

# HUGUENOT HILLS

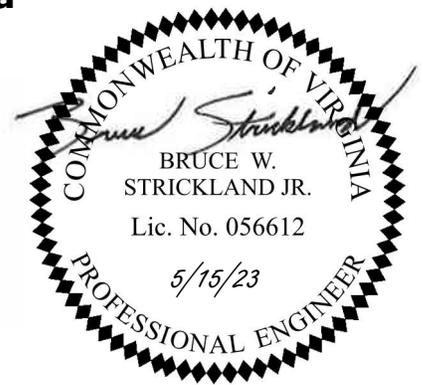
## WATER AND SEWER IMPROVEMENTS

# TECHNICAL SPECIFICATIONS

---



**Goochland County, Virginia**



**Bid Set: May 15, 2023**

**Job Number 50070**

# **HUGUENOT HILLS**

## **WATER AND SEWER IMPROVEMENTS**

### **Technical Specifications**

**Engineer:**

**Timmons Group**

1001 Boulders Parkway, Suite 300

Richmond, VA 23225

Contact: Bruce Strickland, P.E.

Phone: 804-200-6389

Fax: 804-560-1438

Bid Set: May 15, 2023

Job Number 50070

# TABLE OF CONTENTS

SECTION TITLE.....PAGES

**\*\*The following technical specifications are supplemental to the latest edition of the Goochland County Department of Public Utilities Design & Construction Standards, included by reference. Where requirements overlap or conflict, the more stringent of the requirements shall apply.\*\***

## DIVISION 1

01 1100	Summary of Work.....	4
01 2200	Measurement and Payment .....	9
01 3100	Coordination .....	2
01 3119	Project Meetings.....	1
01 3300	Submittals.....	5
01 5000	Temporary Facilities and Environmental Protection.....	3
01 6000	Materials and Equipment .....	6
01 7000	Closeout Procedures .....	4

## DIVISION 2

02 0000	Site Conditions .....	1
---------	-----------------------	---

## DIVISION 31

31 1000	Site Clearing .....	2
31 2300	Trenching and Backfilling.....	6

## DIVISION 32

32 9219	Seeding .....	4
---------	---------------	---

## DIVISION 33

33 0523	Horizontal Directional Drilling.....	4
33 1000	Water Distribution System .....	16
33 3000	Sanitary Sewerage.....	21

## APPENDICES

Appendix A	Geotechnical Engineering Report	
------------	---------------------------------	--

**END OF TABLE OF CONTENTS**

## SECTION 01 1100 SUMMARY OF WORK

### 1. GENERAL

#### 1.1 DESCRIPTION

- A. This Section includes requirements of a general nature applicable to the Contract.
- B. The Work includes but is not limited to the following:
  - 1. The construction of approximately 4,000 linear feet of 8" diameter waterline, approximately 1,500 linear feet of 4" sanitary force main, approximately 2,800 linear feet of 3" sanitary force main, and all necessary structures, services, and appurtenances to serve the existing Huguenot Hills development in Goochland County, Virginia.

#### 1.2 REFERENCE DOCUMENTS

- A. Applicable Codes, Specifications, and Standards:
  - 1. All references to codes, specifications, and standards referred to in the Contract Documents shall be the latest edition, amendment and/or revision of such reference standard in effect as of the date of Bid Opening for this Contract.
  - 2. These Codes, Specifications and Standards are by reference incorporated into these contract documents. In the event of a conflict, the more stringent as determined by the Engineer shall prevail.
- B. Documents on the Site
  - 1. The Contractor shall maintain, on the site, copies of all appropriate documents including codes, specifications, permits, and reference standards referred to for this project.

#### 1.3 ABBREVIATIONS AND SYMBOLS

- |            |  |
|------------|--|
| 1. AASHTO  | American Association of State Highway and Transportation Officials |
| 2. ACI     | American Concrete Institute  |
| 3. ANSI    | American National Standards Institute                              |
| 4. ASCE    | American Society of Civil Engineers                                |
| 5. ASME    | American Society of Mechanical Engineers                           |
| 6. NHI     | National Hydraulics Institute                                      |
| 7. ASTM    | American Society for Testing and Materials                         |
| 8. AWWA    | American Water Works Association                                   |
| 9. BOCA    | Building Officials Code Administration, Inc.                       |
| 10. NACE   | National Association of Corrosion Engineers                        |
| 11. NEC    | National Electrical Code   |
| 12. OSHA   | Occupational Safety and Health Administration                      |
| 13. VAUSBC | Virginia Statewide Unified Building Code                           |
| 14. VDOT   | Virginia Department of Transportation                              |
| 15. VSWCC  | Virginia Soil and Water Conservation Board                         |

#### 1.4 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall, at his own expense, obtain any and all permits and surety required and shall be responsible for all submittals necessary to obtain said permits required in the Contract Documents.
- B. Use of Premises and Off-Site Work
  - 1. Facility Property – The Contractor may use the areas shown on the plans for the staging and storage of materials and equipment. The Contractor may access the other areas of the site for the purpose of construction and installation. The Contractor is required to coordinate the use of areas with the Owner in accordance with Section 01 31 00 Coordination.
  - 2. Lands by Contractor - Any land and access thereto not furnished by the Owner that the Contractor deems necessary for the work, temporary construction facilities, access and egress, or for storage of materials shall be provided by the Contractor at no cost to the Owner. The Contractor shall confine his apparatus and storage to such additional areas as he may provide at his expense. The Contractor shall obtain permits and written approvals from the appropriate jurisdictional agency and or property owner for use of the premises not furnished as described above, and all off-site areas which include but are not limited to off-site borrow pits and waste areas. Such permits and approvals must specify treatment of said areas during and at the completion of construction. Copies of all permits and approvals shall be furnished to the Engineer before utilization of the areas.
  - 3. Private and Public Property - The Contractor shall not enter upon private property for any purpose without obtaining written permission from the property owner. Letters of permission from property owners shall be filed with the Engineer prior to entering private property.
- C. The Contractor shall not load nor permit any part of any structure to be loaded with weights that could endanger the structure, nor shall he subject any part of the work to stresses or pressures that could endanger it.
- D. Public Convenience
  - 1. The Contractor shall, at all times, so conduct his work as to ensure the least possible obstruction to traffic and inconvenience to the Owner, the general public, and the businesses and residences in the vicinity of the work, and to ensure the protection of persons and property. Fire hydrants on and adjacent to the work shall be kept accessible to fire fighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the use of sidewalks and the proper functioning of all gutters, stormwater systems, drainage ditches, and culverts, etc. such that they shall not be obstructed.
- E. Measurements
  - 1. All dimensions shown on existing work and all dimensions required for work that is to connect to existing work shall be verified by the Contractor by actual measurement of the existing work. Any discrepancies between the Contract Documents and the existing conditions shall be referred to the Engineer before any work affected thereby has been completed.
- F. Coordination
  - 1. Phases of the construction of the project which involve the temporary interruption of essential services (water, electricity, etc.) shall be scheduled in consultation with the Engineer, and shall be not of longer duration than essential to accomplish the purpose for such interruptions. Liaison with the Engineer in this matter shall be a salient feature of this Contract.
  - 2. The Contractor shall notify the Engineer and the Owner not less than 48 hours in advance of commencing work. The Owner shall be given no less than 48 hours

notice in advance of the time and date of making any connections and will advise the Contractor as to a suitable time and date.

- G. The Contractor, at his own expense, shall retain the services of a registered Land Surveyor to establish the necessary horizontal and vertical control in order to construct the proposed work in the proper location. Cut sheets performed by a registered Land Surveyor shall be delivered to the Engineer 48 hours prior to installation of any work.
- H. Contractor Checklist: This checklist is intended to be a guide and to assist the Contractor in determining what items need to be submitted to the Owner/Engineer or what services need to be performed by the Contractor. The checklist is not intended to be an all-inclusive list of services to be performed by the Contractor, and does not relieve the Contractor of the responsibilities stipulated within these specifications.

**Contractor Checklist for Major Items to be Performed and/or Submitted**

Required as Part of This Contract		Check Once Item is Completed
Yes	Diagram of location of fuel storage areas on plans	
Yes	Diagram of location of temporary sanitary Facilities on plans	
	No Statement of payment of taxes	
Yes	Affidavit of payment of debts and claims	
Yes	Affidavit of release of liens	
Yes	Construction schedule of work prior to the commencement of any work	
Yes	Updates of the construction schedule if work does not follow the original schedule	
	No Schedule of values (shows the value of each kind of work) prior to first application for payment	
Yes	Schedule of shop drawing submittals	
	No Schedule of estimated monthly payments (within 30 days after contract date)	
Yes	Material and products schedule (include in construction schedule)	
Yes	List of product substitutions (for a period of 30 days after contract date)	
Yes	All required permits (e.g., building permit, land disturbance permit, etc.)	
	No Field office located at project site with the following equipment: 1) Telephone 2) Message recording unit 3) Water and sanitary facilities Temporary field office for use by the Engineer that is approximately 150 square feet and includes: 1) One stick file 2) One drawing table 3) One stool 4) One non-folding desk chair 5) One desk 6) One four-drawer lockable filing cabinet	

Required as Part of This Contract		Description of Submittal Item or Service to be Performed	Check Once Item is Completed
Yes		Shop drawings and product data	
	No	Samples	
Yes		Layout data/schedule for pipe joining and special connections	
Yes		Copies of survey cut sheets	
	No	Diary or log book recording significant construction activities, meetings, weather conditions, etc.	
Yes		Progress reports submitted with each application for payment	
Yes		Test results (e.g., concrete cylinder tests, compaction tests, etc.)	
Yes		One signed original and 3 copies of inspections or approvals of work required to be inspected by local code or law	
	No	Project photographs (a minimum of 10 photos per month during contract) that include two glossy color prints (8 in. x 10 in.) and each negative	
Yes		Product guarantees, certificates, and warranties	
Yes		Contractor's one-year standard warranty for all work	
	No	Operation and Maintenance Manuals	
	No	Spare parts and maintenance materials	
Yes		One complete set of contract drawings and one project manual recording all changes to the work to indicate actual installation	
Yes		Application and Certificate for Payment in appropriate format	
Yes		Monthly progress meetings	
	No	Preliminary inspection and testing (a demonstration that individual components of equipment/work have been completed) scheduled a minimum of 20 days before the pre-final inspection is scheduled.	
Yes		Pre-final inspection (a demonstration that all individual project components function and are coordinated with other systems) scheduled a minimum of 20 days before the final inspection.	
Yes		Final inspection (a demonstration that all elements of the project are ready to be placed in operation and all work has been substantially completed) scheduled a minimum of 20 days before completion date.	
	No	Calibration test results performed by competent experienced test engineers	
	No	Nameplates on all devices	
	No	Brass tags on each field mounted device	
Yes		List of manufacturers, suppliers, and subcontractors who participated in the construction of the project	

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

**SECTION 01 2200**  
**MEASUREMENT AND PAYMENT**

**1. GENERAL**

1.1 SUMMARY OF WORK

- A. The work shall be as described by these Contract Documents and shall consist of providing all labor, equipment, materials and services necessary for the installation of the project described by these Contract Documents.
- B. Estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

1.2 WORK SEQUENCE AND SCHEDULING

- A. CONTRACTOR shall coordinate the work with the OWNER or their designee.

1.3 MEASUREMENT AND PAYMENT

- A. For the information and guidance of bidders, the following explanation of the bid form items is made herein. The omission of reference to any item in this description shall not, however, alter the intent of the bid form or relieve the Contractor of the necessity of furnishing such as a part of the contract. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The Owner reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction. The Owner will not compensate the Contractor for restocking fees or loss of anticipated profit for those items deleted from the contract.
- B. The Contractor shall be responsible for all construction layout. The centerline of all mains and bends, valves and other appurtenances shall be staked prior to construction.
- C. Payments shall be made on the basis of work actually performed in completing each item in the Contractor's bid proposal, such work including, but not limited to the furnishing of all necessary labor, materials, equipment transportation, clean-up and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the drawings and as described in the specifications.

1.4 DEFINITIONS

- A. For purposes of measurement and payment the following terms shall have the meaning assigned to each.
  - 1. Main Trench: A trench essentially parallel to rights-of-way or property lines and in which the proposed utility lines are to be installed.
  - 2. Service Trench: A trench essentially perpendicular to main trenches and in which the proposed utility service pipes are to be installed.
- B. Classified Excavation: The removal and disposal of earth, hardpan or rock materials according to the following:
  - 1. Earth Excavation: The removal and disposal of pavement, less than 4 inches thick, underground structures and utilities indicated to be demolished and removed, and all other materials encountered not classified as hardpan or rock excavation.
  - 2. Hardpan Excavation: The removal and disposal of material that cannot be removed from the trench without the use of an air spade or blasting. Indurated clay, shale or sand with cementitious materials is typical of this material.

3. Rock Excavation: The removal and disposal of all solid rock that cannot be excavated without continuous and systematic drilling and blasting or continuous use of rock excavation equipment. Boulders 1/2 cu. yd. or more in volume, solid rock, and rock in ledges are typical of this material.
4. Hand Excavation: Excavation made with hand tools when in the opinion of the Engineer such excavation is necessary.
5. Test Hole Excavation: Excavation made at the direction of the Engineer for any purpose related to work.
6. Concrete Paving Removal: Removal of paving greater than 4 inches thick, including concrete curbs, gutters and sidewalks.

C. Measurement and Payments for Excavation:

1. Hardpan and Rock: Main line trench shall be computed and paid for according to the actual depth of the hardpan or rock to the invert of the pipe plus the 6 inch bedding material the actual length of the trench, and, for main line trench, the actual width of the trench not to exceed a width of 36 inches for pipe 12 inches and less in diameter. The width of the service trench shall be 2 feet. For pipe over 12 inches in nominal diameter up to but not including 36 inches nominal diameter, the trench width shall be the outside diameter of the pipe barrel plus 24 inches, and trench depth shall be based on the depth of rock to the outside barrel of the pipe plus 6 inches. For pipe 36 inches, or greater in nominal diameter, the trench width shall be the outside diameter plus 36 inches and trench depth shall be based on the depth of rock to the outside barrel of the pipe plus 6 inches. Where the trench width is not calculated to a foot or half-foot, the measurement shall be rounded to the next 6 inches. Manhole and structure excavation shall be for the depth encountered including the base and 6 inch cushion of bedding material. The horizontal dimensions shall assume a square extending 1 foot beyond the exterior walls of the structure when forming is not required and 2 feet when forming is required. Payment for rock excavation in trench will not be allowed for this distance.
2. Earth: Main line trench and service trench, when payment is to be computed on a volumetric basis shall be computed as set forth for hardpan and rock, except that the depth shall be in accordance with the cut sheet, which is the bottom of the pipe for water main and the invert of the pipe for gravity lines. When excavation payments are on a depth basis, measurements shall be from the ground surface at the centerline of the trench to the invert of the pipeline.
3. Bedding in rock, hardpan or earth: Bedding required for pipe laid in rock, hardpan, or earth shall be included in the unit excavation price for these items.
4. For trenches, the pay width for single pipe excavation shall be the nominal diameter of the pipe, plus 12 inches or a minimum width of 24 inches. When two or more pipes are laid in the same trench, the trench width shall be the sum of the nominal diameters of the 7-8 pipe plus 12 inches plus 6 inches for each space between the pipes. For lowering or raising mains, the trench width shall be 48 inches. When pay width is not an even foot or half foot it shall be increased to the nearest foot or half foot.
5. Unauthorized excavation consists of removal of materials beyond indicated elevations or specified widths, without written approval of Engineer. Unauthorized excavation shall be replaced at Contractor's expense.

6. Hardpan or rock excavation shall not be backfilled until Engineer has verified that such excavation was required and has determined the hardpan or rock profile.
- D. Lowering excavation: Excavation made to permit the lowering or raising of water main, force main, and accessories.
- E. Water and sewer accessories shall consist of all valves, retainer glands, fittings, boxes and the like, other than pipe that are a part of the water system.

## 2. PRODUCTS

### 2.1 WATER AND SEWER

- A. The CONTRACTOR shall provide all labor, equipment, materials, and services necessary for the following **BASE BID** items.
  1. General Conditions
    - a. Payment shall be made at the contract unit price on a lump sum basis for mobilization, licenses, bonds, insurance, permits, submittals, administration, and demobilization.
  2. Clearing and grubbing
    - a. Payment shall be made at the contract unit price on a lump sum basis for clearing and grubbing. This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the construction limits shown on the plans, except such objects as are designated to remain. This work shall include the preservation from injury or defacement of all vegetation and objects designated to remain.
  3. Hardpan and Rock Excavation
    - a. Price per cubic yard of hardpan excavation defined under classified excavation above. Pay depth for water and sewer lines shall be depth to invert plus 6 inches. The payment for hardpan and rock excavation, whether in main or service trenches shall include excavation, dewatering, hauling, off-site disposal of unapproved materials, furnishing and placing of approved select backfill material, materials, labor, equipment, blast monitoring, as required for the lawful removal of rock material.
  4. Hand Excavation
    - a. Price per cubic yard for hand excavation when specifically authorized by the Inspector or Engineer. Work done under this item will be limited to that required to protect trees, utility poles or structures that would otherwise be removed during the course of machine excavation. No allowance shall be made under this item for hand excavation necessary to locate or protect culverts and underground utilities.
  5. Removal of Unsuitable Soil and Replacement with Select Material
    - a. Price per cubic yard of select material provided as directed by the Inspector. Payment under this item shall include the removal of unsuitable material and replacement with select material because of unstable foundation below the pipeline as well as material provided because the excavated material is unsuitable for proper backfilling of the trench. Surplus excavation from other portions of the project will be compensated for under this item only when the haul distance exceeds 1,000 feet. Payment for select material required when pipe is laid in rock

and/or hardpan and for backfill because of the inability to use hardpan or rock removed from the trench shall be included in the price bid for hardpan and/or rock. Payment shall be based upon the quantity of select material required for a trench with pay width as specified for hardpan excavation trenches for same depth and pipe diameter, and a select material depth as provided. Payment for furnishing and installing imported backfill material shall include haul and offsite disposal of unsuitable materials. Payment shall include provision of imported material, compaction, and dewatering. The quality of imported materials shall be as indicated on the on the drawings and specifications.

6. Stone on Private Roads, Entrances, and Driveways.
  - a. Price per linear foot of main trench and service trench, surfaced with approved stone. Stone shall be of the same type and placed to the same depth as the original, with a minimum of 4 inches. Payment shall include provision of imported material, and compaction.
7. Additional Stone Pavement Replacement
  - a. Payment for additional pavement replacement with approved stone in areas NOT indicated on the drawings or in these specifications; to be performed at the direction of the Owner's representative. The work under this item shall include all materials and labor for traffic control, surface preparation (scarification), overlay, compaction, and smooth rolling of stone surface with a minimum thickness of 4 inches. This shall not be used to replace pavement damaged due to contractor's carelessness or neglect, which shall be repaired at the contractor's sole expense.
8. Replacement of Surface Treated Pavement on Private Entrances
  - a. Price per linear foot of main trench and service trench for the restoration of surface treated pavement on private entrances and driveways. Price shall include saw-cutting existing pavement and the furnishing and installation of a double surface treatment.
9. Additional Asphalt Pavement Replacement on Private Entrances
  - a. Payment for additional pavement replacement in areas NOT indicated on the drawings or in these specifications; to be performed at the direction of the Owner's representative. The work under this item shall include complete cleanup, milling, overlay and replacement of pavement where directed by the Owner's representative. This shall not be used to replace pavement damaged due to contractor's carelessness or neglect, which shall be repaired at the contractor's sole expense.
10. Furnish and Install 8" PVC C900 DR14 Water Main (In-Situ Backfill).
  - a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for laying of the pipe, dewatering if required, joint restraints, excavation, bedding and backfill with in-situ material, compaction, traffic control, erosion and sediment control, and disinfection and testing. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities



- a. Price for each new water service line connection made to existing water service lines. The price shall include location of the line, as well as excavation, backfill, compaction, materials, and labor necessary for making the connection. Payment will include furnishing and installing the saddle and corporation stop.
15. Furnish and Install Accessories for 1" Water Services to New Meters
- a. Price for each water service accessory furnished and installed. Payment will include furnishing and installing the saddle, corporation stop, meter box and meter yoke.
16. Furnish and Install 1" Type K Copper Water Service Pipe (In-Situ Backfill)
- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for laying of the pipe, pipe fusing, dewatering if required, joint restraints, excavation, bedding and backfill with in-situ material, compaction, traffic control, erosion and sediment control, and disinfection and testing. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.
17. Furnish and Install 1" Type K Copper Water Service Pipe (Select Backfill)
- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for laying of the pipe, pipe fusing, dewatering if required, joint restraints, excavation, bedding and backfill with select material, traffic control, erosion and sediment control, and disinfection and testing. Trenches within the limits of private entrances shall be backfilled entirely with select backfill. Payment for pipe shall include provisions of imported select backfill material as shown on the drawings, compaction, haul and offsite disposal of excess soil. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.
18. Furnish and Install 1" Type K Copper Water Service Pipe (Trenchless)
- a. All utility services that cross existing pavement shall be installed utilizing trenchless installation methods. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for trenchless installation, dewatering if required, joint restraints, excavation, backfill, traffic control, erosion and sediment control, and disinfection and testing. Payment for pipe shall include provisions for hauling and offsite disposal of spoil materials. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and

special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.

19. Furnish and Install 4" HDPE Force Main (Horizontal Directional Drill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for joining of the pipe, launching and receiving pits, dewatering if required, excavation, off-site disposal of drilling spoils, restoration, traffic control, erosion and sediment control, and testing. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings. The cost of furnishing and installing fittings, thrust restraints, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.

20. Furnish and Install 4" HDPE Force Main (In-Situ Backfill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for construction staking, pipe fusing, laying of the pipe, appurtenances, force main connections, connection to manhole, dewatering if required, excavation, bedding and backfill with in-situ material, compaction, traffic control, erosion and sediment control, and testing. Measurement of the pipe will be to the nearest foot along the centerlines. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction (including utilities and drainage structure replacement), and other improvements shown on the drawings (including new grading of swales, vegetative screening, and fences). Full payment will not be made until cleanup and restoration are complete.

21. Furnish and Install 4" HDPE Force Main (Select Backfill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for construction staking, pipe fusing, laying of the pipe, appurtenances, force main connections, connection to manhole, dewatering if required, excavation, bedding and backfill with select material, compaction, traffic control, erosion and sediment control, and testing. Trenches within the limits of roadways and private entrances shall be backfilled entirely with select backfill. Measurement of the pipe will be to the nearest foot along the centerlines. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction (including utilities and drainage structure replacement), and other improvements shown on the drawings (including new grading of swales, vegetative screening, and fences). Full payment will not be made until cleanup and restoration are complete.

22. Furnish and Install 3" HDPE Force Main (In-Situ Backfill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for construction staking, pipe fusing, laying of the pipe, appurtenances, force main connections, connection to manhole, dewatering if required, excavation, bedding and backfill with in-situ

material, compaction, traffic control, erosion and sediment control, and testing. Measurement of the pipe will be to the nearest foot along the centerlines. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction (including utilities and drainage structure replacement), and other improvements shown on the drawings (including new grading of swales, vegetative screening, and fences). Full payment will not be made until cleanup and restoration are complete.

23. Furnish and Install 3" HDPE Force Main (Select Backfill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for construction staking, pipe fusing, laying of the pipe, appurtenances, force main connections, connection to manhole, dewatering if required, excavation, bedding and backfill with select material, compaction, traffic control, erosion and sediment control, and testing. Trenches within the limits of roadways and private entrances shall be backfilled entirely with select backfill. Measurement of the pipe will be to the nearest foot along the centerlines. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction (including utilities and drainage structure replacement), and other improvements shown on the drawings (including new grading of swales, vegetative screening, and fences). Full payment will not be made until cleanup and restoration are complete.

24. Furnish and Install Accessories for 2" Sewer Services

- a. Price for each sewer service accessory furnished and installed. Payment will include furnishing and installing the reducing tee, corporation stop, meter box, isolation valve, cleanout assembly, and check valve.

25. Furnish and Install 2" HDPE Sewer Service Pipe (In-Situ Backfill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for laying of the pipe, pipe fusing, dewatering if required, joint restraints, excavation, bedding and backfill with in-situ material, compaction, traffic control, erosion and sediment control, and testing. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.

26. Furnish and Install 2" HDPE Sewer Service Pipe (Select Backfill)

- a. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for laying of the pipe, pipe fusing, dewatering if required, joint restraints, excavation, bedding and backfill with select material, traffic control, erosion and sediment control, and testing. Trenches within the limits of private entrances shall be backfilled entirely with select backfill. Payment for pipe shall include provisions of imported select backfill material as shown on the drawings, compaction, haul and offsite disposal of excess soil. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of

furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.

27. Furnish and Install 2” HDPE Sewer Service Pipe (Trenchless)

- a. All utility services that cross existing pavement shall be installed utilizing trenchless installation methods. Payment will be made at the contract unit price per linear foot for the pipe installed and shall include all necessary labor and materials for trenchless installation, dewatering if required, joint restraints, excavation, backfill, traffic control, erosion and sediment control, and disinfection and testing. Payment for pipe shall include provisions for hauling and offsite disposal of spoil materials. Measurement of the pipe will be to the nearest foot along the centerlines including the lengths of valves, fittings and road crossings. The cost of furnishing and installing fittings, thrust restraints, thrust blocks, valves, valve boxes, and special accessories shall be included in the contract price per linear foot of pipe. The work under this item shall include complete cleanup and restoration of existing features disturbed during construction; including utilities and drainage structure replacement. Full payment will not be made until cleanup and restoration are complete.

28. Permanent Grading, Topsoiling, Seeding, and Strawing

- a. Price per linear foot of main trench and service trench for permanent grading, topsoiling, seeding (including fertilizing and liming), strawing, and/or hydroseeding. No separate payment will be made for temporary grading, topsoiling, seeding, and strawing. Topsoil and its placement shall comply with the requirements of the Contract Documents.

29. Furnish and Install Flushing Hydrant Assembly

- a. Payment shall be made at the contract unit price for each force main flushing connection assembly installed as shown on the drawings. Payment will include compensation for the flushing connection, isolation valve, pipe, fittings, meter box, thrust block, all excavation, backfill, restoration and all necessary labor for installation.

**3. EXECUTION – NOT USED**

**END OF SECTION**

## **SECTION 01 3100 COORDINATION**

### **1. GENERAL**

#### **1.1 SUBMITTALS**

##### **A. Informational**

1. Statement of Qualifications (SOQ) for Land Surveyor or Civil Engineer.

#### **1.2 UTILITY NOTIFICATION AND COORDINATION**

- A. The Contractor will coordinate the Work with various utilities within the Project limits. The Contractor will notify applicable utilities prior to commencing work and if damage occurs, or if conflicts, or emergencies arise during execution of the Work.

#### **1.3 FACILITY OPERATIONS**

- A. Continuous operation of the Owner's facilities is of critical importance. The Contractor shall schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.
- B. The Contractor shall perform the Work continuously during critical connections and changeovers, and as required to prevent interruption of the Owner's operations.
- C. When necessary the Contractor shall plan, design, and provide various temporary services, utilities, connections, temporary piping, access, and similar items to maintain continuous operation of the Owner's facility.
- D. The Contractor shall not close lines, open or close valves, or take other actions which would affect the operations of the existing systems, except as specifically required by the Contract Documents and after authorization by the Owner and Engineer. Such authorization will be considered within 48 hours after receipt of the Contractor's written request.
- E. Contractor shall not proceed with work affecting the facility's operation without obtaining Owner's and Engineer's advanced approval.

#### **1.4 REFERENCE POINTS AND SURVEYS**

##### **A. Contractor's Responsibilities:**

1. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
2. In the event of a discrepancy in data the Contractor shall request clarification before proceeding with the Work.
3. The Contractor shall retain the services of a Professional Land surveyor or Civil Engineer registered in the State of Virginia, who shall perform or supervise the engineering and surveying necessary for the construction staking and layout.
4. The Contractor shall maintain a complete and accurate log of the survey Work as it progresses as a Record Document.
5. On request of the Engineer, the Contractor shall submit documentation.
6. The Contractor shall provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
  - a) Establish control points, lines, and easement boundaries.
  - b) Check layout, survey and measurement Work performed by others.
  - c) Measure quantities for payment purposes.

## **2. PRODUCTS – NOT USED**

### **3. EXECUTION**

#### **3.1 CUTTING FITTING AND PATCHING**

- A. Cut, fit, adjust, or patch Work and work by others, including excavation and backfill as required, to make the Work complete.
- B. Obtain prior written authorization from the Engineer before commencing the Work to cut or otherwise alter:
  - 1. Structural reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
  - 2. Weather – or moisture-resistant elements.
  - 3. Efficiency, maintenance, or safety element.
- C. Work of others.
  - 1. Refinish surfaces to provide an even finish.
  - 2. Refinish continuous surfaces to nearest intersection.
  - 3. Refinish entire assemblies.
  - 4. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and Work is evident in finished surfaces.
  - 5. Restore existing work, underground facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown.
  - 6. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.
  - 7. Fit Work airtight pipes, sleeves, ducts, conduit and other penetrations through surfaces and fill voids.
  - 8. Remove specimens of installed Work for testing when requested by the Engineer.

