment and material necessary to install concrete piers complete and in place in the locations shown per the Construction Drawings and Details.

VV. Traffic Control

Traffic Control will be measured for payment in a lump sum (LS) basis.

Payment for traffic control is full compensation for performing the traffic control as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, Specifications, and other terms of the contract.

END OF SECTION 012200

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
 - 2. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.

1.03 PROPOSAL REQUESTS

- A. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

1.05 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within twenty-one (21) days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than twenty-one (21) days after such authorization.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.06 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor on form found in Section 00 6363.

1.07 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer may issue a Construction Change Directive on EJCDC Document 1910-8-F. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
 - 2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
 - 4. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.03 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Engineer at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Bid Form as a guide to establish line items for the Schedule of Values.

1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Submit draft of EJCDC Document C-620
3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by

measured quantity. Use information indicated in the Contract Documents to determine quantities.

9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Progress payments shall be submitted to Engineer by the 20th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month
- D. Payment Application Forms: Use EJCDC Document C-620 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
 16. Initial settlement survey and damage report if required.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. "Contractor's Affidavit of Payment of Debts and Claims."
 5. "Contractor's Affidavit of Release of Liens."
 6. Evidence that claims have been settled.
 7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
 - 2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.04 COORDINATION

- A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Pre-Construction conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.

1.05 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three (3) days of the meeting.
- B. Pre-Construction Conference: Schedule a Pre-Construction conference before starting construction, at a time convenient to Owner and Engineer, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.

- c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Responsibility for temporary facilities and controls.
 - o. Construction waste management and recycling.
 - p. Parking availability.
 - q. Equipment deliveries and priorities.
 - r. First aid.
 - s. Security.
 - t. Progress cleaning.
 - u. Working hours.
3. Minutes: Engineer will record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction

behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Status of submittals.
 - 2) Access.
 - 3) Site utilization.
 - 4) Temporary facilities and controls.
 - 5) Work hours.
 - 6) Hazards and risks.
 - 7) Progress cleaning.
 - 8) Quality and work standards.
 - 9) Status of correction of deficient items.
 - 10) Field observations.
 - 11) RFIs.
 - 12) Status of proposal requests.
 - 13) Pending changes.
 - 14) Status of Change Orders.
 - 15) Pending claims and disputes.
 - 16) Documentation of information for payment requests.
3. Minutes: Engineer will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.06 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Engineer
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and return it. Allow seven (7) working days for Engineer's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.

- d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Engineer's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
2. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within ten (10) days of receipt of the RFI response.
- E. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven (7) days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log biweekly with not less than the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Engineer
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Engineer's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION**

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Preliminary Construction Schedule.
 2. Contractor's Construction Schedule.
 3. Submittals Schedule.
 4. Daily construction reports.
 5. Material location reports.
 6. Field condition reports.
 7. Special reports.
- B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
 3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 2. Predecessor Activity: An activity that precedes another activity in the network.
 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Engineer.

- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- H. Major Area: A significant construction element.
- I. Milestone: A key or critical point in time for reference or measurement.
- J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.04 SUBMITTALS

- A. Qualification Data: For scheduling consultant.
- B. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Engineer's final release or approval.
- C. Preliminary Construction Schedule: Submit three (3) copies.

- D. Contractor's Construction Schedule: Submit three (3) copies of initial schedule, large enough to show entire schedule for entire construction period.
- E. Daily Construction Reports: Submit three (3) copies at monthly intervals.
- F. Field Condition Reports: Submit three (3) copies at time of discovery of differing conditions.
- G. Special Reports: Submit three (3) copies at time of unusual event.

1.05 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Discuss constraints, including phasing, work stages, and area separations.
 - 2. Review time required for review of submittals and resubmittals.
 - 3. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 4. Review time required for completion and startup procedures.
 - 5. Review and finalize list of construction activities to be included in schedule.
 - 6. Review submittal requirements and procedures.
 - 7. Review procedures for updating schedule.

1.06 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for Notice to Proceed] to date of Final Completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 1. Phasing: Arrange list of activities on schedule by phase.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Use of premises restrictions.
 - e. Provisions for future construction.
 - f. Seasonal variations.
 - g. Environmental control.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.

- e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.
 - k. Startup and placement into final use and operation.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.03 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven (7) days of date established for Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first sixty (60) days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.04 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within fifteen (15) days of date established for Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
- 1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in ten (10) percent increments within time bar.

2.05 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
- 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.

