

Project Manual



EASTERN GOOCHLAND FORCE MAIN REHABILITATION AND REPLACEMENT

Goochland County, Virginia

DEI Project No.: 50109386

September 2022



PREPARED BY:

Dewberry

4805 Lake Brook Drive, Suite 200
Glen Allen, Virginia 23060
804.290.7957

PREPARED FOR:

Goochland County

Department of Public Utilities
1800 Sandy Hook Road
Goochland, VA 23063

**TABLE OF CONTENTS
PROJECT MANUAL**

**EASTERN GOOCHLAND FORCE MAIN
REHABILITATION AND REPLACEMENT**

DIVISION 00 - BIDDING AND CONTRACT DOCUMENTS

Invitation for Bid (IFB)

TECHNICAL SPECIFICATIONS

Division 01 - General Requirements

Section 01010 – Summary of Work
Section 01013 – Mobilization
Section 01200 – Price and Payment Procedure
Section 01310 – Project Meetings
Section 01330 – Submittal Procedures
Section 01500 – Temporary Facilities and Controls
Section 01730 – Operating and Maintenance Data
Section 01770 – Closeout Procedures

Division 02 – Site Work

Section 02115 – Site Preparation
Section 02120 – Erosion and Sediment Control
Section 02200 – Cleaning of Sewer Mains
Section 02230 – Dewatering
Section 02300 – Earthwork
Section 02325 – Trenching and Backfilling
Section 02400 – Sewer Sliplining
Section 02500 – HDPE Pipe and Fittings
Section 02600 – Backfill Grouting
Section 02710 – Asphalt Paving
Section 02920 – Lawns and Grasses

Division 15 – Mechanical

Section 15120 – Valves, Fittings and Miscellaneous Pipe Accessories

END OF SECTION TOC



GOOCHLAND COUNTY

Purchasing Department
P.O. Box 10, Goochland, Virginia 23063-0010
Phone: 804.556.5802 Fax: 804.556.5676
Email: wtormey@goochlandva.us

INVITATION FOR BIDS (IFB) 2023-01 EASTERN GOOCHLAND PUMP STATION (EGPS) FORCE MAIN REHABILITATION AND REPLACEMENT

DATE OF THIS REQUEST: SEPTEMBER 23, 2022

DESCRIPTION: EGPS FORCE MAIN REHABILITATION AND REPLACEMENT

SEALED BIDS SUBJECT TO THE TERMS, CONDITIONS, AND SPECIFICATIONS HEREIN WILL BE RECEIVED UNTIL 3:00 P.M., **OCTOBER 28**, 2022, LOCAL PREVAILING TIME (LPT) AT WHICH TIME THEY WILL BE PUBLICLY OPENED, READ, AND MADE A PART OF THE PUBLIC RECORD FOR THE REHABILITATION AND REPLACEMENT AS DESCRIBED HEREIN AND IN ACCORDANCE WITH THE DRAWINGS, PLANS, AND SPECIFICATIONS.

SUBMISSION:

Bids shall be submitted in a sealed container. The face of the container shall be clearly marked in the lower left corner as follows:

IFB #: 2023-01
IFB FOR: EGPS Force Main Rehabilitation and Replacement
DUE: **OCTOBER 28**, 2022 at 3:00 p.m. LPT
LICENSE NO. _____ CLASS _____ EXPIRES _____

Bids must be submitted to:

Wanda St. P. Tormey, Purchasing Director
1800 Sandy Hook Road, Room 352
P.O. Box 10
Goochland, VA 23063

Sealed bids must be submitted by the date and time stated above or they will remain unopened. No allowance will be made for postmark or error in delivery to incorrect address. It is the sole responsibility of the bidder to ensure timely and correct delivery of the bid to the Purchasing Department. IMPORTANT – PLEASE NOTE: Not all overnight delivery services guarantee timely next day delivery to this location. Please check with the service you use.

For information relating to this IFB, contact:

Wanda St. P. Tormey, Purchasing Director
Ph: 804.556.5802
Fax: 804.556.5676
wtormey@goochlandva.us

A NON-MANDATORY PRE-BID MEETING HAS BEEN SCHEDULED FOR Tuesday, October 4, 2022 AT 9:00 A.M. THIS MEETING WILL BE VIRTUAL. PLEASE CONTACT WANDA

IFB# 2023-01 EGPS REHABILITATION AND REPLACEMENT

TORMEY FOR THE MEETING LINK.

PROJECT DESCRIPTION

The scope of this project is to replace approximately 11,000 linear feet of large diameter sewer force main within the southeaster region of Goochland County, Virginia. The current force main is primarily comprised of 48-inch fiberglass reinforced pipe (FRP), and will be replaced with 42-inch high-density polyethylene (HDPE) pipe via slipline and open-cut construction methods per the construction plans and specifications.

This project begins at the Eastern Goochland Pump Station (EGPS) at 12320 Patterson Avenue, Richmond, VA and ends just north of Tuckahoe Creek adjacent to the county boundary. The route of this pipeline traverses through several existing neighborhoods and along the River Road right-of-way, so awareness of community presence, traffic, and safety hazards are paramount to the success of this project.

Furthermore, the installation of a bypass pumping connection at the EGPS has been included in the bid form as an add alternate and may be added to the contract scope depending on the final contract amount.

PLANS AND SPECIFICATIONS:

The engineered drawings were created by Dewberry Engineers, Inc. and are titled “Eastern Goochland Force Main Rehabilitation and Replacement” and have Design Professional’s seals dated 9/23/2022. Engineered plans and specifications are provided on the Goochland County Purchasing Department website at www.goochlandva.us and on eVA at www.eva.virginia.gov. Copies can be obtained from Bizport located at 9 North 3rd Street, Richmond, Virginia, 23219, or by calling 804.780.1060 or by emailing bizportplans.com. Plan copies are \$ [REDACTED] per set and the specifications/project manual is \$ [REDACTED]. The cost for the purchase of the plans and specifications are non-refundable. Contractor is responsible for all costs associated with the purchase of the plans and specifications. County will not provide free copies of the plans and specifications for bid purposes. County will not be maintaining a Plan Holders List.

FAITH-BASED ORGANIZATIONS & NON-DISCRIMINATION.

In the solicitation and awarding of contracts, the County does not discriminate against faith-based organizations or any other bidder or offeror because of race, religion, color, sex, sexual orientation, gender identity, national origin, age, disability, status as a service disabled veteran, or any other basis prohibited by state law relating to discrimination in employment.

PANDEMIC OPERATIONS

Bidder agrees to abide by, and to guarantee its employees, subcontractors, and their employees abide by, all state, federal and local rules and regulations regarding pandemic operations and procedures, including but not limited to social distancing, face covering, testing, isolation, quarantine, and proper notification and disclosure requirements, when entering County property or facilities or interacting with County employees.

CONTRACTOR QUALIFICATIONS:

1. Contractor shall have successfully installed more than 2,000 LF of HDPE pipe, greater than or equal to 24-inch diameter within the last five (5) years.

2. Contractor shall have successfully installed greater than 2,000 LF of pipe via sliplining, greater than or equal to 24-inch diameter within the last five (5) years.

The general contractor, or a primary subcontractor, shall have the minimum qualifications that should be submitted with the bid. Additionally, references shall be provided for projects that satisfy these requirements. Failure to meet minimum qualifications and provide references will disqualify contractor from bid consideration.

TIMELINE

As a guideline, Goochland County anticipates the following timetable for selection of a Contractor.

Date Activity/Event

September 23, 2022	Invitation for Bid (IFB) Issued/Posted
October 4, 2022	Non-Mandatory Pre-Bid meeting at 9:00 a.m.
October 11, 2022	Deadline for Questions is 12:00 noon
October 27, 2022	Sealed Bids Due by 3:00 p.m. Deadline
December 6, 2022	Contract Award



BID FORM

EASTERN GOOCHLAND PUMP STATION (EGPS) FORCE MAIN REHABILITATION AND REPLACEMENT

THIS BID IS SUBMITTED TO: **Wanda St. P. Tormey**
 Purchasing Department
 1800 Sandy Hook Road, Room 352
 P.O. Box 10
 Goochland, VA 23063

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into a contract for construction and related services with COUNTY in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the time periods indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
2. BIDDER accepts all of the terms and conditions of the Invitation for Bids and Instructions to Bidders, including, without limitation, those dealing with the disposition of Bid Security. This Bid will remain subject to acceptance for **ninety (90)** days after the day of Bid opening.
3. The successful BIDDER shall sign and submit the contract within ten (10) days of COUNTY'S posting of the Intent to Award, and shall submit the Performance and Payment Bonds within ten (10) days of COUNTY'S execution of the contract.
4. In submitting this Bid, BIDDER represents, as more fully set forth in the Contract Documents, that BIDDER:
 - a. has examined and carefully studied the Bidding Documents and the following addenda receipt of all which is hereby acknowledged; and
 - b. has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the Work; and
 - c. is familiar with and is satisfied as to all federal, state and local laws and regulations that may affect cost, progress, performance and furnishing of the Work; and
 - d. has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents; and
 - e. has given COUNTY written notice of all conflicts, errors, ambiguities or discrepancies that BIDDER has discovered in the Contract Documents and the written resolution thereof by COUNTY is acceptable to BIDDER, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.
5. BIDDER understands that **time is of the essence** and agrees that the time for Substantial Completion of the entire Project shall be fifty two (52) consecutive calendar weeks from the Notice to Proceed, as determined by COUNTY, and Final Completion shall be within thirty (30) consecutive calendar days after the date of Substantial Completion.
6. BIDDER shall submit with bid a list of references for **similar** services performed within the past three (5) years, per the "Contractor Qualifications" section. Reference List attached, see page .
7. BIDDER shall submit with bid a list of key personnel to be assigned to the Work and subcontractors submitting more than 5% of the Work. Include resumes showing projects of similar

size and scope worked on in the past three (5) years, responsibilities on those projects and relevant training and current certifications for this Work.

8. BIDDER shall submit a Bid bond. **Each Bid submitted in response to this IFB shall be accompanied by a Bid bond in an amount equal to five percent (5%) of the Total Bid Price.** An AIA Bid Bond form is acceptable.

9. BIDDER understands that COUNTY may require a Contractor's Qualification Statement (AIA A305) from the three (3) lowest responsive bidders, as determined by COUNTY, within three (3) days after Bid opening.

10. Failure to submit a Bid on the official County Bid Form shall be a cause for rejection of the Bid. Modification of or additions to any portion of the Invitation for Bids may be cause for rejection of the Bid; however, COUNTY reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a Bid as nonresponsive. As a precondition to its acceptance, COUNTY may, in its sole discretion, request that BIDDER withdraw or modify nonresponsive portions of a Bid which do not affect quality, quantity, price, or delivery.

11. If BIDDER wishes to use an escrow account for retained funds, initial here: _____

12. BIDDER attests that it has relied upon the following public historical climatological records: Goochland, Virginia.

Name and Address of Contractor: _____

Date: _____

By: _____
(Signature in Ink)

Name: _____
(Please Print)

Title: _____

Contractor's License NO. _____

FEI/FIN NO. _____

State Corporation Commission (SCC) NO. _____

If none, state why the Vendor is not required to be so authorized:

Phone: (____) _____

Fax: (____) _____

Email: _____

ACKNOWLEDGE RECEIPT OF:

Addendum 1 _____

Addendum 2 _____

Addendum 3 _____

Bid Form

Total Base Bid (or Bid Price) shall be to provide all supervision, management, financing, goods, products, materials, equipment, systems, labor, services, permits, licenses, construction machinery, transportation and other facilities necessary for proper execution and completion of the Work as described per all terms, conditions and specifications herein (including any properly submitted bid modifications). Contract Award will be based on the **TOTAL BASE BID PRICE for a single contract for the Eastern Goochland Pump Station (EGPS) Force Main rehabilitation and replacement.**

EXAMPLE- TO BE PROVIDED BY ARCHITECT/ENGINEER/CONSULTANT

The following items are defined as stated in Project Specification Section 01200 – Price and Payment Procedures:

Commented [JAM1]: Should this be deleted?

TOTAL BASE BID/BID PRICE:

DOLLARS (\$) _____)

Bid shall be shown in both words and figures. In the case of a discrepancy, the amount shown in words will govern.

ALTERNATES: Bidder shall provide bids for all Alternates. Failure to do so will result in the rejection of the Bid.

Alternate #1:

_____ Dollars (\$) _____)

Alternate #2:

_____ Dollars (\$) _____)

Alternate #3:

_____ Dollars (\$) _____)

TOTAL PRICE FOR TOTAL PROJECT (BASE BID AND ALL ALTERNATES) IF AWARDED AS A LUMP SUM

_____ Dollars (\$) _____)

UNIT PRICES: Prices shall be valid for both deductions and additions to the work and shall include the item installation costs. Bidder shall submit one equal price for both deductions and additions of the Work. Failure to quote unit prices will result in rejection of the Bid. County reserves the right to delete unit prices from the executed contract that are deemed unreasonable. Unit prices shall be valid for the duration of the project.

Unit Price #1: \$ _____ per cubic yard

Unit Price #2: \$ _____ per cubic yard

Unit Price #3: \$ _____ per cubic yard

Unit Price #4 \$ _____ per square foot

The following documents shall be attached to and made a condition of this Bid:

1. Completed and signed Bid Form (pages _____)
2. Reference List (page _____)
3. Certification of No Collusion (page _____)
4. Key Personnel List and resumes
5. Bid Bond (AIA Bid Bond form acceptable)

Name of Firm: _____ **Date:** _____

Authorized Signature: _____

Printed Name: _____

REFERENCES		
Contract Date	Client Name & Address	Contract Amount
	Contact Name, phone and email	
	Project title, location, description	
Contract Date	Client Name & Address	Contract Amount
	Contact Name, phone and email	
	Project title, location, description	
Contract Date	Client Name & Address	Contract Amount
	Contact Name, phone and email	
	Project title, location, description	
Contract Date	Client Name & Address	Contract Amount
	Contact Name, phone and email	
	Project title, location, description	



CERTIFICATION OF NO COLLUSION

The undersigned, acting on behalf of _____,
does hereby certify in connection with the procurement to which this Certification of No Collusion
is incorporated and attached that:

He/she has the authority to bind the forenamed BIDDER, and that this Bid is neither the result of,
or affected by, any act of collusion with another person engaged in the same line of business or
commerce; nor the result of, or affected by, any act of fraud punishable under Virginia Code §
18.2-498.1 *et seq.*

By: _____

Print Name

Title

Name of Company

Date

ACKNOWLEDGEMENT

The foregoing Certification of No Collusion was acknowledged before me this ____ day
of _____, 20__, by _____.

Notary Public

My commission expires: _____
Notary Registration Number: _____

Procurement\Construction forms\IFB.doc
Revised 10/19/2020

SECTION 01010
SUMMARY OF WORK

PART 1- GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. DESCRIPTION

1. Project: Construction shall consist of rehabilitation and replacement of approximately 11,000 linear feet of the Eastern Goochland Force Main in Goochland County, VA using HDPE pipe.
2. All work shown on Drawings and/or called for in these Specifications shall be performed under the General Contract, unless specifically noted to the contrary in the Contract Documents. The Project includes, however is not limited to:
 - a. The pump station shall be shut down prior to construction. The Contractor shall coordinate the outage of the pump station with the Owner. Pump station outage shall not commence before 4/1/2023.
 - b. Rehabilitation of the existing force main via a combination of open-cut installation and sliplining.
 - c. Provide and install the following:
 - Approximately 11,000 LF of new 42” HDPE pipe.
 - Annular space grouting between host pipe and carrier pipe for all sections of sliplined force main.
 - Three (3) air release valves to be replaced within existing precast structure.
 - One (1) air release valve with new precast concrete manhole.
 - Two (2) combination valves to be replaced within existing precast structure.
 - Connection from new 42” HDPE force main to existing 48” DIP force main.
 - 30” DIP bypass connection at the pumping station, including 30” plug valve.
 - Appropriate erosion and sedimentation controls as depicted on the Drawings.

B. Contractor's Duties: CONTRACTOR'S duties in performance of the WORK shall include, however are not limited to:

1. Responsibilities: CONTRACTOR shall be:
 - a. Responsible for the management of the Project.
 - b. Responsible for hiring all subcontractors.
 - c. The sole arbitrator of the division of WORK of all trades, associated with WORK provided for in the Contract Documents.

2. Work: Except as specifically noted, provide and pay for all:
 - a. Labor, materials, and equipment.
 - b. Tools, construction equipment and machinery.
 - c. Water, heat, and utilities required for construction.
 - d. Other facilities and services necessary for proper execution and completion of WORK.
3. Permits and Fees: Secure and pay for, as necessary for proper execution and completion of WORK, and as applicable at time of receipt of Bids:
 - a. Permits (including building and trade permits),
 - b. Government fees,
 - c. Bonds,
 - d. Licenses
 - e. Insurance.
4. Notices: Unless specifically indicated otherwise, give required Notices to ENGINEER, government agencies, (local, state and federal), utility companies, Owner and others as required and within the time frames identified in the Contract Documents.
5. Regulations: Comply with all codes, ordinances, rules regulations, orders, and other legal requirements of public authorities which bear on performance of WORK.
6. Written Notice: Promptly submit Written Notice to ENGINEER of observed conflicts in Contract Documents. It is CONTRACTOR'S responsibility to make certain that all work performed as defined in the Drawings and Specifications complies with codes and regulations.
7. Coordinate: Coordinate WORK with appropriate authorities, *i.e.*, utility companies, Virginia Department of Health (VDH), and Virginia Department of Transportation (VDOT), etc, and other Contractors who may be performing other work at the project site of this work or adjacent to this work.

1.2 ADDITIONAL ENGINEERING SERVICES

- A. In the event that the ENGINEER is required to provide additional engineering services as a result of CONTRACTOR error or omissions; substitution of materials or equipment by the CONTRACTOR that are different from what is specified that results in change in dimensions, layout, power requirements, etc.; or if the ENGINEER is required to examine and evaluate any changes proposed by the CONTRACTOR for the convenience of the CONTRACTOR; or if the ENGINEER is required to witness retests of project components, then the ENGINEER's charges in connection with such additional services shall be charged to the CONTRACTOR by the ENGINEER.

1.3 AGREEMENT

- A. Construct WORK under single, all-inclusive AGREEMENT.

1.4 PLANS AND SPECIFICATIONS

- A. Plans and Specifications describe the scope of work for this project. Should there be a conflict between the drawings and specifications the more stringent shall apply.

1.5 LINES, GRADES, AND REFERENCE POINTS

- A. Project Stakeout: Lines, grades, elevations, locations, pipe inverts and centerlines, and construction staking necessary for the proper execution of all the WORK specified here in will be established by CONTRACTOR at his expense by a Professional Land Surveyor licensed in the Commonwealth of Virginia.
- B. Where the ENGINEER deems that additional survey is required for the proper execution of the Work or verification that the Work was completed per Contract Document requirements, the CONTRACTOR at his expense shall provide this additional survey by a Professional Land Surveyor licensed in the Commonwealth of Virginia.
- C. Project Control: Prior to construction, the ENGINEER shall provide up to six (6) ground control points at the direction of the CONTRACTOR. This work will occur within six (6) weeks after the CONTRACTOR has submitted a stakeout/control plan to the ENGINEER after NTP. These points will be provided only one (1) time upon request. All existing grade stakes, reference lines, etc. destroyed by CONTRACTOR during the progress of its WORK will be replaced at CONTRACTOR'S expense.
- D. Field Verification: Where called for on the Drawings and Specifications or, required for accuracy and fit with existing WORK, CONTRACTOR will make its own field measurements to verify any dimensions shown on the Drawings. Consequently, OWNER and ENGINEER present this information only as an approximation and not a guideline. CONTRACTOR shall be responsible for verification prior to submittal.

1.6 RESPONSIBILITY REGARDING EXISTING UTILITIES AND STRUCTURES

- A. Tie-ins and Operation of Owner's Equipment
 - 1. Contractor shall not make any tie-ins to existing systems whether in service or not without pre-approval from the owner and without an owner's representative present. Contractor shall not operate any valves and/or equipment belonging to the owner.
- B. Existing Structures: The existence and location of underground utilities indicated on the Drawings are not guaranteed and shall be investigated and verified in the field by CONTRACTOR before WORK is begun. Excavation in the vicinity of existing structures and utilities shall be carefully performed by hand if deemed appropriate by CONTRACTOR.
- C. Responsibility: CONTRACTOR shall be held responsible for any damages to, and for maintenance and protection of, existing utilities and structures; and, for repair of such to the complete satisfaction of the respective owner(s).

- D. Pre-Existing Conditions: For the protection of both itself and OWNER, CONTRACTOR shall make a survey of adjacent properties before commencing operations. Such a survey shall locate all existing cracks and damage to the existing structures by means of drawings and photographs. "Tell tales" shall be placed as directed by ENGINEER. In addition, a videotape shall be made by the Contractor showing the entire project area prior to commencing work, with copies to be submitted to the ENGINEER and OWNER.
- E. Documentation: A copy of this report shall be filed with ENGINEER. Any refusal of owner(s) of adjacent property to permit entry for purposes of inspection shall be noted in the report. The purpose of filing the report is to document the pre-existing conditions. Any liability resulting from this documentation as provided by the contract is solely the CONTRACTOR's responsibility.
- F. Protection of the Work: CONTRACTOR shall continuously maintain adequate protection of all its WORK and materials from damage or theft and shall protect OWNER'S property and all adjacent property from injury or loss arising in connection with activities provided for this Project. CONTRACTOR shall be liable for any such damage, injury, or loss.
- G. Protection of Adjacent Facilities: CONTRACTOR shall take, use, provide, and maintain all necessary precautions, safeguards, and protection to prevent accidents, or injury to persons or property on, about, or adjacent to the site of the WORK. CONTRACTOR shall post danger signs warning against any hazards created by the WORK being done under this CONTRACT. CONTRACTOR shall designate a responsible member of its organization to be responsible for the prevention of accidents on the Project. The name of this person so designated shall be reported in writing to ENGINEER. In an emergency affecting the safety of life, or of the WORK or adjoining property, CONTRACTOR, without special instructions or authorization from ENGINEER or OWNER, is hereby permitted to act, at its discretion, to prevent such threatened loss or injury. It must take such action if so instructed or authorized by ENGINEER or OWNER.
- H. Requirements of Law: CONTRACTOR shall protect adjacent property as required by law.