**END OF SECTION**

**SECTION 01 3119  
PROJECT MEETINGS**

**1. GENERAL**

1.1 REQUIREMENTS INCLUDED

- A. Contractor participation in preconstruction conferences.
- B. Contractor participation of progress meetings and pre-installation conferences.

1.2 PRECONSTRUCTION CONFERENCES

- A. Engineer will administer preconstruction conference for execution of Owner-Contractor Agreement and exchange of preliminary submittals.
- B. Attendance: Owner, Engineer, Contractor, major Subcontractors, representatives of Quality Control firm(s).

1.3 PROGRESS MEETINGS

- A. Engineer shall schedule and administer project meetings throughout progress of the work at maximum monthly intervals, as well as administer called meetings, and pre-installation conferences.
- B. Engineer shall make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within seven (7) days to Contractor, participants, and those affected by decisions made at meetings.
- C. Attendance: Contractor's Superintendent, Contractor's Project Manager, major Subcontractors and Suppliers; Owner and Engineer as appropriate to agenda topics for each meeting.
- D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments thereto, delivery schedules, submittals, maintenance of quality standards, pending changes and substitutions, and other items affecting progress of Work.

1.4 PRE-INSTALLATION CONFERENCES

- A. When required in individual specification Section, Contractor shall convene a pre-installation conference prior to commencing work of that Section.
- B. Require attendance of entities directly affecting, or affected by, work of the Section.
- C. Review conditions of installation, preparation and installation procedures, and coordination with related work.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

## SECTION 01 3300 SUBMITTALS

### 1. GENERAL

#### 1.1 REQUIREMENTS INCLUDED

- A. Procedures
- B. Schedule of Submittals
- C. Construction Progress Schedules
- D. Shop Drawings
- E. Product Data
- F. Manufacturer's Instructions
- G. Operation & Maintenance Manuals

#### 1.2 PROCEDURES

- A. Contractor is required to provide submittals for all materials and equipment furnished and installed under this contract.
- B. Contractor shall deliver submittals to Engineer.
- C. Transmit each item with Submittal cover attached.
  - 1. Number submittals by specification section and revision number (e.g. 013000-1 for initial submission of schedule of submittals.)
  - 2. Submit only one item per cover. Highlight all deviations from the Contract Documents, and provide explanation/justification for deviation.
  - 3. Complete all portions of the form above the Contractor's signature line. Incomplete submittals or submittals with unhighlighted deviations will be returned unreviewed.
- D. Submit initial progress schedules, and schedule of submittals in duplicate within 15 days after date of Owner-Contractor Agreement. After review by Engineer revise and resubmit as required. Submit revised schedules with each Application for Payment, reflecting changes since previous submittal.
- E. Comply with progress schedule for shop drawings, product data, and manufacturer's instructions related to Work progress, and coordinate submittal of related items.
- F. Allow a minimum of two weeks' review time.
- G. Distribute copies of reviewed submittals to appropriate parties. Instruct recipients to promptly report any inability to comply with provisions.

#### 1.3 SCHEDULE OF SUBMITTALS

- A. Contractor to provide to Engineer a Schedule of Submittals for all products used during construction 2 weeks prior to the start of work.
- B. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

#### 1.4 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit horizontal bar chart with separate bar for each major trade or operation, identifying first work day of each week. Show relationships between critical path items and indicate lead times for equipment and materials delivery, etc.
- B. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Show projected percentage of completion for each item of Work as of time of each Application for Progress Payment.
- C. Construction schedule shall consider the following typical number of weather days, (i.e. > 0.10" of precipitation) as well as days following during which site conditions may impede progress of the work. The Contractor will not be allowed a time extension due to inclement weather conditions if the total number of inclement weather days for the duration of the project is less than the total inclement weather days indicated below.

**J F M A M J J A S O N D**

**6 6 7 6 6 6 8 6 5 5 5 6**

- D. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.
- E. Determination of actual rain days will be based on data published by NOAA for the gauging station nearest the project site, which will be identified at the pre-construction meeting.
- F. At each monthly progress meeting, prepare a Monthly Project Summary Report (form included with this section) and attach to the revised project schedule.

**1.5 SHOP DRAWINGS**

- A. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

**1.6 PRODUCT DATA**

- A. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturer's standard data to provide information unique to the Work.
- B. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

**1.7 MANUFACTURER'S INSTRUCTIONS**

- A. Submit manufacturer's printed instructions for delivery, storage, assembly, installation adjusting, and finishing.
- B. Submit the number of copies required by the Contractor, plus three for the Engineer to retain.

**2. PRODUCTS – NOT USED**

### **3. EXECUTION**

#### **3.1 SHOPDRAWINGS AND SUBMITTALS**

- A. Contractor shall keep a copy of all shop drawings and submittals on the project site for the duration of the contract.

**END OF SECTION**

*(See Monthly Project Summary Report which follows)*  
*(See Submittal Cover which follows)*

**MONTHLY PROJECT SUMMARY REPORT**

MEETING DATE: \_\_\_\_\_

Is the project on Schedule? \_\_\_\_\_ Yes \_\_\_\_\_ No

Number of weeks AHEAD of Schedule \_\_\_\_\_

Number of weeks BEHIND Schedule \_\_\_\_\_

List items from Schedule which are **AHEAD OF SCHEDULE**:

\_\_\_\_\_

List items from Schedule which are **RIGHT ON SCHEDULE**:

\_\_\_\_\_

List items from Schedule which are **BEHIND SCHEDULE**:

\_\_\_\_\_

If behind, what is the Contractor doing to get back on schedule?

\_\_\_\_\_

\_\_\_\_\_

When does the Contractor anticipate the Project to be back on Schedule? Date: \_\_\_\_\_

Are there any outstanding change order items? \_\_\_\_\_ Yes \_\_\_\_\_ No

If so, list them:

\_\_\_\_\_

\_\_\_\_\_

***Adverse Weather Summary***

	J	F	M	A	M	J	J	A	S	O	N	D
Scheduled	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Actual	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Balance	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

SUBMITTED: \_\_\_\_\_ DATE: \_\_\_\_\_

SIGNED: \_\_\_\_\_ TITLE: \_\_\_\_\_

No.      -     

Project: \_\_\_\_\_ Project #: \_\_\_\_\_

To: Timmons Group  
Attn:  
1001 Boulders Parkway, Suite 300  
Richmond, Virginia 23225

From: \_\_\_\_\_

Date Submitted: \_\_\_\_\_ Review Requested Not Later Than: \_\_\_\_\_

---

***Submittal Information and Contractor's Representation***

Subject: \_\_\_\_\_

Pursuant to Specification Section(s): \_\_\_\_\_ Drawing No(s): \_\_\_\_\_

Submitted as:  Specified Item  "Equal" Item  Substitution  \_\_\_\_\_

Items Submitted: \_\_\_\_\_

The Contractor's submittal of items for the Engineer's review and approval constitutes a representation that the items proposed have been reviewed thoroughly by the Contractor and found to be in conformance with the requirements of the Contract Drawings and Specifications. All deviations have been clearly listed in the submittal package and an explanation provided for the deviation.

Contractor's Reviewer (sign): \_\_\_\_\_ Date: \_\_\_\_\_

---

***Review Information***

Timmons Group:  
Received on: \_\_\_\_\_ Forwarded for review to: \_\_\_\_\_

Reviewer:  
Received On: \_\_\_\_\_ Reviewed by: \_\_\_\_\_

**Review is for general compliance with the Contract Documents. Nothing in this review shall be taken as permitting variation from the Contract Documents, unless specifically stated by the reviewer in writing. Sole responsibility for correctness of dimensions, options, details, quantities, and safety during fabrication and erection shall remain with the Contractor. EVALUATION OF INSTALLATION FOR FINAL ACCEPTANCE WILL BE BASED ON THE CONTRACT DOCUMENTS, NOT THE SUBMITTALS, EXCEPT AS SPECIFICALLY APPROVED OTHERWISE IN WRITING.**

- No Exceptions Taken       Rejected       Resubmission Not Required  
 Revise and Resubmit       Submit Specified Item       \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Returned to Timmons Group: \_\_\_\_\_ Returned to Contractor: \_\_\_\_\_

**SECTION 01 5000**  
**TEMPORARY FACILITIES AND ENVIRONMENTAL PROTECTION**

**1. GENERAL**

1.1 TEMPORARY FACILITIES

A. General:

1. Temporary facilities and protective devices include, but are not limited to, the following items: temporary barricades, fences, bridges, guards, temporary utilities, steel plates over trenches, maintenance of traffic and project identification signs.
2. All materials used in construction of the above mentioned items of work shall be of such size, shape and strength as to be suitable for the use intended.
3. The Contractor shall conduct construction operations in such a manner as to cause as little inconvenience as possible to the general public, and the Owner. Wherever required, the Contractor shall erect and maintain signs, fences, barricades, and pedestrian bridges and provide guards and flagmen for the protection of the public.
4. The Contractor shall take positive measures to prevent at all times, entry to the site of the work and storage areas by children, animals, and unauthorized adults.

B. Furnish and construct temporary fencing as needed to fence off excavation, storage, and operating areas. All temporary fences erected by the Contractor shall be substantially constructed, and neat in appearance.

1. Barricade or close all openings in roadways, floors, walls, or other parts of structures or walkways while the openings are not in regular use. Barricades shall be substantial and neat in appearance.

C. Unless otherwise specified, the existing systems shall remain in service during the entire construction period for the project. The Contractor shall provide temporary measures as necessary to maintain operation of the system. The Contractor shall provide water at no cost to the Owner. The Contractor shall assure the availability of drinking water for his work force.

D. The Contractor shall make the necessary arrangements and provide all temporary electrical service and lighting required during the entire construction period. The cost of electricity used shall be borne by the Contractor. The electrical service shall be sufficient capacity and characteristics to supply the proper current for the various types of construction tools, motors, welding machines, lights, heating plant, pumps, and other work required. All necessary temporary wiring, panel boards, outlets, switches, lamps, fuses, controls, and accessories shall be provided.

E. The Contractor shall provide and maintain an adequate number of temporary toilets with proper enclosures as necessary for use of workmen during construction. The Contractor shall keep toilets clean and comply with local and State health requirements and sanitary regulations. Toilet facilities shall be the prefabricated chemical type unless otherwise permitted.

F. The Contractor shall be responsible for provisions of temporary heating, including all costs of equipment and installation, fuel and attendance, whenever and for such periods as such heating may be required, either because of general weather conditions to prevent freezing, to provide suitable working conditions, or to assure progress of the operation within the established scheduled time for curing of concrete.

## 1.2 MAINTENANCE OF TRAFFIC

- A. The Contractor shall be responsible for maintaining a normal through traffic flow in accordance with County and VDOT requirements.
- B. The Contractor shall provide temporary facilities as required for pedestrian and vehicular access to properties adjacent to or contiguous to the project. Should it be necessary to temporarily interrupt access, the Contractor shall so notify the Engineer, and after securing the Engineer's approval, the Contractor shall notify all affected parties of the time, extent, and duration of the interruption.
- C. The Contractor shall not obstruct any driveway longer than two (2) hours without providing an alternate temporary access to the property.

## 1.3 ENVIRONMENTAL PROTECTION

- A. The Contractor shall be responsible for furnishing all necessary items for fulfilling the Work described herein for Environmental Protection including prevention and control of erosion and sedimentation that results directly or indirectly from the project. The Contractor shall also be responsible for compliance with the Erosion and Sediment Control Plan shown on the approved contract drawings.
- B. Prevention of Water Pollution:
  - 1. The Contractor shall take all such precautions in the conduct of his operations as may be necessary to avoid contaminating the water in adjacent watercourses or water storage areas.
  - 2. All earthwork, moving of equipment, and other operations likely to create silting, shall be conducted so as to minimize pollution of water courses and water storage areas.
  - 3. Water used during the work which has become harmful and contaminated with oil, bitumens, or objectionable chemicals, sewage or other pollutants, shall be disposed of so as to avoid affecting all nearby waters and lands. Under no circumstances shall the Contractor discharge pollutants into any watercourse or water storage area. The Contractor shall not allow water used in aggregate processing, concrete curing, foundation, and concrete lift cleanup, or any other waste, to enter a stream. When water from adjacent natural sources is used in the Work, intake methods shall be such to avoid contaminating the source of supply or becoming a source of erosion.
- C. Noise and Air Pollution Control
  - 1. The Contractor shall conduct his operations so as not to violate any applicable ordinances, regulations, rules, and laws in effect in the area pertaining to noise and air pollution.
- D. Preservation of Natural Resources
  - 1. All construction operations, cleanup, and the condition of the adjacent terrain upon completion of the work shall fully comply with all applicable regulations and laws concerning the preservation of natural resources.
- E. Dust Control
  - 1. Throughout the entire construction period, maintain dust control by use of water sprinklers or chemical dust control binder as may be approved by the Engineer and VDOT.

#### 1.4 CONFINED SPACE REQUIREMENTS

- A. The Contractor shall be responsible for all practices and procedures, either singularly or in combination, required for entry into a confined space area as defined by the Virginia Occupational Safety and Health Codes Board. Such practices include, but are not limited to:
  - 1. Preparation
  - 2. Atmospheric Testing
  - 3. Attendants and Rescue Teams
  - 4. Permit Systems
  - 5. Training
  - 6. Special Equipment and Tools
  - 7. Tripods, Safety Harnesses, Retrieval Lines, and Respiratory Protection
- B. The Contractor shall be required to conform to requirements stipulated in the Occupational Safety and Health Administration regulations.

#### 1.5 CLEANING DURING CONSTRUCTION

- A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.
- B. Clean areas prior to start of finish work; maintain areas free of dust and other contaminants during finishing operations.

### **2. PRODUCTS – NOT USED**

### **3. EXECUTION – NOT USED**

**END OF SECTION**

**SECTION 01 6000**  
**MATERIAL AND EQUIPMENT**

**1. GENERAL**

1.1 DEFINITIONS

A. Products:

1. New items for incorporation in the Work whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock and may also include existing materials or components required for reuse.
2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
3. Items identified by Manufacturer's product name, including make or model designation, indicated in Manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.2 DESIGN REQUIREMENTS

- A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of Virginia Statewide Uniform Building Code.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at elevations shown on Drawings.
- B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 0 °F to 104 °F.

1.4 PREPARATION FOR SHIPMENT

- A. When practical, have the factory assemble products, mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.
- C. Extra Materials, Special Tools, Test Equipment, and Expendables:
1. Furnish as Required by Individual Specifications.
- D. Schedule:
1. Ensure that shipment and delivery occur concurrently with shipment of associated equipment.
  2. Transfer to the Owner shall occur immediately subsequent to the Contractor's acceptance of equipment from Supplier and any required O&M Manuals have been delivered to and approved by the Engineer.

E. Packaging and Shipment:

1. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.

F. Prominently Displayed on Each Package, the Following:

1. Manufacturer's part nomenclature and number, consistent with the Operation and Maintenance Manual identification system.
2. Applicable equipment description.
3. Quantity of parts in package.
4. Equipment Manufacturer.

G. Delivery of Materials:

1. Notify the Engineer upon arrival for transfer of materials. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to the Owner.
2. Request a minimum 7-day advance notice of shipment from the Manufacturer. Upon receipt of the Manufacturer's advance notice of shipment, promptly notify the Engineer of anticipated date of equipment arrival.
3. Factory Test Results: Reviewed and accepted by the Engineer before product shipment as required in individual Specification Sections.

1.5 DELIVERY AND INSPECTION

- A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at the Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.
- B. Deliver products in undamaged condition, in the Manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.
- C. Unload products in accordance with the Manufacturer's instructions for unloading or as specified, and record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.
- D. Remove damaged products from the Site, and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.6 HANDLING, STORAGE, AND PROTECTION

- A. Handle and store products in accordance with the Manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, TEMPORARY FACILITIES AND ENVIRONMENTAL PROTECTION.
- B. Provide the Manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by the Owner.

- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.
- D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 °F. Protect electrical, instrumentation, and control products, and insulation against moisture, water, and dust damage. Connect and operate continuously all space heaters furnished in electrical equipment.
- E. Store fabricated products above ground on blocking or skids, prevent soiling or staining, and store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.
- G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.
- H. Hazardous Materials: Prevent contamination of personnel, storage building, and Site. Meet requirements of product specification, codes, and Manufacturer's instructions.

## **2. PRODUCTS**

### **2.1 GENERAL**

- A. Provide the Manufacturer's standard materials suitable for service conditions unless otherwise specified in the individual Specifications.
- B. Where product specifications include a named Manufacturer, with or without model number, and also include performance requirements, named Manufacturer's products must meet the performance specifications.
- C. Like items of products furnished and installed in the Work shall be end products of one Manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, Manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.
- D. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- E. Provide interchangeable components of the same Manufacturer, for similar components, unless otherwise specified.
- F. Equipment, Components, Systems, Sub-systems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, State, and local health and safety regulations.

- G. Regulatory Requirement: Coating materials shall meet Federal, State, and Local requirements limiting the emission of volatile organic compounds and for worker exposure.
- H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated ½” mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.
- I. Authority Having Jurisdiction (AHJ):
  - 1. Provide the Work in accordance with AHJ’s adopted edition of the Virginia Uniform Statewide Building Code. Where required by the VUSBC, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the VUSBC in order to provide a basis for approval under NEC.
  - 2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.
- J. Equipment Finish:
  - 1. Provide the Manufacturer’s standard finish and color, except where specific color is indicated.
  - 2. If the Manufacturer has no standard color, provide equipment with gray finish as approved by the Engineer.
- K. Special Tools and Accessories: Furnish to the Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, hand wheels, chain operators, special tools, and other spare parts as required for maintenance.
- L. Lubricant: Provide initial lubricant recommended by the equipment Manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by the Owner.

## 2.2 FABRICATION AND MANUFACTURE

- A. General:
  - 1. Manufacture parts to U.S.A. standard sizes and gauges.
  - 2. Two or more items of the same type shall be identical, by the same Manufacturer, and interchangeable.
  - 3. Design structural members for anticipated shock and vibratory loads.
  - 4. Use 1/4” minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
  - 5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible Oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform are required.
3. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
4. Provide constant-level oilers or oil level indicators for oil lubrication systems.
5. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.3 SOURCE QUALITY CONTROL

- A. Where Specifications call for factory testing to be witnessed by the Engineer, notify the Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.
- B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).
- C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion

**3. EXECUTION**

3.1 INSPECTION

- A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.2 INSTALLATION

- A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.
- B. No shimming between machined surfaces is allowed.
- C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Repaint painted surfaces that are damaged prior to equipment acceptance.
- E. Do not cut or notch any structural member or building surface without specific approval of Engineer.
- F. Handle, install, connect, clean, condition, and adjust products in accordance with the Manufacturer's instructions, and as may be specified. Retain a copy of the Manufacturer's instruction at the Site, available for review at all times.

- G. For material and equipment specifically indicated or specified to be reused in the Work:
    - 1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
    - 2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.
- 3.3 LUBRICANTS
- A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by the Owner.

**END OF SECTION**

**SECTION 01 7000**  
**CLOSEOUT PROCEDURES**

**1. GENERAL**

**1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for contract closeout, including but not limited to the following:
  - 1. Inspection procedures
  - 2. Warranties
  - 3. Final cleaning
- B. See Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

**1.2 SUBSTANTIAL COMPLETION**

- A. Record Drawings: The Contractor shall maintain an accurate set of Record Drawings and Specifications throughout the Work. 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 the 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, fiberoptic cables and conduits, television cables, electrical cables and conduits, gas lines, water lines, sewer force mains, sanitary sewers, storm sewers, and the like.
  - 2. To all cleanouts new and existing, size of service lines installed, and the like.
  - 3. Location of lines plugged or capped.
  - 4. 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.
  - 5. 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. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in the request.
    - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
    - 2. Advise the Owner of pending insurance changeover requirements.
    - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
    - 4. Obtain and submit releases permitting the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
    - 5. Prepare and submit the Project Record Documents, final completion construction photographs and photographic negatives if available, damage or settlement surveys,

property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with the Manufacturer's name and model number where applicable.
  7. Make final changeover of permanent locks and deliver keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
  8. Complete startup testing of systems.
  9. Submit test/adjust/balance records.
  10. Terminate and remove temporary facilities from the Project site, along with mockups, construction tools, and similar elements.
  11. Advise the Owner of changeover in heat and other utilities.
  12. Submit changeover information related to the Owner's occupancy, use, operation, and maintenance.
  13. Complete final cleaning requirements, including touchup painting
  14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- C. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, the Engineer will either proceed with inspection or notify the Contractor of unfulfilled requirements. The Engineer will prepare the Certificate of Substantial Completion after inspection or will notify the Contractor of items, either on the Contractor's list or additional items identified by the Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of the completed inspection will form the basis of requirements for Final Completion.

### 1.3 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of the list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by the Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
  2. Organize items applying to each space by major element, including categories for individual walls, and equipment, and building systems.

### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting the final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to the General Conditions.
  2. Submit a certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by the Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training DVD's.
- B. Inspection: Submit a written request for Final Inspection for acceptance. On receipt of request, the Engineer will either proceed with inspection or notify the Contractor of unfulfilled requirements. The Engineer will prepare a final Certificate for Payment after inspection or will notify the Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by the Manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces

## **3. EXECUTION**

### **3.1 FINAL CLEANING**

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal, State and Local environmental and antipollution regulations.
- B. Cleaning: Clean each surface or unit to condition equal to original plant condition. Comply with the Manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Final Completion for entire Project or for a portion of Project:
    - a) Clean Project site, yard, and grounds, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.
    - b) Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c) Remove tools, construction equipment, machinery, and surplus material from the Project site.
    - d) Clean exposed exterior and interior hard-surfaced finishes to a dirt free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - e) Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - f) Sweep concrete floors broom clean in unoccupied spaces.
    - g) Remove labels that are not permanent.
    - h) Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      - i. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- i) Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - j) Replace parts subject to unusual operating conditions.
  - k) Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - l) Clean light fixtures, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - m) Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Project site and dispose of lawfully.

### 3.2 SUBSTANTIAL COMPLETION

- A. Contractor shall demonstrate to the Owner and Engineer that each unit process functions and performs in accordance with the plans, specifications, and the Manufacturer's design criteria.
- B. The Contractor shall coordinate the date, time, and duration of the performance testing and demonstration with the Owner and Engineer.
- C. The Contractor shall correct deficiencies identified by the Owner or Engineer during performance demonstration prior to rescheduling a subsequent performance demonstration.
- D. Once the Contractor has demonstrated that each unit process functions and performs as required, the Engineer shall advise the Contractor in writing as to the date of Substantial Completion.
- E. The punch list of items to be corrected before the date of the final completion will be attached to the notification of substantial completion.

### 3.3 FINAL COMPLETION

- A. The Contractor shall coordinate with the Owner and Engineer confirmation that each item appearing on the punch list has been corrected.
- B. Once all punch list items have been corrected, the Engineer shall issue the Certificate of Final Completion.

**END OF SECTION**

**SECTION 02 0000  
SITE CONDITIONS**

**1. GENERAL**

1.1 DESCRIPTION

- A. Existing utility facilities and structures are shown in accordance with the best available information. The Engineer and / or the Owner shall not be responsible for the completeness or accuracy thereof nor for any deductions, interpretations, or conclusions drawn there from. Forty-eight hours in advance of work in the vicinity of existing facilities, the Contractor shall notify "Miss Utility" by calling 800-552-7001. The Contractor shall verify to his own satisfaction, the actual locations of existing facilities prior to construction in their vicinity.
1. Should the Contractor, in the course of his operations, encounter any underground utilities, the presence of which was not previously known or of a different type than shown, he shall immediately notify the Engineer and take all precautions necessary to support and protect the utility and maintain continuous service until said utilities can be adjusted by the appropriate owners or other corrective measures taken.
  2. Relocations by others arranged by and for the convenience of the Contractor shall be at no additional cost to the Owner.
  3. The Contractor shall be responsible for filing all requests with public utility corporations, jurisdictional agencies, or other owners to make all adjustments to public utility fixtures and appurtenances within or adjacent to the limits of construction. Furnish copies of all such requests and replies to the Engineer. The Contractor shall be responsible for coordinating his activities with said body. Additional costs resulting from a lack of coordination between the utilities and Contractor shall be at no additional cost to the Owner, and extension of time, therefore, will not be granted.
  4. Damage caused to utilities either directly or indirectly by the Contractor shall be repaired and the facilities restored to their original condition to the satisfaction of the Engineer and the utility owner, at no additional cost to the Owner.
- B. Work in Vicinity of Existing Utilities
1. At least 48 hours prior to starting work in the vicinity of utility structures and appurtenances, the Contractor shall notify "Miss Utility" as stated hereinbefore. The Contractor, at his own expense, shall support and protect all utility structures and appurtenances in accordance with the Contract Documents and/or the Owner's requirements and shall take any other steps necessary to protect the structures from disturbance and damage.
- C. Access to Utilities Facilities
1. The Contractor shall at all times permit free and clear access to the various affected facilities by personnel of the utility for the purpose of inspection, maintenance, providing additional service requirements and the construction of new facilities. When personnel of the utility are working within the limits of work to be performed by the Contractor, the Contractor will not be relieved of his responsibility for the maintenance and protection of such facilities.
- D. When local codes or laws require notification of work to agencies or departments, the Contractor shall be responsible for providing such notification.

**2. PRODUCTS – NOT USED**

**3. EXECUTION – NOT USED**

**END OF SECTION**

## **SECTION 31 1000 SITE CLEARING**

### **1. GENERAL**

#### **1.1 DESCRIPTION**

- A. This section provides requirements for general site clearing operations, including removal of trees and vegetation, protection of existing trees to be left standing, and clearing and grubbing. The Contractor is responsible for performing all work necessary to meet these requirements.
- B. Provide barricades, coverings, safety fence, or other types of protection necessary to prevent damage to existing facilities and appurtenances not indicated to be removed as well as improvements on adjoining properties.
- C. Restore all improvements damaged by this work to their original condition, subject to acceptance by the Owner and/or authorities having jurisdiction.
- D. Site clearing and grubbing shall be limited to those areas designated on the drawings as being within the limits of construction, easements, and right-of-way designated for the work. The contractor shall not clear or grub outside of the limits of construction without written permission of the property owner.
- E. Depressions caused by clearing and grubbing shall be filled and compacted with suitable material, as approved by the inspector, unless further earthwork is required.

### **2. PRODUCTS – NOT USED**

### **3. EXECUTION**

#### **3.1 CLEARING**

- A. Remove from the site and permanent easements: trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and other incidental structures as needed to allow for new construction. Where fences are removed to perform work, provide relocated temporary fencing as needed.
- B. Undisturbed stumps and roots which will be a minimum of 5 feet below finished grade and which will not be located under or within 10 feet of any structure or pipeline, may be left in place. Tops of stumps left in place shall not be more than 3 inches above original grade.

#### **3.2 EXISTING TREES AND SHRUBS**

- A. Trees and shrubs that are to remain within “Construction Limits” will be indicated on Drawings and conspicuously marked on site.
- B. Protect existing trees and other vegetation indicated to remain in place against cutting, breaking and skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Temporary fences, barricades or guards shall be provided as required to protect trees and vegetation to be left standing.
- C. Felled trees may remain property of the landowner upon request and shall be removed or cut in lengths as mutually agreed to by the Contractor, the Inspector and the landowner. If the landowner does not want the trees, they shall become the property of the Contractor and shall be removed from the site and properly disposed of by the

Contractor.

### 3.3 GRUBBING

- A. Grub areas within and to a point 10 feet outside of all structures and pipelines, except as otherwise indicated on the plans.
- B. Within the work area, remove from the ground to a depth of 18 inches below existing grade, all stumps, roots, root mats, organic material and debris and properly dispose of all materials.
- C. Only hand grubbing methods are permitted inside the drip lines of trees which are to remain.

### 3.4 DISPOSAL OF WASTE MATERIALS

- A. Remove all waste material from site and dispose of it in a legal manner such as an approved landfill.
- B. Continually clean up debris resulting from site clearing operations as the work progresses.
- C. Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times in accordance with the Virginia Department of Transportation Requirements.
- D. Burning of materials on site is prohibited.

**END OF SECTION**

**SECTION 03 2300  
TRENCHING AND  
BACKFILLING**

**1. GENERAL**

**1.1 DESCRIPTION**

- A. Work included in this section includes trenching and backfilling for underground pipelines and related structures only.
- B. Reference Specifications Are Referred to By Abbreviation As Follows:
  - 1. American Society for Testing and Materials --- ASTM
  - 2. American Association of State Highways and  
Transportation Officials ----- AASHTO
  - 3. Virginia Department of Transportation ----- VDOT
- B. Store and use explosives in accordance with Federal, State and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from use of explosives.
- C. Contractor shall provide compaction testing by a licensed, independent testing agency approved by Goochland County. The testing shall be performed by agency personnel in the presence of the County Construction Inspector. The testing company shall submit the results to the County Engineer.
- D. Locate existing utilities, culverts and structures, above and/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 Drawings or when location differs from those shown on Drawings, notify County Engineer for instructions before proceeding.
- E. The Contractor shall contact the power company when working in the vicinity of overhead power line poles. The power company shall hold poles and shield/ground lines as required and all costs associated with this task shall be paid by the Contractor.