3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (refer to special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial Completions and occupancies.
 19. Substantial Completions authorized.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.07 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner and Engineer within two (2) days of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION**3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one (1) week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013223 – PROJECT SURVEY AND LAYOUT

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide construction stakeout sufficient to construct the proposed improvements in accordance with the approved construction plans.
- B. All stakeout services shall be completed under the direct supervision of a Professional Land Surveyor licensed in the State where the project is located.
- C. The Owner shall provide the following prior to the commencement of any stake-out services:
 - 1. Construction site drawings and associated electronic files.
 - 2. Copies of the topographic survey that the approved site plans have been based on. The topographic survey shall include at least one benchmark, which shall be used for vertical control; and,
 - 3. Copies of the boundary survey that the approved site plans have been based on. The boundary survey shall be closed and monumented/ironed. These monuments/irons shall be used for horizontal control related to the site boundary and the dimensional control plan.
- D. Contractor shall verify existing grades prior to performing work under this section. If existing grades are at variance with the drawings, notify the Owner and receive instructions prior to proceeding. No additional compensation will be considered resulting from grade variances once work has commenced.
- E. The Contractor shall retain the services of a registered land surveyor licensed where the project is located.

1.2 SUBMITTALS

- A. The Contractor is required to submit surveys prepared, signed and sealed by a registered land surveyor to the Engineer. These drawings shall constitute the project record documents. The Contractor shall submit the survey information in AutoCAD 2004 or higher format to the Engineer. All elevation information in the AutoCAD file must be at appropriate 3-D elevation. All horizontal data in the AutoCAD file shall be at appropriate coordinates. All entities shall be placed on layer with names, which adequately describe the entity being mapped.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The Contractor/Surveyor shall supply all stakeout materials.

2.2 EQUIPMENT

- A. The Contractor/Surveyor shall supply all equipment necessary to accomplish the work.

PART 3 - EXECUTION

3.1 PERFORMANCE STANDARDS

- A. Building Layout
 - 1. Set a minimum of 4 building corners (to be the outer most building limits or as requested by the Contractor) with 2 (10 foot minimum) offsets per corner. A benchmark or a building pad benchmark shall be set within close proximity to the proposed building.
- B. Building Pad/Limits Certification
 - 1. Grade Elevations for the building limits (pad) shall be provided at a 50 foot grid for subgrade acceptance, stone base acceptance, and prior to slab placement.
- C. Storm Drainage Manholes
 - 1. 15 feet and 25 feet offset stakes in the same directions will be set from the centerline opening of structure lath. One offset stake will have an elevation to top of rim and inverts. Intermediate grade stakes to pipe invert elevation will be provided if needed. (Note: These stakes are not to conflict with piping.)
- D. Catch Basins and Drop Inlets
 - 1. Set a centerline of structure lath with 10 foot offset HUB along the face of curb on either side of the lath at face of curb. One offset stake will have an elevation to top of grate and inverts. (Note: These stakes are not to conflict with piping.)
- E. Utility Layout
 - 1. Centerline of pipes will be staked with no offset.
- F. Roadway Layout
 - 1. Grade stakes shall be located at centerline of roadway at 50 foot intervals, including point of curvature, point on curve, point of tangency, and points of vertical curves. Grades shall be at finished grade.
- G. Limits of Disturbance
 - 1. Clearing limits shall be staked at 100 feet $\pm$ intervals and at all critical areas.
- H. Grade Stakes
 - 1. Stakes will be provided at a 50 foot grid. Grade elevations shall be to finished grade.

3.2 CONTRACTOR VERIFICATION

- A. Contractor will field verify the utility location, size and invert elevations at points of connection in area of conflict, prior to construction and protect them from damage.
 - 1. Finished subgrades shall be verified by the Contractor to ensure proper elevation and conditions for construction above subgrade;

2. Protect subgrade from excessive construction traffic and wheel loading including concrete and dump trucks; and,
- B. Notify Owner if it is necessary to destroy or remove control points and/or benchmarks due to construction. Contractor shall be responsible for the protection of benchmarks, including the cost for relocation as required.
- C. Advise Owner of any discrepancies between plans and field layout.

3.3 QUALITY ASSURANCE

- A. The survey crew shall discuss all layout procedures with the Contractor's supervisor prior to commencing work.
- B. A survey crew daily report detailing that day's work, shall be completed and signed by the Contractor's supervisor at the end of that day's layout.
- C. Copies of sketches, cut sheets, etc. shall be provided to the Contractor by the beginning of the next workday.
- D. All costs related to re-staking due to construction or Contractor's work resulting in destruction or movement of stakes, shall be paid for by the Contractor and at no additional expense to the Owner.
- E. Building dimensions shall be obtained only from the approved architectural/structural drawings. Dimensions are to be obtained only from the appropriate approved (engineering, architectural and structural) drawings. The surveyor shall report any conflicts to the Contractor and Owner.