1.7 APPLICABLE CODES

- A. Specified Codes: Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical organization or body, it shall be construed to mean the latest standard, code, specification, or tentative specification adopted and published at the date of Advertisement for Bids, even though reference has been made to an earlier standard; and such standards are made a part thereof to the extent which is indicated or intended.
- B. Non-Specified Codes: When no reference is made to a code, standard, or specification, the standard Specifications of the ASTM, the ASA, the AIEE, or the NEMA or others, as applicable, shall govern.
- C. Permits: CONTRACTOR shall be responsible for compliance with all state and local codes and ordinances.

1.8 COORDINATION

- A. All WORK shall be coordinated with the OWNER and individual property owners and business owners. At least 48 hours' notice will be given for any WORK involving the existing facilities.

1.9 SEQUENCE OF WORK

- A. All new lines and equipment shall be tested prior to placing into service.
- B. The following suggested sequence of work is anticipated:
 1. CONTRACTOR shall request the existing Force Main be taken offline
 2. OWNER will shut down existing pumping station and redirect flow via gravity sewer. Bypassing flows will not be required.
 3. Installation of necessary E&S measures.
 4. CONTRACTOR shall dewater pipeline as shown on the plans. Dewatering means and methods as well as the cost for removal and disposal of material is the responsibility of the CONTRACTOR.
 5. CONTRACTOR shall perform sliplining and install new ARV and appurtenances.
 6. CONTRACTOR shall test HDPE segments in accordance with project requirements.
 7. CONTRACTOR shall install bypass connection.
 8. CONTRACTOR shall make tie ins and perform system test.
 9. CONTRACTOR shall restore site.

1.10 EQUIPMENT/MATERIAL GUARANTEE

CONTRACTOR shall furnish a written guarantee from the manufacturer of the equipment and material to ENGINEER at the time of completion of WORK and before acceptance of the installation. The guarantee does not apply to any item damaged from misuse, lack of maintenance, alternation, neglect, accident, or wear from normal use.

- A. Initial Installation: All equipment/material installed per the Contract Documents shall be free from defect in material or workmanship, and CONTRACTOR shall repair or replace at its expense any such defective equipment for a period of 1 year from the date of Substantial Completion unless otherwise noted in the Contract Documents.
- B. After Installation: CONTRACTOR shall be responsible for repair or replacement of any equipment or material which fails to meet the design requirements as specified which are revealed during fabrication, installation, demonstration and/or acceptance testing. Repair or replacement of any such equipment/material shall be completed within 60 days at the expense of CONTRACTOR. Liquidated Damages for failure to complete such repair or replacement within the specified time will be assessed in the manner specified in the General Conditions.

1.11 WORK OUTSIDE REGULAR HOURS

- A. If the CONTRACTOR desires to perform work outside the regular hours or on Saturday, he shall request permission to work 48 hours in advance to allow arrangements to be made for proper inspection. The OWNER may refuse the CONTRACTOR permission to

work if the 48-hour notice is not given or for other just cause. Reasonable efforts shall be made by the CONTRACTOR to avoid undue noise during the night and on Sundays, if it is necessary to work at such times. Under normal circumstances the CONTRACTOR will not be permitted to work on Sundays.

- B. Unless specifically scheduled to work outside normal hours by the OWNER in the interest of public safety or convenience, then the CONTRACTOR will be liable for the expense of overtime work required by OWNER's and/or ENGINEER's employees. This expense includes but is not limited to OWNER and ENGINEER called to the job site outside normal working hours to resolve problems directly related to the project. Normal or regular working hours are defined as 7:00 a.m. to 5:00 p.m. Monday through Friday.
- C. IF CONTRACTOR anticipates working outside normal work hours, he shall notify the ENGINEER and OWNER as soon as possible and no less than 48 hours in advance.

1.12 MATERIAL SUBSTITUTIONS

- A. The specifications and project drawings depict equipment and materials which are deemed most suitable for the service anticipated. It is not intended, however, to eliminate other products of equal quality and performance. The contractor shall prepare his bid based on the specified equipment for purposes of determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials.
- B. After execution of the contract, the contractor may offer substitutions to the specified equipment for consideration. The equipment proposed for substitution must be equal to or superior in construction and performance to that specified in the contract, and the quality must be demonstrated by a list of current users of the proposed equipment in similar installations.
- C. In event the contractor obtains engineer's approval for equipment substitution, the contractor shall, at his own expense, make all resulting changes to the enclosures, buildings, piping or electrical systems as required to accommodate the proposed equipment. CONTRACTOR shall at his own expense provide detail drawings illustrating the substituted equipment to be submitted to the ENGINEER for approval prior to acceptance.
- D. Should the substitution not be acceptable to the OWNER or ENGINEER the CONTRACTOR shall resubmit the original equipment specified. The CONTRACTOR shall be responsible for all additional costs accrued by the ENGINEER and OWNER associated with the substitution.
- E. If the cost to the contractor is less for the proposed substitution, the saving shall be equably shared by the CONTRACTOR and the OWNER.

1.13 Storage

- A. Contractor shall store all materials and equipment in accordance with all manufacturers' recommendations. Contractor shall include in his submittal package the manufacturers' recommended long term and short term storage procedures. Storage procedures shall extend to equipment installed but not put into service and shall continue until project completion.

PART 2- PRODUCTS (Not Applicable).

PART 3- EXECUTION (Not Applicable).

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 01113
MOBILIZATION**

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and other Division 1 Specifications Sections, apply to this Section.

1.2 DESCRIPTION

- A. The work covered by this section consists of preparatory work and operation, including but not limited to those necessary for the movement of personnel, equipment, trailers, sanitary facilities, temporary electric supplies, and other facilities necessary for work on the project; video documentation of job site; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site.

PART 2- PRODUCTS

2.1 VIDEO DOCUMENTATION

- A. A High Definition (HD) video file shall be provided digitally to the Owner and Engineer.

PART 3- EXECUTION

3.1 VIDEO DOCUMENTATION

- A. Format - The entire project site shall be videoed prior to beginning work and the video provided to the Owner's Representative. Contractor shall provide video camera and experienced cameraperson who shall walk the entire site. The taping shall be done on a sunny day to provide a clear video. Each taped segment shall begin with the cameraperson verbally noting "Project Name, Company, Camera person's and Name, Date, Time and Brief Description of Segment to be documented". Each video file shall be clearly labeled as to project name, date, and volume. Provide log of each video file which will include footage milestones and segments covered in that volume.
- B. Acceptance – The video files prepared by the Contractor shall be delivered to the Owner's Representative at the preconstruction conference for review. Within seven (7) days of receipt the Owner's Representative shall review video files to determine and notify the Contractor if the video files are acceptable. Video files shall be acceptable prior to beginning work.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 01200
PRICE AND PAYMENT PROCEDURES**

PART 1- GENERAL

1.1 SCOPE

Under this section of the specifications, the CONTRACTOR shall furnish all necessary labor, machinery, apparatus, tools, materials, equipment, services, and other necessary supplies and perform all work including excavation and backfilling at the unit or lump sum prices for the following items.

- A. BASE BID: The base bid for the project includes all material, equipment labor to perform the HDPE sliplining within the project area. This includes dewatering, pre-installation inspection, HDPE installation, HDPE to DIP connections, testing, restoration and project closeout activities from STA 15+00 to project end.
- B. ALTERNATE 1: A mechanical bypass connection is proposed at the Eastern Goochland Pump Station Site at approximately STA 11+00. This work includes new 30" DIP connection, DIP fittings, valves and concrete work. The price to perform this work will be summarized as Alternative A on the bid form.

PART 2- PRODUCTS

2.1 PAYMENT FOR STORED MATERIALS

- A. Payment will be made for materials stored on-site for which a paid invoice or other proof of payment is provided.
- B. All stored materials shall be stored in strict accordance with manufacturer's long term storage requirements. Contactor shall submit a maintenance schedule for stored materials to the Engineer for approval. Maintenance schedule shall be approved by the manufacturer in writing. No payment for stored material shall be made without the receipt of the above and approval by Owner and/or Engineer.
- C. The Maintenance schedule shall be strictly adhered to, witnessed by the owner's representative and documented as having been completed. Should the maintenance schedule not be adhered to, payment for the stored materials shall be withheld from pay applications until the situation is corrected.

2.2 ITEMS INCIDENTAL TO THE WORK

- A. Any item not specifically referenced in the Bid Schedule but required by the plans and specifications shall be considered incidental to the work. The cost for these items shall be included in the most appropriate Bid Item.

2.3 BID FORM ITEMS

- A. The bid price shall be for furnishing all products (excluding all other items listed below), and performing all labor and furnishing equipment to install and erect those products and that equipment, for the construction of the Work as shown and specified including all site work, piping, valving, and all other work shown or specified.
- B. The bid price will be based on furnishing equipment and materials in compliance with the specifications. Should the Contractor fail to provide a manufacturer of equipment which complies with the specifications, the Owner reserves the right to select approved specified equipment of his choice without an increase in the contract price.
- C. The Contractor shall be solely responsible for ensuring that all equipment meet all requirements in the technical specifications. If, during shop drawing submittal review, it is found that an item does not meet the requirements of the technical specifications, the Contractor shall be responsible for all additional costs to remedy the situation without an increase in the contract price or schedule duration.

PART 3- EXECUTION

3.1 PAY ITEMS

- A. The items listed herein before are the same items listed in the Bid herein before and constitute all of the pay items in this contract. Any other items of work listed in the Specifications, or shown on the Drawings, shall be considered incidental to the above items.

3.2 REQUIREMENTS FOR PARTIAL PAYMENTS

- A. Partial Payment requests will be made on an approved form. The Contractor will attach copies of invoices for all materials included in the Payment Request. Payments will be made on all major items of materials stored on site; however, the Owner will not pay for miscellaneous incidental materials stored on site, nor for any materials stored off site.
- B. The effective date for Partial Payment shall be established during the Pre-Construction Conference. Requests for payment shall be evaluated on the basis of work completed as of the effective date, not on the basis of projected work completed.
- C. Retainage for Partial Payments from the Owner shall be in accordance with the General Conditions.
- D. The work to be performed under the Contract will commence with the date established in the Notice to Proceed. Substantial Completion shall be achieved within the time period stated in the Bid Proposal.
- E. Prior to the Pre-Construction Conference, the Contractor shall submit the following:
 - 1. List of principal Subcontractors and Suppliers
 - 2. Schedule of Values
 - 3. Progress Schedule and first progress report
 - 4. Schedule of Submittals and Shop Drawings

5. Copies of building permits, other required permits, and similar start-up authorization certifications

3.3 FINAL PAYMENT

- A. Final Payment may be requested when the Engineer is satisfied and the following conditions have been fulfilled:
 1. Complete close-out requirements shall be in accordance with Division 1.
 2. Complete work listed as incomplete at time of Substantial Completion or otherwise assure Owner of subsequent completion of individual incomplete items. Cost of uncompleted items required under the contract shall be assessed by the Engineer and an amount equal to double the estimated cost to complete the item(s) shall be withheld until the work is completed and approved by the Engineer.
 3. Settle liens and other claims or assure Owner of subsequent settlement. Execute and submit to Engineer for approval, five (5) copies each of Contractor's Affidavit of Payment of Debts and Claims and Contractor's Affidavit of Release of Liens.
 4. Submit proof of payment on fees, taxes, and similar obligations.
 5. Transfer operational, access, security, and similar provisions to Owner and remove temporary facilities, tools, and similar items.
 6. Obtain consent of surety for final payment. Execute and submit to Engineer for approval, five (5) copies of Consent of Surety to Final Payment.

END SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 01310
PROJECT MEETINGS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the County's General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Project meeting minutes will be taken and distributed by the Engineer.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Preconstruction conferences.
 - 2. Pre-installation conferences.
 - 3. Progress meetings.
 - 4. Coordination meetings.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Submittals" for submitting the Contractor's Construction Schedule.

1.3 PRECONSTRUCTION CONFERENCE

Schedule and hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

- A. Attendees: Authorized representatives of the Owner, Engineer, Owner's Representative, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; funding agency representatives; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- B. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Sign-in and agenda.
 - 2. Introduction of official representatives.
 - 3. Status of contract documents.
 - a. Contracts.
 - b. Notice to Proceed.

4. Contract time issues.
 - a. Total contract time.
 - b. Project schedule.
5. Contract price issues.
 - a. Status of contract price.
 - b. Schedule of values.
 - c. Payment requests.
 - d. Change in the work.
6. Submittals.
7. Responsibilities of each stakeholder.
 - a. Engineer.
 - b. Owner's representative.
 - c. Owner.
 - d. Contractor.
 - e. Funding Agency
8. Comments, questions, discussion points.

1.4 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at the Project Site before each construction activity that requires coordination with other construction. Meetings will be determined during the preconstruction conference.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting, and shall notify a minimum 48 hours in advance. Advise the Owner's Representative of scheduled meeting dates.
 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
 - a. Sign-in sheet and agenda distribution.
 - b. Review of minutes from the previous meeting.
 - c. Status of contract time.
 - d. Status of contract price.
 - e. Status of submittals.
 - f. Status of change orders.
 - g. Owner's concerns.
 - h. Contractor's concerns.
 - i. Engineer's concerns.
 - j. Schedule next progress meeting and close.

- k. Site visit.
2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Owner's Representative.
 3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

Can be requested and coordinated by any party as the need arises. Otherwise:

- A. Conduct progress meetings at the Project Site at regular intervals no greater than every 30 days. The Owner and the Owner's Representative and Contractor shall agree on a next day and time for monthly meetings.
- B. Attendees: In addition to representatives of the Owner and the Owner's Representative, each subcontractor, supplier, funding agency or 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 the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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.
 2. Review the present and future needs of each entity present, including the following:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Off-site fabrication progress and issues.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and services.
 - j. Hours of work.
 - k. Hazards and risks.
 - l. Housekeeping.

- m. Quality and work standards.
 - n. Change Orders.
 - o. Documentation of information for payment requests.
- D. Reporting: After each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - 1. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.6 COORDINATION MEETINGS

- A. Conduct project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.7 MEASUREMENT AND PAYMENT

- A. Payment for work described in this section shall be included in the various bid items for this project. No measurement shall be made.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION

**SECTION 01330
SUBMITTAL PROCEDURES**

PART 1- GENERAL

1.1 GENERAL REQUIREMENTS

- A. The Contractor shall provide samples and shop for all materials and equipment furnished and installed under this contract as described in the specifications in accordance with the following requirements. When the Work of the Project is divided into separate Contracts, each Prime Contractor shall provide submittals directly to the Engineer. No materials shall be used in the work which do not equal the approved samples or shop drawings.
- B. Transmit each item with a Submittal cover attached.
 - 1. Number submittals by specification section and revision number (e.g. 01330-1 for initial submission of schedule of submittals.)
 - 2. Submit only one item per transmittal cover.
 - 3. CONTRACTOR shall identify all deviations from the Contract Documents by paragraph number, and provide an explanation/justification for deviation.
 - 4. Incomplete submittals or submittals without identified deviations will be returned un-reviewed.
- C. Materials or appliances requiring approval must not be fabricated or incorporated into the work until approval has been given. The approval or acceptance of samples shall not preclude the rejection of any material upon the discovery of defects prior to the final acceptance of the complete work.
- D. After a material has been approved, no change in brand or manufacturer will be permitted unless satisfactory written evidence is presented to, and approved by the Engineer, that the manufacturer cannot make scheduled delivery of approved material, or that other conditions are apparent which indicate the approval of such substitute materials to be in the best interest of the Owner.
- E. Samples, shop drawings, material lists, manufacturers' literature, and other required information shall be submitted in sufficient time, and clearly marked, to permit proper consideration and action on same before any materials which such samples, shop drawings, and information represent are delivered to the site. The Contractor shall be held responsible for any delay in the progress of the Work which may be due to his failure to observe these requirements.
- F. Shop drawings and samples shall be submitted to the Engineer in PDF format.
- G. Upon approval of shop drawings and samples, provide up to four (4) hard copies to the Owner.
- H. Any submittal which requires the selection of color by the Engineer shall be submitted such that all color selections can be made at the same time. Submittals shall be held by the Contractor for a single submittal of all items requiring color choice or sufficient time

will be allowed for the Engineer to receive all submittals to prepare a comprehensive color selection.

- I. Shop drawings shall include installation instructions and long and short term storage requirements.
- J. No payment shall be made for unapproved materials or equipment purchased or installed by the Contractor even if the materials or equipment meet all the requirements of the specifications and/or is the named product or equipment.
- K. Submittal package shall address all items in the specification section and drawings pertinent to the item being submitted. Additional requirements may be on the drawings in addition to the specification section and must be included in the submittal.
- L. Additional requirements may be on numerous drawings in the contract drawings. Contractor shall coordinate all the requirements and include them in the submittal.
- M. It is not the Engineer's requirement to point out to the contractor missing requirements in the submittal. Submittals not all inclusive of all the requirements shall be returned to the contractor without further review.
- N. Engineer will allow two reviews per item. Engineer reserves the right to charge contractor for additional reviews due to improper procedures, incomplete information and lack of detail required for a complete submittal.

1.2 SAMPLES

- A. Samples and mock-ups shall be submitted in duplicate except where a greater number is specifically required by the specifications.
- B. Samples and manufacturers' literature shall be forwarded (prepaid) to Engineer's office accompanied with a transmittal letter containing the following information: name of project, contractor, description of product, manufacturer, model number, ASTM or Federal Specification number where applicable. Catalogs shall be marked to indicate specific items submitted for approval.
- C. Samples which are rejected by the Engineer must be re-submitted as soon as possible after notification of rejection and shall be marked "Re-submitted Sample" in addition to other required information.
- D. The right shall be reserved to require submission of samples of any material or any material lists, whether or not particularly mentioned in the Specifications.

1.3 SHOP DRAWINGS

- A. Submission of shop drawings shall comply with the following requirements:
 - 1. The shop drawings shall be clearly marked and submitted sufficiently in advance of the work which they cover to afford ample time for checking, correcting, and rechecking if necessary. No claim for delay will be granted to the Contractor if caused by his failure to comply with the requirements of this Section.

2. Before submitting for approval, the Contractor shall check all shop drawings, including those submitted by subcontractors, for accuracy and to ascertain that all work contiguous with and having bearing on other work shown on the shop drawings is accurately drawn, and that the work shown is in conformity with the contract requirements.
3. Shop drawings submitted for approval shall bear the Contractor's stamp of approval as evidence that such drawings and details have been checked by the Contractor. The submission of shop drawings (in either the original submission or when resubmitted with corrections) constitutes evidence that the Contractor has checked all information therein, and that he accepts and is willing to perform the work, as shown, in a workmanlike manner and in accordance with the best standard practices.
4. No claim for an extra shall be based on work shown on the shop drawings, unless such claim is noted on the Contractor's transmittal letter accompanying the shop drawings.

B. The Contractor's approval stamp shall contain the following statement:

"The equipment and material shown and marked in this submittal is that proposed to be incorporated into this Project, and has been checked for and is in compliance with the Contract Documents unless otherwise shown in bold face type or lettering and listed on a page or pages headed "DEPARTURES FROM CONTRACT DOCUMENTS," and can be installed in the allocated spaces.

Checked By: _____ Date: _____

The person signing the stamp shall be one designated in writing by the Contractor as having that authority. The signature shall be handwritten in ink. Stamped signatures are not acceptable.

1. The Engineer's approval of shop drawings and schedules shall not relieve the Contractor from responsibility for deviation from drawings and specifications unless he has in writing called the Engineer's attention to such deviations at the time of submission. The Engineer's approval shall not relieve Contractor from responsibility for errors of any sort on shop drawings or schedules.

C. ENGINEER'S ACTION:

1. Review is only for conformance with the design concept of the project. Markings or comments do not relieve the CONTRACTOR from compliance with the contract documents nor allows departure therefrom. The CONTRACTOR remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for technique of assembly, for coordination of the work with all trades, and for performing this work in compliance with the contract documents.
2. Where action and return is required or requested, ENGINEER will review each submittal, mark with "Action".

3. Final Unrestricted Release: Work may proceed, provided it complies with Contract Documents, when submittal is returned with the following marking:

"Reviewed No Exceptions"
4. Final-But-Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following marking:

"Reviewed Exceptions Noted"
5. Returned for Re-submittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the work:

"Revise and Resubmit"
6. Returned for Non-Compliance: Do not proceed with work. Product submitted does not comply with Contract Documents. Resubmit for product complying with the requirements of the Contract Documents. Do not allow submittals with the following marking to be used in connection with performance of the work:

"Not Approved" or "Rejected"

PART 2- PRODUCTS

Not Applicable

PART 3- EXECUTION

Not Applicable

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Refer to General Conditions for requirements for the CONTRACTOR to provide temporary facilities as required for performance of the Work and fulfillment of the Contract. This section specifies certain minimum temporary facilities to be provided by CONTRACTOR regardless of methods and means selected for performance of the Work. This section is not intended to limit the CONTRACTOR's provisions for temporary facilities nor does it assure compliance with local governing regulations. Use of alternate provisions for temporary facilities is the CONTRACTOR's option, subject to the ENGINEER's acceptance. Temporary facilities are defined to exclude tools and construction machines, testing, demolition, alterations, soil borings, mock-ups and similar items.

1.2 SEPARATE PRIME CONTRACTORS

- A. The CONTRACTOR will be responsible for maintaining temporary facilities. The CONTRACTOR will be responsible for all temporary facilities described herein as part of this WORK.
- B. The CONTRACTOR will be responsible for providing his own Field Office and Materials Storage.
- C. Installation of temporary electrical and water service shall be provided by the CONTRACTOR.