**1.2 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. Rock: Hard bed rock, boulders, or similar material requiring the use of rock drills and/or explosives for removal. The criteria for classification of general excavation as rock is any material that cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material.
- 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 Inspector.

- G. Undercut Excavation: Additional excavation made necessary by the presence of unsuitable bearing materials at the specified subgrade or subsoil elevation. Undercut excavation must be approved by the Inspector. Where unsuitable materials are encountered, Contractor shall perform undercut excavation as needed or as directed by the Inspector.
- 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 Inspector. 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 as indicated on the appropriate Standard Detail.
- J. Backfill: Material placed on top of bedding. Backfill is used to cover the pipe and fill the trench. The contractor shall use the correct type(s) of backfill as indicated on the appropriate Standard Detail for the pipe being installed.

## **2. PRODUCTS**

### **2.1 GENERAL**

- A. Select fill shall be Type I or Type II in accordance with Section 207 of the VDOT Road and Bridge Specifications.
- B. Clean earth fill shall be approved by the Inspector and shall be free of debris, roots, frozen materials, organic matter, rock or gravel larger than 1-½ inches in any dimension or other harmful, deleterious matter and shall be classified as ML or better material in accordance with the Unified Soils System, ASTM D2487.
- C. Fine aggregate shall be #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.
- D. Coarse aggregate shall be #57 stone as per VDOT Road and Bridge Specifications Section 203.
- E. Where concrete is to be used, the Contractor shall submit a job mix with Laboratory Testing Reports for approval by the Department. Concrete for bedding, backfill or encasement shall be 3000 psi minimum.
- F. Riprap, where shown on the Drawings, shall conform to VDOT Specification Sec. 414.03 Dry Riprap.
- G. Topsoil is defined as the top 6 inches of original soil from the trench. Topsoil provided by the Contractor 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 ½- inch diameter, stones larger than ½-inch diameter and other material toxic or harmful to growth.

## **3. EXECUTION**

### **3.1 GENERAL**

- A. Contractor shall strip existing topsoil, leaf mold and organic materials and deposit it in storage piles separate from other excavated material.

- B. Where the trench excavation exceeds the specified width, the Contractor shall consult with the Design Engineer to determine whether measures need to be taken to account for increased loads on pipe.
- C. Where unauthorized excavations occur, the Contractor shall restore affected areas to the elevations and dimensions shown on the Drawings using granular fill material.
- D. The Contractor shall be responsible for removal of any/all unsatisfactory material from the site.

### 3.2 TESTING AND INSPECTION

- A. Compaction testing shall be performed by a licensed, independent testing agency. The testing shall be performed by agency personnel in the presence of the Inspector. The testing company shall submit the results to the County.
- B. In trenching operations, compaction testing shall be performed at increments of approximately 1,000 L.F. of trench, and at all commercial driveway entrance crossings.
- C. Inspector must approve subgrade prior to bedding and pipe installation, and each fill layer prior to installation of the next layer.
- D. The degree of compaction obtained shall be verified by means of field density tests made by an independent agency. Where tests indicate a deficiency in degree of compaction, the Contractor shall correct such conditions and the independent agency shall make additional tests in order to verify that the corrected work is satisfactory.

### 3.3 TRENCHING AND BEDDING

- A. Trenches may be opened only as far in advance of pipe laying as permitted by the Inspector.
- B. Excavate to the lines and grades indicated for pipelines and structures making proper allowance for pipe bedding materials, pipe bells and concrete form work.
- C. Excavate pipeline trenches with vertical walls. Specified trench width shall be maintained from bottom of trench to a point 18 inches above top of pipe.
- D. Where unsuitable soil is encountered, Contractor shall excavate to a depth acceptable to the Inspector, and shall replace unsuitable material with thoroughly and uniformly compacted pipe bedding material as indicated on the applicable Standard Detail.
- E. The width of the trench at and below the top of the pipe shall not exceed the width of the trench as shown on the applicable Standard Detail.
- F. Pipe bedding and backfill shall be performed as follows:
  - 1. Pressure Pipe: Ductile iron, PVC, and HDPE pressure lines 3 inches and larger shall be installed with bedding and backfill in accordance with Standard Detail TR-01 – Pressure Pipe Trench. Pressure pipe smaller than 3 inches of PVC, HDPE and copper tubing shall be backfilled with a minimum of 6 inches of sand or fine aggregate all around. Excavate for bell holes at each joint so that entire barrel of pipe shall be fully supported the entire length. Where rock is encountered, excavate and remove rock to a minimum 6 inches below the bottom of the pipe and use bedding and backfill as specified on Standard Detail TR-01 – Pressure Pipe Trench, regardless of pipe material.
  - 2. Gravity Sewer: Ductile iron and PVC gravity sewer lines shall be installed with bedding and backfill as specified on Standard Detail TR-02 – Gravity Sewer

Trench. Where rock is encountered, excavate and remove rock to a minimum 6 inches below the bottom of the pipe and use appropriate bedding and backfill as specified on Standard Detail TR-02 – Gravity Sewer Trench.

- G. All pipes shall be installed in a dry trench. Dewater excavation as necessary to provide proper protection. The method and equipment used for dewatering shall be subject to the approval of the Inspector.
- H. All soil is unclassified unless indicated otherwise.
- I. All foundation soils and subgrades shall be tested by a licensed, independent, testing agency to determine subgrade soil bearing capacity.
- J. Adequate positive drainage away from trenches and excavations shall be maintained throughout construction. Keep excavation free of water while work is being performed and until backfilled. Where underground streams or springs are found, provide temporary drainage or pumping and notify the Inspector.
- K. Where rock is encountered so that a manhole, vault, or other structure will bear entirely on rock, it shall be used to support the foundation. Where only a part of the foundation would bear on rock, Contractor shall excavate the entire structure to an even depth at least 8 inches below the bottom elevation of the structure and shall back-fill with coarse aggregate fill and thoroughly compact. Provide a minimum of 8 inches between rock excavation and sides of structures.

### 3.4 SHEETING

- A. Contractor shall maintain trench walls in a safe condition at all times. The use of sheeting and/or shoring may be required at the discretion of the Inspector.
- B. Unless otherwise directed by the Inspector, all sheeting and bracing shall be removed 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 approved by the Inspector.
- C. Sheeting and shoring left in place shall be cut off to a depth of not less than 24 inches below grade. The cutoff sections shall be removed from the site.

### 3.5 COMPACTION

- A. Power-driven hand tampers shall be used 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.
- B. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified percentage of maximum density.
- C. Do not place or compact material that is muddy, frozen, or contains frost or ice.
- D. Where compaction 90 percent or greater is required, test reports shall be submitted to the Department prior to Substantial Completion (e.g., for private development projects, prior to Tentative Acceptance).

### 3.6 BACKFILL

- A. Unless otherwise required by DPU Standards or as directed by the Inspector, the Contractor shall backfill all trenches immediately after the pipes and appurtenances are laid therein.
- B. Backfill shall be properly placed uniformly on each side of the pipe and compacted as required. Contractor shall not backfill on muddy or frozen soil, nor shall muddy or frozen soil be used as backfill.
- C. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil. Settlement may be achieved by puddling, mechanical tamping, or other means which satisfy the compaction requirements.
- D. Depressions caused by removal of stumps or other clearing operations shall be excavated to firm subgrade and filled with clean earth fill compacted as specified.
- E. Around and adjacent to structures, backfill shall be of material of suitable stability and perviousness. Backfill shall be placed in 6-inch layers, each layer being compacted by approved means. No backfill shall be placed against a structural wall until all connecting structural members are in place. It shall be the Contractor's responsibility to provide compaction to such a degree that the resultant subsidence after placing shall not be detrimental to the stability or appearance of the structure or adjacent areas. The Contractor shall provide adequate protection to all structures during backfilling and use every precaution to avoid damaging or defacing them.
- F. The Contractor shall compact soil materials using equipment suitable for materials to be compacted and work area locations.
- G. Coarse aggregate fill placed under manholes and other structures shall be compacted to the required density.

### 3.7 GRADING

- A. The Contractor shall:
  - 1. Uniformly grade all areas within the limits designated on the Drawings including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing grades.
  - 2. Finish all surfaces free from irregular changes.
  - 3. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.
  - 4. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.
  - 5. Shape subgrade under pavement to line, grade, and cross-section to within ½ inch of required subgrade elevations.
  - 6. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.
  - 7. Locate and adjust all manholes, valve boxes, etc. to final grade.
- B. Where compacted areas are disturbed by subsequent construction or adverse weather, the Contractor must scarify the surface, reshape and compact to the required density. Hand tampers shall be used for recompacting areas over underground utilities.
- C. Unless otherwise shown on the drawings, all disturbed areas shall be restored to

original grade.

### 3.8 UTILITIES TO BE ABANDONED OR REMOVED

- A. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the “Construction limits” or at points shown.
- B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material, compacted as specified. Plug, cap, or seal utilities with concrete, at the construction limits or at points shown.
- C. All abandoned underground pipe shall be removed or filled with flowable fill.

### 3.9 EROSION CONTROL

- A. The Contractor shall implement the approved erosion and sediment control plan, and continually comply with federal, state and local erosion control laws and the latest edition of the Virginia Erosion and Sediment Control Handbook.
- B. All required erosion and sediment control measures shall be taken prior to work starting.
- C. No more than 100 feet of trench shall be open at any one time without the approval of the Inspector. At the end of the day, all but the last length of pipe installed shall be backfilled at minimum.
- D. All disturbed areas shall be stabilized as soon as possible after backfilling.
- E. Graded areas shall be protected from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.
- F. Upon completion of work, after spoils and debris have been removed, final grading shall be performed and permanent seeding applied to any areas disturbed by operations.

### 3.10 CLEAN UP

- A. The Contractor shall keep the entire work area clean at all times and shall promptly remove all materials and debris not intended for incorporation into the project. The surfaces of all paved areas shall be cleaned in accordance with VDOT requirements.
- B. Maintain backfilled trenches from the nuisance of dust, mud or settling during the entire length of the project and for one year from the date of Final Acceptance.

### 3.11 PREPARATION FOR FINAL INSPECTION

- A. Locate and adjust all manholes, valve boxes, etc. to final grade and flush out all gravity pipelines as necessary prior to final inspection by County Engineer.

**END OF SECTION**

**SECTION 32 9219  
SEEDING**

**1. GENERAL**

1.1 DESCRIPTION

- A. Reference Specifications are referred to by abbreviation as follows:
  - 1. American Society for Testing and Materials ----- ASTM
- B. Submit two copies of following.
  - 1. Seed Test Report
  - 2. Fertilizer Analysis
- C. Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.
- D. Seed only when wind velocity is less than 15 miles per hour.

**2. PRODUCTS**

2.1 GENERAL

- A. Topsoil shall be the top 6 inches of original soil from the site, unless otherwise noted on the Drawings. Topsoil obtained off-site shall be fertile, friable loam, containing not less than 2 percent by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than 1/2 diameter, stones larger than 1/2-inch diameter and other material toxic or harmful to growth.
- B. Fertilizer shall meet requirements of Federal Specification O-F-241. Provide fertilizer that is complete, inorganic, uniform in composition and suitable for application with approved equipment.
  - 1. Proportions of fertilizer nutrients shall be the following:
    - a. 5 lbs. of actual nitrogen
    - b. 10 lbs. of actual phosphate
    - c. 5 lbs. of actual potash
- C. Grass seed, tested within 6 months of sowing, shall have the following characteristics.
  - 1. Permanent Seeding shall be in accordance with Table 3.32 D. from the Virginia Erosion and Sediment Control Handbook:

	<u>Total Lbs.</u> <u>Per Acre</u>
<u>Minimum Care Lawn</u>	
- Commercial or Residential	175-200 lbs.
- Kentucky 31 or Turf-Type Tall Fescue	95-100%
- Improved Perennial Ryegrass	0-5%
- Kentucky Bluegrass	0-5%

High-Maintenance Lawn 200-250 lbs.  
 - Kentucky 31 or Turf-Type Tall Fescue 100%

General Slope (3:1 or less)  
 - Kentucky 31 Fescue 128 lbs.  
 - Red Top Grass 2 lbs.  
 - Seasonal Nurse Crop\* 20 lbs.  
 150 lbs.

Low-Maintenance Slope (Steeper than 3:1)  
 - Kentucky 31 Fescue 108 lbs.  
 - Red Top Grass 2 lbs.  
 - Seasonal Nurse Crop\* 20 lbs.  
 - Crownvetch\*\* 20 lbs.  
 150 lbs.

\*Use seasonal nurse crop in accordance with seeding dates as stated below:

February 16th through April	Annual Rye
May 1st through August 15th	Foxtail Millet
August 16th through October	Annual Rye
November through February 15th	Winter Rye

\*\*Substitute Sericea lespedeza for Crownvetch east of Farmville, VA. (May through September use hulled Sericea; all other periods, use unhulled Sericea). If Flatpea is used in lieu of Crownvetch, increase rate to 30 lbs./acre. All legume seed must be properly inoculated. Weeping Lovegrass may be added to any slope or low-maintenance mix during warmer seeding periods; add 10-20 lbs./acre in mixes.

D. Temporary Seeding shall be in accordance with Table 3.31 B. from the Virginia Erosion and Sediment Control Handbook.

Seeding Dates	Species	Percentages (Min.)			Rate Lb. Acre
		Weight	Purity	Germ.	
Sept. 1-Feb. 15	50/50 Mix of Annual Ryegrass & Cereal (Winter) Rye	100	98	85	100
Feb. 16 – April 30	Annual Rye Grass	100	96	85	100
May 1-Aug31	German Millet	100	98	80	50

- E. For seeding of wetlands or other specific applications, the Engineer shall submit a site-specific seeding schedule.
- F. Lime shall be ground agricultural grade limestone containing not less than 85 percent calcium and magnesium carbonates. Fineness shall be such that 100 percent will pass a No. 20 sieve, not less than 50 percent will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

- G. Type I mulch shall be “Hold/Gro” erosion control fabric manufactured by Gulf States Paper Corporation, P. O. Box 3199, Tuscaloosa, Alabama 35401. The fabric shall be manufactured of materials which degrade in 6 to 8 months under outdoor exposure.
- H. Type II mulch composed of threshed straw of cereal grain, pipe needles or wood fiber shall be free of objectionable weed seeds or other harmful material.
- I. Asphalt adhesive for use with Type II mulch shall be emulsified asphalt meeting requirements of ASTM D977, Grade SS-1.
- J. Synthetic mulch binder for use with Type II Mulch: Curasol, DCA-70, Petroset, or Terra Tack.
- K. Sod shall be composed of at least 70 percent of Kentucky 31 tall fescue and be cut to provide a minimum thickness of 2 inches. Vegetation more than 5 inches in height shall be cut to 3 inches or less before sod is lifted.

### 3. EXECUTION

#### 3.1 TEMPORARY SEEDING

- A. Use in areas when final grading has not been completed or when permanent seeding cannot be done due to the specified permanent seeding dates. Also use in easements where no permanent seeding is required as shown on Drawings.
- B. Apply fertilizer at a rate of 15 lbs. of 10-20-10 per 1000 sq. ft. (600 lbs. per acre) or equivalent.
- C. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.
- D. Seed only between February 15 and November 15. Use mulching or sodding between November 15 and February 15.
- E. For lawn areas, the permanent seed mix shall be used for temporary seeding during the specified planting periods. Any areas receiving temporary seeding shall be reseeded with permanent seed in accordance with these specifications.

#### 3.2 SEEDING

- A. Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6 inches. Remove all stumps and roots, coarse vegetation, stones larger than 1-1/2 inches and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Rake to a uniform, smooth and drainable surface.
  - 1. Apply lime and fertilizer uniformly and mix well into top 4 inches of seed bed. Apply lime at the rate of 100 lbs. per 1000 sq. ft. to achieve a pH of 6.0 to 7.5. Apply fertilizer at the rate of 50 lbs. of 5-10-5 per 1000 sq. ft. or 25 lbs. of 10 - 20-10 per 1000 sq. ft. Rates should be adjusted for other grades of fertilizer.
- B. Sow permanent grass seed between dates of March 1 and April 15 or September 1 and October 15.
- C. Sow permanent seed by mechanical seeder as follows:
  - 1. Mix seed thoroughly with clean dry sawdust and broadcast at a rate of 6 lbs. of

- seed per 1000 sq. ft. in cross directions to ensure uniform distribution. Rake surface lightly and roll with appropriate type of lawn roller weighing maximum of 150 lbs. per foot of width.
2. Apply either Type I or Type II mulch uniformly leaving not more than 10 percent of the soil surface exposed.
    - a. Type I mulch.
      - i. Apply in accordance with manufacturer's instructions.
    - b. Type II mulch.
      - i. Apply uniformly to depth of approximately 1-1/4 inches uniformly leaving not more than 10 percent of the soil surface exposed.
  3. Anchor mulch by the following methods.
    - a. Apply light tack coat of asphalt emulsion:
    - b. In residential areas, apply synthetic mulch binder at rate recommended by manufacturer.
    - c. On slopes steeper than 4 horizontal to 1 vertical fasten heavy jute mesh to wooden stakes.
- D. Remove all soil or staining of finished walks, drives and parking areas resulting from seeding work. Maintain paved areas in clean condition.
- E. Establishment and Acceptance of Seeding
1. The Contractor shall maintain all seeded areas until final acceptance of the project and shall restore or replace any portion of the seeding work that is found defective or which becomes damaged prior to final acceptance. Restoration or replacement work shall include the reestablishment of the grade or profile of the area, replacement of topsoil, refertilization, reseeding, and remulching as directed by the Engineer. When the damage consists only of the displacement of mulch, the mulch shall be replaced within 7 days.
  2. Water as required to keep soil moist during germination period.
  3. If mowing is required to properly maintain all seeded areas until final acceptance, the following criteria shall apply:
    - a. When grass reaches height of 3 ½ to 4 inches, mow to height of 2- ½ inches.
    - b. Maintain grass height between 2 ½ and 4 inches.
    - c. Do not remove more than 33 percent of total height of grass in one mowing.
  4. Reseed and mulch all spots without a uniform stand of grass.
  5. Final project inspection shall not be scheduled until the vegetation is acceptable to the Engineer.
  6. Correct or repair all undue settling as evidenced by complaints received within one year after final inspection.

**END OF SECTION**

**SECTION 33 0523**  
**HORIZONTAL DIRECTIONAL DRILLING**

**1. GENERAL**

1.1 DESCRIPTION

- A. This section includes requirements for using the horizontal directional drilling (HDD) method of installing underground utilities. This method is also commonly referred to as directional boring or guided horizontal boring for pressure pipe.

1.2 QUALITY ASSURANCE

A. Qualifications

1. The Directional Drilling Contractor or Subcontractor shall have a minimum of 5-years' experience constructing water, wastewater, or reclaimed water pipes using the HDD method. Experience shall include pipelines of the same or larger diameter and the same or greater lengths as those included in the project.
2. The Contractor's operations shall be in conformance with the Plastic Pipe Institute "Handbook of Polyethylene Pipe" and the pipe manufacturer's requirements.

1.3 SHOP DRAWINGS AND SUBMITTALS

- A. The Contractor shall provide shop drawings and submittals to the County which are specific to the HDD method. These shall be provided to the County Engineer or Inspector for review and acceptance prior to construction, and shall be comprised of the following:

1. A detailed Work Plan
2. Pipe
3. Joining procedure
4. Training and experience of directional boring machine operator
5. Directional drilling equipment Specifications including calibration records
6. Proposed deviations from design

- B. The Contractor must submit a Work Plan which details the procedures and schedule to be used to execute the HDD installation. At a minimum, the Work Plan shall include the following:

1. A description of all tools and equipment to be used
2. A list of the personnel who will be performing the work, including their qualifications and relevant experience
3. A list of any/all Subcontractors
4. An environmental protection plan specific to the HDD operation
5. Contingency plans for possible problems which may arise during the work

C. Equipment:

1. The Contractor shall submit specifications on directional drilling equipment to be used and shall ensure that the equipment will be adequate to complete the work. Equipment submittals shall include but not be limited to the following:
  - a. Drilling rig
  - b. Mud system
  - c. Down-hole tools

- d. Guidance system
- e. Rig safety systems
- f. Data logger

D. Records:

- 1. Redline drawings shall be maintained throughout the work. Any deviation from the approved plans shall be noted on the redline drawings, including the nature and extent of the deviation.
- 2. Fusion results for all field joints shall be provided to the County for review prior to acceptance of the work.

## 2. PRODUCTS

### 2.1 EQUIPMENT

A. The directional drilling equipment shall consist of the following:

- 1. A directional drilling rig of sufficient capacity to perform the bore and pullback operations.
- 2. A drilling fluid mixing and delivery system of sufficient capacity to complete the installation,
- 3. A guidance system to accurately guide boring operations.
- 4. A vacuum truck of sufficient capacity to handle the drilling fluid volume.

B. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in proper working order for continuous drilling operations.

### 2.2 DRILLING SYSTEM

A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground, if required, to withstand the pulling, pushing, and rotating pressure required to properly complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

### 2.3 PIPE

A. Pipe shall be High Density Polyethylene (HDPE) in accordance with these specifications and Goochland County Standards.

- 1. The pipeline radius of curvature shall not be less than two times the minimum radius as defined by the pipe manufacturer for the size and thickness of the pipe being installed

### 2.4 TRACER WIRE

A. Tracer wire shall be installed with the pipe in accordance with requirements of the pipe manufacturer, the tracer wire manufacturer, these specifications and Goochland County Standards.

### 2.5 DRILLING FLUIDS

- A. Drilling fluids shall consist of a mixture of potable water and gel-forming colloidal material such as bentonite or a polymer surfactant mixture producing a slurry of custard-like consistency.

## 2.6 PERSONELL REQUIREMENTS

- A. Responsible representatives of the Contractor and Subcontractor(s) shall be present at all times during directional drilling operations. A responsible representative as specified herein is defined as a person experienced in the type of work being performed and who has the authority to represent the Contractor in a routine decision-making capacity concerning the manner and method of carrying out the Work.
- B. The Contractor and Subcontractor(s) shall have sufficient number of competent workers on the Project at all times to ensure the utility placement is made in a timely, satisfactory manner. Adequate personnel for carrying out all phases of the directional drilling operation (where applicable: tunneling system operators, operator for removing spoil material, and laborers as necessary for various related tasks) must be on the job site throughout the HDD operation. A competent and experienced supervisor representing the Contractor or Subcontractor who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the project site during the directional drilling operation.

## 2.7 WORK PLAN

- A. The Work Plan must be comprehensive, realistic, and based on actual working conditions for the particular Project. The Work Plan shall document the requirements to complete the Project.
  - 1. Calibration records for guidance equipment shall be included in the Plan.
  - 2. Specifications for any drilling fluid additives that the Contractor intends to use or might use shall be submitted with the Plan.

# 3. EXECUTION

## 3.1 INSTALLATION

- A. Erosion and sediment control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. Drilling mud shall be disposed of off-site in accordance with local, state, and federal requirements.
- B. No added chemicals or polymer surfactants shall be used in the drilling fluid without written consent of the Director, after a determination is made that the chemicals to be added are not harmful or corrosive to the system and are environmentally safe.
- C. Pilot Hole: Pilot hole shall be drilled along the bore path with no deviations greater than  $\pm 1$ -foot in the horizontal plane and  $\pm 1$ -foot in the vertical plane. In the event that the pilot does deviate from bore path more than  $\pm 1$ -foot, the Contractor shall notify the Engineer and the County. The Engineer or County may require the Contractor to pullback and re-drill from the location along bore path before the deviation. The Contractor shall submit any proposed deviations from the design bore path with the submittals.
- D. Reaming: Upon successful completion of pilot hole, the Contractor will ream borehole to a minimum of 25% greater than the outside diameter of the pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

- E. Pullback: After successfully reaming borehole to the required diameter, Contractor shall put the pipe through the borehole. In front of the pipe shall be a swivel and barrel reamer to compact bore hole walls. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pullback operations, the Contractor shall not apply more than the maximum safe pipe pull pressure at any time. A break away link rated below the maximum safe pull force shall be utilized. Pullback duration shall be limited to 12 hours maximum for each drill.
  - F. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole in such a manner as to prevent deformation of, or damage to, the pipe.
  - G. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the County and Engineer have been consulted.
  - H. The pipe shall be pulled back through the borehole using the wet insertion construction technique. The pipe shall be installed full of water.
  - I. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement, or distortion of surface features.
  - J. A boring log shall be kept with horizontal and vertical location of the installation. The horizontal location of the bore shall be marked in the field during the bore at a minimum of 50 foot increments and at directional changes. These marks shall include the bore depths. The contractor shall locate and record these marks in accordance with the requirements for Record Drawings contained in these specifications and Goochland County Standards
- 3.2 INSPECTION
- A. Fusion joining shall include a processor or electronic data recording device capable of reading and storing the input parameters and the fusion results for later download to a record file. The Contractor shall provide this information to the Department prior to acceptance of the work.
- 3.3 FIELD TESTING
- A. Acceptance testing of the directionally drilled pipe shall be in accordance with these specifications and Goochland County Standards for pressure pipe.

**END OF SECTION**

**SECTION 33 1000**  
**WATER DISTRIBUTION SYSTEM**

**1. GENERAL**

1.1 DESCRIPTION

- A. All pumps piping, valves, fittings, fire hydrants, meters, meter vaults, appurtenances and other products shall conform to the requirements of the latest edition of the Goochland County Department of Public Utilities Design and Construction Standards.

1.2 QUALITY ASSURANCE

- A. Comply with all applicable codes and regulations as required by regulatory agencies having jurisdictions over this Work.

1.3 CONNECTIONS TO EXISTING SYSTEM:

- A. The Contractor shall make connections to the existing system under a pressure or non-pressure condition, as indicated, complying with the system owner's requirements for the time of day such work can be done.
- B. Owner's valves and equipment shall be operated only by the Owner.
- C. Contractor shall submit for approval dimensioned layout drawings for all flanged ductile iron pipe. Drawings shall include all fittings, valves, equipment, taps, appurtenances, and dimensions to locate pipe in buildings.
- D. Exposed pipe shall be installed level, plumb and square to building walls and equipment in accordance with industry standards and practices.

**2. PRODUCTS**

2.1 UNDERGROUND PIPE AND FITTINGS

A. Ductile Iron Pipe:

- 1. Ductile iron pipe shall meet the requirements of AWWA C151 and AWWA C150. Minimum thickness shall be Class 52 with a working pressure of 350 psi. Rubber-gasket joints shall meet the requirements of AWWA C111. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. A minimum of 5% of the pipe furnished for a project shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

B. Ductile Iron Restrained Joint Pipe

- 1. Ductile iron restrained joint pipe shall meet the requirements of AWWA C151 and AWWA C150. Minimum thickness shall be Class 52 with a working pressure of 350 psi. Rubber-gasket joints shall meet the requirements of AWWA C111. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. Restrained push-on joints shall utilize a gripper ring, field weldments, or approved equal and shall be designed for a working pressure of 350 psi for sizes 4" through 24". A minimum of 5% of the pipe furnished for a project shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

C. Polyvinylchloride (PVC) Pipe

- 1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 305) for sizes up to 8 inches in diameter. Joints shall be in accordance with manufacturer's instructions and ASTM D2564, D2464, D2467, D319, and F477. Where working pressures over

150 psi are encountered, ductile iron pipe shall be used. Cell classification shall be 12454-B

D. High Density Polyethylene (HDPE) Pipe

1. 3-Inches and Smaller Pipe: Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a cell classification of 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. Pipe shall have a manufacturing standard of ASTM D2737 (copper tubing size), ASTM D2239 (iron pipe size, controlled inside diameter) and ASTM D 3035 (iron pipe size, controlled outside diameter). Pipe shall have a maximum dimension ratio of DR-9 and a minimum pressure class PC 250 psi. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall also have the following agency listing of NSF 14.
2. 4-Inches and Larger Pipe: Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS). Pipe shall have a maximum dimension ratio of DR-9 and a minimum pressure class PC 250 psi. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits per AWWA C906 and listed as NSF 61. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe.
3. HDPE pipe shall be continuously marked by the manufacturer with permanent printing indicating the following:
  - a. "NSF-PW"
  - b. Nominal size (inches)
  - c. Dimension ratio (DR)
  - d. Pressure rating (psi)
  - e. Material classification (PE 4710)
  - f. Plant, extruder, and operator codes
  - g. Resin supplier code
  - h. Date produced
4. HDPE pipe used for water shall be black in color with permanent blue stripes extruded into the pipe length or shall be solid blue.

E. Copper Tubing – 2” and Smaller

1. Underground services shall be seamless, annealed copper tubing Type K, in conformance with ASTM B88. Fittings shall be brass with compression joints suitable for direct burial.

2. Above ground, copper tubing shall be seamless hard copper tubing Type L, in conformance with ASTM B88. Fittings shall be brass or wrought copper. Joints shall be threaded or soldered.
3. Solder shall be 95-5 lead free solder meeting the requirements of NSF 61.