END OF SECTION 013223

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
 - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 3. Division 01 Section "Quality Requirements" for submitting test and inspection reports.
 - 4. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 6. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Engineer's responsive action.
- B. Informational Submittals: Written information that does not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Engineer for Contractor's use in preparing submittals. Refer to Article 1.05
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineers reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow ten (10) days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow twenty-one (21) days for initial review of each submittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 by 6 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.

- k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will discard submittals received from sources other than Contractor.
 - 1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number, numbered consecutively.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
 - 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "APPROVED"
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- K. Use for Construction: Use only final submittals with mark indicating "APPROVED" taken by Engineer.
- 1.05 CONTRACTOR'S USE OF ENGINEER'S CAD FILES
- A. General: At Contractor's written request, copies of Engineer's CAD files will be provided to Contractor for Contractor's use in connection with Project.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's catalog cuts.
 - e. Printed performance curves.
 - f. Operational range diagrams.
 - g. Mill reports.
 - h. Standard product operation and maintenance manuals.
 - i. Compliance with specified referenced standards.
 - j. Testing by recognized testing agency.
 - k. Application of testing agency labels and seals.

1. Notation of coordination requirements.
 4. Submit Product Data before or concurrent with Samples.
 5. Number of Copies: Submit six (6) copies of Product Data, unless otherwise indicated. Engineer will retain two (2) copies; remainder will be returned to the Contractor. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Shopwork manufacturing instructions.
 - e. Templates and patterns.
 - f. Schedules.
 - g. Design calculations.
 - h. Compliance with specified standards.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - k. Relationship to adjoining construction clearly indicated.
 - l. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 3. Number of Copies: Submit six (6) copies of each submittal. Engineer will retain two (2) copies; remainder will be returned.
- D. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.
- E. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entities performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three (3) copies of subcontractor list, unless otherwise indicated.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit three (3) copies of each submittal, unless otherwise indicated. Engineer will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.

2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- T. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Engineer.
1. Engineer will not review submittals that include MSDSs and will return the entire submittal for resubmittal.
- 2.03 DELEGATED DESIGN
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
- C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency. Testing Agency shall meet the requirements of ASTM E 329 and ASTM C 1072.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.04SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.

3. Identification of applicable standards.
 4. Identification of test and inspection methods.
 5. Number of tests and inspections required.
 6. Time schedule or time span for tests and inspections.
 7. Entity responsible for performing tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.05QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and ASTM C 1077; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer with copy to Contractor.

Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.06 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - 2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within thirty (30) days of date established for Notice to Proceed.
1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.02TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Engineer.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer reference during normal working hours.

3.03REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01571 3 - EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventative measures.
- D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.
- E. Work under this section shall include, but not limited to, installation and maintenance of temporary and permanent erosion control measures, slope protection, and stabilization measures. This work shall include all labor, materials, and equipment necessary to meet all applicable standards and requirements of authorities having jurisdiction and as specified in the Contract Documents.

1.2 REFERENCE STANDARDS

- A. SCDHEC Approved Project Storm Water Pollution Prevention Plan (SWPPP).
- B. South Carolina DHEC Storm Water Management Best Management Practice (BMP) Handbook, 2005.
- C. EPA - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2012 Construction General Permit (CGP).
- B. Comply with requirements of State of South Carolina DHEC Storm Water Management BMP Handbook, 2005.
- C. Follow approved Project Storm Water Pollution Prevention Plan (SWPPP). The Contractor shall provide all temporary erosion control measures shown on the Contract Drawings, or as directed by the Owner, Owner's Representative, or authorities having jurisdiction for the duration of the contract. The erosion control plans are intended to be a guide to address the various stages of work shown. Additional measures not specified within the Contract Drawings may be necessary and shall be implemented to address intermediate stages of work and/or any conditions that may develop during construction at no cost to the Owner.

