



General Specifications

TABLE OF CONTENTS

	Page No.
GENERAL REQUIREMENTS	
GENERAL	7
CONTACTING PROPERTY OWNERS	8
CONSTRUCTION DRAWINGS	8
RECORD DRAWINGS	8
DRAWING QUALITY CONTROL SPECIFICATION	9
SANITARY SEWER LOCATION	10
DEPTH OF SANITARY SEWER LINES	12
SANITARY SEWER MANHOLES	12
MANHOLE AND WET WELL REHABILITATION AND COATING	12
SERVICE LATERAL CONNECTIONS	13
STRUCTURAL DESIGN	13
HYDRAULIC DESIGN FOR SANITARY SEWERS	14
SEWAGE PUMP STATIONS AND FORCE MAINS	17
SEWER REHABILITATION DESIGN DECISION PROCEDURE	18
INSTALLATION OF 6-INCH LATERALS TO EXISTING SEWER LINES	20
WATER BOOSTER STATIONS	21
WATER LINE LOCATION	21
WATER LINE DESIGN	22
DEPTH OF WATER LINES	23
WATER LINE APPURTENANCES	23
STRUCTURAL DESIGN	24
HYDRAULIC DESIGN FOR WATER LINES	24
BLOW-OFFS	26
SERVICE CONNECTIONS AND METER REQUIREMENTS	27
WATER FLOW TEST SUBMITTAL AND APPROVAL PROCEDURES (NEW DEVELOPMENT)	27
FIRE SPRINKLER SYSTEM REQUIREMENTS	30
INSTALLATION OF WATER METERS IN COMMERCIAL AND INDUSTRIAL DEVELOPMENT	30
OTHER CONSIDERATIONS	31

GENERAL SPECIFICATIONS & STANDARD DRAWINGS	Page No.
SECTION 1 - SITE CLEARING	32
1.01 RELATED DOCUMENTS	32
1.02 DESCRIPTION OF WORK	32
3.01 GENERAL	32
3.02 LIMITS OF CLEARING & GRUBBING	32
3.03 CLEARING	32
3.04 GRUBBING	32
3.05 ORNAMENTAL TREES, SHRUBS AND FLOWERS	33
3.06 PROTECTION	33
3.07 DISPOSAL OF WASTE MATERIALS	33
3.08 EROSION CONTROL	33
 SECTION 2 - SITE DEMOLITION	 34
1.01 RELATED DOCUMENTS	34
1.02 DESCRIPTION OF WORK	34
1.03 JOB CONDITIONS	34
3.01 DEMOLITION	35
3.02 DISPOSAL OF DEMOLISHED MATERIALS	35
 SECTION 3 - EROSION & SEDIMENT CONTROL	 36
1.01 RELATED DOCUMENTS	36
1.02 DESCRIPTION OF WORK	36
1.03 GENERAL CONTROL MEASURES	36
1.04 STORM DRAINAGE CONTROL	36
1.05 STABILIZATION	37
2.01 STRAW BALES & SILT FENCES	37
2.02 GROUND LIMESTONE	37
2.03 COMMERCIAL FERTILIZER	37
2.04 WATER	37

2.05 TEMPORARY SEEDING	37
2.06 MULCH	38
2.07 LIQUID MULCH BINDERS	38
3.01 INSTALLATION OF STRAW BALES AND SILT FENCES	38
3.02 LIME APPLICATION	38
3.03 FERTILIZER APPLICATION	38
3.04 SEEDING	38
3.05 MULCHING	38
3.06 MULCH BINDING	38
3.07 GENERAL CONTROL MEASURES, INSTALLATION & MAINTENANCE	39
3.08 STOCKPILING EXCAVATED MATERIAL	39
3.09 MAINTENANCE	39
3.10 INSTALLATION OF RIP RAP	39
3.11 CONSTRUCTION IN WETLAND OR WATER OF THE U. S.	39
SECTION 4 - TRENCHING, BACKFILLING AND COMPACTION	40
1.01 RELATED DOCUMENTS	40
1.02 DESCRIPTION OF WORK	40
1.03 QUALITY ASSURANCE	40
1.04 SAFETY	40
1.05 JOB CONDITIONS	40
1.06 COMPACTION	41
2.01 SOIL MATERIALS	41
3.01 INSPECTION	42
3.02 EXCAVATION	42
3.03 HARDPAN EXCAVATION	44
3.04 ROCK EXCAVATION	44
3.05 BLASTING	45
3.06 BACKFILL	45
3.07 BACKFILL FOR STRUCTURES	46

3.08 CONSTRUCTION IN PUBLIC STREETS, ROADS AND ALLEYS	46
3.09 DISPOSAL OF WASTE MATERIALS	50
SECTION 5 - WATER DISTRIBUTION SYSTEM	51
1.01 RELATED DOCUMENTS	51
1.02 DESCRIPTION OF WORK	51
1.03 REQUIREMENTS OF REGULATORY AGENCY	51
2.01 APPROVED MATERIALS	51
3.01 INSTALLATION OF NEW WATER SYSTEMS	52
3.02 TESTING OF WATER DISTRIBUTION SYSTEM	59
3.03 DISINFECTION	60
3.04 SUPPLEMENTAL PROCEDURES FOR DISINFECTION, TESTING AND FLUSHING	64
3.05 ABANDONMENT OF WATER SERVICE	67
3.06 ABANDONMENT OF WATER MAINS	67
3.07 CLEAN-UP	67
SECTION 6 - SANITARY SEWER SYSTEM	68
1.01 RELATED DOCUMENTS	68
1.02 DESCRIPTION OF WORK	68
1.03 REQUIREMENTS OF REGULATORY AGENCIES	68
2.01 APPROVED MATERIALS	68
2.02 PIPE BEDDING	68
3.01 INSTALLATION OF SANITARY SEWER SYSTEMS	69
3.02 TESTING OF NEW SANITARY SEWER SYSTEM	72
3.03 MARKERS	74
3.04 CLEAN-UP	74
SECTION 7 - MANHOLE AND WET WELL REHABILITATION AND COATING	75
1.01 DESCRIPTION OF WORK	75
1.02 SUBMITTALS	75

2.01 GENERAL	76
2.02 REHABILITATION PROCEDURES	76
2.03 LINER AND COATING ACCEPTANCE	79
2.04 MANHOLE STEP REMOVAL	79
2.05 MANHOLE FRAME AND COVER REPLACEMENT	79
2.06 MANHOLE FRAME SEALING	81
2.07 FINAL ACCEPTANCE	81
 SECTION 8 - ESTABLISHING VEGETATION	 82
1.01 RELATED DOCUMENTS	82
1.02 DESCRIPTION OF WORK	82
1.03 SUBMITTALS	82
2.01 LIMESTONE	82
2.02 COMMERCIAL FERTILIZER	83
2.03 SEED	83
2.04 MULCH	83
2.05 WATER	83
2.06 TOPSOIL	84
2.07 SPECIAL SEEDING AND MULCHING EQUIPMENT	84
3.01 SEED BED PREPARATION	84
3.02 LIMING	85
3.03 FERTILIZER	85
3.04 SEEDING	86
3.05 MULCHING	87
3.06 PROTECTION	88
3.07 ESTABLISHMENT	88
APPROVED MATERIALS AND MANUFACTURERS	89
APPROVED MATERIALS LIST AND SPECIFICATIONS	90
APPENDIX	117
STANDARD DRAWINGS AND DETAILS	

GENERAL

Public sanitary sewers, private sewer 8" and larger (with manholes and service laterals), and public water mains shall be designed by a Professional Engineer licensed in accordance with the requirements of the Code of Virginia or a Professional Surveyor with a Class B license issued by the State of Virginia. Designs shall be in accordance with the Latest Edition of Waterworks Regulations and Sewerage Regulations, Virginia Department of Health, Commonwealth of Virginia and any other local, State or Federal agencies having jurisdiction.

The engineer shall also comply with the requirements of the Halifax County Service Authority's subdivision and utilities ordinances as they pertain to water and sewer systems. It is the responsibility of the Engineer to inform developers of the contents as set forth in the applicable local ordinances as it relates to the project under review and consideration by the HCSA Director of Operations.

Prior to construction of public water and/or sanitary sewer facilities, construction drawings for the proposed facilities must be submitted for review to the HCSA Director of Operations. The construction drawings must be in a form acceptable to the Director and be submitted in three copies. If deemed necessary by the Director, the developer or his agent shall submit an overall plan for the water and/or sanitary sewer systems for the proposed development. The plan must be submitted to the HCSA Director of Operations for review and approval at least thirty (30) days prior to submission of any schematic, tentative subdivision, construction or site plan for the property. A detailed checklist of plan requirements can be found in the Appendix of this document.

It is suggested that, for complex projects and projects which may require special considerations, the engineer arrange a meeting with the HCSA Director of Operations and staff to discuss the approach to be taken to supply water and sanitary sewer service. All water and sanitary sewer systems must be located and sized properly to serve the entire service area in conformance with the Halifax County Service Authority's approved Water and Wastewater Facilities Plan.

It should be noted that where it is determined that water or sanitary sewer lines are necessary to serve property beyond the subdivision or development in question, the developer will be required to design and construct his system, properly sized and at an appropriate location, to permit future extensions to be made at the limits of the subdivision or development in question. More specifically, sanitary sewer systems must be designed and constructed along rivers, creeks, and swales where adjacent property will be served by this system. The system must terminate, at all points in new development, to within one lot from the adjacent and/or upstream properties to be served by the system in the future. Elevation of the sewer system must be designed such that future extensions are taken into consideration to allow service to all the area which naturally drains towards the system.

Public water systems must be designed and constructed along major roads and/or through the development to facilitate for future extensions. In selecting routes for water and sanitary sewer extensions, the Halifax County Service Authority requires that the location must be such that it maximizes the potential for serving areas of existing and/or future developments. The developer must enter into a contract with the Halifax County Service Authority before any work begins. A copy of the Utility Contractor's bid proposal as accepted by the developer is required to prepare the contract. The Unit Price Bid Proposals shall be based on the approved water and/or sanitary sewer plans. All work must be performed by a Class A licensed contractor and/or as deemed acceptable to the HCSA Director of Operations.

This document addresses those issues related only to water and sewer utilities work and is not all-inclusive. General contract issues such as advertisement, bidding, awards and employment issues that fall under Federal and State equal opportunity and non-discrimination acts are beyond the scope of this document.

CONTACTING PROPERTY OWNERS

Prior to performing any survey and design work on private property, the engineer/ surveyor shall notify all landowners that may be affected by the design or installation of the proposed utility line. Notification shall be made in the form of a letter to be sent to the property owner a minimum of ten (10) days before commencing work. Copies of such letters shall be provided to the HCSA Director of Operations along with the initial plan submittal.

CONSTRUCTION DRAWINGS

Construction drawings shall contain the information necessary, presented in a clear and legible manner, to construct the utility. Drawing quality shall conform to the specifications as reflected in the Appendix. The engineer shall coordinate the location of all proposed water and/or sanitary sewer lines within all existing and proposed road rights-of-way with regard to existing and proposed roads and drainage structures. In addition, coordination shall be made with other appropriate utility companies and agencies with regard to their existing easements, rights-of-way and facilities. Where the possibility of conflicts with existing utilities exist, it shall be the Engineer's responsibility to secure accurate information on the horizontal and vertical location of such utilities through subsurface exploration.

The engineer must submit a copy of the checklist with a certification that the plans reflect all applicable items on the checklist. The plans will be reviewed and a review letter will be sent to the engineer with a copy to the developer. When the revisions are made, the engineer must resubmit the plans for final review. A letter of approval will be sent when all the Halifax County Service Authority's criteria are met.

Vertical datum for surveys shall be Mean Sea Level (USC & GS Datum). Horizontal control shall be based on Virginia State Plane Coordinate Grid, South Zone, North American Datum of 1983 (NAD 83) by a minimum of two coordinate points. Traverse closure shall be at least 1:5000.

RECORD DRAWINGS

The final revisions to construction drawings will be made when construction is complete. Their purpose is the recording of changes that were made during construction. After the final revisions are properly made, the drawings are considered record drawings.

Record drawings shall be generated by taking the Contractor's as-built drawings and any drawings, shop drawings, notes, etc., from the Halifax County Service Authority's Inspector(s) and updating the latest version of the construction drawings. The Contractor's as-built drawings are generally checked by the Halifax County Service Authority's Inspector(s) for completeness and accuracy.

When making the final revisions to a drawing, modify the drawing to reflect the changes that occurred during construction and remove all previously added revision identification symbols and records on the drawing and in the revision part of the drawing's title block. The final revision is given a revision number that is one number higher than any previous revision number. The final revision number and the date of the final revisions are placed in the revision part of the title block. The final revision should be identified by "Record Drawing Revisions" in the revision block.

DRAWING QUALITY CONTROL SPECIFICATIONS

All plans submitted to the HCSA for review shall conform to the minimum legibility and quality control requirements of this Section. Any drawing submitted for review which substantially does not meet this specification will not be accepted for review. All plans shall conform to the requirements of other Sections of the specifications as to size, form and content. Drawings produced and utilized in the performance of engineering services and work that is performed by and for the Halifax County Service Authority or to be deeded to the Halifax County Service Authority for continued maintenance and/or ownership shall be in both standard size paper drawings and in a compatible electronic format as indicated in this document.

Plans submitted to the HCSA shall be direct prints by the Diazo or similar process, in blueline or black-line, on paper equal to the products of the Azon Company. Photocopies or tele-facsimile reproductions are not acceptable for plan review, but may be submitted for information or preliminary review purposes. Drawings submitted on electronic media must conform to all the requirements of this Section, and with the following requirements.

The contrast of the printed material shall be high, with blank areas being as white as possible, and all information being as dark as practicable, while remaining clear and distinct. Shading, especially that done by filling in with a pencil or the use of the darker shading film, shall not be used on the drawings where it will occlude any other information, such as on the plan views of paved areas. Areas to be set off may be accomplished by stippling (maximum density 21 dots per linear inch, minimum 10 dots per linear inch); or by hatching or cross-hatching with maximum line width of 0.30 mm (#00 pen) and minimum line spacing of 1/10" where this method does not obscure other information.

Line work shall be consistent and sharply defined, with the best results usually obtained from ink on polyester film. The minimum line width shall be 0.30 mm (#00 pen), with the majority of the work in the wider pen sizes.

Lettering (text) shall be consistent and clear, with a minimum height of 0.100" (10 pt.) and minimum line width of 0.35 mm (#0 pen). The larger type shall have correspondingly wider line widths. The preferred font shall be sans serif engineering (LEROY) in vertical or 67½° slant, all capitals.

All information must be contained within the borders of each sheet, particularly on the plan and profile sheets. No photographs, or prints or reproductions of photographs, shall be a part of any drawing. Specifically, aerial photography may not be used in the plan views or at any other location.

- A. Compatibility - Document must be completely compatible with the Halifax County Service Authority's software. Documents created on compatible software should be received in their standard file formats - for example, AutoCAD documents should be received in .DWG format. The Engineer needs to be aware of discrepancies due to different versions of the software; the HCSA Director of Operations must be able to work with the media received and send out revisions the Engineer can utilize. A full size Adobe *.pdf file will be submitted as part of the final "as built" plan approvals.
- B. All correspondence is to be received in Corel WordPerfect, Microsoft Word format or in standard ASCII format.
- C. All CAD documents to be received must be in standard AutoDesk - AutoCAD.DWG Release format compatible to the HCSA Director of Operations. These documents must be free of any third party software restrictions. Restrictions must be purged off the files before sending to the HCSA Director of Operations.

SANITARY SEWER LOCATION

All sanitary sewers located as described in the General Section and in existing or proposed streets shall be constructed along the center of the street or center of the travel lane except when this space has been previously used by another utility or when the width of the street justifies two lines. Exceptions to this specified location will be allowed only when it has been definitely shown that it is not practicable to adhere to the standard location. All sanitary sewers shall be laid on a straight line between manholes except that consideration will be given to laying sewers larger than 24-inches in diameter on a curve.

In a parallel installation sanitary sewer lines or manholes shall be at least 10 feet horizontally from any water main whenever possible. The distance shall be measured edge to edge between the affective structures.

When local conditions prevent a horizontal separation of 10 feet, a sanitary sewer may be closer to a water line provided that:

1. The bottom of the water main is at least 18 inches above the top of the sewer.
2. Where the vertical separation cannot be obtained, the sewer shall be constructed of ductile iron, (Class 52) and shall be pressure tested to assure water-tightness prior to backfilling.
3. The sanitary sewer manhole shall be of watertight construction and be tested in place by vacuum testing. In a crossing installation, sanitary sewers crossing water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. When conditions prevent a vertical separation of 18 inches, the following shall be used:
 - A. Sewers passing over or under water mains shall be in accordance with Item 2 above.
 - B. Water mains passing under sanitary sewers shall, in addition, be protected by providing:
 1. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.
 2. Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking of the water mains.
 3. A section of water pipe centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.
4. Where the sanitary sewer is installed parallel to a storm drainage structure, there shall be at least 10 feet horizontally, measured center to center, between them.
5. Carrier pipe within bores for sanitary sewer installation shall be Ductile Iron (Class 52) and is to be used from manhole to manhole. C-900 PVC DR-18 pipe (Class 150) may be used as an option, provided there are no proposed or future house laterals connected directly into this pipe.
6. All sanitary sewer line crossings of railroads and, where required, roadways, and other major structures shall be encased in a casing pipe. Design of railroad crossings shall comply with the requirements of American Railway Engineering Association Specifications, Part 5 -Pipelines (latest revisions). The engineer shall be responsible for the preparation of the necessary application, at least 180 days in advance of construction or advertisement for bid, for submission by the Halifax County Service Authority to the railroad or in a timely fashion as determined by the HCSA Director of Operations and/or the Engineer.

7. Ductile iron pipe (Class 52) shall be used when crossing storm sewer and other rigid underground conduits when the vertical separation is 18" or less.
8. The tops of all sewers entering or crossing streams shall be a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other material. Less cover will be considered if the proposed sewer crossing is encased in concrete and/or ductile iron pipe is used and will not interfere with future improvements to the stream channel.
9. All sewer pipe within a 100 year backwater where cover is less than 3.0 feet shall be of non-float pipe. Other anti-flotation methods or devices will be considered on an individual basis.
10. Clay dams shall be utilized where the possibility exists that ground or surface water will follow the sewer trench, causing damage or undermining of pipe bedding.
11. In paved channels, the top of the sewer lines shall be placed at least 18" below the bottom of the channel pavement.
12. Sanitary sewers constructed in fill shall be of ductile iron pipe (Class 52) with manholes founded on original ground unless a licensed geo-technical engineer can furnish a certification that the fill has been sufficiently compacted so that settlement of the sewer or manhole will not occur. Such certification shall apply to that area directly above as well as below the pipe.
13. Sanitary sewers shall remain water-tight and fully operational during the 100 year flood.
14. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100 year flood. Sewers located along streams shall be located outside of the streambed and sufficiently removed therefrom to provide for future possible channel widening.
15. Sewers entering or crossing streams, estuaries, lakes, or reservoirs shall be constructed of watertight pipe. The pipe and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that not other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact. In cases where sanitary sewers are to be constructed on steep grades and velocities greater than 15 feet per second are indicated, solid wall PVC pipe or other abrasion resistant material shall be used.
16. Sewers laid on a slope of 20 percent or greater shall be anchored securely with concrete anchors or other approved means. Suggested minimum anchorage is as follows but should be determined by the engineer:
 - a. Not over 36 feet center to center on grades 20 percent to 35 percent.
 - b. Not over 24 feet center to center on grades 35 percent to 50 percent.
 - c. Not over 16 feet center to center on grades 50 percent and over.

Design and installation performance shall comply with the Halifax County Service Authority's ***General Specifications & Standard Drawings***.

DEPTH OF SANITARY SEWER LINES

All sewer lines within existing or proposed streets or areas subject to heavy traffic shall be so constructed as to provide a minimum cover of 6' over the pipe. Greater depths shall be required to serve low properties, where street grades may be lowered in the future, where there is a possibility of further extension of the sewer line, or where clearance must be provided for other utilities. Clearance shall be provided for enlargement of undersized drainage structures. Minimum cover for sewer lines shall be 3.5 feet.

SANITARY SEWER MANHOLES

1. Manholes shall be precast, approved and constructed in accordance with Halifax County Service Authority *General Specifications & Standard Drawings*.
2. Manholes shall be located at the end of each sanitary sewer line, at all changes in pipe size, alignment (except where laid on a curve where diameter is larger than 24"), grade and at sewer junctions. Maximum spacing between manholes shall be a maximum of 400 feet.
3. Manholes subject to flooding shall be easily accessible and have watertight manhole covers. All manhole rims shall be 6 inches above the 100 year flood elevation, except where the rim would be more than 3 feet above the existing grade in which case watertight covers shall be used and manhole be set at a height 3 feet above final grade. Unvented sections of sewer shall not exceed 1,000 feet in length.
4. Drop manholes shall be used when the spring line elevation of the incoming sewer line exceeds the spring line elevation of the outgoing sewer line by 2' or more.
5. Sampling manholes shall be provided for all Significant Industrial Users (SIU) and any facilities discharging over 25,000 gal/day of non domestic wastewater, which includes industrial facilities, food processing, metal processing, hospitals, animal hospitals, photographic finishers, printing shops, etc. Physical design of the sampling point must be appropriate for the type of wastewater to be sampled.

MANHOLE AND WET WELL REHABILITATION AND COATING

Manhole and wet well rehabilitation includes the lining the manhole interiors, internal sealing of the frame-chimney joint area, and reconstructing manhole benches and channels. Work shall include the furnishing of all materials, equipment, tools, and labor as required for the rehabilitation of the manholes.

Rehabilitation products shall be applied to the manhole from the cover seat to and including the benches. The rehabilitation system must provide a non-prorated warranty as herein described in manholes to stop infiltration, prohibit root intrusion, protect the existing structure from further deterioration, and provide a surface coating resistant to sewer gases and chemicals.

Sewage pumping station wet wells shall also be rehabilitated and coated in accordance with this specification.

A comprehensive construction-sequencing plan. At minimum the plan shall include the following:

- a. A proposed schedule.
- b. Identification of all proposed access routes.
- c. Identification of set-up locations for lining installation.
- d. Lining procedures.
- e. Bypass Pumping Plan in accordance with the requirements of this document.
- f. Traffic Control Plan in accordance with VDOT requirements.

Documentation of product experience shall include at least 10 jobs similar in nature completed within the last two years. The jobs submitted shall show that the Contractor or other Contractors have installed at least 500 vertical linear feet of the product and shall also include at least 5 jobs similar in nature completed within the last two years and in which the Applicator has installed at least 200 vertical linear feet of the product. The Owners name, the contact for the job including name, phone number, title, and address, the project description, the value of the job, and the date job was placed in service.

SERVICE LATERAL CONNECTIONS

Service lateral connections shall be provided in accordance with existing Halifax County Service Authority ordinances, specifications and Standard Drawings. Plugged service connections are to be provided when required by the HCSA Director of Operations for all lots and parcels within the new development. A minimum size of 6" diameter pipe is required commercial lateral connections to the public sewer. A minimum size of 4" diameter pipe is required for one-family residential private lateral connections to the public sewer. No lateral will be connected to the public sewer main until a sanitary sewer clean-out has been installed at the property line and approval by the Halifax County Service Authority and/or it's designated agent. No lateral shall be connected to any public main or manhole with an entrance or connection angle in excess of 90 degrees of the direction of flow. Subsequent approval of the connection will be required before the service is made active. The design, installation and performance of all service laterals shall comply with the Halifax County Service Authority's *General Specifications & Standard Drawings*.

STRUCTURAL DESIGN

Structural requirements must be considered in the design of all sanitary sewers and appurtenances. This is a matter of detail design and is not subject to simple generalization. The following criteria should be considered by the design engineer:

1. Special Structures - Whenever possible sanitary sewer structures shall be built as shown in the *General Specifications & Standard Drawings*. Structures other than those shown in the standard drawings shall be considered special structures and shall be designed and detailed by the design engineer.
2. Pipe Foundation - In all cases the proper strength sewer pipe shall be specified for the proposed depth, width of trench and bedding condition. Soil condition should be considered with samples being obtained where necessary to verify pipe selection and foundation design.

HYDRAULIC DESIGN FOR SANITARY SEWERS

The quantity of sewage for design purpose shall be determined by the future requirements of the total drainage area tributary to the section of sewer under consideration. Average quantities of sewage, including allowable infiltration, shall be computed as follows:

Use/Occupancy	Gallons per Day per Acre	Equivalent Persons per Acre
Residential (low density)	500	5
Residential (medium density)	1,000	10
Residential (high density)	2,500	25
Commercial (retail)	2,000	20

Use/Occupancy	Gallons per Day per Acre	Equivalent Persons per Acre
Commercial (office)	1,500	15
Industrial (light)	2,000	20
Industrial (medium & heavy)	3,500	35
Agricultural/Undeveloped	1,000	10

Table 1.

Where site specific determinations can be made, sewage flows may be determined by using the following design information:

Discharge Facility	Design Units	Flow (gpd)
Single-family residential	3.5 people per dwelling	350
Manufactured/Modular Homes	3.5 people per dwelling	350
Apartments & Condominiums	4 people/three-bedroom apt.	350
	3 people/two-bedroom apt.	300
	2 people/one-bedroom apt.	200
Schools /Cafeteria, Showers	per person - Elementary	16
	per person - High School	25
Motels & Hotels	per Room	130
Manufactured Home Park	4 people/mobile home	400
Restaurants	per seat	50
Service Stations	per vehicle serviced	10
Factories	per person/8- hour shift	25
Shopping Centers	per 1,000 sq. ft. of floor space	250
Hospitals	per bed	300
Adult-Assisted Living Homes	per bed	200
Doctor's Office/Medical Clinic	per 1,000 sq. ft. of floor space	500
Laundromats, 9-12 machines	per machine	500
Theaters, Auditoriums	per seat	5
Bowling Alleys	per lane	75
Office Buildings	per 1,000 sq. ft. of floor space	200

Table 2.

NOTE: Other classifications may be found in the Virginia Department of Health Regulations

The design of sanitary sewage flows shall be determined by using the peaking formula as follows:

$$[\text{For } 0\text{-}20 \text{ mgd, } Q_d = 3.5 \text{ QA } 0.807 \text{ and for } 20\text{-}50 \text{ mgd, } Q_d = 2\text{QA}].$$

The engineer should insure that the following design criteria are adhered to:

1. Sewers shall have a continuous slope, straight alignment and uniform pipe material between manholes.
2. At all junctions where a smaller diameter sewer discharges into a larger one, and at all locations where the line increases in size, the invert of the larger sewer shall be set so that the energy gradients of the sewers at the junction are at the same level. Generally, this condition will be met by placing the pipes at crown's level where possible, however, as a minimum, placing the 0.8 depth of flow in each sewer at the same elevation.
3. Sewers shall be designed to be free flowing with the hydraulic grade below the crown and with hydraulic slopes sufficient to provide an average velocity, when flowing full, of not less than 2.25 feet per second. Computations of velocity of flow shall be based on a value of "n" = 0.012 as used in the Kutter or Manning formula for velocity of flow.
4. In cases where the calculated depth of flow is less than pipe flowing full the velocity at actual depth of flow should be computed. For sewage flow depth less than ¼ full, allowance should be made for increased value of "n". In no case should velocities of less than 1.3 feet per second be permitted. Increased velocities shall be accomplished by steeper grades.
5. A minimum slope of 0.520 shall be maintained for terminal 8" lines not likely to be extended. Minimum pipe size between manholes shall be 8". The following are minimum slopes in feet per hundred feet to be provided for pipes flowing ¼ of full depth to full depth:

Pipe size	8"	10"	12"	15"	18"	20"	24"	27"	30"	36"
Slope %	.40	.32	.24	.20	.16	.12	.10	.08	.07	.06

Table 3.

6. In cases where sewers are to be constructed on steep grades for which high velocities are indicated, the maximum permissible velocity at average flow (before applying peak flow factor) should not exceed 15 feet per second. Suitable drop manholes shall be provided to break the steep slopes and to limit velocities to not more than 15 feet per second in the connecting sewer pipes between manholes. Where drop manholes are impracticable for reduction of high velocity, the sewer shall be of solid wall PVC pipe or other abrasion resistant material.
7. Miscellaneous head losses at manholes, curves and junctions shall be estimated and allowed for as follows:
 - a. At manholes on straight runs allow head loss = 0.05 feet.
 - b. 90° turns made inside of manholes, where the radius of turn is less than 2 pipe diameters allow $0.50 V^2 / 2g$. If the radius of turn is greater than 2 pipe diameters, allow $0.25 V^2 / 2g$. In no case should the total allowance be less than 0.05 ft.
 - c. At transitions/ interjections of sewers larger than 24" in diameter, allow $0.50 V^2 / 2g$.

8. In general, the pipe diameter should be continually increasing with increase in tributary flow. Where steep ground slopes make possible the use of a reduced pipe size and substantial economy of construction costs is thereby indicated, the pipe size may be reduced but due hydraulic allowances shall be made to provide for head loss at entry, increased velocity and effect of velocity retardation at the lower end where the flow will be on flatter slopes. In no case, should pipe sizes be thus reduced more than one nominal size in diameter.

Hydraulic computations shall be submitted to the Department of Public Works for approval. Engineer shall submit with all sewer plans the information and calculations on sewer flow demands for the project.

Upon receiving a written request from the developer and/or his agent and the information furnished by the developer's engineer, the Department will then provide the available sewer capacity. After evaluating this information on available capacities, the engineer shall then furnish his calculations supporting that these demands can be met and that the sizing of the proposed sewer mains are adequate.

SEWAGE PUMP STATIONS AND FORCE MAINS

Sewage pump stations will be used when it has been determined to be the only practical way to provide sanitary service based upon a finding that:

1. It is economically impractical to extend the gravity sewer and the use of a pump station will not adversely affect the Halifax County Service Authority's ability to serve the area with a gravity sewer at a future time; and
2. The proposed design and plan for the pump station and connecting lines do not adversely affect the current financial status of the Halifax County Service Authority utility system or the future ability of the Halifax County Service Authority to install a gravity sewer; and
3. The proposed design of the pump station permits replacement of the pump station with a gravity sewer without significant capital outlay at a future time; and
4. The pump station will not overload the existing sewage facilities and will not otherwise negatively affect the Halifax County Service Authority's ability to efficiently manage the sewer system. The design of the sewage pumping facility shall be discussed with staff and the required design criteria determined. At a minimum the following data shall be provided:
 - a. Structural design and calculations, including reinforcing drawings where applicable, of the facility.
 - b. Hydraulic design for the equipment selected, including scaled drawings.
 - c. Electrical and mechanical drawings and specifications for the equipment selected.
 - d. Job Specifications to include but not limited to the "Standard Procedures for the Halifax County Service Authority's Acceptance of Newly Constructed Pumping Stations".

Sanitary sewage force mains shall be ductile iron (Class 52). For 12" and smaller, PVC C-900 may be used. Force mains to be designed with a minimum flow velocity of 3.0 feet per second, a maximum flow velocity of 8.0 feet per second; and a Hazen-Williams "C" value of 120. Minimum size shall be 4 inches in diameter. A constant grade shall be used where feasible. Valves and air releases will be provided at appropriate locations.

Manholes receiving the discharge from force mains shall be designed in accordance with the Halifax County Service Authority's standard drawings. In addition, special acid-resistant manholes and sewer pipe shall be provided downstream of the discharge point as determined by the engineer (hydrogen sulfide calculations are required). On existing systems, manholes shall receive an approved liner. Liner shall be as shown in the standard drawings.

SEWER REHABILITATION DESIGN DECISION PROCEDURE

The following written procedure using many of the general elements involved in a sewer rehabilitation project and assists the Design Engineer in evaluating the feasibility of the various options. The user of this document should note that it is very difficult to generalize engineering design matters without endangering the final product. This document is not intended to replace sound engineering judgment. Engineers should consider the applicability of the contents of this document to specific projects and, based on the characteristics and requirements of the projects make the necessary adjustments as required. In choosing the most suitable pipe rehabilitation method the individual considerations presented below need to be evaluated comprehensively for site specific conditions.

- 1. CCTV or Digital Imaging sewer inspection and evaluation.** In order to determine the condition of the existing sewer pipe, a detailed visual inspection is required. Inspections by personnel entry may be feasible in larger pipelines (48" and above). However, in most cases, personnel access into smaller sewer pipes is not feasible and not preferable due to the confined space and obvious safety and health issues. In these cases, CCTV or the newer digital imaging technology is the preferred method to visually inspect the pipe. Either of these techniques can be used to verify the structural integrity of the pipe, identify sources of infiltration, assess the condition lateral connections and pipe joints, and other features that may affect the integrity and flow characteristics of the pipe. The evaluation of the pipeline is generally rated according to the National Association of Sewer Service Companies (NASSCO) assessment guidelines.
- 2. Structural Integrity.** The internal visual investigation will assist in determining several important design considerations, the most important of which is the structural condition of the pipe. Many of the trenchless techniques are not recommended if there are partial or full collapses of the existing pipe. In most cases, if there are partial or full collapses of the host pipe, pipe bursting or dig and replace are the preferred methods. The visual inspection can also determine if there are any major sags in the existing pipe due to poor bedding conditions or if there is adequate slope of the pipeline. Again, trenchless techniques generally cannot resolve major sags or poor slope conditions because they assume the form of the host pipe. Dig and replace is often the preferred (or only) method that can resolve these issues. Root intrusion, poor or offset joints, and poor lateral or manhole connections are other important defects to note and evaluate, which may affect the structural integrity of the overall collection system. These defects can generally be resolved with trenchless rehabilitation techniques.

3. **Flow Characteristics.** After the visual inspection of the pipe is completed, a hydraulic analysis of the collection system is recommended. The hydraulic analysis should consider whether the existing pipe is sufficient for current and projected flow conditions. In general, if the pipe requires 75% or more of its existing flow capacity, the improved flow characteristics of a rehabilitated pipe should be calculated. If the improved flow conditions of a rehabilitated pipe still indicate a need for 75% or more of the existing flow capacity, consideration should be given to upsizing the pipeline either through dig and replace or pipe bursting. If the analysis shows that the pipe size is sufficient but the diameter cannot be reduced, sliplining, Shotcrete, or other spray on liners that reduce the diameter are generally not feasible and can be eliminated from consideration.
4. **Service Connections.** The quantity and location of the service connections must be carefully considered. Numerous service connections and service connections that enter the main at odd angles can be time consuming and expensive to reconnect or rehabilitate robotically from inside the pipe. Some trenchless techniques – in particular sliplining and pipebursting - require the lateral connections to be reestablished by digging and replacing.
5. **Bends In Host Pipeline.** Any bends that may be present in the sewer line between manholes can make trenchless methods more difficult to successfully rehabilitate the pipe. Techniques such as CIPP, Fold and Form, cement mortar, and chemical and epoxy coatings may be used if the bend is not severe and the host pipe is in reasonably good condition. However, sliplining and pipebursting are not as flexible and generally not as effective even with minor bends in the pipeline. The higher cost and feasibility of these methods should be considered.
6. **Surface Access.** The accessibility of the host pipe is the next consideration. If the pipe is greater than 10 feet deep, issues such as higher cost and safety become limiting factors for the dig and replace option. If the pipe is not accessible from the surface, or the cost to access the pipe is too great (i.e. the pipe is located under a major thoroughfare with numerous utilities in the immediate vicinity that would require a lengthy road closure), the dig and replace method may be eliminated and consideration given to the trenchless techniques.
7. **Existing Utilities.** In most mature cities there may be numerous utilities in close proximity to the sewer main located in the right-of-way or utility easement. In areas with a large number of utility lines, it may not be feasible to dig and replace. Pipebursting may also be eliminated as an option if there is a chance the vibration may affect the surrounding utilities.
8. **Bypass pumping.** Nearly all the techniques to rehabilitate sewer pipelines require some level of bypass pumping or flow diversion to be successful. Some techniques, such as dig and replace and sliplining can be properly installed with a small degree of flow in the collection system. However, other techniques such as Fold and Form, and pipebursting generally require, and result in a better-finished product, if there is no flow in the pipeline. For this reason, the feasibility of bypass pumping is an important aspect to consider.
9. **Access Pit.** Some trenchless techniques do require some surface disruption at each or one end of the line to be rehabilitated, typically at the manhole locations. Sliplining and pipebursting both require access pits, while the other techniques can be performed through an existing or new manhole. Consideration must be given as to whether the existing site will allow an access pit because of traffic and pedestrian impacts, location of the manhole, and location of existing facilities. If an access pit is not feasible, sliplining and pipebursting can generally be eliminated as options.

10. **Existing Soil Conditions.** Pipebursting is one trenchless technique that may have an impact on the surrounding utilities and surrounding soil. If a sewer is less than four feet deep and/or constructed in poor soil that is not conducive to tunneling or vibrational impacts, pipebursting may not be a feasible choice.
11. **Other issues to consider.** After the visual pipe inspection, hydraulic analysis, and site conditions are considered; a decision can be made as to what will provide the best value and best service for the longest period of time. A cost benefit analysis can be done evaluating each of the various methods of sewer rehabilitation. Factors to consider include, but are not limited to:
 - a. Depth of sewer
 - b. Size of pipe
 - c. Site access
 - d. Impacts from surface disruptions (both financial impacts and “good neighbor” impacts)
 - e. Time required for bypass pumping or flow diversion
 - f. Quantity and method of service reestablishment
 - g. Experience and availability of local contractors to perform each method

Decision. The final decision will be based on what provides the greatest value to the overall collection system at the least cost. Some situations may require a combination of several methods. For example, a pipe with numerous leaky joints and one partial collapse may require a dig and replace point repair at the partially collapsed section before sliplining the entire pipe. Regardless of the rehabilitation technique that is ultimately chose, each situation must be evaluated systematically using a procedure similar to the outline herein to determine the best engineering solution.