F. Fittings

1. Ductile Iron Fittings
  - a. Fittings for PVC pipe and DI pipe shall be ductile iron. Ductile iron fittings shall be in accordance with AWWA C110 or AWWA C153. Pressure ratings shall be a minimum of 350 psi. All fittings shall have a single cement mortar lining on the interior and a bituminous seal coating on the exterior. Fittings shall have mechanical joints conforming to the requirements of AWWA C111. Bolts for mechanical joint fittings shall be high strength, corrosion resistant low alloy steel with hexagon nuts having a minimum yield point of 45,000 psi in accordance with AWWA C111. Mechanical joint bolts shall be torqued with a torque wrench as per manufacturer's recommendations.
2. Polyethylene Pipe Fittings
  - a. Fittings for polyethylene pipe shall be manufactured specifically for the intended use and be approved by the piping manufacturer to be compatible with their product. All fittings shall have a working pressure rating equal to or greater than the pipe and shall meet all requirements of NSF 61.
  - b. Butt Fusion Fittings
    - i. Butt fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350 and approved for AWWA use. Butt fusion fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C901 and C906, shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR).
  - c. Electrofusion Fittings
    - i. Electro-fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. Electro-fusion fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electro-fusion fittings shall be suitable for use as pressure conduits, and per AWWA C901 and C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR).
  - d. Flanged and Mechanical Joint Adapters
    - i. Flanged and mechanical joint adapters shall be PE 4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3261.
3. Coupling Style Fittings
  - a. Pipe fittings 2" and smaller may be Dresser style 90, and Ford Meter Products Quick Joint or pack joint fittings upon approval of the engineer or owner.

#### G. Thrust Restraint

1. The Contractor shall install concrete thrust blocks at all tie-in points and as indicated on the contract drawings or as directed by the Inspector based upon field conditions. Thrust blocks shall be sized as indicated on the applicable Standard Detail for thrust blocking. Concrete shall have 3,000 psi strength at 28 days and shall meet the requirements of ASTM C94.
2. All pipe fittings, plugs, caps, tees, and bends on underground ductile iron or PVC piping shall be restrained utilizing approved wedge-action retainer glands. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2.
3. Ductile iron bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the length specified on applicable Standard Detail or as indicated the drawings, whichever is greater. Approved push-on restraining gaskets or harness type restraints shall be used. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.
4. PVC pipe bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the length specified on applicable Standard Detail or as indicated the drawings, whichever is greater. Harness type restraining devices shall be used on PVC bell and spigot pipe joints.

H. Couplings for underground or buried service shall be ductile iron mechanical joint in accordance with underground ductile fittings in this section.

### 2.2 ABOVE GROUND OR EXPOSED PIPING

#### A. Ductile Iron Pipe

1. Ductile iron pipe installed above ground, inside buildings, or in underground vaults shall be flanged ductile iron pipe class 53 in accordance with ANSI A21.15 (AWWA C115). Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints utilizing factory installed screwed flanges meeting the requirements of ANSI B 16.1. No Uniflange-type flanges are permitted. Outside coating shall be red primer. Gaskets for flanged pipe shall be 1/8-inch thick full face red rubber. All steel flanges mating to flat face flanges shall have the raised face machined off. Pipe shall have a single cement mortar lining with asphaltic seal coat meeting the requirements for AWWA C104.

#### B. Ductile Iron Fittings

1. Fittings for above-ground ductile iron pipe shall be flanged ductile iron in accordance with AWWA C110/ANSI A21.10. Fittings shall have a minimum working pressure rating of 250 psi. Unless indicated otherwise on the drawings, fittings shall have Class 125 flanged joints meeting the requirements of ANSI B 16.1. Outside coating shall be red primer. Gaskets for flanged fittings shall be 1/8-inch thick full face red rubber. Fittings shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104.

#### C. Above Ground Copper Tubing

1. Copper tubing for exposed services shall be seamless, hard copper tubing Type L, in conformance with ASTM B88. Fittings shall be wrought copper with soldered joints. Solder shall be 95-5 approved for potable water service.

D. Flange adaptors

1. Flange adaptors shall only be used for final connections to equipment or to allow for disassembly of pipe for equipment maintenance in approved locations. Flange adaptors are not to be used to make up for misaligned pipe. Uniflanges are not permitted.

2.3 TEMPORARY ABOVE GROUND PIPE AND FITTINGS

- A. Temporary above ground piping used for bypass piping, hydrant jumping or other temporary services shall be manufactured from high tensile strength, abrasion-resistant steel that is hot-dipped galvanized. Pipe and fittings shall be joined with quick connections with degree of articulation on coupling joints as indicated in the table below. Working pressure shall be as indicated in the following table.

Pipe diameter (inches)	Working pressure (psi)	Deflection (degrees)
2	290	30
3	290	30
4	175	30
6.25	175	20
7.625	175	20
10	99	10

2.4 GATE VALVES

- A. Gate valves 3" through 12" shall open counter-clockwise, have a resilient seat and meet the requirements of AWWA C509. Body shall be of cast iron with a 250 psig maximum working pressure and hydrostatically tested to 500 psig. Wedge shall be constructed of cast iron, bonded in synthetic rubber in accordance with ASTM D2000. Valve shall be coated inside and out with a fusion epoxy coating of a nominal 10 mil thickness on all exposed iron surfaces in compliance with AWWA C550 and be NSF 61 certified. Valves shall be bi-directional flow and have a ten year limited warranty.
1. Above ground valves or exposed valves in vaults shall utilize outside screw and yoke (OS&Y) with rising stems and have flanged ends meeting the requirements of ANSI B 16.1, Class 125.
  2. Underground valves shall utilize non rising stems, mechanical joint ends with a 2" operating nut in accordance with AWWA C111.
  3. Gate valves 3" and larger when located 6ft. or more above the finish floor or operating platform shall have chain operators.

2.5 BUTTERFLY VALVES

- A. Butterfly valves shall have a ductile iron body, seat in body design, ductile iron disk with a 316 stainless steel disc edge (3- and 4-inch valves to have 316 disk), symmetrical disc, nonmetallic bearings, chevron self-adjusting "V" type packing and have a 250 psi working pressure. Valves shall meet or exceed all the requirements of AWWA C504 standard class 250B and be NSF 61 certified. Exposed piping shall have flange ends Class 125 and underground valves shall have mechanical joint ends. Valves 4 inches and larger shall have gear operators. All exposed valves with gear operators shall have a position indicator.

## 2.6 BALL VALVES - ABOVE GROUND

- A. Ball valves 2" and smaller shall be 150 lb. rated, threaded ends, bronze or stainless steel body (stainless steel valves shall be used on stainless steel pipe), full port, lever operated, ball valves, with stainless steel ball and stem, and Teflon seats.

## 2.7 CHECK VALVES

- A. Swing check valves
  - 1. 3-inch and larger
    - a. Check valves 3" and larger shall be Class 125 flanged ends ductile iron body bronze mounted, bronze disc facing, swing type lever and weight check valves in accordance with AWWA C508. Flanged end dimension and drilling shall comply with ANSI B 16.1, Class 125. Check valves 3" through 24" shall have a 250 psig maximum working pressure.
  - 2. Check valves shall have an adjustable air decelerator (air cushion) installed on the outside of the valve to control valve closing.
  - 3. All check valves shall have a factory installed limit switch to indicate close position for flow confirmation.
  - 4. Check valves 2" and smaller shall be class 150 bronze or stainless steel y-pattern swing check valves with threaded ends.
- B. Silent check valves
  - 1. Silent check valves shall be the globe type with a spring-loaded disk. Valve shall have a ductile iron body, bronze plug, 316 stainless steel spring and a working pressure rating of 250 psig. Valves shall be flanged in accordance with ANSI B 16.1 class 125.

## 2.8 CORPORATION STOPS AND TAPPING SADDLES FOR UNDERGROUND SERVICE

- A. Corporation stops shall have either compression end for 1-inch copper tubing. All corporation stops shall be installed with a tapping saddle. Saddles shall be double strap epoxy coated ductile iron with stainless steel straps, bolts, and nuts.

## 2.9 ABOVE GROUND OR EXPOSED TAPS

- A. All taps on exposed pipe, flanged pipe, or above ground pipe shall be made on fitting bosses. No tapping saddles or tapping of pipe will be allowed unless specifically called for on the drawings.

## 2.10 VALVE BOXES

- A. Valve boxes for buried valves shall be cast iron, screw adjustable shaft boxes, with a minimum shaft diameter of 5-1/4 inches, unless otherwise specified on the Drawings.
- B. Valve box covers shall be marked with the word "WATER".
- C. Valves with valve boxes shall have an extended shaft pinned to the 2-inch operating nut. The extension shall terminate 12 inches below finish grade.
- D. Valve boxes outside pavement shall have a 24-inch by 24-inch by 4-inch concrete collar around top of the valve box as per Standard Details.
- E. A Valve Box Adaptor shall be installed between the valve and the valve box.

## 2.11 AIR RELEASE VALVES

- A. Air release valves shall have a minimum of a 1-inch N.P.T. inlet for pipe sizes 16 inches and smaller with a 3/32-inch minimum size outlet orifice. For pipes 18" and larger, a 2-inch N.P.T. inlet with a 3/16-inch minimum size outlet orifice shall be used.
- B. Valves shall have a cast iron body and cover, stainless steel float, Buna-N seat, Delrin lever frame and all other internal part shall be stainless steel or bronze.
- C. Air release valves shall be suitable for 150 psi working pressure at a minimum.
- D. All air release valve installations shall contain an isolation valve to allow removal of the air release valve for maintenance or replacement while the line is under pressure.
- E. Air release valve shall have a manual valve on the body to allow manual venting of the pipeline without removal of the air release valve.

#### 2.12 Reduced Pressure Zone Backflow Preventer

- A. Reduced Pressure Zone Backflow Preventer assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves, for resilient seated test cocks, a protective bronze wye strainer with a 20-mesh screen and an air gap drain fitting.
- B. The assembly shall meet the requirements of: the latest available American Water works Association (AWWA) standards including Std. C511; hold current University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC) approval and hold the American Society of Sanitary engineers (ASSE) listing.
- C. All RPZ backflow preventers shall be installed in strict accordance with manufacturer's instructions.

#### 2.13 SAMPLE TAPS

- A. All sample taps shall be threadless, lead-free hose bibs unless indicated otherwise on the drawings.

#### 2.14 HOSE BIBBS

- A. Threaded hose bibbs shall be provided with a hose bib vacuum breaker.

#### 2.15 WALL PIPES AND SLEEVES

- A. Pipes through concrete walls and slabs shall be provided with wall pipes or penetration seals. Wall pipes shall comply with cast iron fittings specification and shall have flanged joint connections unless otherwise noted on the drawings. Penetration seals shall be Link-Seal as manufactured by Thunderline Corporation of Wayne Michigan, or equal. All hardware shall be stainless steel. Sleeves inside diameters shall be sized to fit the outside diameter of the penetrating pipe and the link seal. Sleeves shall be of a thickness to maintain their shape and shall be manufactured by the seal manufacturer. All Sleeves shall have waterstops and be hot dipped galvanized after fabrication. Where pipe penetrations are in existing concrete structures, core drilling is acceptable provided the hole size is coordinated with the seal manufacturer.

#### 2.16 FLUSHING HYDRANTS

- A. Flushing hydrants shall comply with AWWA C502 standards for "dry barrel" compression type hydrants that open against pressure.
- B. Hydrants shall have a working pressure rating of 150 psi and a test pressure of 300 psi. They shall meet all the requirements of fire hydrants regarding operating nuts, stems,

working parts, stem design, full 360 rotation, body castings, and repairs without dismantling.

- C. Flushing hydrants shall be equipped with a threaded or mechanical joint inlet of the size as indicated on the plans, and shall have one 2-½-inch outlet with cap and chain.

#### 2.17 WATER SERVICE ACCESSORIES

- A. Meter coppersettors shall be provided for all 5/8- inch and 1-inch meters. Each shall have removable pack joints suitable for copper tubing. All coppersettors shall have saddle nuts, padlock wings, and two valves. Meters and copper settors shall be installed in accordance with Standard Drawings.
- B. Meter coppersettors shall be provided for all 1-½- thru 2 inch- meters. Each shall have removable NPT connections for hard copper tubing adaptors. All coppersettors shall have saddle nuts, padlock wings, and two valves. Meter settors for 1.50-inch and 2-inch meters shall have a lockable bypass. Meters and copper settors shall be installed in accordance with the Standard Drawings.
- C. The meter box shall be in accordance with Standard Drawings.

#### 2.18 TAPPING SLEEVES

- A. Tapping sleeves shall meet requirements of AWWA C110 for pressure ratings shown on the drawings. Sleeves shall be two-part stainless steel with stainless steel bolts and nuts, flanged outlet, and a full circumferential gasket. Tapping sleeves shall be for the size and type of pipe specified on the approved plans.

#### 2.19 COUPLINGS

- A. Bolted, sleeve-type couplings, reducing or transition couplings, and flanged coupling adapters for above ground or exposed service used to join plain-end pipe shall meet the requirements of AWWA C219. Each coupling shall have similar components: a center sleeve (sometimes called a “middle ring”), end rings (sometimes called “followers”), and threaded fasteners (bolts and nuts), that, when tightened, pull the end rings together. These components compress elastomeric gaskets in the space formed between the end rings, center sleeve, and pipes being joined, thereby sealing the coupling/pipe combination. They shall be manufactured from ductile iron and are intended for use in systems conveying water. All couplings shall be rodded.

#### 2.20 FIRE HYDRANTS

- A. Fire hydrants shall be of the safety, flange, breakaway top type, meeting requirements of AWWA C502. Hydrants shall have a barrel diameter no smaller than 6 inches. The hydrant valve diameter shall be 4-½ inches and shall be equipped with two 2-½-inch hose nozzles and one 4-½-inch pumper connection. Hose and pumper outlet threads shall be National Standard. The fire hydrant base shall be coated with fusion bonded epoxy and all hardware below grade shall be ASTM F593/F594 rated stainless steel. Fire hydrant tees shall be used.
- B. Fire hydrant color shall be as required by the Goochland County Code.

#### 2.21 TRACER WIRE

- A. Tracer wire for open cut pipe installations shall be High Strength, High Flexibility 12 AWG Copper Clad Steel (CCS) wire with minimum 0.030” thickness blue-colored insulation of High Molecular Weight Polyethylene (HMW-PE), and shall be specifically manufactured for use as tracer wire.

- B. Tracer wire for HDD pipe installations shall be Extra High Strength 10AWG Copper Clad Steel (CSS) polyethylene insulated with 0.045" wall thickness. Insulation color shall be blue for water lines.

#### 2.22 CONNECTORS FOR TRACER WIRE

- A. Wire connectors for tracer wire on open cut pipe installations shall be Set Screw Pressure type for use with 12AWG wire.
- B. Wire connectors for splicing tracer wire on HDD pipe installations shall be In-line splice type with set screws, a solid brass lug, and a heat-shrink cover, for use on 10AWG wire.
- C. Wire nuts shall not be used on tracer wire.

#### 2.23 TRACER WIRE ACCESS BOXES

- A. Tracer wire access boxes shall be made of cast iron with a permanently attached 3-inch by 12-inch ABS tube with a flared end to secure it in the ground.
- B. Tracer wire access boxes shall have tamper-resistant cast iron locking lids with stainless steel terminal connectors on the bottom side to which tracer wires are attached.
- C. Tracer wire access box lids shall utilize an AWWA pentagon key for opening.
- D. Enough slack shall be coiled inside boxes to allow the removal of the lid.
- E. Lids shall be marked "WATER".

#### 2.24 MARKING TAPE

- A. Tape shall be 3.5 mil polyethylene tape, 3 inches in width, with a 14-gage metallic core, and continuous printed message "Caution – Waterline Buried Below."

#### 2.25 BORE CASING PIPE

- A. Steel casing pipe shall be welded or seamless or smooth wall, consisting of Grade "B" steel as specified in ASTM A-139. Minimum yield strength shall be 35,000 psi, and pipe thickness shall be as specified on the construction plans. All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. Welds shall be a full penetration welds subject to visual inspection. All burrs at pipe ends shall be removed. Encasement pipe must be approved by the appropriate controlling agency (VDOT, railroad, etc.) and the Engineer prior to ordering. Spiral weld casing pipe will not be allowed.

#### 2.26 PRESSURE GAGES

- A. Pressure gauges shall be of all stainless steel construction, 3.5 inch case size, accuracy of 1% over the entire dial arch, 1/4" NPT bottom connection, Pressure range shall be as indicated on the drawings.
- B. Pressure gages shall be Ashcroft stainless steel-case 1009 pressure gauges or approved equal.
- C. All pressure gages shall be installed with a 1/4" stainless steel ball valve and stainless steel nipples.
- D. All pressure gages shall be mounted with fittings or on fitting bosses. NO TAPPING OF PIPE OR SADDLES WILL BE ALLOWED.

#### 2.27 COMBINATION AIR/VACUUM VALVES

- A. Air and vacuum valves shall be constructed with cast iron or stainless-steel bodies, type 304 stainless steel floats, bronze trim, and Buna-N seats. Valves shall be of the size and at the locations indicated on the drawings. Valves shall be of the combination type to relieve large volumes of air as the lines are filled or emptied and also release small quantities of

entrained air under pressure. Valves shall be for working pressures indicated on the drawings. Valves shall be installed with a full-size gooseneck on the outlet.

## 2.28 SERVICE SADDLES

- A. Service saddles shall be stainless steel, with stainless steel double straps and bolts, and tapped for AWWA threads.

## 3. EXECUTION

### 3.1 GENERAL

- A. Water lines shall be laid to lines and grades shown on the drawings with appurtenances and service connections at required locations. Installation of all materials shall be in strict conformance with manufacturer's recommendations, AWWA standards, and Goochland County Department of Public Utilities Design and Construction Standards.

### 3.2 SEPARATION OF POTABLE WATER LINES AND SANITARY AND/OR COMBINED SEWER

- A. Follow State Health Department standards for separation of water mains and sewer lines.
- B. Parallel Installation:
  - 1. Normal Conditions Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge to edge.
  - 2. Unusual Conditions When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sewer manhole provided that:
    - a. The bottom of the water line is at least 18 inches above the top of the sewer.
    - b. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure tested in place to 50 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.
- C. Crossing:
  - 1. Normal Conditions: Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.
  - 2. Unusual Conditions: When local conditions prevent the vertical separation described in crossing, normal conditions, (paragraph above) the following construction shall be used.
    - a. Sewers passing over or under water lines shall be constructed of the materials described in parallel installation, unusual conditions Paragraph b. above.
    - b. Water lines passing under sewers shall, in addition, be protected by providing:
      - i. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water lines.
      - ii. That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.
- D. No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

3.3 EXAMINATION OF MATERIAL:

- A. All pipes, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Owner, who may prescribe corrective repairs or reject materials.

3.4 PIPE ENDS:

- A. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt sand, grit, or any other foreign material before the joint is made. Proper lubricant shall be used for all push joint pipe.

3.5 PIPE CLEANLINESS:

- A. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

3.6 PIPE PLACEMENT:

- A. Laying of the pipe shall be commenced immediately after the excavation is started, and every means must be used to keep pipe lying closely behind the trenching as each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade before the next length of pipe is laid. No more than 200 lf of trench shall be opened at any one time. No opened trenches will be allowed at the end of the work day.
- B. Lay pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, lay pipe uphill with bell ends upgrade.

3.7 PIPE PLUGS:

- A. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

3.8 LAYING CONDITIONS

- A. Pipe shall be placed in a dry trench at the proper line and grade.

3.9 PIPE DEFLECTION

- A. Permissible deflection in mechanical joint pipe shall not be greater than 1/2 of that listed in AWWA C600 or as recommended by pipe manufacturer. No joint deflection shall be allowed in PVC pipe. Radius turn with PVC pipe shall be by bending pipe at 1/2 manufacturers recommended deflection.

3.10 PIPE CUTTING:

- A. Cutting of the pipe shall be done in a neat, workmanlike manner with the proper tools without creating damage to the pipe or cement mortar lining.

3.11 RESTRAINED JOINTS

- A. Provide reaction anchors of concrete blocking, metal harness, retainer gland type, restraining gaskets or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on Drawings.
- B. All mechanical joint bolts shall be torqued with a torque wrench as recommended by the manufacturer.

Bolt Size – Inches	Torque Ft. - Lbs.
5/8	45 - 60

3/4  
1

75 - 90  
100-120

- C. Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed

### 3.12 POLYETHYLENE PIPE INSTALLATION

- A. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.
- B. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.
- C. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.
- D. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

### 3.13 SETTING VALVES AND VALVE BOXES.

- A. Install valves with operator stems plumb in the vertical plane. Locate valves where shown on Drawings.

### 3.14 TRACER WIRE

- A. In addition to detectable tracer tape, tracer wire shall be installed with all water mains and shall be attached to all fittings. Tracer wire shall be taped directly to the top of the pipe at a maximum spacing of 8 feet and within 12" on each side of all fittings, and be installed in a continuous traceable manner.
- B. Tracer wires must be interconnected at pipe intersections. When non-metallic water lines have metallic service lines attached, the conductive tracer wire shall be attached to both the main line tracer wire and the corporation stop.
- C. In Valve boxes, tracer wire shall be brought to within 6 inches of the surface and left in a coil containing at least 24" of wire.
- D. Tracer wire shall be adequately and securely connected to tracer wire access boxes in accordance with the manufacturer's specifications.
- E. Tracer wire access boxes are to be utilized and spaced no more than 1,000 feet apart.
- F. Tracer wire access boxes shall be installed adjacent to all fire hydrants.
- G. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes
- H. Tracer wire shall comply with the product specifications as detailed in Section 5.1 of the County Standards.

### 3.15 MARKING TAPE

- A. Install marking tape in utility trenches above all pipes in accordance with manufacturer's recommendations. Install tape approximately 18 inches above the pipe and not less than 18 inches deep.

### 3.16 TESTING

- A. The County will supply water at no cost, for testing potable water lines only. Where water must be trucked to the test site, the Contractor shall be responsible for the cost of transportation.
- B. A temporary RPZ Backflow Preventer flushing apparatus is required if a direct connection to public water is used to fill the line.
- C. After the line has been backfilled and at least seven days after the last thrust blocking has been poured, the line, or any valved section of the line, shall be subjected to a hydrostatic pressure test. Testing shall be in accordance with AWWA C600, except as modified herein.
- D. The line to be tested shall be filled with potable water at a velocity of approximately 1 foot per second (fps). Take necessary measures to eliminate all air.
- E. After the system has been filled, pressure shall be raised by pump to 1.5 times the working pressure or 150 psi, whichever is greater. Test pressures shall:
  - 1. Not be less than 1.25 times the working pressure or 125 psi at the highest point along the test section.
  - 2. Not vary by more than plus or minus 5 psi.
  - 3. Not exceed twice the rated pressure of the valves or hydrants when test includes closed gate valves.
  - 4. Not exceed rated pressure of valves if resilient-seated gate valves or butterfly valves are used. Thrust restraint shall be designed for the test pressure. Measure pressure at the low point on the line being tested, compensating for gage elevation.
  - 5. Test pressure must be maintained for two hours. If pressure cannot be maintained, the Contractor shall determine the cause, perform necessary repairs, and repeat the test until successful.
- F. A leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water.
- G. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = SD * P^{0.5} / 148,000$$

Where: L is the allowable leakage, in gallons per hour;

S is the length of pipeline tested, in feet;

D is the nominal diameter of the pipe, in inches; and

P is the average test pressure during the leakage test in psig.

All visible leaks shall be repaired regardless of the amount of leakage

- H. Acceptance shall be determined on the basis of allowable leakage. If any test of pipe installed discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified

allowance. ALL VISIBLE LEAKS ARE TO BE REPAIRED REGARDLESS OF THE AMOUNT OF LEAKAGE.

3.17 DISINFECTION

- A. The Contractor shall disinfect, flush and test water mains and accessories in accordance with the procedures listed below. The water used in the disinfection process shall be potable water from an approved supply. If water is to be transported to the subject site, then the tank trucks must also be properly disinfected prior to transporting water. Disinfection of tank trucks shall also include all appurtenances used such as valves, hoses, etc.
- B. Preliminary Flushing: The main shall be flushed prior to disinfection. Flushing shall be at a velocity of not less than 3.0 feet per second (fps). Adequate provisions shall be made for drainage of flushing water. The following chart provides the pipe flow rates needed to maintain 3.0 fps velocity for various pipe diameters, based on CL 52 DIP

D (in)	Flow (GPM)
4	130
6	290
8	585
12	1,140
16	2,025
18	2,565
20	3,165
24	4,560

- C. Form of Chlorine for Disinfection:
  - 1. Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine-gas directly from the supply cylinder is unsafe and shall not be permitted.
  - 2. Calcium hypochlorite contains 70 percent available chlorine by weight. It shall be either granular or tabular form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water. A chlorine-water solution shall be prepared by dissolving the granules in water in the proportion requisite for the desired concentration.
  - 3. Sodium hypochlorite is supplied in strengths from 5.25 to 16 percent available chlorine. The chlorine-water solution shall be prepared by adding hypochlorite to water. Product deterioration shall be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.
- D. Application: The hypochlorite solutions shall be applied to the water main with a gasoline or electrically-powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to safely withstand the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.
- E. Methods of Chlorine Application:

1. Continuous Feed Method: Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid water line. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 MG/L available chlorine. To assure that this concentration is maintained, the chlorine residual shall be measured at intervals along the pipe not exceeding 1,200 feet in accordance with the procedures described in the current edition of "Standard Methods" and AWWA M12 - "Simplified procedures for water examination". In the absence of a meter, the rate may be determined either by placing a pitot gage at the discharge or by measuring the time to fill a container of known volume. Table I gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of one percent (1%) chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately 1 pound of calcium hypochlorite in 8.5 gallons of water.

TABLE I

CHLORINE REQUIRED TO PRODUCE  
50 MG/L CONCENTRATION  
IN 100 FT. OF PIPE - BY DIAMETER

<u>PIPE SIZE</u> <u>(IN.)</u>	<u>100 PERCENT</u> <u>CHLORINE</u> <u>(LB.)</u>	<u>1 PERCENT CHLORIDE</u> <u>SOLUTIONS</u> <u>(GAL.)</u>
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
16	0.430	5.12
20	0.675	8.00

2. During the application of chlorine, valves shall be manipulated or a backflow preventer shall be provided, to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 25 MG/L chlorine throughout the length of the main.
3. As chlorinated water flows past tees and crosses, related valves and hydrants shall be operated to disinfect appurtenances.
4. Final flushing: After the applicable retention period the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 MG/L.
5. Chlorinated water shall be de-chlorinated before disposal. Water shall not be allowed to flow into a waterway without neutralizing the disinfectant residual. See the appendix of AWWA C651, C652, and C653 for acceptable neutralization methods.

6. Chlorine residual testing shall be performed to assure that the heavily chlorinated water has been removed from the pipeline.

### 3.18 BACTERIOLOGICAL TESTS

- A. After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriologic quality and shall show the absence of coliform organisms. At least 2 samples shall be collected at least 24 hours apart at intervals not exceeding 1,200 feet along the water line. Samples shall be tested by a State Health Department approved laboratory and results submitted to the Inspector.
- B. In the case that trench water and/or excessive soil or construction debris has entered the new water main as determined by the contractor, owner, or county inspector, bacteriological samples shall be collected at approximately every 200 feet along the water main from water that has stood within the water main for at least 16 hours after final flushing.
- C. The Contractor may have an independent testing laboratory collect and test samples in accordance with these specifications. The samples shall be taken by laboratory personnel in the presence of the Inspector. The testing laboratory shall submit the results to the Department of Public Utilities.
- D. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory, and disinfection shall be repeated until the samples are satisfactory. Cleaning, disinfection, and testing will be the responsibility of the Contractor. Water for these operations will be furnished by the County, but the contractor shall be responsible for the cost of loading, hauling, and discharging the water.
- E. A sampling tap consisting of a corporation cock with metal pipe shall be installed within two feet of the valves which isolate the section of water line to be tested. The corporation stop inlet shall be male one inch in size and the outlet shall have 1-inch I.P. threads and a cap. After bacteriological testing is completed, the piping shall be removed and the corporation cock shall be closed and capped.
- F. Testing and disinfection of the completed sections shall not relieve the contractor of his responsibility to repair or replace any cracked or defective pipe.

**END OF SECTION**

**SECTION 33 3000  
SANITARY SEWERAGE**

**1. GENERAL**

1.1 DESCRIPTION

A. Work included in this Section consists of all gravity sanitary sewers, force mains, manholes, valves, air vents and all related equipment or material as indicated on the construction plans.

1. Reference Specifications are referred to by abbreviation as follows:

American National Standards Institute ----- ANSI

American Society for Testing and Materials ----- ASTM

American Water Works Association ----- AWWA

American Railway Engineering Association -- ---- AREA

**2. PRODUCTS**

2.1 GENERAL

A. Submit shop drawings on all products supplied and installed in the project in accordance with submittals procedures.

B. Provide certified test results of pipe testing.

2.2 UNDERGROUND PRESSURE PIPE

A. Ductile Iron Pipe

1. Ductile iron pipe shall meet the requirements of AWWA Class 52 and rubber-gasket joints shall meet the requirements of AWWA C111. 3" through 24" pipe shall be, at a minimum, class 52 with a working pressure of 350 psi. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. Pipe subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal. A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

B. Ductile Iron Restrained Joint Pipe

1. Ductile iron restrained joint pipe shall meet the requirements of AWWA C151 and AWWA C150. Minimum thickness shall be Class 52 with a working pressure of 350 psi. Rubber-gasket joints shall meet the requirements of AWWA C111. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. Pipe subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal. Restrained push-on joints shall utilize a gripper ring, field weldments, or approved equal and shall be designed for a working pressure of 350 psi for sizes 4" through 24". A minimum of 5% of the pipe furnished for a project shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

C. Polyvinylchloride (PVC) Pipe

1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 305) for sizes 8 inches and smaller. Joints shall be in accordance with manufacturer's

instructions and ASTM D2564, D2464, D2467, D319, and F477. If working pressures over 150 psi are encountered ductile iron pipe shall be used. Cell classification shall be 12454-B.