1.3 RELATED SERVICES

- A. Intent: The provisions and intent of the AGREEMENT, including the General Conditions, Supplemental General Condition, and other requirements of the Contract Documents apply to the WORK as specified in this Section. WORK related to this Section is described throughout the Specification.

PART 2 - PRODUCTS

2.1 MATERIALS STORAGE

- A. Provide suitable and sufficient enclosed and covered spaces, with raised flooring, to protect materials and equipment subject to damage by weather or construction. Materials stored on site which have not been properly protected will not be acceptable for use in construction or approved for payment.

2.2 FENCING AND BARRICADES

- A. Provide fences and barricades and protection devices sufficient to prevent injury to persons or damage to property in accordance with Safety Requirements of applicable standards, codes, ordinances, and insurance agencies.
- B. Provide temporary walkways as necessary for safe, uninterrupted pedestrian traffic.

2.3 SCAFFOLDING AND SHORING

- A. Provide scaffolding, ramps, runways, platforms, guards, rails, stairs, and ladders as necessary for this work.
- B. Meet safety requirements of applicable Virginia and County standards, codes, and ordinances.
- C. Provide lights and signs to prevent damage or injury.
- D. Provide all shoring, bracing and sheeting as required for safety and proper execution of the Work. Remove when no longer required.

2.4 LIFTING AND HOISTING

- A. Provide hoists, temporary elevators, lifts, cranes, and towers necessary for expediting the handling of materials.

2.5 TOILETS

- A. Provide adequate and sanitary temporary outside toilet facilities for use of persons working at site. Provide toilet facilities with adequate light and ventilation and toilet tissue in suitable holder. Comply with applicable legal and health requirements. Toilet facilities shall be secluded from public observation and shall not create nor allow a public nuisance. Temporary sanitary facilities shall be removed upon completion of the work and the premises shall be left clean. Workmen shall not use permanent washroom facilities in existing facilities or new work except by written permission of the Owner.

2.6 ELECTRICITY

- A. Make arrangements for, and provide temporary equipment, poles, wiring, switches, and outlets necessary to provide an adequate supply of electricity for lighting and power for construction purposes. Cost of temporary service shall be borne by the CONTRACTOR.
- B. The CONTRACTOR shall make arrangements for meter installation, service connections, and wiring to meet the requirements of the completed project.

2.7 WATER

- A. Make arrangements for, and provide temporary equipment and piping necessary to provide an adequate supply of water for construction purposes. Cost shall be borne by the CONTRACTOR.

- B. The CONTRACTOR shall make arrangements for main connection, and incoming pipes to meet requirements of the completed project.

2.8 HEAT

- A. The General Contractor shall provide temporary heat during the course of the project to provide protection for the workmen and all installed materials and equipment during cold weather. The technical specifications outline minimum temperatures required for various portions of the Work.
- B. The General Contractor shall pay for fuel and attendance of the permanent heating system for all heat during construction to maintain the integrity of the building and all installed equipment until the project is accepted by the OWNER as Substantially Complete.
- C. Temporary Heating shall be of a type approved by the ENGINEER and complying with all applicable safety and fire code regulations.

2.9 PUMPING AND DRAINING

- A. Provide pumping equipment to keep construction and storage areas free from standing water that could cause damage or that would interfere with the work.

2.10 ACCESS

- A. The Project Site shall at all times be accessible for delivery of construction materials and equipment. Maintenance of access points and access roads, loading and unloading areas and directional signage shall be the responsibility of the CONTRACTOR.
- B. Provide signage and barricades to clearly direct pedestrian and construction traffic.
- C. Any damage to existing paved surfaces, curbing, landscaping, etc. shall be restored or repaired by the CONTRACTOR.
- D. Stabilize parking areas and access roads with a base of crushed stone as soon as practicable after finish grading.

2.11 FINISHES

- A. The General Construction Contractor shall protect all finished surfaces, including the jambs and soffits of all openings used as passageways or through which materials are handled, against any possible damage resulting from the conduct of work by all trades.
- B. All finished surfaces, including factory finished and job finished items, shall be clean and not marred upon delivery of the building to the OWNER. GENERAL CONTRACTOR shall be responsible for its Subcontractors compliance with this section.
- C. Protect all types of finished floor surfaces in traffic areas with plywood, planking, reinforced non-staining kraft paper, or other approved material.

2.12 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities

1. The CONTRACTOR shall provide at the site, such reasonable equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accident

1. The CONTRACTOR shall promptly report in writing to OWNER and ENGINEER all accidents whatsoever arising out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.
2. If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the OWNER and the ENGINEER.
3. If any claim is made by anyone against the CONTRACTOR or a subcontractor on account of any accidents, the CONTRACTOR shall promptly report the facts in writing to the OWNER and ENGINEER, giving full details of the claim.

2.13 BARRICADES, WARNING SIGNS AND LIGHTS

A. General

1. CONTRACTOR shall provide, erect and maintain as necessary, strong and suitable barricades, fencing, danger signs and warning lights and as may be required for the safety of all those employed in the work, visiting the construction site, and for the general public.

B. Accommodation of Traffic

1. All work in the VDOT right-of-way or local right-of-ways shall be done in accordance with VDOT regulations or local regulations.
2. CONTRACTOR shall be responsible for obtaining necessary VDOT LUP-A or other approvals to perform work prior to the beginning of construction within the VDOT right-of-way.
3. During the progress of the work, streets, driveways, sidewalks, and crossings shall be kept open for the passage of traffic and pedestrians and shall not be unnecessarily obstructed unless authorized by the authority having jurisdiction over same. The CONTRACTOR shall take such measures at his own expense, as may be necessary to keep the street open for traffic and shall give advance notice to the Fire and Police Departments of his proposed street operations.
4. Warning signs shall be provided along all highways while work is in progress; and where traffic direction is required flagmen shall be designated by the CONTRACTOR to direct traffic past the equipment, machinery, or construction

operations. Barricades and lights shall be provided as required to protect traffic. Where trenches have been cut in road shoulders on which traffic may pass at times, red flags and warning signs shall be placed at frequent intervals and maintained until the shoulder is safe for travel. The traveling public shall be warned of the construction with signing that is in accordance with VDOT policy.

5. The CONTRACTOR shall notify the VDOT five working days in advance of work in highway right-of-way, and shall fully cooperate with the Department.
6. The CONTRACTOR shall construct and maintain, without extra compensation, such adequate and proper bridges over excavations as may be necessary or directed for the purpose of accommodating pedestrians or vehicles.
7. All temporary means constructed by the CONTRACTOR for maintaining traffic shall be removed upon completion of the work unless otherwise specified by the ENGINEER and any damage done to public or private property shall be made good by the CONTRACTOR.
8. All dirt spilled from the contractor's trucks on existing pavements over which it is hauled or which has otherwise been deposited thereon shall be removed by the CONTRACTOR at the end of the work day.

2.14 PUBLIC CONVENIENCE AND PROTECTION

- A. During progress of the work, the convenience and protection of the public must be provided for, and interferences held to a minimum.
- B. The CONTRACTOR shall, at all times, conduct the work in such a manner as to insure the least practicable obstruction to public travel. The convenience of the general public and of the residents along or adjacent to the area of the work shall be provided for in a satisfactory manner, consistent with the operation and local conditions. Road and streets must be kept open at all times or suitable detours provided. Access to fire hydrants and other fire extinguishing equipment shall be provided and maintained at all times.
- C. When necessary, for the protection of the public, the CONTRACTOR shall provide watchmen and/or lights to burn between twilight and sunrise, and shall erect and maintain barriers and all other necessary protection around the work at his own expense. He shall also take other precautions as may be necessary to protect life, and property. The OWNER reserves the right to remedy any neglect on the part of the CONTRACTOR as regards to the protection of the work after twenty-four (24) hours notice in writing; and, in cases of emergency, the OWNER shall have the right to remedy any neglect without previous notice, and in either case deduct the cost of such remedy from money due the CONTRACTOR.

2.15 PERIODIC CLEAN UP; BASIC SITE RESTORATION

- A. During construction, the CONTRACTOR shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the CONTRACTOR's yard or base of operations for the project.

- B. When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the CONTRACTOR shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. All work within 500 feet of the forward progress shall be complete with the exception of testing. The CONTRACTORs forward progress is subject to being suspended if in the opinion of the ENGINEER the above requirement is not met. The requirements for temporary paving of streets, walks, and driveways are specified elsewhere. Unightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.
- C. The CONTRACTOR shall perform the clean-up work on a regular basis and as frequently as ordered by the ENGINEER. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore such work shall also be accomplished, when ordered by the ENGINEER, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.
- D. Upon failure of the CONTRACTOR to perform periodic clean-up and basic restoration of the site to the ENGINEER's satisfaction, the OWNER may, upon five (5) days prior written notice to the CONTRACTOR, without prejudice to any other rights or remedies of the OWNER, cause such work for which the CONTRACTOR is responsible to be accomplished to the extent deemed necessary by the ENGINEER, and all costs resulting there-from shall be charged to the CONTRACTOR and deducted from the amounts of money that may be due him. The CONTRACTOR shall receive no consideration for time extension or compensation for production time lost while not in compliance with the requirements for clean up.

PART 3 - EXECUTION

3.1 GENERAL

- A. Maintain all temporary facilities until the project has reached Substantial Completion and is accepted by the OWNER. Project sign(s) shall be maintained until Final Acceptance by the OWNER.
- B. Provide sheds and covered spaces suitable for storage of materials and equipment requiring protection as approved by the ENGINEER.
- C. Erect and maintain scaffolding, ramps, platforms, guards, rails, stairs, and ladders as necessary for this work to meet all applicable safety laws and ordinances.
- D. Maintain safety lights, signage, and other safety provisions. Keep safety lights burning from dark to dusk.
- E. Install lifting and hoisting equipment to meet all applicable safety requirements.
- F. Maintain adequate toilet facilities and keep toilets in clean and sanitary condition.

- G. Make arrangements and install temporary water, electric, and telephone service required for the project.
- H. Maintain temporary heating system during cold weather to adequately protect the work in place or work being placed. Specific requirements for environmental conditions can be found in the technical sections of the Specifications.
- I. Pump or drain water to keep work and storage area free from water which could interfere with the work, or could cause damage. Distribute discharge to prevent erosion.
- J. Remove all temporary work at the completion of the project, unless directed otherwise by the ENGINEER.
- K. Clean spaces that were occupied by temporary work. Periodically, and as directed by the ENGINEER, remove all debris and rubbish from the site.

3.2 PAYMENT

- A. Work specified under this Section shall be included for payment in the CONTRACTOR's price bid for other Pay Items of this Contract. No specific payment will be made under this Section.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 01730
OPERATING AND MAINTENANCE DATA**

PART 1- GENERAL

1.1 REQUIREMENTS

- A. Operation and Maintenance manuals are required for all materials and equipment provided and installed in the project.
- B. Prior to substantial completion, submit to Engineer for review and approval a PDF file that contains complete operation and maintenance instructions including but not limited to the following:
 - 1. Nameplate data, model numbers and serial numbers for all equipment and motors. This information shall be summarized in the front of the Manual for all of the equipment in the manual. This information shall be tabbed and included in the table of contents.
 - 2. Names, phone numbers and company address of local representatives for all of the equipment included in the Manual. This information shall be summarized in the front of the Manual for all of the equipment in the manual. This information shall be tabbed and included in the table of contents.
 - 3. Equipment warranties;
 - 4. Operating and maintenance data;
 - 5. Troubleshooting information and procedures;
 - 6. Lubrication information and schedules;
 - 7. Assembly drawings with part numbers;
 - 8. Approved shop drawings, plan elevation and section drawings showing all details as equipment has been installed.
 - 9. All appurtenances provided with equipment including pipe, valves, fittings, etc.
 - 10. Names, telephone numbers, and addresses of applicable subcontractors, equipment and service suppliers and manufacturers;
 - 11. Adequate information to satisfy State regulatory agency requirements; and,
 - 12. Any other information concerning operation or maintenance of equipment readily available to Contractor and as required to repair and order parts.
- C. Upon approval of digital O&M manuals provide Owner up to six (6) copies of a loose-leaf type manual properly indexed and bound in hard back, three-ring binder(s).

1. The three-ring binder shall be provided with cover and spline inserts for equipment identification. The cover and spline identification inserts shall at minimum include equipment name, manufacturer name, project name, engineer, owner, specification section and any additional pertinent information.
- D. At a minimum, operating and maintenance data shall be supplied for the following equipment:
1. Plug Valves
 2. Air Release Valves
 3. Combination Valves
 4. Pipe valves and fittings

PART 2- PRODUCTS NOT USED

PART 3- EXECUTION

- 3.1 Information included in the O & M Manual shall be specific to the equipment or item installed. Data sheets that include information not pertinent to the specific equipment or product should be omitted. Where data sheets have multiple information all non pertinent information shall be edited out and pertinent information shall be highlighted to make it clear which information applies.
- 3.2 Drawings shall be provided which clearly indicate the item and the installation. These should include plan views, elevation views and section views as required. Drawings should be scaled and dimensioned. Drawings from the approved submittals should be included and corrected if required to indicate the “as-built” condition.
- 3.3 Information shall include serial numbers, order numbers, dates, contact information or other pertinent information that are required to trace a piece of equipment back to the manufacturer.

END OF SECTION

**SECTION 01770
CLOSEOUT PROCEDURES**

PART 1- GENERAL

1.1 SUMMARY

- A. This Section provides for the orderly and efficient transfer of the WORK from the CONTRACTOR to OWNER.

1.2 RELATED SECTIONS

- A. The provisions and intent of the AGREEMENT, including the General Conditions, Supplemental Conditions, and other requirements of the Contract Documents apply to the WORK as specified in this Section. WORK related to this Section is described throughout the Specifications.

1.3 SUBMITTALS

- A. Guarantees/Warranties: Four (4) copies of all guarantees, warranties and bonds called for in these Specifications commencing on the date of Substantial Completion.
- B. Owner's Receipt of Equipment and Spare Parts: Obtain signature of OWNER or its authorized representative on an exact duplicate of "Owner's Receipt of Equipment and Materials Specified to be Furnished Directly to the Owner" and submit two (2) copies of this form to the ENGINEER.
- C. Insurance: Provide four (4) copies of Certificates of Insurance for products and completed operations.
- D. Affidavit of Payment of Claims: Provide evidence of payment and release of liens.
- E. List of Project Participants: Provide a list of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

1.4 WARRANTIES AND GUARANTEES

- A. Contractor shall provide Warrantees and Guarantees on all materials, equipment, workmanship, installations, labor and operation items provided and /or installed by the Contractor or any of its subcontractors and /or suppliers.
- B. Warrantees and Guarantees shall be for a minimum period of one year (unless specially indicated in an equipment specification section for a longer period) after:
 - 1. Being placed in service by owner for the owners use before substantial completion of the project.
 - 2. Date of substantial completion of the project.

3. Being installed and put in service after substantial completion of the project.
 4. Equipment installed does not constitute being “in service.
- C. Guarantee: CONTRACTOR warrants the equipment and/or materials delivered and installed under the AGREEMENT are free from defects in design, material or workmanship, and against damage caused prior to final inspection.
- D. Prompt Repair: CONTRACTOR shall promptly repair or replace all defective or damaged items delivered under the AGREEMENT. CONTRACTOR may elect to have any replaced item returned to its plant at its sole expense.
- E. Owner's Option: In the event of equipment and/or materials failure, during such time or in such a location that immediate repairs are mandatory, CONTRACTOR shall respond promptly, regardless of time. If CONTRACTOR is not available, OWNER personnel or other contractors, secured by OWNER, will affect repairs. CONTRACTOR shall then reimburse OWNER for parts and labor and/or other contractors costs necessary to correct deficiencies as defined within the warranty clause and time.
- F. This specification shall apply to all sections of the specifications as applicable whether mentioned in a specific specification or not. Should the specific specification section have additional requirements or more stringent requirements that this section the more stringent shall apply.
- G. The warranty shall not cover any item that has been subjected to external damage, disassembled and/or repaired by unauthorized persons, flooded or otherwise mistreated, unless flooding is caused by failure or malfunction of other warranted equipment. Items normally consumed in service such as grease, oil, v-belts, fuses, filters, seals, etc., shall not be warranted.

PART 2- PRODUCTS

2.1 SUBSTANTIAL COMPLETION

- A. Record Drawings: The CONTRACTOR shall maintain an accurate set of Record Drawings and Specifications. Prior to Substantial Completion the CONTRACTOR shall prepare marked prints showing the installed locations and sizes of all underground or concealed portions of the WORK that are different from those shown in the Contract Documents. These Drawings shall be based on the set kept at the Project site and shall also show any other changes made to the Project during construction. These Drawings shall be submitted to ENGINEER at completion of the WORK.

Record drawing information shall include the following as a minimum, where applicable:

1. Size, horizontal and vertical location of any existing utilities uncovered during the course of the work. This shall include telephone cables and conduits, fiber-optic cables and conduits, television cables, electrical cables and conduits, gas lines, water lines, sewer force mains, sanitary sewers, storm sewers, and the like.
2. Horizontal and vertical location of the force main installed at every 100 foot station for open cut installation.

3. Horizontal and vertical location of pipeline at insertion pits.
 4. Horizontal and vertical location of all cleanouts new and existing, size of service lines installed, and the like.
 5. Location of lines plugged or capped.
 6. Swing ties to all structures installed such as manholes, air vents, hydrants, valve boxes, blowoffs, cleanouts, and the like.
 7. Depth from rim of valve box to top of operating nut on all valves, and length of valve extensions installed.
 8. Sizes and types of materials used and changes in sizes and types of materials. Rims and inverts of all manholes installed or tied into shall be provided.
 9. Location of all sleeves, bends, and other fittings including method of restraint used; for example, thrust block, retainer glands, tie rods, and the like.
 10. The Record Documents are a specific contract requirement of the Contractor. Final payment will not be issued until said documents have been submitted to the Engineer in an acceptable form.
- B. Owner's Manuals: Prior to Substantial Completion, CONTRACTOR shall submit operation and maintenance manuals to ENGINEER for review/approval and transmit to OWNER per Section 01730 – Operating and Maintenance Data.

2.2 WARRANTIES

- A. Four (4) copies of all warranties shall be submitted prior to substantial completion.

PART 3- EXECUTION

3.1 SUBSTANTIAL COMPLETION PROCEDURES

- A. Owner's Use: The following procedures are to be applied towards OWNER'S utilizing the Project:
1. CONTRACTOR shall give ENGINEER at least two (2) weeks' notice of request for Substantial Completion. The Substantial Completion Inspection will be Scheduled when the OWNER and ENGINEER deem the project is ready for the OWNER to use or occupy the building project or designated portion thereof for the intended purpose.
 2. Initial Punch List: Within a reasonable time after receipt from ENGINEER of a comprehensive list of items which need to be completed or corrected, the ENGINEER will determine status of completion.
 3. Incomplete Work: Should ENGINEER determine that the WORK is not substantially complete:

- a. Notification: ENGINEER will promptly so notify CONTRACTOR, in writing, given the reasons therefore. Contractor Remedy: CONTRACTOR shall promptly remedy the deficiencies and notify ENGINEER when ready for inspection.
 - b. Additional Cost: The cost of additional re-inspections for Substantial Completion will be borne by CONTRACTOR.
4. Completed Work: When ENGINEER concurs that the WORK is substantially complete:
- a. Engineer's Acceptance: ENGINEER will submit the Certificate of Substantial Completion to OWNER and to CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Certificate.
5. Occupancy: Upon Substantial Completion, CONTRACTOR shall obtain a temporary Certificate of Occupancy or other permission from the inspecting authority for OWNER to begin moving in its equipment and furnishings.

3.2 INSTRUCTIONS TO OWNER

- A. Operation and Maintenance: CONTRACTOR shall instruct OWNER or its authorized representative in the proper operation and maintenance of all elements of the Project systems as specified.

3.3 CLEAN-UP/RESTORATION

- A. Definition:
 - 1. Building Improvements: buildings should be free from all construction debris and any tools used for the construction of the project. The finished Project should be in accordance with the Project Drawings and Specifications and shall be operating in the final condition as intended by the OWNER and ENGINEER. Paint touch-ups shall be completed.
 - 2. Site Improvements: Except as otherwise specifically provided, "clean" (for the purpose of this Section) shall be interpreted as meaning the level of cleanliness generally provided by VDOT roadway construction projects.
- B. General: Prior to completion of the WORK, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described above. Restore all disturbed areas to a condition equal to or better than that prior to construction.
- C. Site: Unless otherwise specifically directed by ENGINEER, hose down all paved areas on the site. Completely remove all resultant debris.
- D. Structure: Perform the following:

1. Exterior: Visually inspect all exterior surfaces and remove all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, ENGINEER may require light sandblasting or other cleaning at no additional cost to OWNER.
 2. Interior: Visually inspect all interior surfaces and remove all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only the specified cleaning materials and equipment.
- E. Timing: Schedule final cleaning as approved by ENGINEER, to enable OWNER to receive a completely clean Project.

3.4 FINAL COMPLETION

- A. Notification: Prepare and submit to ENGINEER a written notice that the Project is complete and ready for final inspection and acceptance.
- B. Releases/Consent of Surety: Contractor shall forward a completed "Release of Liens", "Release and Waiver of Debts and Claims" and "Consent of Surety" to ENGINEER prior to Final Payment.
- C. Verification: Verify that the WORK is complete.
- D. Certification: CONTRACTOR shall certify that:
1. Review: Contract Documents have been reviewed
 2. Completeness: WORK has been completed in accordance with the Contract Documents.
 3. Inspection: WORK has been inspected for compliance with the Contract Documents.
 4. Testing: Equipment and systems have been tested as required, and are operational.
 5. Final Inspection: WORK is completed and ready for final inspection.
- E. Incomplete Determination: Should ENGINEER determine that the WORK is incomplete or defective:
1. Notification: ENGINEER will promptly so notify CONTRACTOR, in writing, listing the incomplete or defective WORK.
 2. Contractor Remedy: CONTRACTOR shall remedy the deficiencies promptly, and notify ENGINEER when ready for inspection.