INSTALLATION OF 6- INCH LATERALS TO EXISTING SANITARY SEWER LINES

When it is necessary to tap the main sewer line and install a 6 inch sewer connection, the following guideline shall be adhered to:

1. The work shall be done by an approved utilities contractor specializing in the installation of public water and sewer lines. Upon request, the Halifax County Service Authority will furnish a list of known utilities contractors acceptable to the Halifax County Service Authority to perform such work.
2. If a water line is to be crossed, the tap must be made on Monday -Thursday.
3. The contractor shall notify the HCSA Director of Operations’s 48 hours prior to beginning construction.
4. When tapping the sewer line, a mechanical hole cutter and an approved saddle must be used. The tap must be made so that the 6 inch connection will enter the main line on a slope no greater than 45 degrees. No connection shall be cut into the tap of a sewer line. No lateral shall be connected to any public main or manhole with an entrance or connection angle in excess of 90 degrees of the direction of flow.
5. When tapping into a manhole, bring the 6 inch connection in above the shelf, but no higher than two feet above the lowest invert. A channel to carry the flow from the connection must be built inside the manhole. No lateral shall be connected to any public main or manhole with an entrance or connection angle in excess of 90 degrees of the direction of flow.

6. The 6 inch connection is to be constructed only to the property line and/or the edge of the easement in which the main sewer line lies, or as directed by the inspector.
7. The contractor is responsible for damages to any existing utilities and shall have in his possession and/or furnish evidence upon request of having sufficient insurance to cover any damages that may occur.
8. Work in the State Right of Way:
 - a. The VDOT must grant permission to install a sewer lateral within their right of way. The utilities contractor is responsible for making application to Virginia Department of Transportation for permission to install a 6 inch connection within their right of way and for providing the Inspector a copy of the permit before commencing work.
 - b. Use the necessary signs and barricades to divert traffic.
 - c. One-way traffic must be maintained at all times.
 - d. The trench must be backfilled with 21A stone, and compacted as required.
 - e. Pavement should be replaced within 24 hours. All paving is to be done in accordance with Virginia Department of Transportation (VDOT) specifications.
 - f. On streets subject to school bus traffic, work should be done only between 9:00 A.M. and 3:00 P.M.

Any deviations from these guidelines must be approved by the Halifax County Service Authority's Director of Operations.

WATER BOOSTER STATIONS

Water pump stations shall be considered a special project and specific project standards and plans will be prepared by the Engineer and submitted to the Halifax County Service Authority for review and approval. The project standards shall include but not limited to contents as set forth in the Appendix.

WATER LINE LOCATION

Generally, water lines to be installed in proposed subdivision and local streets shall be located 2 feet off the edge of pavement where there is no curb and gutter and 4 feet in front of the face of curb (pavement side) where there is. However, within proposed curb and gutter streets, an alternate design should be considered if right-of-way is available and a design is feasible. Water lines to be installed along existing roads will generally be installed in easements where the road is likely to be widened in the future and in the right of way where the road will not be widened in the future. Where water lines are to be installed in roads expected to be widened in the future, they shall be located in easements unless the future road cross section is known and location of water line is designed to avoid future relocation.

WATER LINE DESIGN

Water lines shall be designed so that changes in alignment are made with bends and with approved thrust blocks or approved mechanical joint restraint systems wherever applicable. All mechanical joint thrust restraint system calculations to be shown on plans with a detail sketch showing length of pipe and fittings to be restrained. Where it is necessary to change alignment by deflecting successive lengths of pipe, the joint deflection shall be limited. Allowable deflection shall represent one-half the maximum allowable deflection listed by the most manufacturers. For PVC pipe, the deflection is made by curving the pipe, since there is no deflection capability in the joints. The bending radius shall be limited to manufacturer's allowable limit and/or per the standard detail (s) of this manual. Bending and joint deflection limits apply to vertical as well as horizontal curves. Engineer is to verify existing field conditions to develop soil classifications for calculated bearing pressures.

In subdivisions, water mains will be permitted in easements only when there is no other feasible alternative and prior approval is obtained from the HCSA Director of Operations. Easements shall be wide enough to provide sufficient space for both installation and maintenance. The engineer shall consider the location of existing and proposed sanitary sewer and storm drainage systems and all other underground structures and utilities that could affect the location and type of materials for the pipeline. The selected location should avoid conflicts and facilitate future maintenance. Where the possibility of conflicts with existing utilities and/or other structures exist, it shall be the Engineer's responsibility to secure accurate information on the exact horizontal and vertical location of such utilities through subsurface exploration and reflect this exact information on the plans.

The engineer shall consider the requirement for separation of water and sanitary sewer facilities and shall use the same requirements stated in the **SANITARY SEWER LOCATION** section of these standards. Water main crossings of railroads and where required, roadways shall be encased in a casing pipe. Design of railroad crossings shall comply with the requirements of American Railway Engineering Association Specifications, Part 5 - Pipelines (latest revisions). The engineer shall be responsible for the preparation of the necessary application, at least 180 days in advance of construction or advertisement for bid, for submission by the Halifax County Service Authority to the railroad or in a timely fashion as determined by the Department and/or Engineer.

Water mains entering or crossing streams, shall be Ductile Iron Pipe (minimum Class 52). The tops of these mains shall be a sufficient depth below the natural bottom of the streambed to protect the pipe. In general, 3.5 feet of suitable cover is required. The pipe and joints shall be designed, constructed, and protected against anticipated hydraulic and physical, longitudinal, vertical, horizontal loads, erosion and impact. Reasons for requesting less cover shall be given in writing to the Halifax County Service Authority prior to plan submittal.

Water mains constructed in fill shall be Ductile Iron Pipe (Class 52) with restrained joints unless a licensed geo-technical engineer can furnish a certification that the fill has been compacted so that settlement of the main will not occur. Such certification shall apply to the area directly above as well as below the pipe.

Water mains constructed on piers will be permitted only when it can be demonstrated that no other practical alternative exists. The engineer shall submit a design for the piers, pier foundation and pipe that will demonstrate the structural integrity of the proposed system. Above ground pipe shall be adequately supported, protected from damage from freezing, accessible and above the 100 year flood elevation.

Subaqueous water main installations will be permitted only when it can be demonstrated that no other practical alternative exists. The pipe shall be of special construction having flexible watertight joints. Special attention shall be directed to foundation conditions for the pipe and to thrust resistance. For both the above ground and subaqueous crossings the design shall provide for valves at both ends of the crossing so that the section can be isolated for tests and repairs. The valves shall be easily accessible and not subject to flooding.

DEPTH OF WATER LINES

Standard Minimum cover will be 42 inches. Maximum depth will not exceed 10'. Water lines shall be constructed to a depth that will provide protection against freezing and thawing, insure adequate cover over valves and other appurtenances and provide adequate service. New installations of water lines adjacent to road ways shall have a minimum of 42 inches of cover from existing/proposed edge of pavement. Greater depths shall be required where street grades will possibly be lowered in the future. Clearance shall be provided for enlargement of undersized drainage structures. Any development which takes place over an existing water main shall be required to maintain the water main at a maximum depth of 10' below finished grade.

WATER LINE APPURTENANCES

Valve manholes, air relief valves, fire and flushing hydrants, service lines and other appurtenances shall be constructed in accordance with *General Specifications & Standard Drawings*. Hydrants in residential areas should be located at corners or in mid-block at lot lines as approved by the Fire Department and in accordance with I.S.O. guidelines. Maximum hydrant spacing shall be 1,000 feet and no more than 500 feet to any house. When cul-de-sacs are longer than 500', the last fire hydrant shall be designed immediately before the bulb of the cul-de-sac, where practical. The developer is to make the necessary improvements to satisfy fire flow demands as determined and required by Fire Department.

Valves shall be located at not over 1,000 foot intervals and at all changes in pipe diameter. Valves shall also be provided at all pipe line intersections so as to provide shut off for repairs of limited sections without interruption of service to large areas and to facilitate testing. A minimum of two valves shall be provided at tees, three valves at crosses and shall be located as close to the fitting as practical. All Valves are to be restrained to fittings by approved method.

When connecting to an existing water main, installing a tee as opposed to a tapping sleeve and valve is especially desirable when there are long distances between main line valves (greater than 1,000 feet) or even if the distance is less than 1,000 feet where it would be an advantage to add a main line valve for better system control. Therefore, it is important that each project be carefully evaluated by the developer's engineer with the Department of Public Works' assistance to determine if a main line valve is needed and/or cutting in a tee is practical, taking into consideration how many residences, businesses, hospitals, etc. may be without water.

Water mains shall be provided with air release valves and blow-offs at suitable locations to allow testing, chlorination and draining of the line. Fire hydrants, blow-offs or flushing hydrants shall be installed at dead-end mains. Where looping is not feasible, an automatic flushing device, with electrified timer, shall be installed and maintained by the subdivision developer until such lines are inter-connected to form a looped system acceptable to the Halifax County Service Authority.

STRUCTURAL DESIGN

Structural requirements must be considered in the design of all water mains and appurtenances and must not be subject to generalization. The following criteria should be considered by the design engineer:

1. Special Structures - Structures shall be built as shown in the standard drawings, however, structures other than those shown in the standard drawings shall be considered special structures and shall be designed and detailed by the design engineer and submitted for review and approval to the HCSA Director of Operations'.
2. Pipe Foundation - In all cases the proper strength water pipe shall be specified for the proposed depth, width of trench and bedding condition. Soil conditions must be considered.

3. Thrust protection as shown on plans in the standard drawings shall consist of concrete thrust blocks against undisturbed earth. Approved mechanical joint restraint systems may be required for ductile iron and PVC C-900 pipe. Hydrant valves shall be installed with hydrant tees. The hydrant must be protected from thrust by approved mechanical joint restraints and concrete thrust blocks.
4. Where valves are placed for future water line extensions, valves are to be restrained to the fitting and a minimum 20' length of pipe shall be installed past the valve except where calculations or local conditions indicate more pipe is required to provide adequate restraint. Approved mechanical joint restraint systems are to be used as required to provide adequate retention of the pipe and valve when thrust blocks cannot be used.
5. Dead-end lines shall be provided with a flushing hydrant or fire hydrant whichever is practical.

HYDRAULIC DESIGN FOR WATER LINES

Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire flow based on sound hydraulic analysis. Design shall be based on a maximum flow velocity at peak flows (excluding fire flow) of 5 feet per second and a Hazen-Williams "C" Value of 120. The engineer shall be required to comply with the procedures as outlined in the Appendix.

The water distribution system and any extensions thereto shall be designed to supply the demands of all customers while maintaining 20 psi during peak fire and/or domestic hour flow, whichever is greater.

Design of the water system shall generally be such as to maintain 40 psi at maximum day demand. When 40 psi cannot be maintained, the engineer shall be responsible for coordinating with the HCSA Director of Operations to investigate alternatives in order to provide 40 psi.

Minimum water main pipe size shall be 8", except that terminal water lines will be six (6) inches in diameter, unless a larger diameter line is needed to meet the peak domestic demand and/or fire flow requirements. Dead-ends shall be eliminated by looping when feasible. Where looping is not feasible, an automatic flushing device, with electrified timer, shall be installed and maintained by the subdivision developer until such lines are inter-connected to form a looped system acceptable to the Halifax County Service Authority.

Designs providing less than 40 psi will be evaluated on an individual basis. Also, the design of the water line should be such that a velocity of 2.5 f.p.s. can be maintained at blow-off devices (flushing hydrants) and at hydrants for proper flushing. The following criteria shall be used in estimating average daily demands:

Discharge Facility	Design Units	Flow (gpd)
Single-family residential	3.5 people per dwelling	350
Manufactured/Modular Homes	3.5 people per dwelling	350
Apartments & Condominiums	4 people/three-bedroom apt.	350
	3 people/two-bedroom apt.	300
	2 people/one-bedroom apt.	200
Schools /Cafeteria, Showers	per person - Elementary	16
	per person - High School	25

Discharge Facility	Design Units	Flow (gpd)
Motels & Hotels	per Room	130
Manufactured Home Park	4 people/mobile home	400
Restaurants	per seat	50
Service Stations	per vehicle serviced	10
Factories	per person/8- hour shift	25
Shopping Centers	per 1,000 sq. ft. of floor space	250
Hospitals	per bed	300
Adult-Assisted Living Homes	per bed	200
Doctor's Office/Medical Clinic	per 1,000 sq. ft. of floor space	500
Laundromats, 9-12 machines	per machine	500
Theaters, Auditoriums	per seat	5
Bowling Alleys	per lane	75
Office Buildings	per 1,000 sq. ft. of floor space	200

Table 4

NOTE: Other classifications may be found in the Virginia Department of Health Regulations, latest edition.

To determine maximum daily demands and peak hourly demands the following multipliers shall be used:

Maximum Daily Demand	=	1.8 times Average Daily Demand
Peak Hourly Demand	=	2.36 times Average Daily Demand

BLOW-OFFS

Blow-offs shall be provided at low points on mains 16-inches and larger. For 12-inch mains, blow-offs shall be provided at creek crossings. Engineer should use the following guidelines, in regard to location of flush points, air release valves, blow-offs, etc. during the design of public water systems:

1. Access to flush points by contractors and especially to the Halifax County Service Authority HCSA Director of Operations is very important. Flush points serve no purpose if access to the flush points can not be obtained.
2. Engineer needs to make sure that appropriate notes i.e., flow (gpm) expected to be dispersed at points of flushing; etc. are put on the plans.
3. Emphasize (through appropriate notes) to contractor to maintain good erosion control and flushing procedures. Erosion control and environmental impact consideration must be taken into account whenever a flush point is chosen, therefore, certain controls may be needed at the time water line is installed.

4. Engineer needs to advise contractor to coordinate his work through the inspectors and the inspector coordinate with the Halifax County Service Authority HCSA Director of Operations regarding when to flush (time of day and season, etc.).
5. On larger water lines, attempt to locate the flush points as near to the roadways or at a stream (keeping in mind adverse effects to downstream ponds, etc.).
6. Contractor is to perform flushing prior to acceptance of the new water line.
7. Minimize the number of blow-offs, (strategically placed), so that proper flushing can be performed.
8. Minimize the number of air release valves, taking into consideration the depth of proposed water line.
9. Standardize the design of a blow-off needed taking into account the size of blowoff, height of blow-off, positioning of blow-off, etc.
10. Look at easement considerations that would be needed during flushing process. Property owners and the Halifax County Service Authority's HCSA Director of Operations shall be solicited for advice during easement acquisition.
11. Wherever possible, two supply points shall be provided for subdivisions containing more than 25 lots.
12. All exposed water mains shall be adequately insulated as determined by the engineer.

Fire flow requirements for non-residential areas shall be in accordance with the National Fire Protection Association Handbook (latest revisions) and the applicable sections of the Virginia USBC, and shall be coordinated with the Fire Department.

SERVICE CONNECTIONS AND METER REQUIREMENTS

Each service shall have an individual direct tap. One water service is allowed per lot, except that duplexes can have two. Exceptions will be made for residential sprinkler services and irrigation systems where a separate metered service is required with prior approval from the HCSA Director of Operations. New irrigation systems shall be metered separately.

Services and meters shall be sized and locations designed in accordance with the Standard Drawings. Minimum water service size shall be $\frac{3}{4}$ " pipe with $\frac{5}{8}$ " meter. Services shall be designed and reflected on the plans for both residential and commercial developments. When the residential water service from the main to the meter is 50' or greater and the peak hour pressure at the main is under 40 psi, a 1-inch service line will be installed to the Halifax County Service Authority water main.

When, (at the probable house site), the peak hour pressure is under 40 psi, a 1-inch water service from the main to the meter shall be installed and the following note will be added to the plans: "At least a 1-inch water service from the meter to the house is recommended to be installed and depending on the desired pressure at the house, the builder may need to consider an individual booster pump".

Pressure reducing valves shall be installed on the customer side of the meter by builder or property owner, to be operated and maintained by the customer, when the Halifax County Service Authority's system pressure will be greater than 80 psi.

Residential services are generally ¾" or 1" with a ⅝" meter. Design Engineer shall be responsible to design the service and meter size for actual conditions. Calculations for the size of services and meter sizes shall be performed in accordance with AWWA Manual M22, Sizing Water Service Lines and Meters, the latest edition of the Virginia Uniform Plumbing Code, or alternate procedure approved by the Authority.

WATER FLOW TEST SUBMITTAL AND APPROVAL PROCEDURES

The following procedures must be adhered to by the developer or his agent to insure and verify that public water is available to meet the fire flows and domestic demands as required to serve an existing and/or proposed development:

Rates of flow for fire protection shall be estimated based on the latest edition of the Insurance Services Office (ISO) Fire Suppression Rating Schedule, the latest edition of the National Fire Protection Association Handbook, and AWWA Manual 31, except as modified herein. A maximum allowance of 50% reduction in needed fire flow may be allowed for buildings with automatic sprinkler systems that provide full protection.

The minimum fire flow from any individual fire hydrant shall be 500 gpm. The minimum flowing pressure at maximum flow shall be 20 psi measured at the flowing hydrant.

- I. **Start Point** - The developer's engineer must provide a hydraulic modeled flow test at the start of design for their project. The developer's engineer will perform the test(s) under the supervision of the HCSA Director of Operations and/or his representative. A "start point" request must be submitted in writing (faxes are accepted) and must include the following information:
 - A. A sketch, map, or section of plan sheet that clearly shows the location of the proposed tie-in point(s) or the hydrant(s) nearest to the proposed tie-in point(s) where the start point test(s) are to be run.
 - B. A fax number to return the results to the engineer.

- II. **Site Plan Process** - Once the engineer has the "start point" results and completes their design of the project, results of hand written or modeled flow calculations supporting their design must be submitted directly to the HCSA Director of Operations for review and approval. These results shall include the following information:
 - A. Static pressures at all on-site hydrants and the sprinkler system connection (the hydrant, tee, reducer, or other fitting nearest to the public side of the double check assembly).
 - B. Verification that the required ISO total flow requirements can be supported by the on-site hydrants. The ISO calculation sheet must be included showing total flow requirements, divided between the on-site hydrants and the test run simultaneously. The ISO calculation sheet will indicate the required flow and the number of hydrants required for the site.
 1. If the number of hydrants on the site plan matches the number of hydrants indicated as needed on the ISO calculation sheet, each hydrant is first tested at 1000 gpm and then the flow test is run by dividing the ISO required flow evenly among the new hydrants and running the hydrants simultaneously.

2. If the number of hydrants on the site plan exceeds the number of hydrants indicated as needed on the ISO calculation sheet (this may occur due to spacing or other considerations), then an additional test must be performed prior to performing the ISO test. Each hydrant on the site plan must be tested individually and the residual pressure for each hydrant recorded. The ISO test is then performed by flowing a number of hydrants equal to the amount indicated as needed on the ISO calculation sheet, and by dividing the ISO required flow evenly among the ISO required hydrants and run simultaneously. The hydrants to be flowed in this test is determined by using the hydrants with the lowest residual pressures in the individual test. The remaining hydrants will not be used in the simultaneous test.

- C. A mailing address and fax number for the engineer. The flow test information must be submitted in the form of a sketch and table and may be done by hand as long as they are legible. Hydraulic model printouts are unacceptable for review. Once the results are submitted in the proper format, the submittal will be reviewed by Halifax County Service Authority staff. Should there be any discrepancy, the engineer shall be contacted and the discrepancy resolved. If any of the aforementioned standards cannot be met, the Fire Department shall be contacted. The engineer is required to modify the project to accommodate the standard and submit revised flow test results, unless an exception is approved by the Fire Department. Any significant changes in the site plan layout required by the HCSA Director of Operations site plan review staff or by the Fire Department will require that revised flow test results be submitted for review. Once the project flows are approved, the "start point" curve and cover letter is to be included on the plans. This data/information must be put on the Utility plan sheet or Overall Utility plan sheet along with the ISO calculation sheet. If the static pressures are such that an individual PRV or booster pump (greater than 80 or less than 40 psi, respectively) is needed, this information will be indicated on the cover page of the response letter to the engineer.

III. **Residential Subdivision Construction Plan Process** - Once the engineer has the "start point" results and completes their design of the project, results of hand written or modeled flow calculations supporting their design must be submitted directly to the HCSA Director of Operations for review and approval. These results shall include the following information :

- A. Static pressures at all proposed hydrants.
- B. Verification that the proposed hydrants meet flow test requirements of 500 gpm at 20 psi residual for each hydrant. Hydrants are to be tested individually.
- C. A mailing address and fax number for the engineer. The flow test information must be submitted in the form of a sketch and table and may be done by hand as long as they are legible. Hydraulic model printouts are unacceptable for review. Once the results are submitted in the proper format, the submittal will be reviewed by Halifax County Service Authority staff. Should there be any discrepancy, the engineer shall be contacted and the discrepancy resolved. If any of the aforementioned standards cannot be met, the Fire Department shall be contacted. The engineer is required to modify the project to accommodate the standard and submit revised flow test results, unless an exception is approved by the Fire Department.

- D. Any significant changes in the site plan layout required by the HCSA site plan review staff or by the Fire Department will require that revised flow test results be submitted for review. If the static pressures are such that individual PRV's or booster pumps (greater than 80 or less than 40 psi, respectively) are needed, this information will be indicated on the cover page of the response letter to the engineer.

IV. **Tentative Subdivision Plans** - For Tentative Subdivision plans where the entire development is shown, the engineer must submit a flow test for the entire subdivision. If the subdivision is to be phased, a water phasing plan must be submitted that demonstrates the ability of each phase to achieve the required fire flows independently of any future phases.

- B. For tentatives where only part of the entire development is shown, the engineer must submit a flow test for the entire development and for the individual tentative. A water phasing plan must also be submitted that demonstrates the ability of each phase to achieve the required fire flows independently of any future phases. An overall development water/wastewater master plan may be required depending on the complexity of the development.
- C. All tentatives must show individual fire hydrants in a layout approved by the Fire Department and flows are to be tested for each hydrant. Tentatives should also take particular high and low elevations into account for static pressure tests and for fire flow tests.

FIRE SPRINKLER SYSTEM REQUIREMENTS

All fire sprinkler system services may be metered and will be equipped with an approved double check valve detector assembly, with a metered by-pass, to assure protection of the public water supply from contamination. Double check valve detector assemblies will be installed in an approved vault as near to the property line as possible. Maintenance responsibility of the HCSA Operations Division will end immediately preceding the inlet gate valve of the assembly. The owner and/or developer will be responsible for the testing and maintenance of all backflow prevention and /or protective devices serving the facility.

1. The HCSA Director of Operations will perform plan review of the proposed water line extension up to the first OS&Y gate valve located on the inlet side of the double check valve detector assembly and the plan review of the assembly as it relates to the backflow device, etc. For pipe runs greater than 100 L.F. (from main to the vault) a gate valve shall be installed at the main at the tee. In all cases Engineer shall provide details illustrating what type of anchoring will be used on the inlet side of the assembly, so that the OS&Y valve (inlet side) of the double check detector valve will not blow off when the double check detector valve and or outlet valve is removed.
2. The valve pit shall be located at or as near to the property line as possible and out of the main flow of traffic. The vault shall be designed and constructed in accordance with the General Specifications and Standard Drawings. The location will be reviewed by the HCSA Director of Operations and the Fire Department for optimum placement. The review of the site plan is not a detailed review of the water and sewer design when it involves the relocation and/or extension of the public system. However, the site plan (the applicable sheets of the site plan) must reflect the approved water and sewer design and show the exact location of the existing facilities.

Therefore, it is important that the Engineer submit all utilities plans directly to the HCSA Director of Operations at the same time or as near that time to avoid any unnecessary delays in the approval of the site plan and release of the building permit. Installation of double check valve assemblies other than at the property line must be approved by the Fire Department. In these instances a gate valve will be installed at the property line and/or edge of water line easement to designate the point at which HCSA responsibility ends.

3. Under any circumstances where a siamese connection is required, it will be installed on the outlet side of the double check valve assembly. Upon making application for water service, applicants who wish to separate his fire line service must have this reflected on the site plan and the Utility plan (Engineer is required to submit for review and approval a separate utility plan to the HCSA Director of Operations's indicating the size line needed for the fire demand and the size water meter and service line for the domestic use. The applicant must indicate clearly on the water meter sizing form his desire to separate the fire service, otherwise, the water meter and appurtenances will be installed without regard to fire service and applicant will be subject to additional expense to correct the situation. Where the applicant can not accomplish combining the fire/domestic services in the manner described above and/or a separate fire line is needed where there already exists a water meter service, all work must be performed by a licensed utilities contractor approved by the HCSA Director of Operations.

INSTALLATION OF WATER METERS IN COMMERCIAL AND INDUSTRIAL DEVELOPMENTS

1. All commercial and industrial developments (Shopping Centers, Sites, etc.) will be treated the same as residential development where New Water Lines are being installed.
2. Developer or his agent will be required to complete the water meter sizing forms and submit them to the HCSA Director of Operations at the same time plans are submitted for review.
3. A map clearly depicting location of buildings, etc., must be submitted by the Developer or his agent. Same information must be shown on the water plans.
4. Engineer is required to incorporate with his plans a detail of the method to installing meters.
5. All appropriate notes, details, etc. are to be shown on plan.
6. Contract between the developer and contractor shall include the installation of the water meter services and boxes.
7. Developer shall be responsible for informing all builders that the water and sewer connections fees must be paid prior to the Halifax County Service Authority forces setting water meters.
8. Connection fees shall be as stated in ordinance.
9. Engineer and contractor shall refer to the Halifax County Service Authority's General Specifications and Standard Drawings and the latest revised "Approved List of Manufacturers, Materials and Specifications" for approved method for designing and constructing the water meter assemblies.

EXCEPTIONS:

On projects where utility contractors are involved in any new construction, the contractor shall perform all service taps and install services, including taps on existing lines.

OTHER CONSIDERATIONS

For water lines less than 24 inches in diameter, a minimum depth of cover of 36 inches is required. For water lines 24 inches and greater, a minimum depth of cover of 42 inches is required. Additional depth shall be provided where required for thrust restraint or to clear underground obstructions.

The profile of water services at ditch lines shall be shown on the drawings. The water service shall be Copper Tubing Size (CTS) Ultra-high Molecular Weight Polyethylene (PE) AWWA C901 – Polyethylene Tubing, ASTM D-1248, ASTM D-2737 rated at not less than 200 psi or Type K copper and have a minimum cover of 24 inches at the ditch invert.

Where water lines are subject to extreme variations in temperature (i.e., attached to bridges or box culverts) consideration shall be given to expansion and contraction of pipe materials and the freezing of the liquid.

Corrosion Protection - The Design Engineer shall consider ground conditions in the case of metallic conduits and provide suitable corrosion protection where necessary. For pipe sizes greater than 24 inches, the design engineer shall consult a corrosion specialist.

Irrigation systems shall use the appropriate backflow devices as indicated in the Halifax County Service Authority's Cross Connection Control Manual.

Non-ferrous mains shall have a detectable 10 gage insulated copper tracer wire buried in the trench 12 inches above the main with non-detectable warning tape 12 inches above tracer wire. The tracer wire shall be looped at each valve box.

GENERAL SPECIFICATIONS & STANDARD DRAWINGS

SECTION 1 - SITE CLEARING

I - GENERAL

1.01 RELATED DOCUMENTS

The Plans and General Provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, equipment and supplies and shall perform all work and services necessary for or incidental to the performance and completion of all site clearing and grubbing, protection and/or replacement of property pins, removal and disposal of debris resulting from site clearing and grubbing, backfilling to original level of any depressions resulting from such removal, and the protection of existing trees and vegetation. Any existing aggregate, stone, drainage swales or pipe, or any other easement improvements shall be restored to the original pre-contract condition(s).

II - PRODUCTS - Not applicable to work of this Section.

III - EXECUTION

3.01 GENERAL

The Contractor shall remove trees, including stumps and roots, shrubs, grass, flowers and other vegetation interfering with installation of new construction. He shall carefully and cleanly cut roots and branches of trees that will remain where such roots and branches obstruct new construction.

3.02 LIMITS FOR SITE CLEARING & GRUBBING

Site clearing and grubbing activities shall be limited to those areas designated on the construction drawings as being within the limits of construction or within easements and rights-of-way designated for the work. Under no circumstances will the Contractor be allowed to occupy or cut outside the limits established for the work without written permission of the property owner. Clearing and grubbing shall be as indicated on the approved erosion and sediment control plan.

3.03 CLEARING

Clearing shall consist of the removal from above the surface of existing ground standing trees, shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, flowers, vines, rubbish and other debris. Trees may remain the property of the landowner and shall be removed or cut in lengths by mutually agreement. If the landowner does not want the wood, it shall be properly removed and disposed of by the Contractor.

3.04 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots, root mats and other debris to a depth of not less than 18 inches below existing ground elevation.

3.05 ORNAMENTAL TREES, SHRUBS AND FLOWERS

Existing ornamental trees, shrubs and flowers shall be removed in such a manner as not to destroy their viability and shall be stored at or near the site of their removal as approved by the Owner. Such trees, shrubs and flowers shall be maintained in an acceptable manner, watered and protected to maintain healthy growth during the construction period. Said trees, shrubs and flowers shall be replanted as soon as possible or, if so directed, removed from the site. Any trees, shrubs or flowers rendered unusable shall be replaced by the Contractor with approved stock.

3.06 PROTECTION

- A. The Contractor shall protect existing trees and other vegetation that is to remain in place against unnecessary cutting, breaking or 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 are to be provided as required to protect trees and vegetation to be left standing.
- B. Trees and other vegetation to remain within limits of contract work shall be watered as required to maintain their health during course of construction operations.
- C. Provide protection for roots over 1- ½" diameter cut during construction operations. Coat cut faces with a wound paint formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

- D. Repair or replace trees and vegetation that will remain, which are damaged by construction operations, in a manner acceptable to the Owner. Owner may employ an Arborist to repair damages to trees and shrubs at the Contractor's expense when deemed necessary.
- E. Fill depressions caused by clearing and grubbing operations with suitable soil material, unless further excavation or earthwork is indicated. Fill material shall be placed in horizontal layers not exceeding 6" loose depth, and thoroughly compacted to a 90% density equal to adjacent original ground.

3.07 DISPOSAL OF WASTE MATERIALS

- A. The Contractor shall remove all waste material weekly, weather permitting, from the site and shall dispose of it in a legal manner such as an approved landfill.
- B. Burning of combustible materials on-site is prohibited.

3.08 EROSION CONTROL

All activity performed under this section shall conform in strict compliance with Section 3 entitled "*Erosion and Sediment Control*" of this document.

SECTION 2 - SITE DEMOLITION

I - GENERAL

1.01 RELATED DOCUMENTS

The Plans general provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 DESCRIPTION OF WORK

Exact extent of the site demolition may not be fully indicated on the plans. Determine the nature and extent of site demolition that will be necessary by comparing the Contract Documents with existing conditions. Perform all work of a demolition nature that may be required or necessary to a full completion of the Work, whether or not shown or specified.

- A. Demolition includes removal of all existing site improvements which interfere with new construction, and disposal of demolished materials from the site.
- B. Provide an orderly sequence of demolition and removal to ensure the uninterrupted progress of operations.

1.03 JOB CONDITIONS

A. Conditions:

1. Conditions of Site Improvements: The Owner assumes no responsibility for the actual condition of site improvements to be demolished.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner in so far as practicable. However, variations within the structure may occur by Owner's removal and salvage operations prior to the start of the demolition work.

B. Explosives:

The use of explosives will be permitted only upon approval by the owner with appropriate permits and only in accordance with the "Rules and Regulations Governing Manufacture, Storage, Handling, Use and Sale of Explosives" issued by the Department of Labor and Industry.

C. Traffic:

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Damage:

Promptly repair damage caused to adjacent facilities by demolition operations to the satisfaction of the Owner.

II – PRODUCTS - Not Applicable.

III – EXECUTION

3.01 DEMOLITION

- A. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 2. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by the Owner or governing authorities. Return adjacent areas to condition existing prior to the start of the work.
- B. Below-Grade Construction: Demolish and remove below-grade construction and concrete slabs-on-grade.

C. Filling of Holes, Pits, and Foundations:

1. Fill with suitable material to within 4 inches of finished grade in lawn areas, compact to 9001 density and topsoil to finished grade.
2. Fill with suitable material to within 12 inches of finished grade in structural areas and compact as specified in **Section 4 - Trenching, Backfill and Compaction**.

3.02 DISPOSAL OF DEMOLISHED MATERIALS

- A. Burning of removed materials from demolished structures on-site is prohibited.
- B. Transport materials removed from demolished structures weekly, weather permitting, and legally dispose of off the site such as an approved landfill. End of Section

SECTION 3 - EROSION AND SEDIMENT CONTROL

I – GENERAL

1.01 RELATED DOCUMENTS

Plans and general provisions of the Contract, including General and Supplementary Conditions and Specification sections, apply to work specified in this Section. In addition, all work performed on this project shall conform to all rules and regulations set forth by the Virginia Soil and Water Conservation Commission in its "Erosion and Sediment Control Handbook," Halifax County Service Authority and/or any other regulatory agency which has control or jurisdiction over erosion and sedimentation control in the area in which the project is located.

1.02 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, equipment and services necessary for, and reasonably incidental to, preventing pollution of land, air and water and for controlling run-off and erosion of soil. Erosion and sediment control shall be accomplished so as to preclude sedimentation in general and in particular of the public stormwater system.

1.03 GENERAL CONTROL MEASURES

- A. All disturbed areas including but not restricted to stock piles, dams, banks of sediment basins and temporary road banks left unprotected for more than 30 days shall be temporarily seeded within 7 days at the Contractor's expense.
- B. All disturbed areas shall be protected to control erosion and prevent sedimentation of adjacent properties, storm sewers and/or streams.
- C. Sediment control devices such as diversion berms, sediment traps, filter berms, vegetation stabilization, etc., shall be used to prevent off-site sedimentation at all times.
- D. All borrow and/or spoil materials shall only be stockpiled within the limits of the permitted site.

- E. The proposed grading shall not impair existing surface drainage, constitute a potential erosion hazard, or source of sedimentation to any adjacent property, drainage system or right-of-way.
- F. All points of construction ingress and egress shall be protected to prevent tracking of mud on the public streets.

1.04 STORM DRAINAGE CONTROL

If during construction of the utility system the Contractor disrupts the storm drainage, the storm drainage will be piped into the storm drainage system when required or handled by providing positive drainage onto stable areas at nonerosive velocities and in a manner consistent with established drainage patterns. Temporary storm drainage systems shall be approved by the authority having jurisdiction .

1.05 STABILIZATION

- A. Within fifteen days of achieving final grade, all disturbed areas shall be stabilized with permanent vegetation and permanent mulch.
- B. For vegetating critical areas adequate mulch, fertilizer and type of seed will be placed to ensure a vigorous ground cover and such application will be repeated if necessary until such growth is established.
- C. Sediment control measures may not be removed or relocated without the approval of the Inspector.

II - PRODUCTS

2.01 STRAW BALES AND SILT FENCES

Straw bales and fabric silt fences shall be installed in accordance with the latest edition of the Erosion Control and Sedimentation Handbook. Straw bales shall be of standard size.

2.02 GROUND LIMESTONE

Ground limestone shall contain a minimum of 88% of calcium and magnesium carbonates. A total of 100% shall pass the 10 mesh sieve; a minimum of 90% shall pass the 20 mesh sieve; and a minimum of 60% shall pass the 100 mesh sieve. Each container of package limestone shall be clearly marked with the name of the material, net weight of contents, manufacturer's name and guaranteed analysis. Upon Owner's request bulk shipments shall be accompanied by a certificate covering the names, weight, and the analysis specified herein.

2.03 COMMERCIAL FERTILIZER

- A. The basic mix shall be 10-10-10 formula, one-half of the nitrogen being in the form of organic nitrogen and shall conform to the applicable State fertilizer laws. It shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis.
- B. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted. The basic mix may be altered at the Engineer's discretion, based upon laboratory reports.

2.04 WATER

Water shall be clean potable water.

2.05 TEMPORARY SEEDING

- A. Seed shall be fresh, clean, of the latest crop conforming to the current purity and germination standards of the Atlantic Seedmens Association and mixed in the following proportions by weight.
- B. Planting Dates Species Rate (lbs./1000 s.f.)
 - Sept. 1 – Feb. 15 50/50 Mix of Annual Ryegrass (Lolium Multi-Florum) & Cereal (Winter) Rye
 - Feb. 16 – Apr. 30 Annual Ryegrass (Lolium Multi-Florum)
 - May 1 – Aug. 31 German Millet (Setaria Italica)
- C. Upon request, by the Owner, the Contractor shall furnish a certified report by the approved seed testing laboratory, showing a test for purity, viability, and seed content of representative samples of the seed which are proposed for use.

2.06 MULCH

Mulch shall be straw, free from weed seeds.

2.07 LIQUID MULCH BINDERS

Liquid mulch binders shall be in accordance with the Virginia Erosion and Sediment control Handbook, latest edition.

III - EXECUTION

3.01 INSTALLATION OF STRAW BALES AND SILT FENCES

The staked straw bales shall be placed as a first priority item. Each bale shall be staked with two wooden stakes at least 3 feet long. Straw bales shall be maintained throughout the life of this contract. Silt fences shall be placed in strict accordance with the Virginia Erosion and Sediment control Handbook, latest edition.

3.02 LIME APPLICATION

Distribute ground limestone evenly by machine over all areas. Disc or otherwise till it into the top 4 inches of the soil at least five days before seeding. The rate of application shall be 40 pounds per 1,000 square feet. This rate may be altered at the Engineer's or Inspector's discretion.

3.03 FERTILIZER APPLICATION

Distribute fertilizer evenly, by mechanical spreader, over all areas to be seeded and incorporate it into the top 4 inches of soil. Apply at the rate of 60 pounds per 1,000 square feet not more than one week prior to seeding. This rate may be altered at the Engineer's or Inspector's discretion.

3.04 SEEDING

Seed at the rate of 2 pounds per 1,000 square feet and lightly rake into soil.

3.05 MULCHING

Apply mulch to all seeded areas the same day as seeding. Spread uniformly by hand or mechanically at the rate of 1- ½ to 2 tons per acre, or 70 to 90 pounds per 1,000 square feet.

3.06 MULCH BINDING

- A. Application of liquid binders should be heavier at edges where wind catches mulch, in valleys, and at crests of banks. Remaining area should be uniform in appearance.
- B. Apply at the rate recommended by the manufacturers' specifications.