#### D. High Density Polyethylene (HDPE) Pipe

1. 3-Inches and Smaller Pipe: Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a cell classification of 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. Pipe shall have a manufacturing standard of ASTM D2737 (copper tubing size), ASTM D2239 (iron pipe size, controlled inside diameter) and ASTM D 3035 (iron pipe size, controlled outside diameter). Pipe shall have a pressure class as specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe.
2. 4-Inches and Larger Pipe: Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS). Pipe shall be minimum pressure class 250 psi (DR-9). The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits per AWWA C906. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe.
3. HDPE pipe shall be continuously marked by the manufacturer with permanent printing indicating the following:
  - a. Nominal size (inches)
  - b. Dimension ratio (DR)
  - c. Pressure rating (psi)
  - d. Material classification (PE 4710)
  - e. Plant, extruder, and operator codes
  - f. Resin supplier code
  - g. Date produced
4. HDPE pipe used for sewer shall be black in color with permanent green stripes extruded into the pipe length or shall be solid green.

### 2.3 GRAVITY PIPE

#### A. Polyvinylchloride (PVC)

1. For pipes sized 4-inch through 15-inch, pipe shall meet requirements of ASTM D3034 type PSM SDR-26 or of ASTM F1760 DR-26 having reprocessed-recycled content.

2. For pipe sized 18-inch through 36-inch, pipe shall meet requirements of ASTM F679, PS115.

B. Ductile Iron

1. Ductile Iron Pipe shall meet the requirements of ductile iron pressure pipe minimum Class 52 or as recommended by the pipe manufacturer for the depth of bury whichever is greater.

## 2.4 PRESSURE PIPE UNDERGROUND FITTINGS

A. Ductile Iron Fittings

1. Fittings for PVC pipe and DI pipe shall be ductile iron. Ductile iron fittings shall be in accordance with AWWA C110 or AWWA C153. Pressure ratings shall be a minimum of 350 psi for fittings 24-inch and smaller and 250 psi for 30-inch. All fittings shall have a single cement mortar lining on the interior and a bituminous seal coating on the exterior. Fittings subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal. Fittings shall have mechanical joints conforming to the requirements of AWWA C111. Bolts for mechanical joint fittings shall be high strength, corrosion resistant low alloy steel with hexagon nuts having a minimum yield point of 45,000 psi in accordance with AWWA C111. Mechanical joint bolts shall be torqued with a torque wrench as per manufacturer's recommendations.
2. Couplings for underground or buried service shall be ductile iron restrained mechanical joint in accordance with underground ductile fittings in this section.

B. High Density Polyethylene (HDPE) Pipe Fittings

1. Fittings for polyethylene pipe shall be manufactured specifically for the intended use and be approved by the piping manufacturer to be compatible with their product. All fittings shall have a working pressure rating equal to or greater than the pipe.
2. Butt Fusion Fittings: Butt fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350 and approved for AWWA use. Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using data loggers. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits and, per AWWA C901 and C906, shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR).
3. Electro-fusion Fittings: Electro-fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C901 and C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR).
4. Flanged and Mechanical Joint Adapters: Flanged and mechanical joint adapters shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. Flanged and mechanical joint adapters shall have a

manufacturing standard of ASTM D3261.

C. Thrust Restraint

1. Contractor shall install concrete thrust blocks at all tie in points and as indicated on the contract drawings or as directed by the Inspector based upon field conditions. Thrust blocks shall be sized as indicated on the thrust block Standard Details. Concrete shall have 3,000 psi strength at 28 days and shall meet the requirements of ASTM C94.
2. All pipe fittings, plugs, caps, tees, and bends in underground pressure piping shall be restrained. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2.
3. Ductile iron bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the lengths specified on the applicable Standard Detail or as indicated on the drawings, whichever is greater. Approved push-on restraining gaskets or harness type restraints shall be used. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.
4. PVC pipe bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the length specified on applicable Standard Detail or as indicated the drawings, whichever is greater. Harness type restraining devices shall be used on PVC bell and spigot pipe joints.

2.5 ABOVE GROUND OR EXPOSED PRESSURE PIPE

A. Ductile Iron Pipe

1. Ductile iron pipe installed above ground, inside buildings or underground vaults, shall be flanged ductile iron pipe class 53 in accordance with AWWA C115 (ANSI A21.15). Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints utilizing factory installed screwed flanges (no uniface type flanges are permitted) meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8 inch thick full face red rubber. All steel flanges mating to flat face flanges shall have the raised face machined off. Pipe shall have a single cement mortar lining with asphaltic seal coat meeting the requirements for AWWA C104. Pipe subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.

B. Ductile Iron Fittings

1. Fittings for ductile iron pipe shall be flanged ductile iron in accordance with AWWA C110. Fittings up to 30 inches in diameter shall have a minimum working pressure rating of 250 psi. Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8 inch thick full face red rubber. Fittings shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA

C104. Fittings subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.

2. Flange adaptors shall only be used for final connections to equipment or to allow for disassembly of pipe for equipment maintenance in approved locations. Flange adaptors are not to be used to make up for misaligned pipe. Flanged Adapters shall be JCM flanged coupling adaptors model 301R or approved equal. Uniflanges are not permitted.

C. PVC Pipe and Fittings

1. PVC pipe shall only be used for chemical piping in sizes 1" and smaller without special approval by the County Engineer. All PVC pipe and fittings shall be socket weld schedule 80. When transitioning from metal to PVC, the PVC adaptor shall always be a male NPT fitting inside of a female NPT metal fitting. Should the metal fitting be a male thread, a metal coupling shall be installed to provide a female thread for the PVC adaptor.

D. Stainless Steel Pipe and Fittings

1. All stainless steel pipe shall be Schedule 40 type 304 unless specified by equipment manufacturers or for chemical compatibility to be 316. Stainless steel pipe shall be threaded with threaded fittings.

## 2.6 PLUG VALVES

- A. Plug Valves shall be the non-lubricated eccentric type with resilient faced plugs. Port area shall be at least 80 percent of the full pipe area for gravity applications and 100 percent of the full pipe area for pumped applications. Bodies shall be cast iron with welded nickel, raised seats. Valves shall have permanently lubricated corrosion resistant bearings in the bonnet and body.
- B. Packing and packing glands shall be accessible without having to disassemble valves. Packing shall be adjustable.
- C. Valves shall have resilient plug facings suitable for the service intended and shall provide dead-tight shutoff. Opening the valve shall cause the plug to be raised off the seat without scraping the seat or body walls.
- D. Plug valves shall be gear operated unless otherwise shown or specified and shall open counterclockwise. Exposed plug valves (located above ground, inside buildings, valve vaults, etc.) shall be flanged and provided with gear operated hand wheel actuators complete with valve position indicators.
- E. Plug valves for direct burial service shall be provided with right angle worm gear operators. Buried valves shall be provided with adjustable cast-iron valve boxes with extension stems to within 12" of grade.
- F. Valve boxes shall meet the requirements of the Standard Details.
- G. Inside iron or steel surfaces of valves and exterior surfaces of valves which are to be buried in the ground shall be given two coats of asphalt varnish meeting the requirements of Federal Specification TT-V-51a. Exterior iron or steel surfaces of other valves shall be painted as specified for the pipelines in which they are installed.
- H. 4-inch and larger plug valves must pass a 3-inch spherical solid.

## 2.7 CHECK VALVES

- A. Swing check valves
  - 1. 3 inch and larger
    - a. Check valves 3 inches and larger shall be Class 125 flanged ends ductile iron body bronze mounted, bronze disc facing, swing type lever, and weight check valves in accordance with AWWA C508. Flanged end dimension and drilling shall comply with ANSI B 16.1, Class 125.
    - b. Check valves 3 through 24 inches shall have a 250 psig maximum working pressure.
    - c. Check valves larger than 24 inches shall be designed and specified on a case-by-case basis.
    - d. Check valves shall have an adjustable air decelerator (air cushion) installed on the outside of the valve to control valve closing.
    - e. All check valves shall have a factory installed limit switch to indicate close position for flow confirmation.
  - 2. Smaller than 3 inches: Check valves smaller than 3 inches shall be class 150 bronze or stainless-steel y-pattern swing check valves with threaded ends.

## 2.8 TRACER WIRE

- A. Copper tracer wire shall be taped directly to the top of the pipe at maximum interval of 8 feet and within 12” on each side of all fittings, and be installed in a continuous traceable manner. The tracer wire shall be connected to any air-release valves (ARV) along the force main alignment. Appropriately sized lockable connectors shall be used wherever sections of tracer wire must be joined together. Tracer wire shall be adequately and securely connected to tracer wire access boxes in accordance with the manufacturer’s specifications. Tracer wire access boxes are to be utilized and spaced no more than 1,000 feet apart. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes. Tracer wire shall comply with the product specifications as detailed in this Section.
- B. Tracer wire for open cut pipe installations shall be High Strength, High Flexibility 12 AWG Copper Clad Steel (CCS) wire with minimum 0.030” thickness green-colored insulation of High Molecular Weight Polyethylene (HMW-PE), and shall be specifically manufactured for use as tracer wire.
- C. Tracer wire for HDD pipe installations shall be Extra High Strength 10AWG Copper Clad Steel (CSS) polyethylene insulated with 0.045” wall thickness. Insulation color shall be green for sewer lines.

## 2.9 CONNECTORS FOR TRACER WIRE

- A. Wire connectors for tracer wire on open cut pipe installations shall be Set Screw Pressure type for use with 12AWG wire.
- B. Wire connectors for splicing tracer wire on HDD pipe installations shall be In-line splice type with set screws, a solid brass lug, and a heat-shrink cover, for use on 10AWG wire.
- C. Wire nuts shall not be used on tracer wire.

## 2.10 TRACER WIRE ACCESS BOXES

- A. Tracer wire access boxes shall be made of cast iron with a permanently attached 3-inch by 12-inch ABS tube with a flared end to secure it in the ground.

- B. Tracer wire access boxes shall have tamper-resistant cast iron locking lids with stainless steel terminal connectors on the bottom side to which tracer wires are attached.
- C. Tracer wire access box lids shall utilize an AWWA pentagon key for opening.
- D. Enough slack shall be coiled inside boxes to allow the removal of the lid.
- E. Lids shall be marked "SEWER".

#### 2.11 MARKING TAPE

- A. Tape shall be 3.5 mill polyethylene tape 3" in width with a 14 gauge metallic core, with the continuous printed message, "Caution - Sewer Line Buried Below." Tape shall be style 48288 as manufactured by the Seton Safety and Identification or approved equal.

#### 2.12 STEEL CASING PIPE

- A. A. Steel casing pipe shall be welded or seamless or smooth wall, consisting of Grade "B" steel as specified in ASTM A-139. Minimum yield strength shall be 35,000 psi, and pipe thickness shall be as specified on the construction plans. All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. Welds shall be a full penetration welds subject to visual inspection. All burrs at pipe ends shall be removed. Encasement pipe must be approved by the appropriate controlling agency (VDOT, railroad, etc.) and the Engineer prior to ordering. Spiral weld casing pipe will not be allowed.

#### 2.13 MANHOLES

- A. Precast reinforced concrete manholes shall be constructed in accordance with Standard Drawings for the type and size of manhole indicated on the drawings.
- B. Manhole joint types shall comply with one of the following:
  1. Provide tongue and groove joints in manhole sections with a pre-formed groove in the tongue for placement of an O-ring-type rubber gasket in accordance with the requirements of ASTM C443; or,
  2. Provide butyl-rubber-based preformed flexible sealant at each manhole joint. Butyl rubber sealant shall conform to ASTM C990, paragraph 6.2, and AASHTO M-198.
- C. Liners for acid-resistant manholes shall be of fiberglass reinforced polyester (FRP) or polyvinylchloride (PVC) or high-density polyethylene (HDPE) construction and shall be installed to protect the precast manhole sections from the inside base of the manhole to the base of the manhole frame. All connections of pipe to the manhole shall be sealed with the liner in a manner which will eliminate any exposed concrete surfaces that could be subject to damage by corrosive gases.
  1. FRP liners shall consist of a 3/16-inch thick fiberglass reinforced polyester with a 15 mil gel coat interior surface. Joints between sections of the liner shall be sealed with joint sealant.
  2. PVC liners shall consist of polyvinylchloride plates, not less than 0.060 inch thick, with integral bonding ribs. Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.
  3. HDPE liners: Joints between sections of the liner shall be welded in accordance

with the manufacturer's instructions by certified welders. Minimum liner thickness shall be 0.078 inches (2 mm).

- D. Manhole steps shall be corrosion-resistant and shall be 1-inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Standard Drawings. Manhole steps shall be aligned to minimize conflicts with current and planned future connections to the manhole. For sewers up to 15 inches in diameter, steps should be placed over the bench. Manhole steps shall not be placed on the downstream side of the manhole. Steps shall be installed at a maximum spacing of 12 inches.
- E. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in the Standard Details. Manhole covers shall be labeled "SEWER".
- F. Manholes shall be supplied with flexible connectors to allow connection of sewer pipes to the manholes. The manholes shall be cored at the factory as shown on the approved drawings, and shall be supplied with the appropriate flexible connectors.
- G. Sealant for manhole frames shall be a one-component polyurethane sealant.
- H. An external wrap of extruded butyl-rubber-based adhesive tape shall be applied around the full circumference of the manhole at all joints between precast sections. Tape shall be at least 6 inches in width, with minimum 50 mil (1.3 mm) thickness, and shall be overlapped at least twice its width. Backing component shall be HDPE. A release paper may be used. The tape shall meet or exceed the requirements of ASTM C877 Type III and ASTM C990.

#### 2.14 PRESSURE GAUGES

- A. Pressure gauges shall be mounted on a wafer pressure isolator ring (sensor ring) by the sensor ring manufacturer.
- B. Pressure gauges shall be of all stainless-steel construction, liquid filled, 3.5 to 4-inch diameter case size, accuracy of 1% over the entire dial arc, with a 1/4-inch NPT bottom connection. Pressure range shall be as indicated on the drawings.
- C. Gauges shall be graduated so the normal range of operating pressures are in the middle third of the scale.

#### 2.15 WAFER PRESSURE ISOLATORS RING (SENSOR RING)

- A. Wafer pressure isolator rings shall be designed to permit pressure measurement on slurries and other hard-to-handle fluids without compromising gauge function. Isolation ring shall consist of a metal ring with an elastomer inner tube filled with silicone instrument oil. Center section of isolator ring shall be carbon steel. End plates shall be Acetal Homo Polymer (or 316 stainless steel, Kynar, Teflon) and elastomeric sleeve shall be Nitrile (or EPDM, Viton).
- B. Wafer pressure isolator rings shall fit inside the bolt circle of 150# ANSI flanges (or shall be provided with appropriate spacers for 300# or 600# flanges). Face to face length of the wafer pressure isolator ring shall conform to specification MSS-SP67. Wafer pressure isolator ring shall be flow through design with flexible rubber sleeve around full circumference. The center section shall have a cavity behind the

rubber sleeve filled with silicone fluid to transfer pressure to the gauge.

- C. All pressure instruments attached to the wafer pressure isolator ring shall be rigidly supported by a post at least 0.875 inches diameter welded to the isolator. On wafer pressure isolator rings with more than one instrument, all connections shall be 1/2" NPT as a minimum. 1/4" NPT fittings are not acceptable. The wafer pressure isolator ring shall not have a fill plug that can be inadvertently removed with the resultant loss of fill fluid.
- D. The wafer pressure isolator ring shall be vacuum filled and permanently sealed at the factory with a modular seal consisting of a rubber membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. The needle fitting shall have both 1/4" NPT(F) thread and 1/2 NPT(M) threads. The wafer pressure isolator ring shall be capable of operating under pressure with all instruments removed with no loss of fill fluid, without isolating valves. Pressure instruments shall be attached to the wafer pressure isolator ring with a hand tightened lock ring. It shall be possible to remove, rotate or attach pressure instruments to the wafer pressure isolator ring without requiring the use of any tools. The wafer pressure isolator ring shall be permanently filled with high viscosity silicone instrument oil to damp out surges or pressure spikes without a separate snubber.
- E. Max operating pressure without leakage: 1,000 psig

2.16 PIPE SUPPORTS

- A. Pipes shall be supported by steel pipe hangers, clamps, brackets, rods and inserts as required to support the imposed pipe loads. Hangers in general shall be new, manufactured of carbon steel and hot dipped galvanized after fabrication or 304 stainless steel.
- B. Pipes 2 ½ inches and larger shall be supported with adjustable floor stand type pipe supports as detailed on the drawings. Pipe supports shall be Standon Model S89 flange support, Standon Model S96 cradle support as manufactured by Material Resources, Inc. or approved equal.
- C. Pipes 2" and smaller shall be supported from the floor, walls or ceiling depending on the type of building construction. Pipe supports for these size pipes shall be as manufactured by Unistrut Building Systems, B-Line or approved equal. Supports shall consist of floor stands, wall brackets or clevis type hangers. Strut and appurtenances shall be stainless steel. Clips for copper tubing shall be copper coated. Minimum threaded rod size shall be 3/8 inch.
- D. Ductile Iron and steel pipe supports shall be spaced in accordance with the following schedule:

Pipe sizes (inches)	½ - 3/4	1- 1 1/4	1 ½ - 2	3 – 4
Max spacing (feet)	4	6	8	10

- E. PVC pipe supports shall be spaced in accordance with the following schedule:

Nominal pipe size (inches)	½ - 3/4	1 - 1 1/4	1 1/2 - 2	3 - 4
Max spacing (feet)	2.5	3	4	6

- F. Maximum spacing between pipe supports shall be 10 feet for all pipes 6” and above. This is a maximum spacing and does not take into account valves, fittings, flow meters, risers, drops and other devices. Locations where these are installed will require additional supports.
- G. In addition to the above, pipe supports shall be located as per the following:
1. Maximum spacing as indicated above.
  2. Maximum of 12 inches from all horizontal and vertical changes in direction.
  3. On the suction and discharge of pump piping to eliminate pipe stresses on the pump flanges.
  4. On the connections to all equipment to eliminate pipe stresses on the equipment connections and allow equipment removal.
  5. On the inlet and outlet piping to the water meter to allow the removal of the water meter.
  6. At the location of valves, fittings or other devices that cause additional weight to the piping.
  7. Additional pipe supports as indicated on the drawings.

#### 2.17 COMBINATION AIR/VACUUM VALVES

- A. Air and vacuum valves shall be specifically designed for operation on sewage or waste media, constructed with cast iron or stainless-steel bodies, type 304 stainless steel floats, bronze trim, and Buna-N seats. Valves shall be of the size and at the locations indicated on the drawings. Valves shall be of the combination type to relieve large volumes of air as the lines are filled or emptied and also release small quantities of entrained air under pressure. Valves shall be for working pressures indicated on the drawings. Valves shall be installed with a full-size gooseneck on the outlet.

### 3. EXECUTION

#### 3.1 GENERAL

- A. Take all precautions necessary to ensure that pipes, valves, fittings, and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.
1. Keep pipes clean. Exercise care to keep foreign material and dirt from entering pipes during storage, handling and placing in trench. Close ends of in-place pipes at the end of any work period to prevent entry of animals and foreign material.
  2. Bed pipe as specified in Specification 31 2300 - Trenching & Backfilling.
  3. Do not lay pipe when weather or trench conditions are unsuitable.

4. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health Regulations.

### 3.2 GRAVITY SEWER PIPE

- A. Lay gravity sewers so as to maintain a true alignment and grade as indicated on Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.
- B. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill.
- C. Pipe joint. Preparatory to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing material. Use lubricants, as recommended by the manufacturer. Place, fit, join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Section 9 - Trenching & Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade and sufficient backfill to prevent floating.
- D. All sanitary sewer gravity mains buried underground shall have a detectable tracer buried in the trench approximately 18 inches above the conduit but no less than 18 inches below grade.
- E. Place backfill over the pipe immediately after the pipe has been laid. Provide ductile iron pipe where cover over main line sewer pipe is less than 5.5 feet in public roads and 3.5 feet in easements.

### 3.3 SEWER FORCE MAIN

- A. Force mains shall be installed in accordance with the approved plan and profile drawings. Where no grades are shown on the drawings, force mains shall be installed with a minimum depth of cover of 42 inches over the top of the pipe.
- B. Where grades on the force main plans and profiles conflict with existing pipes or structures, then provide additional depth using a uniform vertical curve to provide proper clearance without the use of fittings. Provide allowance for expansion as directed by the Inspector.
- C. Lay force main pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade.
- D. All sanitary sewer force mains buried underground shall have a detectable metallic tracer tape buried in the trench approximately 18 inches above the conduit but no less than 18 inches below grade. The detectable tape shall comply with the product specifications as detailed in Section 5.2.
- E. Copper tracer wire shall be taped directly to the top of the pipe at maximum interval of 8 feet and within 12" on each side of all fittings, and be installed in a continuous traceable manner. The tracer wire shall be connected to any air-release valves (ARV) along the force main alignment. Appropriately sized lockable connectors shall be used wherever sections of tracer wire must be joined together. Tracer wire shall be adequately and securely connected to tracer wire access boxes in accordance with the manufacturer's specifications. Tracer wire access boxes are to be utilized and spaced no more than 1,000 feet apart. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes. Tracer wire shall comply with the product specifications as

detailed in this Section.

### 3.4 JOINING PIPE

#### A. Join mechanical joint pipe as follows:

1. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (half cup granulated soap dissolved in 1 gallon of water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.
2. Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts, and make nuts finger-tight. Tighten nuts as specified by the manufacturer.
3. Use the tightening pattern specified by the manufacturer. If no specific pattern is specified, progressively tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed.
4. Permissible deflection in mechanical joint pipe shall not be greater than  $\frac{1}{2}$  of that listed in AWWA C600 or  $\frac{1}{2}$  the manufacturer's recommended deflection, whichever is less. There shall be no deflection of PVC pipe.

#### B. Join push-on joint pipe as follows:

1. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant, supplied by pipe manufacturer, to the gasket and the spigot end of the joining pipe.
2. Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.
3. Permissible deflection in push-on joint pipe shall not be greater than  $\frac{1}{2}$  of that listed in AWWA C600 or  $\frac{1}{2}$  the manufacturer's recommended deflection, whichever is less. There shall be no deflection of PVC pipe.

### 3.5 THRUST RESTRAINT

- A. Provide concrete reaction anchors (thrust blocking) at all points of tie-in to existing pressure pipelines. Provide mechanical joint retainer glands at all fittings, valves, plugs, caps, and other changes in directions or dead ends of pressure pipelines. Joint restraints shall be installed upstream and downstream of each bend, valve, and fitting for the minimum distance determined by the Engineer. Restraint length calculations shall be provided on the drawings.
- B. Thrust blocks shall bear against undisturbed earth. They shall be of the size and shape indicated on the appropriate Standard Detail drawings, unless specifically stated otherwise on the construction drawings.
- C. Use restrained joint pipe where indicated on the approved drawings.
- D. Use mechanical joint restraining glands for all mechanical joint pipe as indicated on the drawings to be restrained.

- E. All pressure pipe joints at pump stations within the fence boundaries shall be restrained.
- F. On sewer force mains, restraint calculations shall be provided on the drawings and length of restrained joints shall be indicated on the profiles.

### 3.6 SERVICE CONNECTIONS

- A. Service connections shall be in accordance with the Standard Drawings.

### 3.7 MANHOLE CONNECTIONS

- A. Connection to an Existing Manhole: A flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to an existing manhole.
  - 1. The flexible connector shall be installed by coring the manhole wall to the appropriate size. Acceptable connectors shall be listed in the Materials Standards in Section 5. Cored holes shall be sized, and connectors installed, in strict accordance with the manufacturer's recommendations.
  - 2. The connection shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connection manufacturer.
  - 3. The connector shall be of a size specifically designed for the pipe material and size being utilized on the project.
  - 4. This provision shall apply to both gravity sewer lines and service connections.

### 3.8 TESTING GRAVITY SEWER LINES AND MANHOLES.

- A. All gauges used for testing shall be calibrated, liquid-filled, gauges with a minimum of a 4-½-inch dial and a mirrored back.
- B. Sanitary sewer lines 24 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828. Sewer lines larger than 24 inches in diameter and manholes shall be tested by infiltration or exfiltration as hereinafter detailed. All sewer manholes shall be tested by a vacuum test in the presence of the County Inspector. Tests shall be conducted on complete runs of pipe from manhole to manhole. The Contractor shall provide all labor, materials, tools, and equipment necessary to perform the tests. All equipment and methods used shall be acceptable to the Inspector.
- C. Testing of Gravity Sewer Pipes
  - 1. Testing: All structures required to be watertight, and all piping and appurtenances, shall be tested for leakage by the Contractor in accordance with the requirements in these Standards, and in the presence of the Inspector.
  - 2. Gravity sewer pipes testing shall be done by air pressure test as specified herein.
  - 3. Air Test: The Contractor shall plug the pipe and shall conduct a low-pressure air test to determine the acceptability of the completed work. The Contractor shall furnish all men, materials, and supplies necessary to assist in the conducting of this test. This air test shall conform to UNI-BB-6-79 or latest revision.
  - 4. The air testing equipment shall be Air-Lock, as manufactured by Cherne Industrial, Inc., or approved equal. All air used shall pass through a single control panel. Individual air hoses shall be used from control panel to pneumatic plugs; from control panel to sealed line for introducing low pressure air; and from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

5. Test Method: The pneumatic plugs used in the test shall have a sealing length equal to or greater than the diameter of the pipe tested. Plugs shall resist internal test pressures without requiring external bracing or blocking. Plugs shall be tested prior to installation in the pipe run. A joint of pipe shall be sealed at both ends with the plugs which are to be used in the sewer test. Air shall be introduced into the plugs to 25 psi. The sealed pipe shall then be pressurized to 9 psi. The plugs shall withstand this pressure without bracing or movement. The tested line segment shall be plugged and pressurized to 4.0 psi greater than the ground water back pressure but not to exceed 9 psi. The line shall be allowed to stabilize for 2 minutes after pressurization. After the pressure has stabilized, the air pressure shall be decreased slowly to 3.5 psi greater than ground water back pressure and the timing of the test shall commence. The time for the pressure to drop 1 psi from 3.5 psi shall be recorded. The minimum acceptable time durations are shown on Table I. If the elapsed time to drop 1 psi is less than that shown on Table I, then the air loss shall be considered excessive and the section of pipe has failed the test.
6. Sewer lines shall be prepared for the test as follows: Flush and clean the sewer line prior to testing. This will wet the pipe surface and well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.
7. Ground Water Determination: Install a ½-inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.
8. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828. The pressure-holding time is based on an average holding pressure of 3.0 psi gauge or a drop from 3.5 psi to 2.5 psi gauge.

---

**TABLE I****SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP  
FOR SIZE AND LENGTH OF PIPE INDICATED Q=.0015****PART 1A**

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)			
				100'	150'	200'	250'
4	3:46	597	.380 L	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12

---

**PART 1B**

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)			
				300'	350'	400'	450'
4	3:46	597	.380 L	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	106:57	124:38	142:26	160:15
33	31:10	72	25.852 L	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	153:50	179:29	205:07	230:46

9. Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gauge. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.
10. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gauge, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gauge during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.
11. The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.
12. If the pipe to be tested is submerged in ground water, the test pressure shall be increased by 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer, to a maximum of 9 psi.
13. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.
14. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as 250 pounds of force (lb-f) is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, a sudden expulsion of a poorly installed plug, or of a plug that is partially deflated before the pipe pressure is released, can be extremely dangerous.
15. As a safety precaution, pressurized equipment shall include a regulator or relief

valve set slightly over the test pressure to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in manholes during testing.

16. Table: The air test table above has been prepared utilizing applicable formulas from ASTM C828-76T. It is based on an allowable air loss of 0.0015 cubic foot per minute per square foot of internal pipe surface, a maximum air loss per test section of 3.5 cubic feet per minute and a minimum significant air loss per test section of 1.0 cubic foot per minute. It applies when testing one pipe diameter only and for convenience ignores the volume of sewer laterals, which in most instances create only insignificant differences in test time.

### 3.9 MANHOLE NEGATIVE AIR PRESSURE (VACUUM) TEST

#### A. Vacuum Test shall be in accordance with ASTM C1244.

1. All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole.
2. The values recorded are applicable only to the manhole being tested and at the time of testing.

#### B. Preparation of the Manhole.

1. All lift holes shall be plugged.
2. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

#### C. Procedure.

1. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
2. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.
3. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in Table 2.
4. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

**TABLE 2  
MINIMUM TEST TIMES FOR VARIOUS DIAMETER MANHOLES.**

Depth (ft.)	Diameter (in.)		
	48	60	72
	Time (sec.)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97

5. For manholes less than 8 feet in depth the minimum value listed shall be used. For other manhole diameters or greater depths, refer to ASTM C1244.
- D. Test for leakage of gravity sewers using either the infiltration or exfiltration test. Allowable leakage shall be 100 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2400 gallons per mile per 24 hours.
1. Use infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole. Measure the amount of water flowing through the outlet after flow has been stabilized.
  2. Ground water determination: Use same procedure as "low pressure air test" above.
  3. Use exfiltration test when ground water is less than 4 feet above the pipe crown.