Regent Parkway Sanitary Sewer Relief System

- D. Temporary and permanent erosion and sediment control measures shall at all times be satisfactory to the Owner's Representative. Owner's Representative will inform the Contractor of unsatisfactory construction procedures and/or conditions if observed. If the unsatisfactory procedures and conditions are not responded to and corrected within 48 hours, the Owner's Representative may suspend the performance of any or all other construction until the unsatisfactory condition(s) has been corrected. Such suspension shall not be the basis of any claim by the Contractor for additional compensation nor for an extension of time to complete the work. Any complaints, fines, etc. relating to ineffective erosion and sediment control shall be the sole responsibility of the Contractor.
- E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
 - a. Owner will obtain permits and pay for securities required by authority having jurisdiction.
 - b. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due construction activities for this project.
 - a. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - b. Anticipate runoff volume due to the most extreme short term 24-hour rainfall events that might occur in 25 years.
- G. Erosion On-Site: Minimize wind, water, and vehicular erosion of soil on the project site due to construction activities.
 - a. Control movement of sediment and soil from temporary soil stockpiles.
 - b. Prevent development of ruts due to equipment and vehicular traffic.
 - c. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to the Owner.
- H. Erosion Off-Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - a. Prevent windblown soil from leaving the project site.
 - b. Prevent tracking of mud onto public roads outside of the site.
 - c. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - d. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to the Owner.
- I. Sedimentation of Waterways On-Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm drainage systems, and sanitary sewers.
 - a. If sedimentation occurs, install or correct preventative measures immediately at no cost to the Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- J. Sedimentation of Waterways Off-Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm drainage systems, and sanitary sewers.

Regent Parkway Sanitary Sewer Relief System

- a. If sedimentation occurs, install or correct preventative measures immediately at no cost to the Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- K. Open Water: Prevent standing water that could become stagnant.
- L. Maintenance: Maintain temporary preventative measures in accordance with the Contract Drawings until permanent measures have been established.

1.4 SUBMITTALS

- A. Submit product data for each type of product indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Mulch
 - a. Straw or hay: dry and free from mold damage and noxious weeds.
 - b. Wood waste, chips, or bark.
 - c. Erosion control blankets or netting.
- B. Grass Seed for Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons. Refer to Contract Drawings for recommended seeding schedule.
- C. Grass Seed for Permanent Cover: See Section 329200.
- D. Rip Rap – Per SCDOT Specifications.
- E. Temporary Erosion and Sediment Control Best Management Practices (BMPs) – See construction details provided on the Contract Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.
- B. Contractor shall review the erosion control plans within the Contract Drawings as they apply to current site conditions. Any deviation from the drawings must be submitted for approval to the Site Engineer in writing at least 72 hours prior to commencing that work.

3.2 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.
- B. Notify authority having jurisdiction, Owner, and Owner's representative in writing a minimum of 48 hours prior to commencing land disturbing activities.

3.3 CONSTRUCTION SEQUENCE

- A. The approved construction sequence shall be followed during the execution of work under this section. All soil and erosion control measures shall be installed in accordance with the phasing sequence shown on the Contract Drawings.

3.4 SCOPE OF PREVENTATIVE MEASURES

- A. Construction Entrances: Install construction entrances at all points where construction traffic will be leaving the site and moving directly onto a public road as shown on the Contract Drawings.
- B. Silt Fence: Install silt fence along downhill perimeter edge of disturbed areas, stockpiles, and construction entrances.
 - a. Install double row silt fence as shown on the Contract Drawings.
- C. Rock Ditch Check: Install rock check dams in steeply sloped swales, swales where adequate vegetation cannot be established, small open channels, within drainage ditches to reduce the velocity of concentrated flows, and as shown on the Contract Drawings.
- D. Temporary Stockpile – To be placed in areas as shown on the Contract Drawings or as directed by Owner. If stockpile(s) is to remain for more than 14 days, temporary stabilization measures shall be implemented. Silt fence shall extend around the entire perimeter or if stockpile is located on/near a slope, the silt fence shall extend along the contours of the downhill perimeter edge.
- E. Storm Drain Inlet Sediment Trap – Protect each storm drainage inlet structure with Type B wire mesh and stone as detailed on the Contract Drawings.
- F. Temporary Seeding, Permanent Seeding, and Mulching – See Section 329200.
- G. Dry Sediment Basins – To be constructed in accordance with the approved project specific SWPPP and as shown and detailed on the Contract Drawings.
- H. Erosion Control Blankets – As shown on the Contract Drawings or approved equivalent.
- I. Concrete Washout – As shown on the Contract Drawings or approved equivalent

3.5 INSTALLATION

- A. Install temporary and permanent BMPs in accordance with details provided on the Contract Drawings.