3.07 GENERAL CONTROL MEASURES, INSTALLATION & MAINTENANCE

The work site, and areas adjacent thereto, shall be kept clean and free of soil, straw or other materials incidental to the work of this section. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall, if turbidity producing materials are present, be held in suitable sedimentation ponds or shall be graded to control erosion. Temporary erosion and sediment control measures such as berms, dikes, drains, or sedimentation basins, if required to meet the above standards, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operative. The area of bare soil exposed at any one time shall be held to a minimum. Fills and waste areas shall be constructed by a selective placement to eliminate silts or clays on the surface that will erode and contaminate adjacent rivers, streams, lakes, ponds, or properties.

3.08 STOCKPILING EXCAVATED MATERIAL

Contractor shall stockpile excavated material and spoils on the uphill side of the trench and the pipe and/or brush on the downhill side of the trench. Performing this effective control measure will minimize the need for straw bales and silt fences. Disturbance shall be kept to a minimum and methods of controlling erosion shall be performed in accordance with plans and specifications and Contractor is not relieved of his responsibility to perform construction practices which will prevent erosion more clearly defined in the local and State Erosion and Sediment Control Standards.

3.09 MAINTENANCE

Erosion control measures shall be maintained until permanent vegetation is established. During periods of operations, erosion control facilities shall be maintained in proper condition and silt removed as directed by the inspector. Removal of erosion control facilities shall include proper disposal of collected silt and debris. Improper erosion control maintenance or installation shall be grounds to stop work on project by the inspector.

3.10 INSTALLATION OF RIP RAP

Installation shall be in accordance with VDOT Road and Bridge Specifications, latest edition.

3.11 CONSTRUCTION IN A WETLAND OR WATER OF THE U.S.

The area of land disturbance must be kept to the minimum necessary for utility installation. Excavated material may be temporarily sidecast within the disturbed area, provided that it is placed upon a filter fabric and in a location that will not allow it to be dispersed by currents or other forces. In wetlands, the top 6 to 12 inches of the trench should generally be backfilled with topsoil from the trench. Excess material must be removed to upland areas immediately upon completion of the utility line. Any exposed slopes must be stabilized immediately upon completion of the utility line. In waters of the U.S., the original ditch cross-section must be re-established and stabilized with rip rap immediately upon completion of the utility line.

SECTION 4 - TRENCHING, BACKFILL AND COMPACTION

GENERAL I

1.01 RELATED DOCUMENTS 1

The General Provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, equipment and supplies and shall perform all work and services necessary for all operations in connection with excavation, trenching, backfilling and compaction for the installation of underground utilities as indicated or specified. The work includes but is not limited to the installation of:

- A. Sanitary Sewers
- B. Water Piping
- C. Related Utility Appurtenances

1.03 QUALITY ASSURANCE

Work shall conform to Halifax County Service Authority requirements and, where construction is within the State right-of-way, the applicable requirements of the Virginia Department of Transportation.

1.04 SAFETY

It is a requirement of OSHA, VOSHA and these specifications that all safety measures including but not necessarily limited to trenching, confined space, traffic control and other applicable safety measures be strictly adhered to and enforced by the Contractor.

1.05 JOB CONDITIONS

- A. Protection of Existing Utilities: It shall be the responsibility of the Contractor to conduct the work in such a manner as to avoid damage to, or interference with, any utility services. If such damage, interference, or interruption of service occurs as a result of his work, it shall be the Contractor's responsibility to promptly notify the Owner and utility owner of the occurrence and to repair or correct it immediately, at his own expense, and to the satisfaction of the Owner and the owner of the utility. Further, it shall be the Contractor's responsibility to uncover and expose the location of all service connections to avoid damage or interruption of service. If damage occurs, the Contractor shall make the necessary repairs in accordance with the above requirements. It is also the responsibility of the Contractor to determine in advance of beginning his construction effort the exact location of all utilities, and the effect they will have on his work by contacting "Miss Utility" 48 hours prior to starting work. Telephone 1-800-552-7001 for assistance.
- B. Protection of Persons and Property:
 - 1. Barricade open excavations occurring as a part of this work and post with warning lights. Provide warning lights and other protective measures as recommended by authorities having jurisdiction.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- C. Equipment used for this work shall meet all local, State, Federal and any other applicable standards governing this work. All power machinery shall have adequate mufflers to keep noise to a minimum.
- D. Site Information:
 - 1. Data on indicated subsurface conditions, if any, are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available only for the convenience of Contractor.
 - 2. Additional test borings and other exploratory operations may be made by Contractor or at the request of the owner at no cost to Owner.

1.06 COMPACTION

It is the intent of these specifications that the Contractor be responsible for the correct bedding of utility lines, backfill of pipe trenches, and compaction of backfill as outlined in this section. Where (in the inspector's opinion) excavated material is not suitable for backfill, select backfill must be used. The Halifax County Service Authority may require that the Contractor have density and compaction tests performed by a certified independent laboratory verifying that the trench backfill has been compacted as required. Any material not compacted as required shall be removed at the Contractor's expense and replaced, recompact and retested. Any and all work performed by an independent laboratory is to be done under a purchase order from the Contractor. Verbal results of tests should immediately be given the utility inspector. Two written copies of all reports by the independent laboratory confirming the field results shall be given to the inspector within (48) hours of the field tests. Requirements for compaction are covered in further detail later in this section. Where water and/or wastewater utilities are to be installed in the paved area of new roadways to be accepted into the state system, the requirements of the Virginia Department of Transportation compaction procedures are to be followed. This requirement applies to all new Tentative Plans submitted on or after September 1, 2001.

PRODUCTS II

2.01 SOIL MATERIALS

Definitions:

- A. Unstable Soil Materials: Soil that is too wet to permit proper compaction.
- B. Noncohesive Soil Materials: Noncohesive soil materials include gravels, sand gravel mixtures, and gravelly-sands.
- C. Cohesive Soil Materials: Cohesive soil materials include clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands.

- D. Backfill and Fill Materials:
 - 1. Approved excavated or borrow materials must be free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, organic and other deleterious matter.
 - 2. Approved materials must be at a moisture condition suitable for compaction at required density.

EXECUTION III

3.01 INSPECTION

Examine the areas and conditions under which excavating, filling, and grading are to be performed and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner.

3.02 EXCAVATION

- A. Excavation consists of removal and disposal of material encountered when establishing required trench elevations. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be at the Contractor's expense.
- B. Unstable soil shall be removed to a depth determined by the Owner or Owner's representative and replaced with No. 57 stone or other approved material which may include material the Contractor stored on the job for later use and shall be uniformly and thoroughly compacted.
- C. Sheeting, Shoring and Bracing: Provide shoring, sheeting, and bracing as necessary to prevent cave-in of excavation or damage to existing structures, on or adjoining the site.
 - 1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. The Contractor's attention is called to Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry. The Contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U. S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.
 - 2. Maintain sheeting, shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses in accordance with proper authority.
 - 3. Sheeting, shoring and bracing may be left in place with the approval of the utility owner, but must be cut off to a depth not less than two (2) feet below the surface.

- D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavation. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Dewatering shall continue until backfilling has been completed.
 2. Convey groundwater and surface water removed from excavations to collecting or run-off areas approved by the Owner. Trenches shall not be used as temporary drainage ditches.
 3. All dewatering shall comply with the latest edition of the Virginia Erosion and Sediment Control Handbook.
- E. Stability of Excavations:
1. Slope sides of excavations to comply with local, State and Federal codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
 2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- F. Material Storage: Stockpile approved excavated materials where approved by Halifax County Service Authority , until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess soil material and waste materials as hereinafter specified.
- G. Excavation for Trenches and Structures:
1. Trenches shall be opened only so far in advance of pipe laying as the Owner will permit and in no case will this distance exceed 500 feet. Unless special circumstances dictate otherwise, all trenches must be backfilled by the end of the day. The width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus eighteen inches (18") except that for pipe twelve inches (12") or less in diameter, the trench width shall not exceed thirty-three inches (33"). The trench walls above the top of the pipe may be sloped or the trench, above the top of the pipe, may be widened as necessary for bracing, sheeting and shoring. Where these trench widths are exceeded, the Contractor, at his own expense, will be required to mechanically tamp an approved backfill material from the bottom of the trench to six (6) inches above the top of the pipe as directed by the Owner.
 2. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations.

3. Grade bottom of trenches as indicated. For pressure lines, notch under pipe bells to provide solid bearing for the entire body of the pipe.
4. Where pipe for pressure lines is to be laid, the trench shall be in accordance with the HCSA Standard Drawings.
5. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
6. Excavation for structures shall conform to the lines and grades as shown, established or as necessary. Where the bottom of the excavation is in unstable material, such material shall be excavated to a depth of one foot below the bottom of the structure or to a depth required by the Owner and replaced with #57 stone, coarse sand, or other approved material. Bottoms shall be planked or covered with appropriate fabric if necessary to prevent the admixture of earth with the concrete. All sheeting, bracing, and shoring required for safety shall be installed in conformity with applicable rules and ordinances.

3.03 HARDPAN EXCAVATION

Hardpan is classified as indurated clay, shale or sand with a cementitious material, which requires loosening with an air spade or blasting before it can be removed from the trench. The same clearances shall be made between the pipe or structure and hardpan material as is described hereinafter for rock excavation.

3.04 ROCK EXCAVATION

- A. Definition: Rock excavation shall comprise solid rock in the original bed or well defined ledges and which can only be removed by blasting and/or drilling or by the use of jack hammers, and shall include all boulders or detached pieces of rock one-half cubic yard or more in content.
- B. Pipe Trench: Rock shall be excavated a minimum of six (6) inches below the bottom of all pipes. The pipes shall be laid on a cushion of No. 57 stone of sufficient depth to provide the proper grade. A minimum clearance of six (6) inches shall be provided between the vertical walls of the trench and the bell of the pipe.
- C. Structures: Rock excavation for structures shall extend a minimum of eight (8) inches below the bottom or base of structure and a suitable bedding shall be provided. A minimum clearance of six inches (6) shall be provided between the rock and the exterior face of the structure when forming is not used. The minimum clearance shall be two (2) feet when forming is used.

3.05 BLASTING

- A. Blasting operations shall be in strict accordance with "Rules and Regulations Governing Manufacture, Storage, Handling, Use and Sale of Explosives" issued by the Department of Labor and Industry of Virginia and any local ordinances. All blasting shall be done at the sole risk of the Contractor and shall be done only by experienced licensed personnel. Occupants of nearby structures shall be notified prior to beginning blasting operations.

- B. When blasting is required, the Contractor shall conform to the following requirements:
1. Blasting will not be permitted before 9:00 A.M. or after 4:00 P.M. on Monday through Friday.
 2. Blasting on Saturdays, Sundays and holidays will not be permitted.
 3. The Contractor shall not be permitted to blast under any conditions unless a representative of the Owner is present.
 4. The Contractor shall, each day when necessary to blast, set up an approximate schedule of blasting operations, and provide 24 hours notice to the Owner, and property owners with occupied buildings within 1000 feet of blasting.
 5. The Contractor shall use mats to minimize noise impact on nearby residents.
 6. The Halifax County Service Authority reserves the right to require the Contractor to have a repair crew and equipment available on-site to repair any damage caused to the Halifax County Service Authority utility by blasting operations.

3.06 BACKFILL FOR TRENCHES

- A. General: After the installation of the pipe has been field inspected, the trenches shall be backfilled with fine, loose earth deposited carefully on both sides of the pipe or with the appropriate fill material as specified in ***Halifax County Service Authority Standard Drawings***. Large clods, frozen earth, sticks, stones, and other unsatisfactory material must be excluded from the backfill around and to 12" above the pipe. The fill or in the case of plastic pipe where stone is used for bedding and backfill to the top of the pipe, the stone shall be carefully rammed by hand or pneumatic tamping methods under, on both sides and on top of the pipe. The remainder of the backfilling may be done by hand or with mechanical equipment in lifts no greater than 12 inches. Where settlement occurs, the trench shall be refilled, contoured and compacted by an approved method to conform to the surface of the ground. Sheeting and bracing shall, in general, be removed as the backfilling progresses, and in such a manner as to avoid the caving of the trench. Voids left by the withdrawal of the sheeting or shoring shall be carefully filled and rammed. Where in the opinion of the Owner, damage is liable to result from the withdrawal of the sheeting it shall be left in place. No rock should come in contact with pipe.
1. Sewer pipe shall have minimum bedding as shown on the ***Halifax County Service Authority Standard Drawings***.
 2. Backfill shall be compacted in layers with the following percentage of maximum density at optimum moisture content of $\pm 2\%$ as determined by ASTM D698.

- a. 95 percent under pavements and road shoulders.
 - b. 90 percent in other unpaved areas.
- B. Under Existing Roadways and Pavement: Backfill for trenches under roadways and other paved areas shall be backfilled to the top with 21-A stone, except that all fill above the pipe shall be deposited in layers not exceeding 6 inches in thickness. Each lift shall be thoroughly compacted by mechanical or hand tamping methods, in accordance with VDOT requirements so that when the backfilling is completed, the paving may be replaced.
- C. Clay dams: Clay material with an imperviousness of 10-3 cm/sec shall be used in clay dams. Material shall be compacted as indicated in paragraph A above. Inspector shall approve clay material prior to use.

3.07 BACKFILL FOR STRUCTURES

Around and adjacent to structures, backfill shall be of material of suitable stability and perviousness. Backfill shall be placed in 6 inch lifts, each lift being compacted by an approved method. 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 95% per ASTM D-698. The Contractor shall provide adequate protection to all structures during backfilling and use every precaution to avoid damaging or defacing them.

3.08 CONSTRUCTION IN PUBLIC STREETS, ROADS AND ALLEYS

Unless superseded by other specifications or VDOT permit requirements for state maintained roads, the following shall apply: The Contractor's operations in public streets, roads or alleys, shall be confined to as small a space as is practicable, so as not to cause undue inconvenience to the public or abutting properties, and shall be subject at all times to the approval of the Halifax County Service Authority and/or VDOT as applicable. The words Halifax County Service Authority and VDOT as used in the previous sentence means the individual, group or governmental body that has jurisdiction over the streets, roads and alleys. Unless otherwise directed by Halifax County Service Authority, the Contractor shall perform the proposed construction on public streets, roads and alleys as follows:

GENERAL: Typically, water and sewer lines are to cross roadways at right angles and/or to parallel roadways in the roadway or along side the roadway. Uncased water lines are to be designed to have sufficient strength to withstand dead loads and superimposed live loads. All restoration materials and workmanship shall conform to the latest edition of the "Virginia Department of Transportation Road and Bridge Specifications" in addition to permit requirements. The contractor is responsible for obtaining all VDOT highway permits for work outside of the Halifax County Service Authority's corporate limits and on roads maintained by VDOT and forwarding a copy to the Halifax County Service Authority. Method of construction (trenching, boring, tunneling, jacking, etc.) must be shown on permit and plans. During construction, if deemed necessary by the Halifax County Service Authority to assign inspectors to the project, the contractor is to pay an additional inspection fee to cover the cost. The contractor is responsible for identifying, locating, adjusting and/or relocating existing utilities, structures and survey markers (including making all the arrangements necessary to coordinate the work to be performed).

To avoid unnecessary construction delays, the contractor needs to make application for a highway permit at least 10 working days prior to starting construction. Nothing contained herein is intended, nor should be construed, to relieve the contractor in any manner whatsoever of his responsibility for maintaining trenches, pavement structure, shoulders and generally the work site in a manner acceptable to the Halifax County Service Authority and/or VDOT. Prior to the actual open cut, the Halifax County Service Authority and/or VDOT is to be notified 24 hours in advance to arrange a meeting with their representative and the Utilities Inspector.

BACKFILL AND COMPACTION: Typically, backfill will be compacted to 95% of the theoretical maximum density at optimum moisture content, as determined by VDOT testing procedure VTM-1. The contractor shall provide adequate protection to all structures during trenching and backfilling using every precaution to avoid damage or defacement. Not over 500 feet of trench shall be opened at any one time. Backfill for water and sewer lines shall be placed generally in accordance with Halifax County Service Authority and/or VDOT specifications and the following criteria:

- A. Prior to excavation of the trench and prior to the installation of surface course(s), the adjacent plant mix shall be smooth face cut through the full depth.
- B. No trench shall be backfilled until authorized by the Halifax County Service Authority .Materials for backfilling from the bottom of the trench to 12 inches above the water and/or sewer line shall be #57 stone bedding and backfill for sewer lines and VDOT Type B or approved sand for water lines. Material shall be thoroughly and carefully compacted to insure a sound backfill over and around the water and/or sewer line.
- C. Backfill shall be compacted by mechanical tamping throughout the depth of the trench in 6" layers to insure a suitable sub base, acceptable to the Halifax County Service Authority.
- D. Backfilling shall be performed in accordance with the standard drawings, latest revision, for pavement restoration applicable to the situation at hand.

BITUMINOUS PAVEMENT STRUCTURE: Wherever pavement is permitted to be cut as shown on plans, not over one-half of the road width shall be disturbed at one time, unless an approved method of detouring traffic is reviewed and accepted by Halifax County Service Authority . The first opening shall be in travelable condition before the second half can be opened. Where contractor is granted approval from the Halifax County Service Authority to open cut a road, **(this applies to crossings only)** the permit will include the following stipulations but not limited thereto:

- A. Halifax County Service Authority Director of Operations is to be notified 48 hours prior to any open cut work being performed.
- B. Work within the roadway shall be done between the hours of **9 A.M. and 4 P.M.** or as stated in the permit.

- C. Utilize proper sign layout and channelization devices (i.e., cones, plastic barrels, pavement marking, etc.) during construction, according to VDOT's "Virginia Work Area Protection Manual".
- D. The area of the open cut shall be restored in accordance with one of the following applicable standards:

1. Asphalt Road

- a. Backfill entirely with #21-A or #21 stone (95% compaction)
- b. Apply tack material to all joints, before placing surface mix
- c. Install minimum 12" BM-25.0 asphalt concrete in 4" lifts
- d. Overlay a minimum of 25' on both sides of trench with 2" of surface mix
- e. Seal all joints with liquid bituminous sealer

2. Asphalt Road Base with a Surface Treatment Seal

- a. Backfill entirely with #21-A or #21-B stone (95% compaction)
- b. Apply tack coat for all edges and existing surface asphalt
- c. Install 1.5 times the thickness of existing pavement or a minimum of 6" BM-2 (base mix) flush with existing pavement
- d. Surface treat a minimum of 10' on both sides of trench with blotted seal coat type C: the initial seal and final seal shall conform to the requirements of AASHTO M208 @ 0.17 gals./sq. yd. with 15 lbs. of No. 8P stone/sq. yd. each.

3. Surface Treated Road (Tar and Gravel)

- a. Backfill entirely with #21-A or #21-B stone (95% compaction)
- b. Apply tack coat for all edges and existing surface asphalt
- c. Install 4" of BM-2 (base mix) in trench flush with existing pavement
- d. Surface treat a minimum of 10' on both sides of trench with blotted seal coat type C: the initial seal and final seal shall conform to the requirements of AASHTO M208 @ 0.17 gals./sq. yd. with 15 lbs. of No. 8P stone/sq. yd. each.

4. Dirt/Gravel Road or Aggregate Shoulders

- a. Select backfill compacted to 95% maximum density (6" lifts)
 - b. Backfill trench with 10" of #21-A or #21-B stone (95% compaction)
 - c. Apply fresh application of #21-A or #21-B stone to all disturbed areas of the road
- E . The pavement cut shall be covered with a temporary or permanent asphalt patch on the same day that excavation is made.
- F. One travel lane will be maintained at all times.

Placement of all plant mix and surface treated courses shall be rolled where possible with a unit having a manufacturer's rating of 10 tons, and rolled until the aggregate is keyed into the bitumen. Where rolling is not possible, a mechanical tamp will be used. The stone is to be placed in the trench daily up to 1,500 feet at which time the pavement shall be covered with a temporary or permanent asphalt patch. If the application of the bituminous layer is delayed for adverse weather conditions, the contractor shall provide and maintain a base course that is acceptable to both the Virginia Department of Transportation and the Department of Public Works until such time as the appropriate pavement patch can be applied and accepted. Upon completion of the installation of the water and sewer lines (not necessarily all testing completed), contractor shall restore pavement in the manner prescribed by the Halifax County Service Authority within ten (10) days.

SITE MAINTENANCE AND RESTORATION: Road connections and private entrances are to be kept in a satisfactory condition. Entrances are not to be blocked and sufficient provisions made for safe travel to adjacent property at all times. When entrances are disturbed, they must be restored to original condition or to a condition satisfactory to the HCSA or property owner. Road drainage is not to be blocked. The pavement, shoulders, ditches, general roadside and drainage facilities shall be left in as good condition as found (consistent with adjoining sections of the highway), maintained in a satisfactory condition and establish positive drainage in the ditches. All loose material shall be swept from hard surface immediately after backfilling. Calcium Chloride before sweeping or approved alternate shall be used to settle dust whenever necessary. Concrete walks and curbs shall be replaced in entire sections. During rainy periods all trenches shall be watched closely for settlement. If emergency situation arises under any circumstances, repairs will be made at the Contractor's expense. The contractor shall maintain all trenches and damaged pavement in a manner acceptable to the HCSA. Additionally, after paving is complete, the contractor shall be responsible for any settlement of trenches requiring additional fill, pavement or other corrective measures until the permit or road is accepted (this includes future State roads currently developer owned). Upon completion of the work under permit, the contractor will notify the HCSA Director of Operations Superintendent so an inspection can be made to insure compliance with the highway permit. Where landscaped areas are disturbed, the area shall be left with a minimum of 2" or better of topsoil and reseeded according to VDOT Specifications, this shall include reseeding until a stand of grass is obtained.

WORK ZONE PROTECTION: The contractor shall immediately correct any situation which may arise as a result of construction that the Halifax County Service Authority may deem hazardous to the traveling public, even though it may not be specifically covered in the highway permit or other requirements. In the event that these conditions are not complied with, and after reasonable notice has been given by Halifax County Service Authority, it is hereby agreed and understood that the Halifax County Service Authority reserves the right to employ an outside Contractor to perform the necessary work and bill the firm doing the work. The word "firm" used in the previous sentence means the individual, corporation, or partnership in whose name the permit was issued. Traffic is not to be blocked, rerouted or otherwise impeded without written permission from the Director of Operations. Placement and type of traffic control, warning devices and personnel shall be in accordance with VDOT "Work Area Protection Manual". Where one way traffic is permitted, contractor shall perform proper flagging for the duration of the project. The contractor will notify the Halifax County Service Authority at least 24 hours before starting work. If traffic is impeded in any way, the same notice must be given to Fire Department, Rescue Squad, and the Police Department. All open trenches, pits, etc. shall be secured with barricades and any other necessary equipment to protect the public. The Halifax County Service Authority shall not be liable for any damage resulting from construction.

3.09 DISPOSAL OF WASTE MATERIALS

- A. Removal from Project Site: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it legally off the project site.
- B. Dust Control: Water, calcium chloride or approved alternate shall be periodically sprinkled to alleviate problems associated with dust.
- C. Disposal of asbestos cement pipe shall be done in accordance with AWWA Manual 16, "Work Practices for Asbestos Cement Pipe".

SECTION 5 - WATER DISTRIBUTION SYSTEM

I - GENERAL

1.01 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section. Work accomplished under this Section shall be in accordance with the Halifax County Service Authority Standards.

1.02 DESCRIPTION OF WORK

- A. Contractor shall provide all labor, equipment, tools, services, and materials necessary for, or incidental to, the construction of the water distribution system, in conformance with, but not limited to, the following:
1. All trenching, excavation, backfilling as stated herein or shown on the drawings.
 2. Setting new pipe inverts and other appurtenances to the proper location and invert elevations as shown on the Plans or approved cut sheets.
 3. Testing all utility piping systems as applicable and stated herein.
 4. In general all proposed utility systems as covered in this Section will be installed in the confines of the site as noted on the Plans.
- B. Related Work Specified Elsewhere: Site clearing, trenching, backfilling, and compaction.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

Construction as shown on the Plans or stated herein shall be performed in accordance with current and applicable requirements as established by the Halifax County Service Authority, the Virginia Department of Health, or any other agencies having jurisdiction. Where conflicts arise between the Contract Documents and previously mentioned requirements, the more restrictive shall apply. If such requirements shall require a change in the work as stated herein or shown on the plans, the Contractor shall stop work and notify the Owner for further direction.

PRODUCTS II

2.01 APPROVED MATERIALS

All materials shall conform to the Halifax County Service Authority "**Approved Materials and Manufacturers**" list with latest revision date. Contractor shall follow guidelines as established in the **General Conditions** of this document under Shop Drawings. All materials shall be virgin material.

EXECUTION III

3.01 INSTALLATION OF NEW WATER SYSTEMS

- A. Excavating and Backfilling:
1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable material free from frozen earth, rocks, organic material, etc.
 - a. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free of water from any source at all times.
 - b. Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
 - c. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
 - d. Exercise special care in backfilling trenches to guard against disturbing the joint.
 - e. Remove and dispose of any material not used for backfill.
 2. Removal of subsurface obstructions which are uncovered during excavation for installation of the water systems shall be removed by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered they shall be removed two feet from around the area of new facility and backfilled with a suitable material as specified.
- B. Pipe Installation:
1. Take all precautions to insure that pipe 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 materials.
 2. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Contractor shall be responsible for plugging or capping line at the end of each day.
 3. Do not lay pipe when weather or trench conditions are unsuitable.

4. Line and grade hubs shall be set by a registered surveyor at intervals to accurately insure proper location of water line and appurtenances. This shall include finished grade centerline stakes for fire hydrants, stakes at all fittings, referencing all property pins, etc. Cut sheets are required where the water line is to be laid to a grade according to the profiles in the plans, or where the future road grade is not yet to within 6" of its final location.

5. Water Pipe Laying:
 - a. Laying of water pipe shall be accomplished only after the trench has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.

 - b. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans and this shall include digging out for bell ends.

 - c. Water pipe runs intended to be laid straight shall be so laid. Deflection from a straight line may be made by deflecting the joints only when permission has been given by the Engineer or Inspector. Joint deflection shall not exceed one-half that recommended by AWWA Standards or the manufacturer whichever is less. Changes in grade or alignment which cannot be made by deflecting pipe joints shall be made by use of proper bends, offsets or special fittings as required.

 - d. The water pipe, unless otherwise approved by the Owner, shall be laid up grade from point of connection of the existing water line or from a designated starting point. Water pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a water tight plug or cap, plywood or plastic is not acceptable.

 - e. The pipe shall be fitted and matched so that when laid in the work, units will form a smooth, uniform invert.

 - f. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Approved lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.

6. Joining Pipe:

- A. When installing PVC pipe into M.J. fittings, the beveled end of the pipe must be cut off to allow for maximum insertion depth and sealing area to avoid leaks. An approved joint restraint device is required when inserting PVC into MJ fittings. This device does not replace the requirements for a joint restraint system. 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. Lubricate the bell and spigot end of the pipe, using only approved lubricant (Blue Lube or Slikstyx). (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The Halifax County Service Authority will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.) Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Lubricate rubber gasket with approved lubricant referenced above and place on the spigot end with thick edge toward the gland.
- B. Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that is located evenly around the joint. The gland is moved into position, bolts inserted and nuts screwed on finger tight, then tighten all nuts to torque listed below.

Bolts Size - Inches	Torque-Ft.Lbs.
5/8"	40 - 60
3/4"	60 - 90
1"	70 -100
1.25	90 - 120

- C. Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed and torque value is reached.
- D. Permissible deflection in mechanical joint pipe shall not be greater than one-half the maximum amount allowed in AWWA C600.

Push-on joint Ductile Iron pipe

- (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 approved gasket lubricant (Blue Lube or Slikstyx), to the gasket and the spigot end of the joining pipe. The Halifax County Service Authority will not accept completed water lines assembled using unapproved lubricants.)

- (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.
Polyvinyl chloride (PVC) pipe shall be joined in accordance with the manufacturer's recommendations. Polyvinyl Chloride (PVC) Push-on Joint Pipe
- a) Thoroughly clean inside of the bell and 1" beyond the reference mark on the spigot end of the joining pipe. Make certain the ell and rubber gasket have no foreign material that could interfere with the proper assembly of the pipe spigot.
 - b) Lubricate the gasket and spigot end of the pipe, using only approved lubricant (Blue Lube or Slikstyx). (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The Halifax County Service Authority will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.)
 - c) Insert the spigot end into the bell. Align the pipe sections and push the spigot end in until the reference mark on the spigot end is flush with the end of the bell. Use a bar and block of wood to push pipe home.
 - d) Field cut pipe shall be square cut and beveled to insure proper assembly. Use a factory finished beveled end as a guide to produce an equivalent angle and length of taper.
- Asbestos Cement Transition:**
- a) When connecting PVC or Ductile Iron pipe to existing asbestos cement pipe, the transition coupling is to be applied to the rough barrel of the asbestos cement pipe and not to a factory or machined end of the asbestos cement pipe.

- E. A tracing wire of 14 gauge copper shall be installed and taped directly on top of the pipe in a manner that a continuous tract results. Wire is to be wrapped around hydrants, blow offs and corporation stops.
 - 1. Place underground warning tape directly above all water mains, 18" below finished grade. Tape shall be polyethylene tape with a metallic core, 2 inches in width, with the continuous printed message "Caution Waterline Buried Below." Tape shall be Catalog No. 2 WAT as manufactured by the Seton Name Plate Corp. or approved equal.

- C. Installation of Valves, Fittings, and Hydrants:
 - 1. General: Valves, fittings and hydrants shall be set and jointed to the piping system as hereinbefore specified for cleaning, laying and jointing pipe.
 - 2. Valves and Valve Boxes: Cast iron valve boxes shall be firmly supported, centered and plumb over the operating unit of valve. Box cover shall be set flush with the surface of finished pavement or at such other level as may be directed by the Owner. Valve rod extension with guide shall be required to maintain a distance of 2'-4' from operating nut to top of box. All valves shall be properly restrained.
 - 3. Valve Key Extensions: Valve stem extensions shall be required where the valve-operating nut is installed at a depth greater than four feet (4').
 - 4. Cross Connections: Drainage branches or blow-offs shall not be connected to any sewer, submerged in any stream or installed in any manner which, in the opinion of the Owner, will constitute a contamination hazard, or cross connection.
 - 5. Hydrants: Connection to Main: Each hydrant shall be restrained and connected to the main with a minimum 6 inch branch, controlled by an independent 6 inch gate or resilient seat valve. Setting of Hydrants: When hydrants are set, a drainage pit two feet in diameter and two feet below the bowl of the hydrant shall be excavated. Valves: All valves shall be restrained with a hydrant tee. The pit shall be filled with coarse gravel or #57 clean stone, mixed with coarse sand, to a level of 6 inches above the weep hole. No hydrant drainage pit shall be connected to a sewer. The bowls of all hydrants shall be well braced against unexcavated earth with suitable concrete backing, and when directed shall be restrained to the pipe with approved harnessing. All hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.
 - 6. Anchorage of Fittings: As required in **Part V, Section 4** of this document, all fittings i.e., each bend, tee, plug, valve and cap shall be prevented from moving by means of adequate thrust reaction blocking or mechanical restraints; or both.
 - 7. In easements and undeveloped wooded areas, plastic markers shall be installed every 200 feet, and at all valves and fittings. Markers shall be as manufactured by Carsonite or approved equal. Exceptions are where water lines are installed in "kept" yards where the property owners may object to the placement of these markers. Contractors will be required to properly install the markers per manufacturer's recommendations, parallel to the water line facing roadway, or as additionally directed by the Halifax County Service Authority .

- D. Installation of Fabricated Steel Tapping Sleeves: 1. General: Rigorous testing and conditions relating to tapping sleeves, applied to all manufacturers, will become our standard operating procedure. These conditions are as follows:
- a. The tapping sleeve shall be tested in place to a minimum of 200 psi, for a minimum of 10 minutes with no loss of pressure.
 - b. If the sleeve fails the 200 psi pressure test, the original failed sleeve shall be replaced with an entirely new sleeve.
 - c. Tapping sleeves 16" and above shall be supported by a concrete pedestal support, as shown in the Halifax County Service Authority's "Standard Drawings" Section.
- E. Rockwell Tapping Sleeve: In addition to the conditions outlined in Section 1 above, the following procedures must be adhered to be followed by the contractor:
- a. Clean pipe surface thoroughly, particularly in the area where the gasket will seal. The contractor shall wipe the pipe in the area where the tap is to be made with a 1% chlorine solution prior to installing the sleeve.
 - b. Lubricate pipe and gasket with soap and water. It is not necessary to lubricate pipe. (See item C) Under no condition should any antifreeze be used.
 - c. Mount body halves on pipe. Contractor shall ensure gasket is secure in gasket groove. Contractor shall ensure that the tapping nipple is pointing in its final direction so it will not be moved or rotated on the pipe. This half of the sleeve can be blocked in some fashion so the back half of the sleeve and bolts can be installed without having to have several people involved in attaching the sleeve.
 - d. Insert bolts and hand tighten nuts, keeping equal gaps between body halves.
 - e. Prior to tightening nuts, position outlet as required to suit the installation. Contractor should ensure test connection is accessible.
 - f. Tighten bolts, alternating from one side to the other to equalize the gap between halves. Continue to tighten bolts until sleeve halves conform to the contour of the pipe and all bolts are to a uniform tightness. The required torque for dry threads will be 70-100 ft. lbs. (Lubricated threads 35-50 ft. lbs.) On thin wall or badly corroded pipe care should be taken to prevent crushing or collapsing of the pipe.
 - g. A pressure test is required prior to tapping to test the sleeve and valve in place. Prior to pressure testing, the inspector shall obtain a reading of line pressure in the system, either from a hydrant or a service. The pressure test should be at 2 ½ times line pressure or 200 psi, whichever is greater. The duration of this pressure test shall be a minimum of ten minutes. If the sleeve fails the pressure test, it shall be completely removed and returned and a new sleeve used. The tapping sleeve, valve and tapping machine assembly is to be adequately supported furring the tapping operation to prevent movement or rotation of the tapping sleeve.
 - h. Proceed with tapping operation. Contractor shall complete tapping procedures and do necessary checking as required. Contractor shall furnish the inspector with the coupon.

F. Installation of Services:

1. $\frac{3}{4}$ " and 1"

- a. Taps on PVC Pipe shall be made with service saddles (from approved list)
- b. Taps shall be made on a 45° angle
- c. Corporation stops shall have "cc" thread inlet and copper flare outlet
- d. Tap shall be made with a tapping machine equipped with a bit designed for the type of pipe being tapped
- e. Distance between taps or from a joint or bell shall be a minimum of 18"
- f. Service pipe shall be Copper Tubing Size (CTS) Ultra-high Molecular Weight Polyethylene (PE) AWWA C901 – Polyethylene Tubing, ASTM D-1248, ASTM D-2737 rated at not less than 200 psi or type "K" hard copper tubing where corrosive soil conditions do not exist. Water service tubing shall be NSF approved.
- g. Services shall be installed with 3'6" minimum cover up to meter yoke where yoke shall be installed so that meter will set 12" -16" from finished grade
- h. Meter yokes shall be from approved materials list and be installed with a tail piece of type "K" copper 10" - 18" long
- i. Meter yoke and box shall be set 1' inside property line or a reasonable distance inside property line in order to install on reasonable level ground
- j. Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling
- k. Traffic box to be of cast iron in driveways

2. 1½ and 2" Services:

- a. All taps for 1½" and 2" services shall be made with service saddles (from approved materials list)
- b. Taps shall be made at the spring line of the pipe
- c. Corporation stops shall have "cc" thread inlet and copper flare outlet
- d. Tap shall be made with a tapping machine equipped with a bit designed for the type of pipe being tapped
- e. Distance between taps or from a joint or bell shall be a minimum of 18"
- f. Service pipe shall be Copper Tubing Size (CTS) Ultra-high Molecular Weight Polyethylene (PE) AWWA C901 – Polyethylene Tubing, ASTM D-1248, ASTM D-2737 rated at not less than 200 psi or type "K" hard copper tubing where corrosive soil conditions do not exist. Water service tubing shall be NSF approved.
- g. Services shall be installed with 3'6" minimum cover up to meter yoke where yoke shall be installed so that meter will set 12" -16" from finished grade
- h. Meter yokes shall be from approved materials list and be installed with a tail piece 10" - 18" long. Meter yoke and box shall be set 1' inside property line or a reasonable distance inside property line in order to install on reasonably level ground

- i On 1½" and 2" services a curb stop shall be installed on inlet side of yoke, 1' from yoke k. Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling.

3.02 TESTING OF WATER DISTRIBUTION SYSTEM

A. Testing Techniques for Water Distribution System:

1. Each properly isolated section of the piping system including all water services shall be subjected to a pressure test of 150 psi or 1½ times the working pressure, whichever is greater, measured at the high point of the system. Maintain this pressure for a minimum of two hours with no allowable leakage . Prior to applying pressure to the lines all reaction blocking, and/or mechanical restraint shall have been completed to the satisfaction of the Engineer or Inspector. As the pipes are being filled, all air shall be expelled from the pipes by providing suitable taps at the high points of the system. After the system is filled, all taps shall be tightly plugged. Any defects discovered during this test shall be corrected as directed and the test shall be repeated until the results are satisfactory. The Contractor shall provide all equipment and materials and perform all labor necessary to conduct the test in the prescribed manner. The Contractor shall provide a suitable test pump and properly calibrated gauge or other means for measuring leakage to include, a clean 50 gallon barrel with top cut out which is satisfactory to the Engineer or Inspector.
2. The Owner will furnish water for flushing, sterilization and testing without charge. Filling of water line may be performed provided permission has been obtained from the Inspector who will be responsible for coordinating this activity with the Halifax County Service Authority's HCSA Director of Operations. Contractor is not permitted to operate valves on existing lines.
3. Testing shall be performed in accordance with the AWWA Specifications, latest edition.

3.03 DISINFECTION

- #### A. Prior to being placed in service, the pipe line and appurtenances shall be disinfected in general accordance with **ANSI/AWWA C651- 92;** (latest revision of) AWWA Standard for **Disinfecting Water Mains** and the supplemental procedures as set forth below.
1. Section 3 of AWWA C651-92 emphasizes six basic procedures in the disinfection process. The procedures are to:
 - a. prevent contaminating materials from entering the water main during storage, construction, or repair;
 - b. remove, by flushing or other means, those materials that may have entered the water main;
 - c. chlorinate any residual contamination that may remain, and flush the chlorinated water from the main;
 - d. protect the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures; e. determine the bacteriological quality by laboratory test after disinfection; and

- f. make final connection of the approved new water main to the active distribution system.