Plug the pipe at the lower manhole. Fill the line and manhole to 4 feet above pipe crown or top of manhole whichever is less. Let the water stand until pipe as reached maximum absorption and until all trapped air has escaped, 4 hours minimum. After maximum absorption is reached, refill manhole to original level. After 30 minutes, record difference in level and convert to gallons. Subtract manhole loss to obtain pipeline loss. Manhole loss is found by plugging inlet and outlet and filling manhole with water to 4 feet above pipe crown or top of manhole whichever is less. Let water stand one hour to reach maximum absorption. Refill to original level. After 30 minutes, check difference in level and convert to gallons. Manhole leakage shall not exceed 1/2 gallon per hour.

E. All gravity sanitary sewers are to be CCTV'd prior to acceptance into the county system.

### 3.10 FORCE MAIN TESTS SHALL BE AS FOLLOWS:

- A. The Contractor shall supply the pumps, water, calibrated gauges and meters, and all the necessary apparatus for performing the test.
- B. Prior to performing any test, the Contractor must contact the Inspector to schedule a date and time for the test. All tests must be performed in the presence of the Inspector.
- C. Hydrostatic pressure test: After the line has been backfilled and at least seven days after the last concrete anchor block was poured, a hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 1.5 times the working pressure or 150 psi, whichever is greater. Measure the pressure at the lowest point in system with the gauge compensated for elevation. Maintain the pressure for at least two hours. If pressure cannot be maintained, determine the cause, repair and repeat the test until successful.
- D. Leak Test: A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibrated test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure with 5 psi of the specific test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed the amount calculated by the following formula:

$L = S * D * P^{0.5} / 13200$  Where:

L is the allowable leakage, in gallons per hour;

S is the length of pipeline tested, in feet;

D is the nominal diameter of the pipe, in inches; and

P is the average test pressure during the leakage test in psig

E. All visible leaks shall be repaired regardless of the amount of leakage.

### 3.11 CCTV INSPECTION

- A. Immediately prior to applying for acceptance by the County, the Contractor must clean all gravity sewer lines and perform video inspection via CCTV. Video Inspections of sewer systems shall be carried out in compliance with the NASSCO PACP reporting format and coding standards, and the requirements of these Standards.
- B. Required Deliverables:
  - 1. Submit a letter of CCTV completion.
  - 2. Submit a CD of the information as discussed below.

- C. For new installations, the Contractor shall, following construction, conduct a final video inspection of all gravity pipes and a visual inspection of all manholes and wet wells. Copies of reports of this inspection shall be submitted to the Inspector for approval.
- D. The Contractor shall be responsible for all traffic control required during the inspections. This shall include flagging, all applicable signage, and/or detours as designated by the more stringent authority in the design plans, the Goochland County Standards and Specifications, and the VDOT MUTCD design manual (latest editions of all.)
- E. After cleaning, all pipe sections shall be visually inspected by means of closed-circuit television camera. The inspection will be done one section at a time, from manhole to manhole. Any flow in the section being inspected will be suitably controlled as needed. All CCTV inspections shall be performed in accordance with NASSCO PACP standards including the specific date and time of inspection.
- F. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Inspector.
- G. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire pipe section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire pipe section, the inspection shall be considered failed. Additional repairs, cleaning, and inspection will be required.
- H. The camera shall be stopped at each joint and lateral connection, and the head rotated to show a 360-degree picture.
- I. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications among members of the crew.
- J. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be made above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Inspector. Documentation of the television results shall be as follows:
  - 1. Television Inspection Logs: Electronic media location records shall be kept by the Contractor and will clearly show the location, by distance in 1/10 of a foot from the manhole wall, in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, cracks, fractures, broken pipe, presence of scale and corrosion, and other discernible features, as defined in the PACP defect codes, will be recorded on electronic media

and a copy of such records will be supplied to the Owner.

2. Digital photographs of the pipe condition and all defects shall be taken by the Contractor. Photographs shall be located by distance in 1/10 of a foot from the manhole wall, in relation to an adjacent manhole.
3. Electronic media recordings: The purpose of electronic media recording shall be to supply a visual and audio record of problem areas of the lines for review by the Department. Upon completion of the CCTV inspection, an original electronic media recording of conditions and defects will be delivered to the Inspector.
4. All CCTV Inspections shall be performed by CCTV personnel who are trained and certified in the use of NASSCO's Pipeline Assessment and Certification Program (PACP)©.

**END OF SECTION**

# **APPENDIX A**

## **Geotechnical Engineering Report**

# **GEOTECHNICAL ENGINEERING REPORT**

**HUGUENOT HILLS WATER AND SEWER DESIGN  
GOOCHLAND COUNTY, VIRGINIA**

**JOB NUMBER: 50070**

**PREPARED FOR:**

**GOOCHLAND COUNTY  
P.O. BOX 10  
GOOCHLAND, VIRGINIA 23063**

**AUGUST 4, 2022**



**TIMMONS GROUP**

**YOUR VISION ACHIEVED THROUGH OURS.**

## TABLE OF CONTENTS

<b>1. PROJECT INFORMATION</b> .....	<b>1</b>
<b>2. FIELD EXPLORATION</b> .....	<b>1</b>
<b>3. LABORATORY TESTING</b> .....	<b>2</b>
<b>4. SITE GEOLOGY</b> .....	<b>3</b>
<b>5. SUBSURFACE CONDITIONS</b> .....	<b>3</b>
5.1 Ground Surface Cover .....	3
5.2 Existing Fill Soils.....	3
5.3 Residual Soils.....	3
5.4 Weathered Rock.....	4
5.5 Auger Refusal Materials .....	4
5.6 Groundwater .....	4
<b>6. CONCLUSIONS AND RECOMMENDATIONS</b> .....	<b>4</b>
6.1 Site Preparation.....	4
6.2 Excavations.....	4
6.2.1 Moderate to High Consistency Soils.....	5
6.2.2 Weathered Rock.....	5
6.2.3 Mass Rock.....	5
6.3 Trench Backfill .....	5
6.4 Re-use of On-site Soils as Trench Backfill.....	6
<b>7. LIMITATIONS OF REPORT</b> .....	<b>6</b>
<b>8. CLOSURE</b> .....	<b>7</b>

## APPENDICES

Appendix A – Figures

Appendix B – Boring Logs

Appendix C – Laboratory Test Results



1001 Boulders Parkway  
Suite 300  
Richmond, VA 23225

P 804.200.6500  
F 804.560.1016  
[www.timmons.com](http://www.timmons.com)

August 4, 2022

Goochland County  
P.O. Box 10  
Goochland, Virginia 23063

Attention: Ms. Wanda Tormey

Re: **Geotechnical Engineering Report**  
Huguenot Hills Water and Sewer Design  
Goochland County, Virginia  
Timmons Group Project No. 50070

Ms. Tormey:

Timmons Group is pleased to submit this geotechnical engineering report for the referenced project. The objectives of our services were to explore subsurface conditions and provide our geotechnical recommendations for site grading as it pertains to the proposed water and sanitary sewer line construction.

Timmons Group prepared a Preliminary Geotechnical Engineering Report dated August 18, 2021 for this site (Timmons Group Project No. 48806). Information from that Report is included in this design-phase report.

## 1. PROJECT INFORMATION

The project is located along Rochelle Road and Ville Ponteaux Lane in Goochland County, Virginia. A Site Vicinity Map is shown on Figure 1. We understand that the project will consist of installing new underground sanitary sewer and water piping that will extend from Patterson Avenue to approximately 1,500 feet to the north along Rochelle Road and Ville Ponteaux Lane. We assume that these utilities will be installed through open trench excavations.

## 2. FIELD EXPLORATION

The current field exploration included a visual site reconnaissance by a representative of Timmons Group and the performance of seven soil test borings (22B-01 through 22B-07). Boring locations were selected by Timmons Group. Approximate boring locations are shown on Figure 2 in

Appendix A. Locations of prior borings from our Preliminary Geotechnical Engineering Report are also shown on Figure 2. Those preliminary borings are designated as (B-01 to B-07).

Borings from the current exploration were performed to depths of approximately 13 to 15 feet below the existing ground surface with hollow stem auger drilling techniques. Split-spoon samples of subsurface soils were taken within soil test borings at approximate 2-foot intervals above a depth of 10 feet and at 5-foot intervals below 10 feet. Standard Penetration Tests were conducted in conjunction with split-spoon sampling in general accordance with ASTM D 1586.

Water levels were measured in open boreholes at the time of drilling. Upon completion, boreholes were then backfilled up to the original ground surface with drill cuttings. Representative portions of split-spoon soil samples were returned to our laboratory for quantitative testing and visual classification in general accordance with Unified Soil Classification System guidelines.

Boring logs and generalized soil profiles (Figures 3 & 4), which present specific information from the borings, are included in the Appendix. Stratification lines shown on the boring logs and profiles are intended to represent approximate depths of changes in soil types. Naturally, transitional changes in soil types are often gradual and cannot be defined at particular depths. Ground surface elevations shown on these documents were interpolated from a project topographic plan and should be considered approximate.

### 3. LABORATORY TESTING

Laboratory testing was performed on representative split-spoon samples obtained from the current borings. This testing consisted of natural moisture contents, Atterberg limits and grain size analyses. Laboratory tests were performed in general accordance with applicable ASTM procedures. Individual laboratory test data sheets are provided in the Appendix. A summary of laboratory test data is provided in the tables below.

#### Natural Moisture and Classification Tests

Boring	Sample	Depth (Feet)	Natural Moisture Content (%)	Atterberg Limits			Grain Size Analysis			USCS Classification
				LL	PL	PI	% Sand	% Fines*	% Gravel	
22B-01	S-3	4-6	26.4	64	21	43	42.8	57.2	0.0	CH
22B-01	S-6	13-15	22.6	44	27	17	2.0	98.0	0.0	ML
22B-02	S-4	6-8	17.9	--	--	--	--	--	--	SM**
22B-03	S-3	4-6	11.1	30	24	6	45.0	55.0	0.0	ML
22B-04	S-5	8-10	21.7	33	21	12	69.6	30.4	0.0	SC
22B-05	S-4	6-8	15.6	31	23	8	39.0	61.0	0.0	CL
22B-06	S-3	4-6	20.1	38	19	19	22.8	77.2	0.0	CL
22B-07	S-5	8-10	37.0	--	--	--	--	--	--	CL**

\*Material passing No. 200 sieve (clay and silt)  
\*\*Visual Classification

Based on the Atterberg limits testing, near-surface soils are of moderate to high plasticity. The time of year the construction occurs will likely have a significant impact on the moisture levels of near-surface soils.

#### 4. SITE GEOLOGY

According to the 1993 Geologic Map of Virginia, the site is predominately located in the Piedmont Physiographic Province of Virginia. The Piedmont is characterized by low, rounded hills composed of saprolitic soils overlying folded metamorphic and igneous bedrock. Locally, the site appears to be underlain by the Newark Supergroup Triassic Sandstone. The majority of soils in the Piedmont were formed from the chemical weathering of parent bedrock and are termed “residual” soils.

#### 5. SUBSURFACE CONDITIONS

The following is a summary of subsurface conditions encountered during the preliminary and design phase exploration.

##### 5.1 Ground Surface Cover

Borings B-01 and B-02 encountered 3 to 4 inches of surficial asphalt pavement. The remaining borings encountered approximately 2 to 6 inches of surficial topsoil (forest litter) or surficial gravel.

##### 5.2 Existing Fill Soils

Beneath the ground surface cover, existing fill soils were encountered in Borings B-02, B-05, B-06, 22B-01, 22B-02, 22B-03 and 22B-07 to depths of approximately 2 to 8 feet. These fill soils consisted of very soft to very stiff highly plastic clay (CH), elastic silt (MH), very loose to medium dense silty sand (SM) and clayey sand (SC). Standard Penetration Test (SPT) N-values within the fill ranged from 0 (weight of hammer) to 27 blows per foot (bpf).

##### 5.3 Residual Soils

Beneath the ground surface cover or fill soils in the previously mentioned locations, the majority of the borings encountered undisturbed residual soils to depths up to 22 feet below the ground surface. These soils consisted of medium stiff to hard highly plastic clay (CH), elastic silt (MH), lean clay (CL), silt (ML), loose to dense clayey sand (SC), and silty sand (SM). SPT N-values within the soil profile ranged from 5 to 50 blows per foot (bpf).

#### **5.4 Weathered Rock**

Weathered rock was encountered in Borings B-01 through B-07, 22B-01, 22B-03 and 22B-06 at depths ranging from approximately 4 to 22 feet below the existing ground surface. Weathered rock is defined as a residual material having Standard Penetration Test N-values of 60 blows per foot or greater. Weathered rock was sampled as silty sand (SM), clayey sand (SC), elastic silt (MH), or silt (ML).

#### **5.5 Auger Refusal Materials**

Materials refusing auger advancement or spoon refusal were encountered in Borings B-01 through B-03 and B-05 through B-07 at depths of approximately 9.0 to 19.1 feet below the ground surface. Auger refusal materials could represent competent bedrock, hard lenses within the weathered rock profile, or boulders.

#### **5.6 Groundwater**

At the time of exploration, water was encountered in borings 22B-02 and 22B-04 at depths of approximately 8 and 12 feet below the ground surface. Groundwater was not encountered in the remaining borings. It is important to realize that groundwater levels will fluctuate with changes in rainfall and evaporation rates. In addition, perched groundwater could be encountered within near-surface soils, particularly after rainfall.

### **6. CONCLUSIONS AND RECOMMENDATIONS**

The following conclusions and recommendations are based upon our borings, laboratory testing, engineering analysis, and past experience with similar projects and subsurface conditions.

#### **6.1 Site Preparation**

Within the project limits, site preparation should begin with clearing and grubbing of existing trees, stripping of topsoil, removal of pavement sections (where planned), and the removal of any other unsuitable materials. Approximately 3 to 4 inches of surficial asphalt pavement and 2 to 6 inches of surficial topsoil (forest litter) or surficial gravel was encountered in the borings. However, in wooded areas, removal of root mat associated with trees will likely cause stripping depths to be greater than actual topsoil depths. Topsoil and demolition debris should be wasted from the site.

#### **6.2 Excavations**

We expect that excavations will extend through moderate to high consistency soils and weathered rock. Based on the borings, we expect excavation of weathered rock could be necessary in the vicinities of Borings B-01 through B-03, B-05 through B-07, 22B-01 and 22B-06. Excavation of

mass rock could be necessary in the vicinity of Boring B-02. Soil types with respect to trench safety must be evaluated on a case-by-case basis. The Contractor shall be responsible for all site safety, including the determination of appropriate trench safety measures according to OSHA guidelines. Water was encountered in two of the borings at depths of approximately 8 and 12 feet. The contractor is responsible for controlling and removing water that collects in excavations.

Our comments regarding excavation of on-site materials are presented in the following sections.

### **6.2.1 Moderate to High Consistency Soils**

Local excavation of moderate to higher consistency soils will likely require the use of a large track-mounted excavator, such as a CAT 330D, equipped with rock teeth. However, the rate of excavation in the higher consistency soils is typically slow.

### **6.2.2 Weathered Rock**

Our experience is that confined excavations into soft weathered rock (SPT N-values of 60 blows per foot to 50/4") are practical with the above-referenced excavator, but the excavations becomes slower and more difficult as the SPT N-value increases, particularly for SPT N-values exceeding 50/6". Weathered rock materials with SPT N-values greater than 50/4" are considered "hard" weathered rock and will likely require preloosening with blasting or use of a hoe ram. Most of the weathered rock encountered in the borings appears to be "soft", with SPT N-values less than 50/4".

It is important to note that the success of excavating weathered rock materials in confined excavations is dependent upon many factors. These include weakness seams within the weathered rock, orientation of the seams, skill of the operator, and the diligence with which the contractor pursues excavation.

### **6.2.3 Mass Rock**

Mass rock will require preloosening with blasting or use of a hoe ram. If blasting is performed, a pre-blast survey of nearby structures should be performed. In addition, blast-induced vibrations on nearby structures should be monitored and should be such that they do not cause damage to these structures.

## **6.3 Trench Backfill**

All work and backfill materials should be in accordance with Section 9 of the Goochland County's 2015 Standards and Specifications of Public Utilities. Per this Section, the separate requirements for trench backfill compaction in unpaved areas and roadways are summarized below.

- Unpaved Areas – unpaved areas are defined as those located outside of paved roadways and shoulders. On-site soils may be used as trench backfill in unpaved areas, provided they

meet the material requirements in the Goochland County's Standards and Specifications manual. Trench backfill in unpaved areas should be compacted to at least 85 percent of the Standard Proctor maximum dry density.

- Pavements and Road Shoulders—Trench backfill should be compacted to at least 95 percent of the Standard Proctor maximum dry density and within 2 percent of optimum compaction moisture. The final 12 inches of trench backfill should be compacted to at least 98 percent of the Standard Proctor maximum dry density. All trench backfill within pavements and road shoulders should be placed in maximum 4-inch loose lifts if compacted by hand operated equipment.

Site work, including fill placement and compaction, should be observed by a qualified soils technician working under the direction of a Geotechnical Engineer. During fill placement, a sufficient amount of in-place density tests should be conducted to confirm that compaction and fill moisture is in accordance with the County's requirements.

#### **6.4 Re-use of On-site Soils as Trench Backfill**

Soils encountered in the borings, excluding those with topsoil, organics or debris, should be suitable for re-use as trench backfill, provided the moisture content can be properly controlled and they meet the requirements provided in Goochland County's 2015 Standards and Specification of Public Utilities.

Prevailing weather conditions will have a significant impact on the amount of moisture manipulation (i.e., drying or wetting) required prior to fill placement. Fine-grained soils are often difficult to dry and manipulate, even during favorable weather conditions.

### **7. LIMITATIONS OF REPORT**

The recommendations contained in this report are made on the basis of the site information made available to us and the surface and subsurface conditions that existed at the time of the exploration. While this exploration has been conducted in accordance with generally accepted geotechnical engineering practices, there remains some potential for variation of the subsurface conditions in unexplored areas of the site. If the subsurface conditions encountered during construction vary significantly from those presented in this report, we should be notified to reevaluate our recommendations. No other warranty, expressed or implied, is made as to the professional advice included in this report.

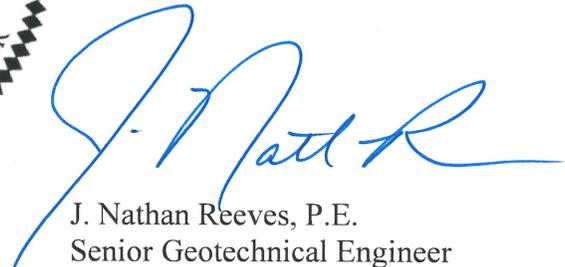
## 8. CLOSURE

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this study or if we can be of further assistance, please contact us at (804) 200-6500.

Respectfully submitted,  
**TIMMONS GROUP**

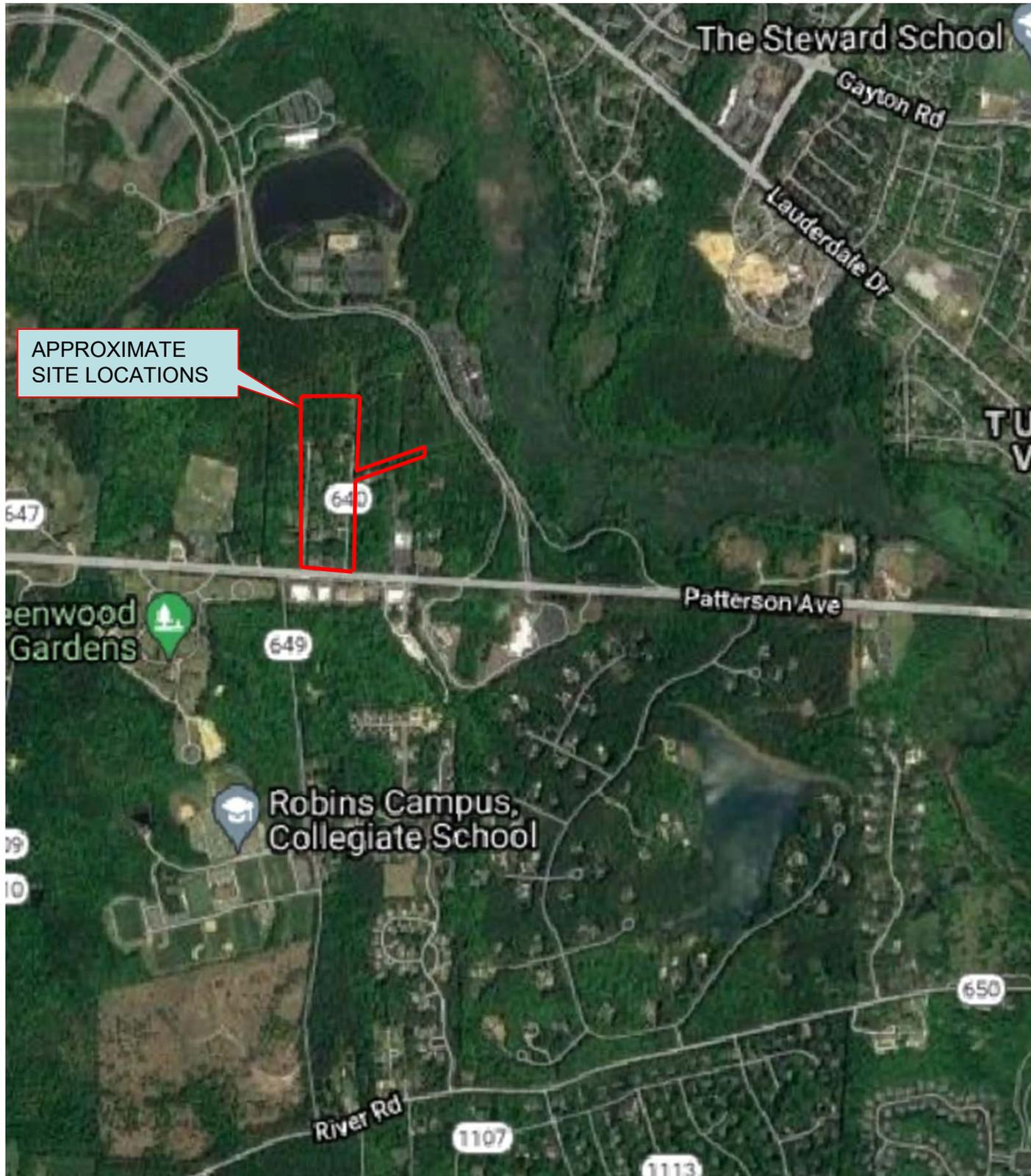


  
Julian M. Ruffin IV, P.E.  
Geotechnical Engineer  
VA Registration No. 050631

  
J. Nathan Reeves, P.E.  
Senior Geotechnical Engineer  
VA Registration No. 049619

APPENDIX A  
FIGURES

NORTH



Source: Google Maps

SCALE: NTS

CHECKED BY: JNR

PLOTTED BY: JMR

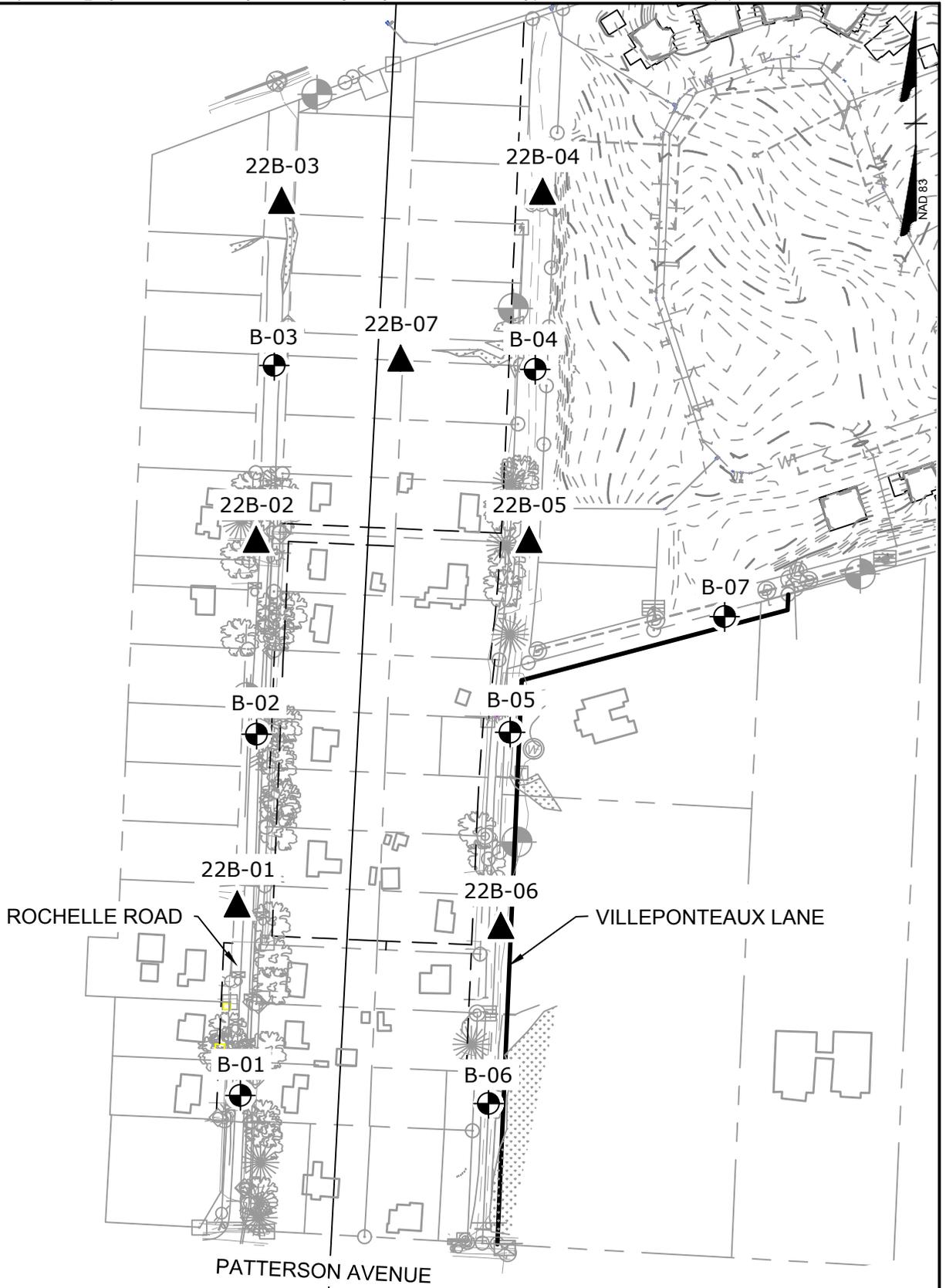
DATE: 5-6-2022



PROJECT NUMBER: 50070

**SITE VICINITY MAP**  
HUGUENOT HILLS  
WATER AND SEWER DESIGN  
GOOCHLAND COUNTY, VA

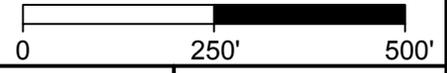
FIGURE  
**1**



NAD 83

- ▲ APPROXIMATE LOCATION OF TEST BORING (2022)
- ⊗ APPROXIMATE LOCATION OF TEST BORING (2021)

SCALE 1"=250'



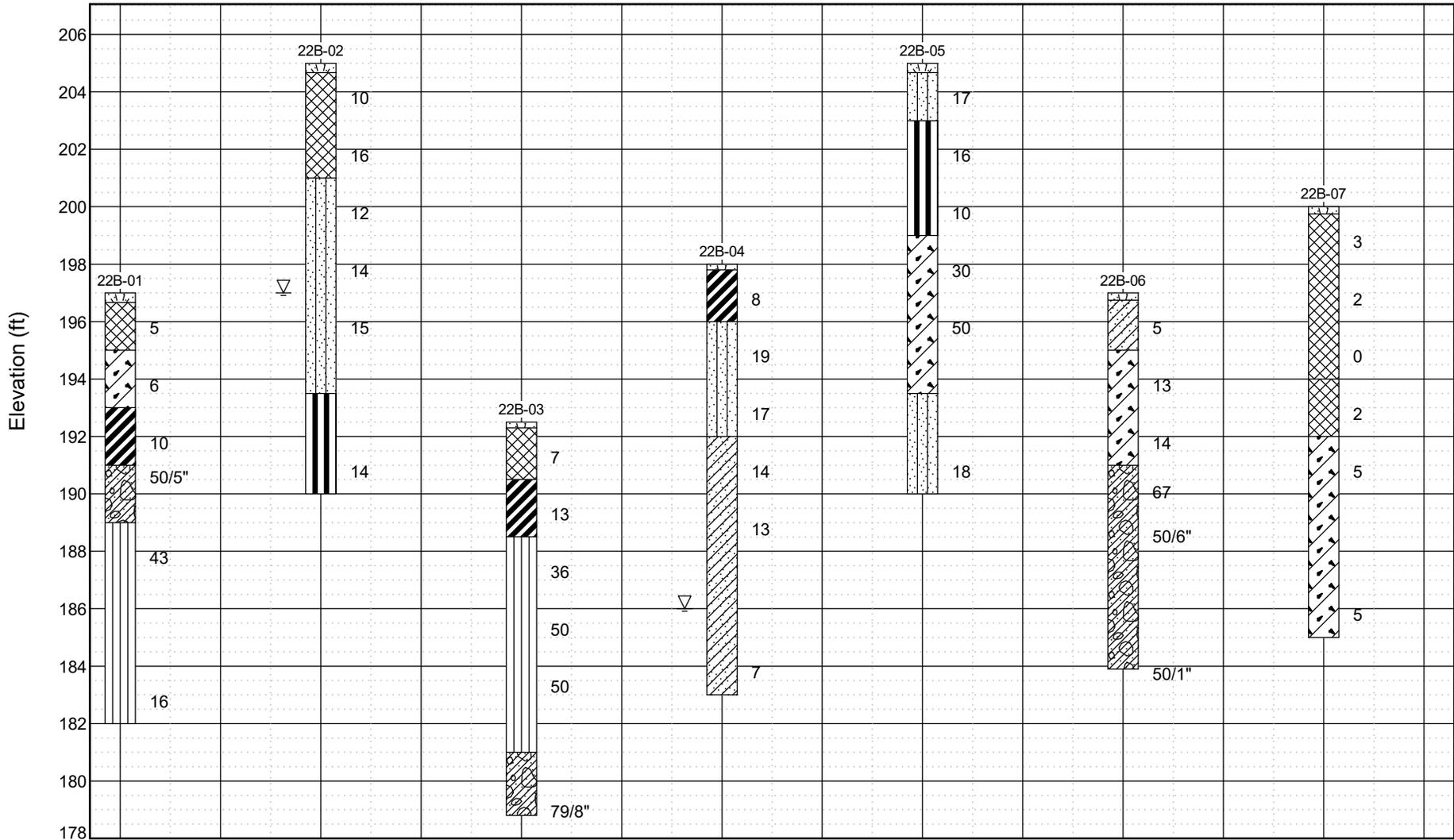
# TIMMONS GROUP

YOUR VISION ACHIEVED THROUGH OURS.