- 3. Additional Cost: The cost of re-inspection for Final Completion will be borne by CONTRACTOR.
- F. Acceptance: When ENGINEER determines that the WORK is acceptable under the Contract Documents, it will request the final Application for Payment from CONTRACTOR.
- G. Reimbursement: CONTRACTOR shall reimburse OWNER for all trips to the Project site by ENGINEER after Substantial Completion in excess of two (2) trips if such excess trips are necessitated due to the Project's remaining incomplete.
- H. Retainage: Retainage will be released per the provisions of the Contract Documents.

3.5 FINAL PAYMENT

- A. Application: Submit a final Application for Payment to ENGINEER, showing all adjustments to the agreed to sum.
- B. Change Order: If so required, ENGINEER will prepare a final Change Order showing adjustments to the AGREEMENT which were not made previously by Change Orders.

END OF SECTION

**SECTION 02115
SITE PREPARATION**

PART 1- GENERAL

1.1 SCOPE

- A. The CONTRACTOR shall be responsible for preparation of the site for construction of the project in accordance with the Contract Documents and as specified herein.

PART 2- PRODUCTS

Not Applicable

PART 3- EXECUTION

3.1 STAKING AND LAYOUT OF WORK

- A. The CONTRACTOR shall locate bench marks, monuments, base lines, reference lines, and other reference points for the staking and layout of the WORK. Locations of bench marks, base line control points, and other reference points which were established during design of the project by the ENGINEER will be made available to the CONTRACTOR one time only upon request without charge.
- B. The CONTRACTOR shall complete the layout of the WORK and shall be responsible for all measurements that may be required for the execution of the WORK, to the location and limits that may be required for the execution of the WORK, to the location and limit marks prescribed in the Contract Documents, subject to such modifications as the ENGINEER may require to meet changed conditions in the contract WORK. All WORK under this contract shall be done to the lines and grades shown on the Contract Drawings.
- C. The CONTRACTOR shall furnish competent men, tools, stakes, and other material as required, without charge, for properly staking out the WORK. He shall furnish the ENGINEER with one (1) copy of all field notes of such surveys. Final "cut" sheets/grade sheet shall be provided to the ENGINEER and OWNER. All staking and layout shall be performed under the supervision of a surveyor licensed in the Commonwealth of Virginia.
- D. It shall be the duty of the CONTRACTOR and his employees to call to the attention of the ENGINEER any reference lines or points, or any bench marks which may have been disturbed or which seem to be off line or grade.
- E. Where called for in the Contract Documents or required for accuracy and fit with existing WORK, the CONTRACTOR will make his own field measurements to verify any dimensions shown on the Contract Drawings.

3.2 PROTECTION OF EXISTING PROPERTY IRONS AND MONUMENTS

- A. The CONTRACTOR shall use care in protecting existing property irons and monuments adjacent to his working area. If a property iron or monument must be removed to install new facilities, the CONTRACTOR shall be responsible for locating the iron or monument in such a manner that it can be accurately replaced after construction of the new facilities by a properly licensed surveyor. If a property iron or monument is destroyed because of neglect on the part of the CONTRACTOR, it shall be replaced at his expense by a properly registered surveyor.

3.3 RIGHT-OF-WAYS AND LIMITS OF CONSTRUCTION

- A. The CONTRACTOR shall confine his construction operations to the immediate vicinity of the location shown on the Contract Drawings and in no case shall he encroach beyond the limits of the OWNER'S property, easements, or rights-of-way. He shall place materials, equipment, supplies, etc. so as to cause the least possible damage to property and interference with traffic. His method of operation and placing of equipment and materials shall be subject to the review of the ENGINEER.
- B. It shall be the duty of the CONTRACTOR to locate the limits of easements, the rights-of-way, and property lines, prior to beginning construction. He shall be solely responsible for damage to trees, crops or other property outside the boundaries of the rights-of-way and shall make satisfactory settlement for any damage directly with the property OWNER involved.
- C. Where timber is located within the limits of construction and inside the easements on the property or rights-of-way, the CONTRACTOR shall preserve and protect from damage all trees that do not directly interfere with the prosecution of the WORK. The CONTRACTOR shall not cut any tree greater in diameter than six (6) inches and located more than eight (8) feet from the centerline of ditch or structure without first consulting the ENGINEER. Unless otherwise notified, all timber located on rights-of-way and easements is the property of the land OWNER, and the land OWNER must be given a reasonable amount of notice and time by the CONTRACTOR to remove any timber. Prior to removing any timber the land OWNER and the OWNER must be notified by the CONTRACTOR.
- D. Where shrubbery or grass is located on the construction easements or rights-of-way, the CONTRACTOR shall be fully responsible for any damage thereto. He shall remove, protect and replant all shrubbery to the full satisfaction of the ENGINEER, OWNER, and property OWNER and shall either remove and resod or replant all lawns or pasture grass damaged by the construction WORK. Topsoil shall be replaced and grass of the same type found shall be planted, fertilized, mulched and watered in accordance with the Specifications, until a satisfactory stand of grass is secured.
- E. Excavation, grading, fill, storm drainage, paving and any other construction or installations in rights-of-ways of streets, highways, public carrier lines, utility lines (either aerial, surface or subsurface), etc., shall be done in accordance with requirements of the authorities having jurisdiction and of applicable requirements of these Specifications. CONTRACTOR shall make all necessary arrangements with the proper authorities, including the obtaining of permits, approval of construction methods, etc., and shall pay all costs charged in connection with the WORK.

3.4 PROTECTION OF PROPERTY AND EXISTING UTILITIES AND STRUCTURES

- A. CONTRACTOR shall be responsible for the preservation and protection of property adjacent to the WORK site against damage or injury as a result of his operations under this WORK. Any damage or injury occurring on account of any act, omission or neglect on the part of the CONTRACTOR shall be restored in a proper and satisfactory manner as determined by the ENGINEER and OWNER or replaced by and at the expense of the CONTRACTOR.
- B. CONTRACTOR shall comply promptly with such safety regulations as may be prescribed by the ENGINEER, OWNER or the local, state and federal authorities having jurisdiction and shall when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of his employees. In the event of the CONTRACTOR's failure to comply, the ENGINEER or OWNER may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the CONTRACTOR. Failure of the ENGINEER to direct the correction of unsafe conditions or practices shall not relieve the CONTRACTOR of his responsibility hereunder.
- C. In the event of any claims for damage or alleged damage to property as a result of WORK under this WORK, the CONTRACTOR shall be responsible for all costs in connection with the settlement of or defense against such claims.
- D. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the WORK may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the CONTRACTOR to ascertain the actual extent and exact location of existing utilities and structures. In every instance the CONTRACTOR shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any WORK in the vicinity of existing utilities.
- E. The WORK shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to ensure uninterrupted of existing services. Any damage resulting from Construction of this WORK shall be repaired within 24 hours. The CONTRACTOR shall make these repairs at his own expense in a manner approved by the ENGINEER, and further, subject to the requirements of any authority having jurisdiction, that they perform their own repairs or have them done by others, the CONTRACTOR shall be responsible for all costs thereof.
- F. Where excavations by the CONTRACTOR require any utility lines or appurtenant structure to be temporarily supported and otherwise protected during the construction WORK, such support and protection shall be provided by the CONTRACTOR. All such WORK shall be performed in a manner satisfactory to the ENGINEER and the respective authority having jurisdiction over such WORK. In the event the CONTRACTOR fails to provide proper support or protection to any existing utility, the ENGINEER may, at his direction, have the respective authority provide such support or protection as may be necessary to ensure the safety of such utility, and the costs of such measures shall be paid by the CONTRACTOR.

3.5 OBSTRUCTIONS

- A. The CONTRACTOR shall be responsible for removing and disposing of any obstructions or obstacles at the site of the WORK or along the easements and right-of-way therefore, to the satisfaction of the ENGINEER. Minor obstruction shall be removed and properly disposed of or protected and re-erected to as good condition as found, at the same or adjacent locations, as directed by the ENGINEER.

3.6 FENCES

- A. Fences at the site or along rights-of-way, which interfere with the construction operations, shall be maintained by the CONTRACTOR until completion of the WORK unless written permission is obtained from the OWNER thereof to leave the fence dismantled until construction is completed. He shall remove, rebuild and extend fences as necessary.

3.7 DEMOLITION

- A. Demolition shall be as specified in Division 2.

END OF SECTION

SECTION 02120
EROSION AND SEDIMENT CONTROL

PART 1- GENERAL

1.1 SUMMARY

- A. This work shall be performed in accordance with the erosion and sediment control plan of the Construction Drawings and the details provided therein, and as described, detailed and required by the Virginia Erosion and Sediment Control Handbook, latest edition, and land disturbance permit. The land disturbance permit shall be obtained by the Contractor from the Goochland County Department of Community Development.

The Contractor shall be responsible for providing an employee who will be responsible for the erosion and sediment control plan and requirements for the project that is certified by the Virginia Department of Conservation and Recreation as a Responsible Land Disturber (RLD). The name of the Contractor's RLD and copy of his current certification shall be provided to the Owner, Engineer, and Erosion and Sediment Control Plan Approving Authority.

- B. The erosion and sediment control measures and devices shown on the Drawings and described herein have been reviewed and approved by the appropriate governing State and/or Local agencies. The Contractor is responsible for stabilizing all disturbed areas, fill slopes, borrow areas, etc. with whatever means necessary to ensure a dense, well vegetated ground cover. If the Contractor has not installed, repaired, or maintained these devices, or seeded disturbed areas at optimum dates, additional measures or devices may be required at no additional cost to the Owner.

The Contractor's selected construction methods may require modifications to the erosion and sediment control measures shown on the Drawings. The Contractor is responsible for complying with the land disturbance permit and obtaining approval for any modifications to the approved Erosion and Sediment Control Plan.

1.2 RELATED SECTIONS

Intent: The provisions and intent of the AGREEMENT, including the General Conditions, Supplemental Conditions, and other requirements of the Contract Documents apply to the WORK as specified in this Section. WORK related to this Section is described throughout the Specifications.

1.3 REFERENCES

Virginia Erosion and Sediment Control Handbook

1.4 SUBMITTALS

- A. Submittals shall be in accordance with Division 1.

- B. Permanent Seed Mixture: Provide written notification as to the permanent seed mixture to be used.
- C. Temporary Seed Mixture: Provide written notification as to the temporary seed mixture to be used.
- D. Erosion and Sediment Control: Submit and maintain on-site a copy of the Erosion and Sediment Control permit issued by the local approving authority for both on-site and off-site operations.
- E. Responsible Land Disturber: Copy of Certification to be submitted at the pre-construction meeting.

1.5 MAINTENANCE

- A. Maintain all erosion and sediment control structures to be utilized during the life of the Project in compliance with the regulations of the Division of Soil and Water Conservation and the requirements of the County until vegetative cover is acceptable to the Division's and County's field personnel and approval acceptance is received.

PART 2- PRODUCTS

2.1 PRODUCTS

- A. All products shall comply with details shown on the Drawings and the requirements of the Virginia Erosion and Sediment Control Handbook, latest edition.

PART 3- EXECUTION

3.1 EROSION AND SEDIMENT CONTROL MEASURES

- A. Sequencing: All WORK shall be performed to limit the area of construction necessary to install Erosion and Sediment control devices prior to conducting WORK.
- B. Siltation and Erosion Control Measures: Inlet protection, slope protection, mat linings, ditch linings, diversion dikes, silt fence, construction entrances, temporary & permanent vegetation, sediment traps & ponds, diversion ditches and all other items for siltation and erosion control shall be constructed in the locations shown or designated on the plans in accordance with the details provided as directed by the Engineer.
 1. The Contractor shall institute the erosion control program as part of clearing and grubbing, and prior to rough grading. The initial program shall include, but not be limited to, the installation of construction entrance, inlet protection, silt fence, as shown on the Drawings at the limits of clearing and grubbing where silt-carrying surface water runoff may be diverted and/or filtered prior to leaving the disturbed area.
 2. All siltation and erosion control devices installed during the course of construction shall be maintained in proper working order at all times, and shall

not be removed until final stabilization of all disturbed areas or at the direction of the Engineer or local regulating authority.

- C. Temporary Seeding: All disturbed areas that have no construction activity in close proximity shall be temporarily seeded within 7 days of completion of the disturbing activities. Establish temporary cover for erosion control by seeding and/or mulching. This shall be accomplished as soon as rough grading work is done.
 - 1. When construction schedule requires seeding outside of the appropriate seeding dates, temporary seeding shall be installed per the detailed seeding schedules on the Drawings. Contractor shall reseed at an appropriate time.
- D. Steep Slopes: On all steep slopes, where erosion is probable, hydroseed areas as soon as possible in strict accordance with applicable provision, of Section 603, of the VDOT *Road and Bridge Specifications*. Maximum allowable slope to be seeded is 3:1.
- E. Cleaning of Roads and Streets: The Contractor shall maintain a vehicle wash rack or gravel bed at all vehicle egress areas. All vehicles shall be thoroughly cleaned of mud and silt before leaving the construction site to avoid tracking mud and silt onto roads, streets, and highways. In the event that tracking does occur, the Contractor shall immediately clean the street or road of all debris, mud or silt and shall pay all damages resulting therefrom. A daily survey of the condition of the adjacent streets and roads shall be made and recorded in the field log.
- F. Protection of Stormwater Systems: Stormwater structures which will receive runoff from the construction shall be protected from the buildup of mud or silt as detailed on the Drawings and shall be cleaned out as silt loading occurs and prior to end of construction.
- G. Fines for Siltation and Erosion Control: Any fines that are assessed upon the Contractor or Owner by the governing agency due to negligence of the Contractor shall be paid by the Contractor.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 02200
CLEANING OF SEWER MAINS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, material, tools, equipment and incidentals as shown, specified, and required to clean and inspect the pipelines in order to successfully complete the sewer sliplining.
- B. The cleaning Work required includes, but is not limited to, the following:
 - 1. Dewatering force main to allow for proper cleaning.
 - 2. Cleaning shall include the proper high-pressure water jetting, rodding, snaking, bucketing, brushing and flushing of sewers, laterals and manholes prior to inspection by closed circuit television.
 - 3. Light and heavy cleaning of existing pipeline.
 - 4. Cleaning shall dislodge, transport and remove all sludge, mud, sand, gravel, rocks, bricks, grease, roots, sticks, and all other debris from the interior of the sewer pipe.
 - 5. Removal of debris from the sewers.
 - 6. Disposal of waste and sediment.
 - 7. Cleaning up as the Work progresses and after the completion of all Work activities
 - 8. Pump and haul settled sewage from low point along force main alignment. Contractor shall be responsible for making provisions for fully draining the line.
 - 9. All other Work required for the complete and satisfactory cleaning of the sewer pipelines.

1.02 RELATED DOCUMENTS

- A. Drawing and Technical Specification Sections apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly pertinent to this Section, and this Section is directly pertinent to them.

1.03 GENERAL PRECAUTION

- A. Adhere to all federal, state and local requirements for safety in confined spaces.
- B. Take precautions to protect sewer mains from damage that might be inflicted by the improper selection of the cleaning process or improper use of the equipment.

- C. When using hydraulically propelled devices, take precautions to ensure that the water pressure created does not cause damage or flooding to public or private property.
- D. Do not surcharge the sewer beyond the elevation that could cause overflow of sewage into area waterways, homes, or buildings or onto the ground.
- E. Restore or repair any facility, public or private, which is damaged by Contractor actions at no cost to Goochland County.
- F. Specifications of the sewer cleaning equipment, including performance data on pump, hose diameter and length, tank capacity, and intended nozzles and root cutters, to be used on the job. Provide a chart that shows hose length and diameter versus volume and pressure.
- G. Specifications on the equipment to be used for light and heavy cleaning to remove sediment and debris at the downstream manhole of each reach to be cleaned.
- H. Valid waste disposal permit as approved by Goochland County.
- I. Plan for disposal of debris and sediment removed from the sewer lines. For each truckload or container of material disposed of, the Contractor shall submit to the Goochland County disposal receipts from the disposal facility indicating date and quantity of material disposed. Contractor shall be responsible for all fees associated with the sampling and analyses that may be required for the disposal of the material removed from the sewer.
- J. Contractor shall have experience in the cleaning of sewers. Documentation of experience shall be furnished to Goochland County upon request.

PART 2 PRODUCTS

2.01 MAINLINE SEWER CLEANING EQUIPMENT – JETTER:

- A. Pipe Sewer cleaning equipment shall consist of truck-mounted, high velocity hydro-cleaning equipment. The equipment shall be provided with a minimum of 500 feet of one-inch inner diameter high-pressure hose with a selection of high velocity nozzles, as required for the cleaning operation. The various nozzles shall produce a scouring action from 10 to 45 degrees in all size sewers to be cleaned. Use nozzles matched to the pumps and the site-specific cleaning requirements. Mount all nozzles with skids. A tiger tail or boot or downhole roller is required. A pressure gauge shall show operating pressure and a flow meter shall show flow rate. A table to translate shown pressures to delivery pressure shall accompany each cleaner unit.
- B. The pumps shall be capable of delivering a minimum 60 gpm at 2,000 psi at the nozzle head. A relief valve shall regulate pressure to the nozzle. The unit shall

carry its own water tank, minimum of 1,000 gallons, auxiliary engines and pumps, and a hydraulically driven hose reel.

- C. All controls shall be located so that the equipment can be operated above ground.

2.02 MAINLINE SEWER CLEANING EQUIPMENT – BUCKET/RODDER/CLAMSHELL:

- A. For sewer pipelines greater than 24-inches, CONTRACTOR may propose the use of buckets, rodders or clamshell equipment in addition to hydraulic jetting described in this Section. CONTRACTOR shall obtain approval of OWNER for use of all equipment not described in Part 2 of this Section.
- B. Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

2.03 VACUUM EQUIPMENT:

- A. Provide equipment capable of removing all sand, dirt, rocks, roots, and other debris from the sewer and manhole.
- B. Provide screens to prevent scoured debris from migrating downstream of the limits of the Work.

2.04 CUTTING EQUIPMENT:

- A. Mainline Sewers: Provide equipment capable of mechanically removing roots, grease, and intruding seal material. Devices shall include a root saw, spring blade root cutter chuck, chain cutter, or approved equal.

2.05 DEBRIS REMOVAL - > 5 CUBIC FEET:

- A. Bulk objects with volumes greater than 5 cubic feet each that requires equipment not described in Part 2 of this Section requires approval by Goochland County.

2.06 FLUSHING/CLEANING WATER:

- A. Provide all flushing water required for the cleaning of sewers either by truck or by an agreement with Goochland County.

PART 3 EXECUTION

3.01 GENERAL

- A. Pipe cleaning and inspection work shall be completed with a minimum of inconvenience and disturbance to the residents and the employees of the adjacent dwellings, commercial and government facilities and the traveling public.
- B. Precaution shall be taken to protect the existing sewer from damage that might be caused by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools which depend upon water pressure to provide their cleaning force are used, precautions shall also be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property or damage to internal pipe walls. Sewer damage as a result of the Contractor's cleaning operations shall be promptly reported to Goochland County who will provide direction regarding repairs. All repairs of damage created by the Contractor's cleaning efforts shall be at no additional cost to the Goochland County.
- C. Contractor shall take precautions to avoid damage or flooding to public or private property being served by the line being cleaned.
- D. Use properly selected equipment to remove all dirt, grease, rock and other deleterious materials and obstructions.
- E. All dirt, sand, rock, gravel, sludge, grease, coatings and other deleterious materials in the sewer that would interfere with installation of the sliplining sewer shall be removed. All debris resulting from the cleaning operation shall be placed in a suitable container and disposed of by the Contractor in accordance with local, state and federal laws and regulations.

END OF SECTION

**SECTION 02230
DEWATERING**

PART 1 - GENERAL

1.1 SUMMARY

Keep all excavations and site structures free from water during construction.

1.2 RELATED SECTIONS

Intent: The provisions and intent of the AGREEMENT, including the General Conditions, Supplementary Conditions, and other requirements of the Contract Documents apply to the WORK as specified in this section. WORK related to this Section is described throughout the Specifications.

1.3 SUBMITTALS

- A. Dewatering Plan: CONTRACTOR shall submit, for ENGINEER'S review, Drawings and data showing its proposed plan and required equipment for dewatering of all WORK areas. The Drawings and data shall include the planned method of dewatering excavations, wells, well points, sumps, collection and discharge lines, standby units proposed, and protective fills and ditches required for control of ground water, leachate and surface water.
- B. Schedule: The plan for dewatering shall be submitted within 15 days before the start of work. CONTRACTOR shall furnish such other information as may be required for ENGINEER'S complete understanding and analysis of the dewatering, grading and excavation plan.
- C. Engineer's Review: Review by ENGINEER shall not relieve CONTRACTOR of the responsibility for the adequacy of the dewatering plan or for furnishing all equipment, labor and materials necessary for dewatering the various parts of the WORK. If, during the progress of the WORK, it is determined by ENGINEER that the dewatering system grading and excavation Drawings, text and proposed methodology are inadequate, or that CONTRACTOR'S plan of construction is inoperative, CONTRACTOR shall, at its sole expense, furnish, install and operate such additional dewatering equipment and make such changes in other features of the Dewatering Plan or operation as may be necessary to perform the WORK in a manner satisfactory to ENGINEER.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 METHODS

- A. Method: Dewatering can be accomplished by ordinary pumping methods, by the use of underdrains or deep well points, whichever will produce the above results. The CONTRACTOR shall ensure that continuous dewatering can be provided through the method chosen.
- B. Location: All site WORK areas where surface and/or ground water flows, if any, will adversely impact construction shall be dewatered.
- C. Maintenance: All permanent improvements shall be constructed in areas free from water. Construct and maintain all permanent or temporary slopes, dikes, levees, drainage ditches, sumps, and observation wells necessary for the removal of water from WORK areas. Design, furnish, install, maintain, and operate all necessary pumping and other dewatering equipment required for dewatering the various site WORK areas and for keeping the foundation and other areas free from water from any and all sources.
- D. Schedule: All dewatering shall be performed in advance of grading, excavation and/or filling. The dewatering shall be accomplished in a manner that will prevent loss of fines from the foundation, will maintain stability of all excavated slopes and bottoms of excavations, and will permit all construction operations to be performed in the dry. Dewatering of excavations shall be performed to the extent required to permit placement of compacted fill materials in the dry and to prevent sloughing of the excavation side slopes.
- E. Requirements: Lower the ground water level a minimum of 3 feet below sub-foundation grade or as recommended by Geotechnical Engineer prior to sub-foundation preparation and placement of foundation materials. During the placement and compaction of fill or bedding materials, the water level shall be maintained at this level in order that the required compaction can be achieved.