2. Preliminary Flushing:

The main shall be flushed prior to disinfection at a velocity of not less than 2.5 Ft./Sec. unless the owner determines that conditions will not permit the required flow. Adequate provisions shall be made by the contractor for disposal of flushing water so that no physical or environmental damage results. Contractor will find additional instructions on flushing in the supplemental procedures within this section.

3. Forms of Chlorine for Disinfection:

It is the contractor's responsibility to be familiar with and have available for his employees the "Product Data Safety Sheets" of any products used as a source of chlorine and to provide the proper safety instructions and personal protective equipment to the employees mixing and using materials for disinfection of the water facilities.

- a. Acceptable sources of chlorine for disinfection may be obtained from either one of the following sources:

- 1) Liquid sodium hypochlorite (household bleach) is supplied in strengths from 5.25 percent available chlorine (commercially available household bleach) to 15 percent available chlorine (industrial strength sodium hypochlorite). A water-sodium hypochlorite solution shall be prepared by adding liquid sodium hypochlorite to water.

- 2) Calcium hypochlorite granules

- b. Only under extreme conditions and with the written approval of the Owner and under the direction of a holder of a State of Virginia Class III (or higher) water works operator's license can chlorine gas, regulated through metering equipment, be mixed with water to obtain a suitable disinfecting solution. A water calcium hypochlorite solution shall be prepared by dissolving calcium hypochlorite granules containing 65% available chlorine by weight in a pre-determined volume of water to make the desired water-calcium hypochlorite concentration. Disinfection of new mains by water calcium hypochlorite solution shall not be used unless a suction or in-line strainer is available on the solution pump to prevent any undissolved solids from entering the piping. An alternative method of straining the solution to remove undissolved granules may be approved by the inspector on a case by case basis.

- c. The direct introduction of chlorine gas (or liquid) from a pressure cylinder into a water line is not safe and shall not be allowed. d. The use of calcium hypochlorite pills affixed to the interior of water pipe for disinfection shall not be an acceptable form of disinfection. e. The mixing of a source of chlorine to obtain a suitable disinfecting solution shall be as follows:

A water-chlorine gas solution may be used only when suitable equipment is available and shall be done under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who has a State of Virginia Class III or above water works operator's license and is properly trained and equipped to handle any emergency that may arise. The direct introduction of chlorine gas (or liquid) from a pressure cylinder into a water line is not safe and shall not be allowed.

4. Method of Chlorine Application and Testing:

- a. The continuous feed method of applying the disinfecting solution shall be as follows: Water from the existing distribution system or other approved sources of potable water supply shall flow through an approved flushing mechanism at a constant, measured rate into the newly-laid pipeline. The water shall be mixed with a chlorine-water solution as prepared above, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration of the water and water/chlorine solution in the pipe is elevated to and maintained at, a minimum of 35 mg/1 available chlorine. Since the forms of preparation for a water sodium hypochlorite or water calcium hypochlorite concentration are a batch process, a method acceptable to the inspector shall be available to replenish the concentration being fed and mixed with the water flow, so there is no interruption of the flow of disinfection solution. To assure that this concentration is maintained, the chlorine residual shall be measured at intervals not exceeding 2,000 feet and at the end of all branch lines or cul-de-sacs in accordance with the procedures outlined herein. During the application of the chlorine-water solution, valves, hydrants and any other appurtenances shall be operated in order to be thoroughly disinfected. Chlorine-water solution application shall continue until the entire new main is filled with water having a residual of a minimum of 50 mg/1 chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours.
- b. The Owner will furnish the personnel and equipment for determining water-chlorine solution strengths and residuals.

- c. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine residual of the water leaving the main is equal to the chlorine residual of the incoming system water. At that time, the new system shall be valued off and bacteriological testing shall begin.

B. Bacteriological Tests:

1. After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriological quality as follows:
 - a. If total chlorine is 1.5 mg/L or less: Begin bacteriological testing at 24 hours after final flush.
 - 1) Test for total and fecal coliform for 2 consecutive days. Both test samples must be less than 1 colony/100 ml.
 - 2) Test for heterotrophic plate count on 2nd day. Test sample must be less than 500 colonies/ml.
 - b. If total chlorine is greater than 1.5 mg/l: Wait 5 days or until residual drops to 1.5 mg/l or less, whichever is sooner, then test.
 - 1) Test for total and fecal coliform for 2 consecutive days. Both test samples must be less than 1 colony/100 ml.
 - 2) Test for heterotrophic plate count on 2nd day. Test sample must be less than 500 colonies/ml.
 - c.. Samples shall be collected at least 24 hours apart at intervals determined by the Inspector (not exceeding 2,000 feet apart and at the end of all branch lines and cul-de-sacs) and tested by the Halifax County Service Authority laboratory and the results submitted to the Owner.
2. Samples for bacteriological analysis shall be collected in approved sterile bottles or bags treated with sodium thiosulfate provided by the Halifax County Service Authority laboratory. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory and disinfection shall be repeated as prescribed above until the samples are satisfactory. Cleaning, disinfection and testing shall be under the direction of the Inspector but remains the responsibility of the Contractor. Water for these operations will be furnished by the Owner, but the Contractor shall be responsible for any cost associated with the loading, hauling, and discharging of the heavily chlorinated water.

3.04 SUPPLEMENTAL PROCEDURES FOR DISINFECTING, TESTING, AND FLUSHING

A. General:

1. All work shall be performed in general accordance with AWWA C651-92.
2. The supplemental procedures are developed to compliment the AWWA C651-92 Standard, particularly with respect to flushing, testing and tie-in to the existing water distribution system.
3. These procedures and construction acceptance for final tie- in of a new water main are performance based, predicated on the new construction passing pressure and bacteriological testing. In order to best assure satisfactory bacteriological results, it is essential that all aforementioned preventive and precautionary measures be taken prior to and during construction to protect the interiors of pipe, fittings and valves against contamination. Failure to follow the precautionary measures increases the likelihood of unsatisfactory bacteriological tests and increases the construction requirements necessary for final acceptance. Refer to AWWA C651-92, Section 4, entitled "Preventive and Corrective Measures During Construction".
4. No contaminated material or any material capable of supporting the growth of microorganisms or causing taste, odor, or other aesthetic water quality concerns shall be used in sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation or sealing gaskets shall be Blue Lube or Slikstyx pipe gasket lubricant. Blue Lube and Slikstyx are the only pipe joint lubricant for such use. It shall be kept clean and applied clean with dedicated applicators. (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The HCSA will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.)
5. **Table 1A, Flushing Schedule** gives flushing flow rates and flushing mechanism sizes for water mains 6" through 24" in diameter. Specific flushing schedules for line sizes above 24" will be site specific. Directions will be given on the project drawings.

B. Filling and Testing Procedures:

1. Connection of the new water main to the existing distribution system for filling and testing shall be through a contractor furnished flushing mechanism as shown on Standard Detail WAT-6 of these specifications and sized as noted in Table 1A, entitled "Flushing Schedule". The contractor is to furnish the single gate valve, double check valve flushing assembly and all necessary fittings, reducers, increases and sleeves to make the piping connections. A suitable valued piping arrangement for the additions of the water-chlorine solution is to be available on the new line side of the flushing assembly. The assembly is to be furnished with 125 psi rated flange connections and installed in a manner approved by the Inspector.
2. Initial flush time is to be in accordance with Table 1A, entitled "Flushing Schedule".
3. Pressure test the line as noted in Section 3.02, A.1 of these specifications.
4. Make any necessary repairs and pressure test again until the line passes this test.
5. Disinfect the line in accordance with AWWA C651-92, Section 5. A water-chlorine solution prepared in accordance with Section 3.03. A.3 above shall be used for disinfection.

6. Bacteriological samples will be taken by the Halifax County Service Authority in accordance with AWWA C651-92, Section 7.
 7. If unsatisfactory bacteriological test results are received, repeat steps 2, 5 and 6. Where only an unsatisfactory heterotrophic plate count is received, steps 2 and 6 need only be repeated at existing residuals.
 8. After receiving satisfactory bacteriological test results, the contractor shall coordinate with the Inspector the connecting of the new main to the existing system. All connecting pipe and fittings shall be clean and free of debris and shall be swabbed or sprayed with a 1 percent sodium hypochlorite solution before they are installed. The contractor shall tie-in new water lines to the existing water system within 10 working days of successful completion of all bacteriological tests, otherwise the disinfection process must be repeated.
 9. Final flush of line to be in accordance with Table 1A, entitled "Flushing Schedule". C. The Disinfection and Supplemental Procedures as covered in sections 3.03 and 3.04 may be modified by the HCSA Director of Operations Superintendent for site specific problems that do not physically allow for following the normal disinfection procedures. Modified instructions will be given in writing from the Utilities Superintendent through the Inspector and will be executed by the Contractor in a manner that does not subject the existing distribution system to undue problems and assures that adequate disinfection and flushing will be given to the new main.
- D. The procedure for the disinfection of short leads to fire hydrants and the connector pipe to fire suppression systems/double check assemblies shall be as follows:
1. Initial flush time is to be in accordance with Table 1A, entitled "Flushing Schedule".
 2. Pressure test the line as noted in Section 3.02, A.1 of these specifications.
 3. Make any necessary repairs and pressure test again until the line passes this test.
 4. Disinfect the line in accordance with AWWA C651-92, Section 5. A water-chlorine solution prepared in accordance with Section 3.03. A.3 above shall be used for disinfection.
 5. Bacteriological samples will be taken by the Halifax County Service Authority in accordance with AWWA C651-92, Section 7.
 6. If unsatisfactory bacteriological test results are received, repeat steps 2, 5 and 6. Where only an unsatisfactory heterotrophic plate count is received, steps 2 and 6 need only be repeated at existing residuals.
 7. After receiving satisfactory bacteriological test results, the contractor shall coordinate with the Inspector the connecting of the new main to the existing system. All connecting pipe and fittings shall be clean and free of debris and shall be swabbed or sprayed with a 1 percent sodium hypochlorite solution before they are installed. The contractor shall tie-in new water lines to the existing water system within 10 working days of successful completion of all bacteriological tests, otherwise the disinfection process must be repeated.
 8. Final flush of line to be in accordance with Table 1A, entitled "Flushing Schedule".

- C. The Disinfection and Supplemental Procedures as covered in sections 3.03 and 3.04 may be modified by the HCSA Director of Operations for site specific problems that do not physically allow for following the normal disinfection procedures. Modified instructions will be given in writing from the Superintendent through the Inspector and will be executed by the Contractor in a manner that does not subject the existing distribution system to undue problems and assures that adequate disinfection and flushing will be given to the new main.
- D. The procedure for the disinfection of short leads to fire hydrants and the connector pipe to fire suppression systems/double check assemblies shall be as follows:

Connector piping, fittings and valves from an existing main to a fire hydrant or to a fire system double check assembly, which does not contain domestic use branches and is equal to or less than eighteen (18) feet in length from the main, may be spray disinfected or swabbed with a minimum 1 percent solution of chlorine just prior to installation, tied-in and flushed at a velocity of not less than 2.5 ft/sec. Bacteriological sampling will be taken downstream for confirmation.

- E. Water for filling the line and flushing will be supplied by the Owner at no cost to the Contractor. Therefore, the use of water for making the new water line available for service will be as follows:

1. Initial Flush:

See Table 1A, entitled "Flushing Schedule". This is to be a high velocity flush through all sections of the new line. Since the large volume of water may have effects on the existing distribution system, the initial flushing is to be done only with the approval of and under the direction of the Inspector. System demands may cause this flushing to be done at times when the existing distribution system demands are low. Because of the large volume of water to be flushed from the fire hydrants or flushing hydrants, the Contractor must inspect the areas of discharge and provide the necessary equipment or materials to prevent any environmental damage or erosion. Sufficient hose length and termination fittings are to be provided so as to discharge the water into stable, heavily vegetated areas, drainage ponds, storm sewers, paved ditches, etc. The contractor is to be responsible for any damage that may result from flushing.

2. Flush to remove disinfecting solution:

This is a low velocity, low flow, flush through fire or flushing hydrants to remove the disinfecting solution from the new line. In new subdivisions, or in areas where there is an existing sanitary sewer, this discharge may be made into the sanitary sewer system. The Contractor is to provide sufficient hoses to connect from the hydrants to a manhole in a manner that provides a suitable air gap for backflow prevention. In projects where there are no sanitary sewers, the flushing of the disinfecting solution must not enter any streams or be discharged in a manner that causes any environmental damage. For site specific locations the Inspector may require the use of a neutralizing chemical and piping arrangement. The expense of a neutralizing station is the responsibility of the Developer/Contractor. The Engineer shall indicate the need for a neutralizing station on the drawing.

3. Final Flush:

See Table 1A, entitled "Flushing Schedule". The final flush is a medium velocity, medium flow flush to clear the line of any chlorine solution used in the tie-in and to provide for fresh water throughout the new lines.

TABLE 1A FLUSHING TABLE

Main Size	Double Check valve Single Gate Size (See Note 1)	Initial Flush (See Note 2) Minimum Flow (gpm)	Initial Flush (See Note 2) Maximum Flow (gpm)
6"	4"	220	88
8"	4"	400	160
10'	6"	650	255
12"	6"	900	350

NOTE:

- 1) See description of "Preassembled Flushing Mechanism" Section II of the specifications.
- 2) Approximation of flushing flows can be made by using either a pitot tube or a method of measuring the static discharge pressure from a hydrant used for discharge of the flushing water.

3.05 ABANDONMENT OF WATER SERVICE

Excavate at the main and expose the corporation stop. Turn off the corporation stop and disconnect the copper tubing from the corporation stop. Assist the Inspector in referencing the location of the corporation stop for Halifax County Service Authority records. Remove the meter box, yoke and service line. The Inspector will turn in the meter to the Halifax County Service Authority's HCSA Director of Operations. When existing water services are to be abandoned as a part of a utility project, the Utility Contractor shall review the scope of the work with the Halifax County Service Authority Inspector and then proceed to abandon those services prior to any other work commencing.

3.06 ABANDONMENT OF WATER MAINS

Water mains and hydrant laterals to be abandoned shall be permanently disconnected from the remaining system. If the abandonment takes place at a tee, the tee shall be removed from the main and straight pipe installed. For other instances involving fittings, the proper fitting shall be installed to eliminate the previous connection. All open ends on abandoned pipe to be permanently sealed by plugging with masonry and/or mortar or plug. All valve boxes, fire hydrants, flushing hydrants blow-offs or other appurtenances to be removed. Salvageable fire hydrants are to be returned to the Halifax County Service Authority.

3.07 CLEAN-UP

Upon the completion of the installation of the water system and prior to the Owner's final acceptance, sediment and debris shall be removed from the system. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT and/or Halifax County Service Authority .

SECTION 6 - SANITARY SEWER SYSTEM

GENERAL I

1.01 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section. Work accomplished under this Section shall be in accordance with Halifax County Service Authority Standards.

1.02 DESCRIPTION OF WORK

- A. Contractor shall provide all labor, equipment, tools, services, and materials necessary for, or incidental to, the construction of sanitary sewers and appurtenances, in conformance with (but not limited to) the following:
1. All trenching, excavation, backfilling as stated herein or shown on the drawings.
 2. Setting new pipe inverts, rim elevations of manholes, and other utility structures to the proper elevations as shown on the Plans.
 3. Testing all utility piping systems as applicable and stated herein.
 4. In general all proposed utility systems as covered in this Section will be installed in the confines of the site as noted on the Plans.
- B. Related Work Specified Elsewhere: Site clearing, trenching, backfilling, and compaction.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

Construction as shown on the Plans or stated herein shall be performed in accordance with current and applicable requirements as established by the Halifax County Service Authority, the Virginia Department of Health, or any other agencies having jurisdiction. Where conflicts rise between the Contract Documents and previously mentioned requirements, the more restrictive shall apply. If such requirements shall require a change in the work as stated herein or shown on the drawings, the Contractor shall stop work and notify the owner for further direction.

PRODUCTS-II

2.01 APPROVED MATERIALS

All materials shall conform to the Halifax County Service Authority "Approved Materials and Manufacturers" list with latest revision date. Contractor shall follow guidelines as established in the General Conditions of this document under Other Plans and Working Drawings (Shop Drawings). All materials shall be virgin material.

2.02 PIPE BEDDING

Bedding material to be crushed stone #57 gradation in accordance with VDOT Road and Bridge Specifications, latest edition.

EXECUTION-III

3.01 INSTALLATION OF NEW SANITARY SEWER SYSTEMS

- A. Excavating and Backfilling:
1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable material free from frozen earth, rocks, organic material, etc.
 - a. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free from water from any source at all times.
 - b. Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
 - c. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
 - d. Exercise special care in backfilling trenches to guard against disturbing the joints.
 - e. Remove and dispose of any material not used for backfill.
 2. Removal of subsurface obstructions which are uncovered during excavation for installation of the sanitary sewer systems shall be by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered, they shall be removed two feet from around the area of new work and the excavation backfilled with a suitable material as specified.
- B. Pipe Handling:
1. Take all precautions to insure that pipe 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.
 2. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Flushing line may be necessary by the Contractor.
 3. Survey Line and Grade:
 - a. Line and grade shall be maintained by the Contractor by use of a laser and Contractor shall adhere to the following criteria:
 - 1) Control point shall be set at a minimum of fifty foot (50') interval. Line and grade of the laser shall be checked at a maximum of one hundred foot (100') intervals.

- 2) Standard cut sheet shall be provided to the Halifax County Service Authority showing center line cut each twenty-five (25') where payment for installation is on a cut increment basis and hub cut at each fifty foot (50') station.
- 3) The level vial on the grade instrument of the laser shall be checked at a minimum of each 30 minutes of use or more frequent if equipment is being used around the grade instrument that could cause the instrument to become unlevel.
- 4) A blower shall be used when required to keep a uniform air temperature in the pipe to prevent any bending of the light beam.
 - a. Contractor shall have level or transit in good working order on job set up at all times to periodically check line and grade of pipe.

4. Sewer Pipe Laying:

- a. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.
- b. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the drawings. After completion the pipe shall exhibit a full circle of light at one manhole when viewed from the next.
- c. The sewer pipe, unless otherwise approved by the Owner, shall be laid up to grade from point of connection of the existing sewer or from a designated starting point. If the starting point is an existing stub, it shall be removed and a full length of pipe installed. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a water tight plug or cap.
- d. The pipe shall be fitted and matched so that when installed it will form a smooth, uniform invert. Lined or radius concrete pipe shall be placed as indicated by the marking on the pipe.
- e. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.
- f. Joining Pipe:
 - 1) Ductile iron pipe to be joined in accordance with the requirements of the AWWA Standard C600 and the manufacturer's recommendations.
 - 2) Reinforced concrete pipe shall be jointed in accordance with manufacturer's recommendations.

- 3) Polyvinyl chloride (PVC) pipe shall be joined in accordance with ASTM Standard D-2321.
- g. All visible leaks shall be corrected before testing.
- h. PVC pipe shall be provided with anti-flotation ballast where cover is less than 3'.

C. Manhole Installation:

1. Manholes shall be constructed to the elevations indicated in accordance with the Standard Drawings.
 - a. Set manhole base section on bed of #57 stone to a minimum depth of 8 in. Stone shall be thoroughly compacted and carefully leveled to the excavated wall.
 - b. Join all manhole risers, cone top sections, and any other sections by the use of rubber gaskets.
 - c. Install pipe stubs in manholes where called for on the Plans. All stubs shall extend beyond the manhole as reflected on the plans and shall be sealed with a watertight plug or cap.
 - d. Install flexible manhole connections for all pipes sizes 6 in. to 21 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.
 - e. Plug lift holes from the outside with non-shrink grout and repair any defects in manhole.
 - f. Set adjusting rings in portland cement mortar bed (minimum of ¼" thickness and parge ⅛" to ¼" thickness on inside and outside of manhole).
 - g. Rings will not be required outside of paved roadways or walkways unless called for on the Plans.
 - h. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame. Maximum height of rings shall not exceed 12, otherwise, the cone section will require removal and an additional manhole riser installed to allow for the upward and downward adjustment as stated above.
 - i. Construct bench of concrete only.
 - 1) Elevation of bench at the channel shall be at the spring line of the incoming and outgoing pipe.
 - 2) Bench shall be three inches lower at channel than at manhole wall.
 - 3) Where B.U.O. or stubs are provided for future pipe connections, bench and invert shall be so formed.
 - 4) Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.
 - 5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.
 - 6) All inverts to be smooth.
 - j. All visible leaks shall be corrected before testing.

- D. Service Connections: Place a tee fitting with 6-inch outlet in the sewer where service connection is to be constructed. Lay 6 inch PVC or ductile iron pipe from the tee to the property line or easement limits on a grade of not less than ¼ in. per foot unless otherwise shown on Plans. Where connections are laid out of manholes, Contractor shall use a laser beam. Close service connection at the property line with an approved watertight plug, and mark the end with a 2" x 4" board installed plumb from bottom of 6" plug to 2' above ground. Service connection shall be of same type of pipe as sewer unless otherwise approved by Owner. When making a service connection to an existing sewer, the Contractor shall use a mechanical hole cutter and approved saddle.

- E. Existing Manhole Tie-In: Core drilling and a flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes, where stubs or bricked up openings (B.U.O.) do not exist. The connector shall be Kor-N-Seal assembly or approved equal. The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer. The connector shall be of a size specifically designed for the pipe material and size being utilized on the project. All materials must conform to the approved products reflected in this document. Where bricked up openings (B.U.O.) exist, a PVC manhole adaptor shall be used in the connection of the sewer pipe to precast manholes and installed using the proper conventional methods such as the process established for the "GPK PVC Manhole Adaptors" or equal.

3.02 TESTING OF NEW SANITARY SEWER SYSTEM

- A. Testing Technique for Sanitary Sewer System:
 - 1. Sanitary sewer lines 30 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828-90 or latest edition. All manholes shall be vacuum tested. All testing shall be conducted in the presence of the Owner or Owner's representative. All labor, materials, tools, and equipment necessary to make the tests shall be provided by the Contractor. All equipment and methods used shall be acceptable to the Owner. All monitoring gauges shall be subject to calibration, if deemed necessary.
 - 2. Low Pressure Air Test:
 - a. Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.
 - b. Preparation of the Sewer Line: If required by Owner, flush and clean the sewer line prior to testing and cleaning out any debris. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested. Give special attention to laterals.
 - c. Ground Water Determination: Install a ;4 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.

- d. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828-90 or latest edition. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 psi gage. Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of approximately 4.0 psi gage 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. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psi gage. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gage 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 psi gage drop has not occurred. 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. 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 waterlevel is above the invert of the sewer.
 - e. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 lb. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous. As a safety precaution, pressurized equipment shall include a regulator or relief valve set at no more than 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.
3. All manholes will be tested using the negative air pressure test (vacuum) in accordance with ASTM C 1244-93 or latest edition, for water-tightness, and manhole will be visually inspected after backfilling. Contractor may backfill before testing with the understanding that any repairs will be made from the exterior of the manhole. Manholes shall be vacuum tested and shall have 10-inches of mercury applied to the manhole and the time measured for the vacuum to drop from 10-inches to 9-inches of mercury. Vacuum equipment shall be approved by the Halifax County Service Authority and/or Engineer prior to its use. See Standard Drawings for minimum allowable test times for manhole acceptance at the specified vacuum drop. Test times for structures other than manholes will be based on the times for manholes of the nearest equivalent volume or as directed by the Engineer. Written verification must be furnished that the following steps are followed:
- a. The test method is only to be applied to precast concrete manholes.
 - b. Stub-outs, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.
 - c. If a manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.

4. Test for leakage of gravity sewers using either the infiltration or ex-filtration test:
 - a. Allowable leakage shall be 50 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours for gravity sewers greater than 42" in diameter.
 - b. 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.
 - c. Ground Water Determination: Use same procedure as "low pressure air test" above.

B. Testing Requirements for Sewer Force Mains:

1. All pressure testing shall conform to the requirements as established for Water Distribution Systems as outlined in this document.

3.03 MARKERS

In easements and in undeveloped wooded areas, plastic markers shall be installed every 200 feet, and at all manholes, valves, and fittings. Markers shall be as manufactured by Carsonite, Greenline, or approved equal. Exceptions are where sanitary gravity and force main lines are installed in "kept" yards where the property owners may object to the placement of these markers. Contractors will be required to properly install the markers per manufacturer's recommendations, parallel to the sewer line facing roadway, or as additionally directed by the Halifax County Service Authority .

3.04 CLEAN-UP

Upon the completion of the installation of the sanitary sewer system and prior to the Owner's final acceptance, sediment and debris shall be removed from the system. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT and/or Halifax County Service Authority .

SECTION 7- MANHOLE AND WET WELL REHABILITATION AND COATING

GENERAL I

1.01 DESCRIPTION OF WORK

- A. This section include the requirements for providing a system for manhole rehabilitation that includes lining the manhole interiors, internal sealing of the frame-chimney joint area, and reconstructing manhole benches and channels. It is the Contractor's responsibility to stop all active leaks in association with the lining of the manhole interiors.
- B. This work shall include the furnishing of all materials, equipment, tools, and labor as required for the rehabilitation of the manholes.
- C. Rehabilitation products shall be applied to the manhole from the cover seat to and including the benches. The rehabilitation system must provide a non-prorated warranty as herein described in manholes to stop infiltration, prohibit root intrusion, protect the existing structure from further deterioration, and provide a surface coating resistant to sewer gases and chemicals.
- D. Sewage pumping station wet wells shall also be rehabilitated and coated in accordance with this specification.

1.02 SUBMITTALS

Submittals shall be made by the Contractor in accordance with the procedures set forth in Section 105 - Control of Work, and as described below. After notification of a specific project, the Contractor shall provide the following information for review and approval.

- 1. A comprehensive construction-sequencing plan. At minimum the plan shall include the following:
 - a. A proposed schedule.
 - b. Identification of all proposed access routes.
 - c. Identification of set-up locations for lining installation.
 - d. Lining procedures.
 - e. Bypass Pumping Plan in accordance with Section 812 – Bypass Pumping.
 - f. Traffic Control Plan in accordance with VDOT requirements.
- 2. Letter identifying the crewmembers performing the lining. If any of the crew members are not identified on the original certification letter received during the pre-qualification process, then a new certification letter listing the crew member(s) must be received from the rehabilitated system supplier prior to initiation of the specific project.
- 3. Documentation of product experience. The documentation shall include at least 10 jobs similar in nature completed within the last two years. The jobs submitted shall show that the Contractor or other Contractors have installed at least 500 vertical linear feet of the product. Include the Owners name, the contact for the job including name, phone number, title, and address, the project description, the value of the job, and the date job was placed in service. Based on these references, the Owner reserves the right to reject the product and require the Contractor to submit another product meeting these specifications.

4. Documentation of Applicator experience. The documentation shall include at least 5 jobs similar in nature completed within the last two years. The jobs submitted shall show that the Applicator has installed at least 200 vertical linear feet of the product. Include the Owners name, the contact for the job including name, phone number, title, and address, the project description, the value of the job, and the date job was placed in service. In addition, submit certification that applicator(s) is approved by the manufacturer in application of the specified products. Based on these references, the Owner reserves the right to reject the Applicator and require the Contractor to submit the name(s) of another Applicator meeting these specifications.
5. Calculations (or certified letter from an officer of the manufacturer) supporting recommended liner thicknesses or wall coverage thicknesses.
6. Shop drawings and product data for the manhole rehabilitation method including a report outlining the process to be used in the rehabilitation of the sewer manholes. The report shall also include information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions and bypass pumping.
7. All measurements made by the Contractor to verify manhole elevations, prior to ordering of material.

EXECUTION II

2.01 GENERAL

- A. Prior to performance of the actual work carefully inspect the entire site and locate those manholes designated to be rehabilitated.
- B. Cleaning: Cleaning of sewer lines and manholes shall be performed as specified in Section 810 - Sewer Line Cleaning.
- C. TV Inspection: Inspection of sewer lines shall be performed as specified in Section 811 - Television Inspection.
- D. Bypass Pumping: When required for acceptable completion of the rehabilitation process, the Contractor shall provide for adequate flow control including but not limited to required pumping and bypassing as stipulated in Section 812 - Bypass Pumping.

2.02 REHABILITATION PROCEDURES

- A. Place cover over invert to prevent extraneous material from entering the sewer lines.
- B. All foreign material shall be removed from the manhole wall and bench to produce a sound surface with adequate profile to provide a strong bond between the protective coating and the substrate as recommended by the manufacturer. This can generally be accomplished through the use of a high-pressure water spray (minimum 1200 psi), abrasive blasting, shot blasting, grinding, and/or scarifying. Detergent water blasting and hot water blasting may be necessary to remove grease, oils, and other hydrocarbon residues from the structure surface. Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick-setting patching mix in accordance with Section 200 – Products and Materials. The surface to be repaired must be clean and free of any loose materials with walls totally saturated with water.

- C. Minor leaks shall be stopped using the quick-setting specially formulated infiltration control mix and shall be mixed and applied per manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application, after which the weep holes shall be plugged with the quick-setting infiltration control mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious or chemical grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
- D. After all preparation work has been completed, remove all loose material and wash wall again.
- E. Any bench, invert, or service line repairs shall be made at this time using the quick setting patching mix per manufacturer's recommendations.
- F. Invert Repair: Invert repair shall be performed on all inverts with visible damage or infiltration. After blocking flow through the manhole and thoroughly cleaning invert, the quick-setting patch mix shall be applied to the invert in an expeditious manner. The mix shall be troweled uniformly onto the damaged invert extending out onto the base of the manhole sufficiently to tie into the structural/structurally enhanced monolithic liner to be applied. The finished invert surfaces shall be smooth and free of ridges. The flow may be re-established in the manhole within 30 minutes after placement of the mix.
- G. Cementitious Liner Installation
 - 1. Described are procedures for manhole preparation, cleaning, application and testing. The applicator, approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying a cementitious mix with machinery specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications which include:
 - a. Elimination of active infiltration prior to the application.
 - b. Removal of loose and unsound material and cleaning surfaces in accordance with Section 810 - Sewer Line Cleaning and per manufacturer's recommendations.
 - c. Repair and sealing of the invert and benches.
 - d. Spray application of a cementitious mix to form a liner.
 - 2. Liner Application: Prior to liner application onto walls, manhole bench area shall be covered with plywood sections, which conform to the internal dimensions of the manhole, to prevent accumulation of liner material on bench. No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95° F, precautions shall be taken to keep the mix temperature at time of application below 90° F. Mix water temperature shall not exceed 85° F. Chill with ice if necessary.
 - 3. Mixing: For each bag of product, use the amount of water specified by the manufacturer and mix for the duration and in the manner recommended by the manufacturer. Empty the mixed material into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.

4. Spraying:
 - a. First Application: The surface prior to spraying shall be damp without noticeable free water droplets or running water, but totally saturated. Materials shall be spray applied from the bottom of the wall to the top, to a minimum uniform thickness to ensure that all cracks, crevices, and voids are filled and a relatively smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.
 - b. Second Application (as necessary per manufacturer's recommendations): A second application is to be applied after the first application has begun to take an initial set (disappearance of surface sheen which could be 15 minutes to 1 hour depending upon ambient conditions) to assure a minimum total finished thickness of ½ inch. Again application shall be from the bottom up. The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed when more than 24 hours have elapsed between applications.
 - c. Bench Application: The plywood covers shall be removed and the bench sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than ½ inch. The wall bench intersection shall be rounded to a uniform radius equal to the full circumference of the intersection.
 - d. The Contractor shall take precautions to keep over spray or excess material from entering the newly installed liner pipe and any other pipes in the manhole.
5. Curing: Caution should be taken to minimize exposure of applied product to sunlight and air movement. If application of second coat is to be longer than 15 minutes after completion of application of first coat, the manhole cover shall be set back in place. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover. The final application shall have a minimum of 4 hours cure time before being subjected to active flow. Traffic shall not be allowed over manholes for 6 hours after rehabilitation is complete. Allow the finished cement process to have a minimum of 6 hours cure time, or as a minimum, the cure time recommended by the manufacturer, whichever is longer, before being subjected to active flow. Testing: Four 3-inch by 6-inch test cylinders or six 2-inch cubes shall be cast each day or from every 50 bags of product used. The test specimen shall be properly labeled and sent in for testing in accordance with the manufacturer's directions for compression strength testing as described in ASTM C 495.
- H. Cured-In-Place Fiberglass Insert: The installation of the approved liner system shall be in strict accordance with the manufacturer's written instruction. This shall include re-grouting all inlet and outlet lines and benches as needed, plus the preparation, installation, curing, and finish operation, for the completion of the rehabilitation process.
- I. Epoxy Coating Installation: The installation of the approved epoxy coating system shall be in strict accordance with the manufacturer's written instruction. This shall include regrouting all inlet and outlet lines and benches as needed, plus the preparation, installation, curing, and finish operation, for the completion of the rehabilitation process. Any cementitious materials used under the epoxy coating for patching or repairs shall be as recommended by the epoxy coating manufacturer for compatibility.

2.03 LINER AND COATING ACCEPTANCE

All rehabilitated manholes shall be tested as follows:

- A. Visually verify the absence of leaks.
- B. Perform a vacuum test in accordance with Section 802 – Sanitary Gravity Sewer Systems.
- C. (Optional – Perform an exfiltration test. For manholes up to 6 feet deep: A water loss of 1 inch or less in 5 minutes is acceptable. For manholes over 6 feet deep: A water loss of 1 inch or less plus 1/8 inch per additional foot of depth in 5 minutes is acceptable.)
- D. (Optional - wet film thickness gage meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.)
- E. (Optional for epoxy coatings – Note that this procedure is sometimes difficult or impossible to perform in tight manhole or vault structures) After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surface shall first be dried. An induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.
- F. (Optional for epoxy coatings) Measurement of bond strength of the protective coating to the substrate shall be measured in accordance with ASTM D4541. 10% of the manholes being rehabilitated shall be tested at 3 locations. The Owner shall evaluate any areas detected to have inadequate bond strength. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and the Contractor shall make repairs in strict accordance with manufacturer's recommendations. At the discretion of the Owner, additional bond tests in the remaining manholes may be directed at no additional cost to the Owner. The Contractor shall make any repairs necessary at no additional cost to the Owner.

2.04 MANHOLE STEP REMOVAL

The Contractor shall remove all steps. Removal shall consist of neatly cutting steps flush with the wall prior to any lining installation. The Contractor shall be responsible for proper disposal of steps.

2.05 MANHOLE FRAME AND COVER REPLACEMENT

- A. Excavation and site restoration in paved and unpaved areas shall be in accordance with Halifax County Service Authority Standards to a minimum of established pre-construction conditions.

- B. The Contractor shall remove and dispose of the existing manhole frames and covers, as specified on the Drawings. It shall be the responsibility of the Contractor, at no additional cost to the Owner, to repair any damage to the chimney or corbel caused by the removal of the existing manhole frame.
- C. New replacement frames and covers shall be as specified in the APPROVED MATERIALS LIST AND SPECIFICATIONS section of this document.
- D. Repair of Manhole Chimney and Corbel, Requiring Excavation (when directed by the Owner):
1. In Paved Areas:
 - a. The removal of the manhole frame shall be accomplished by making a square cut of sufficient size in the pavement.
 - b. Material in the exposed area shall be dug out to a sufficient depth to permit the required repairs. All excess material, including pavement, shall be disposed of as surplus material in accordance with Section 303 – Earthwork.
 - c. Backfill materials shall be in accordance with VDOT Road and Bridge Standards.
 - d. The surfacing needed to cover the exposed area (concrete or asphalt) shall conform to the existing pavement. It shall be placed to the same elevation and grade and have a thickness equal to or greater than the existing pavement.
 - e. Replacement of pavement not satisfactorily performed by the Contractor shall be reworked at no expense to the Owner.
 2. In Unpaved Areas:
 - a. Only necessary excavation around manhole shall be performed.
 - b. Backfill shall be replaced and compacted to prevent settlement and to restore the setting to a condition equal to or better than that found in accordance with Section 303 - Earthwork. Backfill shall not cover the manhole.
 - c. Any private property which is removed for access to the manhole shall be replaced by the Contractor in existing or better condition. If replacement does not satisfy of the Owner, it shall be redone at no cost to the Owner.
 3. The Contractor shall take all necessary precautions to prevent falling debris from damaging the manhole trough and/or entering the sewer. The damaged or deteriorated portions of the existing manhole chimney and corbel shall be removed and property disposed of by the Contractor.
 4. The chimney and corbel shall be repaired or rebuilt with new brick or precast concrete grade rings as appropriate to reconstruct the chimney to the height needed for the frame and cover to meet the required grade. The manhole frame shall be sealed using either a manufactured or applied sealing method.

2.06 MANHOLE FRAME SEALING

The manhole frame and the chimney above the cone shall be sealed in accordance with the manufacturer's recommendations. Refer to the Contract Documents details for additional requirements.

2.07 FINAL ACCEPTANCE

After the various types of rehabilitation work have been completed, the work shall be visually inspected for compliance and tested for watertightness in accordance with paragraph 2.3 by the Contractor in the presence of the Owner. The Owner reserves the right to inspect the rehabilitated manholes during the warranty period. Any leakage or defects in the work found by this inspection shall be corrected by the Contractor within 30 days from notice, at no additional cost to the Owner.

SECTION 8 - ESTABLISHING VEGETATION

GENERAL I

1.01 RELATED DOCUMENTS

The Plans and general provisions of the Contract, including General and Supplementary Conditions and Specification sections, apply to work specified in this Section.

1.02 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, equipment and services necessary for and reasonably incidental to, seed bed preparation, liming, fertilizing, seeding and mulching of all residential areas. In wooded areas, the requirements of Section 3 shall apply.

1.03 SUBMITTALS

- A. Seed: Furnish duplicate signed copies of a statement from the vendor, certifying that each container is fully labeled in accordance with the Seed Improvement Association requirements for certification. This certification shall appear on, or with, all copies of invoices for the seed. Each lot of seed will be subject to sampling and testing at the discretion of the Owner. Sampling and testing will be in accordance with the latest regulation under the Federal Seed Act. Samples shall be submitted at least 40 days in advance of the planned planting date.