THIS DRAWING PREPARED AT THE  
Corporate Headquarters  
1001 Boulder Parkway | Richmond, VA 23225  
TEL 804-200-5500 FAX 804-560-1016 www.timmons.com

SHEET NO. 2	JOB NO. 50070	HUGUENOT HILLS WATER AND SEWER DESIGN				DATE 4.6.2022	REVISION DESCRIPTION
		GOOCHLAND COUNTY - VIRGINIA					
BORING LOCATION PLAN		AS SHOWN	CHECKED BY J. RUFFIN	DESIGNED BY J. RUFFIN	DATE 4.6.2022		

These plans and associated documents are the exclusive property of TIMMONS GROUP and may not be reproduced in whole or in part and shall not be used for any purpose whatsoever, inclusive, but not limited to construction, bidding, and/or construction staking without the express written consent of TIMMONS GROUP.



**Lithology Symbols**

- Topsoil
- Low Plasticity Clay
- Weathered Rock
- Silty Sand
- Fill (made ground)
- High Plasticity Clay
- Silt
- Elastic Silt

**Groundwater Symbols**

- At End of Drilling
- At 24 Hours

**Exploration Symbols**

- B-01 (Exploration ID)
- 13 (N-Value)
- 53% 98%(RQD REC)

**TIMMONS GROUP**  
YOUR VISION ACHIEVED THROUGH OURS.

Timmons Group, Inc.  
1001 Boulders Parkway Suite 300  
Richmond, VA 23225

Fence Diagram			
Huguenot Hills Water and Sewer Design			
Goochland County, Virginia			
<b>PROJECT NUMBER</b>		<b>DRAWN BY</b>	<b>DATE DRAWN</b>
50070		JR	7.13.2022
<b>HORIZONTAL SCALE</b>	NTS	<b>APPROVED BY</b>	<b>FIGURE</b>
<b>VERTICAL SCALE</b>	NTS	NR	3

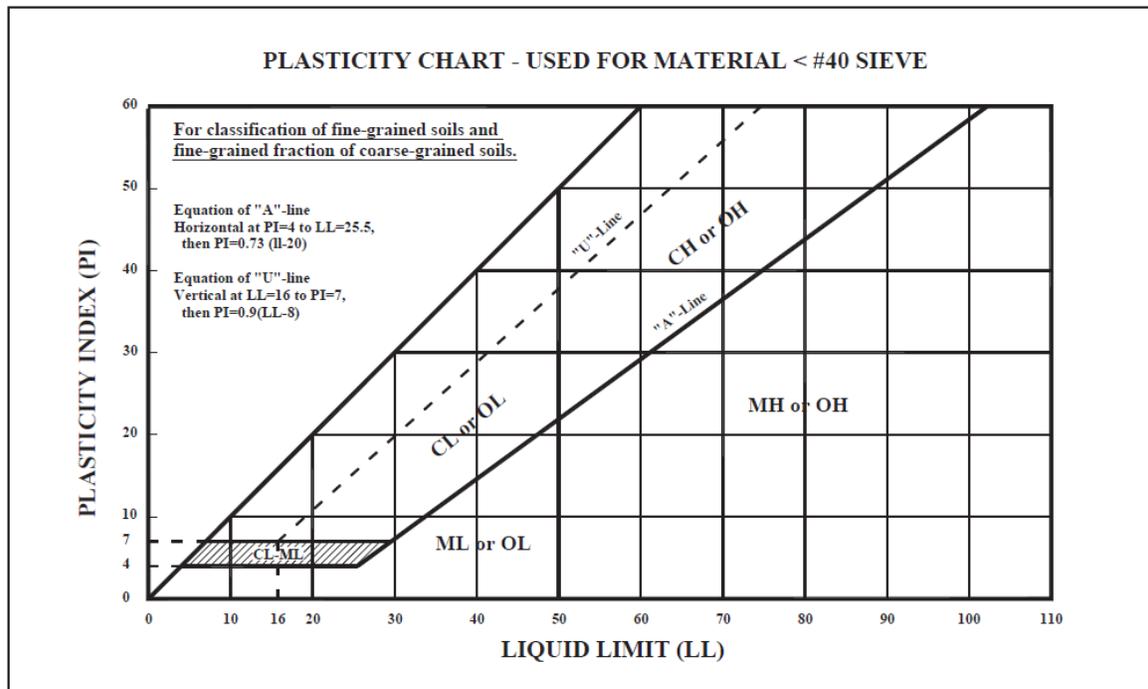


APPENDIX B  
BORING LOGS

### KEY TO BORING LOG TERMINOLOGY

Relative Density – Used for soils with less than 50% passing No. 200 sieve		Consistency – Used for soils with 50 percent or more passing No. 200 sieve	
Relative Density	SPT N-Value (blows/ft)	Consistency	SPT N-Value (blows/foot)
Very Loose	0 to 3	Very Soft	0 to 1
Loose	4 to 9	Soft	2 to 4
Medium Dense	10 to 29	Medium Stiff	5 to 8
Dense	30 to 50	Stiff	9 to 15
Very Dense	Greater than 50	Very Stiff	16 to 30
		Hard	31 to 50
		Very Hard	Greater than 50

Grain Size Terminology (U.S. Standard Sieves)		Natural Moisture Content	
Term	Particle Size		
Boulder	12 inches +	Dry	Very little apparent moisture, dusty
Cobble	3 to 12 inches		
Coarse Gravel	¾ to 3 inches	Moist	Damp, but no free water visible
Fine Gravel	#4 to ¾ inches		
Coarse Sand	#10 to #4		
Medium Sand	#40 to #10	Wet	Visible free water, or in cohesive soil, clearly saturated
Fine Sand	#200 to #40		
Silt and Clay	<#200		



# SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS		
			GRAPH	LETTER			
<p><b>COARSE GRAINED SOILS</b></p> <p>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</p>	<p><b>GRAVEL AND GRAVELLY SOILS</b></p>	<p>CLEAN GRAVELS</p> <p>(LITTLE OR NO FINES)</p>		<b>GW</b>	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES		
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>GP</b>	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES		
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>GM</b>	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES		
	<p><b>SAND AND SANDY SOILS</b></p>	<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>	<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>		<b>SW</b>	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
			<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>		<b>SP</b>	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
			<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>SM</b>	SILTY SANDS, SAND - SILT MIXTURES	
		<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>	<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>SC</b>	CLAYEY SANDS, SAND - CLAY MIXTURES	
			<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT LESS THAN 50</p>	<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT LESS THAN 50</p>		<b>ML</b>	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT LESS THAN 50</p>		<b>CL</b>	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT GREATER THAN 50</p>	<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT GREATER THAN 50</p>	<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT GREATER THAN 50</p>		<b>OL</b>	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT GREATER THAN 50</p>		<b>MH</b>	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS		
		<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT GREATER THAN 50</p>		<b>CH</b>	INORGANIC CLAYS OF HIGH PLASTICITY		
<p><b>HIGHLY ORGANIC SOILS</b></p>				<b>OH</b>	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
<p><b>HIGHLY ORGANIC SOILS</b></p>				<b>PT</b>	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS		

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



Timmons Group, Inc.  
1001 Boulders Parkway Suite 300  
Richmond, VA 23225

<b>PROJECT NUMBER</b> <u>50070</u>	<b>PROJECT NAME</b> <u>Huguenot Hills Water and Sewer Design</u>
<b>CLIENT</b> <u>Goochland County</u>	<b>PROJECT LOCATION</b> <u>Goochland County, Virginia</u>
<b>DATE STARTED</b> <u>4/8/2022</u> <b>COMPLETED</b> <u>4/8/2022</u>	<b>GROUND ELEVATION</b> <u>197 ft</u> <b>HOLE DEPTH</b> <u>15 feet</u>
<b>DRILLING CONTRACTOR</b> <u>Fishburne Drilling, Inc.</u>	<b>BOREHOLE WATER LEVELS:</b>
<b>DRILLING METHOD</b> <u>Hollow Stem Auger</u>	<b>AT TIME OF DRILLING</b> <u>--- not encountered</u>
<b>LOGGED BY</b> <u>Julian Ruffin</u> <b>CHECKED BY</b> _____	<b>AT 24 HOURS DRILLING</b> <u>---</u>
<b>NOTES</b> _____	<b>CAVE DEPTH</b> _____

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:44 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0							
		TOPSOIL: (4 Inches)		S-1, SPT 3-3-2-1 (5)			
	195	SANDY ELASTIC SILT, (MH): light brown and gray, moist, medium stiff, trace roots, fill		S-2, SPT 3-3-3-3 (6)			
		SANDY LEAN CLAY, (CL): light brown, moist, medium stiff		S-3, SPT 3-3-7-10 (10)			
5		SANDY FAT CLAY, (CH): brown and gray, moist, stiff		S-4, SPT 50/5"			
	190	SILTY SAND, (SM): orangeish brown and gray, fine to coarse grained, moist, very dense, weathered decomposed rock		S-5, SPT 26-30-13-14 (43)			
		SANDY SILT, (ML): light brown, moist, hard					
10							
	185						
		SILT, (ML): brown and dark gray, very stiff, trace sand		S-6, SPT 4-7-9-15 (16)			
15							

Bottom of borehole at 15.0 feet.



Timmons Group, Inc.  
1001 Boulders Parkway Suite 300  
Richmond, VA 23225

<b>PROJECT NUMBER</b> <u>50070</u>	<b>PROJECT NAME</b> <u>Huguenot Hills Water and Sewer Design</u>
<b>CLIENT</b> <u>Goochland County</u>	<b>PROJECT LOCATION</b> <u>Goochland County, Virginia</u>
<b>DATE STARTED</b> <u>4/8/2022</u> <b>COMPLETED</b> <u>4/8/2022</u>	<b>GROUND ELEVATION</b> <u>205 ft</u> <b>HOLE DEPTH</b> <u>15 feet</u>
<b>DRILLING CONTRACTOR</b> <u>Fishburne Drilling, Inc.</u>	<b>BOREHOLE WATER LEVELS:</b>
<b>DRILLING METHOD</b> <u>Hollow Stem Auger</u>	▽ <b>AT TIME OF DRILLING</b> <u>8.00 ft / Elev 197.00 ft</u>
<b>LOGGED BY</b> <u>Julian Ruffin</u> <b>CHECKED BY</b> _____	▼ <b>AT 24 HOURS DRILLING</b> <u>---</u>
<b>NOTES</b> _____	<b>CAVE DEPTH</b> _____

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:44 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0	205						
		TOPSOIL: (4 Inches)	[Cross-hatch symbol]	S-1, SPT 13-6-4-4 (10)			
		SANDY FAT CLAY, (CH): light brown, moist, stiff, fill Very stiff	[Diagonal lines symbol]	S-2, SPT 5-7-9-7 (16)			
5	200	SILTY SAND, (SM): light pink and gray, fine to coarse grained, moist, medium dense, trace mica Orangeish brown and gray	[Dotted symbol]	S-3, SPT 7-5-7-8 (12)			
		▽		S-4, SPT 6-7-7-8 (14)			
10	195			S-5, SPT 4-8-7-12 (15)			
		ELASTIC SILT, (MH): orangeish brown, moist, stiff	[Vertical lines symbol]	S-6, SPT 4-6-8-12 (14)			
15	190						

Bottom of borehole at 15.0 feet.





Timmons Group, Inc.  
 1001 Boulders Parkway Suite 300  
 Richmond, VA 23225

**PROJECT NUMBER** 50070 **PROJECT NAME** Huguenot Hills Water and Sewer Design  
**CLIENT** Goochland County **PROJECT LOCATION** Goochland County, Virginia  
**DATE STARTED** 4/8/2022 **COMPLETED** 4/8/2022 **GROUND ELEVATION** 198 ft **HOLE DEPTH** 15 feet  
**DRILLING CONTRACTOR** Fishburne Drilling, Inc. **BOREHOLE WATER LEVELS:**  
**DRILLING METHOD** Hollow Stem Auger **▽ AT TIME OF DRILLING** 12.00 ft / Elev 186.00 ft  
**LOGGED BY** Julian Ruffin **CHECKED BY** \_\_\_\_\_ **▽ AT 24 HOURS DRILLING** ---  
**NOTES** \_\_\_\_\_ **CAVE DEPTH** \_\_\_\_\_

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:44 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070\_HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0							
		TOPSOIL: (2 Inches)		S-1, SPT 2-3-5-10 (8)			
		FAT CLAY WITH SAND, (CH): brown and gray, moist, medium stiff		S-2, SPT 7-10-9-11 (19)			
195		SILTY SAND, (SM): brown, fine to coarse grained, moist, medium dense		S-3, SPT 4-8-9-8 (17)			
5				S-4, SPT 5-6-8-11 (14)			
		CLAYEY SAND, (SC): orangeish brown, fine to medium grained, moist, medium dense, contains mica		S-5, SPT 8-5-8-10 (13)			
190		Brown and gray					
10							
	▽						
	185	Light grayish brown, loose		S-6, SPT 3-4-3-4 (7)			
15							

Bottom of borehole at 15.0 feet.







Timmons Group, Inc.  
 1001 Boulders Parkway Suite 300  
 Richmond, VA 23225

<b>PROJECT NUMBER</b> <u>50070</u>	<b>PROJECT NAME</b> <u>Huguenot Hills Water and Sewer Design</u>
<b>CLIENT</b> <u>Goochland County</u>	<b>PROJECT LOCATION</b> <u>Goochland County, Virginia</u>
<b>DATE STARTED</b> <u>4/8/2022</u> <b>COMPLETED</b> <u>4/8/2022</u>	<b>GROUND ELEVATION</b> <u>200 ft</u> <b>HOLE DEPTH</b> <u>15 feet</u>
<b>DRILLING CONTRACTOR</b> <u>Fishburne Drilling, Inc.</u>	<b>BOREHOLE WATER LEVELS:</b>
<b>DRILLING METHOD</b> <u>Hollow Stem Auger</u>	<b>AT TIME OF DRILLING</b> <u>--- not encountered</u>
<b>LOGGED BY</b> <u>Julian Ruffin</u> <b>CHECKED BY</b> _____	<b>AT 24 HOURS DRILLING</b> <u>---</u>
<b>NOTES</b> _____	<b>CAVE DEPTH</b> _____

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:45 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0	200						
		TOPSOIL: (3 Inches)		S-1, SPT 2-1-2-2 (3)			Weight of Hammer (WOH)
		FAT CLAY WITH SAND, (CH): orangeish brown and gray, moist, soft, fill Trace organics		S-2, SPT 2-1-1-2 (2)			
5	195			S-3, SPT 0-0-0-1 (0)			
		CLAYEY SAND, (SC): gray, fine to medium grained, wet, very loose, trace roots, fill		S-4, SPT 1-1-1-1 (2)			
10	190			S-5, SPT 1-2-3-3 (5)			
		LEAN CLAY WITH SAND, (CL): orangeish brown and gray, moist, medium stiff					
		Light orangeish brown and gray		S-6, SPT 3-2-3-6 (5)			

Bottom of borehole at 15.0 feet.



Timmons Group, Inc.  
 1001 Boulders Parkway Suite 300  
 Richmond, VA 23225

**PROJECT NUMBER** 50070 **PROJECT NAME** Huguenot Hills Water and Sewer Design  
**CLIENT** Goochland County **PROJECT LOCATION** Goochland County, Virginia  
**DATE STARTED** 7/23/2021 **COMPLETED** 7/23/2021 **GROUND ELEVATION** 203.5 ft **HOLE DEPTH** 13.5 feet  
**DRILLING CONTRACTOR** Ayers & Ayers, Inc. **BOREHOLE WATER LEVELS:**  
**DRILLING METHOD** Hollow Stem Auger **AT TIME OF DRILLING** --- not encountered  
**LOGGED BY** Julian Ruffin **CHECKED BY** J. Ruffin, P.E. **AT 24 HOURS DRILLING** ---  
**NOTES** \_\_\_\_\_ **CAVE DEPTH** \_\_\_\_\_

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:45 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0		ASPHALT: (4 Inches)		S-1, SPT 7-6-6 (12)			
		SILTY SAND, (SM): brown and gray, fine to medium grained, moist, medium dense		S-2, SPT 8-4-6 (10)			
		No Recovery					
5		CLAYEY SAND, (SC): light orangeish brown and gray, fine to coarse grained, moist, very dense, weathered decomposed rock		S-3, SPT 62/12"			
		SILT, (ML): light brown, moist, very hard, trace sand, weathered decomposed rock		S-4, SPT 11-24-38 (62)			
10				S-5, SPT 36-39-50 (89)	25.0		
190							

Refusal at 13.5 feet.  
 Bottom of borehole at 13.5 feet. S-6, SPT 50/0"



Timmons Group, Inc.  
1001 Boulders Parkway Suite 300  
Richmond, VA 23225

**PROJECT NUMBER** 50070      **PROJECT NAME** Huguenot Hills Water and Sewer Design  
**CLIENT** Goochland County      **PROJECT LOCATION** Goochland County, Virginia  
**DATE STARTED** 7/23/2021      **COMPLETED** 7/23/2021      **GROUND ELEVATION** 202 ft      **HOLE DEPTH** 9 feet  
**DRILLING CONTRACTOR** Ayers & Ayers, Inc.      **BOREHOLE WATER LEVELS:**  
**DRILLING METHOD** Hollow Stem Auger      **AT TIME OF DRILLING** --- not encountered  
**LOGGED BY** Julian Ruffin      **CHECKED BY** J. Ruffin, P.E.      **AT 24 HOURS DRILLING** ---  
**NOTES** \_\_\_\_\_      **CAVE DEPTH** \_\_\_\_\_

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:45 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070\_HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0							
		ASPHALT: (3 Inches)		S-1, SPT 8-6-6 (12)			
	200	SILTY SAND, (SM): gray, fine to coarse grained, moist, medium dense, fill Brown and gray, trace gravel		S-2, SPT 7-6-7 (13)			
5		SILTY SAND, (SM): brown and gray, fine to coarse grained, moist, very dense, trace mica, weathered decomposed rock		S-3, SPT 50/5"			
	195	SANDY SILT, (ML): orangeish brown and gray, moist, very hard, weathered decomposed rock		S-4, SPT 11-32-50 (82)			

Refusal at 9.0 feet.  
Bottom of borehole at 9.0 feet.      S-5, SPT  
50/0"



Timmons Group, Inc.  
1001 Boulders Parkway Suite 300  
Richmond, VA 23225

**PROJECT NUMBER** 50070 **PROJECT NAME** Huguenot Hills Water and Sewer Design  
**CLIENT** Goochland County **PROJECT LOCATION** Goochland County, Virginia  
**DATE STARTED** 7/23/2021 **COMPLETED** 7/23/2021 **GROUND ELEVATION** 195 ft **HOLE DEPTH** 13 feet  
**DRILLING CONTRACTOR** Ayers & Ayers, Inc. **BOREHOLE WATER LEVELS:**  
**DRILLING METHOD** Hollow Stem Auger **AT TIME OF DRILLING** --- not encountered  
**LOGGED BY** Julian Ruffin **CHECKED BY** J. Ruffin, P.E. **AT 24 HOURS DRILLING** ---  
**NOTES** \_\_\_\_\_ **CAVE DEPTH** \_\_\_\_\_

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:45 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0	195	Topsoil, (4 Inches)		S-1, SPT 9-8-6 (14)			
		SILTY SAND, (SM): brown and gray, fine to coarse grained, moist, medium dense		S-2, SPT 6-6-8 (14)			
5	190	ELASTIC SILT WITH SAND, (MH): orangeish brown and gray, moist, stiff		S-3, SPT 5-8-12 (20)			
		Gray		S-4, SPT 7-18-32 (50)			
		Light brown and gray, hard		S-5, SPT 17-35-37 (72)			
10	185	SANDY SILT, (ML): brown, moist, very hard, weathered decomposed rock					

Refusal at 13.0 feet.  
Bottom of borehole at 13.0 feet.

S-6, SPT  
50/0"



Timmons Group, Inc.  
1001 Boulders Parkway Suite 300  
Richmond, VA 23225

<b>PROJECT NUMBER</b> 50070	<b>PROJECT NAME</b> Huguenot Hills Water and Sewer Design
<b>CLIENT</b> Goochland County	<b>PROJECT LOCATION</b> Goochland County, Virginia
<b>DATE STARTED</b> 7/20/2021 <b>COMPLETED</b> 7/20/2021	<b>GROUND ELEVATION</b> 203 ft <b>HOLE DEPTH</b> 24.33 feet
<b>DRILLING CONTRACTOR</b> Ayers & Ayers, Inc.	<b>BOREHOLE WATER LEVELS:</b>
<b>DRILLING METHOD</b> Hollow Stem Auger	<b>AT TIME OF DRILLING</b> --- not encountered
<b>LOGGED BY</b> Julian Ruffin <b>CHECKED BY</b> J. Ruffin, P.E.	<b>AT 24 HOURS DRILLING</b> ---
<b>NOTES</b>	<b>CAVE DEPTH</b>

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:45 - Y:\801\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0							
		CRUSHED STONE: (3 Inches)		S-1, SPT 17-14-17 (31)			
	200	ELASTIC SILT WITH SAND, (MH): orangeish brown and gray, moist, hard Orangeish brown, stiff		S-2, SPT 5-7-8 (15)			
5		CLAYEY SAND, (SC): reddish brown and gray, fine to coarse grained, moist, medium dense		S-3, SPT 6-9-10 (19)			
	195			S-4, SPT 7-9-11 (20)			
10		SILTY SAND, (SM): light brown and gray, fine to coarse grained, moist, dense		S-5, SPT 10-20-20 (40)			
	190						
15		Medium dense		S-6, SPT 16-9-18 (27)			
	185	ELASTIC SILT WITH SAND, (MH): brown and gray, moist, very stiff		S-7, SPT 5-10-12 (22)			
20							
	180	ELASTIC SILT, (MH): brown and gray, moist, very hard, trace sand, weathered decomposed rock		S-8, SPT 68/10"			
Bottom of borehole at 24.3 feet.							





Timmons Group, Inc.  
 1001 Boulders Parkway Suite 300  
 Richmond, VA 23225

<b>PROJECT NUMBER</b> <u>50070</u>	<b>PROJECT NAME</b> <u>Huguenot Hills Water and Sewer Design</u>
<b>CLIENT</b> <u>Goochland County</u>	<b>PROJECT LOCATION</b> <u>Goochland County, Virginia</u>
<b>DATE STARTED</b> <u>7/20/2021</u> <b>COMPLETED</b> <u>7/20/2021</u>	<b>GROUND ELEVATION</b> <u>200 ft</u> <b>HOLE DEPTH</b> <u>19.1 feet</u>
<b>DRILLING CONTRACTOR</b> <u>Ayers &amp; Ayers, Inc.</u>	<b>BOREHOLE WATER LEVELS:</b>
<b>DRILLING METHOD</b> <u>Hollow Stem Auger</u>	<b>AT TIME OF DRILLING</b> <u>--- not encountered</u>
<b>LOGGED BY</b> <u>Julian Ruffin</u> <b>CHECKED BY</b> <u>J. Ruffin, P.E.</u>	<b>AT 24 HOURS DRILLING</b> <u>---</u>
<b>NOTES</b> _____	<b>CAVE DEPTH</b> _____

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SYMBOL	SAMPLING BLOW COUNTS (N-VALUE)	RECOVERY (%)	LAB TESTS	REMARKS
0	200						
		CRUSHED STONE: (4 Inches)		S-1, SPT 9-11-16 (27)			
		SILTY SAND, (SM): brown and gray, fine to medium grained, moist, medium dense, fill		S-2, SPT 3-3-3 (6)			
5	195	FAT CLAY WITH SAND, (CH): orangeish brown and gray, moist, medium stiff		S-3, SPT 2-2-3 (5)			
		Brown and gray		S-4, SPT 5-10-50 (60)			
		ELASTIC SILT WITH SAND, (MH): dark orangeish brown and gray, moist, very hard, weathered decomposed rock		S-5, SPT 16-16-46 (62)			
10	190	SANDY SILT, (ML): brown and gray, moist, very hard, Contains clay lenses, weathered decomposed rock		S-6, SPT 50/4"			
		SILTY SAND, (SM): brown, fine to coarse grained, moist, very dense, weathered decomposed rock					
15	185						
Refusal at 19.1 feet. Bottom of borehole at 19.1 feet.				S-7, SPT 50/1"			

TG GEOTECH BH LOG V2.1 - GINT STD US LAB.GDT - 8/3/22 13:45 - Y:\8011\GEOTECH\PROJECTS\2022 PROJECTS\50070 - HUGUENOT HILLS SEWER DESIGN PHASE\LOGS\HUGUENOT.GPJ



APPENDIX C  
LABORATORY TEST RESULTS

**Grain Size Analysis**  
 AASHTO T88



**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	4/20/22 to 5/13/22
Project Location:	Goochland County, Virginia	Tested By:	MLT and KP
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-01	Sample #:	S-3	Sample Date:	4/8/2022
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	6134
Material Description:	Brown and gray, SANDY FAT CLAY (CH)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 mm and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.1%	Fine Sand	36.8%
Gravel	0.0%	Medium Sand	5.9%	Silt & Clay	57.2%
Liquid Limit	64	Plastic Limit	21	Plastic Index	43
Specific Gravity	---			Moisture Content	26.4%

**Description of Sand & Gravel Particles:**      **Rounded** x      **Angular** x  
**Hard and Durable** x      **Soft**      **Weathered and Friable**

**References / Comments / Deviations:**

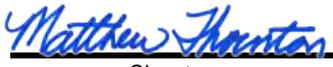
---



---



---

<u>Matthew Thornton</u> Technical Responsibility	 Signature	<u>Laboratory Manager</u> Position	<u>6/27/22</u> Date
---	--	---------------------------------------	------------------------

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

**Liquid Limit, Plastic Limit and Plasticity Index**  
 AASHTO T89 AASHTO T90

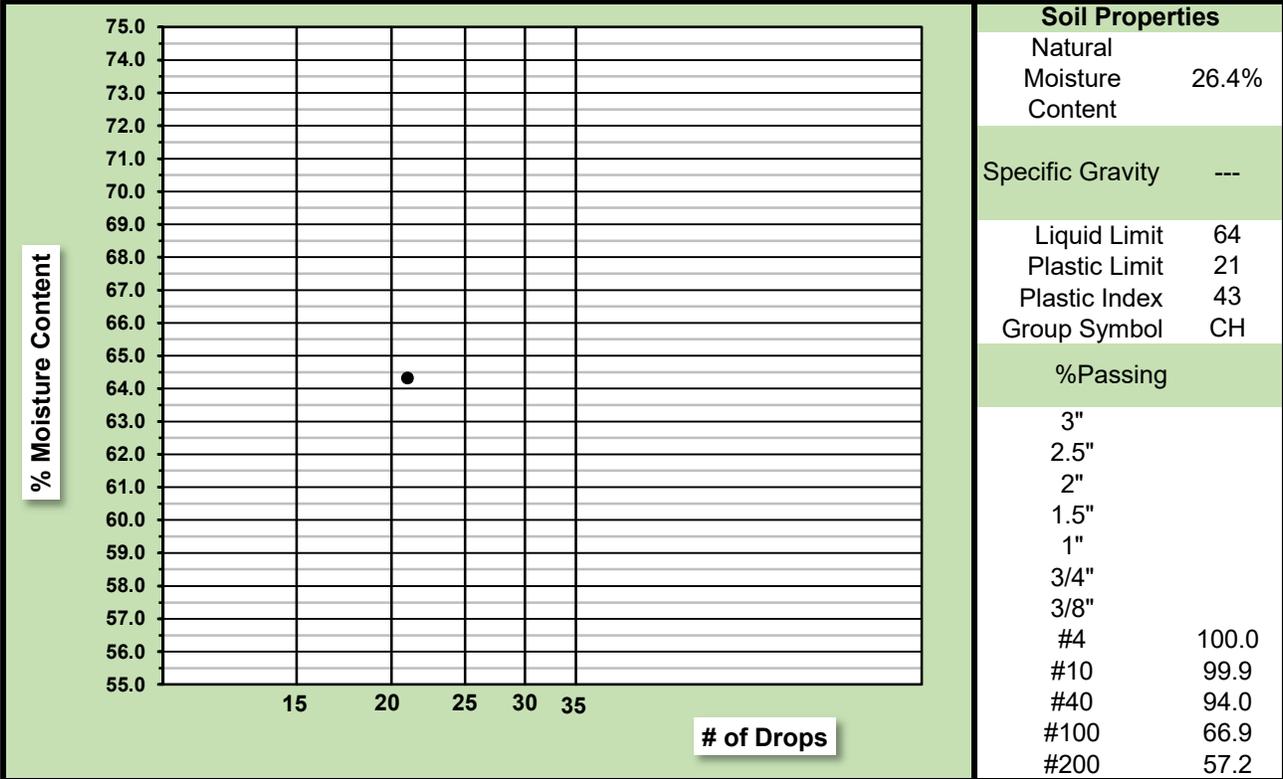


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	6/26/2022
Project Location:	Goochland County, Virginia	Tested By:	Matthew Thornton
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-01	Sample #:	S-3	Sample Date:	4/8/2022
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	6134
Material Description:	Brown and gray, SANDY FAT CLAY (CH)				



Prior to testing the specimen was air dried at room temperature and prepared in general accordance with AASHTO R58.  
 The Liquid Limit was determined using a One-Point Method with a Flat Grooving Tool.