Where conditions are such that running or standing water occur in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps and suitable means such as well points or previous underdrain bedding until the pipe has been installed and the backfill has been placed to a efficient height to prevent pipe flotation.

No installation will be permitted in trenches unless the subgrade is dry. If, in the opinion of the ENGINEER, the CONTRACTOR has failed to obtain a dry subgrade by use of all known methods of trench dewatering, the ENGINEER may then order the CONTRACTOR to excavate below grade and place sufficient selected fill material over the trench bottom. Additional excavation and fill shall meet the requirements of Division 2 and be provided and installed at no extra cost to the Owner.

3.2 PROTECTION OF FOUNDATIONS AND EXISTING FACILITIES

- A. Contingency: Furnish standby equipment of sufficient size and capacity to insure continuous operation of the dewatering system. Any damage to structures due to a failure of dewatering equipment shall be repaired by CONTRACTOR at its expense, to the satisfaction of ENGINEER. CONTRACTOR may consider the use of recharge systems or other methods of protection of existing facilities.
- B. Completion: Dewatering shall be maintained in the WORK areas for as long as is necessary for the completion of WORK. Upon completion of the dewatering and control of water operation, all temporary dewatering facilities shall be removed in a manner satisfactory to ENGINEER.

3.3 DISPOSAL OF DRAINAGE WATER

The disposal of all water from the dewatering and control of water operation and surface drainage shall be accomplished in a manner to have no detrimental effect on any of the new or existing facilities or cause siltation of existing streams. The method and location of disposal of all water shall be subject to the approval of ENGINEER and OWNER; in addition, no water shall be drained into WORK completed or under construction without prior consent of ENGINEER or OWNER. All Commonwealth of Virginia erosion and sediment control requirements shall be met.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 02300
EARTHWORK**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Preparing subgrades.
 2. Excavating and backfilling.
 3. Drainage course for slabs-on-grade.
 4. Subbase course for concrete walks and pavements.
 5. Base course for roadway.

1.2 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation. Materials for backfill shall be the same as Compacted Structural Fill as described herein.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Excavation: Removal of material encountered above design subgrade elevations.
1. Additional Excavation: Excavation below design subgrade as directed by Architect/Engineer. Additional excavation and fill shall meet the requirements of Division 2 and be provided and installed at no extra cost to the Owner.
 2. Unauthorized Excavation: Excavation below design subgrade or beyond indicated dimensions without approval by Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- J. Design Subgrade: Generally, surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.
 - 1. Unless described otherwise, design subgrade for structures is defined as the bearing elevation of concrete footings or structural slabs, extending one foot beyond the edge of the structure and extending up on a 2.5H:1V slope to existing grades.
- K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- L. Rock: Mass Rock is defined as any material that cannot be dislodged by a Caterpillar Model No. D-8 heavy-duty tractor, or equivalent, equipped with a hydraulically operated, single-tooth power ripper without the use of hoe ramming or blasting. Trench rock is defined in terms of a Caterpillar Model No. 325 hydraulic excavator, or equivalent, instead of a Caterpillar D-8 tractor. These classifications do not include materials such as hardpan, loose rock, concrete, cemented gravel, or other materials that can be removed by means other than hoe-ramming or blasting, but for reasons of economy in excavating, the contractor chooses to remove by hoe-ramming or blasting. Mass and trench rock do not include boulders less than 1 cubic yard in volume.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify the local utility locator service Miss Utility in the area where Project is located before beginning earth moving operations.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner, Architect and Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's and Architect's or Engineer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.

- D. Demolish and completely remove from site existing utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 02 Section "Siltation and Erosion Control," and Division 02 Section "Site Clearing," are in place.

1.4 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency hired by Contractor and qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM e 548 for testing indicated.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. It is anticipated that work outside previously excavated material will be comprised of rock and/or hard rock. The excavation is unclassified for this project.
- B. General: Provide approved borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- C. Compacted Structural Fill: ASTM D 2487 Soil Classification Groups CL, ML, SC, SM, SP, SW, GC, GM, GP, or GW, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- D. Unsatisfactory Soils: ASTM D 2487 Soil Classification Groups MH, CH, OL, OH, and PT, a combination of these group symbols, or as determined by the geotechnical engineer.
- E. Borrow: On-Site soils meeting compacted structural fill or Off-Site borrow materials meeting Soil Classification Groups SC, SM, SP, SW, GC, GM, GP or GW per ASTM D-2487; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- F. Backfill and Fill: Compacted Structural Fill.
- G. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch(38-mm) sieve and not more than 12 percent passing a No. 200(0.075-mm) sieve.
- H. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch(38-mm) sieve and not more than 8 percent passing a No. 200(0.075-mm) sieve.

- I. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch(25-mm) sieve and not more than 8 percent passing a No. 200(0.075-mm) sieve.
- J. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch(38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieves.
- K. Sand: ASTM C33; fine aggregate, natural or manufactured sand.
- L. Lean Concrete: Self compacting, flowable concrete material produced from the following:
 - 1. Portland Cement: ASTM C 150, Type II.
 - 2. Fly Ash: ASTM C 618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM c33, 3/8-inch nominal maximum aggregate size.
 - 4. Foaming Agent: ASTM C 869.
 - 5. Water: ASTM C 94, C94M.
 - 6. Air-Entraining Admixture: ASTM C 260.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, freezing temperatures or frost, and other hazards created by earthwork operations. Provide protective insulating materials as necessary.
- B. 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.
- C. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- D. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

3.2 EXCAVATION

- A. Excavation to design subgrade shall be classified regarding rock and excavations below design subgrade, and unclassified regarding other materials. Excavation of rock materials and unsuitable materials as defined herein, shall be based upon the quantities shown in the bid form.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Compensation for rock within the design subgrade envelope shall be made based upon unit prices set forth in the bid form.
 3. Compensation for approved removal of rock and replacement with compacted structural fill beyond design subgrade shall be based upon unit prices set forth in the bid form.
 4. Compensation for approved removal of unsatisfactory soil materials and replacement with compacted structural fill beyond design subgrade shall be based upon unit prices set forth in the bid form.
- B. Excavate for structures, pavements, and walks to indicated elevations and dimensions. Extend excavations for placing and removing concrete formwork, for installing services and other construction, and for inspections. Trim bottoms to required lines and grades to leave solid base to receive other work.
- C. Proof roll subgrades, before placing concrete, filling or placing aggregate courses, to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades. Unsuitable areas shall be undercut and replaced with compacted structural fill at the direction of the testing agency.
1. All undercut shall be surveyed to determine volume removed. No truck counts shall be allowed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities. The contractor shall use pumps, site drainage or other measures to minimize water levels to the satisfaction of the testing agency.
- E. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete may be used to backfill to original subgrade elevation when approved by Engineer.
1. Fill unauthorized excavations under other construction as directed by Engineer.
- F. Stockpile borrow materials and satisfactory soil materials, without intermixing, in shaped, graded, drained, and covered stockpiles. Stockpile soil materials away from edge of excavations and outside drip line of remaining trees.
- G. All excavations shall be braced or sloped in accordance with current OSHA regulations. Excavations greater than 20 feet deep require in writing a slope stability evaluation for open excavations by a licensed geotechnical engineer or a sheeting design professional for sloped excavations. The evaluation shall be prepared and sealed by a professional engineer registered in the Commonwealth of Virginia. The specialty contractor shall have at least five years experience in this type work and shall submit plans through the general contractor for review by the Engineer. It is the contractor responsibility to provide this design to the Engineer for review prior to beginning deep excavations.

3.3 BACKFILLS AND FILLS

- A. Fill: Place and compact fill material in layers to required elevations. Plow, scarify, bench, or break up sloped surfaces steeper than to 4 horizontal to 1 vertical so fill material will bond with existing material.
- B. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.
- C. Compaction: Place backfill and fill materials in layers not more than 8 inches(200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches(100 mm) in loose depth for material compacted by hand-operated tampers. Only light hand-operated equipment should be used to compact back fill against walls.
- D. Compact soil to not less than the following percentages of maximum dry density according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 95 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 90 percent.
- E. Grading: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1 inch (25 mm) and pavements and areas within building lines to plus or minus 1/2 inch (13 mm).
- F. Subbase and Base Courses: Under pavements and walks, place subbase course on prepared subgrade. Place base course material over subbase. Compact to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- G. Under slabs-on-grade, place drainage course on prepared subgrade. Compact to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports. Agency to be approved by Engineer.
- B. Require testing agency to test and inspect subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained to the satisfaction of the geotechnical engineer.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities.
- E. Testing Agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM d 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. or less of paved area or building slab, but in no case fewer than one test per lift.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests per wall.
- F. When testing agency reports that subgrades, fills or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.5 PROTECTION AND DISPOSAL

- A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 02325
TRENCHING, AND BACKFILLING**

PART 1 - GENERAL

- 1.1 This section is designed to provide the minimum requirements for trenching and backfilling of pipe trenches. Should the drawings provide specific details for specific installations the drawing requirements shall take precedent. When working in VDOT right of ways the VDOT requirements shall take precedent.
- 1.2 Earthwork and trenching **EXCAVATION IS UNCLASSIFIED** and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. No extra payment will be made, regardless of the suitability or unsuitability of on-site soils for the disposal or importing of soils to the project site.
- 1.3 Locate existing utilities, culverts and structures, above or below ground, before any excavation starts. Coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on the Contract Drawings or when locations differ from those shown on the Contract Drawings, notify the Owner's Representative for instructions before proceeding.
- 1.4 Explosives
 - A. No explosives will be used on this project.
- 1.5 Testing and Inspection
 - A. In trenching operations, compaction testing shall be performed at the start of trenching, in increments of approximately 1000L.F. of trench and at all commercial driveway entrance crossings.
 - B. Allow Owner's Representative to approve subgrade and each fill layer, or for every 2,000 square feet of fill placed, whichever results in more frequent inspection.
 - C. The degree of compaction obtained shall be verified by means of field density tests made by an Independent Laboratory. Where tests indicate a deficiency in degree of compaction, the Contractor shall correct such conditions and the Testing Laboratory shall make additional tests in order to verify that the corrected work has been satisfactory. The Testing Laboratory shall provide four (4) certified copies of all test reports.
- 1.6 Definitions
 - A. Excavation: Removal of material encountered to required subgrade and/or subsoil elevations indicated, and the subsequent disposal of materials removed.
 - B. Fill: Material placed and compacted above the level of the subsoil which existed before construction of the project.
 - C. Mass Rock is defined as any material that cannot be dislodged by a Caterpillar Model No. D-8 heavy-duty tractor, or equivalent, equipped with a hydraulically operated, single-

tooth power ripper without the use of hoe ramming or blasting. Trench rock is defined in terms of a Caterpillar Model No. 325 hydraulic excavator, or equivalent, instead of a Caterpillar D-8 tractor. These classifications do not include materials such as hardpan, loose rock, concrete, cemented gravel, or other materials that can be removed by means other than hoe-ramming or blasting, but for reasons of economy in excavating, the contractor chooses to remove by hoe-ramming or blasting. Mass and trench rock do not include boulders less than 1 cubic yard in volume. Boulders larger than 1 cubic yard in volume will be considered rock for payment purposes.

- D. Subgrade: The undisturbed earth, or the compacted soil layer, immediately below granular subbase, drainage fill, or topsoil materials.
- E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.
- F. Unauthorized Excavation: Removal of materials below indicated subgrade elevations or beyond horizontal excavation dimensions without specific direction of the Owner's Representative.
- G. Undercut Excavation: When excavation has reached required sub-grade elevations, notify the Owner's Representative who will make an inspection of conditions. If unsuitable bearing material is encountered at required subgrade elevations, carry excavations deeper as directed by the Owner's Representative.
- H. Unsuitable Material: Material such as clay mass, frozen materials, cinders, ashes, refuse, and vegetable, organic material or any other material deemed unsuitable by the Owner's Representative. Unsuitable material shall be removed and replaced with suitable material as specified herein for the intended use.
- I. Bedding. Bedding is the material placed under the pipe.
- J. Haunching. Material that is placed on the sides of the pipe to the spring line.
- K. Initial Backfill. Material placed on top of the haunch material until 12" above the pipe.
- L. General Backfill. Material Placed on top of the initial backfill up to grade.

1.7 Suitability of Materials

- A. Unless otherwise noted, the Contractor shall be responsible for the disposal of excess material (including but not limited to undercut, root mat and excess topsoil and fill material), obtaining borrow material and the suitability of all on-site material above subgrade.

PART 2 - PRODUCTS

2.1 Product Definitions

- A. Clean Earth Fill: Approved material free of debris, roots, frozen materials, organic matter, rock or gravel larger than 2 inches in any dimension or other harmful matter and be classified as ML or better material in accordance with the Unified Soils System, ASTM D-2487.

- B. Fine Aggregate: #9 or #10 stone as per VDOT Road and Bridge Specifications Section 203 or Grade A or Grade B fine aggregate as per VDOT Road and Bridge Standard Section 202.
- C. Coarse Aggregate: #57 stone as per VDOT Road and Bridge Specifications Section 203.
- D. Crusher Run Aggregate: #26 as per VDOT Road and Bridge Specifications Section 205.
- E. Select Material: Type I or II according to Section 207 of the VDOT Road and Bridge Specifications.
- F. Shoulder Stone: Aggregate material #21A or #21B as per VDOT Road and Bridge Specifications Section 209.
- G. Topsoil: In trenching operations, topsoil shall be the top 6 inches of original soil from the trench. Otherwise, topsoil shall be fertile, friable loam, containing not less than 2 percent by weight of finely divided, decomposed vegetation. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than 1/2 inch, stones larger than 1/2 inch diameter and other material toxic or harmful to growth.
- H. Geotextile Fabric: Woven or nonwoven polypropylene or polyester equaling or exceeding the following tests.
 - 1. Weight ASTM D-1910 3.9 oz per sq. yd. minimum
 - 2. Grab Tensile Strength ASTM D-1682 200 lbs. minimum
 - 3. Trapezoid Tear Strength ASTM D-1117 100 lbs. minimum
 - 4. Grab Modulus (Mullen Burst) ASTM D-3786 370 lbs. minimum

PART 3 - EXECUTION

3.1 General Trench Excavation

- A. Remove vegetation, debris, unsatisfactory materials and harmful materials prior to placement of fill. Plow, strip, or break up sloped surfaces steeper than 4 to 1 so that fill material will bond with existing surface.
- B. Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements. Deposit in storage piles separate from other excavated material.
- C. Provide adequate and positive site drainage throughout construction. Keep excavations free of water while work is being performed and until backfilled. Where underground streams or springs are found, provide temporary drainage and notify the Owner's Representative.
- D. Excavate unsatisfactory soil materials encountered that extend below required elevations, to the additional depth as directed by the Owner's Representative.
- E. Where rock is encountered so that a manhole, vault, or other structure will bear on rock, the rock shall be used to support the foundation. When only a portion of the foundation will bear on rock, the Contractor shall excavate the rock at least 8 inches below the foundation and provide at least 8 inches of aggregate fill.

- F. Where unauthorized excavation has been carried below authorized depth, backfill and compact in the same manner as specified for authorized excavations of same classification, unless otherwise directed by the Owner's Representative.
- G. Stockpile excavated soil material satisfactory for backfill or fill until required. Place, grade and shape stockpiles for proper drainage. Do not store within drip lines of trees indicated to remain.
- H. Sheeting and Shoring
 - 1. Sheeting and shoring shall be provided as necessary to construct and protect the excavation, structures of all types, and as necessary for the safety of the employees.
 - 2. All sheeting and bracing shall be removed unless directed otherwise by the Owner's Representative, in such a manner so the construction or other structures are not endangered. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately with approved material and compacted by ramming with tools especially adapted for that purpose, or by other means directed by the Owner's Representative.
 - 3. All sheeting and bracing which is left in place shall be cut to a depth of eighteen inches below the final grade line. The cut off ends shall be removed from the site.
- I. Remove surplus or unsuitable material and dispose of the materials off the site at no additional cost to the Owner.
- J. Dewatering
 - 1. Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water should be removed by pumps and suitable means such as well points or pervious underdrain bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation (see Section 02230 – Dewatering).
- K. Trenching
 - 1. Excavate to the lines and grades indicated for pipelines and structures making proper allowance for pipe bedding materials, pipe bells and concrete form work.
 - 2. Excavate pipeline trenches with vertical walls. Maintain trench width within allowable trench width from bottom of trench to a point 12 inches above top of pipe.
 - 3. Where rock is encountered, excavate 6 inches below the pipe bottom and provide stone to bed the pipe.
 - 4. Where unsuitable soil is encountered, excavate to depth determined by the Owner's Representative and replace with coarse granular fill (pipe bedding) thoroughly and uniformly compacted.

3.2 Backfilling of Pipe and Trenches

- A. The following is the minimum requirement for backfilling of pipes and trenches. Should the drawings indicate a deviation from these minimum specifications the more stringent shall apply.
- B. Pipe Bedding
 - 1. Ductile Iron Pressure Pipe
 - a. Ductile iron pipe shall be laid in a flat bottom trench on undisturbed earth. If rock is encountered at the bottom of the trench, bedding shall be a minimum of six inches of compacted course aggregate or crusher run aggregate. Trench bottom shall be hand excavated for bell holes at all joints. Over rock, the six-inch minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
 - 2. Ductile Iron Gravity Pipe
 - a. Ductile iron pipe shall be laid on a minimum of 4 inches of compacted course aggregate or crusher run aggregate. If rock is encountered at the bottom of the trench, bedding material shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. Over rock, the six-inch minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
 - 3. PVC, HDPE, PE and CT Pressure Pipe 3 inches and smaller
 - a. PVC, HDPE, PE and CT pipe shall be laid on a minimum of 4 inches of compacted fine aggregate placed upon undisturbed earth. If rock is encountered at the bottom of the trench, fine aggregate shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. The minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).
 - 4. PVC Pressure Pipe 4 inches and larger
 - a. PVC pressure pipe shall be laid on a minimum of 4 inches of compacted course aggregate or crusher run aggregate placed upon undisturbed earth. If rock is encountered at the bottom of the trench, course aggregate shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. The minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).

5. PVC Gravity Pipe 4 inches and larger

- a. PVC gravity pipe shall be laid on a minimum of 4 inches of compacted course aggregate or crusher run aggregate placed upon undisturbed earth. If rock is encountered at the bottom of the trench, bedding shall be a minimum of six inches. Trench bottom shall be hand excavated for bell holes at all joints. The minimum depth of bedding shall be maintained at all joints or other pipe appurtenances. Bedding material shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).

C. Haunching

1. Haunching material shall be the same as the bedding material. Material shall be placed and consolidated under the pipe haunch to provide adequate side support to the pipe while avoiding both vertical and lateral displacement of the pipe from proper alignment. Haunching is placed to the pipe springline and shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698 (standard Proctor).

D. Backfilling Trenches

1. All trenches shall be backfilled immediately after the pipes and appurtenances are laid therein with the exception of pressure pipe, where joints are to remain uncovered until after pressure testing is completed.
2. Initial Backfill
 - a. Ductile Iron Pressure Pipe and Gravity Pipe
 - 1) Initial backfill shall be with select material. Initial backfill shall begin at the springline of the pipe and shall be placed in six-inch layers up to a minimum level of 12 inches above the crown of the pipe. Initial backfill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698.
 - b. PVC Pressure Pipe 4" and larger
 - 1) Initial backfill shall be with select material. Initial backfill shall begin at the springline of the pipe and shall be placed in six-inch layers up to a minimum level of 12 inches above the crown of the pipe. Initial backfill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698.
 - c. PVC, HDPE, PE and CT Pressure Pipe 3" and smaller
 - 1) Initial backfill shall be with the same material as the haunching material and shall be placed in 6" layers to a minimum level of 6" over the crown of the pipe. The remainder of the initial

backfill shall be with select material to a minimum level of 12" above the crown of the pipe.

d. Gravity Pipe

- 1) Initial backfill shall be with select material. Initial backfill shall begin at the springline of the pipe and shall be placed in six-inch layers up to a minimum level of 12 inches above the crown of the pipe. Initial backfill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D698.

E. Final Backfill

1. General

- a. Final backfill for trenches shall be with general backfill material. Final backfill not subjected to vehicular traffic or greater than 5' feet from the edge of pavement shall be placed in layers no greater than one foot thick and compacted to at least 90 percent maximum density as determined by ASTM D698. Final backfill shall not contain stones larger than 6 inches in their greatest dimension, the stones shall not be in excess of 20 percent of the volume of backfill material, and such stones shall be well distributed throughout the mass. Topsoil (in grassed areas) shall be deposited in the final layer of backfill to guarantee the areas will be returned to original or better conditions.

2. Roadways and Pavement

- a. Where excavation has been made through pavement, subgrades of roadways under construction, where subgrades are undercut by excavation, or where excavation is within 5' of edge of pavement, backfilling shall be performed with shoulder stone. Backfill material shall be placed in layers not greater than six inches thick, with each layer thoroughly compacted to 95 percent of maximum density as determined by ASTM D698. Work within VDOT rights-of-way shall meet all requirements of the Virginia Department of Transportation.