- B. Fertilizer and Lime: Furnish duplicate copies of invoices for all fertilizer and lime used on the project. Invoices for fertilizer shall show the analysis and the quantity furnished. Invoices for lime shall show the percentage of magnesium oxide and quantity furnished. Upon completion of the project, a final check of the total quantities of fertilizer and lime used will be made against the total area seeded and if the rates of application have not been met, additional quantities of these materials shall be applied to make up the application specified.

- C. Mulch: At least 5 working days prior to the initiation of the seeding work, the Contractor shall furnish for approval representative samples of the materials proposed to be used.

- D. Liquid Mulch Binding: Shall be in accordance with the Virginia Erosion Control Handbook, latest edition. Asphaltic binders will not be allowed.

PRODUCTS II

2.01 LIMESTONE

Lime shall be dolomitic agricultural-ground limestone containing not less than 10% magnesium oxide.

2.02 COMMERCIAL FERTILIZER

Fertilizer shall be the standard commercial product of 10-10-10 analysis. All fertilizer shall be delivered in bags bearing the manufacturer's name, the chemical analysis of the product, and its weight. If not used immediately after delivery, fertilizer shall be stored in a manner that will not allow it to harden or destroy its effectiveness.

2.03 SEED

Seed shall be new crop seed labeled in accordance with the U.S. Department of Agriculture, "Rules and Regulations under the Federal Seed Act." All seed shall be furnished in sealed standard containers. Seed which has become wet, moldy, or otherwise damaged prior to seeding, will not be acceptable.

2.04 MULCH

Mulch shall be any of the materials noted below:

- A. Grain Straw: Mulch material which contains an excessive quantity of matured seed of noxious weed or other species which would hinder the establishment of desirable vegetation will not be accepted. Any mulch material which is fresh or excessively brittle or which is in such an advanced stage of decomposition as to smother or retard growth of grass will not be accepted.

- B. Wood Cellulose Fiber Mulch: Wood cellulose fiber mulch for use with the hydraulic application of grass seed and fertilizer shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will contain no growth or germination inhibiting factors and shall be dyed an appropriate color to facilitate metering of materials. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with fertilizers, grass seeds, water, and any other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry; that when hydraulically sprayed on the ground, the material will form a blotter like ground cover impregnated uniformly with grass seed; which after application, will allow the absorption of moisture and allow rainfall or mechanical watering to percolate to the underlying soil. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished, and that it meets all of the foregoing requirements based upon such testing. Weight specifications of this material from suppliers, and for all applications, shall refer only to air dry weight of the fiber material. Absolute air dry weight is based on the normal weight standard of the Technical Association of the Pulp and Paper Industry for wood cellulose and is considered equivalent to 10% moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content.

2.05 WATER

Water shall be clean, potable water.

2.06 TOPSOIL

Topsoil required in excess of that available from stripping topsoil from the site shall be provided by the Contractor from sources offsite. The topsoil shall be natural, friable, sandy loam or fine sandy loam, possessing the characteristics of producing heavy growths of agricultural crops and shall be obtained from naturally well-drained areas. The topsoil shall be reasonably free from subsoil, clay lumps, brush, stumps, objectionable weeds, other litter, and any other material or substance which might be harmful to plant growth or a hindrance to grading, planting or maintenance operations. The topsoil proposed for use shall be inspected and approved at its natural location prior to its being moved to the construction site. At the time of inspection, the Owner may require representative soil samples to be taken from several locations of the areas under consideration and tested for physical properties, pH, available phosphate and potash and organic matter. If such tests are required, they shall be at the Contractor's expense.

2.07 SPECIAL SEEDING AND MULCHING EQUIPMENT

- A. Seeder: Equipment to be used for applying a seed-fertilizer mix over prepared slopes shall be a hydraulic seeder designed to pump a water-seed-fertilizer mixture over areas to be seeded at the specified rates. A power-driven agitator keeps the mixture uniform during the seeding cycle.
- B. Mulch Spreader: Equipment to be used for spreading mulch shall be equipment designed to apply a liquid binder to the straw mulch material at the end of a movable broom, then with a high velocity air stream, blow the straw over the graded areas to form a uniform, porous, stable blanket, tied in place by the liquid binder.
- C. Wood Cellulose Fiber Mulch Spreader: Hydraulic equipment used for the application of fertilizer, seed, and slurry or prepared wood pulp shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to 40 pounds of fiber plus a combined total of 70 pounds of fertilizer solids for each 100 gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which will provide even distribution of the slurry on the various slopes to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. Equipment with smaller tank capacity may be used provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

EXECUTION III

3.01 SEED BED PREPARATION

- A. General: Equipment necessary for the proper preparation of the seed bed and for handling and placing of all required materials shall be on hand, in good condition and shall be approved before the work is started.
- B. Clearing: Prior to or during grading and tillage operations, the ground surface shall be cleared of stumps, stones, roots, cable, wire, grade stakes, and other materials that might hinder proper grading, tillage, seeding, or subsequent maintenance operations.

- C. Grading: Grades on the area to be treated shall be maintained in a true and even condition. Maintenance shall include any necessary repairs to previously graded areas.
- D. Tillage: All graded areas shall be thoroughly tilled to a depth of at least 4 inches by plowing, disking, harrowing, or other approved methods until the condition of the soil is acceptable. On sites where soil conditions are such that high clay content and excessive compaction cause difficulty in getting clods and lumps effectively pulverized, the Contractor shall use the rotary tillage machinery, until the mixing of the soil is acceptable and no clods or clumps larger than 1- ½ inches in diameter remain. A firm and compact seedbed is required, and after being graded, the seedbed shall be lightly compacted with a land roller, such as a cultipacker, before and after seeding. All tillage operations shall be as near on the contour as is practical but in no instance up and down the slope.
- E. Topsoiling: The topsoil shall be uniformly distributed on the designated areas and evenly spread to an average thickness of 4 inches, with a minimum thickness of 3 inches. Prior to placing the topsoil, the subgrade, wherever excessively compacted by traffic or other causes, shall be loosened by disking or by scarifying to a depth of at least 2 inches, to permit bonding to the subgrade. The spreading shall be performed in such a manner that planting can proceed with little additional soil preparation or tillage. Any irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent the formation of depressions where water will stand. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to the planting or to proper grading.

3.02 LIMING

Limestone shall be uniformly applied at a rate of 3,000 pounds per acre (70 pounds per 1,000 square feet) to all areas to be vegetated. Limestone may be applied to the area prior to the preparation of the seed bed, but in all cases, it shall be applied before seeding and thoroughly incorporated into the entire depth of the prepared seed bed. The incorporation of the lime may form a part of the tillage operation specified above.

3.03 FERTILIZING

The fertilizer shall be uniformly applied at the rate of 1,000 pounds per acre (23 pounds per 1,000 square feet) to all areas to be vegetated. The fertilizer shall be incorporated into the upper three or four inches of prepared seed bed. This can be done just prior to the last tillage operation or just prior to seeding, but in no case, will it be applied more than 3 days before seeding or before the lime is applied. Distribution by means of an approved seed drill equipped to sow seed and distribute fertilizer at the same time will be acceptable. When hydro-seeding equipment is used for planting operation, fertilizer shall be applied simultaneously with seed using the above rate of application.

3.04 SEEDING

A. General: The Contractor shall make use of special hydro-seeding equipment or approved mechanical power-drawn seeders. When conditions are such, by reason of drought, high winds, excessive moisture, or other factors that satisfactory results are not likely to be obtained, the work shall be stopped, and resumed only when conditions are favorable. If inspection during seeding operation, or after there is a show of green, indicates that strips wider than spaces between the rows planted have been left, or other areas skipped, additional seed shall be sown on these areas. Seed shall be sown as specified in the following table:

SITE SPECIFIC SEEDING MIXTURES FOR PIEDMONT AREA

<u>Minimum Lawn Care</u>	Total Lbs. Per Acre
-Commercial or Residential	175-200 lbs.
-Kentucky 31 or Turf-Type Tall Fescue	-95-100%
-Improved Perennial Ryegrass	0-5%
-Kentucky Bluegrass	0-5%
 <u>High-Maintenance Lawn</u>	 200-250 lbs.
-Kentucky 31 or Turf-Type Tall Fescue	100%
 <u>General Slope (3:1 or less)</u>	
-Kentucky 31 Fescue	128 lbs.
-Red Top Grass	2 lbs.
-Seasonal Nurse Crop*	<u>20 lbs.</u>
	150 lbs.
 <u>Low-Maintenance Slope (Steeper than 3:1)</u>	
-Kentucky 31 Fescue	108 lbs.
-Red Top Grass	2 lbs.
-Seasonal Nurse Crop*	20 lbs.
-Crown vetch**	<u>20 lbs.</u>
	150 lbs.

*Use seasonal crops in accordance with seeding dates below:

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

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

- B. Broadcast Seeding: In areas too confined for the operation of machinery, hand-operated equipment, such as the "Cyclone" seeder, shall be employed. The seed shall be uniformly distributed over the designated areas. Half the seed shall be sown with the sower moving in one direction, and the remainder shall be sown with the sower moving at right angles to the first sowing. In confined areas, the seed shall be covered, but no deeper than ¼ inch, by means of rakes or other approved hand tools. Broadcast seeding shall not be done during windy weather.
- C. Slurry Seeding: Seed shall be sown with an approved hydro-seeder in combination with fertilizer, or in combination with wood cellulose fiber mulch and fertilizer. Seed shall be uniformly distributed over the areas to be seeded.
- D. Mechanical Power-Driven Seeder: Seeding shall be accomplished with a combination grass planter and land packer or pulverizer, the seed shall be planted no deeper than ¼ inch. The seeding operation should be as near on the contour as is practical, but never up and down the slope. After seeding, the seeded areas shall be compacted with a land roller, such as a cultipacker. It will be permissible to sow the seed and cultipack the soil all in one operation if the proper equipment is used.

3.05 MULCHING

- A. General: The surface of all seeded areas shall be protected by the application of any of the before-mentioned mulch material unless otherwise specified.
- B. Straw shall be applied evenly over the seeded area in such a manner that thickness of the mulch is approximately uniform throughout the treated area and sunlight is not completely excluded from penetration to the ground surface. The straw mulch shall be applied at the rate of one and one-half tons per acre.
- C. Wood Cellulose Fiber Mulch: The application of the wood cellulose fiber mulch shall be with the hydro-seeder and shall be accomplished immediately after completion of the final tillage operation. The wood cellulose fiber mulch shall be applied at the rate of 1,000 pounds per acre in combination with water, fertilizer and seed and shall be sprayed over the soil in a uniform coat.
- D. Anchoring Mulch: Straw shall be anchored in place by use of a cut-away rolling flat disk packer or by uniformly spraying the straw with the liquid binder at the application rate recommended by the manufacturer.

3.06 PROTECTION

The area shall be protected against foot and vehicular traffic by erecting adequate barricades immediately after seeding is completed, and by placing warning signs of an approved type.

3.07 ESTABLISHMENT

The Contractor shall be responsible for the proper care of the seeded area during the period when the vegetation is being established or until a good stand of grass has been obtained. In the event of an erosive rain before an adequate stand of vegetation is established, damaged areas shall be repaired, limed, fertilized, seeded, and mulched wholly at the Contractor's expense.

APPROVED MATERIALS AND MANUFACTURERS

INTRODUCTION

This document represents a listing of specific manufacturers whose products have been approved for use within Halifax County Service Authority's water and sanitary sewer systems. The listing is divided into four sections. Sections 1 and 2 contain lists by type of material and indicate the approved product of each. Section 3 provides a listing of approved manufacturers followed by their addresses and local suppliers. Section 4 provides detailed materials specifications. This listing is intended to be used as a reference source for the Operations Department's employees, contractors and vendors. Materials produced by manufacturers not listed herein are not acceptable for use within the Halifax County Service Authority's systems. Manufacturers interested in submitting products for evaluation and possible approval should communicate their interest to:

HCSA Director of Operations
Halifax County Service Authority
P.O. Box 640
Halifax, Virginia 24558.

It should be noted that in some cases manufacturer approval and/or dis-approval is on a documented history of performance, product availability and inventory and installation criteria. The Halifax County Service Authority reserves the right to perform a comprehensive product evaluation and testing based on HCSA Operations application and use, and at the sole option of the division, system(s) evaluations may be required on an on-going basis for new and existing facilities. The Halifax County Service Authority also reserves the right to limit the number of approved manufacturers and products as they deem necessary to control parts inventory and maintenance/ training requirements.

Halifax County Service Authority

APPROVED MATERIALS LIST

(Minimum Criteria: Meets AWWA and/or ASTM Standards and Halifax County Service Authority Design Standards, Latest Revisions)

SECTION 1: WATER SYSTEM

A. Pipes

1. C-900 or C-909 - P.V.C. (DR-18, CL. 150) (Sizes 6", 8" & 12")
2.
 - a. Class 51 minimum or higher classification depending upon design consideration. (Push-On and Mechanical Joint) (6", 8", 12", 16", 20", 24", 30" & 36")
 - b. Restrained Joint Pipe (Pipe Application: Use only where mechanical joint pipe is not available or in vertical applications).
 - 1) Griffin Snap-Lok (6" – 30")
 - 2) American D.I. Pipe Flex-Ring (6" – 36")
 - 3) U.S. Pipe TR-FLEX (6" – 36")
 - 4) Clow Super Lock D.I. (6" – 24")
 - 5) McWane D.I. (30" – 36")
3. Prestressed Concrete Pressure (AWWA C301 as modified)

B. Valves

1. Resilient Seated Gate Valves (for main sizes 4"-12" only)
 - a. American Flow Control - Series 500 Gate Valve with Non-Rising Stem (NRS)
 - b. Clow R/W Valve
 - c. U.S. Pipe - Metroseal 250: with non-rising stem (NRS) and outside stem yoke (OSY)
 - d. M&H (Style 3067-NRS; 3068 OSY)
 - e. Kennedy (Model KenSeal II 4571RSGV)
 - f. Mueller A-2360 (Resilient Wedge)
 - g. American Flow Control - Series 2500 (Resilient Wedge)
2. Butterfly Valves (For Use on 16" and Larger Lines)
 - a. Mueller - Lineseal III
 - b. DeZurik Baw AWWA
 - c. Pratt's Groundhog Class 150B and Triton HP-250
 - d. M&H Style 4500 (for 16"-24") and Style 1450 (for 30"-54")
 - e. Mosser Series 810 & 830
 - f. Rodney Hunt Streamseal (24" and Larger)
 - g. K-Flo 47 Series (30"-72")

C. Fire Hydrants

1. Mueller Centurion A-421
2. Kennedy "K81D" (Dual rotated hydrant)
3. M & H Style 929 Reliant
4. U.S. Pipe - Metropolitan 250 (Model 94)
5. Clow Medallion
6. American Darling - Mark 73

D. Meter (Setters) Yokes

1. For 5/8" Meters: 5/8" x 7" Riser Meter Yoke with one lockwing plug angle meter stop, with saddle nuts, 3/4" copper tube flare or compression inlet and outlet.
 - a. Ford V71-7W-22-33, V71-7W-44-33G
 - b. McDonald 29-107WXCC33, 29-107WXTT33
 - c. Mueller H-1434, H-1470-5
 - d. Hays Model # 6020-207H3H3V0

Note: Halifax County Service Authority requires manufacturer to supply these connections "completely factory assembled" and tightened to proper torque.

2. For 1" Meters: Commercial - Domestic use by Businesses, Doctors and Dentists Etc. 1" x 12" Riser Meter Yoke with two lockwing, ball or plug type angle stop on inlet and outlet, saddle nuts, copper tube flare or compression inlet and outlet with ball valve bypass.
 - a. Ford VV74-12W-22-44, VVB-74-12W-22-44, VV74-12W-44-44G
 - b. McDonald 29B412WWCC443, 29B412WWTT443
3. All Other Users i.e. for Irrigation, Residential, Etc. 1" x 12" Riser Meter Yoke with 1 lockwing ball or plug type angle stop on inlet only, saddle nuts, copper tube flare inlet and outlet. No bypass.
 - a. Ford V74-12W-22-44, V74-12W-44-44G
4. For 1 1/2" and 2" Meters:
 - *a. Ford - for 1 1/2" Meter - VBB76-7B-11-66 and for 2" Meter - VBB77-8B-11-77
 - *b. Mueller (for both) - H-1423
 - *c. A.Y. McDonald - 20A609 WWFF 665 for 1 1/2" meter, 20A709 WWFF 775 for 2" meter

*These products are acceptable provided manufacturer makes the necessary modifications to comply with the Halifax County Service Authority's materials specifications for 1 1/2" and 2" water meter setters.

E. Corporation Stops - Plug Type only for ¾” and 1”; **Plug Type or Ball Valves for 1½” and 2”** (¾” thru 2” with “cc” thread inlet)

1. Mueller H-15000, H-15008 (¾”), H-15071 (¾” and 1”)
2. Ford F-600, F-1000-3G, C04-33G
3. McDonald 4701, 4701-T
4. JJC #J-1500
5. Ford FB-600 (Ball valve with flare outlet only for 1½” & 2”)
6. Ford FB-100OG (Ball valve with compression outlet only for 1½” & 2”)
7. Cambridge 102-A Plug,- (¾”, 1”, 1½”, 2”), 201-A Ball valvet - (1½”, 2”)

Compression Fittings - (for 1½” and 2” only)

1. Mueller 110
2. McDonald T-Compression
4. Ford Grip Joint
5. Cambridge Compression - CB

Curb Stops - ¾” and 1” copper flare, full port, ball or plug type curb stop, with or without check

1. Ford ¾” Z22-333 B22-333, Ford 1” Z22-444 B22-444
2. Mueller ¾” & 1” H-15300 N/A
3. McDonald ¾” & 1” 4713 6100
4. Cambridge Brass ¾” 128-C3C3 202-C3C3, Cambridge Brass 1” 128-C4C4 202-C4C4

Curb Stops - ¾” and 1” copper compression, full port, ball or plug type curb stop, with or without check.

1. Ford ¾” Z44-3336 B44-3336, Ford 1” Z44-4446 B44-4446
2. Mueller ¾” & 1” H-15207 B-25209
3. McDonald ¾” & 1” 4713-T 6100-T
4. Cambridge Brass ¾” 128-H3H3 202-H3H3, Cambridge Brass 1” 128-H4H4 202-H4H4

Curb Stops – 1½” and 2” pipe threaded or compression, full port, ball type curb stop, with or without check

1. Ford 1½” B44-6666 B11-666, Ford 2” B44-7776 B11-777
2. Mueller 1½” & 2” B-25209 B-20283
3. McDonald 1½” & 2” 6100-T 6101
4. Cambridge Brass 1½” 202-H6H6 202-F6F6, Cambridge Brass 2” 202-H7H7 202-F7F7

F. Vaults, Precast Concrete - Requirements and configurations as shown on plans. (For other approved vaults, see “Water Meter Boxes” under Section 1).

1. Americast
2. Elite Fire Protection, Inc.
3. Tindall Vaults
4. Clear Flow Company

G. Tapping Sleeve - Sleeves must conform to Halifax County Service Authority's latest application instructions as specified in Section 4 entitled **Materials Specifications.**

1. (Fabricated Steel Sleeves) with Epoxy Coating and Stainless Steel Bolts and Nuts

- a. Smith Blair (Rockwell Product) #622 (4"-30")
- b. J.C.M. Industries #412 ESS (4"-48")
- c. ROMAC # FTS 420 SS (4"-30")
- d. Ford FTSC (4"-30") w/SS bolts

2. (Stainless Steel Sleeves)

- a. Power Seal Model 3480 AS and 3480 MJ (6"-24"), Model 3490 AS and 3490 MJ (6"-24")
- b. ROMAC SST and SST III (6"-24")
- c. Ford FAST (6"-24")
- d. Cascade Model CST-EX (4"- larger), Model CST-SL (4"-24")
- e. JCM Model 432 (6"-24")
- f. Mueller H304 (6"-24")
- g. Dresser Style 630 (6" – 12")
- h. Smith-Blair Models 662 & 663 (4"-20")
- i. Smith-Blair Model 622 MJ (4"-20")
- j. Mueller H300 (Not to be used on Asbestos Cement and Cast Iron Pipe)

3. (M.J. Steel Sleeve)

- a. JCM 414 Mechanical Joint

4. (M.J. Cast/Ductile Iron Sleeve)

- a. Mueller (H-615 for 4"-24,"on Ductile Pipe and H-619, for 4"-12" C/A Pipe)
- b. Clow (F-5205)
- c. American Flow Control - (Model 2800-A for A/C pipe; Model 2800-C for 4"-12" D.I. and PVC pipes; Model 1004 for PVC pipe and 16" and larger D.I. pipe)
- d. U. S. Pipe D.I. T-9 MJ Sleeve

H. Resilient Seated Wedge Tapping Valves

- 1. American Flow Series 500 Resilient Wedge Valve (for 6"-12" only)
- 2. Mueller T-2360 Resilient Wedge Valve (for 6"-12" only)
- 3. American Flow Control - Series 2500 (for 16"-30" only)
- 4. Kennedy Model #4950 (for 16" and 20" only)
- 5. Clow Model F6114 (for 16" and 20" only)

I. Fittings (Bends, Crosses, Tees and Grade Lok Offset Glands) Ductile Iron only

- 1. D.I. Compact AWWA C153 or D.I./C.I. AWWA C110
- 2. D.I. Special Coated Compact Fittings AWWA 153

Couplings (For pipe sizes 12" and smaller)

1. Cast Couplings (transition or straight)

- a. Romac 501 series (long sleeve coupling)
- b. Ford #FC2A (long sleeve coupling)
- c. Smith Blair (Rockwell) #442 (long sleeve coupling)
- d. Power Seal Model # 3501 (long barrel coupling)
- e. Maxi Fit (long sleeve coupling)

2. Cast D.I. Couplings

- a. FEHR

J. Air Release or Combination Air Release and Vacuum Valves (Engineer is responsible for specifying the appropriate type for its designated use)

- 1. Clow 5401-E (for 2" inlet with small orifice)
- 2. Clow 5402-A (for 1" inlet and 1" orifice)
- 3. APCO (Product Bulletin No. 600 and/or 601)
- 4. G. A. Industries Type 1 GH4-150 Type 4 GH 7-K
- 5. Valmatic
- 6. Cla Val (Models 34, 35 & 36)

K. Blow Off Valves

- 1. 2" Bronze Gate Valve (open to most manufacturers, i.e., Grinell, Epsco, etc.)

L. Line Stopping Valves

- 1. Hydra-Stop

M. Water Meter Boxes/Vaults

1. Precast Concrete Box:

- a. Lyttle Service Co. LLC A Stamie E. Lyttle Co., Inc. (used with 1", 1½" or 2" water metersb.)
- b. Smith-Midland Model 550 (for 3" & 4" water meters and assemblies)
- c. Clear Flow Model CFLD6060 (for 3" and 4" water meters and assemblies)
- d. M&B – Model #MB1500BF/WM (for 3" and 4" water meters and assemblies)

2. Hi-Density Polyethylene Plastic Box (for 5/8" and 1" water meters and assemblies only in areas not subject to vehicular traffic):

- a. Mid-States Plastics' meter box (for 5/8" water meters)
MSBC1015-24-RL with cast iron cover and reader lid
- b. Mid-States Plastics' meter box (for 1" water meters)
MSIBC1118-26-RL with ductile iron cover and reader lid

3. Cast Iron Box (for 5/8" water meters and assemblies only in areas subject to vehicular traffic):

- a. Capitol Foundry Design # MBX-10 and MBX-11

N. Valve Boxes (Slip Type Only)

- 1. SIGMA
- 2. Bingham and Taylor
- 3. Capitol Foundry
- 4. Star Pipe

O. Copper Tubing - (as manufactured for domestic use)

- 1. Type "K" (soft) - for 3/4" and 1" service lines
- 2. Type "K" (hard copper only) - for 1 1/2" and 2" service lines

P. Service Saddles

- 1. ROMAC Style 202N with Stainless Steel Strap
- 2. Smith-Blair (Rockwell) SB 317 - (with Double Stainless Steel Straps)
- 3. Ford FS 202 Series, with cc Threads
- 4. JCM 404 (with Double Stainless Steel Straps)
- 5. PowerSeal Model No. 3417 (with double straps)
- 6. Cascade - Styles CNS2 (for 12" and smaller pipe), CBS2 (for 12" and smaller pipe), and CDSL (large diameter saddles for 16" and larger pipe)
- 7. Mueller Models DB2S & DE2S (with double straps for 2"-12")

Q. Pipe Restraints (must be UL Listed and FM Approved)

1. For PVC Pipe (Sizes up to 12")

- a. Megalug Series 2000 PV (PVC Pipe - MJ Fittings), Megalug Series 1500 (PVC Bell and Spigot Joints)
- b. Romac Style 611 (PVC Bell and Spigot Joints)
- c. Uni-Flange Series 1390-C (PVC Bell and Spigot Joints), Uni-Flange Series 1500 (PVC Pipe - MJ Fittings)
- d. STARGRIP Series 3600 (PVC Pipe - MJ Fittings)
- e. AquaGrip Intergral Restraint System for use on the Centurion Fire Hydrants and Mueller RS Valves
- f. SIGMA One-Lok Model SLC

2. For Ductile Iron Pipe -

- a. Megalug 1100 Series (MJ Fittings) All Sizes
- b. Uni-Flange Series 1400 Block Buster Wedge Action Retainer Glands (MJ Fittings) Sizes 4"-24"
- c. Uni-Flange Series 1390-C (Bell and Spigot Joints) Sizes 6"-16"
- d. STARGRIP Series 3000 (MJ Fittings) Sizes 4"-24", STARGRIP Series 3600 (MJ Fittings) Sizes 4"-12"

- e. RomaGrip Sizes 4”-12”
- f. SIGMA One-Lok Model SLD (MJ Fittings) Sizes 4”-36”

R. Markers

1. For All Types of Pipes

- a. 66” Carsonite White Utility Marker Post with two (2) factory applied decals (#CW-112 or #CWV-116, whichever is applicable; and Stock #P-101 decal)
- b. Greenline Markers - Model #'s FLUIWH66 and DSUIWH66 with factory applied decals 159A, 029A or 094A, whichever is applicable in Halifax County Service Authority .

S. Flushing Hydrants

- 1. Gil Industries 2” Aquarius “One-O-One” HH (Chesterfield Type)
- 2. Kupferle 2” Main Guard Model #78 (Chesterfield Type)

T. Double Check and Double Detector Check Devices (U.L. classified or F.M. Approved, AWWA compliant and ASSE listed 1015 for DC’s and 1048 for DDC’s)

Manufacturer	Model #'s	Size
Ames Co., Inc.	2000SS	4” - 10”
	2000DCA	4” - 8”
	2000SE	8”
	3000SS	4” - 10”
	3000DCDA	4” - 10”
	3000SE	8”
	200A Colt Series	2½” - 10”
	300A Colt Series	2½” - 10”
Cla-val Co.	D	2” - 10”
	16DDC	3” - 10”
Conbraco Industries, Inc.	40-10A	4”
	4060A02	4”
	4060C02	6”
	40-10C	6”
	4010E02	8”
	4010G02	10”
	4S100	2½” - 6”
	40100	2½” - 10”
	Febco 805 YD	3” - 10”
	806 YD	3” - 10”
	850	2½” - 8”

Manufacturer	Model #'s	Size
Conbraco Industries, Inc(cont.)	856	2½" - 8"
	870 (V)	2½" - 10"
	876 (V)	2½" - 10"
Hersey Products	DDC11	3" - 10"
	No. 2	3" - 10"
	FDC	¾" - 2"
	HDC	¾" - 2"
Watts Regulator Co.	700	3" - 4"
	709	3" - 10"
	709DCDA	3" - 10"
	770DCA	4" - 10"
	770DCDA	4" - 10"
	007	½" - 3"
	007DCDA	2" - 3"
Zurn Industries, Inc(Wilkins)	550	3" - 6"
	MX-550	6" - 10"
	MX-DCDA	6" - 10"
	350	2½" - 6"
	350DA	4" - 6"
	450	4" - 6"
	450DA	4" - 6"
	950	2½" - 10"
	950 LF	¾" - 4"
	950 DA	2½" - 10"
	950 XL	¾" - 2"

U. Reduced-Pressure Principle Zone Devices (U.L. classified or F.M. approved, AWWA compliant and ASSE listed 1013)

Manufacturer	Model #'s	Size
Ames	4000 RP	4" - 10"
	4000 SS	3" - 10"
Cla-val Co.	RP-	2 ¾" - 1 ½"
Conbraco Industries, Inc.	40-200	3"
	40-20A	4"
	40-20C	6"
	4020E02	8"
	4020G02	10"
	40200	2½" - 10"
Febco	6C-M	3" - 10"
	FRPII	¾" - 1½"
	825 D & YD	3" - 10"
	860	2½" - 8"
	880 (V)	2½" - 10"
Hershey Products, Inc.	6	4" - 10"
	6C	4" - 10"
Watts Regulator Co.	900	3" - 6"
	909	3" - 10"
	009RP	3"
Zurn Industries, Inc. (Wilkins)	375	2½" - 6"
	375DA	4" - 6"
	475	4" - 6"
	475V	4" - 6"
	975	2½" - 10"
	975DA	2½" - 10"

V. Casing Spacers

- 1. Cascade
- 2. Advance Model SSI
- 3. PSI Model No. C8G-2, Model No. C12G-2
- 4. Power Seal Model No. 4810

W. Lubricants

- 1. Blue Lube
- 2. Slikstyx (new product formulation only)

X. Water Sampling Stations

- 1. GIL # EH101

SECTION 2: SANITARY SEWER SYSTEM

A. Pipes

1. Concrete
 - a. Circular Reinforced (ASTM C76)
2. PVC Sanitary Sewer Pipe SDR35 (ASTM D3034 6" - 15")
3. PVC Sanitary Sewer Pipe Envrio-Tite SDR 35, (ASTM F1760 6"-15")
4. PVC Sanitary Sewer Pipe SDR 35, (ASTM F679, 18"-48"), T1 Wall Thickness
5. Perma Loc (21"-36") Series 46 with minimum wall thickness of .17"
6. Ultra Rib (21"-36") with minimum wall thickness of .17"
7. Ductile Iron Pipe Class 52 Minimum or higher classification depending upon design consideration.
(Push-On and Mechanical Joint) (6", 8", 10", 12", 16", 20", 24", 30" & 36")
8. Carlon Vylon H.C. - a.k.a. Lamson Pipe (21"-48") with minimum wall thickness of .17"
9. Ultra-Corr PVC Pipe (24"-36") with minimum wall thickness of .17"

B. Manholes, Precast Concrete (ASTM C478)

1. Hanson Pipe & Products
2. Americast
3. Concrete Specialties, Inc.

C. Frames and Covers

1. Manhole
 - a. Street Type (MH-1-S)
 - 1) Neenah Foundry
 - 2) Capitol Foundry
 - 3) Sigma Corporation
 - 4) East Jordan Iron Works
 - 5) FasTech
 - b. Watertight
 - 1) Capitol MH 1-S/WT
 - 2) East Jordan Iron Works
 - 3) FasTech

D. Fittings (Gasketed)

1. Concrete
 - a. Circular Reinforced (ASTM C76)
 - 1) Hanson Pipe & Products
 - b. Kor-N-Tee
 - c. Inserta Tee

5. American Step Company Model #ML-10 (Standard Grade)

I. Stoppers (Plugs)

1. For PVC Sanitary Sewer Pipe (with wing nuts and ears)
 - a. Certain-Teed Products Corporation
 - b. Cherne

2. For D.I. Pipe (Slip Joint Plug)
 - a. Griffin Pipe Products
 - b. Tyler
 - c. Union Foundry
 - d. Harrington Corporation (HARCO)
 - e. Standard International
 - f. Trinity Valley
 - g. American Cast Iron
 - h. U. S. Pipe and Foundry
 - i. Cherne

J. Valves

1. Sewage Air/Vacuum Release Valves (Note: Engineer must design project using the appropriate valve.)
 - a. Vent-O-Mat Series RGX or RGSb – “Anti-Surge”

2. Plug Valves
 - a. DeZurik Series 100 [Figure 118] -(Non-Lubricated Eccentric)
 - b. Val-Matic Series 5900 or 5800 Cam-Centric
 - c. Milliken-Millcentric (Eccentric Plug Valve)
 - d. Homestead Eccentric Plug Valve Series 120
 - e. Clow Eccentric Plug Valve (3”-24”)

K. Manhole Adjusting Rings

1. Concrete Reinforced
2. LadTech H.D.P.E.

SECTION 4: MATERIALS SPECIFICATIONS

All products must comply with the Materials Specifications as referenced in Part IV herein, and the Standard Drawings as reflected in the HCSA Director of Operations General Specifications and Standard Drawings Manual. All references to ASTM, AWWA, and other standards shall include latest revisions. In addition, all products must have the approval of the State Health Department prior to the submittal to the Halifax County Service Authority for consideration.

A. WATER SYSTEMS

1. Water Pipe:

- a. Ductile iron pipe shall meet the requirements of AWWA C151. Pipe shall be thickness Class 51. Pipe shall have cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA Standard C104. Thickness class shall meet the requirements of AWWA C150. Minimum wall thickness for pipe shall be as follows: 6"-0.28", 8"-0.30", 12"-0.34", 16"-0.37", 20"-0.39", 24"-0.41", 30"-0.47". A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked.
- b. Pipe fittings shall meet the requirements of AWWA C110 (ductile iron or cast iron) or AWWA C153 (ductile iron compact). All fittings shall be Pressure Class 250. Fittings shall have a cement-mortar lining and a bituminous seal coating or a 6-8 mil (nominal thickness) fusion bond epoxy lining/coating in compliance with AWWA C550.
- c. Pipe and fittings shall have either mechanical joint or push-on joint, both conforming to the requirements of AWWA C111. Bolts shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.
- d. Polyvinyl chloride pipe (PVC) 6", 8", and 12" in size shall conform to the requirements of AWWA Specification C-900, with gasket joints, DR-18 Class 150 with iron pipe O.D. Fittings shall be ductile iron or cast iron, Pressure Class 250, with mechanical joints. Additional criteria as set forth by the Halifax County Service Authority is outlined in Section 4.C.1. entitled "Supplemental Specifications - Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems".
- e. Prestressed concrete cylinder pipe with rubber and steel joint shall conform to AWWA Specification C-301. All fittings and pipes shall be cement-lined and emulsion treated.
- f. Gaskets - Gaskets for mechanical and push-on joints shall meet the latest AWWA Specifications. Hemp or jute shall not be used. Gaskets for 8" I.D. pipe and smaller shall be 1/16" thick and gaskets for installation on larger size pipe shall be 3/32" thick.
- g. Flange Bolts and Nuts - Flange bolts shall be of the length required for various connections. Bolts shall be of steel and have rough square heads made to American Standard rough dimensions and shall be chamfered and trimmed. Bolts and nuts shall be threaded in accordance with American Standard ASA B1.1-1935 coarse thread series, Class 2 fit.
- h. Tracing wire shall be 14 gauge copper wire and used with all PVC pipe.

2. Valves:

- a. Resilient Seated Gate Valves
 - 1) All resilient gate valves shall fully comply with AWWA C-509 (3"-12") or C-515 (4"-12"), latest revision.
 - 2) All valves shall be manually operated non-rising stem, equipped with operating nut, for installation in a vertical position, unless otherwise specified, and the valve body shall be ductile iron or high strength cast iron with reinforced flanges.
 - 3) All iron surfaces, internal and external must be coated with a minimum 8 mils thickness of hand applied epoxy or 3-5 mils thickness fusion bonded epoxy.
 - 4) The valve stem shall have an independent stem nut (not rigidly attached to the gate) which allows the gate to flex without stressing the stem.

- 5) All valves shall have either a bronze stem collar bushing with two O-rings above the stem or a stem collar with one O-ring below and one O-ring above the stem collar.
- 6) Seating shall use compression closure. The gate shall be of a true bi-directional, mirror image design.
- 7) Valves shall have a smooth bottom design.
- 8) Valves shall have a port in the bottom of the gate to allow purging of the gate.
- 9) All valves shall open left and have end connections of Mechanical Joint, or as specified by the HCSA Director of Operations.
- 10) All castings shall be clean and sound without defects. The castings shall be clean and perfect without blow or sand holes or defects of any kind. No plugging, welding or repairing of cosmetic defects will be allowed.
- 11) Valves 3" through 12" must have a minimum 200 psi working and 400 psi test pressure.
- 12) If the standard valve provided by a Manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each valve must be permanently marked to indicate the option or options that have been provided. The method of marking valves to indicate that options are included must be approved by the Utilities Superintendent.

b. Resilient Seated Wedge Tapping Valves:

- 1) Tapping valves shall meet above specifications as referenced in a) except, the body seat rings shall have a clear inside opening sufficient to pass a cutter of full diameter and equal to the nominal size of the valve. The outlet end shall be suitable for use with the type of pipe specified, either M.J. or Hub end.
- 2) Tapping valves will be suitable for use with all approved manufactured tapping sleeves without modification.

3. Valve Key Extensions:

- a. The extension shall be one and one half inches (1½") solid core steel with the upper operating nut and bottom coupling welded to the stem.
- b. The 2" square operating nut on top shall be welded to form a complete box with no openings.
- c. 2½" square socket section on bottom shall be tapped on 4 sides for minimum 5/16" N.C. socket head set screws and screws shall be provided.
- d. Valve extensions shall be coated with oil-based enamel or other rust preventative coating.
- e. The operating nut of the valve shall be drilled on opposite sides to allow insertion of the setscrews.
- f. A four and one half inch (4½") diameter steel plate, ¼" thick rock shield, shall be welded to the stem two inches (2") below the bottom of the top operating nut.

4. Double Check Assembly

- a. Valve Pit:
 - 1) Valve pits shall be of adequate size and readily accessible for inspection, testing, maintenance, and removal of equipment contained therein. They shall be constructed and arranged to properly protect the installed equipment from movement of earth, freezing, and accumulation of water. Poured-in-place or precast concrete, with reinforcement, are appropriate materials for construction of valve pits. Pits constructed of block material are not acceptable. Precast concrete vaults will be as reflected on the standard drawings.