3.6 INSPECTION & MAINTENANCE

- A. Contractor shall be responsible for regular inspection and maintenance of BMPs in accordance with the requirements provided in the details on the Contract Drawings.

3.7 CLEANUP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owner.

- B. Cleanout temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 015713

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Progress cleaning.
 - 5. Protection of installed construction.
- B. Related Sections include the following:
 - 1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
 - 2. Division 01 Section "Submittal Procedures" for submitting surveys.
 - 3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.03 SUBMITTALS

- A. Qualification Data: For Land Surveyor.
- B. Certificates: Submit certificate signed by Land Surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit two (2) copies signed by Land Surveyor.

1.04 QUALITY ASSURANCE

- A. Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3.02 PREPARATION

- A. Existing Utility Information: Furnish information to Owner, Engineer and local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to connect to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate construction schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a Land Surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels as needed to locate each element of Project.
 - 2. Do not scale Drawings to obtain required dimensions.
 - 3. Check the location, level and plumb, of every major element as the Work progresses.

4. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer

3.04 FIELD ENGINEERING

- A. Identification: Engineer will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of major site improvements and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- D. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- E. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 PROGRESS CLEANING

- A. Site: Maintain Project site free of waste materials and debris.
- B. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.07 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

1.3 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.2 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection procedures.
 2. Warranties.
 3. Final cleaning.
- B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
 2. Division 01 Section "Execution" for progress cleaning of Project site.
 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Advise Owner of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents.
 6. Complete startup testing of systems.
 7. Submit test/adjust/balance records.
 8. Terminate and remove temporary facilities from Project site.

- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of areas in sequential order.
 2. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Engineer
 - d. Name of Contractor.

e. Page number.

1.06 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 2. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.03 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one (1) set of marked-up Record Prints.
 - 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one (1) set of plots from corrected Record CAD Drawings and one (1) set of marked-up Record Prints. Engineer will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Engineer will return plots and prints for organizing into sets, printing, binding, and final submittal.
 - b. Final Submittal: Submit one (1) set of marked-up Record Prints, one (1) set of Record Transparencies, three (3) copies printed from Record Transparencies and one (1) set of digital copy (PDF format) Record Drawings on CD. Print each Drawing, whether or not changes and additional information were recorded.

PART 2 - PRODUCTS**2.01 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Actual equipment locations.
 - f. Locations of concealed internal utilities.
 - g. Changes made by Change Order or Construction Change Directive.
 - h. Changes made following Engineer's written orders.
 - i. Details not on the original Contract Drawings.
 - j. Field records for variable and concealed conditions.
 - k. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Engineer. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to Engineer for resolution.

3. Owner will furnish Contractor one (1) set of transparencies of the Contract Drawings for use in recording information.
 4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Engineer will make the Contract Drawings available to Contractor's print shop.
- C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Engineer. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Engineer for resolution.
 4. Engineer will furnish Contractor one (1) set of CAD Drawings of the Contract Drawings for use in recording information.
 - a. Engineer makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
- D. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Engineer for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- E. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
 3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
 4. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Engineer.
- e. Name of Contractor.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION

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 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 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.

1.4 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.

B. Notify Owner of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.
2. PRODUCTS (NOT USED)

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 nonpotable 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.

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 02 41 00

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 Surfacing, 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. 3
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 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 Rod Diameter / Dowel Size	Uncracked Concrete		Cracked Concrete	
	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
7/8-inch / #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. Eucopoly 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. NBEC Grout by Five Star Products, Inc.
 - e. Or equal.

2.7 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 rehandling 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 03 00 05

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 allwelded 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 05 50 13

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 05 56 00

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 caulking 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 caulking 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, caulking 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 caulking 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
 - 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 caulking 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 contaminants 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 07 92 00

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 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 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 31 11 00

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 00 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/ft³ (600 kN-m/m³)).
15. ASTM D1556, Test Method for Density and Unit Weight of Soil in Place by the SandCone Method.
16. ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).

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) Sheet piling 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

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 $\frac{3}{4}$ 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, 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.

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 sidewalk	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 31 23 05

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, crosssections 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. Televiser 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, aboveground 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 lifesafety facilities with utmost care, after properly notifying and coordinating with utility owners, lifesafety 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 31 23 16.26

SECTION 31 37 00

RIPRAP

PART 1 GENERAL1.1 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 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 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 32 12 00

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 lot's 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 mulch.
 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 colloidal 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 oven-dry 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 soiltesting 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 erosioncontrol fiber mesh and where slopes exceed one on four, by providing erosioncontrol 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 32 92 00

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. 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 33 05 05

TABLE 33 05 05-A BURIED PIPING SCHEDULE

B.