3.3 Compaction

- A. Percentage of Maximum Density Requirements. Compact each layer of fill or backfill to not less than the following percentages of the maximum density at optimum moisture content as determined by ASTM D 698 (AASHTO T-99). Compact soil materials using equipment suitable for materials to be compacted and work area locations.

1. 95 percent beneath and within 25 feet of buildings and structures, including those shown for future construction.
2. 95 percent beneath pavements, walks, road shoulders, including those shown for future construction or proposed, 95 percent up to 12 inches above top of pipes.
3. 90 percent in other unpaved areas.

4. If the density of the adjacent soil is more than the density specified, compact to a density not less than the density of the adjacent soil in non-traffic areas only.
- B. Use power-driven hand tampers for compacting materials adjacent to structures and in areas inaccessible to rollers. Use equipment capable of adding moisture to the soil material as determined by moisture-density tests. Where required, uniformly apply water to the surface of the subgrade or layer of soil material in such a manner as to prevent free water appearing on the surface, either during or subsequent to compacting operations.
- C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified percentage of maximum density.
- D. Do not place or compact material that is muddy, frozen, or contains frost or ice.

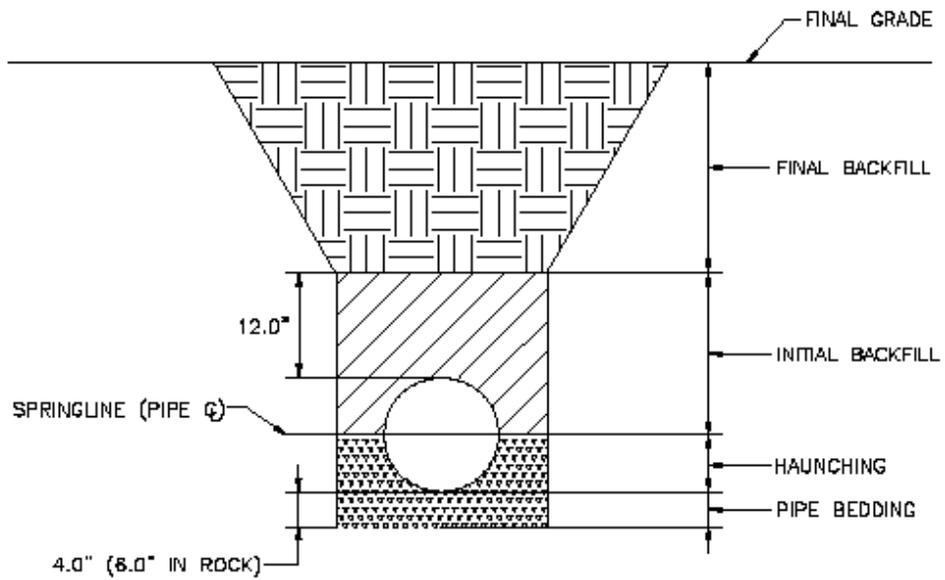
3.4 Pipe Bedding and Backfill

- A. Place clean earth fill to obtain elevations shown on the drawings. Do not place fill on muddy or frozen areas.
- B. When the existing ground surface has been disturbed and has a density of less than that specified for the particular area classification, scarify the ground surface, pulverize, adjust moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density. Excavate depressions caused by removal of stumps or other clearing operations to firm subgrade. Fill with clean earth fill.
- C. Place backfill and fill materials in loose lifts no less than 4 inches and no more than 8 inches in depth. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.
- D. Place backfill materials evenly adjacent to structures. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
- E. Backfill excavations to excess elevations (above the finished grade) to allow for shrinkage and settlement. Excess elevation under paved and surfaced roadways and parking areas shall not exceed 2 inches.
- F. Place and compact bedding in accordance with the these specifications below bottom of pipe prior to laying pipe. Where directed by the Owner's Representative place soil stabilization fabric in the excavation before placing bedding. Place fabric in accordance with the manufacturer's recommendations.
- G. Compact pipe bedding using compaction equipment suitable for the situation. If necessary hand tamp and rod as required to prevent settlement.
- H. Unless otherwise required, backfill trench to a compacted depth of one foot over the pipe with clean earth fill. Backfill shall be placed uniformly on each side of the pipe and compacted in layers not exceeding 6 inches. Do not backfill when the subgrade is muddy or frozen or when the backfill material is frozen or muddy.

3.5 Grading.

- A. In the VDOT R-O-W Grade in compliance with VDOT specifications. Uniformly grade areas within limits of grading, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Protect newly graded areas from traffic and erosion. Where compacted areas settle, or are disturbed by subsequent construction or adverse weather, scarify the surface, reshape and compact to the required density, with additional fill material if required. Use hand tamper for recompaction over underground utilities.
- C. Where topsoiling is specified, excavate or fill below finished grades shown, leaving space for topsoiling.
- D. Where not otherwise shown on the Contract Drawings, all disturbed areas shall be restored to the original grade.
- E. Tolerances
 - 1. Shape subgrade under pavements to line, grade, and cross-section to within 1/2 inch of required subgrade elevations.
 - 2. Finish areas to receive topsoil to within 1" foot of required elevations.

Trench Cross-section Terminology



TRENCH CROSS-SECTION TERMINOLOGY

END OF SECTION

**SECTION 02400
SEWER SLIPLINING**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The work specified in this Section includes requirements for slip lining existing Fiberglass Reinforced Plastic (FRP) pipe with new High Density Polyethylene Pipe (HDPE).
- B. Insertion pits and sliplining plans as shown on the project drawings as a baseline. The proposed approach includes a combination of open cut installation as well as sliplining installation. The Contractor will develop an overall installation approach and sliplining procedure to install a new HDPE pipeline from the connection point near the pump station to the downstream tie in point at the end of the project. Alternative methods of installation may be accepted by the ENGINEER and OWNER.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. ASTM D3350 - Standard Specification for Polyethylene Plastics Sewer Pipe and Fitting Materials.
- B. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- C. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data shall be submitted for all pipe and fittings for approval. Data shall indicate compliance with specifications including thickness, materials, working pressure and joints.
- B. Sliplining Insertion & Assembly:
 - 1. Contractor shall submit an installation plan that shows the installation of HDPE pipe through the use of open-cut installation and sliplining. The sliplining plan will include insertion and assembly plan outlining the following:
 - a. Insertion Pit Location & Dimensions
 - b. Insertion Pit Support of Excavation
 - c. Pipe staging and laydown

- d. Sequencing of Insertion and Connection
- e. Final Assembly and Testing

PART 2 PRODUCTS

2.01 MATERIALS

- A. HDPE shall be used as material of construction to perform the sliplining and will serve as carrier pipe after completion. See specification Section 02500 for material and performance requirements

PART 3 EXECUTION

3.01 INSTALLATION

- A. Dewatering: Pump Station shall be offline during construction. Contractor shall submit water control/dewatering plan for approval prior to beginning of construction. Settled sewage must be fully drained from the line prior to construction. Contractor is solely responsible for the means and methods utilized to perform the necessary dewatering.
- B. Cleaning: Prior to the sliplining operation, all pipe will need to be cleaned of heavy solids and debris to allow for installation of the new HDPE pipeline.
- C. Pipe Grouting: Annular space grouting shall not damage the line and shall conform to the manufacturer's requirements. See Specification Section 02600 – Backfill Grouting.
- D. Pipe Handling: See HDPE specification section 02500.

END OF SECTION

SECTION 02500
HIGH-DENSITY POLYETHYLENE PIPING AND FITTINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. High-Density Polyethylene (HDPE) piping and appurtenances for the use of installation of sanitary force main systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 - General Requirements.
3. Section 01020 – Project Materials
4. Section 01300 – Submittals

1.2 QUALITY ASSURANCE

A. Manufacturer's Requirements

1. All piping shall be made from compound conforming to a minimum cell classification of PE 445474C or PE 445574C per ASTM D3350.

B. Fusion Technician Requirements

1. Fusion Technicians shall be fully qualified by the pipe manufacturer to install, handle and fuse HDPE pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

C. Manufacturer and Installer Qualifications:

1. HDPE pipe manufacturer shall have experience in manufacturing HDPE pipe of similar size and type to that specified herein. For a manufacturer to be determined acceptable for providing HDPE pipe, they must show evidence of manufacturing a minimum of 25,000 linear feet of HDPE piping and fittings and ten years experience in the design and manufacturing of HDPE pipe and fittings of similar size, type and application (water/wastewater) as specified herein.

2. Installer shall have experience in installing HDPE pipe and fittings and fusion of similar diameter and configuration as included herein. For installer to be determined acceptable for installing HDPE pipe and fittings, they must show evidence of installing a minimum of 5,000 linear feet of HDPE piping and fittings and ten years of experience for pipe and fittings of similar size, type and application (water/wastewater) as specified herein.
- D. Pipe and HDPE fittings shall be by the same manufacturer and not have been used in any previous application. HDPE fittings shall be used only where specifically indicated on the plans.

1.3 REFERENCE STANDARDS:

A. ASTM International (ASTM):

1. D3350, Standard Specification for Polyethylene Plastics Pipe and Fitting Materials
2. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
3. F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
4. F2206, Standard Specification for Fabrication Fittings of Butt-Fused Polyethylene (PE)
5. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
6. D2837, The Hydrostatic Design Basis for Thermoplastic Pipe Materials
7. F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
8. F2620, Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings.
9. D3216, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
10. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

B. American Water Works Association (AWWA):

1. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Water Distribution and Transmission
2. AWWA M55, PE Pipe – Design and Installation

- C. Plastics Pipe Institute (PPI)
 - 1. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
 - 2. PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe
 - 3. PPI Material Handling Guide for HDPE Pipe and Fittings
 - 4. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects

1.4 SUBMITTALS

- A. Refer to Specification Section 01300 – Submittals for requirements for the mechanics and administration of the submittal process.
- B. Qualifications
 - 1. Manufacturer shall submit documented experience in manufacturing HDPE pipe and fittings similar in nature to the proposed work detailed in the Contract Documents.
 - 2. Contractor shall submit documented experience including project name, description, size and length of pipe, pipe materials, owner name and contact information and any other pertinent information for projects similar in nature to the proposed work detailed in the Contract Documents.
- C. Testing Plan:
 - 1. Testing Plan: Submit a minimum of one week prior to testing and include at least the information that follows.
 - a. Maximum testing length of 3,000 LF per AWWA requirements.
 - b. Testing dates.
 - c. Piping systems and section(s) to be tested as indicated on a copy of the approved piping layout drawings.
 - d. Test type.
 - e. Method of isolation.
 - f. Calculation of maximum allowable leakage for piping section(s) to be tested.
 - 2. Certifications of Calibration: Testing equipment.
 - 3. Certified Test Report.

D. Shop Drawings:

1. Refer to Specification Section 01300 – Submittals for requirements for the mechanics and administration of the submittal process.
2. Product technical data for pipe and appurtenances including:
 - a. Acknowledgement that products submitted meet the requirements of standards referenced.
 - 1) Acknowledgement shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating or supplying company and at a minimum include:
 - a) Name and location of the Work.
 - b) Name and address of the Contractor.
 - c) Quantity and date or dates of shipment and/or delivery to which the certificate applies.
 - d) Name of the manufacturing or fabricating company.
 - b. Certificates:
 - 1) Certifications shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating, or supplying company.
 - c. Test reports:
 - 1) All laboratory test reports, requested by the Owner, shall be provided at no additional cost and shall show the following information:
 - a) Date or dates of testing. Test data should be the most current available and be within 5 years of the Bid opening.
 - b) The specified requirements for which testing was performed.
 - c) Results of the test or tests.
 - d. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation for each type of pipe.
3. Fabrication and/or layout drawings with information including:
 - a. Scale (minimum scale 1 IN equals 10 FT).
 - b. Dimensions of pipe lengths and fittings.

- c. Invert or centerline elevations of pipe crossings.
 - d. Acknowledgement of bury depth requirements.
 - e. Details of transitions, tapping locations, thrust blocks, and related appurtenances.
 - f. Line slopes and vent locations.
4. Details of temporary restraints required for testing.
- E. Fusing
- 1. Submit documents related to execution of fusion process, including but not limited to:
 - a. Certificates for all workers performing fusion, demonstrating they have been fully trained on equipment to be used for the fusion
 - b. List of equipment to be used during fusion process
 - c. Literature from the manufacturer/supplier of the fusion equipment that indicated required temperature and pressure to which the pipe shall be heated and pressed together and where such readings are indicated on the equipment.
- F. Field quality control documents:
- 1. Test reports summarizing results of the following final field tests:
 - a. Backfill Compaction Test
 - b. Hydrostatic Pressure Test
 - c. Leakage Test
- G. Lay Schedule

1.5 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall use all means necessary to protect pipe materials, fittings, valves and products before, during, and after installation. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe, pipe linings and pipe coatings. The Contractor shall comply with AWWA M55 (HDPE), and, the referenced AWWA Standards for shipping, handling and storage procedures.
- B. Protect pipe and appurtenances during handling using methods recommended by the manufacturer and approved by the Engineer.
 - 1. Pipe shall be transported to the job site on padded bunks or oak timbers and secured with nylon tie down straps to adequately protect the pipe and coating.

2. Use of bare cables, chains, hooks, metal bars or narrow skids in the contact with coated and/or lined pipe is not permitted.
 3. Handle only from the outside of the pipe and fittings. Lifting by inserting forks into the pipe or fittings is not permitted.
 4. No metal tools or heavy objects shall be permitted to come in contact unnecessarily with the finished coating.
- C. Prevent damage to pipe during transit.
1. Pipe with noticeable abrasions, scars and blemishes shall be rejected. If repair of satisfactory quality cannot be achieved, replace damaged material in its entirety immediately.
 2. Any damage to linings or coatings discovered during the examination shall be repaired in accordance with the manufacturer's recommendations to the satisfaction of the Owner, before proceeding with the Work
 3. The Owner reserves the right to reject defective material shipped to and/or stored on site, and to examine the same to determine if damage has occurred prior to installation.
- D. Store materials in a manner to keep interior free from dirt and foreign matter and protect from the elements.
1. The pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, or other method approved by the Owner. Stacking shall conform to manufacturer's recommendations and/or AWWA M55.
 2. Storing on stones or other hard material that can damage the pipe exterior is not permitted.
 3. Storing pipe on top of pipe is not permitted.
 4. Materials subject to corrosion shall be protected in accordance with the manufacturer's recommendations.
 5. Materials subject to UV degradation shall be protected in accordance with the manufacturer's recommendations.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers of Pressure Rated HDPE systems are acceptable:
1. HDPE Pipe and Fittings:

Eastern Goochland Force Main
Rehabilitation and Replacement

02500-6

High-Density
Polyethylene Piping and Fittings

- a. CPChem Performance Pipe
 - b. JM Eagle Manufacturing Pipe, Inc.
 - c. AGRU America
 - d. Or approved equal.
- B. Submit request for substitution in accordance with Specification Section 00700, General Conditions.

2.2 HDPE PIPE

A. Pipe:

1. HDPE pipe shall be PE4710 HDPE in accordance with ASTM F714 and AWWA C906-15 and shall have a nominal IPS (Iron Pipe Size) outside diameter unless otherwise specified. The nominal size, pressure classification rating, and SDR of the pipe shall be as specified in the Contract Documents. All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. Pipe sizes 3” and larger shall have a manufacturing standard of ASTM F 714.
2. A Pipe shall be homogeneous and uniform throughout; shall be free of injurious defects such as visible cracks, holes, foreign inclusions, voids, and blisters; and shall have uniform color and physical properties according to the provisions of AWWA C906-15.
3. Commercial virgin PE Compounds shall meet ASTM D3350 physical property requirements and shall be classified per ASTM D3350 as shown in Table 1 of AWWA C906-15. The compound shall have HDB (Hydrostatic Design Basis) ratings at 73°F (23°C) and at 140°F (60°C) and HDS (Hydrostatic Design Stress) ratings at 73°F (23°C) determined in accordance with ASTM D2837 and PPI TR-3 (Policies and Procedures for Developing Recommended Hydrostatic Design Stress for Thermoplastic Pipe Materials).
4. The PE Compound in the pipe shall contain color and ultraviolet (UV) stabilizer meeting the requirements of ASTM D3350 Codes C or E. Code C compounds shall contain 2 to 3 percent carbon black when material from the pipe is tested in accordance with Section 4.3.11 of AWWA C906-15. Code E compounds used for solid color pipe, color stripes, or color layer (shell) shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure. Color PE compounds used for stripes or color layers shall be of the same materials designation codes as the pipe material, varying only by color and UV stabilizer.
5. Clean rework materials derived from pipe production by the same manufacturer are acceptable as part of a blend with virgin PE compound meeting section 4.2.1 of AWWA C906-15 for the production of new pipe, including sections 4.2.3.1, 4.2.3.2, 4.2.3.3 and 4.2.4.

6. HDPE fittings or components shall be molded. Molded fittings shall meet the requirements of AWWA C906-15 and the requirements of ASTM D2683 for socket-type fittings, or ASTM D3261 for butt-type fittings. Electrofusion fittings shall have a manufacturing standard of ASTM F1055.
7. High Density Polyethylene pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
8. High Density Polyethylene pipe shall be manufactured in a standard 40' nominal length or custom lengths as specified, and shall be black with a green identification stripe.
9. Pipe shall be marked as follows:
 - a. Nominal pipe size
 - b. HDPE
 - c. Dimension Ratio, Standard Dimension Ratio, or Schedule
 - d. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable.
 - e. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable.
 - f. Extrusion production-record code.
 - g. Trademark or trade name
 - h. Cell Classification and/or HDPE material code may also be included.
10. HDPE pipe for this project shall be as indicated on the drawings, iron pipe size (IPS), DR 21.
11. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F 2206. Each fitting will be marked per ASTM F 2206 section 10 including the nominal size and fitting EDR, which will meet or exceed the pipe DR.

2.3 FUSION JOINTS

- A. Unless otherwise specified, high density polyethylene pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe manufacturer's written guidelines for this procedure. All fusion joint shall be completed as described in this specification.
- B. All joints shall have the internal beads removed from the weld. No internal beads will be allowed within the system.

- C. Closure connections within insertion pits shall be composed of all HDPE connections. DIP or other materials will not be allowed outside of connections to existing DIP.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Items of material furnished under this Section shall be subject to inspection by the Owner's representation prior to installation.
1. Carefully examine material for defects, and do not install material which is known to be defective.
 2. Replace all material found defective in manufacture or damaged in transit or handling at the Contractor's expense.
 3. Items found not to be in compliance with this Section shall be removed from the project site and replaced with items that have been approved for installation.
 4. Inspections and approvals do not relieve the Contractor from complying with the Contract Documents.
 5. The Goochland County Representative reserves the right to reject all defective pipe, fittings, and appurtenances shipped to the job site or stored on the site. The County Representative shall examine the pipe and determine if the pipe is damaged prior to the installation. Failure of the County Representative to detect damaged pipe shall not relieve the Contractor from his total responsibility for the pipe if it leaks or breaks after installation. Classify defective pipe as follows:
 - a. Damage to exterior.
 - b. Damage to interior.
 - c. Pipe out of round.
 - d. Denting or gouges in plain end of pipe.
 - e. Any other item which would result in the potential failure of the pipe.
 - f. If the exterior or interior surface of any section of pipe which is nicked, cut or chipped greater than 0.5 inch in diameter (or 1 inch length) or greater in depth than 10% of the wall thickness shall be cut out and disposed.
 6. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded.

3.2 TRANSPORTATION, UNLOADING, HANDLING, AND STORAGE

- A. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.
- B. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.
- C. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.
- D. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.
- E. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

3.3 CLEANING PIPE AND FITTINGS

- A. Clean and remove all dirt, sand, debris and foreign matter from each pipe, fitting before placing in the trench. Should foreign material or contaminants be observed in the pipe, cease work until foreign material or contaminated pipe is decontaminated or removed.
- B. Close open ends of pipe with a watertight plug at all times when pipe laying is not in progress

3.4 ALIGNMENT AND GRADE

- A. The temporary force main shall be laid above ground. The Contractor shall be responsible for locating underground utilities and obstructions within the areas of buried crossings and adjusting the bury depth of the force main to avoid said utilities and obstructions.

3.5 PIPE INSTALLATION

- A. Open Cut Installation General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.

1. Sections of pipe should be joined into continuous lengths on the jobsite above ground. The joining of the pipe shall be done in such a manner not to interfere with vehicular and/or pedestrian traffic within the public right-of-way.
2. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2321 or ASTM D 2774 for pressure systems and AWWA Manual of Water Supply Practices M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 (page 65 of 2006 version) shall be considered acceptable design and installation conditions.
3. Unless required by the owner's engineer, no thrust blocks shall be placed in the HDPE pipe system since the fused system is fully restrained.
4. The joining method shall be butt fusion performed in accordance with the pipe manufacturer's recommendations. The butt fusion process shall produce a weld strength equal to or greater than that of the pipe.
5. Thoroughly clean the pipes and fittings before installation. Pipes and fittings shall be kept clean until the acceptance of the completed work.
6. All appurtenances (tees, elbows, valves, air relief valves, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stressed may be encountered when appurtenances are inadequately supported.
7. Take necessary precautions to prevent the floating of the pipe line by the accumulation of water in the trench, or the collapse of the pipe line from any cause. Should floating or collapse occur, restoration shall be at the Contactor's expense.
8. Close all openings in the pipe line with watertight plugs when pipe laying is stopped at the close of the day's work for other reasons, such as rest breaks or meal breaks.
9. Place enough backfill over the center sections of the pipe to prevent floatation.

- B. High Density Polyethylene Pipe Care

1. The HDPE pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks will not be permitted.
2. Sections of the HDPE pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and rejoining.