- 2) The vault shall be watertight. The vault shall be coated on the outside face with a mastic or bituminous coating to prevent infiltration.
 - 3) The vault will contain positive drainage. A sump with gravity flow is required if water table problem does not exist. Where water table problem exists, a sump pump is required.
 - 4) Pipe penetrations shall be sealed with "Link-seals", a waterproof mastic coating or equal. A clearance of 1"-3" shall be provided around the pipe where the fire line enters and exists the pit.
 - 5) Vaults greater than 3.0' in depth will have some type of ladder provided for ingress and egress.
 - 6) The entrance hatch to the vault will be a JD-2AL 4'-0" x 4'-0" Bilco door, or as manufactured by Elite Fire Protection, Inc., Hydro Tap Service, Inc.; or approved equal.
- b. Valving:
- 1) The double check valve assembly shall be a Watts No. 709 or equal surrounded by an OS&Y gate valve on both the inlet and outlet side of the assembly.
 - 2) The Fire Department connection may or may not be located in the vault. The use of post indicating valves, location of the Fire Department connection, and other related fire questions will be addressed by the Fire Department.
 - 3) Pipe stands such as poured concrete or fabricated metal shall be provided to support the entire assembly. Metal Pipe stands shall be galvanized or be coated with an acceptable paint to prevent rust. Concrete block or brick is not an acceptable support material.

5. Fire Hydrants:

- a. Fire hydrants shall be manufactured in full compliance with this specification and shall also comply with the American Water Works Association Fire Hydrant Specification C-502, latest revision and the following:
- 1) Type: Compression - Dry Standpipe: Valve shall open against and close with the pressure. The design shall be such that all internal operating parts can be removed through the standpipe and main valve rod extended without excavating.
 - 2) Size: Internal valve diameter shall be a minimum 4½".
 - 3) Inlet Size and Type: 6" mechanical joint end with accessories.
 - 4) Hose Nozzles: Each hydrant shall be equipped with two 2½" I.D. hose nozzles with National Standard threads, one quarter turn bayonet lock or threaded in with O-ring seal and suitable locking arrangement.
 - 5) Steamer Nozzle: Each hydrant shall be equipped with one 4½" Steamer Nozzle having National Standard Threads, one quarter turn bayonet lock, or threaded in with O-ring seal and suitable locking arrangement.
 - 6) Direction of Open: Left, counter-clockwise.
 - 7) Size and Shape of Operating Nut and Cap Nuts: to be 1½" point to flat pentagon. Each hydrant shall be equipped with a weather cap or weather seal.
 - 8) Seal Plate: The hydrant shall be so constructed that a moisture-proof lubricant chamber is provided which encloses the operating threads, thereby automatically lubricating the threads each time the hydrant is operated. The lubricant chamber shall be enclosed with at least three O-rings. The two lower O-rings will serve as pressure seals; the third O-ring will serve as a combined dirt and moisture seal to prevent foreign matter from entering the lubricant chamber. The hydrant shall be equipped with either an anti-friction washer or bronze bushing to reduce operating torque. The bonnet will be secured to the hydrant using bolts and nuts.

- 9) Standpipe - Groundline Safety Construction: The standpipe sections shall be connected at the groundline by a two part, bolted safety flange or breakable lugs. The main valve rod sections shall be connected at the groundline by a frangible coupling. The standpipe and groundline safety construction shall be such that the hydrant nozzles can be rotated to any desired position without disassembling and removing the top operating components and the top section of the standpipe. The minimum inside diameter of the standpipe shall be 6".
- 10) Main Valve, Rod Assembly: The main valve rod assembly shall be so constructed to allow removal of all operating parts through the standpipe regardless of depth of bury, using a removal wrench which does not extend below the groundline of the hydrant. The main valve seat ring shall be bronze and its assembly into the hydrant shall involve bronze to bronze thread engagement, and the valve assembly pressure seals shall be obtained without the employment of torque compressed gaskets. The design of the main valve rod shall be such that the operating threads at the top of the rod and the valve assembly threads at the bottom of the rod are isolated from contact with water in the standpipe or in the hydrant inlet shoe.
- 11) Drain Valve: The operation of the drain mechanism shall be correlated with the operation of the main valve and shall involve a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2½ turns open and the drainage channel in the bronze valve seat ring shall connect to two or more outlet drain ports. No springs may be employed in the hydrant valve or drain valve mechanism.
- 12) Depth of Bury: Hydrant shall be suitable for installation in trenches 4½' deep, unless otherwise specified.
- 13) Painting Instruction: Two prime coats and one aluminum finish coat shall be used, unless otherwise specified. Exposed area of fire hydrant shall receive one field coat of aluminum after installation. The wetted surface of the hydrant shoe shall be epoxy coated to prevent corrosion of the waterway.
- 14) Pressure Rating: Test pressure 300 psi, working pressure 150 psi.

6. Check Valves:

Check valves shall be of the horizontal swing type; iron body bronze mounted, equipped with weighted lever or spring as specified or shown on the plans.

7. Water Service Assembly for 5/8" Water Meters:

All materials for the installation of water services shall be as follows or approved equal:

- a. Water meter boxes (for use with all 5/8" and 1" meters) shall be as manufactured by Mid-States Plastics, Inc. for high density polyethylene boxes or approved equal. The meter box shall be 24" high with a cover and reader lid. The box shall have a 1¼" anti-settling flange on the bottom edge. It shall be made of hi-density polyethylene plastic of one piece, molded construction for durability with dimensions as shown on the standard drawings of this document. The box must have solid walls with an average thickness of no less than .550" and have been tested to withstand a 15,000 lb. vertical load freestanding. The inside color shall be white to reflect light for ease of meter reading and the outside shall be black to protect against UV degradation during prolonged exposure to sunlight i.e. during outside storage. All edges shall be clean and smooth for safety during handling. The meter box cover shall be one-piece, with reader lid made of cast iron for 5/8" and ductile iron for 1" boxes. One piece cover designed to fit the corresponding opening in the meter box frame and have a square treadplate surface design. "WATER METER" shall be on the reader lid. The lid dimensions shall be: for 5/8" box – 15.437" x 10.125" with a minimum weight of 17 lbs. and for 1" box – 11.125" x 18" with a minimum weight of 21.5 lbs. It shall have a minimum thickness of .25", with tensile strength 65,000 psi, yield strength 45,000 psi. The castings shall be made of ductile iron and conform to ASTM A536-80.

- b. Water meter boxes used in traveled areas shall be made of cast iron as manufactured by Capitol Foundry or approved equal. Material shall consist of gray iron per ASTM A-48 (latest revision) Class 30.
- c. Meter yokes/setters shall be ¾" for 5/8" meter with saddle nut. Inlet and outlet sides of meter setter shall be equipped with ¾" flare or compression copper coupling.
- d. ¾" Corporation stop with corporation cock thread inlet shall be those as specified in the approved materials list shown in Section 1 entitled Water System.
- e. Pipe shall be ¾" type "K" copper domestic manufactured.
- f. Tail piece on yoke shall be ¾" type "K" copper and be long enough to extend 18" outside of meter box.
- g. Service Saddles:
 - 1) All saddle castings must be ductile iron and meet the requirements of ASTM A-536-80, protected with epoxy or nylon coating.
 - 2) All saddles must have a minimum of two (2) 1 ½" wide (including bolts) stainless steel straps type 304 (18-8) where welds are stabilized for resistance to corrosion. Exception: Ford FS202 which has two (2) bolts and a single strap with a minimum width of 3 ¼".
 - 3) Gaskets must be made of Virgin NBR compound.
 - 4) Service saddles are required on all taps made onto PVC pipe.

9. Water Service Setter for 1", 1 ½" and 2" Water Meters:

All Materials for the installation of water services shall be as follows or approved equal:

- a. The water meter box and cover (for use with all 1"meters) shall be as manufactured by Mid-States Plastics, Inc. for high density polyethylene boxes or approved equal. The boxes shall conform to the specifications as outlined under the "Water Meter Assembly for 5/8" Water Meters" and the dimensions as specified in the standard detail shown in this document.
- b. **General:** All 1 ½" and 2" meter setters shall be constructed of seamless threaded red brass pipe, standard Type K hard copper tube (per ASTM B-88-62,) high quality brass (per AWWA C-800,) and leadless solder, and provide horizontal female pipe threads on both front and rear connections. Setters must include a valued bypass for meter maintenance, except for 1" irrigation and residential meters. Meter setters for 1" meters shall be 1" x 12" riser meter yokes with copper tube flare nut or compression on the inlet and outlet sides. Meter setters for domestic use at businesses, Doctor or Dentist offices etc., shall be equipped with a valued bypass for meter maintenance. Setters for residential or irrigation uses etc., shall NOT be equipped with a bypass.
- c. **Bypass:** Meter setters shall have an appropriately sized bypass line with an inverted key or ball type stop threaded directly into the inlet bypass tee fitting. This bypass valve shall have a solid tee head and be either lock wing type or provide a bracket or other device to lock this valve in the "off" position upon installation. If copper tube is used for the bypass line, the compression connection for the copper side of the bypass valve must be as produced by the following manufacturers:
 - Mueller Co., "110" compression connection for copper pipe; or
 - Ford Meter Box Co., "Pack Joint" connection for copper pipe; or
 - A. Y. McDonald, "T" compression connection for copper pipe.
 Otherwise, a tee head inverted plug or ball type bypass valve is required with a threaded connection. Both of the bypass tee fittings, (inlet and outlet,) shall have brace pipe eyelets cast within them to stabilize setter upon installation, if necessary.

d. **Angle Valves:** Flanged, inverted key or ball-type "tee head" angle valves are required on both meter connections, and will include lock wings and meter support bracket to aid in meter installation. Pack Joint or Compression connections are NOT allowed on the vertical riser pipe; these connections must be threaded or soldered copper. Valves shall be double drilled, (2" size only,) to accommodate both 1 ½" and 2" meters. Angle or ball valves shall provide a stop or check to limit movement of tee head at 90° Maximum, (from fully open to completely off.) Arrows cast within the inlet valve shall indicate direction of flow while in service.

e. **Dimensions:** Meter setters shall accommodate the following meter dimensions:

1" Male x male pipe thread laying length: 10 ¾"± 1/16", 1 ½" Flanged meter laying length: 13", plus gaskets

2" Flanged meter laying length: 17", plus gaskets The rise or height of meter setter, measured vertically from center line of inlet pipe thread to center line of meter flange bolt shall be:

1" Meter setter, maximum height of 12"

1 ½" Meter setter, maximum height of 8 ½"

2" Meter setter, maximum height of 9 ½"

The copper used on the bypass and vertical riser pipe, if so equipped,) shall be Type K and comply with ASTM B-88-62, which states outside diameters as shown here:

¾" Nominal pipe size, .875" outside diameter, .065" wall

1" Nominal pipe size, 1.13" outside diameter, .065" wall

1 ¼" Nominal pipe size, 1.38" outside diameter, .065" wall

1 ½" Nominal size pipe, 1.63" outside diameter, .072" wall

2" Nominal size pipe, 2.13" outside diameter, .083" wall

The bypass assembly shall be sized as follows:

1" Meter setter requires minimum ¾"

1 ½" Meter setter requires minimum 1 ¼" bypass pipe & valve

2" Meter setter requires minimum 1 ¼" bypass pipe & valve

10. Valve Boxes: All underground valves shall be installed in approved cast iron valve boxes, having suitable base and shaft sections and covers to protect the valve and permit easy access and operation. Box assemblies shall have slip adjustment (two-piece sliding type adjustable valve box).

11. Air Release Valves: All valves shall be designed in accordance with the following standard and/or by the Engineer as required.

a. Type 1: Small orifice valves shall be either of the kinetic design type, employing only one moving part, a stainless steel float ball or of the stainless steel float and lever type. It shall maintain closed position to prevent the loss of water by positive seating of the float ball against a smoothly ground contact surface of the exhaust orifice. It shall automatically provide for the escape of air to atmosphere without the loss of water when the float ball moves away from the orifice seat. The body of the valve shall be cast iron and shall be coated to withstand moist environment. Valve shall have a minimum of a one-inch N.P.T. inlet for 6", 8" and 12" pipe sizes and a two-inch N.P.T. inlet for pipes 16" and larger; and shall have a minimum of a 3/32" outlet orifice for 6", 8" and 12" pipe sizes and a 3/16" outlet orifice with 16" and larger pipes. Valve shall be suitable for 150 psi working pressure.

- b. Type 2: Shall be a combination, dual unit valve, combining one (1) small and one (1) large unit, both employing the kinetic operating principal or of the stainless steel and lever type. For the Kinetic type, the only moving parts shall be two (2) stainless steel balls (one for each unit) which will remain in the respective throat areas when discharging air without blowing shut or collapsing the float ball(s). In the closed position, resulting from water filled line, the valve shall prevent leakage. The large orifice seat shall be of composition material and replaceable. The body of the valve shall be cast iron and shall be coated to withstand moist environment. Valve size shall be six (6) inch with $\frac{3}{8}$ " orifice for small unit and shall be suitable for 150 psi working pressure.

13. Manholes:

Gate Valve Manhole and Air Release Manhole: Shall be concrete, ASTM C-478 and diameters shall be as shown on plans and meets the specifications as described in Part V, Section B of this document entitled "Sanitary Sewer Systems".

14. Joint Restraint Systems:

When gray cast or ductile iron fittings are used with AWWA C900 PVC pipe in sizes up to 12 inches or Ductile Iron Pipe in sizes up to 48 inches and the engineer has determined thrust blocking will not provide adequate thrust restraint, an approved Mechanical Joint Restraint System can be installed. Under normal conditions, the approved method of restraint shall be concrete thrust blocking per Halifax County Service Authority standard drawings for dead-ends (cul-de-sacs, etc.) ; and horizontal bends, reducers, tees and crosses; and a Mechanical Joint Restraint System for vertical bends, all valves, and carrier pipe thru casings. Mechanical Joint Restraint Systems and Concrete Thrust Blocks must be used in poor soil conditions and in the Halifax County Service Authority's Public Water System.

All valves should be as close to a tee as possible and restrained to that tee, using approved mechanical joint restrainers. Where the valve cannot be installed and restrained at a tee, the valve (12" and larger) must be restrained using an approved Mechanical Joint Restraint System. However, where valves are installed on permanent dead-end lines, only the feed side needs to be mechanically restrained. When Mechanical Joint Restraint Systems are required due to specific applications), special design considerations, or poor soil conditions the engineer shall provide the calculations used in determining the required length of pipe on either side of the fitting to be restrained. Also, the engineer shall provide special plan details for each necessary mechanical joint restraint system with a justification for its determined installation over thrust blocking. Mechanical Joint Restraint Systems require that sufficient lengths of pipe in addition to the fittings, be restrained. The standard length of pipe requiring restraint varies from application to application and is designed based on variables such as soil bearing capacity, soil condition, pipe size, pipe material, pressure and fittings.

Where conditions are encountered in the field during construction in which thrust blocks do not provide the required thrust protection, the Developer's and/or Halifax County Service Authority's contractor shall be responsible for insuring that the engineer and those individuals on the Halifax County Service Authority staff responsible for plan review prior to plan approval are contacted to evaluate and/or adjust the design appropriately. The Halifax County Service Authority's Inspector should consult with HCSA Director of Operations personnel if there are any questions about whether field conditions warrant special or additional restraint systems due to unsuitable soil conditions encountered during construction.

All restraint devices must be UL listed and FM approved. Restraints are acceptable for PVC and D.I. pipe under the following conditions:

- a. For PVC Pipe

Where PVC pipe is connected to fittings, mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility and minimal deflection of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. There shall be no dissimilar metals allowed. Dimensions of the gland shall be such that it can be used with all AWWA approved standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153.53/A21.53 of latest revision. The mechanical joint restraint device shall have a working pressure of at least twice the working pressure of the pipe with a minimum of 150 psi.

Twist-off nuts shall be used to insure proper actuating of the restraining devices. All bell and spigot end joints within this length shall be restrained with a clamping ring and an additional ring designed to fit behind the bell end of the PVC pipe. The rings shall be connected with T-Head Bolts or Rods. All clamping rings shall incorporate serrations on the inside surface to provide positive restraint on the outside surface of the pipe and shall provide full support around the circumference of the pipe to maintain roundness. Restraining devices shall have a pressure rating equal to or greater than the PVC pipe, and shall be capable of withstanding a minimum test pressure of 2 times the pressure rating of the device. Restraining devices and T-bolts shall be manufactured from high strength ductile iron, ASTM A536, Grade 65-45-12. Clamping bolts and nuts shall be manufactured from completely corrosion resistant COR-TEN STEEL.

b. For Ductile Iron Pipe

Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility and minimal deflection of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. Twist-off nuts shall be used to insure proper actuating of the restraining devices. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. There shall be no dissimilar metals allowed. Dimensions of the gland shall be such that it can be used with all AWWA approved standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153.53/A21.53 of latest revision. The mechanical joint restraint device shall have a working pressure of at least twice the working pressure of the pipe. All bell and spigot end joints within this length shall be restrained with a clamping ring and an additional ring designed to fit behind the bell end of the DI pipe. The rings shall be connected with T-Head Bolts or Rods. Rods must be protected from corrosion either by rod material or coating.

15. Markers:

- a. All markers shall have one of the applicable decal description to reflect the following:
 - 1) Upper decal, white and blue 2 7/8" x 11" standard, worded "CAUTION WATER PIPELINE".
or
 - 2) Upper decal, white and blue 2 7/8" x 11" standard, worded "CAUTION WATER VALVE".
 - b. In addition, the lower decal shall contain the following:
 - 1) Lower decal, white and blue 2 7/8" x 1 3/4" standard, worded "MISS UTILITY - 1-800-552-7001, Halifax County Service Authority".
- c. Total height shall be 66".
- d. Basic marker shall be white in color.

16. Flushing Hydrants - (Chesterfield Model): Flushing hydrants shall be manufactured in full compliance with the following specifications and shall also comply with AWWA's latest specifications on flushing hydrants:

- a. The flushing hydrant shall offer a 360-degree directional discharge and shall have easy above ground accessibility at all times. It shall be capable of being locked and shall be freeze-proof. It shall be equipped with National Standard fire thread connections and a breakaway union for high traffic areas.
- b. It shall be of size 2".
- c. The hydrant barrel shall be 2" iron pipe. The exterior shall be painted with approved coating for durability. The overall length of hydrants can vary according to the depth of water systems.
- d. The barrel and the standpipe shall be joined with a breakable malleable union. A brass hose connection, 2 1/2" NSFT with attached cap and chain, shall be provided for convenience in flushing.

- e. The body valve shall have bronze body with automatic weep, such that when the valve is in OFF position the hydrant barrel shall automatically drain. The valve stem shall be above ground and shall be lockable to prevent tampering. Its operating device shall be of key type design, with permanent attachment to the valve stem.

17. Cast Couplings: Center Sleeve: Made of ductile iron, Spec ASTM-A536, and coated with an enamel shop coat, sized to accommodate all AWWA pipes of the same nominal size. The center sleeve length of long barrel (sleeve)_couplings shall be a minimum of 10". End Ring: Made of ductile iron Spec ASTM-A536, and color coded with an enamel shop coat to easily identify its use on various types of pipe. Gaskets: SBR rubber compound, Grade 30 per Spec ASTM D-2000 for normal water service and an extended shelf life. Bolts: High strength low alloy steel bolts with heavy hex nuts, per AWWA C-111.

18. Casing Spacers: Casing Spacers shall be bolt on style with a shell made in two sections of heavy T-304 stainless steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090" thick with 85-90 durometer or neoprene rubber. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer (UHMW) or glass reinforced plaster. Runners shall be supported by risers made of heavy T-304 stainless steel or 10 gauge welded steel. The supports shall be mig welded to the shell and all welds shall be passivated or 3/8" diameter stud welded to band and locked with a locking fastener. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least .75" from the casing pipe wall at all times.

B. SANITARY SEWER SYSTEMS

1. Sewer Pipe and Fittings:

- a. Reinforced concrete pipe, fittings and specials shall meet requirements of ASTM C76 minimum Class II unless stronger pipe is required by the plans and specifications. Pipe ends shall have O-ring gasket groove provided during manufacturing process. Rubber gaskets and joints of concrete pipe shall meet requirements of ASTM C361. Pipe and joints shall be tested in accordance with Section 11 of ASTM C76 and ASTM C443. If requested by Department of Public Works or Engineer, test reports shall be submitted to the Engineer.
- b. Polyvinyl chloride (PVC) nonpressure pipe (6"-15") and fittings shall meet requirements of ASTM D3034 Type PSM SDR-35 or ASTM F1760 SDR-35 with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the Halifax County Service Authority for plastic pipes as shown in the Halifax County Service Authority's Standard Drawings. Additional criteria as set forth by the Halifax County Service Authority is outlined in Section 4.C.1. entitled "Supplemental Specifications - Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems".
- c. Polyvinyl Chloride (PVC) non-pressure pipe (18"-48") and fittings shall meet requirements of ASTM F679, Table I Type SDR-35 for large diameter solid wall PVC pipe with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the Halifax County Service Authority for plastic pipes as shown in the Halifax County Service Authority's Standard Drawings.
- d. Perma-Loc (Series 46) PVC nonpressure sewer pipe (21"-36") and fittings shall meet requirements of ASTM F794 specification for large diameter ribbed sewer pipe with elastometric gasket joints meeting requirements of ASTM D3212 and fittings based on controlled inside diameter. Bedding shall be as required by the Halifax County Service Authority for plastic pipes as shown in the Halifax County Service Authority's Standard Drawings.
- e. Ultra-Rib PVC Gravity (non-pressure) sewer pipe (21"-36") shall meet requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the Halifax County Service Authority for plastic pipes as shown in the Halifax County Service Authority's Standard Drawings.
- f. Carlon Vylon H.C. PVC Gravity (non-pressure) sewer pipe (21"-48") shall meet requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the Halifax County Service Authority for plastic pipes as shown in the Halifax County Service Authority's Standard Drawings.
- g. Ultra-Corr PVC sewer pipe (24"-36") shall be seamless profile wall and meet the requirements of ASTM F794 and fittings shall meet the requirements of ASTM 3034-35 PVC sewer pipe with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the Halifax County Service Authority for plastic pipes as shown in the Halifax County Service Authority's Standard Drawings. Pipe shall have a smooth interior with a corrugated cross-sectional rib exterior. Exterior corrugations shall be perpendicular to the axis of the pipe to allow placement of the sealing gasket without field marking, beveling, sealing channels, gluing, welding, additional cutting or machining. The pipe stiffness shall be a minimum of 50 psi when tested at 5% deflection in accordance with D2412. Pipe shall be green in color.
- h. Ductile iron pipe shall meet requirements of AWWA C151. Pipe shall be thickness Class 52. Pipe shall have cement-mortar lining and a bituminous seal coat. Thickness classes shall meet requirement of AWWA C150.
- i. Cast iron fittings shall meet requirements of AWWA C110. Fittings shall have cement-mortar lining and a bituminous seal coat.
- j. Mechanical joints and jointing materials shall meet requirements of AWWA/ANSI C111/A21.11.
- k. Push-on-joint and rubber gasket shall meet requirements of AWWA C111.
- l. Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings shall meet requirements

of AWWA/ANSI C104/A21.4. Cement mortar lining shall be standard thickness.

- m. Exterior bituminous coating for cast iron fittings and ductile iron pipe shall meet requirements of AWWA/ANSI C106/A21.6 or AWWA/ANSI C151/A21.51 as applicable.

2. Sanitary Sewer Manholes:

- a. Manholes shall be constructed of precast reinforced concrete manhole sections in accordance with requirements of ASTM C478 and as shown on the Standard Drawings.
- b. A maximum of two lift holes per manhole section may be provided.
- c. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket or Press Seal, Inc's Profile RS gasket. Gasket shall comply with requirements of ASTM C361. Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.
- d. Provide flexible pipe connections to manholes for pipes 21 inches in diameter and smaller in size. Materials shall consist of EPDM and elastomers designed to be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming to ASTM C443 and ASTM C923 and all stainless steel elements of the connector shall be totally non-magnetic Series 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break-away torque wrench available from the precast manhole supplier, and set for 60 - 70 inch/lbs. Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacements. Connectors not suitable for field replacement are unacceptable. The assembled connectors shall allow at least an 11° angular deflection of the pipe and at least one inch of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used. Connectors shall be Kor-N-Seal as manufactured by National Pollution Control Systems, Inc. or approved equal.
- e. Manhole steps shall be corrosion-resistant and shall be one-half inch grade 60 steel reinforcing rod encapsulated in a copolymer polypropylene. The steps shall conform with ASTM C478 paragraph 11 and to the dimensions shown on the Standard Drawings.
- f. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall not be coated. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown on the Standard Drawings.
- g. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" type 430.
- h. Sealant for flexible pipe connections shall be a two-component polysulfide sealant similar to Sika "Sikaflex" type 412 with primer type 419.
- i. All manholes shall be watertight.

3. Sewage Air/Vacuum Break Valves without Bias Mechanism -

All valves shall be designed in accordance with the following standard and/or by the Engineer as required: The Sewage Air Release and Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in H.D.P.E. – stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat. The valve shall have an integral “Anti-Surge” Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to less than 1.5x valve rated working pressure. The intake orifice area shall be equal to the nominal size of the valve i.e., a 6” valve shall have a 6” intake orifice. Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile rubber ‘O’ ring housed in a dovetail groove circumferentially surrounding the orifice. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented. The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure. Connection to the valve inlet shall be facilitated

by flanged ends conforming to ANSI B16.1 Class 125 or Class 250 Standards. Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard. **Nuts, washers, or jointing gaskets shall be excluded.**

4. Sewage Air/Vacuum Break Release Valves with Bias Mechanism

All valves shall be designed in accordance with the following standard and/or by the Engineer as required: The Sewage Air Release and Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in H.D.P.E. – stainless steel nozzle and woven dirt inhibitor screen, nitrile/E.P.D.M. rubber seals and natural/E.P.D.M. rubber seat. The valve shall have an integral 'Anti-Surge' Orifice mechanism which shall operate automatically to limit surge pressures or shock induced by liquid oscillation and/or rapid air/gas discharge to less than 1.5x valve rated working pressure. The intake orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice. Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile/E.P.D.M. rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural/E.P.D.M. rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented. The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure. Connection to the valve inlet shall be facilitated by flanged ends conforming to ANSI B16.1 Class 125 and Class 250 and ANSI B16.5 Class 150 and Class 300 Standards. Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard. **Nuts, washers, or jointing gaskets shall be excluded.**

5. Sewage Plug Valves

- a. All plug valves shall be of the non-lubricated, eccentric type with resilient faced plug and round ports of no less than 90%, or rectangular ports of no less than 80%, of the connecting pipe area, except valves of 24" or larger size shall have port areas of no less than 70% of the connecting pipe area.
- b. Valves shall be for buried underground service as well as plant service and shall be rated for 175 psi up to 12" and 150 psi for sizes 14" and larger. Drop-tight shut off shall be provided at full rated working pressure in the standard flow direction and 50 psi in the reverse direction, except when full-rated sealing is required in both directions.
- c. Valves 6" and larger shall be equipped with geared actuators with a 2" square operating nut. Handwheel and power actuated valves shall also include a 2" square operating nut for emergency operation. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.
- d. Valves shall open left (counterclockwise) and shall have mechanical joint end connections, or as specified by the HCSA Director of Operations.
- e. Valve bodies and all other cast iron parts shall conform in all respects to the American Society for Testing Materials' Standard Specifications of Gray Iron Castings, ASTM Specification Designation A-126, Class B. The castings shall be clean and perfect without blow or sand holes or defects of any kind. No plugging or stopping of holes will be allowed. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125 or mechanical joint in accordance with AWWA Standard C-111 or ANSI A21.11. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets and glands).

- f. Valve bodies shall be furnished with a raised seat surface completely covered with 90% pure nickel to insure that the resilient plug face contacts only nickel, or a one-piece 304 stainless steel seat ring threaded to the body. The nickel seat must be welded to the valve body or the body seat ring to produce a metallurgical bond with interpenetration to the base metal with a bond strength equal to or greater than the valve body or seat ring material. The nickel or stainless steel seat must be machined to a finish of not more than 16 micro-inches to achieve minimal friction and wear to the resilient plug face during valve operation. Whether welded or screwed, the valve seat shall be designed to provide uniform contact with the resilient plug face and to prevent the plug face from contacting any cast iron surface. Resilient seats or seats attached to the body by screws or any other method not specified herein are not acceptable. Plated or sprayed nickel seats or epoxy seats are not acceptable.
- g. Valve bodies shall be furnished with an adjustable closed position stop. The seat end and standard flow direction shall be cast onto the valve body.
- h. Resilient faced plug/operating shaft shall be of a one piece design of ASTM A126 Class B cast iron with a seating surface eccentrically offset from the center of the plug shaft, and shall have a precision molded resilient facing of chloroprene (Neoprene), Buna-N (nitrile) or nitrile-butadiene (Hycar). With the valve in the open position, all surfaces of the plug/shaft shall be substantially out of the fluid flow path.
- i. Valve shaft journal bearings shall be sleeve type, sintered, oil impregnated, permanently lubricated, type 316 ASTM A743 grade CF-8M or AISI type 317 L stainless steel, or phenolic backed Teflon. Thrust bearings shall be located in the upper and lower journal areas and shall consist of stainless steel, Teflon, or a combination of those materials. Grit seals shall be provided in the upper and lower journals to prevent abrasive material from entering the bearing and seal areas.
- j. Valve shaft seals shall conform to AWWA Standard C504-87, Section 3.7 and shall be of the bronze cartridge type utilizing O-rings, or the adjustable multiple V-ring type and shall be replaceable without disassembling the valve, while the valve is under system pressure.
- k. Valve interiors and exteriors shall be coated according to AWWA Standard C550-90 with a two-component high build epoxy suitable for potable water service, with interior surfaces receiving 8 -10 mils (dry film thickness) and exterior surfaces receiving 3 - 5 mils (dft) or 8 - 10 mils (dft) hand-applied epoxy coating. For buried or submerged service, 8 -10mils (dft) of asphalt varnish may be substituted for the exterior coating.
- l. Valve testing shall be conducted per AWWA C504-87 Section 5, covering rubber seated butterfly valves. Each valve shall be performance tested per paragraph 5.2 assuring valve operation. Body seat and shell leakage testing is to be conducted on each valve as per paragraphs 5.3 and 5.4. Proof of design testing shall be conducted per paragraph 5.5 and witnessed by a third party inspection agency. Certified copies of this report shall be available upon request.
- m. Eccentric plug valves for wastewater service shall be as approved by the Halifax County Service Authority's HCSA Director of Operations Superintendent
- n. If the standard valve provided by a manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each valve must be permanently marked to indicate the option or options that have been provided. The method of marking valves to indicate that options are included must be approved by the HCSA Director of Operations Superintendent.

C. SUPPLEMENTAL SPECIFICATIONS

1. Additional Criteria for Polyvinyl Chloride Piping for Water and Sanitary Sewer Systems: Effective September 1, 1991, all PVC piping must meet the following criteria:
 - a. Cell Classification for Water Pipe shall be 12454-B.
 - b. Cell Classification for Sewer Pipe shall be 12454-B or 12364-C.
 - c. Water Pipe (C-900) shall meet the specification requirements and have the following certifications from:
 - 1) FM (Factory Mutual)
 - 2) UL (Underwriters Laboratory)
 - 3) NSF (National Sanitation Foundation)
 - d. All pipe (sizes - 16" and smaller) shall be furnished with standard industry color coding:
Water - Blue
Gravity Sewer - Green
Force Main Sewer - Brown
 - e. Manufacturer's Certification of ASTM and AWWA testing requirements will include the following:
 - 1) For Water and Force Main Sewer Pipes (C-900) (4", 6", 8" and 12")
 - a) Each piece has been hydrostatically proof tested to AWWA C-900 Requirements
 - b) Pipe meets all other applicable ASTM & AWWA C-900 Requirements
 - 2) For Gravity Sewer Pipe (SDR 35) (4"-15")
 - a) Pipe meets all ASTM D3034 Requirements
 - b) Pipe meets cell classifications as established by ASTM standards, the Halifax County Service Authority's minimum criteria for plastic pipe, and the certification shall state what the cell classification is.
 - 3) Manufacturer's certification will be signed by an officer of the company and will be furnished to the contractor and/or supplier before pipe is delivered to a project site. Certifications from supplier shall include:
 - a) Halifax County Service Authority Contract Number
 - b) Location - Project Name
 - c) Utilities Contractor Name
 - d) Pipe type class
 - e) Manufacturer's name

APPENDIX

		Page No.
APPENDIX I	Review Procedure for Water And/or Sewer Plans (<i>Developer Projects</i>)	118
APPENDIX II	Design Engineer Submission Checklist for Water & Sewer Projects	119
APPENDIX III	Developer' s Checklist for Utility Projects	120
APPENDIX IV	Site Plan Checklist	122
APPENDIX V	Site Plan Requirements for Water and/or Sewer Main Line Extensions	124
APPENDIX VI	Wastewater Collection System Design Checklist Drawing Requirements	126
APPENDIX VII	Sewage Pumping Station Design Checklist & General Requirements	128
APPENDIX VIII	Water Distribution System Design Checklist Drawing Review	130
APPENDIX IX	Easement Processing Checklist	132
APPENDIX X	Sewer Installation Construction Inspection Checklist	133
APPENDIX XI	Pipeline Rehabilitation Construction Inspection Checklist	135
APPENDIX XII	Construction Checklist for Manholes	138
APPENDIX XIII	Pressure Pipe Installation Construction Inspection Checklist	139
APPENDIX XIV	Standard Procedures for Acceptance of Newly Constructed Pump Stations	142
APPENDIX XV	Procedure for Estimating Customer Water Demand	145
APPENDIX XVI	Sample Letter to Resident - Proposed Engineering and Construction	146
APPENDIX XVII	Information Required for Utilities Contract	147
APPENDIX XVIII	National CAD Standard Layering Format	148

APPENDIX I

Review Procedure for Water And/or Sewer Plans (*Developer Projects*)

Prior to construction of public water and/or sewer facilities and issuance of any building permits, water and/or sewer plans must be submitted to and approved by the Department of Public Works.

- A. It is required for water and sewer projects, that the engineer arrange a meeting with the Director of Operations, 720 Hamilton Blvd., South Boston, Virginia 24592, (434)575-4245, to discuss the approach to be taken to supply water and sewer service. All water and sewer systems must be sized properly and the location designed to provide sewer and water availability to the entire service area. An overall water and sewer plan shall be submitted for development.
- B. The water and sewer plans must be designed by a Professional Engineer in Civil Engineering or Professional Surveyor with a Class B license who is registered by the State of Virginia. The plans must conform to the Halifax County Service Authority's overall water and sewer master plan and the Engineer's Checklist for Water and Sewer Plans (see Appendix).
- C. Prior to approving the water and/or sewer plans, an erosion and sediment control plan for the water and/or sanitary sewer installations must be approved by the Halifax County Soil & Water Conservation Board.
- D. The engineer shall coordinate the location of all proposed water and/or sewer lines within all existing and proposed road rights-of-way with regard to existing and proposed roads and drainage structures. In addition, coordination shall be made with other appropriate utility companies and agencies, i.e., Dominion-Virginia Power, Sprint, Adelphia, gas companies, railroad rights-of-way, VDOT, State Health Department, etc. with regard to their existing easements, rights-of-way, and facilities.
- E. The engineer must submit a copy of the checklist with his/her certification that the plans reflect all applicable items on the checklist. The plans will be reviewed and a review letter will be sent to the engineer with a copy to the developer. When the revisions are made, the engineer must resubmit the plans for final review. A letter of approval will be sent when all the Halifax County Service Authority criteria are met. Four sets of additional plans shall be sent once all the approvals are granted for construction purposes.
- F. Prior to the beginning of construction, all water and/or sewer easements outside the boundaries of the new subdivision and/or within a complex not recorded by a subdivision plat, must be dedicated to the Halifax County Service Authority. The developer is to pay all recordation costs. When a VDOT permit is required to install the water and/or sewer lines, the engineer needs to follow the "Review Process for Water and Sewer Lines in VDOT's Right-of-Way" (see Appendix). A letter from VDOT accepting the location of the water and sewer lines in the right-of-way and design of the pavement replacement is required prior to approval of the water and sewer plans. The developer is responsible to have a copy of the highway permit sent to the Department of Public Works prior to the start of construction within the VDOT highway.
- G. The developer must enter into a Contract with the Halifax County Service Authority. A copy of the accepted bid proposal and a completed copy of "Information for Utilities Contract form" are required to prepare the Contract. The unit price bid proposals shall be based on the approved water and sewer plans and all work must be performed by an acceptable licensed utilities contractor.
- H. Before the utilities contractor can start work, a road grade certification must be furnished by the engineer. It shall include his verification that the entire proposed road rights-of-way where water lines are proposed have been graded as specified. Also, prior to the release of any on-site work, Halifax County Service Authority must approve the erosion control devices for the subdivision.
- I. Upon meeting all the above criteria, plans will be turned over to the Director of Public Works for the issuance of notice to proceed. The contractor must give the Halifax County Service Authority Inspector at least 48 hours notice before construction may begin. At such time, a pre-construction meeting may be required and if so, shall be arranged by the contractor and the Inspector. Notification shall be given to the HCSA Director of Operations Superintendent (434)575-4245.