**References / Comments / Deviations:**


Matthew Thornton		Laboratory Manager	6/27/22
Technical Responsibility	Signature	Position	Date

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500

**Grain Size Analysis**  
 AASHTO T88

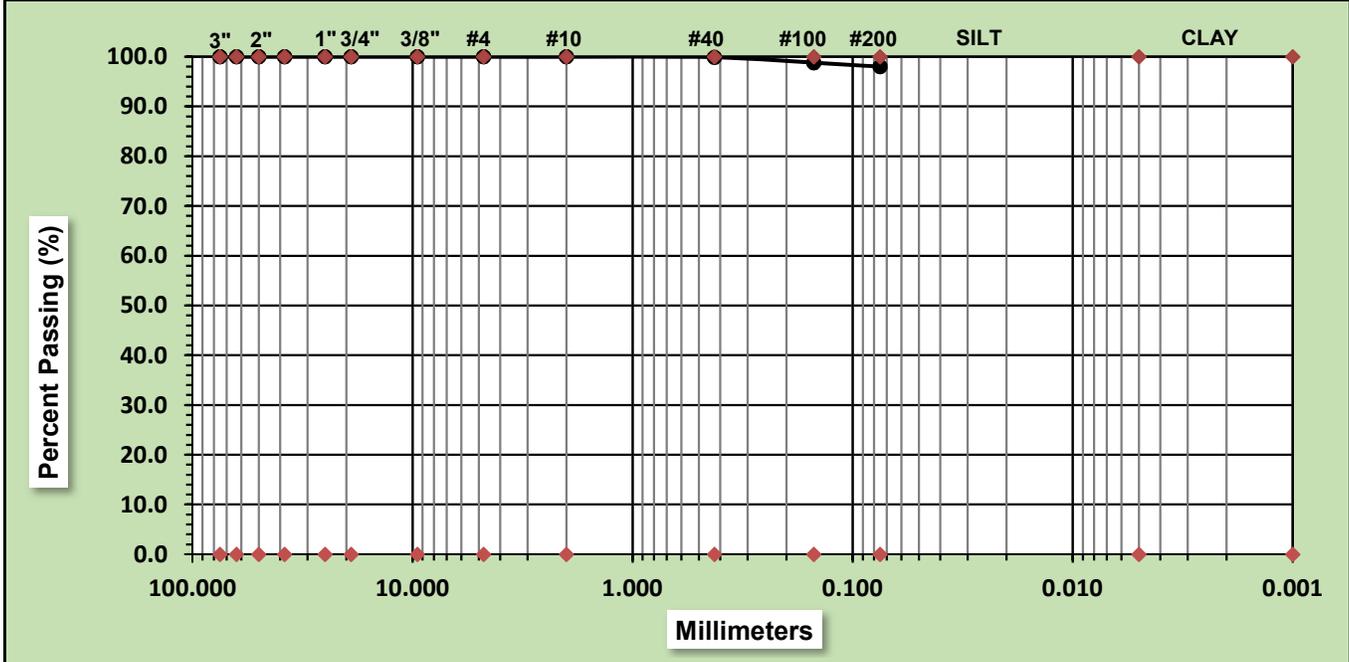


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	4/20/22 to 5/13/22
Project Location:	Goochland County, Virginia	Tested By:	MLT and KP
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-01	Sample #:	S-6	Sample Date:	4/8/2022
Depth:	13 to 15 feet	Offset:	N/A	Lab Control #:	6135
Material Description:	Dark gray and brown, SILT, trace sand (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 mm and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	1.9%
Gravel	0.0%	Medium Sand	0.1%	Silt & Clay	98.0%
Liquid Limit	44	Plastic Limit	27	Plastic Index	17
Specific Gravity	---			Moisture Content	22.6%

**Description of Sand & Gravel Particles:**      **Rounded** x      **Angular** x  
**Hard and Durable** x      **Soft**      **Weathered and Friable**

**References / Comments / Deviations:**

---



---



---

Matthew Thornton		Laboratory Manager	6/27/22
Technical Responsibility	Signature	Position	Date

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

**Liquid Limit, Plastic Limit and Plasticity Index**  
 AASHTO T89 AASHTO T90

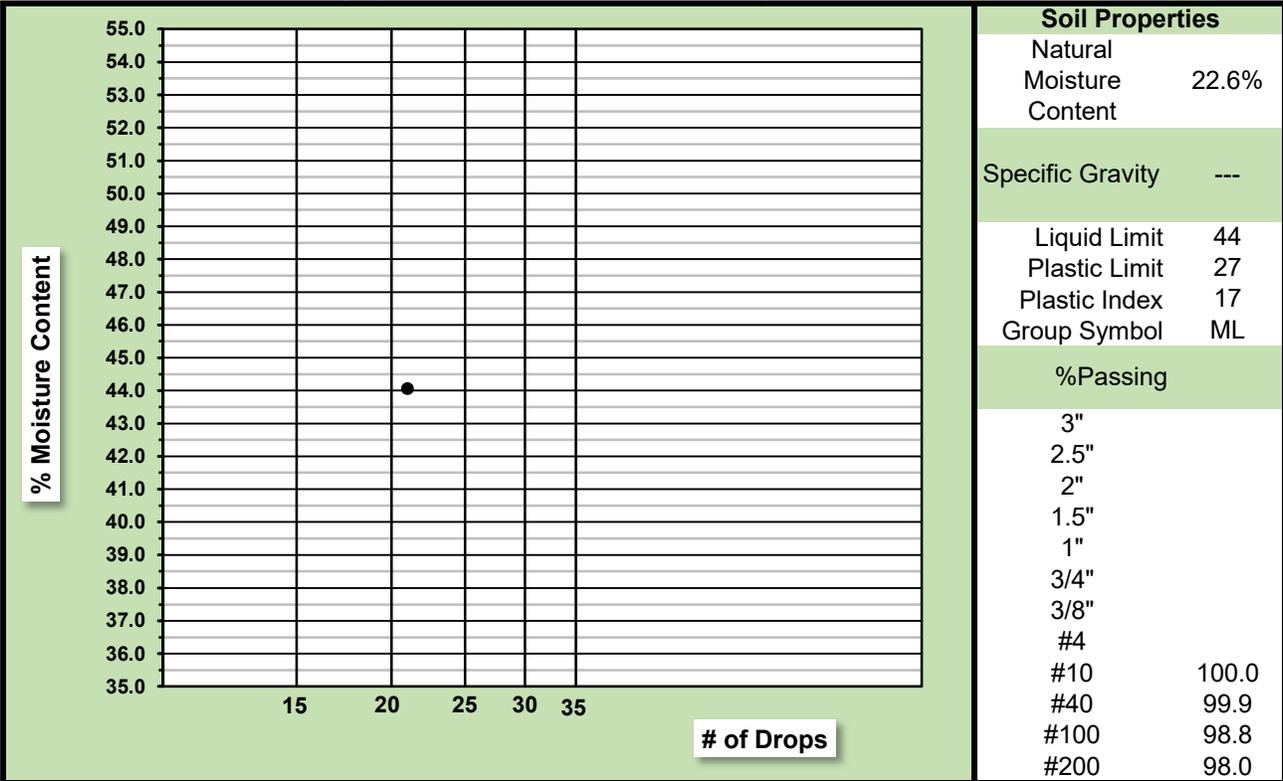


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	6/26/2022
Project Location:	Goochland County, Virginia	Tested By:	Matthew Thornton
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-01	Sample #:	S-6	Sample Date:	4/8/2022
Depth:	13 to 15 feet	Offset:	N/A	Lab Control #:	6135
Material Description:	Dark gray and brown, SILT, trace sand (ML)				



Prior to testing the specimen was air dried at room temperature and prepared in general accordance with AASHTO R58.  
 The Liquid Limit was determined using a One-Point Method with a Flat Grooving Tool.

**References / Comments / Deviations:**


Matthew Thornton		Laboratory Manager	6/27/22
Technical Responsibility	Signature	Position	Date

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500

**Grain Size Analysis**  
 AASHTO T88



**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	4/20/22 to 5/13/22
Project Location:	Goochland County, Virginia	Tested By:	MLT and KP
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-03	Sample #:	S-3	Sample Date:	4/8/2022
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	6137
Material Description:	Brown, SANDY SILT, contains mica (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 mm and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Coarse Sand	0.2%	Fine Sand	43.3%
Gravel	0.0%	Medium Sand	1.5%	Silt & Clay	55.0%
Liquid Limit	30	Plastic Limit	24	Plastic Index	6
Specific Gravity	---			Moisture Content	11.1%

**Description of Sand & Gravel Particles:**      **Rounded** x      **Angular** x  
**Hard and Durable** x      **Soft**      **Weathered and Friable** x

**References / Comments / Deviations:**

---



---



---

<u>Matthew Thornton</u> Technical Responsibility	 Signature	<u>Laboratory Manager</u> Position	<u>6/27/22</u> Date
---	--	---------------------------------------	------------------------

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

**Liquid Limit, Plastic Limit and Plasticity Index**  
 AASHTO T89 AASHTO T90

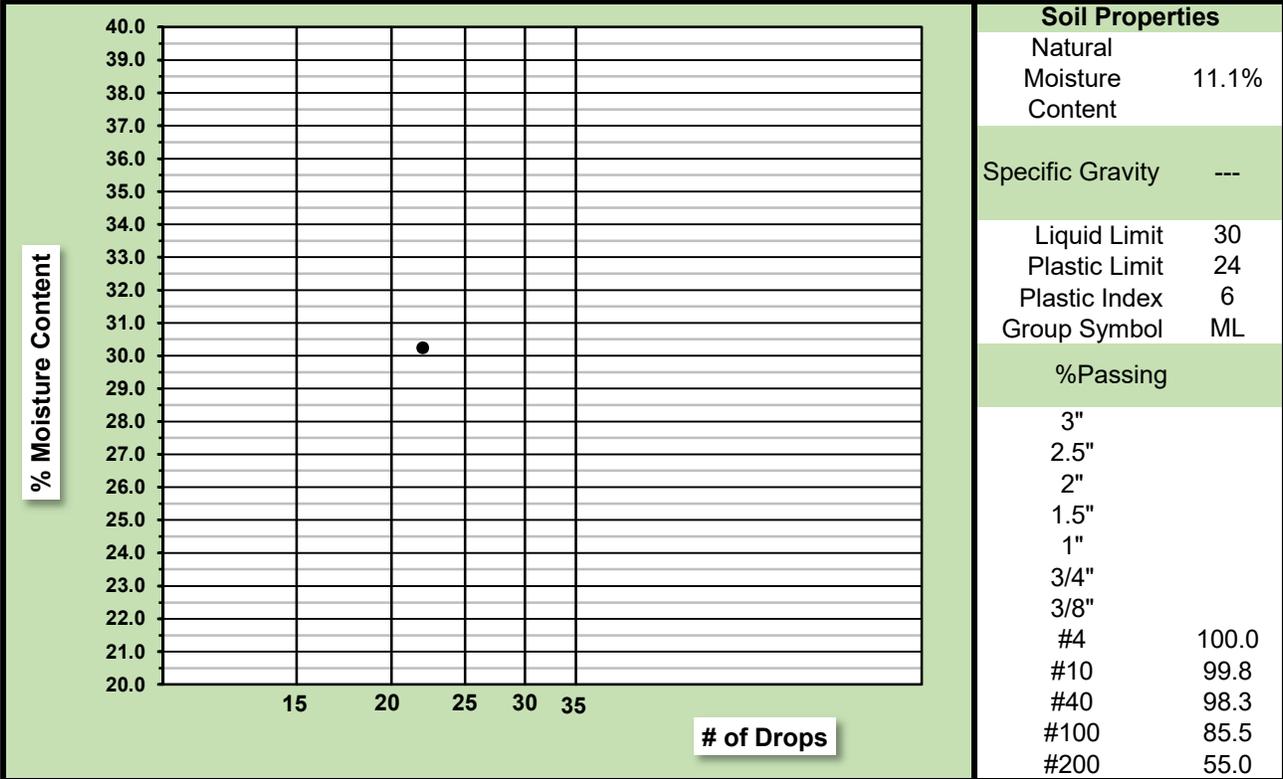


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	6/26/2022
Project Location:	Goochland County, Virginia	Tested By:	Matthew Thornton
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-03	Sample #:	S-3	Sample Date:	4/8/2022
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	6137
Material Description:	Brown, SANDY SILT, contains mica (ML)				



Prior to testing the specimen was air dried at room temperature and prepared in general accordance with AASHTO R58.  
 The Liquid Limit was determined using a One-Point Method with a Flat Grooving Tool.

**References / Comments / Deviations:**


Matthew Thornton		Laboratory Manager	6/27/22
Technical Responsibility	Signature	Position	Date

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500

**Grain Size Analysis**  
 AASHTO T88



**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	4/20/22 to 5/13/22
Project Location:	Goochland County, Virginia	Tested By:	MLT and KP
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-04	Sample #:	S-5	Sample Date:	4/8/2022
Depth:	8 to 10 feet	Offset:	N/A	Lab Control #:	6138
Material Description:	Brown and gray, fine to medium CLAYEY SAND, contains mica (SC)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 mm and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	56.0%
Gravel	0.0%	Medium Sand	13.6%	Silt & Clay	30.4%
Liquid Limit	33	Plastic Limit	21	Plastic Index	12
Specific Gravity	---			Moisture Content	21.7%

**Description of Sand & Gravel Particles:** *Rounded* x *Angular* x  
*Hard and Durable* x *Soft* *Weathered and Friable* x

**References / Comments / Deviations:**

---



---



---

<u>Matthew Thornton</u> Technical Responsibility	 Signature	<u>Laboratory Manager</u> Position	<u>6/27/22</u> Date
---	---------------	---------------------------------------	------------------------

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

**Liquid Limit, Plastic Limit and Plasticity Index**  
 AASHTO T89 AASHTO T90

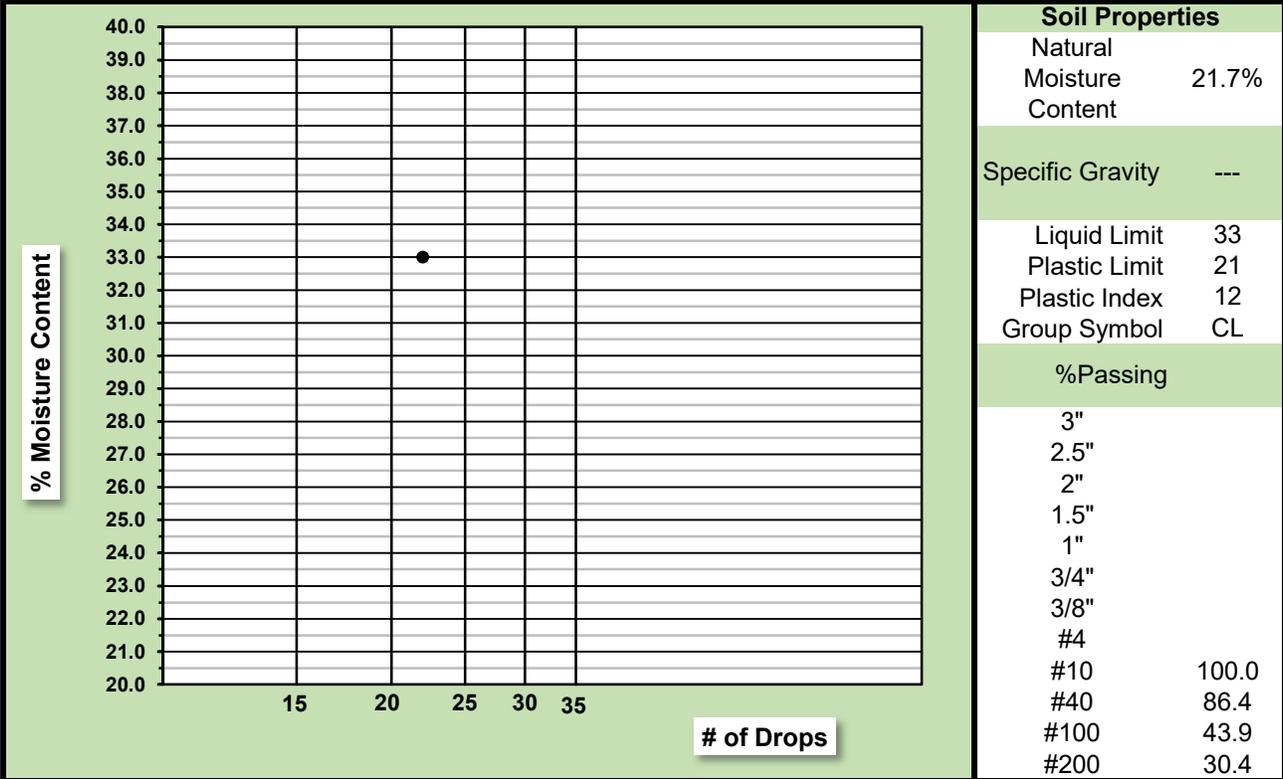


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	6/26/2022
Project Location:	Goochland County, Virginia	Tested By:	Matthew Thornton
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-04	Sample #:	S-5	Sample Date:	4/8/2022
Depth:	8 to 10 feet	Offset:	N/A	Lab Control #:	6138
Material Description:	Brown and gray, fine to medium CLAYEY SAND, contains mica (SC)				



Prior to testing the specimen was air dried at room temperature and prepared in general accordance with AASHTO R58.  
 The Liquid Limit was determined using a One-Point Method with a Flat Grooving Tool.

**References / Comments / Deviations:**


Matthew Thornton <hr style="width: 100%;"/> Technical Responsibility	 <hr style="width: 100%;"/> Signature	Laboratory Manager <hr style="width: 100%;"/> Position	6/27/22 <hr style="width: 100%;"/> Date
---	--	---	--

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500



**Liquid Limit, Plastic Limit and Plasticity Index**  
 AASHTO T89 AASHTO T90

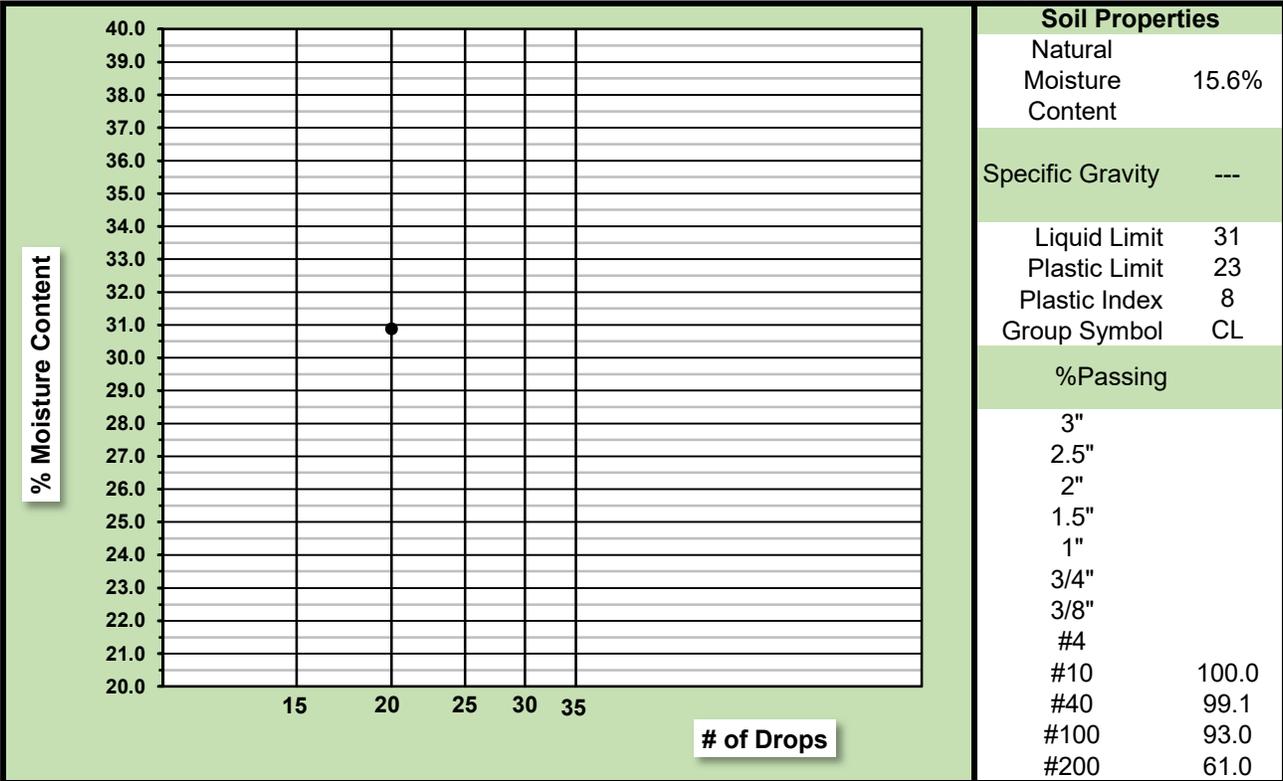


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	6/26/2022
Project Location:	Goochland County, Virginia	Tested By:	Matthew Thornton
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-05	Sample #:	S-4	Sample Date:	4/8/2022
Depth:	6 to 8 feet	Offset:	N/A	Lab Control #:	6139
Material Description:	Brown mottled with black, SANDY LEAN CLAY, contains mica (CL)				



Prior to testing the specimen was air dried at room temperature and prepared in general accordance with AASHTO R58.  
 The Liquid Limit was determined using a One-Point Method with a Flat Grooving Tool.

**References / Comments / Deviations:**


Matthew Thornton		Laboratory Manager	6/27/22
Technical Responsibility	Signature	Position	Date

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500

**Grain Size Analysis**  
 AASHTO T88



**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	4/20/22 to 5/13/22
Project Location:	Goochland County, Virginia	Tested By:	MLT and KP
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-06	Sample #:	S-3	Sample Date:	4/8/2022
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	6140
Material Description:	Gray and orange, LEAN CLAY WITH SAND (CL)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 mm and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	21.1%
Gravel	0.0%	Medium Sand	1.7%	Silt & Clay	77.2%
Liquid Limit	38	Plastic Limit	19	Plastic Index	19
Specific Gravity	---			Moisture Content	20.1%

**Description of Sand & Gravel Particles:**      **Rounded** x      **Angular** x  
**Hard and Durable** x      **Soft**      **Weathered and Friable** x

**References / Comments / Deviations:**

---



---



---

<u>Matthew Thornton</u> Technical Responsibility	 Signature	<u>Laboratory Manager</u> Position	<u>6/27/22</u> Date
---	--	---------------------------------------	------------------------

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

**Liquid Limit, Plastic Limit and Plasticity Index**  
 AASHTO T89 AASHTO T90

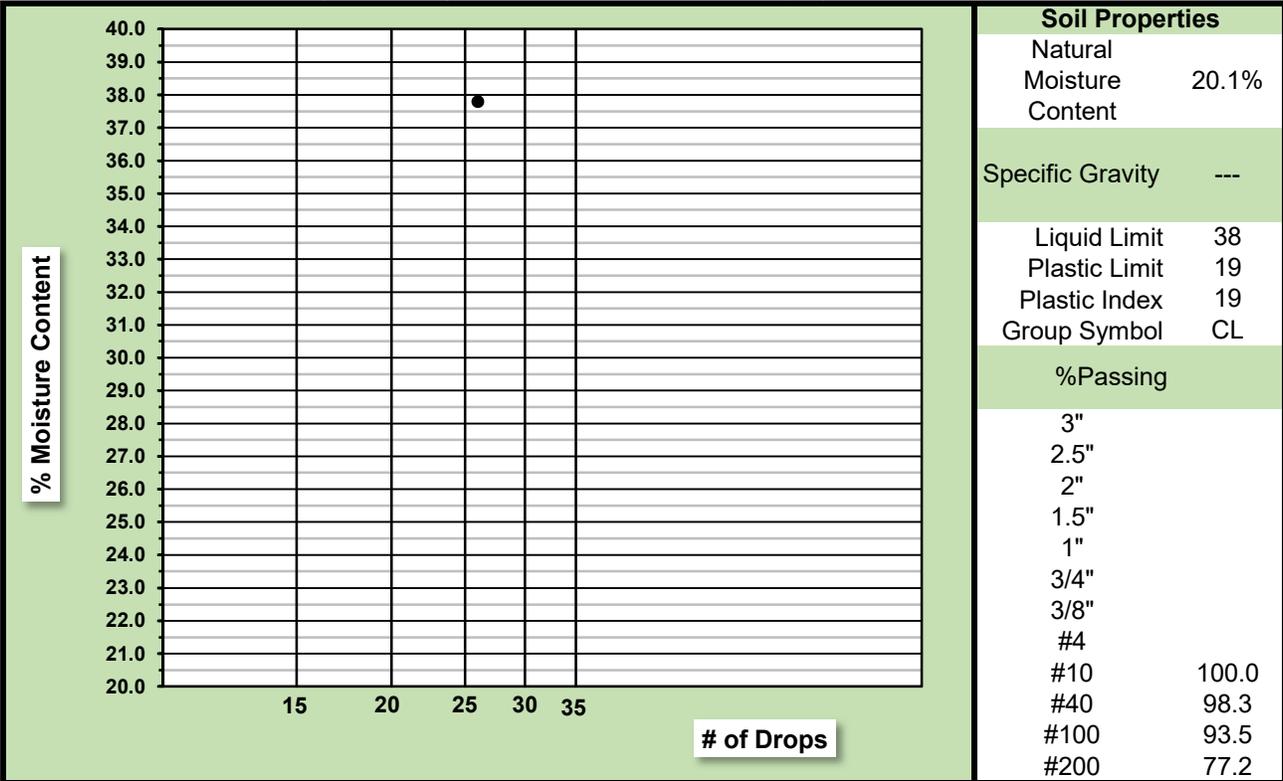


**PROJECT INFORMATION**

Project #:	50070	Report Date:	6/27/2022
Project Name:	Huguenot Hills Water and Sewer Design	Test Date(s):	6/26/2022
Project Location:	Goochland County, Virginia	Tested By:	Matthew Thornton
Client Name:	Goochland County		

**SAMPLE INFORMATION**

Location:	22B-06	Sample #:	S-3	Sample Date:	4/8/2022
Depth:	4 to 6 feet	Offset:	N/A	Lab Control #:	6140
Material Description:	Gray and orange, LEAN CLAY WITH SAND (CL)				



Prior to testing the specimen was air dried at room temperature and prepared in general accordance with AASHTO R58.  
 The Liquid Limit was determined using a One-Point Method with a Flat Grooving Tool.

**References / Comments / Deviations:**


<u>Matthew Thornton</u> Technical Responsibility	 Signature	<u>Laboratory Manager</u> Position	<u>6/27/22</u> Date
---	---------------	---------------------------------------	------------------------

Information included in this report relates only to material sampled at the time of testing.

This report shall not be reproduced, except in full, without the written approval of Timmons Group

Timmons Group / 430 Southlake Boulevard Suite B-15 Richmond, VA 23236 / p 804.200.6500