C. Joining Method:

1. Fusing

- a. The manufacturer will recommend the best joining method based on the project needs.
- b. Pipe sections shall be joined on the job site above ground into continuous lengths by the thermal butt-fusion or electrofusion method, which shall be performed in strict accordance with the manufacturer's recommendations. The butt-fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400° F, optimum 425° F and maximum 450° F unless otherwise governed by manufacturer's recommendations; alignment, and 75 psi interfacial fusion pressure. Butt-fusion joining shall be 100% efficient and shall provide a joint weld strength equal to or greater than the tensile strength of the pipe. Socket-fusion, extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications. Flanges, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to mechanically connect HDPE pipe without butt-fusion, if specified in the Contract Documents and approved by the manufacturer.
- c. The fusion joint must be equal to or stronger than the strength of the pipe.
- d. The face of opposing pieces of pipe to be fused shall be machined smooth in accordance with the equipment supplier's requirements.
- e. In inclement weather, the fusion operation should be enclosed or shielded to avoid precipitation or excessive wind. The joint area and its parts that are being fused must be completely dry. No liquid of any kind running through the pipe or its fittings is permissible.
- f. No attempt by the Contractor shall be made to shorten cooling times of fusion by applying wet cloths, water, or the like. Pipe shall not be handled or installed in the trench until the joints are sufficiently cooled in accordance with manufacture's recommendations to prevent weakening the joint.
- g. When removing pipe from the butt fusion machine and pulling into place, the Contractor must use lifting slings and pulling leads in good condition.

- h. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the Owner, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.
- i. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four).
- j. Electrofusion couplings will not be permitted unless authorized by the OWNER and ENGINEER

2. Joining by Other Means

- a. Unless otherwise required in the contract drawings, all HDPE pipe shall be joined through fusion as outlined above. All pipe shall be connected using fully restrained joints as necessary. Where HDPE is shown on the design plans to be joined through the use of other means, the following is acceptable:
 - 1) Flanged connections (flange adapters and backup rings)
 - 2) Mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, and
 - 3) MJ adapter.
- b. When transitioning between plain-end DIP and HDPE pipe, a DIPS Bell MJ adapter with kit for DIP pipe shall be supplied from ISCO Product Catalog or approved equal. DIP to HDPE transitions shall include MEGALUG (or approved equal) connections at each connection point.
- c. When joining by other means, the installation instructions of the joining device manufacturer shall be observed. All materials must be approved through a signed shop drawing submittal.
- d. All buried metallic component shall be protected with tape or other coating system to prevent corrosion.

- 3. The Contractor shall submit methodology for making restrained connections to the Engineer for approval prior to the beginning of Work.

D. Sliplining Installation

1. Sliplining Installation shall be conducted in accordance with Specification Section 02400.

3.6 FIELD QUALITY CONTROL

A. Installation

1. The manufacturer's representative shall be made available a minimum of 2 working days (time on site) during the project when requested by the Owner, including the first 2 Days of pipeline installation.
2. The cost for the services of the manufacturer's representative, including expenses, shall be considered incidental to the project and will not be paid separately.

B. Testing of Pipe:

1. General Procedures for Hydrostatic Pressure Testing:

- a. Hydrostatic testing shall be conducted in accordance with the latest edition of Goochland County's Design and Construction Standards. The maximum testing pressure for the pipeline will be 70 PSI.
- b. Hydrostatic testing shall be conducted on segments not exceeding 3,000 feet in length and shall meet AWWA M55 requirements.
- c. Connection points between test segment shall be tested using visual inspection prior to backfill.
- d. The Contractor shall furnish all pumps, fittings, and gauges as necessary to fill the line with water, expel air from the system, and pressurize the pipeline for the tests. The contractor shall be responsible for bracing the testing areas as required for the project and in accordance with PPI and AWWA M55 requirements.
- e. The Contractor will be responsible for providing proper safety measures during pressure testing operations.
- f. Testing shall be in accordance with ASTM F2164 and per the Manufacturer's requirements as approved by the Goochland County Representative.
- g. The Contractor shall test the line prior to contacting the Owner for the formal pressure test.
- h. There shall be no leakage in heat-fusion joined HDPE pipe. In addition, heat-fusion joined HDPE pipe pressure testing shall be in accordance with ASTM F2164 and shall also comply with the following:

- 1) Before testing, heat fusion joints are to be completely cooled.

- 2) All parts of the test section shall be restrained against movement. Temporarily remove, restrain, or isolate expansion joints and expansion compensators before starting.
 - 3) Observe all safety precautions identified in ASTM F2164.
- i. Retesting - If retesting is necessary, depressurize the test section per ASTM F2164 and correct any faults/leaks. Allow the test section to “relax” for at least 8 hours before repressurizing and repeat the Initial expansion and test phases as indicated above.

C. Testing Procedure

1. All HDPE mains shall be field-tested. Contractor shall supply all labor, equipment, material, gages, pumps, meters and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing. The Contractor shall provide all temporary restraint at terminal locations prior to filling and testing the line. Testing against valves shall not be permitted.
2. The Contractor shall submit his plan for testing to the Goochland County Representative for review prior to starting the test and shall notify the Engineer a minimum of 48 hours prior to test.
3. The test pressure shall be 70 PSI.
4. The total test time including initial pressurization, initial expansion, and the time at the test pressure, must not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure, etc., the test section shall be depressurized, and allowed to relax for at least eight (8) hours before bringing the test section up to pressure again.
5. Pressure testing procedure shall be per Manufacturer’s recommendations or as follows:
 - a. Fill lines slowly with water. Maintain flow velocity less than 2 feet per second.
 - b. Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at point of highest elevation.
 - c. Apply initial test pressure and allow to stand without makeup pressure for three hours, to allow for diametric expansion or pipe stretching to stabilize.
 - d. After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for three hours.

- e. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Goochland County Representative at the point where the pressure is being monitored.
6. Allowable amount of makeup water for expansion during the pressure test shall conform to ASTM F2164. If there are no visual leaks or significant pressure drops during the final test period, the installed pipe passes the test.
7. If a pressure drop greater than the manufacturer's recommended loss is observed, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line.
8. All visible leaks are to be repaired regardless of the amount of leakage.
9. Visual Leak Test
 - a. Joints at tie-ins that cannot be hydrostatically tested shall be visually inspected for leaks in the presence of the Goochland County Representative in accordance with this specification.
 - b. Test pressure shall not vary by more than ± 5 psi for the duration of the leakage test.
 - c. The contractor shall not wrap or backfill any joints of the new force main that have not been previously tested until the force main has been placed back in service, operating pressure restored, and the pipe work inspected by the Goochland County Representative
 - d. Any joints not inspected by the Goochland County Representative will not be approved and shall be excavated for inspection. All joints and connections not pressure tested shall be visually inspected for leaks by the Goochland County Representative in accordance with the following procedure:
 - 1) Goochland County re-establishes service in the line and vents air.
 - 2) One half hour will elapse after air venting is complete.
 - 3) Joints will be visually inspected for signs of leakage. No leakage shall be permitted.
 - 4) Any leakage noted shall be corrected to the satisfaction of the Goochland County Representative.

END OF SECTION

**SECTION 02600
BACKFILL GROUTING**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The work specified in this Section includes requirements for filling the annular space between the outside of the carrier pipe and the inside of the existing sewer with Low-Density Cellular Concrete (LDCC).

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. American Concrete Institute (ACI)
 - 1. ACI 523. 1 R, Guide for Cast-in-Place Low-Density Concrete.
 - 2. ACI 523.3R, guide for Cellular Concretes Above 50 pcf, and for Aggregate Concretes above 50 pcf with Compressive Strengths Less-than 2500 psi.
- B. American National Standards Institute (ANSI)
 - 1. B40.1, Recommended Practice for Evaluation of Strength Test Results of Concrete.
- C. ASTM International (ASTM)
 - 1. C94, Specification for Ready-Mixed Concrete.
 - 2. C150, Specifications for Portland Cement.
 - 3. C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.
 - 4. C567, Standard Test Method for Unit Weight of Structural Lightweight Concrete.
 - 5. C618, Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 6. C796, Standard Method of Testing Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.
 - 7. C869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

1.03 SUBMITTALS

- A. Informational Submittals
 - 1. Qualifications:
 - a. Qualifications of manufacturer supplying the LDCC.

- b. Qualifications of CONTRACTOR or subcontractor personnel placing the LDCC.
- 2. Pre-Placement Test Reports and Certifications:
 - a. Proposed LDCC mix designs with mix data for all components, mix properties including estimated air content and wet unit weight, and testing results including cured unit weight and compressive strength tests reports from a certified testing laboratory.
 - b. Foaming agent material manufacturer certification that, the method where the foaming agent is introduced to the batching system is acceptable, and that the CONTRACTOR or subcontractor personnel are qualified, knowledgeable, and experienced in the formation and adjustment of LDCC mix designs.
- 3. Daily reports and records of backfill grout placement, including but not limited to:
 - a. A delivery ticket with the information stated in Section 16 of ASTM C94; except actual scale weights of materials shall be furnished to the ENGINEER with each batch of concrete before unloading at the site.
 - b. A printout of the actual scale weights for all loads batched shall be submitted to the ENGINEER at the end of each working day.
 - c. Volumes placed and lift (stage) heights achieved.
 - d. Stationing of LDCC placement.
 - e. Injection locations and pressures.
 - f. Unit weight testing results.
 - g. Time of placement.
 - h. Designation of cylinder samples prepared that day.
 - i. Compressive strength tests reports from a certified testing laboratory.

B. Action Submittals

- 1. Work Plan for placing LDCC including the following:
 - a. Sequence of work
 - b. Type(s) of equipment
 - c. Location of equipment
 - d. Placing procedures, (i.e., batching, mixing, and pumping location and procedures)
 - e. Pump line arrangement (including moving and breaking)
 - f. Maximum pipe length to be backfilled
 - g. End bulkhead details
 - h. Method of determining LDCC levels placed or completion of void filling
 - i. Communications provisions
 - j. Methods for monitoring mix
 - k. Testing procedures
 - l. Cleanup procedures
 - m. Pumping pressures

- n. Pumping rates
 - o. Theoretical annulus volume for actual sewer ID and carrier pipe OD with adjustments for bells and spacers
 - p. Daily results of calculated anticipated volume and actual volumetric measurements of backfill material placed
 - q. Injection locations
 - r. Method of surveying or monitoring carrier pipe for movement during LDCC placement
 - s. Maximum LDCC age before set initiation
 - t. Maximum injection pressures
 - u. Methods, approaches, and calculations on preventing deformation of carrier pipe during LDCC placement
 - v. Methods, approaches, and calculations on preventing flotation of the carrier pipe during LDCC placement
 - w. Methods and approaches to diverting water and groundwater during LDCC placement
 - x. Sequence of placement
 - y. Staging of backfill lifts
 - z. Pumping method
2. Product Data:
- a. Submit mix designs for each LDCC mix proposed for use. Each mix design shall show the ingredients of the mix and shall include:
 - 1) Type, brand, source, and amounts of cement, pozzolans, admixtures, and other additives.
 - 2) Source and amount of water.
 - 3) Combined grading of each mix design.
 - 4) Specific gravity of all materials.
 - 5) Results of required tests.
 - b. Submit material specifications and instructions for use of any proposed concrete admixtures, including evidence from foam manufacturer that proposed admixtures are compatible with the foaming agent.
 - c. Air content, unit weight, and compressive strength test results for proposed mix design.
3. Equipment:
- a. Submit the following for each type of LDCC proposed: Manufacturer's specifications and operation instructions for conveyance equipment.
 - 1) Pump specifications.
 - 2) Grout and air-release hose, valve, and port sizes and specifications.
 - 3) Foam generators and ancillary equipment.

1.04 QUALIFICATIONS

- A. The CONTRACTOR or Subcontractor supplying and placing LDCC shall:

1. Be capable of developing a mix design, and batching, mixing, handling and placing LDCC under sewer conditions
 2. Have a minimum 10 years of successful experience in batching and placing LDCC
 3. Have furnished and placed LDCC on at least three sewers, in total having at least 3,000 cubic yards of LDCC placement or be of the general type and the size specified herein which have been in successful operation
 4. Have a record of experience and quality of work using foam grout that is satisfactory to the ENGINEER.
- B. As an alternative and with OWNER approval, the CONTRACTOR may employ a manufacturer's representative to supervise supplying and placing of LDCC. The manufacturer's representative shall be capable of complying with the qualifications specified for the CONTRACTOR. The manufacturer's representative shall supervise all LDCC operations including training the CONTRACTOR's personnel, mixing designs, and placement of LDCC in the sewer.
- C. Personnel Qualifications: Workers, including the LDCC CONTRACTOR's superintendent and foreman, shall be fully qualified to perform the work. The LDCC CONTRACTOR's superintendent shall have had previous experience under similar ground and sewer conditions, or the foam grout supplying and placing shall be under the supervision of the foaming agent supplier's representative.

1.05 DEFINITIONS

- A. Low-Density Cellular Concrete (Foam Grout): A lightweight cementitious material that contains stable air or gas cells uniformly distributed throughout the mixture.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement: Portland cement, ASTM C150, Type I or II.
- B. Fly ash: Type F, ASTM C618
- C. Water: Use potable water free from deleterious amounts of alkali, acid, and organic materials which would adversely affect the setting time or strength of the backfill grout.
- D. Admixtures: Shall not contain chlorides, substances that promote corrosion, may only be used when specifically approved by foaming agent supplier.
- E. Foaming Agent

1. Foaming agent shall comply with ASTM C869 when tested in accordance with ASTM C796.
2. Foaming agent shall maintain stability until the cement sets to form a self-supporting matrix comprising closed cells and low water absorptive characteristics.
3. Foaming agent manufacturers:
 - a. Aerix Industries,
 - b. Or approved equivalent

2.02 MIX DESIGN

- A. General: LDCC mix shall be designed in accordance with the requirements of ACI 523.1R, ACI 523.3R, and the additional requirements herein. Mixes shall be adjusted in the field as necessary to meet the requirements of these specifications. The foaming agent material manufacturer's field services representative shall approve all changes to the mix designs.
- B. The mix design shall meet the following requirements:
 1. Wet Cast Density: 45 lbs./ cu. ft.
 2. Average 28-day Compressive Strength per ASTM C495: 350 psi.
 3. Minimum 28-day Compressive Strength per ASTM C495: 100 psi.
- C. The slurry composition shall be .5W:C with Aerlite foam.
 1. 1024 lb water
 2. 2048 lb Type I/II Portland Cement
- D. Limiting Requirements: Unless otherwise specified, each LDCC mix shall be designed and controlled within the following limits:
 1. Wet Density: Wet density (unit weight) of the foam grout shall be not less than 30 pcf, at the point of placement.
 2. Preformed Foam: Preformed foam shall be generated by combining controlled quantities of air, water, and foaming agent under pressure. Foam shall retain its stability until the cement sets to form a self-supporting matrix. The resulting LDCC shall have essentially closed cell and low water absorptive characteristics. The concentration of foam agent shall be in accordance with the foaming agent material manufacturer's recommendations.
 3. Admixtures: The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for minimum shrinkage and for compliance with these specifications. Admixtures may be used when specifically approved by foaming agent material manufacturer and shall be in accordance with their recommendations. No calcium chloride or admixture containing chloride from other than impurities from admixture ingredients will be acceptable.

4. A tentative mix shall be designed and tested in accordance with ASTM C796 for each consistency intended for use. These results will be compared with field test results to confirm consistent properties are obtained in the field. Testing for each mix shall be as follows:
 - a. Two sets of compression test cylinders (3 inches by 6 inches), three cylinders per set, shall be made from each proposed backfill grout mix. One set of three cylinders shall be tested at an age of 7 days and the other set shall be tested at an age of 28 days. Foam grout specimens shall be made, cured, stored, and tested in conformity with ASTM C495.
 - b. Determine total air content of each proposed foam grout mix in accordance with ASTM C796.
 - c. Determine unit weight of each proposed foam grout mix in accordance with ASTM C567.

2.03 EQUIPMENT

A. General

1. Use equipment for mixing and injecting foam grout, which is designed for underground backfill grouting service. Maintain equipment in good operating condition, capable of satisfactorily mixing, agitating, and forcing LDCC into injection ports at a uniform flow rate under the required constant pressure.
2. Backfill grouting equipment shall be configured so flushing can be accomplished with grout intake valves closed, with water supply valve open, and with grout pump running at full speed.
3. An adequate inventory of spare parts or backup equipment shall be provided to ensure that operable backfill grouting equipment is available at all times during the work. Maintain sufficient quantities of spare pressure gauges, stop valves, and other wear parts on site.

B. A foam generator shall be used to produce a predetermined quantity of preformed foam, which shall be injected into the mixer and blended with the cement slurry. The foam generator shall be timer-controlled to repetitively discharge a pre-selected quantity or to discharge continuously at a fixed rate. Foam generating equipment shall be tested and calibrated for dilution percentage, density, and volume output. Two types of foam generating systems, batch and continuous generating, are acceptable.

1. The batch system shall consist of a tank in which the foam liquid concentrate and water are first premixed. This dilute solution is then discharged from either a pressurized tank or by means of a mechanical pump through a foam-making nozzle in which this solution is blended with compressed air in fixed proportions.
2. A continuous generating system container, which continuously draws the concentrate directly from its shipping container, automatically blends it

with water and compressed air in fixed proportions, and forms the stable micro-bubbled foam.

3. Both types utilize foam refining columns or nozzles calibrated for foam quality and discharge rate. The foam nozzles may be timer-controlled to repetitively discharge any preselected quantities or to discharge continuously at a fixed rate.
 4. Batching, mixing and pumping equipment shall be compatible and of sufficient size and capacity to place LDCC to distances and volumes proposed by the CONTRACTOR.
 5. Provide graphical or digital printout records of batch scale readings, accurate to 1 pound, of the dry mix ingredients before delivery to mixer.
- C. Specially designed batch mixers may also be used in conjunction with surge hopper equipped pumps. The rates of mixing and pumping shall be properly adjusted and a continuous flow of foam grout shall be obtained at the point of placement.
- D. Injection Hoses and Connections
1. Use hose of proper type and diameter to withstand maximum injection pressures used.
 2. At the point of injection, suitable valves and calibrated pressure gauges shall be provided so that the pressure and grout flow at the grout hole may be regulated and monitored. A meter shall be provided to measure the total volume of LDCC pumped into each port. Provide at or very near the point of injection, a system of valves in the line transporting the grout that will allow easy access for collection of test specimens. Provide an automatic bypass valve set to the maximum pressure specified.
 3. Injecting hoses and connections shall be a minimum of 1-1/2 inches and a maximum of 2-1/2 inches in diameter.
 4. Provide suitable stop valves at collar of hole for use in maintaining pressure, as required, until LDCC has set.

PART 3 EXECUTION

3.01 GENERAL

- A. The CONTRACTOR shall submit a bulkhead and grouting plan to the ENGINEER for review prior to the beginning of Work.
- B. LDCC shall be properly placed as specified herein. LDCC shall be made using preformed foam process equipment approved by the foaming agent material manufacturer.
- C. Methods for completely filling the annular space between carrier pipe and existing sewer pipe shall be utilized in accordance with submittals that are

reviewed and approved by the ENGINEER. No standing water, soil, and debris shall be allowed where LDCC is to be placed.

- D. Bulkheads shall be constructed at the end of each reach of pipe to be backfilled.
 - 1. Bulkheads shall be constructed so the annular space will be completely backfilled.
 - 2. Bulkheads shall incorporate a minimum 1-inch diameter drainpipe in the annular space of the sewer to facilitate drainage of water during LDCC backfilling. This pipe shall be securely capped and plugged once LDCC begins to flow from the drain line.
- E. Annular grouting shall be completed prior to connection of individual slip lined pipe segments. Connection of pipe segments shall be performed in accordance with project specification Section 02500 – HDPE Pipe and Fittings.
- F. Inform ENGINEER at least 24 hours in advance of the times and place where placement of LDCC is anticipated.

3.02 BATCHING AND MIXING

- A. General: Conform to the requirements of accepted submittals and the foaming agent manufacturer's recommendations.
- B. Mixing
 - 1. All LDCC shall be mechanically mixed to produce a uniform distribution of the materials with a suitable consistency and the specified limiting requirements. Excessive mixing shall be avoided in order to reduce the possibility of changes in unit weight and consistency.
 - 2. In batch mixing operations, follow the manufacturer's recommendations concerning the order of charging the mixer with the various ingredients. The as-cast unit weight shall be monitored at the point of placement. Allowance should be made for any additional mixing that may result from the method of placement, such as mechanical or pneumatic pumping, and for any unit weight changes that may result from these methods.
 - 3. For continuous mixing operations, provision shall be made for reasonably uniform and continuous rate of addition of all mix components at appropriate positions in the mixing machine, and in the correct ratio, to assure uniformity and the specified limiting requirements at the point of placement.
 - 4. Alternative methods for batching and mixing LDCC will be considered by and must be acceptable to the ENGINEER.

3.03 PLACING LOW-DENSITY CELLULAR CONCRETE

- A. General Requirements: All void space outside of the carrier pipe shall be completely filled with LDCC. Place LDCC in accordance with approved submittals.
- B. Backfilling of the annular space between the carrier pipe and the sewer shall be accomplished by placing LDCC in one or more stages (lifts). Monolithic placements (one stage) may be acceptable, provided the CONTRACTOR can demonstrate that placement techniques will not induce movement of the pipe, pipe overstressing, pipe overheating, or excessive deformation. The LDCC shall be placed through grout pipes installed within the annular space between the carrier pipe and the sewer.
- C. Pressure gauges of appropriate range for monitoring the backfill grout injection pressures shall be located in the line transporting the LDCC at the point of injection. Injection pressure shall be low enough to prevent pipe movement and shall not exceed 12 psi at the point of injection for stages below the crown of the pipe.
- D. The maximum allowable pressure difference between the internal pressure of the carrier pipe and the grouting pressure is 2 PSI. The contractor shall pressurize the new HDPE carrier pipe using water to overcome the pressure differential prior to grouting.
- E. Volume of LDCC injected shall be measured, recorded, and compared with the anticipated volume per foot of pipe backfilled.
- F. Provide a means of direct communication between the injection point and the pump operator.