APPENDIX II

Design Engineer Submission Checklist for Water & Sewer Projects

Project Title: _____

- ___ 1. Virginia registered engineer's stamp, signature, and date.
- ___ 2. Engineering Report including a System Layout Plan has been submitted.
- ___ 3. Water System is designed to provide adequate domestic service and fire protection to owner's property.
 - ___ " -diameter line is required to adequately serve this project in accordance with Halifax County Service Authority Standards.
 - a. Average Domestic Design Flow _____
 - b. Peak Hour Domestic Flow _____
 - c. Design Fire Flow _____
 - d. Total Design Peak Flow _____
 - e. Residual Pressure at Total Design Peak Flow (last hydrant) _____
- ___ 4. Sanitary Sewer Service area map is submitted with plans. Sanitary Sewer Analysis is shown on sewer shed map.
 - ___ " -inch diameter line is required to adequately serve this project in accord with the Halifax County Service Authority Standards.
 - a. Average Daily Flow _____
 - b. Design Peak Flow _____
- ___ 5. This is a phased project. Overall water and sewer plans have been submitted for approval with fire hydrants and valve locations shown.
- ___ 6. Plan and profile sheets are on 24 x 36" paper presented in industry standard format.
- ___ 7. A cover sheet is provided which includes the Owner/Developer name and address, project vicinity map, and Standard Water and Sewer Notes.
- ___ 8. The sewer drawings include stationing, pipe size, material, bearings, direction of flow, deflection angles, grade and distance between centerline of manholes. Benchmarks are shown every 500 feet.
- ___ 9. Domestic water meter calculations are shown on plans where applicable in accordance with A.W.W.A. Manual M-22.
- ___ 10. I.S.O. Fire Flow computations are included (where applicable).
- ___ 11. All sanitary sewers are profiled. Crossings with other utilities are shown and conflicts resolved.
- ___ 12. All water mains are profiled. Where water mains of any size cross other utilities, these crossings are profiled, and the means for crossing and resolving any conflicts are clearly shown.
- ___ 13. Any and all existing sewer and water connections to the property are shown on plans.
- ___ 14. All proposed water and sewer lines connect to existing water and sewer lines which have been previously accepted by the Halifax County Service Authority for operation and maintenance.
- ___ 15. All off-site easements necessary for the completion of this project have been acquired, recorded and their Deed Book and Page references are shown on the plans.
- ___ 16. A list of the Approximate Material Quantities to be used and the latest Material Notes are shown on the plans.
- ___ 17. A backflow prevention device is provided on domestic and fire service connections in accordance with Part II, Article 3 of the Commonwealth of Virginia, State Board of Health Waterworks Regulations and the Halifax County Service Authority's Cross-Connection Policy.
- ___ 18. Drawings comply with all applicable Local, State and Federal regulations including Halifax County Service Authority and State erosion control ordinances and application has been made for all required permits.

I have reviewed this Checklist for accuracy and hereby certify that the water and/or sewer plans as submitted have been designed in accord with the latest Halifax County Service Authority Standards and Specifications, Waterworks Regulations and Sewerage Regulations (whichever is more restrictive). The plans have been reviewed for completeness and accuracy and are herewith submitted for approval.

Engineers Name _____ Name of Firm Represented _____

Virginia Certification/License Number _____

Date _____

APPENDIX III

Developers Checklist for Utility Projects

The following steps must be completed before the Halifax County Service Authority will permit the Utilities Contractor to start construction:

- ____ 1. One week prior to the meeting, the Developer shall submit a plat of the tract of land to be developed showing boundaries, title to the property and such other information required by the Department.
- ____ 2. The Department has reviewed the utilities plan. (Initial review of the plan will normally be completed within 2 to 3 weeks of receipt provided the engineer has submitted all required information needed to perform a proper review.
- ____ 3. The project plan has been approved by the appropriate agencies (i.e., Halifax County Service Authority (sewer, water, roads and drainage); Virginia Department of Transportation (if applicable); Virginia Department of Health, Virginia Department of Environmental Quality (DEQ), U.S. Army Corp of Engineers (COE), Halifax Soil and Water Conservation District (HSWCD) and other relevant agencies for review and approval where applicable. A copy of each transmittal letter is attached to checklist.
- ____ 4. The developer has sent a letter to the requesting the Halifax County Service Authority to prepare a utilities contract. The letter needs to include the "Information Required For Utilities Contract" form and a copy of the "accepted" unit price bid proposal between the owner and the utilities contractor. Normally, the contract will be prepared within 10 days.
- ____ 5. Both copies of the utilities contract have been executed and returned to the Halifax County Service Authority.
- ____ 6. All off-site and on-site easements, not included in a subdivision plat for the project, have been dedicated to the Halifax County Service Authority . The Developer is to provide a check payable to the Clerk of the Circuit Court in the amount of the recordation costs when the executed easements are returned to the HCSA Director of Operations. A charge will be calculated and the developer will be informed.
- ____ 7. The Utilities Contractor has obtained all Halifax County Service Authority permits, land disturbance permit, and highway permit, if required, and sent a copy of the permit to the Department of Public Works.
- ____ 8. For the onsite subdivision work, the erosion control measures have been installed and approved by the Halifax County Service Authority Inspector. However, for the offsite utility work in conjunction with a subdivision, the field installation has been inspected by the Halifax County Service Authority Inspector as approved by the Halifax County Service Authority. Confirmation of approval should be obtained by the developer as early in the process to avoid any unnecessary delays in starting construction of the utilities.
- ____ 9. Prior to the installation of water mains, the Developer's engineer has submitted certification that:
 - a. All pavement and shoulder areas within the right-of-way and/or traveled areas of the development are graded to within 6" of subgrade.
 - b. All ditches and slopes have been graded to final grade to a point 1 foot outside the right-of-way area.
 - c. Markers for the sewer laterals are visible.

APPENDIX IV

Site Plan Checklist

PROJECT _____

TAX ID# _____ DATE _____

(Tax Map & Parcel Numbers)

UTILITIES

1. ____ Sheet index and materials list provided.
2. ____ Legend of sanitary sewer and water lines, other utilities and structures existing and proposed ground and pavement profile. Profile information must be shown on profile sheet.
3. ____ The utility plan includes an overall plan of the water and sewer layout, including any phasing of the development.
4. ____ Engineer and/or Surveyor has notified all off-site property owners where water and sewer easements are existing (copy of such notification is attached).
5. ____ Water and Sewer Notes (as a minimum, reference has been made to Halifax County Service Authority Standards & Specifications).
6. ____ Vertical scale is 1" = 5' or 1" = 10' ; and horizontal scale is 1" = 50' or as approved by the Halifax County Service Authority .
7. ____ All water and sewer designs conform to the latest Halifax County Service Authority , State and Federal regulations or standards.
8. ____ If irrigation and/or fire suppression is required, show how the water is to be obtained.
9. ____ All water, sewer, road and drainage structures are shown on one plan sheet, where applicable. May require larger scale to adequately obtain horizontal integrity.
10. ____ Existing water and/or sewer lines are properly labeled with size, type material and Halifax County Service Authority project number and with horizontal and vertical distances referenced on the plan.
11. ____ A bench mark is required on the site plan.
12. ____ All existing easements are shown accurately and proposed utility easements are shown on plans. The existing easements reflect accurate recordation information.
13. ____ All existing and proposed storm sewer lines, gas, telephone, power, and other utility lines, which cross or run parallel to the sewer or water lines, are shown with exact horizontal and vertical separations given, where applicable. Subsurface exploration has been performed where potential conflicts exist, where applicable.
14. ____ Adjacent road and drainage projects are shown as required.
15. ____ Consideration has been given to areas where roads and drainage structures may be lowered in the future.
16. ____ Plan and profile are drawn in the same direction. Stations shall ascend from left to right.
17. ____ Proposed utilities lines are shown with reference distances from right of way, boundary, buildings, other utility lines, etc.
18. ____ Locations of existing houses, buildings, fences, wells and other structures as shown on the plans.
19. ____ Locations of special features (conc. Encasement, rip-rap stabilization at creek crossings, clay dams, etc.).
20. ____ All fill and cut areas are shown for sewer and water.
21. ____ Location and size of all water and sewer connections.
22. ____ Miss Utility notation is shown.
23. ____ All revisions shall include an explanation either on the plans or by separate transmittal.
24. ____ All sanitary sewer plans are labeled with size, grade, length, direction of flow, and type and class of pipes (with backup calculations on the type and class pipe needed, where applicable).
25. ____ Manholes shall be labeled with top and invert elevations; coordinates; and location, size and inverts of drop stacks when a vertical drop exceeds two (2) feet.
26. ____ Deflection angles at all manholes or bearings of all lines are shown the plans.

27. ____ A sewerage drainage area map with hydraulic analysis is included in plans, if applicable.
28. ____ The engineer has field verified the inverts of the existing manhole(s). If the invert is different from the as-built plan, the engineer will verify his survey work and notify the HCSA Director of Operations of the discrepancy.
29. ____ All manholes are designed to an elevation above the 100 year flood plain elevation as set forth in the design standards, unless otherwise approved by the HCSA Director of Operations.
30. ____ Ground coverage over sewer pipe meets minimum criteria.
31. ____ Engineer has put a notation that a backwater valve is to be used where the building with a finished floor elevation of the building is below the top elevation of the nearest upgrade manhole from the building connection.
32. ____ Where the sewer lines are in excess of 12' deep, the Engineer has identified where the sewer lateral must be installed in accordance with the standard drawings and the appropriate notes are reflected on the plans.
33. ____ Maintain greater than the 0.4% minimum slope whenever possible.
34. ____ Solid lines have been used for proposed sewers, short dashed lines for existing sewer and label future sewer or portions covered under other phases of construction.
35. ____ A minimum of ten (10) feet horizontal separation is maintained between sewer lines and water lines, sewer laterals and water meters or water blowoff devices (flushing hydrants) and between sewer line and storm drainage structures, unless otherwise approved by the HCSA Director of Operations.
36. ____ All silt basins and BMP's are shown and the sewer lines and manholes have been designed around these structures, unless otherwise approved by the HCSA Director of Operations.
37. ____ All existing sewer laterals are shown on the plans, with station, length and depth, as depicted on the as built plans.
38. ____ All sewer lines are designed with the entry into the manhole by the proposed sewer lines at an angle of 90° or greater to the downstream line, or if an exception has been granted, the engineer has increased the drop through the manhole to compensate for the reduced angle and has provided an blowup detail for the appropriate invert shaping that achieves the same results as a 90° or greater entry.
39. ____ The crowns of all sewer lines enter the manholes at crown's level or higher as specified in the design standards.
40. ____ Where new manholes are proposed over existing lines, distance from the new manhole to the two existing manholes is shown; inverts of the manhole and each existing manhole are shown; slope of existing line from the new manhole to upstream and downstream existing manholes is shown.
41. ____ All manholes proposed within areas where vehicles travel are to be located either on center line of the road or center of the traveling lane.
42. ____ Sampling manholes are required for new facilities currently regulated by local or federal industrial waster pretreatment laws. Appropriate measures have been included in the design to allow for sampling of industrial waste. A sampling manhole shall be provided at the property line to facilitate random 24-hour composite sampling. In those cases where a private manhole on site can be utilized for this function, adequate provisions will be agreed upon to facilitate sampling. Provisions include ingress/egress to the private manhole, ability to sample, and adequate space to set a 24-hour composite sampler. Existing on site manholes, possibly inside buildings, will be approved on a case by case basis.
43. ____ At all existing manholes, the engineer has provided the manhole number as reflected on the as-builts, and the Halifax County Service Authority project number associated with the existing manhole.
44. ____ Plans show all fittings, fire hydrants, and valves including sizes. Each appurtenance is properly labeled.
45. ____ A minimum of eighteen (18) inches of vertical clearance has been designed and obtained at all crossings of other utilities, or as specified by other utility agencies, or otherwise approved by the HCSA Director of Operations.
46. ____ All water lines have a minimum of 3.5' of cover.
47. ____ Fire hydrants and air relief valves are shown on plans and profile.
48. ____ Hydrants or blow-off valves are designed at major low places in the line where possible and air release valves are designed at the high points.
49. ____ All water services are shown in accordance with the design standards.
50. ____ Engineer has designed the water system in accordance with available pressures and has provided fire flow and pressure calculations in accordance with the Appendix.
51. ____ Pipe sizes noted on the plans.
52. ____ Ditch lines are shown on the plan and depth of ditch(s) are shown on the profile at the fire hydrant locations and services lines, where necessary.
53. ____ Water line stubs for future extensions are designed to be installed beyond the edge of pavement.

54. _____ Location of water meter boxes are shown outside of non-vehicular traveled areas. Where it is not possible to locate the boxes out of the driveways, and/or vehicular traveled area, a cast iron box is specified.
55. _____ For water line tie-ins, the engineer has shown the valve to be used for cut off during the tie-in. Where tapping the main line vs. Cutting in a tee is applicable, the engineer has evaluated which method will be used as outlined in the Halifax County Service Authority's Design Standards.
56. _____ Necessary easement plats on-site and/or off-site have been submitted for processing by the right of way section. Plats conform to the requirements reflected in the Appendix.
57. _____ The engineer understands that any changes made to the road, drainage, water and/or sewer design will require a submittal to the HCSA Director of Operations for review and approval of the revised water and sewer plans reflecting those changes.
58. _____ If the waterline is greater than sixteen inches in diameter and/or the sewer serves over 400 people, plans need to be submitted to the Virginia Department of Health for review and approval. A copy of the transmittal letter must be attached to the engineer's checklist when the checklist is submitted.
59. _____ If horizontal bore is required, bore location, length of bore, pit location (average 8' x 35') are shown and shown in relation to all existing and/or proposed utilities on the plan and profile.
60. _____ Utility plans reflect those conditions as approved by the Planning Commission/Halifax County Service Authority Council.
61. _____ Engineer has contacted Virginia Power and received as-built information. Utility plans reflect this information accurately and is in accordance with the "Overhead High Voltage Line Safety Act."
62. _____ A NOTE stating that the contractor must field verify the inverts of all existing manholes, gas lines, other utility lines prior to the start of construction.
63. _____ All pipe between manholes are of like material and class.
64. _____ Knockdown meter box shall not be located within any travel areas.

APPENDIX V

Site Plan Requirements for Water And/or Sewer Main Line Extensions

1. The location of the existing sewer main and water lines must be shown on the site plan.
2. The exact location of the existing sewer (lateral) connection and/or water service and box must be shown, making reference to the length, depth and station location of the sewer lateral and the relationship of the water and sewer services and appurtenances with the existing, proposed and future buildings, etc. Also, show size of existing water meter where applicable.
3. Existing and proposed water and sewer line easements must be shown on the site plan and Engineer needs to make sure there are no buildings or other permanent structures encroaching onto easements. Also, if there are any other type of structures and/or activities proposed i.e., storm sewers, retaining walls, grading, curb and gutter, concrete paving, obstacles (garbage pads, light posts, and other utility lines) etc., the Engineer shall make site design changes and take appropriate measures to protect the existing water and/or sewer line and its' appurtenances.
4. Existing plumbing from building to connection and/or water meter must be shown. Proposed plumbing from building to sewer connection and/or new water meter must also be shown.
5. When the site plan reflects the installation of a new sewer connection, the appropriate notes outlining the Utilities Division's requirements for installing a connection must be shown on the plan. The point where the utilities contractor stops his work and the plumber begins needs to be clearly denoted on the plan.
6. Site plan needs to clearly reflect the proposed "Fill" and "Cut" areas. Engineer is to analyze how it will affect the existing and/or proposed water and/or sewers and submit his evaluation and recommendation with the site plan in writing for review and approval by the Department of Public Works.
7. Adjustment of water and sewer appurtenances will require notes, i.e., notifying the Inspector at (434)575-4260 to inspect any adjustments, that an acceptable licensed Utilities Contractor perform all utility work, etc.
8. Engineer must be aware of where proposed and future water and/or sewer extensions are needed and show this information on the plans and reflect sufficient (minimum of 20' permanent and 15' construction easement for water lines and/or 20' permanent easement and 20' construction easement for sewer lines) easement width for future water and/or sewer extensions. A separate easement plat needs to be submitted to the Department of Public Works and an agreement will be prepared for the developer to obtain necessary signatures. All onsite and offsite water and/or sewer easement(s) for future improvements where septic tanks and/or wells are being used, and offsite utility easements where proposed extensions are needed to serve the site must be recorded prior to the release of the building permit. Normally, the site plan will not be approved until the offsite easement is dedicated.
9. Where additional Road R/W and/or widening is proposed, the site plan needs to reflect the extension of the existing sewer (lateral) connection and clean-out and/or existing water service and meter box just beyond new R/W line.
10. A water meter sizing form must be submitted to the HCSA Director of Operations for commercial properties connecting to public water where existing and/or new services are proposed. Applicant must complete all spaces on the sizing form prior to submitting it to the HCSA Director of Operations.
11. If the existing water meter size needs to be decreased or removed due to change in water demand, a letter from the Developer is required authorizing the Halifax County Service Authority to either replace the existing meter with a smaller meter or remove the meter at Developer's expense.
12. For all new building additions with proposed water and sewer facilities, the engineer needs to submit a "Water Meter Sizing Form" for the addition as well as the existing building to determine if the existing water meter size is sufficient for new water usage. At that point the Developer should be aware that additional water and sewer connection fees are required.
13. Engineer shall provide all calculations necessary to support the sizing of the proposed water improvements that provide both fire and domestic demands being placed on the site. Determination of existing water line pressures will require engineer's coordination with appropriate staff in the HCSA Director of Operations. Such coordination requires written request being sent to the Division. Fire flow requirements and approvals are the engineer's responsibility to coordinate with appropriate staff in Fire Department.

14. Engineer shall note the ISO requirements on the site plan.
15. If an underground fire line is proposed, engineer must show the proposed water line tie-in and the proposed location of the double-check assembly.
16. Schematic Plans will be reviewed by the Department's Utilities Planning Section. As a minimum, all plans must reflect the following information:
 1. Vicinity map - scale 1: 2000';
 2. Tax Identification Number(s) (formerly known as the Tax Map and Parcel Numbers);
 3. Development name
 4. Conceptual layout of water and sewer;
 5. Existing easement, including deed book and page number;
 6. Proposed easements.

APPENDIX VI

Wastewater Collection System Design Checklist Drawing Requirements

- ___ 1. The drawings are in accordance with Halifax County Service Authority Standards with the use of standard symbols, symbol keys and labels.
- ___ 2. The drawings are clear and legible.
- ___ 3. Only sanitary wastes are collected and transported – no storm drains or surface water are shown entering the sanitary sewer system.
- ___ 4. Any affected wetland areas or Resource Protection Areas (RPA) are properly shown and labeled.
- ___ 5. Benchmark(s) are identified on the site plan and located every 500 feet along the route of the new sewer line(s).
- ___ 6. A north arrow and horizontal and vertical scale are included on each sheet, where applicable.
- ___ 7. All existing easements are shown accurately and proposed utility easements are shown on drawings. The existing easements reflect accurate record information.
- ___ 8. Proposed and existing water and sewer lines are properly labeled with size and type of pipe, and the horizontal and vertical distances shown on the drawings.
- ___ 9. All existing and proposed sanitary sewer, storm sewer, gas, telephone, power, any other utility lines, and all water services which cross or run parallel to the sewer line(s), are shown with horizontal and vertical separations given, where applicable. Subsurface exploration has been performed where potential conflicts exist, where applicable.
- ___ 10. All existing sewer laterals are shown on the drawings, with station, length and depth, as depicted on the record drawings.
- ___ 11. A minimum of ten (10) feet horizontal separation is maintained between sewer lines; between sewer lines and water lines and appurtenances; and between sewer lines and storm drainage structures.
- ___ 12. Adjacent road and drainage projects are shown as required.
- ___ 13. Consideration has been given to areas where roads and drainage structures may be lowered in the future.
- ___ 14. Road names, state route numbers, and right-of-way widths are shown.
- ___ 15. Stations ascend from left to right.
- ___ 16. Proposed sewer lines are shown with reference distances from rights-of-way, boundaries, buildings, other utility lines, etc.
- ___ 17. All subdivisions, property lines, and property markers (stones, rods, pins, pipes, monuments, etc.) are shown.
- ___ 18. Location of existing houses, buildings, fences, wells and other structures are shown on drawings. In lawn or kept areas, trees and shrubs in the easements are shown (size and type).
- ___ 19. All designs conform to the latest Halifax County Service Authority and State erosion control and sedimentation rules, regulations, and ordinances.
- ___ 20. The Design Engineer has coordinated the utility design and construction work with other Design Engineers where their projects connect or affect each other.
- ___ 21. Locations of special features (concrete encasement, rip- rap stabilization at creek crossings, clay dams, etc.) are shown in sufficient detail.
- ___ 22. Detail drawings of all stream crossings are included, with elevations of the streambed, 100-year flood elevation, and normal water elevation shown.
- ___ 23. All fill and cut areas are shown within the area of the existing and proposed sewer line(s).
- ___ 24. Necessary easement plats onsite and/or offsite have been submitted for processing.
- ___ 25. Pavement replacement and/or landscaping details are shown on all drawings.
- ___ 26. Proposed and existing ground elevations are shown.
- ___ 27. All revisions from previous submittals include an explanation either on the drawings or by separate transmittal.
- ___ 28. Contract Documents (drawings and specifications) have been submitted to State Health Department for review and approval where applicable. A copy of transmittal letter is attached to checklist.
- ___ 29. If horizontal bore is required, bore location, length of bore, pit location are shown in relation to all existing and/or proposed utilities on plan and profile.
- ___ 30. Alignment of utility in existing Virginia Department of Transportation (VDOT) rights-of-way is consistent with Halifax County Service Authority and VDOT guidelines. A copy of a transmittal letter to VDOT for their review is attached. The Design Engineer understands that a letter of approval from VDOT is required prior to final utility plan approval.

- ___ 31. All sanitary sewer drawings are labeled with size, grade, length, direction of flow, and type and class of pipes (with backup calculations on the type & class pipe needed, where applicable).
- ___ 32. Manholes are labeled with top and invert elevations; coordinates; and locations, size and inverts of drop stacks.
- ___ 33. Deflection angles at all manholes or bearings of all lines are shown on the drawings.
- ___ 34. All sewer lines are designed with the entry into the manhole by the proposed sewer lines at an angle of 90° or greater to the downstream line. If an exception has been granted, the Design Engineer has increased the drop through the manhole to compensate for the reduced angle and has provided a blowup detail for the appropriate invert shaping that achieves the same results as a 90° or greater entry.
- ___ 35. The Design Engineer has field verified the inverts of the existing manhole(s). Where invert elevations are different from the record drawings, the Design Engineer has verified his survey work and notified the HCSA Director of Operations of the discrepancy.
- ___ 36. All manholes are designed to an elevation above the 100-year flood plain elevation or provided with watertight inserts as set forth in the design standards, unless otherwise approved by the HCSA. Reference all manholes in easements.
- ___ 37. Manholes are spaced a maximum of 300 feet apart.
- ___ 38. A NOTE stating that the contractor must field verify the inverts of all existing manholes, gas lines, other utility lines prior to the start of construction.
- ___ 39. The Design Engineer has provided the manhole number as reflected on the record drawings at all existing manholes.
- ___ 40. All pipe between manholes are of like material and class.
- ___ 41. Where new manholes are proposed over existing lines, distance from the new manhole to the two existing manholes is shown; inverts of the manhole and each existing manhole are shown; slope of existing line from new manhole to upstream and downstream existing manholes is shown.
- ___ 42. All minimum finished floor elevations and basement elevations are to be shown on drawings, where applicable.
- ___ 43. Ground coverage over sewer pipe meets the minimum criteria of 36 inches.
- ___ 44. The Design Engineer has identified where the sewer laterals must be installed in accordance with the standard drawings.
- ___ 45. Where future extensions are necessary, these lines are reflected on the drawings.
- ___ 46. The sewer system is designed for the estimated ultimate tributary population with an upper limit consisting of the 50-year population growth projection for the proposed service area.
- ___ 47. A sewerage drainage area map and a completed hydraulic analysis table are included with the drawings.
- ___ 48. The table in the design standards has been used to determine average daily sewage flow. Any deviations from the table are documented and are based on sound engineering judgment.
- ___ 49. The peak sewage flow is determined from the chart in the design standards.
- ___ 50. The Design Engineer has provided computations that indicate the slopes on the sewer lines produce a minimum velocity of three feet per second.
- ___ 51. The minimum size pipe in the sewer system is eight (8) inches.
- ___ 52. Head loss calculations are provided and in accordance with the design standards.
- ___ 53. The Design Engineer has investigated the potential for hydrogen sulfide attack and has provided appropriate protection of the sewer system.
- ___ 54. The Design Engineer has addressed special circumstances such as water crossings, road crossings, sewers in inaccessible areas, etc., in accordance with the design standards.
- ___ 55. The sewer main is designed such that all service connections have a slope of not less than ¼ inch per foot.

APPENDIX VII

Sewage Pumping Station Design Checklist & General Drawing Requirements

- ___ 1. The drawings are in accordance with the Standards and use of the Halifax County Service Authority's standard symbols or an appropriately labeled symbol key.
- ___ 2. The drawings are clear and legible.
- ___ 3. The Halifax County Service Authority Seal is located adjacent to the front door.
- ___ 4. The appropriate applications have been properly filled out and submitted:
 - a. CMOM Flow Certification
 - b. Portable Equipment Form (VDH)
 - c. Dominion Virginia Power Request for Service
 - d. Health Department Submittal
- ___ 5. Only sanitary wastes are collected and transported – no storm drains or surface water are shown entering the sanitary sewer system
- ___ 6. Any affected wetland areas or Resource Protection Areas (RPA) are properly shown and labeled.
- ___ 7. Benchmark(s) are identified on the site plan and located every 500 feet along the route of the new sewer force main(s).
- ___ 8. A north arrow and horizontal and vertical scale are included on each sheet, where applicable.
- ___ 9. All existing easements are shown accurately and proposed utility easements are shown on drawings. The existing easements reflect accurate record information.
- ___ 10. Proposed and existing water and sewer lines are properly labeled with size and type of pipe, and the horizontal and vertical locations shown on the drawings.
- ___ 11. All existing and proposed sanitary sewer, storm sewer, gas, telephone, power, any other utility lines, and all water services which cross or run parallel to the sewer line(s), are shown with horizontal and vertical separations given, where applicable. Subsurface exploration has been performed where potential conflicts exist, where applicable.
- ___ 12. Adjacent road and drainage projects are shown as required.
- ___ 13. Road names, state route numbers, and right-of-way widths are shown.
- ___ 14. Stations ascend from left to right.
- ___ 15. Proposed sewer lines are shown with reference distances from rights-of-way, boundaries, buildings, other utility lines, etc.
- ___ 16. All subdivisions, property lines, and property markers (stones, rods, pins, pipes, monuments, etc.) are shown.
- ___ 17. Location of existing houses, buildings, fences, wells and other structures are shown on drawings. In lawn or kept areas, trees and shrubs in the easements are shown (size and type).
- ___ 18. All designs conform to the latest Halifax County Service Authority and State erosion and sediment control rules, regulations, and ordinances.
- ___ 19. The Design Engineer has coordinated the utility design and construction work with other Design Engineers where their projects connect or affect each other.
- ___ 20. Locations of special features (concrete encasement, rip-rap stabilization at creek crossings, clay dams, etc.) are shown in sufficient detail.
- ___ 21. All fill and cut areas are shown within the area of the existing and proposed sewer line(s).
- ___ 22. Necessary easement plats onsite and/or offsite have been submitted in accordance with the Halifax County Service Authority Planning and Engineering Requirements for processing.
- ___ 23. Pavement replacement and/or landscaping details are shown on all drawings.
- ___ 24. Proposed and existing ground elevations are shown.
- ___ 25. Contract Documents (drawings and specifications) have been submitted to the State Health Department for review and approval where applicable. A copy of transmittal letter is attached to checklist.
- ___ 26. Alignment of utility in existing Virginia Department of Transportation (VDOT) right-of-way is consistent with Halifax County Service Authority and VDOT guidelines. A copy of a transmittal letter to VDOT for their review is attached. The Design Engineer understands that a letter of approval from VDOT is required prior to final utility plan approval.

- 27. All sanitary sewer drawings are labeled with size, grade, length, direction of flow, and type and class of pipe(s) (with backup calculations on the type & class pipe needed, where applicable).
- 28. Manholes are labeled with rim and invert elevations; coordinates; and locations, size and inverts of drop stacks.
- 29. Deflection angles at all manholes or bearings of all lines are shown on the drawings.
- 30. Manholes are spaced a maximum of 300 feet apart.
- 31. All minimum finished floor elevations and basement elevations are to be shown on drawings, where applicable.
- 32. Ground coverage over sewer pipe meets the minimum criteria of 36- inches.
- 33. Is emergency pump connection shown and does it conform to standard detail?
- 34. Is an adequate buffer zone shown around the pumping station?
- 35. Is there an ample driveway that allows for the largest Department of Utilities vehicle to access the pumping station?
- 36. Is the wet well access hatch easily accessible and free from obstructions?
- 37. Are the bar screen and emergency bypass channel shown and are they easily accessible for maintenance?
- 38. Are the alarm levels and elevations shown?
- 39. Is the wet well designed to prevent solids deposition?
- 40. Is the wet well designed to prevent free-fall of sewer influent during normal operation?
- 41. Is there an isolation valve on the sewer influent line located in a valve vault outside of the wet well?
- 42. Is all interior metal Type 316L stainless steel?
- 43. Are all electrical fixtures in the wet well explosion-proof?
- 44. Are there appropriate flow-measuring device(s) and pressure recording device(s) shown?
- 45. Is an appropriate coating specified for the interior of the wet well?
- 46. Is there sufficient (minimum 3 feet) clearance between pieces of equipment, pipes, and structural elements?
- 47. Is there sufficient access and handling equipment to facilitate removal and reinstallation of pumps and motors? Does the beam extend through the door to facilitate loading and unloading?
- 48. Is the sump pump properly sized with the discharge into the wet well above the wet well high-level elevation?
- 49. All lights and switches easily accessible?
- 50. All valve operators shall be accessible from the pump room floor or stair landing.
- 51. Is there an appropriate backflow prevention device on any potable water supply line?
- 52. Is there a gate valve on the suction line?
- 53. Is there a check valve and a gate valve on the discharge line?
- 54. Is the control system in accordance with HCSA Director of Operations Standards?
- 55. Is there sufficient lighting? Is the lighting shielded?
- 56. Does the pumping station meet the requirements of Class I Reliability?
- 57. Has a capacity analysis of the influent collection system been completed in accordance with the HCSA Director of Operations General Specifications and Standards?
- 58. Has a pump sizing analysis been completed in accordance with the HCSA Director of Operations General Specifications and Standards?
- 59. If the pumps are larger than 50 hp, has the Design Engineer performed a cost analysis to determine if three or more pumps is more cost effective for the HCSA Director of Operations?
- 60. Has the system curve been determined and transposed to a manufacturer's pump performance curve?
- 61. Has hydraulic transient control been considered by the Design Engineer?
- 62. Has a ventilation analysis been completed to ensure proper air changes in the wet well and the pump house?
- 63. Is the lifting equipment properly sized for the largest piece of equipment in the pumping station?

APPENDIX VIII

Water Distribution System Design Checklist Drawing Review

- ___ 1. The drawings are in accordance with Halifax County Service Authority Standards with the use of standard symbols, symbol keys and labels.
- ___ 2. The drawings are clear and legible.
- ___ 3. No cross-connections to unapproved water facilities are shown on the drawings.
- ___ 4. Any affected wetland areas or Resource Protection Areas (RPA) are properly shown and labeled.
- ___ 5. Proposed and existing water and sewer lines are properly labeled with size and type of pipe, and the horizontal and vertical distances shown on the drawings.
- ___ 6. Benchmark(s) are identified on the site plan and located every 500 feet along the route of the new water line(s).
- ___ 7. A north arrow and horizontal and vertical scale are included on each sheet, where applicable.
- ___ 8. All existing easements are shown accurately and proposed utility easements are shown on drawings. The existing easements reflect accurate record information.
- ___ 9. All existing and proposed sanitary sewer, storm sewer, gas, telephone, power, any other utility lines, and all water and sewer services which cross or run parallel to the water line(s), are shown with horizontal and vertical separations given, where applicable. Subsurface exploration has been performed where potential conflicts exist, where applicable.
- ___ 10. A minimum of eighteen (18) inches of vertical clearance has been designed and obtained at all crossings of other utilities, or as specified by other utility agencies, or otherwise approved by the Division.
- ___ 11. Adjacent road and drainage projects are shown as required.
- ___ 12. Consideration has been given to areas where roads and drainage structures may be lowered in the future.
- ___ 13. Road names, state route numbers, and right-of-way widths are shown.
- ___ 14. Stations ascend from left to right.
- ___ 15. Proposed water line(s) are shown with reference distances from rights-of-way, boundaries, buildings, other utility lines, etc.
- ___ 16. All subdivisions, property lines, and property markers (stones, rods, pins, pipes, monuments, etc.) are shown and identified.
- ___ 17. Location of existing houses, buildings, fences, wells and other structures are shown on drawings. In lawn or kept areas, trees and shrubs in the easements are shown (size and type).
- ___ 18. All designs conform to the latest Halifax County Service Authority and State erosion control and sedimentation rules, regulations, and ordinances. Erosion and sediment control devices are shown on the drawings.
- ___ 19. The Design Engineer has coordinated the utility design and construction work with other Design Engineers where their projects connect or affect each other.
- ___ 20. Locations of special features (concrete encasement, rip-rap stabilization at creek crossings, clay dams, etc.) are shown in sufficient detail.
- ___ 21. Detail drawings of all stream crossings are included, with elevations of the streambed, 100-year flood elevation, and normal water elevation shown.
- ___ 22. All fill and cut areas are shown within the area of the existing and proposed water line(s).
- ___ 23. Necessary easement plats onsite and/or offsite have been submitted for processing.
- ___ 24. Pavement replacement and/or landscaping details are shown on all drawings.
- ___ 25. Proposed and existing ground elevations are shown.
- ___ 26. All revisions from previous submittals include an explanation either on the drawings or by separate transmittal.
- ___ 27. Contract Documents (drawings and specifications) have been submitted to State Health Department for review and approval where applicable. A copy of transmittal letter is attached to checklist.
- ___ 28. If horizontal bore is required, bore location, length of bore, pit location are shown in relation to all existing and/or proposed utilities on plan and profile.
- ___ 29. Alignment of utility in existing Virginia Department of Transportation (VDOT) right of ways is consistent with Halifax County Service Authority and VDOT guidelines. A copy of a transmittal letter to VDOT for their review is attached. Design Engineer understands that a letter of approval from VDOT is required prior to final utility plan approval.

- ___ 30. Main line valves are shown at intervals not greater than 1000 feet and at tees and crossings. One less valve than the number of mains at tees and crosses may be allowed if Design Engineer demonstrates adequate flow control.
- ___ 31. Water mains 16 inches and smaller are shown a minimum of 10 feet from any part of a structure. Water mains larger than 16 inches are shown a minimum of 20 feet from a structure.
- ___ 32. All water lines shall have a minimum depth of cover of 42 inches.
- ___ 33. The location of fire hydrants have been coordinated with the Fire Department by the HCSA Director of Operations. Fire hydrant locations comply with NFPA and ISO design guidelines
- ___ 34. Fire hydrants and air relief valves are shown on plans and profile.
- ___ 35. Hydrants or blow-off valves are designed at major low places in the line where possible and air release valves are designed at the high points.
- ___ 36. Blowoff devices (flushing hydrants) or fire hydrants are designed at the end of all lines in cul-de-sacs. Location of hydrants comply with guidelines outlined in design standards
- ___ 37. All proposed water services are shown in accordance with the design standards.
- ___ 38. Line location is shown 5' from face of curb or 2' off pavement where there is ditch.
- ___ 39. Ditch lines are shown on the drawings and depth of ditch(es) are shown on the profile at the fire hydrant locations and service lines, where necessary.
- ___ 40. Water line stubs for future extensions are designed to be installed beyond the edge of pavement.
- ___ 41. Location of water meter boxes are shown outside of non-vehicular traveled areas, driveways, and sidewalks. The boxes are shown on the edge of the right-of-way in the center of the lot.
- ___ 42. For water line tie-ins, the Design Engineer has shown the valve to be used for cut off during the tie-in. Where tapping the main line vs. cutting in a tee is applicable, the Design Engineer has evaluated the proper method to be used.
- ___ 43. Valves and sample taps are located at both ends of under water crossings. The pipe specified is appropriate for water crossings and has flexible watertight joints.
- ___ 44. Water lines crossing over surface water are adequately supported, protected from freezing, are accessible for maintenance, and are located above the 100-year flood elevation.
- ___ 45. The Design Engineer has developed a tabular analysis of the total number of people proposed to be served based on existing zoning. The analysis assumes full build-out of the proposed service area.
- ___ 46. Average, maximum day, maximum hour, and fire flows have been developed for areas and sub-areas and tabulated in the report
- ___ 47. The system is designed to maintain a minimum pressure of 20 psi in the distribution system at the design flow, but no more than 80 psi at any service tap.
- ___ 48. All mains are looped and there are no dead-ends. Where dead-ends are unavoidable, an appropriate hydrant or blow-off is provided.
- ___ 49. Hydraulic modeling information is provided with all design assumptions clearly indicated.
- ___ 50. Fire flows at hydrants have been calculated and are in accordance with design standards and applicable codes.
- ___ 51. Design Engineer has designed the water system in accordance with available pressures and has provided fire flow and pressure calculations
- ___ 52. Where pipe size is not determined by the HCSA Director of Operations, line size calculations are included with the drawings verifying that available pressures meet the required minimum standards.
- ___ 53. Minimum sized water line is 6 inches for single-family residential areas and 8 inches for multi-family residential, commercial, and industrial areas.
- ___ 54. Appropriate joint restraints are shown and design calculations with summary table are provided that show restraint length requirements.
- ___ 55. Steel casing requirements have been considered and design conforms to design standards and standard drawings.
- ___ 56. Service and meter sizing calculations are provided and conform to the design standards.
- ___ 57. Appropriate corrosion protection has been considered. For pipe sizes greater than 24 inches, a corrosion specialist has been consulted..

APPENDIX IX

Easement Processing Checklist

General Requirements

- _____ 1. Has the Design Engineer investigated all options to use existing public rights-of-way or existing easements for the proposed utility?
- _____ 2. Has an entire easement survey been completed and plat developed?
- _____ 3. Are all lines of proposed construction tied to existing property lines and/or corners?
- _____ 4. Are permanent easements a minimum of 20 feet wide?
- _____ 5. Will the easement provide adequate space to maintain the utility or replace the utility while existing line remains in service, if necessary?
- _____ 6. Are water and/or sewer lines the only utilities shown located in the easement?
- _____ 7. If a temporary or construction easement is being requested, is there ample room for construction traffic?
- _____ 8. Is the submittal signed and sealed by a state of Virginia registered land surveyor or engineer?
- _____ 9. Does the Legal Description Sheet meet the requirements of the Authority having jurisdiction and the Halifax County Service Authority Standards?
- _____ 10. Is the property being taken clearly described and the owner identified?
- _____ 11. Are metes and bounds descriptions clear and concise? (Note: No coordinates shall be included in the legal description)
- _____ 12. Is adjacent property clearly described and identified?
- _____ 13. Does the Property Plat meet the requirements of the Halifax County Service Authority Code and the Standards?
- _____ 14. Are there appropriate bearings, distances, etc., shown on the drawings?

APPENDIX X

Sewer Installation Construction Inspection Checklist

General Requirements

- ___ 1. Check plan requirements:
 - a. Existing utilities and other substructures
 - b. Pipe and fitting materials
 - c. Bedding requirements
 - d. Traffic control requirements
 - e. Bypass pumping requirements
- ___ 2. Are existing utilities located and marked at the site by Miss Utility or determined by potholing at frequent intervals? (Simply calling Miss Utility is not acceptable the utilities must be marked.)
- ___ 3. Is access to private or public property impeded? Are temporary bridges or other means of access required?
- ___ 4. Are street closures authorized? Have all interested agencies (i.e. police, fire, property owners, etc.) been properly notified?
- ___ 5. Are temporary traffic signs and/or barricades installed properly and at the proper locations?
- ___ 6. Has the Contractor provided for the control of surface drainage?

Pipe Materials – Delivery, Storage and Handling

- ___ 7. Are materials on site in accordance with approved Shop Drawings?
- ___ 8. Was the pipe and/or fittings carefully removed from truck and kept under control at all times in a secure area?
- ___ 9. If handling the pipe with a crane, is a suitable sling being used around the pipe? Note: Under no condition pass the sling through the pipe.
- ___ 10. Are suitable blocking and stakes installed to prevent pipe from rolling?
- ___ 11. Are gaskets for pipe joints stored in a cool place and protected from sunlight, heat, oil, or grease until installed?
- ___ 12. Are gaskets showing any signs of checking, weathering or other deterioration?
- ___ 13. Check for maximum trench width. Is it in accordance with the Standard Drawings?
- ___ 14. Did the excavation expose any unusual conditions requiring consideration by the Engineer?
- ___ 15. Are line and grade control being maintained satisfactorily? Is a laser level being used?
- ___ 16. Do actual soil conditions agree with plan? Is shoring method adequate for actual trench condition?
- ___ 17. Is spoil bank clear of trench? Is it encroaching into required traffic lanes or private property?
- ___ 18. Is there evidence of movement of adjacent improvements or structures? (Separation cracks, settlement, etc.)
- ___ 19. Have property owners been notified if work encroaches on private property?
- ___ 20. Is the subgrade firm? Is it granular or will imported bedding material be required?
- ___ 21. Check trench for evidence of unconsolidated fill. (If in the trench bottom, it may require additional excavation. If located above pipe invert, it may require additional mechanical compaction.)
- ___ 22. Is temporary support of existing utilities and improvements being provided? Are owners promptly notified ?
- ___ 23. All loose soil removed from the trench?
- ___ 24. Is groundwater encountered? If so, are efforts being made to obtain a dry trench bottom?
- ___ 25. Is the discharge from dewatering pumps in compliance with regulatory requirements?
- ___ 26. Is a dry trench bottom unachievable due to improper or insufficient use of all known methods of trench dewatering? If so, has the Supervisor been contacted?
- ___ 27. Is backfill material as specified and approved in shop drawing?
- ___ 28. Is material free of foreign debris and not frozen?
- ___ 29. Is backfill being installed in lifts and compacted as specified in the Contract Documents?
- ___ 30. Is final landscaping or pavement installed as specified in the Contract Documents?

Pipe Laying – General

- _____ 31. Is pipe being handled and installed in accordance with the manufacturer's recommendations and approved shop drawings?
- _____ 32. Is each pipe checked for damage before lowering into trench?
- _____ 33. Is the required concrete cradle or granular bedding material and thickness provided? Shaped to cradle the pipe?
- _____ 34. Is pipe being installed in a straight line between manholes?
- _____ 35. Are all bells pointing ahead?
- _____ 36. Is a laser being used to maintain line and grade and each pipe checked for alignment? Is some other acceptable means being used at a minimum of every 100 l.f.?
- _____ 37. Are adjustments to bring pipe to line and grade made by scraping away or filling in select fill material under the body of the pipe as recommended by the manufacturer?
- _____ 38. Are the faces of the spigot ends and the bells of pipes brought into fair contact and the pipe firmly and completely shoved home?
- _____ 39. As the work progresses, is the interior of pipelines kept clean of all dirt and superfluous materials?
- _____ 40. Are pipes closed off with bulkheads, plugs, or other suitable means when pipe laying is not in progress?
- _____ 41. Are bell holes excavated for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length?
- _____ 42. Are bell holes thoroughly tamped with select fill material following the making of each joint?
- _____ 43. Are pipe cuts for valves and fittings cut at 90 degrees, ground smooth, and rough edges removed?

Ductile Iron Pipe Installation – Rubber Gasket Joints

- _____ 44. Are the surfaces with which the rubber gasket comes in contact properly cleaned and prepared prior to assembly of the joint?
- _____ 45. Is the gasket placed in the socket with the large round end entering first so that the groove fits over the bead in the seat?
- _____ 46. Is a thin film of lubricant applied to the inside surface of the gasket that will come in contact with the entering pipe?
- _____ 47. Is sufficient force exerted on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint?
- _____ 48. Is pipe lined with “Sewpercoat” or “Protecto 401”?

PVC Pipe Installation

- _____ 49. Is the sealing surface of the pipe spigot end, the pipe bell, the coupler or fitting, and the gasket properly cleaned before assembly?
- _____ 50. Is gasket properly lubricated?
- _____ 51. Is pipe spigot end fully homed after jointing?
- _____ 52. For pipe 12” and smaller only – are any bends in accordance with the manufacturer’s recommendations and guidelines?

Miscellaneous Considerations

- _____ 53. Are appurtenances (i.e. fittings, services, valves, and hydrants) installed in accordance with manufacturer’s recommendations and the Contract Documents?
- _____ 54. Is the line properly cleaned prior to testing?
- _____ 55. Is the line properly tested in accordance with the Contract Documents?

APPENDIX XI

Pipeline Rehabilitation Construction Inspection Checklist

General Requirements

- _____ 1. Check Contract Documents for the following:
 - a. Existing utilities and other substructures
 - b. Pipe and fitting materials
 - c. Traffic control requirements
 - d. Bypass pumping requirements
- _____ 2. Are existing utilities located and marked at the site by Miss Utility or determined by potholing at frequent intervals?
- _____ 3. Is access to private or public property impeded? Are temporary bridges or other means of access required?
- _____ 4. Are street closures authorized? Have all interested agencies (i.e. Department of Public Works, police, fire, property owners, etc.) been properly notified?
- _____ 5. Are temporary traffic signs and/or barricades installed properly and at the proper locations?
- _____ 6. Has the Contractor provided for the control of surface drainage?
- _____ 7. Does the contractor's project safety program address confined space safety?
- _____ 8. Have sewer users been notified if service will be interrupted?
- _____ 9. Are contact persons and telephone numbers available for both Department personnel and contractor personnel?
- _____ 10. Have manufacturer's recommendations for installation (where applicable) been submitted and approved?
- _____ 11. Have measurements been made by the Contractor to verify length and diameter of pipe prior to ordering of material?

Point Repair

- _____ 12. Has a pre-installation video been made and reviewed?
- _____ 13. Is bypass pumping required? If so, is the bypass setup in accordance with the Contract Documents and approved shop drawing?
- _____ 14. Is repair pit excavation in accordance with the Contract Documents?
- _____ 15. Is the sewer pipe used in the repair in accordance with the Contract Documents and approved shop drawings?
- _____ 16. Is the bottom of the trench reshaped and compacted (appropriate bedding material brought in if necessary) so that the grade for the new pipe will match existing?
- _____ 17. Are the existing and new pipe ends cut flush in order to mate properly?
- _____ 18. Is an approved watertight coupling installed properly to connect the existing and new pipe?
- _____ 19. Are service connections properly reestablished?
- _____ 20. Has the post-rehabilitation video been made and reviewed?

Cured-in-Place Pipe (CIPP) Liner Installation

- _____ 21. Has a pre-installation video been made and reviewed?
- _____ 22. Has the existing pipeline been adequately cleaned of all debris and obstructions such as solids, dropped joints, intruding service connections, collapsed pipes or roots? Is re-cleaning required?
- _____ 23. Have the necessary point repairs been made?
- _____ 24. Is the lubricant proposed for inversion process compatible with the Halifax County Service Authority's wastewater treatment plant operations and pretreatment program?
- _____ 25. Is bypass pumping required? If so, is the bypass setup in accordance with the Contract Documents and approved shop drawing?
- _____ 26. Has a test section been pulled through the existing pipeline to ensure that the liner will fit?

- _____ 27. In the event of insertion being delayed after chemical application, is the Contractor properly storing the liner at a temperature of less than 30° F for use when conditions allow?
- _____ 28. Is the folded liner being passed down a suitably reinforced column or chute into the pipe to be lined?
- _____ 29. Is the Contractor using a suitable heat source to heat the water in the liner quickly and evenly?
- _____ 30. Are the initial cure and post-cure temperatures being maintained in the liner for the appropriate time in accordance with the manufacturer's recommendations?
- _____ 31. Is the Contractor maintaining a curing log?
- _____ 32. Is the installed liner free from defects that could affect future performance of the pipeline?
- _____ 33. Has the liner and connection in manhole been properly sealed in accordance with manufacturer's recommendations?
- _____ 34. Has any annular space in the liner to manhole connection been properly grouted?
- _____ 35. Are the house connections re-established with the installed liner prior to grouting?
- _____ 36. Has the Contractor take the required number of representative coupons to be tested? Are the coupons properly marked?
- _____ 37. Is the pushing or pulling force on the liner being continuously monitored during insertion?
- _____ 38. Has the post-rehabilitation video been made and reviewed?

Fold-in-Form Liner Installation

- _____ 39. Has a pre-installation video been made and reviewed?
- _____ 40. Has the existing pipeline been adequately cleaned of all debris and obstructions such as solids, dropped joints, intruding service connections, collapsed pipes or roots? Is re-cleaning required?
- _____ 41. Have the necessary point repairs been made?
- _____ 42. Is bypass pumping required? If so, is the bypass setup in accordance with the Contract Documents and approved shop drawing?
- _____ 43. Is the folded liner pipe properly heated and prepared prior to insertion into host pipe?
- _____ 44. Is the pipe pulled through at a constant speed in accordance with the manufacturer's recommendations?
- _____ 45. Are the appropriate fittings installed at each end for the pressurized steam to enter the liner pipe?
- _____ 46. Is the manufacturer's recommended temperature and pressure being maintained for the recommended time?
- _____ 47. After the liner is completely rounded, is the pipe cooled according to manufacturer's recommendations?
- _____ 48. Is the liner properly cut and sealed at each manhole?
- _____ 49. Are service connections properly reestablished?
- _____ 50. Has the post-rehabilitation video been made and reviewed?

Sliplining

- _____ 51. Has a pre-installation video been made and reviewed?
- _____ 52. Has the existing pipeline been adequately cleaned of all debris and obstructions such as solids, dropped joints, intruding service connections, collapsed pipes or roots? Is recleaning required?
- _____ 53. Have the necessary point repairs been made?
- _____ 54. Is bypass pumping required? If so, is the bypass setup in accordance with the Contract Documents and approved shop drawing?
- _____ 55. Are access pits of sufficient size and constructed in accordance with the Contract Documents and manufacturer's recommendations?
- _____ 56. Does the sliplining material conform to the Contract Documents and approved shop drawings?
- _____ 57. Is the Contractor following the manufacturer's recommended installation procedure?
- _____ 58. Has the liner and connection in manhole been properly sealed in accordance with manufacturer's recommendations?
- _____ 59. Has any annular space in the liner to manhole connection been properly grouted?
- _____ 60. Are the house connections properly re-established?

Chemical Grout Repair

- _____ 61. Has a pre-installation video been made and reviewed?
- _____ 62. Has the existing pipeline been adequately cleaned of all debris and obstructions such as solids, dropped joints, intruding service connections, collapsed pipes or roots? Is re-cleaning required?
- _____ 63. Have the necessary point repairs been made?
- _____ 64. Is bypass pumping required? If so, is the bypass setup in accordance with the Contract Documents and approved shop drawing?
- _____ 65. Does the grouting equipment comply with the Contract Documents and the approved shop drawing?
- _____ 66. Has the grouting successfully been tested on a sample piece above ground?
- _____ 67. Does the grout chemical comply with the Contract Documents and approved shop drawings?
- _____ 68. Is the grout pot life carefully checked and is grout only applied within the manufacturer's recommended time frame?
- _____ 69. Are the tests completed and documented for each joint in accordance with the Contract Documents?

APPENDIX XII
Construction Checklist for Manholes

General Requirements

- _____ 1. Review Contract Documents and the Special Provisions.
- _____ 2. Does the contractor's project safety program address excavation support?
- _____ 3. Have sewer users been notified if service will be interrupted?
- _____ 4. Are contact persons and telephone numbers available for both Department personnel and contractor personnel?
- _____ 5. Have manhole shop drawings and manufacturer's recommendations for installation (where applicable) been submitted and approved?

Manhole Installation

- _____ 6. Has the manhole been inspected for direction and sizes of openings, cleanliness, joints, and handling damage and cracks?
- _____ 7. Is the excavation in the correct location and of sufficient size for the manhole and for working room? Are the sides properly sloped back or shored?
- _____ 8. Is the manhole bedding prepared as specified in the Standard Drawings?
- _____ 9. Is the manhole bedding at the proper grade prior to installation of manhole?
- _____ 10. Are lift holes plugged from the outside with non-shrink grout after being lowered into place?
- _____ 11. Are manhole sections being placed and joined in accordance with manufacturer's recommendations for a watertight joint? Is pre-formed joint sealer installed in accordance with manufacturer's recommendations?
- _____ 12. Are pipes being joined to the manhole in accordance with Standard Drawings and manufacturer's recommendations?
- _____ 13. Do pipe and pipe joints at the manhole provide for flexibility as required?
- _____ 14. Are pipe stubs required and installed accurately? Are they properly sealed with a watertight plug or cap?
- _____ 15. Check channels and shelves for dimension, slope, and finish. Are they in accordance with the Contract Documents?
- _____ 16. Is the proper backfill material installed in accordance with the Contract Documents and manufacturer's recommendations?
- _____ 17. Is the top of the manhole brought to proper grade for receiving frame and cover in accordance with the Standard Drawings?
- _____ 18. Check frames and covers for compliance. Does cover seat in frame properly without rocking? Inner cover required? Locking cover required?
- _____ 19. Is approved chemical resistant coating properly applied in accordance with manufacturer's recommendations?

APPENDIX XIII

Pressure Pipe Installation Construction Inspection Checklist

1. General Requirements

- ___ 1. Check Contract Documents for the following:
 - a. Existing utilities and other substructures
 - b. Pipe and fitting materials
 - c. Bedding requirements
 - d. Traffic control requirements
 - e. Bypass pumping requirements
- ___ 2. Are existing utilities located and marked at the site by Miss Utility or determined by potholing at frequent intervals? (Simply calling Miss Utility is not acceptable the utilities must be marked.)
- ___ 3. Is access to private or public property impeded? Are temporary bridges or other means of access required?
- ___ 4. Are street closures authorized? Have all interested agencies (i.e. police, fire, property owners, etc.) been properly notified?
- ___ 5. Are temporary traffic signs and/or barricades installed properly and at the proper locations?
- ___ 6. Has the Contractor provided for the control of surface drainage?
- ___ 7. Has the project been properly laid out in approved shop drawings?

Pipe Materials – Delivery, Storage and Handling

- ___ 8. Are materials on site in accordance with approved Shop Drawings?
- ___ 9. Was the pipe and/or fittings carefully removed from truck and kept under control at all times in a secure area?
- ___ 10. Was the pipe and/or fittings dropped, bumped, dragged, pushed, or moved in any way that may cause damage to the pipe or coating.
- ___ 11. If handling the pipe with a crane, is a suitable sling being used around the pipe? Note: Under no conditions can the sling pass through the pipe.
- ___ 12. Are suitable blocking and stakes installed to prevent pipe from rolling?
- ___ 13. Are gaskets for pipe joints stored in a cool place and protected from light, sunlight, heat, oil, or grease until installed?
- ___ 14. Are gaskets showing any signs of checking, weathering or other deterioration?
- ___ 15. Check for minimum and maximum trench width. Is it in accordance with the Standard Drawings?
- ___ 16. Did the excavation expose any unusual conditions requiring consideration by the Design Engineer?
- ___ 17. Are line and grade control being maintained satisfactorily?
- ___ 18. Do actual soil conditions agree with plan? Is shoring method adequate for actual trench condition?
- ___ 19. Is spoil bank clear of trench? Is it encroaching into required traffic lanes or private property?
- ___ 20. Is there any evidence of movement of adjacent improvements, utilities or structures? (Separation cracks, settlement, etc.)
- ___ 21. Have property owners been notified if work encroaches on private property?
- ___ 22. Is the subgrade firm? Is the subgrade as specified in the Contract Documents or will imported bedding material be required?
- ___ 23. Check trench for evidence of unconsolidated fill. (Additional excavation may be required if located in the trench bottom; additional compaction may be required if located above the pipe invert.
- ___ 24. Is temporary support of existing utilities and improvements being provided? In event of damage, are owners promptly notified?
- ___ 25. All loose soil removed from the trench?
- ___ 26. Is groundwater encountered? If so, is the trench bottom kept dry?
- ___ 27. Is the discharge from dewatering pumps in compliance with regulatory requirements?
- ___ 28. Is a dry trench bottom unachievable due to improper or insufficient use of all known methods of trench dewatering? If so, has the Supervisor been contacted?

- _____ 29. Does backfill material meet that specified in the Contract Documents and approved in shop drawing?
- _____ 30. Is backfill material free of foreign debris and not frozen?
- _____ 31. Is backfill being installed in lifts and compacted as specified in the Contract Documents?
- _____ 32. Is final landscaping or pavement installed as specified in the Contract Documents?

Pipe Laying – General

- _____ 33. Is pipe handled and installed using the manufacturer's recommendations approved shop drawings?
- _____ 34. Is each pipe checked for damage before lowering into trench?
- _____ 35. Are the required concrete cradle or granular bedding material and thickness provided to cradle the pipe?
- _____ 36. For pipelines intended for gravity flow, did pipeline laying begin at the low end of a run and proceed upgrade?
- _____ 37. Are all bells pointing ahead?
- _____ 38. Is each pipe checked for alignment and grade?
- _____ 39. Are adjustments to bring pipe to line and grade made by scraping away or filling in select fill material under the body of the pipe as recommended by the manufacturer?
- _____ 40. Are the faces of the spigot ends and the bells of pipes brought into fair contact and the pipe firmly and completely shoved home?
- _____ 41. As the work progresses, is the interior of pipeline kept clean of all dirt and superfluous materials?
- _____ 42. Are pipes closed off with bulkheads, plugs, or other suitable means when pipe laying is not in progress?
- _____ 43. Are bell holes excavated for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length?
- _____ 44. Are bell holes thoroughly tamped with select fill material following the making of each joint?
- _____ 45. Are pipe cuts for valves and fittings cut at 90 degrees, ground smooth, and rough edges removed?
- _____ 46. Are joint restraints installed at locations identified in the Contract Documents?
- _____ 47. Are cement mortar lined joints being properly sealed as specified in the Contract Documents?

Ductile Iron Pipe Installation – Mechanical Joints

- _____ 48. For all ductile iron pipe in sewer force mains – is the pipe lined with “sewpercoat” or “protecto 401”?
- _____ 49. Is the spigot properly centered in the bell?
- _____ 50. Are the surfaces with which the rubber gasket comes in contact properly cleaned and prepared prior to assembly of the joint?
- _____ 51. Are the gaskets lubricated just prior to installation?
- _____ 52. Are the nuts tightened with a torque wrench to the appropriate torque so that the gland is brought up toward the pipe evenly?
- _____ 53. Are bolts properly sealed with a bituminous coating?

Ductile Iron Pipe Installation – Rubber Gasket Joints

- _____ 54. Are all surfaces, contacting the rubber gasket, properly cleaned and prepared prior to assembly of the joint?
- _____ 55. Is the gasket placed in the socket so that the groove fits over the bead in the seat?
- _____ 56. Is a thin film of approved lubricant applied to the inside surface of the gasket that will come in contact with the entering pipe?
- _____ 57. Is sufficient force exerted on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint?
- _____ 58. For restrained joints - Are locking segments and retainer gland locked and installed according to manufacturer's instructions? Note: Larger diameter pipes may have more locking segments and retainer glands, all must be securely locked and installed.

PVC Pipe Installation

- _____ 59. Is the sealing surface of the pipe spigot end, the pipe bell, the coupler or fitting, and the gasket properly cleaned before assembly?
- _____ 60. Is gasket properly lubricated?
- _____ 61. Is pipe spigot end fully homed after jointing?
- _____ 62. For pipe 12" and smaller only – are any bends in the pipe less than manufacturer's recommendations?
- _____ 63. Is the appropriate tracer wire and non-metallic tape being installed?

Miscellaneous Considerations

- _____ 64. Are appurtenances (i.e. fittings, services, valves, and hydrants) installed in accordance with manufacturer's recommendations and the Contract Documents?
- _____ 65. Is the pipe properly cleaned prior to testing?
- _____ 66. Is the pipe properly tested in accordance with the Contract Documents?
- _____ 67. For potable water – Has the pipe been properly disinfected in accordance with the Contract Documents?
- _____ 68. Following disinfection, is highly chlorinated water disposed of in accordance with environmental regulations?

APPENDIX XIV

Standard Procedures for the Acceptance of Newly Constructed Pumping Stations

I. Pre-Construction Phase

- A. A pre-construction meeting is set up by Inspection for both Halifax County Service Authority and Developer projects.
 - 1. This meeting will include the Engineer, the Inspector, Contractor, and the Owner.
 - 2. The Contractor will furnish to the Inspector a detailed construction schedule.
 - 3. Discuss preparation of O & M Manual and subsequent application from DEQ for Certificate of Operation.
 - 4. Minutes will be furnished by the Engineer.

- B. A Notice to Proceed is issued by Design Section to the Contractor.

II. Construction Phase

- A. Daily, thorough inspection of construction carried out by the Inspector.
 - 1. The Inspector will be responsible for daily reports, project status and construction issues.
 - 2. In the case of project schedule deviation, Inspector is to notify the Owner, Contractor, and the Engineer

- B. Monthly meetings will be set up by the Inspector which will include the Engineer, the Contractor, and the Inspector with the minutes supplied by the Engineer.

- C. Once the construction is complete, we will require a letter of completion from the Owner/Owner's Agent insuring that all work has been completed, which will include Dominion-Virginia Power work, water services, Sprint work, telemetering, etc. This letter will also request a start up inspection ten days in advance. This letter is to be sent to the inspector.

III. Start Up Inspection

- A. Inspection sets up a start up inspection by sending a written notification to the Engineer, the Contractor, the HCSA Director of Operations, and the owner where applicable.

- B. An extensive inspection is carried out by the, HCSA Director of Operations Superintendent, Inspector, and the Engineer.
 - 1. All equipment is to be operated.
 - 2. All other facilities per plans and contract documents are inspected.
 - 3. The Inspector develops the punch list by using the attached checklist.

- C. Inspection will write a letter addressing all deficiencies and send it to the Owner/Owner's Agent with a copy to the Contractor, the Engineer, the HCSA Director of Operations. This letter will also request a time frame for repairs.
 - 1. This letter will come from the Chief Inspector and the Inspector.
 - 2. The Owner/Owner's Agent must submit in writing, to the HCSA Inspector, HCSA Director of Operations, and Engineer with a specific time and date for completion.
 - 3. The Contractor shall notify the Inspector 24 hours prior to making any repairs or additions regarding the punch list.

- D. The Owner/Owner's Agent is required to respond, in writing, to the Inspector certifying the completion of the punch list with a copy sent to the Engineer.
- E. The Owner/Owner's Agent shall request in writing from the Inspector a Pre-Final Inspection within ten days after completion of the punch list.

IV. Interim - Start Up - Pre-Final

- A. The Inspector is responsible for keeping lines of communication open between Inspection and all parties. He is to keep the job progressing.
- B. Through out this period no service connections will be allowed. The Halifax County Service Authority will not be held responsible for the cost of the associated utilities, or operation and maintenance of the facility.

V. Pre-Final Inspection

- A. Inspection sets up a Pre-Final inspection by sending a written notification to the Engineer, the Contractor, the HCSA Director of Operations and the Owner/Owner's Agent.
- B. Re-inspecting the Station
 1. All equipment is to be operated.
 2. All punch list items must be complete.

VI. If Station Deficiencies are still noted repeat procedures detailed in Start Up Inspection

VII. If Station Passes Pre-Final Inspection

- A. A letter will be required from the Engineer indicating that the project has reached a stage of substantial completion. In this letter a statement that all requirements for the facility have been fulfilled will be included.
- B. The Engineer must submit three copies of the Operations and Maintenance Manual to the HCSA Director of Operations, Operations Division Superintendent, Wastewater Treatment Superintendent, and send a sufficient number of copies to the Virginia Department of Health and the Department of Environmental Quality.
- C. The Engineer is responsible to obtain the Certificate for Operation prior to putting the station into operation, with a copy of the Certificate being sent to the HCSA Director of Operations, Operations Division Superintendent, Wastewater Superintendent, Owner/Owner's Agent and the Contractor.
 1. The Engineer sends a letter to the Virginia Department of Health stating that the Pumping Station has been built in accordance with the approved plans and specifications.
 2. The Virginia Department of Health will issue the Certificate for Operation for a water pumping station, and the Department of Environmental Quality will issue the Certificate for Operation for a sewage pumping station.
- D. The Inspector is required to notify the HCSA Director of Operations in writing that the Station is acceptable.
- E. Upon receipt of the completion statement, the HCSA Director of Operations. HCSA Director of Operations will issue a letter to the Owner/Owner's Agent stating the acceptance of the Station.

- F. Connections will be allowed to the Station at this point in time.
- G. The Operational Costs (power, telephone, etc.) are assumed by the Halifax County Service Authority at this time.
- H. Equipment warranties and yearly acceptance begin at this time.
- I. The contractor is responsible for furnishing evidence of sufficient bonding during the warranty period.
- J. Daily Operations and Maintenance begin at this time at the Halifax County Service Authority's cost.
- K. Procedure for handling equipment failures that are covered by warranty are carried out if necessary.
 - 1. Operation and Maintenance contacts the Inspector in writing.
 - 2. The Inspector notifies the Owner/Owner's Agent in writing indicating the degree of the problem and when the repairs need to be completed.
 - 3. The Owner/Owner's Agent will make the necessary repairs and will send a letter to the Design Section indicating that the necessary repairs are complete with a copy sent to the Engineer, the HCSA Inspector and the HCSA Director of Operations.

VIII. Final Inspection

- A. The Inspector sets up a Final Inspection by sending a written notification to the Engineer, the Contractor, the HCSA Director of Operations. and the Owner/Owner's Agent This inspection will take place during the final month of the warranty period.
- B. All remaining equipment problems should be resolved. The punch list created by the HCSA Director of Operations the HCSA Inspector through out the year should be used as the checklist.
- C. After the Station passes the Final Inspection
 - 1. The Design Section will send a written statement stating that the Halifax County Service Authority accepts full responsibility of the station to the Owner/Owner's Agent with a copy to the Engineer, and the HCSA Director of Operations.
 - 2. The Wastewater Treatment Plant assumes full responsibility for the station.

IX. General

- A. Full open communication between Design, Inspection, Engineer and HCSA Director of Operations is mandatory.
- B. All correspondence, being written, verbal, or by telephone, etc., must be appropriately documented by all parties.
- C. The Senior Utility Engineer is responsible for making sure all inspection duties are carried out properly.

APPENDIX XV

Procedure for Estimating Customer Water Demand

1. Determine the number and type of water fixtures needed and list on the "Sizing Water Service Lines and Meters" form where applicable.
2. To determine the combined fixture value: Multiply the fixture values times the number of fixtures to obtain the Total Fixture Value for each type of fixture. Add all total fixture values and place answer in the space provided on the sizing form.
3. All other demands shall be substantiated with data furnished by the owner's engineer and/or his agent. If it is necessary to have a fixed demand and/or an irrigation demand, owner's engineer and/or his agent must complete Part B of the sizing form.

Caution: The person completing Part B of this form needs to include all water demands necessary for the buildings) and/or its' intended use. For conversion from combined Fixture Value to gpm, refer to Figures 4.4 and 4.5 of the AWWA Manual of Water Supply Practices No. M 22, latest revision.

4. You have the option of calculating the water demand using the International Plumbing Code (IPC) instead of using the "Sizing Water Service Lines and Meters" form. In this instance, you must list the type and number of fixtures; the IPC fixture unit value for each fixture; and the total number of IPC fixture values.
5. If you install water saving flush valve water closets, the Halifax County Service Authority's virtual meter policy may apply.
6. Upon completion of this form, send to the following address:

Director of Operations
Halifax County Service Authority
P. O. Box 640
Halifax, Virginia 24558

APPENDIX XVI
(Sample Letter) — (Engineer's/surveyor's Letterhead)

(Date)

(Property Owner's Name)

(Address)

Re: Halifax County Service Authority Project # _____

Dear _____,

Our firm has been retained to design a water/sewer line to become a part of the Halifax County Service Authority's overall utility system. In conjunction with this, surveying is the first phase of work that must be completed. Information obtained by this survey will allow our firm to recommend a location taking into consideration existing trees, shrubs, creeks, etc.

Should you have any trees or topographic features you wish preserved, we would appreciate being advised so that we may consider these in our design.

After surveys and design are complete, you will be contacted should it become necessary to obtain easements for construction. We propose to start survey work on or near your property within ten days to two weeks. Should you have any questions concerning either the survey or utility line, please contact the HCSA Director of Operations at _____ to discuss this matter.

Your cooperation in this matter is greatly appreciated.

Sincerely,

cc: Halifax County Service Authority

APPENDIX XVII

Information Required for Utilities Contract

(PLEASE TYPE OR PRINT)

1. PROJECT NAME: _____

2. AGENT'S NAME: PHONE _____ ADDRESS: _____ ZIP _____

3. PROPERTY OWNER: PHONE _____ ADDRESS: _____ ZIP _____

A. If Corporation, will sign for a Corporation as This Corporation was organized in the State of _____.

B. If Partnership, will sign for the partnership as its general partner. This partnership was organized in the State of _____.

C. If a Limited Liability Corporation _____ will sign as managing member.

D. If person signing the contract is not an officer of the corporation or partnership, a certified copy of the Corporate/Partnership Resolution authorizing that person to sign such documents must be attached to the Halifax County Service Authority /Developer contract.

4. LEGAL DESCRIPTION (Lot and Block Number and Tax Parcel Number as property exists): _____

5. MAGISTERIAL DISTRICT: _____

6. DEED BOOK _____, PAGE _____ (must reflect #3 above)

7. UTILITIES CONTRACTOR'S NAME: _____

Phone No: _____ Fax No: _____ E-Mail Address: _____

8. LAND USE:

Residential: Subdivision _____ Townhouse/Condo _____

Apartment _____ Other _____

Commercial: Office _____ Retail _____

Industrial: Type _____

I certify that the above information is true and correct. _____

Owner/Agent

Date

APPENDIX XVIII

National CAD Standard Layering Format

Layer Naming Protocol

This layering standard is based on the NCS (National CAD Standard) layering format. There are four defined layer name data fields: Discipline Designator, Major Group, two Minor Groups, and Status. The Discipline Designator and Major Group fields are mandatory. The Minor Group and Status fields are optional. Each data field is separated from adjacent fields by a dash (“-”) for clarity.

Layers are selected for a given project based on the level of detail required. If differing pipe systems need to be differentiated for color or visibility, then they should be placed on different layers. If they do not need to be differentiated, then they could all be placed on the M-PIPE layer. Objects defined by layers will be drawn on that layer. For example, existing walls could be drawn on the A-WALL-E layers, whereas new walls could be drawn on the A-WALL layer. Objects should be associated with their named layers and the layer color should determine the object color.

The following Discipline Designators are to be used: Designator Discipline

C Civil	M Mechanical	I Instrumentation	E Electrical
H HVAC	P Plumbing	S Structural	A Architectural

The following table is a list of layers by discipline:

Layer	Name Description	Layer	Name Description
C-DFLD	Drain fields	C-PRKG-SIGN	Parking lots: signs
C-DRIV	Driveways	C-POND	Ponds
C-DRIV-ASPH	Driveways: asphalt surface	C-POWR	Power
C-DRIV-CNTR	Driveways: centerline	C-PROP	Property
C-DRIV-CONC	Driveways: concrete surface	C-PVMT	Pavement
C-DRIV-GRVL	Driveways: gravel surface	C-RAIL	Railroad
C-SIGN	Signs	C-RAIL-CNTR	Railroad: centerline
C-CURB	Curb	C-RIVR	River
C-MRKG	Pavement markings	C-ROAD	Roadways
C-DTCH	Ditches or washes	C-ROAD-ASPH	Roadways: asphalt surface
C-DTCH-CNTR	Ditches or washes: centerline	C-ROAD-CNTR	Roadways: centerline
C-EROS	E & S control	C-ROAD-CONC	Roadways: concrete surface
C-EROS-DDIV	E & S control: drainage divides	C-ROAD-GRVL	Roadways: gravel surface
C-EROS-SILT	E & S control: silt fence	C-ROAD-SIGN	Roadways: signs
C-ESMT	Easements	C-RRAP	Riprap
C-FENC	Fences	C-SSWR-STRC	Sanitary sewer structures
C-GRAIL	Guard rail	C-“X”-SSWR	Sanitary sewer where X = pipe size
C-HYDR	Fire protection: hydrants	C-STEAM	Steam system
C-FUEL	Fuel gas	C-SD	Storm drain
C-FUEL-EQPM	Fuel gas: equipment	C-SWLK	Sidewalks
C-FUEL-PIPE	Fuel gas: piping	C-TOPO	Topography
C-FUEL-TANK	Fuel gas: storage tanks	C-TOPO-MAJR	Topography: major contours
C-FUEL-UNDR	Fuel gas: underground piping	C-TOPO-MINR	Topography: minor contours
C-LOCN	Limits of construction	C-SPOT	Topography: spot elevations
C-NGAS	Natural gas (pumps, etc.)	C-TRAIL	Trails or paths
C-PRKG	Parking lots	C-WALL	Walls
C-PRKG-ASPH	Parking lots: asphalt surface	C-“X”-WATR	Water supply system where X = pipe size
C-PRKG-CONC	Parking lots: concrete surface		
C-PRKG-GRVL	Parking lots: gravel surface		

<u>Layer</u>	<u>Name Description</u>	<u>Layer</u>	<u>Name Description</u>
C-WATR-STRC	Water supply systems: structures	H-VALVE	Valves
C-WETL	Wetlands	H-PUMP	Pumps, Water Heaters & Tanks
M-EQUIP	Mechanical Equipment	H-OUTLINE	Outline of HVAC equipment
M-PIPE	Pipe, Valves, Fittings	H-NOTE	General Text and Notes
M-PIPE-SL	Single Line Piping	H-LDR	Leader Lines, Flow-Directional Arrows
M-item-PAD	Concrete equipment pads	H-DIM	Dimension Lines, Witness Lines
M-NOTE	General Text and Notes	H-INFO	Transfer Information ONLY
M-DIM	Dimension Lines, Witness Lines	P-HW	Hot Water Lines
M-INFO	Transfer Information ONLY	P-CW	Cold Water Lines
I-DATALINK	Data link Lines	P-HWC	Hot Water Circulating Lines
I-PCLAN	Personal Computer LAN	P-DRAIN	General Drains
I-INST	Instrument Bubbles	P-DRAINROOF	Roof Drains
I-SYMBOL	Non-Instrument Symbols	P-DRAIN-SAN	Sanitary Drains
I-PANEL	Line work for Panels	P-EQUIP	Water Heaters, Tanks, etc.
I-SCHEDULE	Line work for Schedules	P-FIXT	Plumbing Fixtures
I-GRAPHIC	Background Equipment/Structures	P-AIR	Air Line
I-NUMBER	Instrumentation & Equipment Numbers	P-GAS	Gas Supply
I-COND	Conduits containing signal wires	P-VENT	Sanitary Vents
I-NOTE	General Text and Notes	P-OUTLINE	Outline of plumbing equipment
I-LDR	Leader Lines, Flow- Directional Arrows	P-LDR	Leader Lines, Flow-Directional Arrows
I-DIM	Dimension Lines, Witness Lines	P-DIM	Dimension Lines, Witness Lines
I-INFO	Transfer Information ONLY	P-INFO	Transfer Information ONLY
E-LIGHT	Light Fixtures	S-REBAR	Structural Rebar
E-MTR	Motors	S-CONC	Line work for concrete cut section
E-PANEL	Control Panels & Consoles	S-CONCSLOPE	Lines delineating drainage slopes of slabs
E-EQUIP	Electrical equipment & items	S-CONCBACK	Line work for concrete items .
E-GND	Grounding wires, grids, etc.	S-WALLMASO	Bearing masonry walls.
E-OUTLINE	Outline of electrical equipment	S-COL	Columns, concrete unless appended
E-NOTE	General Text and Notes	S-BEAM	Beams, concrete unless appended
E-LDR	Leader Lines, Flow-Directional Arrows	S-PILE	Piles
E-DIM	Dimension Lines, Witness Lines	S-STEEL	Line work for structural steel shapes
E-INFO	Transfer Information ONLY	S-EXPIT	Expansion & Construction Joints, Etc.
H-EQUIP	Primary HVAC Equipment	S-CJ	Construction & Control Joints
H-EQUIP-SEC	Secondary HVAC Equipment	S-STAIR	Stairs, Walkways, Ramps
H-HWS	Hot Water Supply	S-OPEN	'X' lines to denote openings
H-HWR	Hot Water Return	S-FPRINT	Footprint of Structure
H-MOTOR	Motors	S-BL	Building Limit Line
H-PIPE	HVAC Related Piping	S-LDR	Leader Lines, Flow-Direction Arrows
H-PIPE-FUEL	Fuel Oil Piping	S-DIM	Dimension Lines, Witness Lines
H-PIPE DG	Digester Gas Piping	S-BRKLN	Break lines
H-PIPE-COND	Condensate Piping	S-INFO	Transfer Information ONLY