The following abbreviations are used in the Buried Piping Schedule.

A. Service Abbreviations

<u>Service</u>	<u>Abbreviation</u>
Sanitary Sewer	SAN
Storm Sewer	ST
Sanitary Force Main	SFM
Raw Water	RW
Potable Water	PW
County Water	CW

<u>Service</u>	<u>Abbreviation</u>
Wastewater	WW
Chlorine Solution	CLS
Sodium Hypochlorite	NAOCL
Plant Effluent Water	PEW
Drain	DR
Chlorine Gas	CLG

B. Material Abbreviations

<u>Material</u>	<u>Abbreviation</u>
Ductile Iron	DI
Cast Iron	CI
Chlorinated Polyvinyl Chloride	CPVC

<u>Material</u>	<u>Abbreviation</u>
Polyvinyl Chloride	PVC
Copper	C

C. Lining/Coating Abbreviations

<u>Lining</u>	<u>Abbreviation</u>
Cement Mortar Lined	CL
Painted	P
Ceramic Epoxy	CE

<u>Lining</u>	<u>Abbreviation</u>
Asphaltic Coated	AC
Polyethylene Wrapped	PEW

D. Joint Abbreviations

<u>Joint Type</u>	<u>Abbreviation</u>
Bell and Spigot	BS
Restrained Bell and Spigot	RBS
Push-on Joint	POJ
Restrained Push-on Joint	RPOJ
Mechanical Joint	MJ
Sleeve-type Flexible Coupling	SLFC

<u>Joint Type</u>	<u>Abbreviation</u>
Restrained Mech. Joint	RMJ
Soldered	Sd
Threaded	Thd
Split Flexible Coupling	SPFC
Plasticized PVC Coupling	PPVC

E. Test Abbreviations

<u>Test</u>	<u>Abbreviation</u>
Hydrostatic Test (test pressure in psig)	HYD ()
Exfiltration	EX
Low-pressure Air Sewer Test	AIR
Vertical Deflection	VD

<u>Test</u>	<u>Abbreviation</u>
Process Air Pipe Test (test pressure in psig)	PA ()
Vacuum Test	VAC
Disinfection and Bacteriological Testing	DBT
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 flangemounted 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 flangemounted 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 $\frac{3}{4}$ ", 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 $\frac{3}{4}$ ", 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 33 05 06

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, Tnemec Perma-Shield 431, or equal.

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 ChemicalResistant 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 1/12th 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 33 05 13

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-foot 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 33 05 23.17

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 HANDLING

- 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, preapproved equivalent).
 2. For sewer cut-ins on 36-inch and larger sewer mains a Kor-N-Tee, Inserta-Tee or preapproved 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 33 31 01

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 fullface 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 40 05 05

The following abbreviations are used in the Exposed Piping Schedule.

A. Service Abbreviations

<u>Service</u>	<u>Abbreviation</u>
Sanitary Force Main	SFM
Wastewater	WW

<u>Service</u>	<u>Abbreviation</u>
Fuel Oil	FO

B. Material Abbreviations

<u>Material</u>	<u>Abbreviation</u>
Ductile Iron	DI
Copper	C

C. Lining/Coating Abbreviations

<u>Lining</u>	<u>Abbreviation</u>
Cement Mortar Lined	CL
Ceramic Epoxy	CE

<u>Lining</u>	<u>Abbreviation</u>
Painted	P

D. Joint Abbreviations

<u>Joint Type</u>	<u>Abbreviation</u>
Soldered	Sd
Brazed	Bz

<u>Joint Type</u>	<u>Abbreviation</u>
Flanged	Flg
Flanged Adapter	FA

E. Test Abbreviations

<u>Test</u>	<u>Abbreviation</u>
Hydrostatic Test (test pressure in psig)	HYD ()

<u>Test</u>	<u>Abbreviation</u>
Exfiltration Test	EX

TABLE**40 05 05-A, EXPOSED PIPING SCHEDULE**

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/Thickness	Joint	Test	Remarks

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. $\Delta T = 100$ (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:

<u>Nominal Pipe (Inches)</u>	<u>Rod Diameter (Inches)</u>
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 40 05 07

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:

<u>Pipe Size</u>	<u>Sleeve ID Minus Pipe or Insulation OD</u>
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 40 05 08

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.

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 40 05 19

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 Oring 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 Oring 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 40 05 31