3.04 FIELD QUALITY CONTROL

- A. CONTRACTOR to perform field control tests, including unit weight (wet density) and compression tests.
 - 1. The frequency specified herein for each field control test is approximate. A greater or lesser number of tests may be made, as required by ENGINEER.
 - 2. Test specimens shall be collected near the connection where the LDCC is being injected.
 - 3. Assist in obtaining additional test cylinders where requested by OWNER.
 - 4. Provide at or very near the point of injection, a system of valves in the line transporting the LDCC, which will allow easy access for collection of test specimens without disconnecting the line from the outlet. Submit the valve arrangement to the ENGINEER for review at least 15 days prior to commencing LDCC backfilling operations.

- B. Unit Weight: Unit weight (wet density) tests shall be made from the first batch mixed each day, after a change in mix design, every 30 minutes during pumping, and from each batch of LDCC from which compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C567. Unit weight at the point of placement shall be within plus or minus 5 percent of the unit weight established for the mix design being placed. Adjust mix as required to obtain the specified wet density.
- C. Buoyancy Measures: The CONTRACTOR shall make provisions to ensure that the line is full and plugged at each end of the pipe run while backfill grouting is being conducted.
- D. Compression Tests: One set of four grout test cylinders (3-inch by 6-inch) shall be made for each shift when LDCC is placed. One additional set shall be made from each additional 200 cubic yards, or major fraction thereof, placed in any one shift. Two cylinders from each set will be tested at an age of 28 days.
 - 1. Compressive strength of LDCC shall be considered satisfactory if both of the following requirements are met:
 - a. Average of three consecutive compressive strength tests equal or exceed the specified unconfined compressive strength.
 - b. No individual compressive strength test (average of two cylinders) is below the specified unconfined compressive strength by more than 20 percent.
 - 2. A strength test shall be the average of two compressive strengths of two cylinders made from the same concrete sample and tested at 28 days.
 - 3. Test cylinders shall be made in the field, cured and stored in the laboratory, and tested in accordance with ASTM C495.
 - 4. Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the LDCC represented by the cylinder was placed, batch number, and unit weight (wet density).

3.05 PROTECTION AND CLEAN UP

- A. Take all necessary precautions to protect and preserve the carrier pipe from damage.
- B. Spills shall be minimized and shall be cleaned up immediately. Any damage to the pipe caused by or occurring during the backfilling operations shall be repaired by a method approved by the ENGINEER and at no additional cost to the OWNER.

END OF SECTION

**SECTION 02710
ASPHALT PAVING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cold milling of existing hot-mix asphalt pavement.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt paving.
 - 4. Hot-mix asphalt paving overlay.
 - 5. Asphalt surface treatments.
 - 6. Pavement-marking paint.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Qualification Data: For qualified manufacturer and Installer.
- D. Material Certificates: For each paving material, from manufacturer.
- E. Material Test Reports: For each paving material.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by VDOT.
- B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the latest edition of the VDOT Road and Bridge Specifications for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in the VDOT Road and Bridge Specifications do not apply to this Section.
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range specified required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.
- C. Prime Coat: Asphalt emulsion prime coat complying with VDOT Road and Bridge Specifications and requirements.
- D. Water: Potable.
- E. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes and colors as designated on the plans.

- E. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

- 1. Dowels: Galvanized steel, 3/4-inch diameter, 18-inch minimum length.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by VDOT and complying with the following requirements:

- 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: BM-25.0A
 - 3. Surface Course: SM-9.5A.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade, under geotechnical inspector supervision, below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of 1-1/2 inches.

2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Transport milled hot-mix asphalt to asphalt recycling facility.
7. Keep milled pavement surface free of loose material and dust.

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompress existing unbound-aggregate base course to form new subgrade.
- B. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving.

3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at minimum temperature of 250 deg F.
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 9 feet wide unless infill edge strips of a lesser width are required.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 5. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F.

- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus 1/2 inch, no minus.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/8 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with ENGINEER.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and pressure wash clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop ($\frac{1}{2}$ " – $1 \frac{1}{2}$ "

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: OWNER shall engage a qualified Testing Agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.

- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 02920
LAWNS AND GRASSES**

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:
 - 1. Seeding.
 - 2. Hydroseeding.
 - 3. Sodding.
 - 4. Plugging.
 - 5. Sprigging.
 - 6. In some parts of the U.S., meadows may be called "prairies." If needed for clarity, revise the term "meadow" throughout the Section Text or insert a definition.
 - 7. Erosion-control material(s).
 - 8. Grass paving.

1.3 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and

viruses.

- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

- A. Submittals shall be in accordance with Division 1.
- B. CONTRACTOR shall provide submittals for all materials to be used including but not limited to:
 - 1. Grass seed
 - 2. Fertilizer
 - 3. Top soil

1.5 QUALITY ASSURANCE

- A. Installer qualifications: A qualified landscape installer whose work has resulted in successful sodded lawn installations.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
- C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

1.7 SCHEDULING

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 1. Seeded Turf: 60 days from date of Substantial Completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 2. Sodded Turf: 30 days from date of Substantial Completion.
 3. Plugged Turf: 30 days from date of Substantial Completion.
 4. Sprigged Turf: 30 days from date of Substantial Completion.
- B. Maintain and establish 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:
 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. 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 height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass heights:
 1. Mow grass 2 to 3 inches (50 to 75 mm) high.
- D. Lawn Post fertilization: Apply fertilizer after initial mowing and when grass is dry.
 1. Use fertilizer and application rates recommended in Topsoil Analysis.

1.9 MAINTENACE SERVICE

- A. Lawns: Sixty days from date of Substantial Completion.

PART 2- PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. Full Sun to Partial Shade: Proportioned by weight as follows:
 - a. 75 percent Tall Fescue (*Festuca arundinacea*) varieties, including Jaguar, Mustang, Rebel II, or Olympic.
 - b. 15 percent Kentucky Bluegrass (*Poa pratensis*) varieties, including Medit and South Dakota.
 - c. 10 percent Perennial Ryegrass (*Lolium perenne*).
 2. Shade: Proportioned by weight as follows:
 - a. 50 percent Chewings red fescue (*Festuca rubra* spp *rubra*).
 - b. 35 percent Rough Bluegrass (*Poa trivialis*).
 - c. 15 percent redtop (*Agrostis alba*).

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Sod shall be from a reputable local dealer.
- B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. Full Sun to Shade:
 - a. 90 percent Tall Fescue (*Festuca arundinacea*).
 - b. 10 percent Kentucky bluegrass (*Poa pratensis*).

2.3 INORGANIC SOIL AMENDMENTS

- A. Inorganic Soil Amendments: Lime, sulfur, iron sulfate, aluminum sulfate, perlite, agricultural gypsum, sand, diatomaceous earth, and zeolite.

2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: 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 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

- 1. Organic Matter Content: 50 to 60 percent of dry weight.

2.5 FERTILIZER

- A. Fertilizers: Bonemeal and slow-release fertilizer.

2.6 PLANTING SOILS

- A. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil with the following soil amendments per the soils test and recommendations. See drawings for details.

2.7 MULCHES

- A. Mulches: Straw and tackifier for hydroseeded areas.

2.8 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Invisible Structures, Inc.; Slopetame 2.
 - b. Presto Products Company, a business of Alcoa; Geoweb.
 - c. Tenax Corporation - USA; Tenweb.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. 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 and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install 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

3.3 LAWN PREPARATION

- A. Apply inorganic soil amendments, organic soil amendments and fertilizers as recommended in Topsoil Analysis.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus ½ inch of finish elevation.
- C. Compaction: Compact growing medium sufficiently to reduce settling but not enough to prevent movement of water through growing medium. Compacted medium should feel firm to foot pressure, leaving only slight heel prints.

- D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in Section 3.3 Lawn Preparation.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate per manufactures seed type recommendations.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:3 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 6:1 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
- G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or peat mulch or planting soil within 24 hours after completing seeding operations. Soak

areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 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.
 - 1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 - 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
 - 3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.7 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to growth media layer or sod during installation. Tamp and roll lightly to ensure contact with growth medium layer, eliminate air pocket, and form a smooth surface. Work growth medium or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.8 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering.
1. Adjacent to Buildings: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 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 turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
 2. All other areas.
 - a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Revise timing of fertilizer application in paragraph below if a slow-release fertilizer was initially applied.
- D. Turf Post fertilization: Apply fertilizer after initial mowing and when grass is dry.
1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer:
1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities.
 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
 3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
 4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.

- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove growth medium and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil 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 maintenance period and remove after lawn is established.
- C. Remove temporary erosion-control measures after grass establishment period.

END OF SECTION

SECTION 15120
VALVES, FITTINGS AND MISCELLANEOUS PIPE ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section of the specification defines the class, type, pressure and materials that will be required for the various valves and accessories used. The Contractor shall furnish, install, paint, test and adjust all valves and other miscellaneous equipment, including all auxiliary equipment and devices such as handwheels, position indicators, valve boxes, extension stems, stem guides, gasketing and accessories and appurtenances as shown, specified.

B. The following valves are required for this project.

Valve No	Sta	Valve Type	Valve Size	Make & Model	No. of Valves
1	15+07.5	ARV	2"	ARI D-020	1
2	24+80.5	ARV	2"	ARI D-020	1
3	48+04.5	ARV	4"	VENT-O-MAT RGX III	2
4	58+29.4	ARV	4"	VENT-O-MAT RGX III	2
5	67+17.0	ARV	4"	VENT-O-MAT RGX III	2
6	116+82.4	ARV	2"	ARI D-020	1

1.2 SUBMITTALS

A. The manufacturer shall submit complete shop drawings and engineering data to the Owner or Engineer, per Specification Section 01300, Submittals.

1.3 STARTUP SERVICES

A. The manufacturer's representative for the check valves and surge relief valve shall be present at start-up to adjust these valves.

1.4 QUALITY CONTROL

A. The minimum pressure class for flanged and mechanical joint fittings shall be Class 350 in diameters 3" through 24".

PART 2 - PRODUCTS

2.1 SEWAGE SURGE RELIEF VALVE

A. Manufacturer

1. The valve shall be Figure 624D, Class 125 Flange, Elbow-Body Pattern Surge Relief Valve as manufactured by GA Industries LLC, Cranberry Township, PA, USA or approved equal.
2. The valve shall be designed to be suitable for use in wastewater applications.

B. Design

1. Main valve body shall be elbow-body pattern of cast iron conforming to ASTM A126 Class B, with integral flanges, faced and drilled per ANSI B16.1 Class 125 250. The valve body shall be inherently self-cleaning and have a net flow area through the valve no less than the area of its nominal pipe size. The valve body shall have a removable bronze seat. The valve body shall have integral flanges, flat faced and drilled per ANSI B16.1 Class 125 with the same size inlet and outlet, or an outlet that is one or two sizes larger than the inlet, as shown on the plans or schedule.
2. The valve disc shall be cast iron or steel with a renewable, resilient seat ring of rubber or other suitable material and retained by a stainless steel follower and screws. The valve stem shall be stainless steel and guided in a long bronze bushing retained in the valve cover.
3. The valve stem shall be sealed where it passes through the body by dual seals separated by a lantern ring with external leak detection port. An integral hydraulic system shall permit quick opening and adjustable, slow closing without the need of pre-charged cylinders.
4. Sizes through 8" shall have dual compression springs; 10" through 16" shall have a single compression spring. Springs shall be encased in steel cylinders; exposed springs or tension springs are not acceptable. The valve shall be fully capable of operating in any position.
5. The valve shall be factory tested and set to open at a pre-determined pressure. Springs shall permit field adjustment from near zero to 10 percent above factory setting.
6. Shop paint outside surfaces with standard shop primer.
7. Each surge relief valve shall be equipped with a rigid mounted open limit switch with roller type actuators supplied by the valve manufacturer. The rotary actuated switches and levers shall be Honeywell HDLS Series or approved equal.

C. Function

1. The pressure relief valve shall quickly open when the system pressure exceeds

the spring setting, remain open as long as the pressure exceeds this setting, and slowly close drop tight when the pressure subsides below the spring setting.

2.2 BURIED PLUG VALVES

- A. Plug valves for sewage and sludge shall be permanently lubricated eccentric plug valves, suitable for at least 125 psi working pressure. Valves installed in horizontal runs of pipe shall be mounted with the plug horizontal and at the top of the body when the valve is open, except as otherwise specified. Valves installed in pipelines carrying suspended or settleable solids shall be mounted with higher pressure (upstream) against plug face (seat side) when valve is in closed position.
- B. Plug valve pressure ratings shall be as follows and shall be established by hydrostatic tests as specified by ANSI Standard B16-1-1967. Pressure ratings shall be 175 psi for valves through 12", 150 psi for valves in sizes 14" through 36" and 125 psi for valves in sizes 42" and larger. Valves shall be capable of providing drip-tight shutoff up to the full rating with pressure in either direction. Valve bodies shall be of ASTM A126 Class B cast iron, in compliance with AWWA Standard C-504, Section 54. All exposed nuts, bolts, springs, washers, etc. shall be zinc plated. Resilient plug facings shall be neoprene, suitable for use with sewage. Valves shall be furnished with corrosion resistant seats which comply with AWWA Standard C507, Section 7, paragraph 7.2, and with AWWA Standard C504 Section 8.3. Seats in 3" and larger valves shall have a welded-in overlay of not less than 90% pure nickel on all surfaces contacting the plug face.
- C. Plug valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. These bearings shall comply with AWWA Standard C507, Section 8, paragraphs 8.1, 8.3, and 8.4, and with AWWA Standard C504, Section 9. Valves through 20" shall have stainless steel permanently lubricated upper and lower plug stem bushings. Valves 24" and larger shall have stainless steel upper and lower plug stem sleeves and bronze bushings. Valve shaft seals shall comply with AWWA Standard C507, Section 10, and with AWWA C504 Section 10. Stem bushings with "O" ring seals must be in accordance with AWWA C504, Section 10.3, relative to a removable corrosion resistant recess. All valves 4" and larger shall be of the bolted bonnet design. Valves shall be designed so that they can be repacked without removing bonnet from valve. Packing on all valves shall be adjustable.
- D. Bell ends shall be in accordance with AWWA Standard C100, Class B. Screwed ends shall be in accordance with the NPT Standard.
- E. Port areas for plug valves through 20" shall be at least 100% of full pipe area. Port areas of 24" and larger valves shall be at least 80% of full pipe area. The port shall be smoothly shaped with an unobstructed waterway when open.
- F. All plug valves 4" and larger shall be equipped with gear actuators. All gearing shall be enclosed, suitable for running oil, with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze, bearing bushings. Actuator shall clearly indicate valve position, and an

adjustable stop shall be provided to set closing torque. Valve packing adjustment on non-submerged valves shall be accessible without removing the actuator from the valve. Construction of actuator housing shall be semi-steel. All exposed nuts, bolts and washers shall be zinc plated.

- G. Plug valves and actuators for submerged or buried service shall have seals on all shafts, and gaskets on valve and actuator covers, to prevent the entry of water. Actuator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers for submerged valves shall be stainless steel.
- H. Gear actuators shall be of the type that can be mounted for remote operation and a high head extension, waterproof, enclosure pipe.
- I. Plug Valve Floor Stand - Where specified floor stands shall be the handwheel actuated type with valve position indicator. Buried valves shall have pipe encasements around the shaft extension for protection.
- J. 4" plug valves shall be capable of passing a 3" spherical solid.
- K. Plug valves shall be Dezurik, Milliken, Pratt, Valmatic, or approved equal.

2.3 VALVE BOXES

- A. Valve boxes for valves 3" and larger shall be cast iron.
- B. Boxes shall be sliding type adjustable boxes by Mueller or equal as approved by the OWNER. They shall have 5-1/4" shaft with a drop lid marked sewer. Valve box bottoms shall be round with all pieces manufactured of grey cast iron. Boxes shall have a coal tar epoxy coating.
- C. Extension Stems shall be made of stainless steel 304 of a diameter to safely withstand the opening and closing thrust encountered in operation of the valves. The exact length of all extension stems shall be determined by measurements in the field.
- D. Stem Guides shall be cast iron and bronze bushed. The guides shall be adjustable in two directions to provide full adjustment for proper alignment with the stem. The slenderness ratio (L/4) of the stem shall not exceed 100. Guides shall be spaced per manufacturer recommendations or as shown on the drawings, whichever is more stringent.
- E. Valve boxes shall be of cast iron, three-piece screw type with covers and bases. They shall be of suitable size for the valve with which they are used and fully adjustable for depth of setting, extension pieces being furnished where necessary. Drop type covers shall be provided for each box with the proper word, "WATER" or "SEWER" designating the valve service cast into its top surface. Oval type

bases shall be provided and shall be so designed to fully support the box without weight of the box and/or superimposed load being transmitted to any part of the valve or adjacent pipe on either side.

- F. One foot-eight inch by one foot-eight inch by six inch deep (1' 8" x 1' 8" x 6") concrete collar or equivalent circular precast collar shall be installed around all valve boxes or as called out on the contract plans, whichever dimension is greater.
- G. Wrenches of the various lengths needed shall be provided for operating valves with operating nuts. One wrench of suitable length for each three of such size operating nuts shall be provided.

2.3 PRESSURE RELIEF, REDUCING AND REGULATING VALVES

- A. Pressure reducing and regulating valves (water service) 1/2-inch and under shall be bronze and above 1/2-inch shall have cast iron bodies bronze fitted. Valves shall be constructed with full openings and capable of supplying a full flow of water at reduced pressure. Valves shall be so constructed that repairs can be made without removing the valves from the line. The valves shall be equipped with a sedimentation chamber and stainless steel or bronze strainer. Pressure reducing and regulating valves shall be the back pressure sustaining type and shall operate over a range at differential pressures from 5 to 120 psi. Reducing and regulating valves shall meet or exceed the requirements of ASSE 1003 (ANSI A112.26.2) and shall be Model 616R, as manufactured by Fisher Controls, WATTS Series 25 AUB, GA, or equal.
- B. Pressure relief valves for sewage shall be direct-acting, spring-loaded and single-seated. The valve shall be normally closed, designed to open quickly when the inlet pressure reaches the preset maximum pressure. The valve shall close slowly by means of an integral hydraulic system and closing speed control valve when the pressure subsides below the maximum. The net flow area through the valve shall be no less than the area of its nominal pipe size. The valve body shall be ASTM 126 Class B cast iron elbow or wye as shown on the plans with integral flanges faced and drilled per ANSI B16.1 Class 125, 316 stainless steel body seat and renewable, resilient disc seat. Dual seals shall seal the valve stem where it passes through the body, separated by lantern ring with external leak detection port. There shall be a single compression spring, enclosed in a steel cylinder, field adjustable and initially set at 190 PSI. The valve shall be GA Industries Figure 624-D or equal.

2.4 RESTRAINING GLAND

- A. Gland shall have a pressure rating of 350 psi for sizes 4" through 16"
- B. 316 SS hardware in accordance with ANSI/AWWA C111/A21.11
- C. Approved manufacturers:
 - 1. EBAA, Megalug

2. Sigma, One-Lok

2.5 OMNI-SLEEVE

- A. Provide an Omni-Sleeve mechanical coupling by Sigma Corporation at all pipe wall penetrations for the grinder manhole, wet well, valve vault and meter vault. Sleeve shall be rated for 350 psi.
- B. Mechanical Joint sleeve seal is designed, manufactured, and tested in strict accordance with the applicable provisions of ANSI/AWWA C111/A21.11, American National Standard for Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.
- C. Drilling and Tapping conform to ANSI B1.11960, Unified Screw Threads, and to B1.2-1966, Screw Thread Gages and Gaging. Threads conform to standards and dimensions of the Coarse Thread Series, Class 2B Limits. OMNI-SLEEVE™ Hub and Sleeve Pipe are assembled and sealed with an exclusive OMNI-SEAL™ gasket.

2.6 FLANGE ADAPTER

- A. Shall conform to ANSI/AWWA C115/A 21.11.
- B. All hardware shall be 316SS.
- C. EBAA, Inc, 2100 Megaflange, no substitutions.

2.11 DISMANTLING JOINT

- A. Shall conform to ANSI/AWWA C115/A 21.11. Body shall be ductile iron per ASTM A636 Grade 65-45-12.
- B. All hardware shall be 316SS.
- C. Smith-Blair, SB 971 Series, no substitutions.

PART 3 - EXECUTION

3.1 SETTING OUTSIDE VALVES

- A. Valves installed in trenches shall be located where indicated on the Plans. Valves and valve boxes shall be plumb. Valve boxes shall be placed directly over the valves, the top of the box being constructed flush with the surface of the finished grade in accordance with para. 1.3 of this section. After installation, trench shall be backfilled for a distance of 4 feet on each side of the box.

3.2 SETTING DEEPER VALVES

- A. Valves deeper than four feet shall have operator extension rods installed, and shall be pinned at the operating nut. The extension shall come to within one foot of the ground.

3.3 IDENTIFYING VALVES

- A. The Contractor shall identify each valve and cleanout except potable water faucets and hose bibbs. The identification system shall be submitted for approval by the Engineer and Owner.
- B. Valve tags shall be stamped 19 gauge brass tags, 1-1/2 inch round with a 3/16 inch hole. Numbers shall be 1/2 inch black filled numbering only.
- C. Valve tag chain shall be a number 16 brass jack chain with adjustable open and close links.
- D. The tags shall be attached to the valves by handwheel or lever where split-key rings soldered so that rings and tags cannot be removed except where shown in concrete as per standard details.
- E. The contractor shall furnish and install an approved valve directory. The directory shall show each valve number, the location of each valve, and the equipment, apparatus, or fixtures controlled by that valve, and the number of any other valve or valves that must be operated in conjunction with said valve. The directory shall be framed in a glazed frame with screw eyes and wires for hanging same, and shall be located, as directed by the engineer. Submit shop drawing of valve directory for approval before tagging any valves. Provisions shall be made for unseating way plug valves using the pedestal and lever as shown on the standard detail sheet.

3.4 FIELD SERVICE

- A. The equipment manufacturer or his representative shall supply a qualified service technician to inspect the installation, certify that it was installed per manufacturer's recommendations, and train the Owner's personnel in the operation of all equipment specified in this section.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK