

**HANOVER COUNTY
DEPARTMENT OF PUBLIC UTILITIES
WATER AND SANITARY SEWER STANDARDS
HANOVER COUNTY, VIRGINIA**

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1. DESIGN STANDARDS AND PROCEDURES

1.1 General

These Design Standards have been prepared to assist engineers who are designing plans for water and sanitary sewer projects in Hanover County, Virginia. These Standards are for use by experienced design professionals. Variations will be permitted based solely on sound engineering practice and will be reviewed and approved by the Department of Public Utilities on individual bases. Such variations must be requested in writing along with sufficient documentation supporting the request.

Designs shall be in accordance with the latest edition of the Waterworks Regulations and Sewage Collection and Treatment Regulations (SCAT). Designs shall also be in accordance with the rules and regulations of the Virginia Department of Health, State of Virginia and any other local, State or Federal agencies within whose jurisdiction the design exists. The engineer shall also comply with the requirements of the Code of Hanover County as it pertains to water and sanitary 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 Department of Public Utilities.

1.1.1 Preliminary Matters

It is recommended that for most projects, particularly for complex projects and those projects which may require special considerations, the engineer arrange a pre-submission meeting with the Department of Public Utilities to discuss the approach to be taken to supply water and sanitary sewer service.

It is recommended that the engineer confer with the Virginia Department of Transportation or the Town of Ashland (when applicable), prior to preparing plans for a water main or sewer line extension in any public right-of-way so that location issues may be resolved prior to preparation and submittal of the plans.

1.1.2 Master Plan

Prior to the approval of any portion of a phased development, subdivision or site plan, the developer or his agent shall submit an overall master plan of proposed water and/or wastewater systems for the entire development for review and approval by the Department of Public Utilities. When construction plans for future phases are submitted for approval and the proposed phases are not in accordance with the approved master plan, the master plan shall be amended and re-submitted for review and approval.

1.1.3 Construction Drawings

Prior to construction of public water and/or sanitary sewer facilities, construction drawings for the proposed facilities must be submitted for review and approved by the Department of Public Utilities. The construction drawings must be in a form acceptable to the Department of Public Utilities.

Construction drawings are typically submitted to the Hanover County Planning Department, the Town of Ashland Planning Department, or the Hanover County Department of Public Works

which forward the plans to the Department of Public Utilities. If plans are submitted directly to the Department of Public Utilities, three sets of plans will be required for the Department's use. If additional sets are required, the Department of Public Utilities will contact the developer or the responsible engineer.

All water and sanitary sewer systems as shown on the construction plans must be located and sized properly to serve the entire service area. The adequacy of the plans as designed will be determined by the Department of Public Utilities.

It should be noted that where it is determined that water or sanitary sewer lines are necessary to serve adjoining properties or properties beyond the subdivision or development in question, the developer will be required to adequately design and construct his system at an appropriate location to permit future extensions to be made at the limits of the subdivision or development in question. If a subdivision or development is divided into logical phases, the water and sanitary sewer improvements to serve adjoining properties may be phased along with the subdivision or development. All improvements, within or adjacent to, a phase must be constructed as each phase is developed.

The sanitary sewer system normally will terminate at or within one lot from the adjacent and/or upstream properties to be served by the system in the future. The termination point shall be approved by the Department of Public Utilities. Normally sanitary sewers will be constructed to the limits of construction within a development so that future extensions to adjoining properties will not disrupt improvements. Elevations of the sanitary sewer system must be designed such that future extensions are taken into consideration to allow service to all of the area which naturally drains towards the system. Utility easements to adjoining properties to allow for the extension of the public sewer system shall be provided.

The water system must be designed and constructed through the development to facilitate future extensions. Typically, this will include the construction of water mains along the full extent of any public road frontage of a subdivision or development unless such a water main is already present. The termination point shall be approved by the Department. If a water main is required outside of, and not parallel to, a right-of-way, the water main will be constructed to the limits of construction within the development so that future extensions to adjoining properties will not disrupt any improvements. Utility easements shall be provided to allow adjoining properties to connect to the public water system as appropriate.

Construction drawings shall contain the information necessary to construct the utilities shown. The information shall be presented in a clear and legible manner. Drawings shall meet the requirements of the Department of Public Utilities as outlined in the appropriate checklist contained in these Standards.

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, the Department of Public Utilities

reserves the right to require that the engineer secure accurate information on the horizontal and vertical location of such utilities through subsurface exploration prior to approving the plans.

The plans will be reviewed and a review letter will be prepared. After revisions are made, the engineer must resubmit the plans for review. Plans will be approved when all comments made by the Department of Public Utilities and other departments and/or agencies have been addressed by the engineer.

Vertical datum for surveys shall be noted on the plans. Vertical datum shall be National Geodetic Vertical Datum of 1929 (NGVD 29). Horizontal datum should be NAD 83.

1.1.4 Utility Service Agreement, Fees, Bonds, and Construction Permit

The developer must enter into a Utility Service Agreement with Hanover County before a Utility Construction Permit will be issued. All plan review and inspection fees must be paid and performance bonds or surety posted before a Utility Construction Permit will be issued. Work on utilities may not begin until a Utility Construction Permit is issued by the Department of Public Utilities.

1.1.5 Contractor Requirements and Inspection

All utility work must be performed by a Class A licensed contractor deemed acceptable to the Department of Public Utilities. The Department of Public Utilities may allow service laterals to be installed by a licensed plumber. All utility construction shall be subject to inspection, testing, and approval by the Department of Public Utilities.

1.1.6 Contacting Property Owners

Prior to performing any survey or design work on private property, the engineer or surveyor shall notify the landowner and obtain the landowner's permission for all work being performed. In addition, the Department of Public Utilities may require that letters be sent to landowners with existing easements on their property prior to any work being completed in the easement. Notification shall be made in the form of a letter to be sent to the property owner. If requested, copies of these letters shall be provided to the Department of Public Utilities.

End of Section

1.2 Sanitary Sewers

1.2.1 Location

Whenever possible, sanitary sewers shall be constructed within street rights-of-way. All sanitary sewers located 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 definitively shown that it is not practicable to adhere to the standard location. All sanitary sewers shall be laid on a straight line and grade between manholes.

1.2.2 Horizontal Separation from Water Mains and Wells

In a parallel installation, sanitary sewer lines and/or manholes shall be located at least 10 feet horizontally from any water main when possible. The distance shall be measured edge to edge between the structures and/or pipes.

Minimum horizontal separation shall meet or exceed 10 feet whenever possible. The designer should consider alternate alignments and/or locations for water mains and sanitary sewer lines, if required, to provide the required horizontal separation. If it is not possible to obtain the specified horizontal separation based on specific local conditions then in accordance with SCAT regulations a sanitary sewer may be closer to a water main provided that:

1. The bottom of the water main is at least 18 inches above the top of the sewer.
2. Where the water main cannot be located at least 18 inches above the top of the sewer, the sewer shall be constructed of ductile iron per Section 3.2.1.D. and shall be pressure tested to assure a watertight connection prior to backfilling. The test pressure shall be 5 psi, or a pressure greater than the pressure exerted by a column of water equal to the depth of the deepest section of the sewer being tested, whichever is greater. The test pressure shall be held for a minimum of 2 hours.
3. Sanitary sewer manholes, located within 10 feet of water mains shall be of watertight construction and be tested in place by vacuum testing.

Sanitary sewer lines shall be constructed of ductile iron pressure pipe (appropriate class for diameter per DPU Standards for “water main pipe”) and maintain a minimum of 10 feet separation from any existing wells.

1.2.3 Vertical Separation from Water Mains

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 sanitary sewer whenever possible. Minimum vertical separation shall be provided whenever possible. The designer should consider alternate alignments and/or locations for water mains, sewer lines, and storm sewers if required to provide the required vertical separation between sanitary sewers and water mains. If it is not possible to obtain the specified vertical separation based on specific local conditions then, in accordance with the SCAT regulations, the following criteria must be met:

1. Sewers passing over or under water mains shall be constructed of AWWA approved water pipe and shall be pressure tested to assure a watertight connection prior to backfilling. The test pressure shall be 5 psi, or a pressure greater than the pressure exerted by a column of water equal to the depth of the deepest section of the sewer being tested, whichever is greater. The test pressure shall be held for a minimum of 2 hours.
2. In addition, water mains passing under sanitary sewers shall be protected by providing:
 - A. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water mains.
 - B. Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking of the water mains.
 - C. A full section of water pipe centered at the point of crossing so that the joints will be equidistant and as far as possible from the sanitary sewer.

1.2.4 Vertical Separation Other Utilities

Normally where storm sewers or other utilities pass over or under sanitary sewers, a minimum of 18 inches of separation should be maintained. The County may allow the separation to be less than 18 inches but no less than 6 inches on a case-by-case basis. Ductile iron pipe (Class 52 minimum) must be utilized for the sanitary sewer where the separation is less than 12 inches.

1.2.5 Horizontal Separation Other Utilities

Where the sanitary sewer is installed parallel to a storm sewer, there shall normally be a minimum of 5 feet of horizontal separation measured edge to edge between them. Under unusual conditions, this requirement may be reduced by the County. If a sanitary sewer is located more than 5 feet below the bottom of a parallel storm sewer, the Department of Public Utilities may require that the distance between the pipes be increased.

1.2.6 Bores and Tunneling

Carrier pipes within bores or tunnels for sanitary sewer installation shall be ductile iron (Class 52 minimum) pressure pipe with restrained joints. All casing pipes shall have an exterior corrosion protective coating.

1.2.7 Crossings of Railroads, Major Roadways and Other Major Structures

All sanitary sewer line crossings of railroads, major roadways, and other major structures shall be contained in a casing pipe or tunnel pipe. Design of railroad crossings shall comply with the requirements of American Railway Engineering Association Specifications, Part 5 - Pipelines (latest revision). The developer shall be responsible for obtaining required railway permits and/or agreements for the County, paying any fees and posting any required construction bonds for the railway crossing prior to beginning construction on any part of the project. A copy of the permit and/or agreement shall be provided to the Department of Public Utilities prior to a Utility Construction Permit being issued for the project.

1.2.8 Sanitary Sewers near Force Main Discharge Points

Where a sanitary sewer pipe is located within 2,000 feet downstream of the discharge end of a force main, the pipe shall be constructed of PVC materials whenever possible. If ductile iron pipe is required within 2,000 feet of the discharge end of a force main because of lack of cover, lack of separation or any other reason, the pipe shall have a special interior coating resistant to corrosion by hydrogen sulfide. The special coating shall be consistent with Section 3.2.1.D. and approved by the Department of Public Utilities. If in the County's or engineer's judgment corrosion by hydrogen sulfide will continue to be a problem for more than 2,000 feet, corrosion-resistant materials shall continue to be used for an appropriate distance from the discharge end of the force main.

1.2.9 Sanitary Sewers Crossing Streams, Lakes, or Drainages

The tops of all sanitary sewers entering or crossing streams shall be a sufficient depth below the natural bottom of the streambed to protect the sanitary sewer line. Typically, sanitary sewers crossing streams shall have a minimum of 3 feet of cover from the natural stream bottom. Less cover will be considered if no other option is available and the proposed sanitary sewer is ductile iron pipe, encased in concrete or otherwise protected and the sanitary sewer will not interfere with future improvements to the stream channel. The sanitary sewer trench within the streambed shall be protected from erosion by the use of rip-rap, concrete, gabion mats, or other appropriate measures. The developer shall be responsible for obtaining all required environmental permits for stream crossings and related construction activities. All conditions of any environmental permit must be acceptable to the Department of Public Utilities. It is the developer's responsibility to obtain the Department of Public Utilities' approval of any conditions prior to accepting any environmental permit.

Sanitary sewers located under paved channels, concrete channels, rip-rap lined channels, or other lined channels shall be located at least 2 feet below the bottom of the channel lining.

Sanitary sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Construction methods and materials of construction shall be such that sanitary sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic loads, physical loads and erosion.

Sanitary sewers will normally not be allowed to be constructed under lakes, estuaries, or stormwater facilities. When constructed adjacent to such features, the sanitary sewer shall be located far enough away from the water surface that the sewer can be excavated without entering the water body for maintenance purposes.

1.2.10 Sewers within Floodplains

All sanitary sewer pipes within a 100-year floodplain where cover is less than 4 feet or where size is greater than 12 inches shall be checked for flotation assuming the pipes are empty. Non-float pipe shall be utilized if appropriate. Other anti-flotation methods or devices will be considered on an individual basis.

Clay dams shall be utilized in the trench where the possibility exists for damage or undermining of pipe bedding due to ground or surface water following the sanitary sewer trench.

Sanitary sewers shall be designed to remain fully operational during the 100-year flood. Sanitary 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. Sanitary sewers located along streams shall be located outside of the streambed and sufficiently removed from the stream channel to provide for future possible channel widening and meandering. Sewers located adjacent to streams and swales shall be located deep enough so that adjoining areas on the opposite side of the stream or swale can be served by the sanitary sewer while maintaining the minimum cover requirements for stream crossings outlined earlier.

1.2.11 Sewers Constructed in Fill

Sanitary sewers constructed in fill shall be of ductile iron sewer pipe (Class 52 minimum) with manholes founded on original ground unless a licensed geotechnical engineer furnishes a written certification that the fill has been sufficiently compacted so that settlement of the sanitary sewer and/or manhole will not occur.

1.2.12 Steep Slopes

In cases where sanitary sewers are to be constructed on steep grades and velocities greater than 15 feet per second are indicated, only solid-walled PVC pipe or other abrasion-resistant material shall be used.

Whenever possible, sanitary sewers shall not be laid at slopes greater than 20 percent. If no other alternative exists, sewers may be laid at grades greater than 20 percent with the prior approval of the Department of Public Utilities. Sanitary 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 shall be determined by the engineer:

1. Not over 36 feet center to center on grades 20 percent to 35 percent.
2. Not over 24 feet center to center on grades 35 percent to 50 percent.
3. Not over 16 feet center to center on grades 50 percent and over.

Details of anchorage must be shown on the construction plans before the plans will be approved by the Department of Public Utilities.

1.2.13 Utility Easements

Sanitary sewers not located in public rights-of-way shall be located in utility easements. Easements shall be wide enough to provide sufficient space for both installation and maintenance and shall have a minimum width of 20 feet. The Department of Public Utilities may require wider easements for sewers greater than 24 inches in diameter and/or greater than 12 feet in depth.

1.2.14 Depth of Sanitary Sewer Lines

All PVC sanitary sewers within existing or proposed streets or areas subject to traffic shall be designed to provide a minimum cover of 6 feet over the pipe. Where less than 6 feet of cover is provided in areas subject to traffic, the sewer shall be constructed of ductile iron sewer pipe (Class 52 minimum). Sanitary sewers in areas subject to traffic shall have no less than 4 feet of

cover unless otherwise approved by the County. Greater depths shall be provided to serve low properties, where street grades may be lowered in the future, where there is a possibility of further extension of the sanitary sewer line to serve adjoining areas, to maintain separation from water mains, to maintain separation between sanitary sewer services and water mains, or where clearance must be provided for other utilities. Adequate clearance shall be provided for the future enlargement of undersized drainage structures. Sanitary sewers and sanitary sewer services shall generally be located at least 18 inches below water mains unless it can be demonstrated that no other practical alternative exists.

All sanitary sewer lines in easements not subject to traffic shall be provided with a minimum of 4 feet of cover unless otherwise approved by the Department of Public Utilities. The Department of Public Utilities may approve sewers with as little as 2 feet of cover provided no other practical alternative exists, in which case certain conditions must apply. The sewer must be constructed of ductile iron sewer pipe (Class 52 minimum), and a concrete cap, pavement, gabions, geotextile fabric and/or other appropriate stabilization measures must be utilized to protect the sanitary sewer.

When sewer lines have more than 15 feet of cover, the engineer shall verify the type of pipe material proposed, particularly PVC pipe, is appropriate for the intended installation based on the soils, loading, and bedding conditions. If appropriate, the engineer shall provide special details showing how the pipe is to be bedded. The Department of Public Utilities generally recommends the use of Class 52 ductile iron pipe in installations with greater than 15 feet of cover and may require written verification that such an analysis has been completed. However, regardless of whether written verification is requested by the Department of Public Utilities, and regardless of sewer depth, the engineer is responsible for the design.

If a sanitary sewer line is to have more than 20 feet of depth as measured from the final grade above the sewer line to the invert of the sewer pipe, the pipe shall have a corrosion-resistant interior coating such as epoxy, Griffin H₂Sewer Safe sewer pipe, Protecto 401 lining, or other coating as approved by the County.

1.2.15 Sanitary Sewer Manholes

1.2.15.1 General

Manholes shall be constructed in accordance with Hanover County's Standards and Details.

Manholes shall be located at the end of each line, at all changes in pipe size, at all changes in grade and at sewer junctions. Maximum spacing between manholes on straight runs shall be 400 feet for sewers 15 inches or less in size and 500 feet for sewers 18 inches and larger unless otherwise approved by the Department of Public Utilities.

Manholes in residential neighborhoods shall not be installed near the middle of front or rear yards. Manholes in residential yards shall be located near or at the side property lines. This limits the possibility of the manhole being in conflict with future improvements of the homeowner.

The angle between any incoming and outgoing pipe in a manhole shall typically not be less than

90 degrees. Under special circumstances, the County may approve an angle of not less than 85 degrees. Manhole diameters shall be determined in the design and are based on pipe diameters and intersecting angles per Detail MAN-1. Minimum separation between pipes shall be 6 inches unless approved by DPU. Depth shall also be considered when sizing manhole diameters as depths over 20 feet generally require upsizing of the manhole diameter per MAN-2.

It is preferred that sewer service laterals tie to a proposed manhole on new construction when feasible. Manholes shall be limited to the intersection of 4 lines (3 in and 1 out). This includes sewer service laterals.

1.2.15.2 Manholes Subject to Flooding

Manholes subject to flooding shall have watertight manhole covers per Detail MAN-12. All manhole rims shall be 1/2 foot above the 100-year flood elevation, except where the rim would be more than 4 feet above the existing grade in which case watertight covers shall be used and the manhole top set at a height of 18 inches above final ground elevation.

1.2.15.3 Vandal-Proof Frames and Covers

Vandal-proof manhole frame and covers shall be used for manholes located in unmaintained easements (easements located in areas not normally maintained by the property owner) unless watertight covers are required. Unless otherwise approved by the Department of Public Utilities, rims of manholes in unmaintained easements shall be placed at least 18 inches above final ground elevation.

1.2.15.4 Drop Manholes

Drop manholes are to be avoided whenever possible. Their use may be approved by the Department on a case-by-case basis when required to avoid excessive depth on a connecting sewer (greater than 12 feet). Drop manholes shall only be used when the invert elevation of the incoming sewer line exceeds the invert elevation of the outgoing sewer line by 2 feet or more. If proposed distance is less, the incoming pipe shall be lowered to the appropriate invert elevation at the base of the manhole unless this is not feasible due to elevation conflict with another crossing utility.

Inside drop manholes per Detail MAN-16 shall be utilized whenever possible. For new construction, inside drop manholes shall have a minimum diameter of 60 inches to allow for extra room lost by the addition of the piping to the interior of the manhole. Inside drop installations will be approved on a case-by-case basis on 48 inch diameter manholes for retrofit applications only.

Exterior drop connections shall be avoided and are to only be allowed on a case-by-case basis and shall be per Detail MAN-10.

1.2.15.5 Sewer Venting

Standard and vandal proof manhole frame and covers provide adequate venting for most sanitary sewers. When watertight manhole frames and covers are utilized on sanitary sewers, unvented sections of sanitary sewer shall not exceed 1,000 feet in length. If watertight frames and covers must be utilized on runs of sanitary sewer longer than 1,000 feet in length, air vents must be

provided at manholes at increments spaced no more than 1,000 feet apart. Where it is not feasible to set the air vents above the 100-year floodplain due to excessive height, they shall be equipped with a backwater valve.

1.2.15.6 Sanitary Sewer Manholes near Force Main Discharge Points

If a manhole is located within 2,000 feet of the discharge end of a force main, the manhole shall have an interior coating and concrete admixture resistant to corrosion by hydrogen sulfide. Coatings and admixtures utilized shall be approved by the Department of Public Utilities per Section 3.2.3. If in the County's or engineer's judgment corrosion by hydrogen sulfide will continue to be a problem for more than 2,000 feet, corrosion-resistant materials shall continue to be used for an appropriate distance from the discharge end of the force main.

1.2.16 Sanitary Sewer Service Connections

1.2.16.1 General

Service connections shall be provided in accordance with the County ordinances, specifications and details. The sewer service connection is the pipe that runs from the sewer main to the edge of the easement, property line or right-of-way as appropriate for the particular installation. The sewer service connection to this point is owned and maintained by the Department of Public Utilities. Beyond this point, on private property, the sewer service is privately owned and maintained and is not subject to these requirements but is subject to the requirements of the Building Official. The Building Official should be contacted to determine these requirements.

Plugged service connections are to be provided to the easement, property line or right-of-way as appropriate for all lots and parcels within new developments unless otherwise approved by the Department of Public Utilities.

The minimum diameter pipe to be used for a service connection is 6 inches. Normally the minimum grade for service connections shall be 2.08 percent (1/4 inch per foot). Under unusual conditions, the Department may approve a minimum slope of 1.04 percent (1/8 inch per foot) for a lateral. **A cleanout is to be provided on all service connections at the easement, property line or right-of-way by the plumber when the service is extended with the actual building construction. The utility contractor is to not install the tee, stack, and cleanout top when service connection is extended from the sewer main.** The County will own and maintain the sewer service from the main sewer line to the easement, property line, right-of-way or clean-out as applicable. The remainder of the sewer service including the cleanout is the property owner's responsibility to own, operate, and maintain. The County shall have the right to utilize the clean-out for inspections and maintenance of its lines. See Detail SEW-11 for further information.

Direct service connections to sewers 18 inches in diameter and larger are not allowed unless otherwise approved by the Department of Public Utilities. Service connections to sewers 18 inches in diameter and larger must be made at manholes. In certain cases, it may be appropriate to construct a parallel 8 inch sewer line to provide local service in an area. In such cases, additional easement shall be provided to allow for the construction and maintenance of the parallel 8 inch sewer line.

Where sewers run between lots, sewer services to the lots on either side shall be placed near

either the front or rear building set-back line, depending on at which set-back line the sewer is closer. In no case shall services be installed within the building envelope unless a detailed house location plan is provided showing the service will not be located immediately adjacent to the house.

Service connections to force mains shall not be allowed. All properties are to be served by a gravity sanitary sewer connection.

1.2.16.2 Depth of Sanitary Sewer Services

Sanitary sewer service connections will generally not be allowed to be made to sewer lines more than 20 feet deep, as measured from final grade above the sewer line to the invert of the sewer. The Department of Public Utilities may require shallower local sewer lines to be installed in areas where the main sewer line is more than 20 feet deep. The Department of Public Utilities may approve connections to sewers more than 20 feet deep on a case-by-case basis. Parallel local sewer lines shall be located far enough away from the deeper main sewer line to allow for excavation of each line without disturbing the other.

Sewer laterals shall be no more than 8 feet deep at the edge of the easement or right-of-way unless otherwise specifically identified on the approved plans as being deeper than 8 feet.

1.2.16.3 Grease Traps

Grease traps shall be provided on the private portion of the service connection for all facilities with the potential to deposit grease in the County's sewer system. Grease traps shall be installed on all service lines serving restaurants, food preparation establishments and other businesses or industries identified by the Department. Domestic waste should not be plumbed through the grease trap, but should connect to the grease trap outlet prior to the monitoring manhole. The size of grease traps shall be indicated on the plans and is subject to approval by the Department and the Building Official. Monitoring manholes shall be provided downstream of all grease traps. Grease traps and monitoring manholes shall be privately owned and maintained.

1.2.16.4 Monitoring Manholes

Monitoring manholes shall be provided on the private portion of the service connection for all facilities discharging non-domestic wastewater to the public sewer system. These include industrial facilities, eating establishments, facilities with central kitchens and/or central laundry such as nursing homes, grocery stores, bakeries, automobile service stations, gasoline stations, hospitals, medical offices, dental offices, animal hospitals, veterinary clinics, cleaners, machine shops, photographic finishers, printing shops, laboratories, funeral homes, and other such facilities as determined by the Department of Public Utilities. Monitoring manholes are owned by the property owner and shall not be located in utility easements whenever possible. Monitoring manholes shall be easily accessible and the County shall be given the right of access to monitoring manholes at all times. Commercial buildings with multiple tenants and multiple meters shall have individual sewer laterals to each space served by its own meter to facilitate proper future monitoring of strong waste.

Monitoring manholes should be constructed in accordance with Detail MAN-17 for all new projects or redevelopment of properties that require a site plan to be submitted to the County for

agency review. Detail MAN-17b is only for use on retrofit applications where a new tenant is occupying a space or a current user wishes to construct this for an accurate evaluation of their waste in accordance with the Strong Waste and Surcharge Policy.

1.2.17 Sanitary Sewer 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 generalization. The following general criteria should be considered by the design engineer at a minimum:

1. Special Structures - Whenever possible sanitary sewer structures shall be built as shown in the Standard Details. Structures other than those shown in the Standard Details shall be considered special structures and shall be designed and detailed by a professional engineer licensed in the State of Virginia.
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 conditions should be considered with samples being obtained where necessary to verify pipe selection and foundation design.
3. Flotation - Sewer shall be designed to resist flotation where such conditions may be reasonably expected to exist, i.e. – large diameter PVC pipe in high ground water areas.

1.2.18 Hydraulic Design for Sanitary Sewers

The quantity of sewage for design purposes shall be determined by the requirements of the total drainage area which is tributary to the section of sewer under consideration in its built out condition, unless otherwise approved by the Department of Public Utilities.

Average quantities of sewage, including an infiltration allowance, shall be computed using the following:

<u>Land Use</u>	<u>Gallons per Day per Acre</u>	<u>Equivalent Persons per Acre</u>
Residential - 1 to 2 dwellings/acre	500	5
Residential - 1 to 4 dwellings/acre	1,200	12
Residential - 4 to 8 dwellings/acre	2,500	25
Agricultural	500	5
Commercial - Retail	2,000	20
Commercial - Office	1,500	15
Industrial - Light Water Use	1,000	10
Industrial - Medium Water Use	2,000	20
Industrial - Heavy Water Use	3,000	30

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

<u>Discharge Facility</u>	<u>Design Units</u>	<u>Flow (gpd)</u>
Single Family Residential	3.5 people/unit	350
Three Bedroom Apartment	3.5 people/unit	350
Two Bedroom Apartment	3 people/unit	300
One Bedroom Apartment	2 people/unit	200
Three Bedroom Condo	4.0 people/unit	400
Two Bedroom Condo	3 people/unit	300
Elementary School	per person	10
High School	per person	16
Motel and Hotels	per room	130
Trailer Courts	per trailer	300
Restaurants	per seat	50
Service Stations	per vehicle serviced	10
Factories	per person per 8 hour shift	25
Shopping Centers	per 1,000 sq. ft.	250
Hospitals	per bed	300
Nursing Homes	per bed	200
Homes for the Aged	per bed	100
Medical Center	per 1,000 sq. ft.	500
Laundromat	per washing machine	500
Theaters	per seat	5
Bowling Alleys	per lane	75
Office Buildings	per 1,000 sq. ft.	200

Flows for other uses may be determined by using flow information approved by the Department of Public Utilities.

Peak flows shall be utilized for design of sanitary sewers. Peak flows shall be determined as follows:

For average daily flows (Q_A) greater than 0 mgd and less than 0.50 mgd, peak flows (Q_p) will be 4.0 times the average daily flow. ($Q_p = 4.0 \times Q_A$)

For average daily flows greater than 0.50 mgd but less than 6.00 mgd, the peak flow in mgd will be equal to $(4.136 - (0.273 \times Q_A)) \times Q_A$, where Q_A is in mgd.

For average daily flows greater than 6.0 mgd, peak flows shall be 2.5 times the average daily flow. ($Q_p = 2.5 \times Q_A$)

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

1. Sewers shall have a continuous slope, straight alignment and uniform pipe material between manholes. Pipe material may transition from DIP to PVC when drop connections are utilized one joint of pipe away from the drop connection.
2. At all junctions where a smaller diameter sewer line discharges into a larger diameter line 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 matching the crowns of the two pipes. If this is not possible, the 0.8 depth of flow in each sewer should be placed at the same elevation.
3. Sewers shall be designed to be free flowing with the hydraulic grade below the crown of the sewer and with hydraulic slopes sufficient to provide an average velocity, when flowing full, of not less than 2 feet per second. Computations of velocity of flow shall be based on a value of "n" = 0.013 as used in Manning's formula for velocity of flow unless otherwise approved by the Department of Public Utilities.
4. The following are minimum slopes in feet per hundred feet to be provided for sewer lines. Slopes greater than minimum are desirable. Sewers shall be placed at 1 percent slope or greater whenever possible. Slopes less than this should be utilized only when required to serve upstream areas. Pipe size shall not be increased solely to reduce required slope unless approved by the Department of Public Utilities.

Pipe Size	8"	10"	12"	15"	16"	18"	21"	24"	27"	30"	36"
Slope (%)	.40	.28	.22	.15	.14	.12	.10	.08	.06 7	.05 8	.04 6

A minimum slope of 0.52 percent shall be maintained for terminal 8 inch lines not to be extended.

Minimum pipe size for all sewers between manholes shall be 8 inches.

5. In cases where sewers are to be constructed on steep grades for which high velocities are anticipated, 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.

6. Miscellaneous head losses at manholes, curves and junctions shall be estimated and allowed for as follows:
 - a. In sewers 24 inches and less in diameter, allow head loss equal to at least 0.10 feet at each manhole. The Hanover Department of Public Utilities may allow this to be reduced to 0.05 feet under special circumstances.
 - b. At transitions and intersections of sewers larger than 24 inches in diameter, allow $0.50 V^2/2g$, where "V" is the velocity in the pipe assuming pipe full conditions.
7. In general, the pipe diameter should be continually increasing with the 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 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 shall pipe size be reduced more than one nominal size in diameter.

If requested, hydraulic computations shall be submitted to the Department of Public Utilities for approval. Information submitted shall include, at a minimum, sewage flow generation calculations, sewer service shed drawings including tributary areas, average and peak sewage flow for each pipe, average and peak capacity of each pipe, top and invert information for manholes, and, if requested, an analysis of downstream capacity of existing improvements.

The Department of Public Utilities may require a project to include off-site improvements to the County's existing sewer system if such improvements are required to meet the needs of the project.

1.2.19 Sewage Pump Stations and Force Mains

Public sewage pump stations will only be allowed when approved by the Department of Public Utilities and consistent with the Department's Facility Master Plan. Sewage pump stations will be used when it has been determined by the Department of Public Utilities that a pump station is the only practical way to provide sanitary service based upon a finding that:

1. It is economically impractical to extend a gravity sewer and the use of a pump station will not adversely affect the County'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 County utility system; 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 County's ability to efficiently manage the sewer system.

The design requirements for a sewage pumping facility shall be determined through discussions with the Department of Public Utilities **PRIOR TO INITIATING THE DESIGN**. A peaking factor of 2.5 shall be utilized in the design of all sewage pump stations. After the design criteria have been determined, the engineer shall prepare a preliminary engineering report for approval by the Department of Public Utilities and the Virginia Department of Environmental Quality, as applicable. The preliminary engineering report shall address all issues requested by the Department of Public Utilities and meet the requirements of the Virginia Department of Environmental Quality, as applicable.

The pump station design shall be in accordance with the approved preliminary engineering report and all requirements of the Virginia Department of Environmental Quality. At a minimum, the following information shall be provided in the construction plans:

1. Structural design and calculations, including reinforcing drawings where applicable, for the facility.
2. Hydraulic design for the equipment selected, including scaled drawings.
3. Electrical and mechanical drawings and specifications for the equipment selected.
4. Project specifications and basis for design including hydraulic calculations and the sewer shed analysis map.
5. Pump and system head curves.
6. Site Plan.

The construction plans shall be approved by the Department of Public Utilities and the Virginia Department of Environmental Quality, as applicable. Sanitary sewage force mains shall be ductile iron water pipe (Class 52 minimum), with a corrosion-resistant coating, PVC AWWA C-900 pipe, HDPE (appropriate pressure rating), or other pipe approved by the Department of Public Utilities. Generally PVC or HDPE will only be allowed on pipes 12 inches in diameter or less. Force mains are to be designed with a minimum flow velocity of 2.0 feet per second and a maximum flow velocity of 8.0 feet per second with a preferred velocity between 3 and 4 feet per

second for maintenance reasons. A Hazen-Williams “C” value of 120 shall be used for design. Minimum force main size shall be 4 inches in diameter unless otherwise approved by the Department. A constant grade shall be used where feasible. Valves and air releases will be provided at appropriate locations. Minimum cover on force mains shall be 3.5 feet or deeper where necessary to accommodate water services and/or future waterline extensions, etc.

Manholes receiving the discharge from force mains shall be designed in accordance with the County’s Standard Details. In addition, special acid-resistant manholes and sanitary sewer pipe shall be provided downstream of the discharge point for a minimum of 2,000 feet. On existing systems, existing manholes and sewer pipes shall receive a liner and/or coating approved by the Department of Public Utilities.

End of Section

1.3 Water Mains

1.3.1 Water Main Location

Generally, water mains are to be installed along public or private streets or travel aisles so they can be easily accessed. In subdivisions, water mains will be permitted in easements only when there is no other feasible alternative and approval is obtained from the Department of Public Utilities.

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 types of material for the water main. The selected location should avoid conflicts and facilitate future maintenance. Water mains shall be located above sanitary and storm sewers whenever possible.

Where the possibility of major conflicts with existing utilities and/or other structures exist, the Department of Public Utilities may require that the engineer obtain accurate information on the horizontal and vertical location of such utilities through subsurface exploration and reflect this information on the plans.

1.3.1.1 Utility Easements

Easements shall be wide enough to provide sufficient space for both installation and maintenance of the water main. The minimum utility easement width for any water main shall be 20 feet unless an easement is located adjacent to a right-of-way in which case the easement shall be wide enough to provide 10 feet of easement beyond the water main. Easement widths may be increased by the Department of Public Utilities for water mains larger than 16 inches in size or with more than 10 feet of cover.

1.3.1.2 Where Required

Typically, water mains will be required to be constructed along the full street frontage, both internal and perimeter, of any project or development. Water service and fire protection must be provided to each individual lot in a subdivision. This includes both streets being constructed as part of the project and existing streets which abut a project. Water mains may not be required to be constructed along the full frontage of existing streets if the following conditions exist:

1. A water main along the street frontage is not required to serve the project or the overall needs of the County's water system as determined by the Department of Public Utilities.
2. A water main of the appropriate size to meet the overall needs of the County's system already exists along the street frontage.
- 3.. Information on the size and/or location of a water main is not available to allow the Department of Public Utilities to provide adequate direction for the installation of a water main. If this is the case, the Department of Public Utilities may require that an utility easement be dedicated adjacent to the right-of-way to allow the future extension of a water main by others should it become necessary.

4. A project has been broken into multiple phases and the Department of Public Utilities has approved the phasing plan for the construction of water mains along the project's existing street frontage. In this case, water mains may be constructed with the approved phase of a project at the appropriate time.
5. The project is located on a large parcel of land where building and parking lot construction, not including private access roads to buildings and parking lots, is not proposed within 400 feet of the existing street frontage. Improvements, which would interfere with future water main extensions, are not proposed in the vicinity of an existing street, and the project is not required by proffer of special condition to construct street improvements. Although full existing street water main improvements may not be required if these conditions are met, the Department of Public Utilities may require that an appropriately sized water main stub-out, with appropriate appurtenances and utility easements, be provided to the existing street to allow the logical development of the County's water system. The Department of Public Utilities may also require utility easements be dedicated along the street frontage and the water mains be terminated beyond any entrance.
6. Other special conditions that may exist and that are approved by the Director of Public Utilities on a case-by-case basis.

1.3.1.3 Subdivision Streets

In subdivision streets that have curb and gutter, water mains should generally be located 5 feet in front of the face of curb (3 feet from the gutter pan) except in streets less than 30 feet in width from face of curb to face of curb where the water main may be located behind the curb at least 3 feet if there is also sewer located in the street. In subdivision streets without curb and gutter or along existing subdivision streets, water mains should be located 3 feet to 5 feet off of the edge of pavement or behind the ditch line if there is sufficient right-of-way to allow this. Future widening of the roadway shall be considered during the design of the water main.

1.3.1.4 Arterial and Collector Streets

In arterial and collector streets with curb and gutter, water mains should generally be located 5 feet behind the curb. In arterial and collector streets without curb and gutter, water mains should generally be located 5 feet behind the edge of pavement. Water mains adjacent to arterial and collector streets are allowed to be located under turn lanes. If, on an arterial or collector street, it is not possible or feasible to locate the water main behind the curb, the water main shall generally be located 5 feet in front of the face of curb (3 feet from the gutter pan). In no case shall the water main be located closer than 2 feet to the front of the gutter pan or less than 3 feet behind the curb. Future widening of the roadway shall be considered during the design of the water main. Ductile iron pipe shall be utilized for water mains constructed adjacent to arterial and collector streets unless otherwise directed by the Department.

1.3.1.5 Four Lane or Greater Roadways

The location of water mains along major roadways (roads 4 lanes or greater in width) shall be determined on a case-by-case basis. Generally, water mains shall be located on both sides of major roadways so that service connections need not cross the major road with appropriate

interconnection points between the parallel water mains.

1.3.1.6 Future Roadway Improvements

Future widening of roadways shall be considered during the design of any water main. Where water mains are to be installed in proposed or existing 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 main is designed to avoid future relocation. Water mains shall be designed so that they will not need to be lowered when the road is widened or driveways are installed.

1.3.1.7 Depth of Water Mains

Standard minimum cover shall be 42 inches and maximum cover shall be 10 feet unless otherwise approved. Water mains shall be constructed at minimum cover whenever possible. All water mains shall be constructed to a depth that will provide protection against freezing and thawing, and to ensure adequate cover over valves and other appurtenances. New installations of water mains adjacent to roadways 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 earthwork which takes place over an existing water main shall be required to maintain the water main at a maximum depth of 10 feet below finished grade and minimum depth of 42 inches below finished grade. Where the depth of a water main will exceed 10 feet, the water main shall be raised. Where the depth of cover is less than 42 inches, the water main shall be lowered.

1.3.2 Water Main Design

1.3.2.1 Changes in Alignment

Water mains shall be designed so that changes in alignment are made by deflecting successive lengths of pipe whenever possible. Joint deflection shall be limited to one-half of the pipe manufacturer's maximum allowable deflection. For PVC pipe, the deflection is made by the use of bends with approved joint restraint systems. Curving the pipe or deflection at the joints is not permitted. For ductile iron, joint deflection limits apply to vertical, as well as, horizontal curves. Bends with approved joint restraint systems shall be used when deflecting the pipe joints is not practical, or as shown on the approved plans.

1.3.2.2 Separation between Water and Sanitary Sewer Facilities

The engineer shall meet the requirements for separation between water and sanitary sewer facilities as stated in section 1.2, Sanitary Sewers, of these Standards.

1.3.2.3 Vertical Separation Other Utilities

Normally where storm sewers or other utilities other than sanitary sewer pass over or under water mains, a minimum of 18 inches of separation should be maintained. The County may allow the separation to be reduced to 6 inches on a case-by-case basis when the water main passes over the utility; however, ductile iron pipe must be utilized when the separation is less than 1 foot.

1.3.2.4 Bores and Tunneling

Water mains within bores or tunnels shall be ductile iron pipe (minimum thickness Class 52) with restrained joints. All casing pipes shall have an exterior corrosion protective coating.

1.3.2.5 Crossings of Railroads, Major Roadways and Other Major Structures

Water main crossings of railroads, major roadways, and other major structures shall be contained in a casing pipe. Design of railroad crossings shall comply with the requirements of American Railway engineering Association Specifications, Part 5 - Pipelines (latest revision). The engineer or developer shall be responsible for obtaining required railway permits and/or agreements for the County, paying any fees, and posting any required construction bonds for the railway crossing prior to beginning construction on any part of the project. A copy of the permit and/or agreement shall be provided to the Department of Public Utilities prior to the approval of construction plans for the project by DPU.

Isolations valves are generally required to be installed on either side of the crossing.

1.3.2.6 Water Mains Crossing Streams

Water mains entering or crossing streams shall be restrained joint ductile iron pipe. The tops of these mains shall be a sufficient depth below the natural bottom of the streambed to protect the pipe. In general, a minimum of 4 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 County prior to plan submittal. The trench above the pipe in streams must be stabilized through the use of rip-rap, concrete, gabion mats, or other approved methods.

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 and thrust restraint for the pipe.

For all subaqueous crossings, the design shall provide 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.

1.3.2.7 Water Main Overhead Crossings

Water mains constructed on piers or hung from bridges 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 water pipes shall be adequately supported, protected from damage by freezing, accessible for repair or replacement, and be located above the 100-year flood elevation.

Water mains installed on bridges shall be designed for such an application and an allowance for expansion and contraction shall also be provided within the design. This typically means that an expansion coupling shall be provided.

Isolation valves on either side of the crossing will be required.

1.3.2.8 Water Mains Constructed in Fill

Water mains constructed in fill shall be ductile iron pipe with restrained joints unless a licensed geotechnical engineer can furnish a certification that the fill has been compacted so that settlement of the main will not occur.

1.3.2.9 Structural Design of Water Mains

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

1. Special Structures - Structures shall be built as shown in the Standard Details, however, structures other than those shown in the Standard Details shall be considered special structures and shall be designed and detailed by the design engineer and submitted for review and approval to the Department of Public Utilities prior to plan submittal or brought to the Department's attention at the time of plan submittal.
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 condition should be considered with samples being obtained where necessary to verify pipe selection and foundation design.
3. Thrust protection as shown on plans in the Standard Details shall consist of concrete thrust blocks against undisturbed earth and/or the use of approved restraint systems for ductile iron and PVC AWWA C900 pipe as appropriate. Hydrant valves shall be installed with hydrant tees and the hydrant protected from thrust by the use of approved restraints and/or thrust blocks. In certain circumstances and where conditions warrant as determined by the County, the use of both may be required to assure that the appurtenances remain in place. All fire hydrant or double detector check leads shall be ductile iron per Details FIR-1 or 2. Use of restraint joint systems is preferred over concrete thrust blocks.
4. Where valves are placed for future water main extensions, valves are to be restrained to the fitting and a minimum of one joint of pipe, restrained to the valve, shall be installed past the valve except where calculations or local conditions indicate more pipe is required to provide adequate restraint, or as directed by DPU, or as indicated on the approved plan. Dead-end mains shall be provided with a flushing device or fire hydrant, noting that a fire hydrant is preferred when practical. Approved 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. Restrained joint pipe is required for all waterline stub-outs and dead ends for a minimum of 90 feet or back to the far side of the nearest valve, tee, or cross, whichever is shorter, unless another distance is specifically called out on the plans

(Note #16 on Detail DES-2). Larger diameter pipe (16 inches and above) should receive special consideration regarding restraint.

1.3.2.10 Hydraulic Design for Water Mains

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. Values of existing demand and supply pressures shall be coordinated with the Department of Public Utilities. If required, the engineer shall contact the Department of Public Utilities to schedule a fire flow test. The Department of Public Utilities must be present during any test but will not provide equipment or manpower for a test. Hanover County is not responsible for the results of any test or for any design made on the basis of any test. Hanover County does not imply or warrant that conditions occurring during a test are necessarily representative of the system’s ability to provide water under all or even normal conditions.

The engineer shall submit with all water plans, information and calculations on water demands for the project. If requested, the engineer shall provide a detailed analysis for evaluation by the Department of Public Utilities to ensure that the requirements of this section have been followed and that the proposed water system design meets these specifications and satisfies maximum day demands plus fire flow requirements or peak hour demands, whichever flow condition is more difficult to meet. The engineer shall provide this information with all water plans submitted for review when requested. Whether the detailed analysis is requested or not, the engineer is responsible for ensuring that the design as proposed meets the requirements of these Standards. If the design does not meet any part of these Standards; the engineer is responsible for notifying the Department of Public Utilities of all deficiencies.

The water distribution system and any extensions thereto shall be designed to supply the demands of all customers while maintaining the following minimum pressures at all points in the system:

20 psi for the greater of maximum day or peak hour domestic demand plus fire flow.

The following criteria shall be used in estimating average daily demands:

<u>Land Use</u>	<u>Gallons per Day per Acre</u>	<u>Equivalent Persons per Acre</u>
Residential - 1 to 2 dwellings/acre	500	5
Residential - 1 to 4 dwellings/acre	1,200	12
Residential - 4 to 8 dwellings/acre	2,500	25
Residential - Low	500	5
Residential - Medium	1,000	10
Residential - High	2,500	25

Agricultural	1,000	10
Commercial - Retail	2,000	20
Commercial - Office	1,500	15
Industrial - Light Water Use	1,000	10
Industrial - Medium Water Use	2,000	20
Industrial - Heavy Water Use	3,000	30

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

<u>Discharge Facility</u>	<u>Design Units</u>	<u>Flow gpd</u>
Single Family Residential	3.5 people/unit	350
Three Bedroom Apartment	3.5 people/unit	350
Two Bedroom Apartment	3 people/unit	300
One Bedroom Apartment	2 people/unit	200
Three Bedroom Condo	4.0 people/unit	400
Two Bedroom Condo	3 people/unit	300
Elementary School	per person	10
High School	per person	16
Motel and Hotels	per room	130
Trailer Courts	per trailer	300
Restaurants	per seat	50
Service Stations	per vehicle serviced	10
Factories	per person per 8 hour shift	25
Shopping Centers	per 1,000 sq. ft.	250
Hospitals	per bed	300
Nursing Homes	per bed	200
Homes for the Aged	per bed	100
Medical Center	per 1,000 sq. ft.	500
Laundromats	per washing machine	500
Theaters	per seat	5
Bowling Alleys	per lane	75
Office Buildings	per 1,000 sq. ft.	200

Flows for other uses may be determined by using demands approved by the Department of Public Utilities.

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

Maximum Daily Demand (residential) = 1.8 times Average Daily Demand

Maximum Daily Demand (non-residential) = 1.3 times Average Daily Demand

Peak Hourly Demand = 2.7 times Average Daily Demand

1.3.2.11 Water Main Size and General Layout

Minimum pipe size shall be 8 inches, except that dead-end water mains may be 4 inches in diameter if there is not a fire hydrant on the line and 6 inches in diameter if there is a single fire hydrant on the line and design flow and residual pressures can be maintained. Dead-ends shall be eliminated by looping whenever feasible. Where looping is required, the minimum size pipe shall be 6 inches. It may be necessary to install water mains in areas of limited accessibility to comply with requirements for looping mains. In these cases all pipe shall be ductile iron. Valves shall be installed to allow piping in these cases to be isolated from the system.

The Department of Public Utilities may require a project to increase the size of its water mains above the size required to meet the specific needs of the project in order to meet the overall needs of the County or improve system performance or reliability. Typically, the Department of Public Utilities will require a project to extend regional water mains through its interior and along its public street frontage in order to meet the overall needs of the County and improve system performance and reliability.

1.3.2.12 Commercial and Industrial Areas – Fire Requirements

Hydrants in commercial and industrial areas should generally be located at street corners and at entrances to facilities. Hydrants should generally be located on the right hand side of the road before the turn, based on the route that would be taken by a truck dispatched from the nearest fire station. The exact location of fire hydrants shall be approved by the Department of Public Utilities. The maximum spacing between hydrants shall be 1,000 feet along water mains. The hose laying length to any outside wall of a structure shall be no more than 500 feet from a hydrant and two fire hydrants shall be provided within the required maximum hose lay length unless otherwise approved by DPU.

New water systems in commercial and industrial areas shall be designed to provide a minimum flow of 2,000 gallons per minute at a residual pressure of 20 psi unless otherwise approved by the Department of Public Utilities. This is to include attached townhouses, attached condos, or multi-unit apartment type developments. If it is not possible to obtain a fire flow of 2,000 gallons per minute, reductions down to but not less than 500 gallons per minute will be considered on a case-by-case basis. Reductions of fire flow below 1,000 gallons per minute will only be considered with the written concurrence of Hanover County Fire Marshall.

If a facility is to have an automatic fire suppression (sprinkler) system that requires a fire department connection, there shall be a dedicated fire hydrant within 100 feet of the fire department connection. This hydrant cannot be utilized for meeting the building coverage requirements outlined above.

1.3.2.13 Fire Department Connections

Fire sprinkler systems shall be equipped with an approved double detector check valve assembly with bypass low-flow meter in a vault located as close to the property line as possible. The bypass low-flow meter shall be purchased from the County and installed per County requirements with a touch pad for meter reading installed on the hatch to facilitate ease of reading. Installation of double detector check valve assembly at locations other than the property line must be approved by the Department of Public Utilities. The property owner will own and be responsible for the maintenance of the valves, meter, double check assembly and vault. Valve vaults shall be located out of the main flow of traffic and parking lots or driveways whenever possible and have adequate drainage provisions per Details FIR-3 & 4. Fire department connections shall be placed on the outlet side of the double detector check valve assembly and shall have a dedicated hydrant located within 100 feet of the connection. Fire department connections shall be in a location that is readily accessible for use and not blocked by parked cars, landscaping, or other site improvements. An isolation valve should be placed at the tee where the sprinkler lead connects to the main.

Where required by building code, a fire sprinkler system may be installed to serve a single family dwelling unit. The connection, lines, and appurtenances shall be done per Detail FIR-8.

1.3.2.14 Residential Areas – Fire Requirements

Hydrants in residential areas should generally be located at street corners or in mid-block at lot lines. Hydrants should generally be located on the right hand side of the road, before the turn, based on the route that would be taken by a truck dispatched from the nearest fire station. The exact location of fire hydrants shall be approved by the Department of Public Utilities. The maximum spacing between hydrants shall be 1,000 feet along water mains. The hose laying length to any residential lot shall be no more than 500 feet from at least one hydrant.

New water systems shall be designed to provide a minimum fire flow of 1,000 gallons per minute in single family detached and duplex residential areas with a residual pressure of 20 psi being maintained in the system unless otherwise approved by the Department of Public Utilities. Attached townhouses, attached condos, or multi-unit apartment type developments in which the building contains more than two units shall meet the requirements for commercial fire flow. Reductions of fire flow down to but not less than 500 gallons per minute will be considered on a case-by-case basis by the County.

New water systems shall be designed to provide a minimum fire flow of 2,000 gallons per minute for apartments with a residual pressure of 20 psi being maintained in the system unless otherwise approved by the Department of Public Utilities. Reductions of fire flow for apartments down to but not less than 500 gallons per minute will be considered on a case-by-case basis by the County. Reductions of fire flow below 1,000 gallons per minute will only be considered with the written concurrence of Hanover County Fire Marshall.

As noted above, where required by the applicable building and/or fire code, individual single family residential fire sprinkler systems may be installed per Detail FIR-8. For multi-family residential applications, Detail FIR-3 or 4 should be used.

1.3.2.15 Supply Points

At least two supply points shall be provided for subdivisions containing more than 50 lots. Phased developments may develop up to 50 lots without a second supply point. At the time that more than 50 lots are approved, a second supply point must be provided unless the Department has approved a waiver from this requirement.

1.3.3 Non-Residential Water Services

Service lines shall at a minimum be one size larger than the water meter when initially installed to allow for future upsizing of the water meter without requiring replacement of the water service. Minimum service size shall be 1 inch pipe with 5/8 inch meter. Services shall be shown and detailed on the plans.

Service lines for 1.5 inch and 2 inches meters shall all be served by a 4 inch main line tee branch and 4 inch gate valve with 4 inch ductile iron pipe extended past the edge of pavement. 4 inch pipe is to end in a tapped cap to accommodate the installation of the appropriate sized copper service line from that point to the actual meter setter. See Detail MET-11B for further details. In applications where the water meter is piggy-backed on the fire system supply line, a 4 inch main line tee branch and 4 inch gate valve with tapped plug shall be installed. See Detail MET-11C for further details.

Non-residential water meters shall be sized in accordance with the Department's requirements found in these Standards. The County's standard meter sizing forms shall be submitted on all site plans. If an irrigation exclusion meter is used, the main meter shall be sized assuming that both domestic and irrigation demands are occurring simultaneously. Irrigation exclusion meters are privately owned and maintained, however they must be purchased from DPU and installed per DPU Standards. Irrigation exclusion meters should generally be located outside of any utility easement, be located in the proximity of the domestic meter (for ease of reading) with the connection point a minimum of 3 feet from the line exiting the domestic meter box, and shall be no larger than one standard meter size smaller than the domestic meter, unless otherwise approved by DPU.

Pressure reducing valves shall be installed on the customer side of the meter by the builder or property owner when the service connection system pressure will be greater than 80 psi. The pressure reducing valve shall be owned, operated and maintained by the property owner and shall be inspected by the County's Building inspector.

Non-residential parcels may not share a service line. Master metering a non-residential building is preferred. Individual metering of spaces within a building is allowed only when individual tenants will own or rent space within a development. Each building within a parcel should be individually meter unless otherwise approved by DPU.

1.3.4 Residential Water Services

Residential water meters shall be 5/8 inch in size. Individual residential service lines, a

minimum of 3/4 inch in size, shall be installed to each lot.

A 1 inch County service line will be installed when the residential water service from the main to the meter is 60 feet or greater.

Services shall be shown and detailed on the plans for both residential and commercial developments.

Pressure reducing valves shall be installed on the customer side of the meter by the builder or property owner when the service connection system pressure will be greater than 80 psi. The pressure reducing valve shall be owned, operated and maintained by the property owner and shall be inspected by the County's Building inspector.

1.3.5 Valves

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 2 valves shall be provided at tees and 3 valves at crosses unless otherwise approved by DPU. However an additional valve may be required at the discretion of the Department of Public Utilities. Valves shall be located as close to the fitting as practical. All valves are to be restrained to fittings by approved methods.

1.3.6 Connecting to Existing Water Mains

When connecting to an existing water main, the preferred method is to install 2 main line valves and a tee with an isolation valve (for a total of 3 valves) as opposed to utilizing a tapping sleeve and valve when there are long distances between main line valves (greater than 1,000 feet). Even when the distance is less than 1,000 feet, it would be an advantage to add main line valves for better system control. Therefore, the engineer must contact the Department of Public Utilities prior to beginning design for each project to determine a method acceptable to the Department of Public Utilities for making any connection to the existing water system. If it is determined that main line valves and a tee must be cut-in, temporary line stop valves may also be required in order to maintain service to existing customers while the work is being completed. Under some circumstances, where only a limited number of customers will have their service disrupted, the Department may allow a water main to be taken out of service in order to cut-in the main line valves and tee. If this is done, the developer will be required to communicate with all existing customers and schedule the work to minimize disruptions to existing customers. The developer shall obtain the approval of the County's inspector prior to taking any water main out of service.

1.3.7 Water Main Appurtenances

Valve boxes, air relief valves, fire hydrants, service lines, vaults and other appurtenances shall be constructed in accordance with Hanover County Standards and Details.

Water mains shall be provided with appurtenances such as air release valves, blow offs, and water quality monitoring stations at suitable locations to allow testing, disinfection and flushing of the main. Flushing or fire hydrants shall be installed on all dead-end mains. The Department of Public Utilities may require the installation of an automatic or manual flushing device as it

deems appropriate. Where appropriate, it is preferred to have a fire hydrant installed in-lieu of a flushing hydrant. Fire hydrants should also be utilized when appropriate in-lieu of providing a blow off per Detail WAT-4. When utilizing a fire hydrant at the end of a line for flushing purposes, a maximum of 20 feet of pipe may be laid past the fire hydrant tee without the installation of a separate flushing hydrant.

1.3.7.1 Blow offs at Low Points

A fire hydrant (preferred where appropriate) or blow off (minimum size blow off shall be 4 inches for 12 inch mains, 6 inches for 16 inch mains, and 8 inches for 24 inch mains per Detail WAT-4) shall be provided at low points on mains 12 inches and larger to facilitate flushing. On lines smaller than 12 inches, fire hydrants shall be located at low points whenever possible to facilitate flushing. If it is not possible to place a hydrant at the low point, a flushing hydrant may be used on lines smaller than 12 inches. In-line isolation valves shall be provided on either side of fire hydrants or blow off on water mains located at low points.

1.3.7.2 Location of Flushing Hydrants, Air Releases, Blow offs

The engineer should use the following guidelines with regard to location of flushing hydrants, air release valves, blow offs, etc. during the design of water main extensions:

1. Access to flush points by the Department of Public Utilities personnel shall be provided. Flush points serve no purpose if access to the flush points cannot be obtained.
2. Emphasize (through appropriate notes) to contractor to maintain adequate 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 the water main is installed.
3. Engineer needs to advise contractor to coordinate his work through the inspector. The inspector will coordinate with the Department of Public Utilities Operations section regarding when to flush (time of day and season, etc.).
4. Attempt to locate the flush points as near to the roadways as possible or at a stream (keep in mind adverse effects to downstream ponds, etc.).
5. contractor is to perform flushing prior to acceptance of the new water main.
6. Minimize the number of blow offs, and strategically place them so proper flushing can be performed.
7. Minimize the number of air release valves, taking into consideration the depth that the water main is to be placed.
8. The chlorine in heavily chlorinated water flushed from mains shall be neutralized before discharge. contractors must provide equipment for neutralizing heavily chlorinated water flushed from mains during construction prior to discharging the water.

1.3.8 Offsite Improvements

The Department of Public Utilities may require a project to include off-site improvements to the County's existing water system if such improvements are required to meet the needs of the project.

1.3.9 Private Central Fire Systems

Private central fire systems are privately owned and maintained water systems connected to the public water system that provide fire protection to two or more lots, or that serve one lot and have private fire hydrants located on them. Private central water systems can only be utilized for fire protection purposes and shall be designed and constructed in accordance with the requirements of the Fire Marshall and Building inspector. Water in private central fire systems shall only be utilized for fire protection purposes. No other use is allowed. If private central fire fighting systems are utilized, they shall be provided with a fire water meter and a double check assembly per Details FIR-5, FIR-6 and FIR-7. The fire water meter shall be purchased and installed by the owner and then dedicated to the County. Fire water meters shall be in accordance with the requirements of the Department of Public Utilities. The fire water meter and its associated vault shall be constructed in a utility easement and shall be owned and maintained by the County. The double check valve assembly and its associated vault shall be installed immediately after the County owned meter and shall not be located within a utility easement. The double check valve assembly is privately owned and maintained. The vault for the double check valve assembly shall be provided with a gravity drain line or sump pump, whichever is appropriate for the specific field conditions.

1.3.10 Water Pump Stations

Water pump stations are a special project and specific project standards and plans will be prepared by the engineer and submitted to the County for review and approval. Water pump stations will only be allowed when approved by the Department of Public Utilities.

The design requirements for a water pump station shall be determined through discussions with the Department of Public Utilities **PRIOR TO INITIATING THE DESIGN**. After the design criteria have been determined, the engineer shall prepare a preliminary engineering report for approval by the Department of Public Utilities and the Virginia Department of Health. The preliminary engineering report shall address all issues requested by the Department of Public Utilities and meet the requirements of the Virginia Department of Health.

The pump station design shall be in accordance with the approved preliminary engineering report and all requirements of the Virginia Department of Health. At a minimum, the following information shall be provided in the construction plans:

1. Structural design and calculations, including reinforcing drawings where applicable, for the facility.
2. Hydraulic design for the equipment selected, including scaled drawings.
3. Electrical and mechanical drawings and specifications for the equipment selected.
4. Project specifications and basis for design including hydraulic calculations.

5. Pump and system head curves. The construction plans shall be approved by the Department of Public Utilities and the Virginia Department of Health.

1.3.11 Backflow Prevention

Backflow prevention devices shall be installed on all new development structures as required per VDH *Waterworks Regulations*, Hanover County Code, and DPU's Backflow Prevention Program and Policies. Type, size, and locations shall be shown on the construction plans for facilities where these devices are required. These devices (domestic, irrigation, and fire) must be tested and a Backflow Prevention Device Certification form submitted to DPU prior to DPU sign-off on the certificate of occupancy. See Section 10 for a copy of the Backflow Prevention Device Certification form.

1.3.12 Additional *Waterworks Regulations*/VDH Specific Requirements

As stated in Section 1.1, the engineer is reminded that all plans shall include addressing requirements of the VDH *Waterworks Regulations*. Many of these items have already been incorporated into Section 1.3 Water Mains already. The following are specific topics/items to account for in the design and in no way are to be considered a complete compilation of all the requirements of the VDH or the *Waterworks Regulations*.

1. The following factors shall be considered in providing adequate separation of water mains and sewers:
 - a. Materials and types of joints for water and sewer mains
 - b. Soil conditions
 - c. Service branch connections into the water main and sewer mains
 - d. Compensating variations in the horizontal and vertical separations
 - e. Space for repairs and alterations of water and sewer mains
 - f. Offsetting of pipes around manholes
 - g. Identification of the physical restraints preventing normal separation.
2. Regarding water-sewer separation, no water pipes shall pass through or come in contact with any part of the sewer manhole.
3. Water system appurtenance and chamber items:
 - a. Chambers or pits containing valves, blowoffs, meters, or other appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blowoffs or air relief valves be connected directly to any sewer.
 - b. Such chambers, or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits located above the seasonal ground water elevation. Sump pumps may be used where other means are not practicable.
 - c. The open end of the air relief pipe shall be extended from the manhole or enclosing chamber to a point at least one foot above ground and provided with a screened, downward facing elbow.
4. Hydrant and dead-end line blow-off items:

- a. Where hydrants drains are not plugged, they shall be drained to the ground surface or to dry wells provided exclusively for this purpose.
 - b. Hydrants drains shall not be connected to sanitary sewers or storm drains.
5. Surface water crossing items:
- a. Sample taps shall be available at each end of the crossing and at a reasonable distance from each side of the crossing not subject to flooding.
 - b. Permanent taps shall be made for testing and locating leaks.

End of Section

2. CONSTRUCTION SPECIFICATIONS

2.1 General Requirements

2.1.1 General

- A. Construction on any utility project will not be allowed to begin until all criteria of the design review and approval process have been satisfied and a Utility Construction Permit has been issued by the Department of Public Utilities.
- B. A pre-construction meeting will be required unless waived by the inspector. Prior to beginning any work, at least 48 hours advance notice must be given to the Department of Public Utilities' Inspection Section to schedule a pre-construction meeting.
- C. Cut sheets may be required on gravity and force main wastewater projects, on water main projects where the subgrade has not been reached or in areas where final grades for future roads and paved areas cannot be determined, and on projects where utility lines are installed in easements. Three copies of construction "cut sheets" shall be submitted to the Department of Public Utilities Inspection Section prior to the beginning of construction. "Cut sheets" shall show, at a minimum, offset hub elevations and amount of cut. Cut sheets are to be prepared by a licensed engineer or surveyor. Cut sheets shall consist of the following information:
 - 1. Temporary bench marks at each manhole on sanitary sewer projects and at no more than 500 feet on any other project.
 - 2. Each downgrade manhole shall show the plan station and shall begin with station 0+00 to readily identify the station of each service connection.
 - 3. Centerline elevations every 50 feet and at every valve box and manhole location for water main projects where cut sheets are required and for force main projects.

The Department of Public Utilities may waive the requirement for cut sheets if it believes they are not required to properly construct a project.

- D. The contractor is reminded that prior to the installation of water mains, unless waived by the inspector, a licensed engineer or surveyor must certify in writing that:
 - 1. All pavement and shoulder areas within the right-of-way are graded to within 6 inches of subgrade.
 - 2. All ditches and slopes to 1 foot outside the right-of-way have been graded to final grade.

- E. The contractor shall be required to comply with erosion and sediment control requirements of the Department of Public Works before beginning clearing or construction and the requirements of the project's Land Disturbance Permit, if one is required.
- F. The contractor is required to obtain and adhere to the permits issued by Hanover County, the Virginia Department of Transportation, and other applicable agencies.
- G. It shall be the responsibility of the developer or his agent to acquire all off-site easements necessary for water or sewer installation. Easements shall be obtained, recorded, and the deed book and page noted on the plans prior to the plans being approved. Deeds for easements shall be in a form acceptable to the County. The developer shall adhere to any special agreements negotiated with the landowner regarding restoration of the easement in addition to the usual and customary requirements of the Department of Public Utilities and Department of Public Works.
- H. These specifications are to be used in conjunction with the County's Standard Details; County's approved materials list, County's materials specifications, and the approved plans. If there is a discrepancy between these documents, the Department of Public Utilities shall make the final determination as to which standard is to be enforced.
- I. Connections to the County's water or sewer system shall only be made by a state licensed Class A utility contractor that has been authorized to make such connections by the Department of Public Utilities.

2.1.2 Laws and Regulations

The contractor shall keep fully informed of all state and federal rules, laws and local ordinances, and regulations which may in any manner affect those employed or engaged in the work, or in any way affecting the conduct of the work. The contractor must also comply with the requirements of all such rules, laws and local ordinances, and regulations. These specifically include stormwater run-off and erosion and sediment control, as well as, applicable safety regulations.

2.1.3 Permits

The contractor must obtain all required licenses and permits and pay all charges and expenses connected with the work. The contractor is responsible for adherence to the conditions and requirements of the permits. This shall include County Land Disturbance, VDOT, and/or Town of Ashland where applicable.

Misunderstanding or ignorance on the part of the contractor will not be considered as a valid excuse for his failure to secure the necessary permits.

2.1.4 Materials and Workmanship

It is the intent of the County's specifications to describe in general and broad terms the character of materials and workmanship required with regard to all ordinary features and to require first-

class work and materials in all particulars. For any unexpected features arising during the progress of the work and not fully covered in the specifications, the County shall require first-class work to be performed and first class materials to be used by the contractor.

The County reserves the right to employ an independent testing laboratory to conduct tests in addition to those to be completed by the developer and/or contractor of materials, soils, workmanship, facilities, etc. as the County may deem necessary to assure complete compliance with the requirements of the County's specifications. The developer and contractor shall offer full cooperation with personnel in the employ of the County in taking these tests. If any such test completed by the County shows that substandard work has been performed or substandard materials provided, the developer shall be charged the County's cost for completing these tests. The Department of Public Utilities will not issue "Tentative Acceptance" for any part of the water or sewer system serving the project until all such charges have been paid.

2.1.5 No Deviation from Plans, Specifications, Etc. by the Contractor

The contractor shall not deviate from the plans, profiles, cross-sections and specifications without the approval of the County. If deviation occurs on the part of the contractor, he shall correct the error at his expense in a manner satisfactory to the County.

2.1.6 Other Plans and Working Drawings (Shop Drawings)

The Department of Public Utilities may require at its sole discretion the submission of shop drawings for materials and equipment to be provided for any project. **Shop drawings will not normally be required for regular water and sewer line construction projects but will normally be required for water or sewer pump stations, water storage tanks, control valves, special structures, and other special projects.**

When required, the contractor shall submit to the engineer and/or the inspector for their approval such additional detailed shop or working drawings as may be required for the construction of any part of the work. Pending the approval of such drawings, any work done or materials ordered shall be at the risk of the contractor.

Working drawings shall consist of such detailed drawings as may reasonably be required for successful execution of the work and which are not included in the plans furnished by the engineer. These may include drawings for anchor bolts, centering and form work, masonry, layout diagrams, etc.

It is expressly understood that the approval of working drawings relates to the general concept, and not the detail, and such approval will not relieve the contractor from any responsibility for errors or omissions in dimensions or quantities.

It is understood that shop drawings or working drawings processed by the engineer are not change orders; that the purpose of shop or working drawing submittals by the contractor is to demonstrate that the contractor understands the design concept, to demonstrate his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

If deviation, discrepancies, or conflicts between shop drawing submittals and the plans and

specifications are discovered either prior to or after Shop Drawings submittals are processed, the approved construction plans and the County's specifications shall control and shall be followed unless otherwise authorized by the County. All shop or working drawings and blueprints shall be made at the expense of the contractor and/or developer.

2.1.7 Discrepancies

Any discrepancies found between the plans and the County's specifications and site conditions or any inconsistencies or ambiguities in the plans or specifications shall be immediately reported to the engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing after obtaining the County's approval. Work done by the contractor after his discovery of such discrepancies, inconsistencies or ambiguities prior to County approval shall be done at the contractor's risk.

2.1.8 Correction of Work

The contractor shall promptly remove from the premises all work rejected by the engineer or County for failure to comply with the County's specifications, whether incorporated in the construction or not, and the contractor shall promptly replace and re-execute the work in accordance with the County's specifications and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

If the contractor does not take action to remove such rejected work within 10 days after receipt of written notice, the County may remove such work and store the materials at the expense of the developer.

2.1.9 Qualifications of Workmen and Equipment

The contractor shall employ superintendents, foremen and workmen that are careful, experienced, and competent. The County reserves the right to issue a "stop work" order for any utility project if a contractor fails to employ or utilize qualified personnel.

2.1.10 Superintendent

The contractor shall personally supervise the work and when not personally present shall be represented by a superintendent who shall have full authority to act as the contractor's representative and all orders and instructions given to the superintendent shall have the same force and meaning as if given to the contractor in person. The superintendent or contractor shall be on duty at all times while construction work is being done.

2.1.11 Responsibility of Contractor

The contractor shall take all responsibility for the work and take all precautions to prevent injuries to persons and property in or about the work.

Until tentative acceptance of the work by the County, it shall be under the charge of the contractor and he shall take every care and necessary precaution against injury or damage to the work or any part thereof by the action of the elements or any other cause whatsoever, whether arising from the execution or the non-execution of the work.

The contractor shall rebuild, repair, restore and make well at his expense all injuries or damage

to work occasioned by any of the above causes before it will be accepted.

2.1.12 Work in Bad Weather

During stormy or inclement weather, no work shall be done except as can be done satisfactorily and in a workmanlike manner to secure first-class construction throughout. If in the County's opinion satisfactory work is not being performed due to inclement weather, the County may issue a "stop work" order.

2.1.13 Work Outside Regular Hours

If the contractor desires to perform work outside normal working hours, or on Saturdays or Sundays, he shall request permission to work such hours at least 48 hours in advance to allow arrangements to be made for proper inspection. The County may refuse the contractor permission to work outside of normal hours and may require that the developer agree to reimburse the County any expenses it incurs due to work occurring outside of normal business hours in addition to the normal inspection fees. Reasonable efforts shall be made by the contractor to avoid undue noise during the night and on Sundays if it is necessary to work at such times. Under all conditions, the contractor is responsible for complying with the County's noise ordinance. Under normal circumstances the contractor will not be permitted to work on Sundays or County holidays.

The County reserves the right to schedule the contractor to work outside normal working hours in the interest of public safety or convenience. Normal working hours are defined as 7:00 A.M. to 5:00 P.M., Monday through Friday.

2.1.14 Use of Water

No water shall be drawn from the County's facilities for testing or other purposes until suitable arrangements have been made with the County's Utility inspector.

2.1.15 Job Safety

The County shall not be responsible for the contractor's safety precautions or for means, methods, techniques, sequences or procedures required for the contractor to perform his work; such precautions include but are not limited to shoring, scaffolding, underpinning, temporary retainment of excavation and any erection methods and temporary bracing.

2.1.16 Existing Structures

The location of existing sewers, water and gas pipes, conduits, other utilities, and structures across or along the line of the proposed work may not be shown on the plans, and if shown, the location, depth and dimensions of such structures may only be approximately correct. The contractor shall have a working pipe locator on the job at all times and utilize hand excavation to locate existing underground facilities as appropriate.

The contractor shall dig test holes for the purpose of locating existing underground structures as required to protect existing underground structures. Such excavation shall not be undertaken without 48 hours prior notice to the County or owner of the existing facility.

2.1.17 Care of Existing Structures

The contractor shall be liable for all damage done to any structure or property arising through his negligence or carelessness. He shall take care of and maintain all underground, overhead or surface utilities encountered in the performance of the work.

Prior to commencing work contractor shall contact the Utility Information Center (“Miss Utility”), telephone 1-800-552-7001 for marking of existing underground utilities.

The contractor shall observe all precautions with respect to fire and avoid the indiscriminate mutilation or cutting down of trees. Any damage to property not in the work area or easements will be the contractor’s responsibility to repair and restore.

2.1.18 Inspectors

The inspector is authorized to inspect all materials and equipment to be utilized and work done. In case of any dispute arising between the contractor and the inspector as to materials furnished or the manner of performing the work, the inspector will have the authority to reject material or suspend work until the question at issue can be resolved to the satisfaction of all parties.

The County shall have access at all times to all parts of the work being done for the purpose of inspection, measurements, and establishments of lines and grades.

2.1.19 Final Inspection

Before final inspection of the work, the contractor shall clean up the site of the work including all rights-of-way, leaving it in as clean, neat and sanitary condition as originally found and shall remove all machinery, tools, surplus material, temporary buildings, and other structures from the site of the work. Disturbed areas shall be stabilized and/or restored. Final Inspection should be requested by the owner in writing to the assigned Utility Agent.

2.1.20 Notification to Property Owners

When working in off-site easements, the contractor and/or developer shall notify, **in writing**, all adjoining property owners, at least two weeks prior to the start of any construction, that work will be taking place in the easement. Copies of the letters shall be presented to the County at the pre-construction conference.

2.1.21 Waterline Tie-Ins

All waterline tie-ins to the existing distribution system including vertical and horizontal relocations shall be coordinated with the Operations and Maintenance Section of the Utilities Department. Tie-ins shall be scheduled Monday thru Thursday from 9:00 a.m. to 4:00 p.m. Tie-ins may be required outside of this time and/or during nighttime hours.

The County reserves the right to require the contractor to perform tie-ins outside of the normal working hours detailed above in the interest of public safety or customer service. No claim for additional compensation shall be made by the contractor when such occasions occur.

Proper preparation including field verification of the plans shall be accomplished to minimize shutdown time and prevent the tie-in from exceeding scheduled shutdown time. Sufficient personnel, equipment and materials shall be on-site prior to the water being shut off. Where applicable, excavation and preassembling of fittings shall be performed, and if in the opinion of the inspector sufficient resources are not available, the tie-in will be cancelled and rescheduled.

Tie-ins to asbestos cement pipe shall be made to rough barrel pipe. Tie-ins to the machined section of asbestos pipe will not be permitted. Where asbestos cement pipe couplings have been removed, the machined end of the pipe shall be removed. Abandonment of asbestos cement pipe shall be per state and federal requirements.

Tie-ins involving fittings shall include provisions for temporary blocking until concrete blocking has cured unless mechanical restraint systems are used. All pipe and fittings used for a tie-in are to be swabbed with a one percent (1%) chlorine solution prior to connection.

Before a tie-in will be allowed, all new valves, including fire hydrant valves, shall be accessible and verified fully open by the contractor unless there are valves designated as “normally closed”. Prior to tie-in, the inspector shall verify that all valves, including fire hydrant valves are fully open and accessible. Immediately after a tie-in has been made, all valves used during the shutdown shall be verified fully open by the inspector. All fire hydrants shall be checked by the inspector to ensure water is available and each hydrant is in working order.

End of Section

2.2 Trenching, Backfilling and Compaction

2.2.1 General

2.2.1.1 Quality Assurance

Work shall conform to County of Hanover requirements. Where construction is within the State or Town of Ashland right-of-way, the requirements of the Virginia Department of Transportation or the Town of Ashland shall apply.

2.2.1.2 Safety

The contractor is responsible for job site safety. The contractor shall comply with all applicable safety rules and regulations of OSHA, VOSHA and other agencies having jurisdiction over the work. All safety measures related to, but not necessarily limited to trenching, confined space, traffic control and other applicable safety measures, shall be strictly adhered to and enforced by the contractor.

2.2.1.3 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, the contractor shall promptly notify the County and utility owner of the occurrence. The contractor must immediately repair (or cause to be repaired) the damage at his own expense to the satisfaction of the County and the owner of the utility. Further, the contractor is 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.
- B. Protection of Persons and Property:
 - 1. Barricades for open excavations or work area shall be provided. All such barricades shall be in accordance with the requirements of the authorities or agencies within whose jurisdiction the design exists.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by work or other operations in the area.
- C. Equipment used for this work shall meet all local, state and federal safety standards and any other applicable standards governing this work. All power machinery shall have adequate mufflers to keep noise to a minimum. The contractor is responsible for complying with the requirements of the County's noise ordinance.

2.2.1.4 Compaction

The contractor is responsible for the correct bedding of utility lines, backfill of pipe trenches, and compaction of backfill as outlined in this section, shown on the construction plans, included elsewhere in this Standard, or as required by the applicable permits. Where, in the inspector's opinion, excavated material is not suitable for backfill, select backfill shall be used.

The County 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 and replaced, re-compacted and retested. Verbal results of tests should immediately be given to the 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.

2.2.2 Products

2.2.2.1 Soil Materials

Definitions:

- A. Unsuitable Soil Materials: Soil that is too wet to permit proper compaction or not appropriate for the use intended as determined by the inspector.
- B. Non-cohesive Soil Materials: Non-cohesive 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.

2.2.3 Execution

2.2.3.1 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 County.

2.2.3.2 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 County.
- B. Unsuitable soil shall be removed to a depth determined by the inspector and replaced with No. 57 stone or other material approved by the inspector which shall be uniformly and thoroughly compacted.
- C. Sheeting, Shoring and Bracing: Provide sheeting, shoring, and bracing as necessary to prevent cave-in of excavation or damage to existing structures on or adjoining the site.
 - 1. Requirements that are established for trench shoring and bracing should comply with codes and authorities having jurisdiction over the work being performed. 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 State 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. Sheeting, shoring and bracing may be left in place with the approval of the County, but must be cut off to a depth of not less than 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 collection or run-off areas approved by the County. Trenches shall not be used as temporary drainage ditches.
 - 3. All dewatering shall comply with the requirements of 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 because of the instability of the material being excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

F. Material Storage:

1. Stockpile approved excavated materials in approved areas, until required for backfill or fill.
2. Place, grade, and shape stockpiles for proper drainage.
3. Locate and retain soil materials away from edge of excavations.
4. Dispose of excess soil material and waste materials as hereinafter specified.
5. Stabilize soil stockpiles with temporary seeding as required.

G. Excavation for Trenches and Structures:

1. Trenches shall be opened only so far in advance of pipes being laid as the County will permit and in no case will this distance exceed 300 feet. The width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus 24 inches except that for pipe 18 inches or less in diameter, the trench width shall not exceed 42 inches. 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 will be required to mechanically tamp an approved backfill material from the bottom of the trench to 6 inches above the top of the pipe as directed by the County and the trench re-excavated to the proper dimension.
2. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to the indicated flow lines and invert elevations plus the required bedding material, if applicable.
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. Cold Weather Protection: Protect excavation bottoms against freezing.

5. Excavation for structures shall conform to the lines and grades as shown, established or as necessary. Where the bottom of the excavation is in unsuitable material, such material shall be excavated to a depth of 1 foot below the bottom of the structure or to a depth required by the County and replaced with No. 57 stone, coarse sand, or other material approved by the County. Bottoms shall be covered with appropriate fabric if necessary to prevent the mixture of earth with the backfill material. All sheeting, bracing, and shoring required for safety shall be installed in conformity with applicable rules and ordinances.

2.2.3.3 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.

2.2.3.4 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 6 inches below the bottom of all pipes. The pipes shall be laid on a cushion of #57 stone or other approved material, of sufficient depth to provide the proper grade. A minimum clearance of 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 8 inches below the bottom or base of structure and suitable bedding shall be provided. A minimum clearance of 6 inches shall be provided between the rock and the exterior face of the structure when forming is not used. The minimum clearance shall be 2 feet when forming is used.

2.2.3.5 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 County 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 shall not be permitted before 9:00 A.M. or after 5:00 P.M. on Monday through Friday unless otherwise authorized by the County.
2. Blasting on Saturdays, Sundays or holidays shall not be permitted unless specifically authorized by the County.
3. The contractor shall, each day when necessary to blast, set up an approximate schedule of blasting operations and provide 24 hours notice to the County and property owners with occupied buildings within 1,000 feet of blasting.
4. The contractor shall use mats to minimize noise and control flying debris.
5. The contractor shall obtain all required permits including a permit from the Hanover County Fire Marshall.

2.2.3.6 Backfill for Trenches

- A. After the installation of the pipe has been field inspected the trenches shall be backfilled as specified and shown in the County's Standard Details.
- B. Sewer pipe shall have minimum bedding as shown on the County Standard Details. Pipe bedding shall be VDOT #57 stone or other material approved by the Department of Public Utilities. Large clods, sticks, stones, and other unsatisfactory material must be excluded from the initial backfill around and to 12 inches above the pipe. Approved soil materials may be used for ductile iron and concrete pipe for the initial backfill. For plastic pipe VDOT #57 stone (or other approved material) must be used for initial backfill to the top of the pipe. The next foot of the initial backfill must be approved soil materials or VDOT #57 stone.
- C. The initial backfill shall be carefully compacted by hand or pneumatic tamping methods under the pipe, on both sides of the pipe, and above the pipe.
- D. After the initial backfill has been placed, the remainder of the backfilling may be done by hand or with mechanical equipment in lifts no greater than 12 inches.
- E. Where settlement occurs, the trench shall be refilled contoured and compacted by an approved method to conform to the surface of the ground.
- F. Sheeting and bracing shall, in general, be removed as the backfilling progresses and in such a manner as to avoid 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 County, damage is liable to result from the withdrawal of the sheeting it shall be left in place.
- G. No large rocks should come in contact with pipe.

- F. Backfill shall be completed in 12 inch layers with the following percentage of maximum density at optimum moisture content as determined by ASTM D698.
 - 1. 95 percent under pavements, road shoulders and other structures.
 - 2. 90 percent in all other areas.
- H. Under Existing Roadways and Pavement: Backfill for trenches under roadways and other paved areas shall be in accordance with the requirements specified above or, if more stringent, the requirements of the Virginia Department of Transportation or the Town of Ashland.
- I. Clay dams: Where required, clay dams shall be installed in the trench to prevent groundwater from flowing down the trench and damaging the subgrade as directed by the inspector. Clay material with an imperviousness of 1×10^{-3} cm/sec shall be used in clay dams. Dams shall be constructed as shown on Detail SEW-9. Remaining trench backfill material shall be compacted as indicated in paragraph A above. inspector shall approve clay material prior to use.

2.2.3.7 Backfill for Structures

Around and adjacent to structures, backfill shall be of material of suitable stability and permeability. 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 percent 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.

2.2.3.8 Construction in Public Streets, Roads and Alleys

Unless superseded by other specifications, the requirements of the Town of Ashland, or the permit requirements of the Virginia Department of Transportation (VDOT) 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 County. Unless otherwise directed by agency controlling the public street, road or alley in which work is occurring, the contractor shall perform proposed construction within public streets, roads and alleys as follows:

- A. Typically, water and sewer lines are to cross roadways at right angles and/or to parallel roadways. Uncased utility 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 highway permits and forwarding a copy to the County. Method of construction (trenching, boring, tunneling, jacking, etc.) must be shown on permit and plans. 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 anticipated start of 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 an acceptable manner. Prior to the actual open cut, the Department of Public Utilities and the agency within whose jurisdiction the road exists is to be notified 48 hours in advance to arrange a meeting with their representative and the inspector.

- B. Wherever pavement is permitted to be cut, not over one-half of the road width shall be disturbed at one time unless an approved method of detouring traffic is reviewed and approved by the agency within whose jurisdiction the road exists. The first opening shall be in drivable condition before the second half can be opened.
- C. Where contractor is granted approval to open cut a road by VDOT or the Town of Ashland, the following requirements shall be complied with unless specific permit requirements are more restrictive:
 - 1. VDOT or Town of Ashland, as appropriate, is to be notified 48 hours prior to any open cut work being performed.
 - 2. Work within the roadway shall be done between the hours of **9 A.M. and 3 P.M** unless otherwise approved by VDOT or the Town of Ashland.
 - 3. Utilize proper sign layout and channelization devices (i.e., cones, plastic barrels, pavement marking, etc.) during construction, according to the latest edition of VDOT's "Virginia Work Area Protection Manual", as amended.
 - 4. The area of the open cut shall be restored in accordance with one of the following applicable standards:
 - a. Asphalt Road
 - 1. If the average daily traffic count (A.D.T.) is greater than 2,000 vehicles, then the pavement design will be determined by engineer depending on route and location.
 - b. Asphalt Road
 - 1. Backfill entirely with #21-A or #21 stone (95 percent compaction)
 - 2. Apply tack material to all joints before placing surface mixture.

3. Install minimum 12 inches of BM-25.0 asphalt concrete in 4 inch lifts (see Standard Detail).
 4. Overlay a minimum of 25 feet on both sides of trench with 2 inches of surface mix asphalt (SM-9.5A or other approved mixture).
 5. Seal all joints with liquid bituminous sealer.
- c. Asphalt Road Base with a Surface Treatment Seal
1. Backfill entirely with #21-A or #21-B stone (95 percent compaction).
 2. Apply tack coat for all edges and existing surface asphalt (see Standard Detail).
 3. Install 1.5 times the thickness of existing pavement or a minimum of 6 inches BM-25 (base mix) flush with existing pavement.
 4. Surface treat a minimum of 10 feet 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 gal./sq.yd. with 15 lbs. of No. 8P stone per sq. yd. each.
- d. Surface Treated Road (Tar and Gravel)
1. Backfill entirely with #21-A or #21-B stone (95 percent compaction).
 2. Apply tack coat for all edges and existing surface asphalt (see Standard Detail).
 3. Install 4 inches of BM-25 (base mix) in trench flush with existing pavement.
 4. Surface treat a minimum of 10 feet 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 gal./sq. yd. with 15 lbs. of No. 8P stone per sq. yd. each.
- e. Dirt/Gravel Road or Aggregate Shoulders
1. Select backfill compacted to 95 percent maximum density (6 inch lifts).
 2. Backfill trench with 10 inches of #21-A or #21-B stone (95 percent compaction).
 3. Apply fresh application of #21-A or #21-B stone to all disturbed areas of the road

5. The pavement cut shall be covered with a temporary or permanent asphalt patch on the same day that excavation is made.
 6. One travel lane will be maintained at all times.
- D. Where the contractor is granted approval to open cut the road for parallel installation within the pavement and service crossings, pavement replacement shall be in accordance with the details reflected in these Standards, the approved plans, or the highway permit; whichever is more stringent.
- E. 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 trench 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 the Virginia Department of Transportation and/or the Town of Ashland and the Department of Public Utilities until such time as the appropriate pavement patch can be applied and accepted.
- F. Upon completion of the installation of the water and sewer lines (not necessarily all testing completed), contractor shall restore pavement in the manner prescribed on the VDOT or Town of Ashland permit within 10 days. All trenches and repaving shall be maintained in accordance with the highway permit.
- G. 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 VDOT and/or the Town of Ashland, the Department of Public Utilities, and the property owner. Road drainage is not to be blocked. The pavement, shoulders, ditches, general roadside and drainage facilities shall be left in as good of a 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 an emergency situation arises under any circumstances, repairs will be made at the contractor's expense. 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 or Town roads currently developer owned).
- H. Work Zone Protection: The contractor shall immediately correct any situation which may arise as a result of construction that the Department of Public Utilities

or any other Agency having jurisdiction over the work area, deems hazardous to the traveling public. The contractor shall comply with the requirements of the agency that issued a permit for the construction.

- I. Traffic is not to be blocked, rerouted or otherwise impeded without written permission from the appropriate agency. 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 proper agency at least 24 hours before starting work. If traffic is impeded in any way, the same notice must be given to the fire department, rescue squad, VDOT, police department, sheriff and school board. All open trenches, pits, etc. shall be secured with barricades and any other necessary equipment to protect the public. The State of Virginia, Town of Ashland, and Hanover County shall not be liable for any damage resulting from construction.

2.2.3.9 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 applied 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”.

End of Section

2.3 Sanitary Sewer Systems

2.3.1 General

2.3.1.1 Requirements of Regulatory Agencies

Construction as shown on the approved plans, or stated herein, shall be performed in accordance with current and applicable requirements as established by the County of Hanover and the Virginia Department of Environmental Quality or any other agencies having jurisdiction over the construction being performed. Where conflicts arise between the contract documents and previously mentioned requirements, the more restrictive shall apply. If such requirements require a change in the work as stated herein or shown on the plans, the contractor shall stop work and notify the County for further direction.

2.3.2 Products

2.3.2.1 Approved Materials

All materials shall conform to the County of Hanover “Approved Materials and Manufacturers” list. All materials shall be new, virgin material. If requested by the County, the contractor shall submit a statement from the supplier and/or manufacturer stating that all materials being supplied for the work meet AWWA, ASTM and/or County Standards and, if requested by the County, the contractor shall submit the manufacturer’s literature for the materials being proposed.

In addition, the contractor may be required to submit shop drawings for approval. If required, the information needs to be sent as far in advance as possible (at least 14 days) to avoid any unnecessary delays in beginning the project. The County will require two sets of all approved shop drawings for its use. The certification and/or shop drawings must include manufacturer’s name, type of product, location of plant, project name and number, etc. for each product.

2.3.3 Execution

2.3.3.1 Installation of Sanitary Sewer Systems

- A. Excavating and Backfilling:
 - 1. contractor shall remove 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 materials, 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 lights 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 from 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 2 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 ensure 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 lines shall be required of the contractor when directed to do so by the inspector.
3. Survey Line and Grade:
 - a. Line and grade shall be maintained by the contractor and the County provided with cut sheets unless the County waives this requirement.
 - 1) Control point shall be set at a minimum of 50 foot intervals. Line and grade of the laser shall be checked at a maximum of 100 foot intervals.
 - 2) Standard cut sheet shall be provided to the County showing center line cut each 25 feet where payment for installation

is on a cut increment basis and hub cut at each 50 foot 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.

- b. contractor shall have level or transit in good working order on the 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 as indicated on the County approved plans and 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 shall be laid upgrade from point of connection to the existing sewer or from a designated starting point. If the starting point is at 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 is not being laid the forward end of the pipe shall be kept tightly closed with a watertight plug or cap. When the upstream end of a sewer does not terminate at a manhole, it shall be plugged and its location marked in a manner approved by the inspector.
- d. The pipe shall be fitted and matched so that when installed it will form a smooth, uniform invert.
- 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", or the pipe is inserted until the home line is even with the edge of the pipe bell. 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 watertight plug or cap.

f. Joining Pipe:

- 1) Ductile iron pipe is to be joined in accordance with the requirements of AWWA Standard C600 and the manufacturer's recommendations.
- 2) Polyvinyl chloride (PVC) pipe shall be joined in accordance with ASTM Standard D 2321.
- 3) Other type pipe shall be joined in accordance with the manufacturer's recommendations and the requirements of the County approved plans and specifications.

g. All visible leaks shall be corrected prior to testing.

h. Pipe laying and joining for force mains shall be the same as the requirements for waterlines.

i. PVC pipe shall be provided with anti-flotation ballast where cover is less than 3 feet.

j. Required polyethylene encasement shall be installed as shown on the plans and in accordance with the manufacturer's recommendation, AWWA C105, and applicable publications and Standards by the Ductile Iron Pipe Research Association (DIPRA).

C. Manhole Installation:

1. Manholes shall be constructed to the elevations indicated on the County approved plans in accordance with the Standard Details.

a. Set manhole base section on bed of #57 stone with a minimum depth of 8 inches. Stone shall be thoroughly compacted and carefully leveled to the excavated earth 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 inches to 24 inches, 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. For manhole frame and covers set flush with final grade, set adjusting rings in Portland cement mortar bed or in a bitumastic material (minimum of 1/4 inch thickness). Parge 1/8 inch to 1/4 inch thickness on inside and outside of manhole with Portland cement.

For manhole frames and covers set above grade. Adjusting rings are not allowed. The manhole frame shall be attached to the concrete manhole by the use of two 1/2 inch diameter stainless steel epoxied anchor bolts, two 1/2 inch diameter stainless steel wedge anchors, or two 1/2 inch diameter stainless steel stud anchors which extend no more than two inches above the top of the manhole frame flange when installed. Stainless steel washers and nuts shall be utilized to firmly attach the frame to the manhole. The flange of the manhole frame shall be drilled neatly with two 5/8 inch± holes on opposite sides of the frame which align with the anchor bolts. A bitumastic material shall be placed between the manhole frame and the top of the concrete manhole to seal this space. The exterior of the manhole frame shall have Portland cement neatly placed around it which shall cover the top of the anchor bolts.

Watertight manhole frame and covers per Detail MAN-12 shall be attached with four bolts in addition to the requirements above and be equipped with a Cretex, or approved equal, manhole chimney seal sized to fit the field application.

- g. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame. Maximum height of rings shall not exceed 12 inches otherwise the cone section will require removal and a new manhole riser installed to allow for the upward and downward adjustment as stated above.
- h. Construct bench of concrete.

- 1) Elevation of bench at the channel shall be at the spring line of the incoming and outgoing pipe.
- 2) Bench shall be 3 inches lower at channel than at manhole wall.
- 3) Where bricked up openings or stubs are provided for future pipe connections, bench and invert shall be so formed.
- 4) Use Type II sulfate-resistant cement for concrete or mortar on all manholes bench construction.
- 5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.
- 6) All inverts shall be smooth.

j. All visible and known leaks shall be corrected prior to 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 connection to the property line or easement limits on a grade of not less than 1/4 inch per foot unless otherwise shown on plans. Where connections are laid out of manholes, contractor shall use a laser beam. Terminate service connection at the property line with an approved watertight plug and mark the end with a two inch by 4 inch board installed plumb from bottom of 6 inch plug to 2 feet above ground. Service connection shall be of same type of pipe as sewer unless otherwise approved by County. When making a service connection to an existing sewer, the contractor shall use a mechanical hole cutter and approved saddle or Inserta-Tee gasketed fitting.

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 manholes, where stubs or bricked up opening do not exist. DPU inspector shall approve alternative tie-in techniques when the existing manhole cannot be cored due to construction methods or condition. All ties to existing manholes shall be watertight to prevent groundwater for entering the sewer system.

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 these Standards.

Where bricked up openings exist, a PVC manhole adapter 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 Adapters” or equal.

2.3.3.2 Testing of New Sanitary Sewer System

A. Testing Technique for Sanitary Sewer System:

1. Sanitary sewer lines 42 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828, latest edition. Sewer lines larger than 42 inches in diameter shall be tested by infiltration/exfiltration test. Manholes shall be vacuum tested as directed by DPU inspector. All testing shall be conducted in the presence of the County’s inspector. 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 County. 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 County, 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 that is being tested. Give special attention to laterals.
 - c. Ground Water Determination: If a line is located below the water table the elevation of the water table must be determined prior to testing. To determine the elevation of the water table the following procedure shall be utilized unless another procedure is approved by the inspector. Install a 1/2 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, 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 duration for the section under test by computation from the applicable formulas shown in ASTM C828, 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 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. 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 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 water level 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. A force of 250 lbs. 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. When requested by DPU, manholes shall be tested for watertight connections using the negative air pressure test (vacuum) in accordance with ASTM C 1244, latest edition. Manholes 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 County prior to its use. See Detail SEW-10 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 inspector.

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 exfiltration 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 inches 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 downstream manhole. Measure the amount of water flowing through the outlet after flow has been stabilized. Test shall be conducted in accordance with ASTM C-654.
 - c. Ground Water Determination: Use same procedure as “low-pressure air test” above.

- d. Exfiltration test shall be accomplished by plugging the sewer at the downstream end and filling the upstream manhole with water to the top of the manhole.

B. Testing Requirements for Sewer Force Mains:

1. All pressure testing shall conform to the requirements as established for Water Systems or as directed in the specific contract documents.

2.3.3.3 Tracing Wire and Locating Tape

Force mains shall have a tracing wire and locating tape installed.

A tracing wire of 12 gauge copper or Trace-Safe by Neptco, 19 gauge conductor shall be installed and taped directly on top of the pipe in a manner that a continuous trace results. Wire is to be run through all force main appurtenance manholes or boxes and shall be accessible for test hook-up at all manholes, boxes, and test stations. The tracing wire must be completely insulated from ground. The tracing wire will be attached to the top of the pipe using duct tape at an interval no greater than 16 feet. Tracing wire within test stations, appurtenance manholes, or other boxes shall be stripped 3/4 inch from the end and capped with a wire nut to minimize electrical ground contact. All connections at the main line must be electrically sound and physically secure with screw connections or clamps. In addition all connections must be taped with electrical tape and sealed with an electrical coating sealant. Test stations shall be installed at intervals of no greater than 1,000 feet along force mains. Concrete pads, as detailed, shall be provided for test stations on force mains and a line marker/witness post installed per Section 2.3.3.4 when located outside of a right of way. Tracing wire for force mains shall be color coded green. See Section 3.3.1 for further details.

Locating tape shall be installed in the trench approximately 12 inches below finish grade. Tape shall be polyethylene with metallic core, two inches in width, with continuous printed message "Caution - Force Main Buried Below". Tape shall be manufactured by the Seton Name Plate Corp. or approved equal.

See Sections 3.3.1 and 3.3.2 for more information on tracing wire and marking tape.

2.3.3.4 Line Markers/Witness Post

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 or approved equal. See Section 4.2.21 for further details. 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 County.

2.3.3.5 Abandonment of Sanitary Sewer Service

Excavate at the main and expose the lateral connection. Sever the lateral pipe in the vicinity of

the main and cap both ends of the pipe as approved by the inspector. If it is impractical to excavate the lateral at the main due to depth or location, e.g. a highly travelled road, then the service shall be abandoned using an inserted expandable plug, (Zurn is an acceptable manufacturer) which is inserted down the service to the vicinity of the main and then grout filled behind to seal the pipe. The sewer main shall be inspected with CCTV to verify that it was not affected by the work prior to tentative acceptance being granted by DPU.

2.3.3.6 Abandonment of Sanitary Sewer Mains and Manholes

Sanitary sewer mains and manholes to be abandoned shall be permanently disconnected from the remaining system. Details of special abandonment shall be approved by the Department on a case-by-case basis and per Detail MAN-19.

All open ends on abandoned pipe to be permanently sealed by plugging with a pipe plug or cap unless otherwise approved by the County. Salvageable items shall be returned to the Department of Public Utilities.

2.3.3.7 Clean-Up

Upon the completion of the installation of the sanitary sewer system and prior to tentative acceptance by the County, sediment and debris shall be removed from the system. Unless waived by the inspector, the contractor shall flush the sewer system and install proper devices to capture debris flushed from the sewer system so that it does not enter the County's existing sewer system prior to the County issuing Tentative Acceptance for the project. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT, the Town of Ashland, and/or the County. All trash and debris shall be removed and properly disposed. Areas not otherwise stabilized shall be seeded and mulched and a good stand of grass established.

End of Section

2.4 Water Distribution System

2.4.1 General

2.4.1.1 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 County of Hanover and the Virginia Department of Health or any other agencies having jurisdiction over the work being performed. Where conflicts arise between the construction documents and previously mentioned requirements, the more restrictive shall apply. If such requirements require a change in the work as stated herein or shown on the plans, the contractor shall stop work and notify the County immediately for further direction.

2.4.2 Products

2.4.2.1 Approved Materials

All materials shall conform to the County of Hanover “Approved Materials and Manufacturers” list. All materials shall be new, virgin material. If requested by the County, the contractor shall submit a statement from the Supplier and/or Manufacturer stating that all materials being supplied for the work meet AWWA, ASTM and/or County Standards. If requested by the County, the contractor shall also submit the manufacturer’s literature for the materials being proposed.

Shop drawings, as defined in the General Section, and operation manuals are required on projects where there are special structures, and on Pump Stations, Tanks, Pressure Reducing Vaults and Treatment Plant projects. This requirement includes, but is not necessarily limited to pipe and accessories, manholes and appurtenances, valves, and other assorted products, etc. Shop drawings shall be submitted by the contractor to the County for approval. The information needs to be sent as far in advance as possible (at least 14 days) to avoid any unnecessary delays in beginning the project. The contractor shall submit 4 more copies than he wants returned for review and approval by the engineer and County.

The certification and/or shop drawings must include manufacturer’s name, type of product, location of manufacturing plant, project name and number, etc. for each product.

2.4.3 Execution

2.4.3.1 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 earth free from 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 2 feet from around the area of new facility and backfilled with a suitable material as specified.

B. Pipe Installation:

1. Take all precautions to ensure 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 waterline 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 waterline 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 six (6) inches 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 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 County. Joint deflection in pipe shall not exceed one-half that recommended by AWWA Standards or the manufacturer whichever is less (ductile iron installations only). 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 (ductile iron only). PVC pipe joint deflection is not permitted per Section 2.4.3.1.B.5.g.2).e).
- d. The water pipe, unless otherwise approved by the inspector, shall be laid upgrade from point of connection of the existing water main or from a designated starting point. Water pipe shall be installed with the bell end forward or upgrade. When pipe is not being laid, the forward end of the pipe shall be kept tightly closed with a watertight 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. 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 watertight plug or cap.

g. Joining Pipe:

1) Ductile iron pipe to be joined as follows:

(a) Mechanical joint pipe:

- (1) 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. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (1/2 cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.
- (2) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. The gland is moved into position, bolts inserted and nuts turned finger tight.

Tighten all nuts to torque listed below:

Bolt Size (inches)	Torque (ft - lbs)
5/8	40 -60
3/4	60 - 90
1	70 - 100
1 - 1/4	90 - 120

- (3) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed, and torque value is reached.
- (4) Permissible deflection in mechanical joint pipe shall not be greater than one-half of that listed in AWWA C600.

- (b) 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 gasket lubricant supplied by pipe manufacturer, to the gasket and spigot end of the joining pipe.
 - (2) Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.
 - (3) Permissible deflection in push-on joint pipe shall not be greater than 1/2 of that listed in AWWA C600.

- 2) 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 inch beyond the reference mark on the spigot end of the joining pipe. Make certain the bell 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 lubricant supplied by pipe manufacturer.
- 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.

- e) **Deflection of the joint or the length of pipe by bending is strictly prohibited for PVC pipe. PVC pipe is to be laid on a straight line and all deflections made using the appropriate degree bend.**

Waterline bend locations shall be included in the construction stake out.

3) 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.

h. A tracing wire shall be installed and taped directly on top of the pipe in a manner that a continuous trace results. Wire is to be wrapped around hydrants, blow offs and corporation stops and shall be accessible for test hook-up at all water meter boxes, and test stations. The tracing wire must be continuous and completely insulated from ground. The tracing wire will be attached to the top of the pipe using duct tape at an interval no greater than 16 feet. Tracing wire within test stations and meter boxes shall be stripped 3/4 inch from the end and capped with a wire nut to minimize electrical ground contact. Test stations shall be installed within 2 feet of **all** fire hydrants and at intervals no greater than 1,000 feet. All connections at the main line must be electrically sound and physically secure with screw connections or clamps. All connections must be taped with electrical tape and sealed with an electrical coating sealant. Tracing wire for water mains shall be color coded blue. See Section 3.3.1 for further details.

i. Place underground warning tape directly above all water mains, 12 inches below finished grade. Tape shall be polyethylene tape with a metallic core, two inches in width, with the continuous printed message "Caution - Waterline Buried Below". Tape shall be manufactured by the Seton Name Plate Corp. or approved equal.

See Section 3.3.2 for more information on marking tape.

j. 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 per Section 3.1.20 for further details.

Exceptions are where waterlines are installed in "kept" yards where the property owners may object to the placement of these markers. Markers are required to be properly installed per manufacturer's recommendations parallel to the waterline and facing the roadway. Generally for waterline construction, DPU will install the necessary markers. If the contractor is going to be required to install the markers, the requirement will be specifically called out on the plan.

- k. Required polyethylene encasement shall be installed as shown on the plans and in accordance with the manufacturer's recommendation, AWWA C105, and applicable publications and Standards by the Ductile Iron Pipe Research Association (DIPRA).

C. Installation of Valves, Fittings, and Hydrants:

1. General: Valves, fittings and hydrants shall be set and joined to the piping system as specified for cleaning, laying and joining 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 inspector. Valve rod extension with guide shall be required to maintain a maximum distance of two-feet-four-inches from operating nut to top of box and per Detail WAT-12. All valves shall be properly restrained.

Valve boxes not located in pavement or concrete shall have a two foot square by 4 inches thick concrete pad poured around them. Concrete pad shall be neatly formed with a troweled finish. Concrete shall be minimum 3,000 psi concrete. In limited circumstances, such as when the valve box is located in a narrow ditch bottom (a situation that should be avoided if possible) and pouring the pad would require widening the ditch, the inspector may waive the requirement for the concrete pad or reduce the dimensions of the concrete pad.

Butterfly valves in paved areas shall be installed in a manhole per Detail MAN-13.

3. 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 inspector will constitute a contamination or cross-connection hazard.
4. Hydrants:

Connection to Main: Each hydrant shall be restrained and connected to the main as shown in the Standard Details. Each hydrant shall be provided with a minimum six inch diameter ductile iron branch, controlled by an independent six inch resilient seat gate valve.

Setting of Hydrants: When hydrants are set, a drainage pit 2 feet in diameter and 2 feet below the bowl of the hydrant shall be excavated.

All hydrant valves shall be restrained to the hydrant tee on the main line.

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 restrained to the pipe with approved restraint systems. All hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

5. Anchorage of Fittings: All fittings (i.e., each bend, tee, plug, valve and cap) shall be prevented from moving by means of adequate thrust reaction blocking and/or mechanical restraints as shown in the Standard Details and approved by the inspector.
6. In easements and in undeveloped wooded areas, plastic markers shall be installed every 200 feet and at all valves and fittings. Markers shall be per Section 3.1.20. Exceptions are where waterlines are installed in "kept" yards where the property owners may object to the placement of these markers. Markers are required to be properly installed per manufacturer's recommendations parallel to the waterline and facing the roadway. Generally for waterline construction, DPU will install the necessary markers. If the contractor is going to be required to install the markers, the requirement will be specifically called out on the plan.

D. Installation of Fabricated Steel Tapping Sleeves:

1. General: The following testing and conditions apply to all sleeves:
 - 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 inches and larger shall be supported by a concrete pedestal support, as approved by the DPU inspector.
2. For Rockwell Tapping Sleeves in addition to the conditions outlined in 1 above, the following procedures must 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 percent chlorine solution prior to installing the sleeve.
- b. Lubricate pipe and gasket with soap and water. Under no condition shall 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.

- 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 shall 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 2-1/2 times line pressure or 200 psi, whichever is **greater**. The duration of this pressure test shall be a minimum of 10 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 during the tapping operation to prevent movement or rotation of the tapping sleeve.

- h. Proceed with tapping operation.

Contractor shall complete tapping procedure and perform the necessary checking as required. Contractor shall furnish the inspector with the tap coupon.

- i. Check the bolts for tightness and re-torque, if required.
- E. Installation of Services:
 1. 3/4 inch and 1 inch:
 - a. Taps shall be made on a 45 degree angle and utilizing a saddle.
 - b. Corporation stops shall have “cc” thread inlet and compression fitting outlet.
 - c. Tap shall be made with a tapping machine equipped with a bit designed for the type of pipe being tapped.
 - d. Distance between taps or from a joint or bell shall be a minimum of 18 inches.
 - e. Service pipe shall be type “K” soft copper.
 - f. Services shall be installed with 42 inches minimum cover up to meter yoke where yoke shall be installed so that meter will set 12 inches to 18 inches below finished grade.
 - g. Meter yokes shall be from approved materials list and be installed with a tail piece of type “K” soft copper, approximately 18 inches long.
 - h. Meter yoke and box shall be set 1 foot inside right-of-way or easement or as directed by the inspector. Meters shall be installed on reasonably level ground or conform to the angle of the slope. Meter locations shall be staked by a licensed surveyor in order to assure that they are properly located in reference to the right-of-way boundary, utility easement boundaries, and adjacent properties’ separating boundary line.
 - i. Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling.
 - j. Water meter boxes in areas subject to vehicular traffic to be constructed of cast iron.
 2. 1-1/2 inch and 2 inch Services:
 - a. Services shall be made utilizing a four inch branch tee with a 4 inch gate valve and 4 inch ductile iron “service” line to the edge of the pavement or behind the curb. 4 inch service line is to end with

a restrained tapped cap where service will transition to 2 inch copper to the proposed meter. All piping shall be restrained joint from the tee to the cap. See Detail MET-11B for further details and alignment of appurtenances.

- b. Coupler shall have iron pipe thread (IPT) c inlet and compression outlet.
- c. Service pipe shall be type “K” hard copper.
- d. Services shall be installed with 42 inches minimum cover up to meter yoke where yoke shall be installed so that meter will set 12 inches -18 inches from finished grade.
- e. Meter setters shall be from approved materials list and be installed with a valved bypass and a tail piece of type “K” soft copper or brass, approximately 18 inches long.
- f. Meter setters and box shall be set 1 foot inside right-of-way or easement or as directed by the inspector. Meters shall be installed on reasonable level ground or conform to the angle of the slope. Meter locations shall be staked by a licensed surveyor in order to assure that they are properly located in reference to the right-of-way boundary, utility easement boundaries, and adjacent properties’ separating boundary line.
- g. Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling.

F. Installation of Water Mains and Water Meter Boxes Related to Sidewalks:

- 1. Sidewalks and waterlines shall be constructed to accommodate at least a four foot horizontal separation between the sidewalk and the County’s public water main(s).
- 2. When sidewalks are constructed with a proposed project, the street side of all water meter boxes shall be installed 3 feet behind the house side of the sidewalk or to the right-of-way line, whichever is greater. If meter is located outside of the public right-of-way, then an appropriate sized utility easement must be provided and proper coordination with all other utilities accounted for. Coordination and consideration shall also be given to conflicts between public water facilities and required streetscape, if applicable.

2.4.3.2 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 1-1/2 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 zero allowable leakage. Prior to applying pressure to the lines, all reaction blocking, and/or mechanical restraints shall have been completed to the satisfaction of the inspector. As the pipes are being filled, all air shall be expelled from the pipes by providing manual air relief valves at the high points of the system.

Any defects discovered during this test shall be repaired and the test repeated until the results are satisfactory to the inspector. The contractor shall provide all equipment, materials and labor necessary to conduct the test. The contractor shall provide a suitable test pump and properly calibrated gauge or other means for measuring leakage which is satisfactory to the inspector.

2. Water from the County's water system shall be used for flushing, sterilization and testing. Filling of water main may be performed provided permission has been obtained from the inspector who will be responsible for coordinating this activity with the County's Operations and Maintenance Sections and the appropriate backflow prevention device is installed. Contractor is not permitted to operate valves on existing lines unless approved by the County's inspector.
3. Testing shall be performed in accordance with the AWWA Specifications, latest revision or as directed by the DPU inspector.

2.4.3.3 Disinfection

- A. Prior to being placed in service, the pipe line and appurtenances shall be disinfected in general accordance with ANSI/AWWA C651, latest edition; AWWA Standard for **Disinfecting Water Mains** and the supplemental procedures as set forth below:
 1. Section 3 of AWWA C651 emphasizes six basic procedures in the disinfection process. These 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/s unless the County determines that conditions will not permit the required flow. See table “Flushing Schedule”. Adequate provisions shall be made by the contractor for disposal and neutralization 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. **Only liquid sodium hypochlorite (household and industrial strength bleach) are acceptable sources of chlorine for disinfection.**

Sources of chlorine shall be in conformance with AWWA B300 Standard for Hypochlorites, and NSF 60 and 61.

- b. The use of chlorine gas is hazardous and is **strictly prohibited** for use of disinfection of public waterlines.
- c. The use of calcium hypochlorite pills affixed to the interior of water pipe for disinfection **shall not be an acceptable form of disinfection.**
- d. The mixing of a source of chlorine to obtain a suitable disinfecting solution shall be as follows:
 - 1) Liquid sodium hypochlorite 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) A water calcium hypochlorite solution shall be prepared by dissolving calcium hypochlorite granules containing 65percent 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.

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 backflow prevention device (see Detail WAT-13 for further information) 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 50 mg/l 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 1,200 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/l chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours. The free chlorine residual must be at least 10 mg/l after 24 hours in accordance with AWWA C651.

- b. The **owner or contractor** 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 (low-flow) from the main until the chlorine residual of the water leaving the main is equal to the chlorine residual of the incoming system water. Additional instructions for disposal of the heavily chlorinated water are covered in Section 2.4.3.4.E, entitled “Flushing”.

B. Bacteriological Tests:

- 1. After low-flow flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriological quality. Two consecutive negative tests from the same location shall show the absence of coliform organisms. At least two samples shall be collected and tested by a State of Virginia certified laboratory at least 24 hours apart at intervals determined by the inspector (not exceeding 1,200 feet apart and at the end of all branch lines and cul-de-sacs).
- 2. Samples for bacteriological analysis shall be collected in approved sterile bottles or bags treated with sodium thiosulfate. 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. The contractor shall be responsible for any cost associated with the loading, hauling, discharging and dechlorination of the heavily chlorinated water.

2.4.3.4 Supplemental Procedures for Disinfecting, Testing, and Flushing

A. General:

- 1. All work shall be performed in general accordance with AWWA C651, latest edition.
- 2. The supplemental procedures are developed to compliment the AWWA C651 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, 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 as supplied by the pipe manufacturer and suitable for application in a potable water system. It shall be kept clean and applied clean with dedicated applicators.

Note: The County will not accept completed waterlines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.

5. The table entitled “Flushing Schedule” gives flushing flow rates and flushing mechanism sizes for water mains 6 inches through 24 inches in diameter. Specific flushing schedules for line sizes above 24 inches will be project and site specific and 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. 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. Assembly shall be approved by the Department of Public Utilities prior to its use. A suitable valved piping arrangement for the addition 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 150 psi rated flange connections and installed in a manner approved by the inspector. See Detail WAT-13 for further information.
2. System testing will not commence until all administrative items have been resolved and the project is ready for tentative acceptance pending the successful performance of all required testing.
3. Initial flush time is to be in accordance with the *Sequence of Construction, Testing, and Flushing of New Waterline* notes shown in Detail DES-3.
4. Pressure test the line as noted in Section 2.4.3.2.A.1 of these specifications.

5. Make any necessary repairs and pressure test again until the line passes this test.
 6. Disinfect the line in accordance with AWWA C651, Section 5. A water-chlorine solution prepared in accordance with Section 2.4.3.3.A.3 above shall be used for disinfection.
 7. 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.
 8. Bacteriological samples will be taken in accordance with AWWA C651, Section 7.
 9. If unsatisfactory bacteriological test results are received, repeat steps 6, 7 and 8.
 10. 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 waterlines to the existing water system within 10 working days of successful completion of all bacteriological tests; otherwise the disinfection process must be repeated.
 11. Final flush of line to be in accordance with *Sequence of Construction, Testing, and Flushing of New Waterline* notes shown in Detail DES-3.
- C. The Disinfection and Supplemental Procedures may be modified by the Director of Public Utilities for site specific problems that do not physically allow for following the normal disinfection procedures. Modified instructions will be given in writing from the Director 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 before placing it into service.
- D. The procedure for the disinfection of short leads to fire hydrants and the connector pipe to fire suppression systems/double detector 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 detector check assembly, which does not contain domestic use branches and is equal to or less than 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 of uncontaminated water. Connections to existing mains must be done within 10

working days of the successful completion of all bacteriological tests; otherwise, the disinfection process shall be repeated.

E. Flushing:

Water for filling the line and flushing will be taken from the County’s water system. The use of water for making the new water main available for service will be as follows:

1. Initial Flush:

See table 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. The contractor is to provide sufficient hoses to connect from the hydrants to a suitable discharge point. 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 (see Detail WAT-8 for further information). The expense of a neutralizing station is the responsibility of the developer/contractor.

3. Final Flush:

See the table below. 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.

Flushing Schedule

Main size	Double Check	INITIAL	FINAL FLUSH
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(Nominal)	Valve Single Gate Size (Note 1)	FLUSH (Note 2) Min. Flow (gpm)	(Note 2) Max. Flow (gpm)
6"	4"	220	88
8"	4"	400	160
12"	6"	900	350
16"	6"	1,500	624
20"	8"	2,450	978
24"	10"	3,525	1,410
30"	Designed by Consultant	5,505	2,202
36"	Designed by Consultant	7,935	3,174

Notes:

1. See description of "Preassembled Flushing Mechanism" Detail WAT-13 of these 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. See Detail WAT-7 "Discharge Flow Rates for Flushing" of these Specifications.
3. On a case-by-case basis, dependent upon such variables as length of new water main (<200'), space limitations or other unforeseeable obstacles, the inspector may authorize the use of a smaller flushing device if the use of this device will provide for adequate flushing of the new water main.

2.4.3.5 Testing of Double Detector Check Assembly

- A. The inspector will be responsible for ensuring the appropriate test is performed up to the outside isolation valve located on the inlet side of the double detector check assembly.
- B. The developer is responsible for having the double detector check assembly tested by an approved tester prior to service being authorized to the building. Tests on the double detector check assembly shall be conducted on an ongoing basis annually by a certified tester approved by the Department of Public Utilities. The results of the test shall be sent to the Department of Public Utilities.

2.4.3.6 Abandonment of Water Service

Excavate at the main and expose the corporation stop. Turn off the corporation stop and disconnect the service pipe from the corporation stop. If practical, the corporation stop should be removed and a screw plug installed in the hole. If it is not practical to remove the corporation stop, provide a screw plug for the corporation stop. If the corporation stop is left in place, assist the inspector in referencing the location of the corporation stop for County records. Remove the meter box, yoke and service line. The inspector will deliver the meter to the Customer Service Section of the Department of Public Utilities.

2.4.3.7 Abandonment of Water Mains

Water mains and hydrants to be abandoned shall be permanently disconnected from the remaining system. Details of the abandonment shall be approved by the Department on a case-by-case basis.

All open ends on abandoned pipe to be permanently sealed by plugging with a pipe plug or cap unless otherwise approved by the County. All valve boxes, fire hydrants, flushing hydrants (blow offs) or other appurtenances shall be removed. Salvageable items shall be returned to the Department of Public Utilities.

2.4.3.8 Clean-Up

Upon the completion of the installation of the water system and prior to the County acceptance all restoration shall be complete. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT, the Town of Ashland, and/or the County. All trash and debris shall be removed from site and disposed of properly. Areas not otherwise stabilized shall be seeded and mulched and a good stand of grass established.

End of Section

3. MATERIAL SPECIFICATIONS

All products must comply with the Materials Specifications as referenced in this Section and the County's Standard Details. All references to ASTM, AWWA, and other standards shall include latest revisions.

3.1 Water Systems

3.1.1 Water Pipe

- A. Ductile iron pipe shall meet the requirements of AWWA C150 and C150. 3 inch through 12 inch pipe shall be a minimum thickness of Class 52. 16 inch and larger pipe shall be a minimum thickness of Class 51. Pipe shall have cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA Standard C104. A minimum of 5 percent of the pipe furnished shall be gauged for roundness full length and so marked. Class of pipe shall be increased if the specific installation warrants it. All pipe located within a casing pipe to be thickness Class 52 unless otherwise specified.

Pipe fittings shall be ductile iron meeting the requirements of AWWA C110 or AWWA C153, and pressure class 350 for 3 inches – 24 inches and pressure class 250 for 30 inches and above. 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 C116.

Buried pipe and fittings shall have either mechanical joint or push-on joint, both conforming to the requirements of AWWA C111. Bolts for mechanical joint fittings shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.

Exposed pipe and fittings shall have flanged joints conforming to the requirements of AWWA C115. Pipe shall be minimum thickness of class 53. 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.

- B. Polyvinyl chloride pipe (PVC) 4 inches, 6 inches, 8 inches, and 12 inches in size shall conform to the requirements of AWWA Specification C900, with gasket joints, minimum DR-18 Class 150 with iron pipe O.D. Fittings shall be ductile iron, Pressure Class 350, with mechanical joints. Ductile iron pipe shall be utilized if the working pressure for PVC pipe will be exceeded in the specific installation. Pipe shall be certified by the National Sanitation Foundation.

Cell Classification for PVC water pipe shall be 12454-B.

- C. High Density Polyethylene (HDPE) – Will be considered for installation for transmission lines only with no branches or taps allowed. Its general installation will be reviewed on a case-by-case basis when normal open trench construction and/or jack and bore casing pipe with internal carrier pipe is not practical. The

design engineer shall specify the particular pipe and the rating shall meet or exceed 150 psi operating pressure. These installations will generally be by directional drilling.

- D. Gaskets for mechanical and push-on joints shall meet the latest AWWA Specifications. Hemp or jute shall not be used. Gaskets for 8 inch I.D. pipe and smaller shall be 1/16 inch thick and gaskets for installation on larger size pipe shall be 3/32 inch thick.
- E. 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.
- F. Tracing wire shall be 12 gauge insulated copper wire or Trace-Safe by Neptco, 19 gauge conductor and used with all pipes and services. See Section 3.3.1 for further details.

3.1.2 Gate Valves and Tapping Valves

- A. Resilient Seat Gate Valves
 - 1. All resilient seat gate valves shall fully comply with AWWA C509 (3 inches-12 inches) or C515 (4 inches-12 inches), 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. All valves shall open left (counter-clockwise). Buried valves shall have mechanical joints while exposed valves shall have flanged joints.

9. For AWWA C509 valves, the bodies, bonnets and other cast iron parts shall conform in all respects to ASTM Specification Designation A126, Class B for valve sizes 2 inches through 12 inches.

For AWWA C515 valves, the bodies and bonnets shall conform in all respects to ASTM Specification Designation A536, Class 70-50-6 for valve sizes 4 inches through 12 inches.

All castings whether ductile or cast iron 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.

10. Valves must have a 250 psi working and 400 psi test pressure.
11. 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 County.
12. All internal and external bolts, **including the bonnet bolts**, shall be a minimum Type 304 stainless steel.

B. Resilient Seated Wedge Tapping Valves:

1. Tapping valves shall meet above specifications as referenced in 3.1.2.A. above 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 being utilized.
2. Tapping valves will be suitable for use with all approved manufactured tapping sleeves without modification.

3.1.3 Butterfly Valves (16 Inches - 72 Inches)

All butterfly valves shall conform to the latest revision of AWWA Standard C-504, Class 150-B unless otherwise indicated and meet the following:

- A. Valve bodies shall be cast iron, ASTM A-126 Class B or ductile iron per ASTM A-536 grade 65-45-12. 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), and is for underground use only. All valves shall conform with AWWA C-504, Table 3, Laying Lengths For Flanged Valves and Minimum Body Shell Thickness for all Body Types.

- B. Valve disc shall be cast iron, ASTM A-126 Class B or ductile iron ASTM A-536, grade 65-45-12. Valve disc shall be of the offset or symmetrical design providing 360 degree uninterrupted seating. For sizes 30 inches and larger, disc shall be of the flow through type, cored, or domed with ribs parallel to flow.
- C. The resilient seat shall be BUNA-N located in the valve body mechanically retained by epoxy or 18-8, Type 304 stainless steel retaining ring secured by 18-8, Type 304 stainless steel screws. The seat shall be capable of mechanical adjustment in the field and field replaceable without the need for special tools on 24 inch and larger valves. Valve body seat shall be 18-8, Type 304 Stainless Steel.
- D. Valve shaft shall be 18-8, Type 304 stainless steel. Valves shall have either one piece (through shaft) or two piece (stub shaft). The shaft should be attached to the disc by means of O-ring sealed taper pins with lock nuts on 30 inch and larger valves. Taper pins should be either 304 stainless steel or 416 stainless steel heat treated for added strength or shaft is attached with stainless steel shaft journals hexmated to drive shaft.
- E. The valve assembly shall be furnished with a non-adjustable factory set thrust bearing designed to center the valve disc at all times.
- F. Shaft bearing shall be contained in the integral hubs of the valve body and shall be of non-cold flowing phenolic backed, PTFE or corrosion-resistant self-lubricated sleeve type.
- G. Valve shaft seal shall consist of O-ring or Split-V ring. Where the valve shaft projects through the valve body for the actuator connection, the O-ring or Split-V ring packing seal shall be field replaceable without valve disassembly. Connection to the actuator shall be provided by means of at least two bolts for 16 inch - 24 inch valves and at least four bolts for 30 inch and larger valves.
- H. Valves shall open counter-clockwise.
- I. When required, manual actuators shall be amply sized for line conditions. All manual actuators should be traveling nut or wormgear type. All 16 inch through 72 inch butterfly valve manual actuators shall be capable of withstanding 450 foot pounds of input torque against the open or closed stops. All actuators shall have adjustable mechanical stop limits. The closed position stop may or may not be externally adjustable.
- J. All valves shall be coated with AWWA Standard Epoxy Coatings in conformance to AWWA Standard C550, latest revision. All interior ferrous surfaces, including disc, shall be coated a nominal 10 mils thick for long life; and body exterior shall have a minimum 8 mils thickness of hand applied epoxy or 3-5 mils thickness fusion bonded epoxy coating in order to provide protection in shipment and storage, and to afford a superior base for field-applied finish coats.

3.1.4 Valve Key Extensions

- A. The extension shall be 1-1/2 inch solid core steel with the upper operating nut and bottom coupling welded to the stem.
- B. The 2 inch square operating nut on top shall be welded to form a complete box with no openings.
- C. 2-1/2 inch square socket section on bottom shall be tapped on four sides for minimum 5/16 inch N.C. socket head stainless steel 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 all four sides to allow insertion of the setscrews.
- F. A 4-1/2 inch diameter steel plate, 1/4 inch thick centering disc, shall be welded to the stem 2 inches below the bottom of the top operating nut.
- G. See Detail WAT-12 for further details.

3.1.5 Tapping Sleeves (Fabricated Steel)

- A. The body of the tapping sleeve shall be of 3/8 inch carbon steel, ASTM grade A285.
- B. Flange to be AWWA C207 Class D ANSI, 150 lb. drilling.
- C. The carbon steel body shall have a 12 mil thick coating of fusion-bonded epoxy. Bolts shall be 18-8, Type 304 stainless steel.
- D. Gaskets shall be Grade 60 compounded for use with water, alkalis, mild acids and most hydro-carbon fluids, up to 212 degrees Fahrenheit.

3.1.6 Tapping Sleeves (Stainless Steel)

- A. The body of the tapping sleeve shall be of 18-8 type 304 stainless steel.
- B. Branch/flange to be 304 stainless steel, 150 lb. drilling.
- C. Gaskets shall be Grade 60 compounded for use with water, alkalis, mild acids and most hydro-carbon fluids, up to 212 degrees Fahrenheit.
- D. Clamping hardware (nuts, bolts and washers) shall be 18-8 type 304 stainless steel, with plastic anti-gall washers. Drop-in bolts or welded-on studs are acceptable.

3.1.7 Tapping Sleeves (Fabricated Steel with Mechanical Joint Ends)

- A. Sleeve body, valve flange, gaskets, hardware and coating to be the same as the fabricated steel tapping sleeve.
- B. The mechanical joint glands to be ASTM-A36 iron or ductile iron.
- C. The gland retaining hardware (nuts, bolts and washers) to be 18-8 type 304 stainless steel.

3.1.8 Tapping Sleeves (Cast Iron with Mechanical Joint Ends)

- A. The body and glands of the tapping sleeve shall be of ASTM-126, Class B cast or ductile iron. Sleeve shall be furnished complete with all mechanical joint accessories (bolts, nuts, gaskets and glands), and shall have a bituminous seal coating.
- B. Valve flange, body gaskets and clamping hardware (bolts, nuts and washers) shall be as specified for the fabricated steel tapping sleeve.

3.1.9 Tapping Sleeve Applications

- A. The use of tapping sleeves and valves on the County water system will be considered where it can be shown that installation of a tee and line valve on the existing water main will not be beneficial to the County.
- B. The stainless steel or fabricated steel with mechanical joint ends or cast/ductile iron with mechanical joint ends tapping sleeves may be used for any approved tap on PVC or ductile iron water main.
- C. The stainless steel or fabricated steel with mechanical joint ends or cast/ductile iron with mechanical joint ends tapping sleeves may be used for all approved taps on asbestos-cement pipe (except for 16 inch size) and for size-on-size or one size down taps on all other pipe material.
- D. Due to the non-availability of the mechanical joint tapping sleeve for 16 inch asbestos-cement pipe, the stainless steel sleeve must be used for taps on this pipe.
- E. The fabricated steel tapping sleeve may be used for approved two (or more) size down taps on PVC, cast iron or ductile iron water main.
- F. Certification, Testing and Installation:
 - 1. The following testing and conditions relating to tapping sleeves apply to all manufacturers:
 - a) The tapping sleeve shall be tested in place to a minimum of 200 psi. It is the contractor's responsibility to order the correct pressure rated tapping sleeve.

- b) If the sleeve fails the 200 psi pressure test, the original failed sleeve shall be replaced with an entirely new sleeve.
- c) The concrete thrust block shall be poured to also support the tapping sleeve from beneath. The tapping sleeve, valve and tapping machine assembly is to be adequately supported during the tapping operation to prevent movement or rotation of the tapping sleeve.
- d) Installation instructions must be followed in strict accordance with the latest County's procedures.

3.1.10 Double Detector Check Valve 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 Detail drawings. See Section 4.2.10 for list of approved manufacturers.
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 inch – 3 inches shall be provided around the pipe where the fire line enters and exits the pit.
5. Vaults greater than 3 feet 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 approved equal.
7. While pits should generally be located outside of traffic areas, if a pit has to be located in a vehicle travel area, all of its components should be designed with the appropriate traffic loading capacity as approved by the design engineer, i.e. H-20, etc.

B. Valving:

1. Must be U.L. listed or F.M. approved. The double detector check valve assembly shall have a bypass meter with 3/4 inch check valve assembly surrounded by an OS&Y gate valve on both the inlet and outlet side of the assembly. The double detector check assembly shall meet the requirements of the American Society of Sanitary Engineering and the International Plumbing Code Standards for backflow prevention devices. The bypass meter shall be purchased from the County and installed per County requirements with the meter reading touch pad installed on the hatch to facilitate ease of reading.
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 fire related questions will be addressed by the Hanover Fire Administration.
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 are not acceptable support materials.

3.1.11 Fire Hydrants

- A. Fire hydrants shall be manufactured in full compliance with this specification and shall also comply with the AWWA 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 5-1/4 inches.
 3. Inlet Size and Type: 6 inch mechanical joint end with accessories.
 4. Hose Nozzles: Each hydrant shall be equipped with two 2-1/2 inch 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 4-1/2 inch 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 1-1/2 inch 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 inches.
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 2-1/2 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: Normally hydrants shall be suitable for installation in trenches 4 feet 6 inches deep. Required parts and materials to adjust fire hydrants to different depth of bury shall be provided by the manufacturer to meet actual field conditions as required.
13. Painting Instruction: At least two prime coats and one aluminum finish coat shall be used and must be applied by the original manufacturer, unless otherwise specified. Exposed area of fire hydrant shall receive one

field coat of “aluminum” color Rust-Oleum paint after installation, unless otherwise directed by the inspector. Final field coat shall be brush applied. The wetted surface of the hydrant shoe shall be epoxy coated to prevent corrosion of the waterway. All fire hydrants that arrive at the job site that are not factory painted “silver” will be rejected.

14. Pressure Rating: Test pressure 400 psi, working pressure 200 psi.

- B. If the standard hydrant provided by a manufacturer does not fully comply with these specifications, but compliance can be attained by providing optional features, then each hydrant must be permanently marked to indicate the option or options that have been provided. The method of marking hydrants to indicate that options are included must be approved by the County.

3.1.12 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. Check valves shall generally conform to the requirements of the most recent version of AWWA C508.

3.1.13 Water Service Assembly for 5/8 Inch Water Meters

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

- A. Water meter boxes shall be Carson-Brooks 2200 (18 inches depth), NDS D-2400 (18 inch Pit), or approved equal.
- B. Meter box lids shall have a 1-3/4 inches diameter hole located in its center. The hole shall either be cast in place, at the foundry or, after casting, be retrofitted via a plasma arc torch. Holes shall be compatible with the County’s touch read meter system.
- C. Water meter boxes in areas subject to vehicular traffic 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.
- D. Meter yokes shall be 3/4 inch Ford 500 Series, AY McDonald, Mueller, Cambridge Brass Series 460, or approved equal with angle valve. Expanders shall be Ford EC23 or approved equal supplied by the yoke manufacturer.
- E. Corporation stop with corporation cock thread inlet shall be as specified in the approved materials list.
- F. Pipe shall be 3/4 inch or 1 inch type “K” soft copper domestic manufactured. 1 inch service line is required when the line is longer than 60 feet.
- G. Tail piece on yoke shall be 3/4 inch or 1 inch type “K” soft copper, approximately 18 inches long.
- H. 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 1-1/2 inches wide (including bolts) stainless steel straps type 304 (18-8) where welds are passivated for resistance to corrosion. Exception: Ford FS202 which has two bolts and a single strap with a minimum width of 3-1/4 inches.
 3. Gaskets must be made of virgin NBR compound.
 4. Service saddles are required for all service taps.
- I. Backflow prevention devices or check valves at yokes are not to be used.

3.1.14 Water Service Assembly for 1 Inch Water Meters

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

- A. Water meter boxes shall be Carson-Brooks 2200 (18 inches depth), NDS D-2400 (18 inch Pit), or approved equal.
- B. Meter box lids shall have a 1-3/4 inches diameter hole located in its center. The hole shall either be cast in place at the foundry or after casting be retrofitted via a plasma arc torch. Holes shall be compatible with the County's touch read meter system.
- C. Water meter boxes in areas subject to vehicular traffic 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.
- D. Meter yokes shall be one inch Ford 500 Series, AY McDonald, Mueller, Cambridge Brass Series 460, or approved equal with angle valve. Expanders shall be Ford EC4 or approved equal supplied by the yoke manufacturer.
- E. Corporation stop with corporation cock thread inlet shall be as specified in the approved materials list.
- F. Pipe shall be 1-1/2 inches type "K" hard copper domestic manufactured.
- G. Tail piece on yoke shall be 1 inch or 1-1/2 inches type "K" copper or brass, approximately 18 inches long.
- H. 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 1-1/2 inches wide (including bolts) stainless steel straps type 304 (18-8) where welds are passivated for

resistance to corrosion. Exception: Ford FS202 which has two bolts and a single strap with a minimum width of 3-1/4 inches.

3. Gaskets must be made of virgin NBR compound.
 4. Service saddles are required for all service taps.
- I. Backflow prevention devices or check valves at yokes are not to be used on domestic services. Residential fire sprinkler systems require the use of dual check valve on the outlet side of the meter yoke per Detail FIR-8.

3.1.15 Water Service Setter for 1-1/2 Inches and 2 Inches Water Meters

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

- A. **General:** All 1-1/2 inches and 2 inch 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 C800), and provide horizontal female pipe threads on both front and rear connections. Setters must include a valved bypass for meter maintenance and have components rated for maximum of 300 psi working pressure. Service line should extend a minimum of 18 inches past the meter box for future connection of the building plumbing/service line.
- B. **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:
1. Mueller Co., “110” compression connection for copper pipe; or
 2. Ford Meter Box Co., “Grip Joint” connection for copper pipe; or
 3. A.Y. McDonald, “T” compression connection for copper pipe.

Otherwise, a 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.

- C. **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 inch size only), to accommodate both 1-1/2 inches and 2 inch meters. Angle or ball valves shall provide a stop or check to limit movement of tee head at 90 degrees maximum,

from fully open to completely off. Arrows cast within the inlet valve shall indicate direction of flow while in service.

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

1. 1-1/2 inches flanged meter laying length: 13 inches, plus gaskets
2. 2 inches flanged positive displacement meter laying length: 17 inches, plus gaskets
3. 2 inches flanged compound laying length: 15 inches, 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. 1-1/2 inches meter setter, maximum height of 8-1/2 inches
2. 2 inches meter setter, maximum height of 9-1/2 inches

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:

1. 1 inch nominal pipe size, 1.13 inches outside diameter, .065 inch wall
2. 1-1/2 inches nominal size pipe, 1.63 inches outside diameter, .072 inch wall
3. 2 inches nominal size pipe, 2.13 inches outside diameter, .083 inch wall

The bypass assembly shall be sized as follows:

1. 1-1/2 inches meter setter requires minimum 1 inch bypass pipe & valve
2. 2 inches meter setter requires minimum 1 inch bypass pipe & valve

E. Meter boxes and services lines from the main to the meter for 1-1/2 inches and 2 inches meters shall be as shown in the Detail MET-11B.

F. Backflow prevention devices or check valves at setters are not to be used.

3.1.16 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 screw adjustment.

3.1.17 Air Release Valves

All air release 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 a) kinetic design type employing only one moving part, a stainless steel float ball or b) of the stainless steel float and lever type. It shall maintain the 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 a moist environment.

Air release valves shall have a minimum of a 1 inch N.P.T. inlet for 6 inches, 8 inches, and 12 inches, pipe sizes and a 2 inches N.P.T. inlet for pipes 16 inches and larger; and shall have a minimum of a 3/32 inch outlet orifice for 6 inches, 8 inches, and 12 inches pipe sizes and a minimum 3/16 inch outlet orifice with 16 inches and larger pipes.

Air release valves shall be suitable for a minimum working pressure of 150 psi.

Air release valves for sewage force mains shall be specifically designed for sewage applications.

All flushing attachments shall be provided with air release valves.

- B. Type 2: Shall be a combination, dual unit valve, combining one small and one 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 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.

Air release valve size shall be 6 inches with a 3/8 inch orifice for the small unit and shall be suitable for 150 psi working pressure. Large unit shall be sized based on the specific application.

- C. Offset air release valves will be considered when appropriate and conditions allow and warrant their use. This is the installation of the air release valve remotely from the pipe location to allow ease of access when the pipe is installed in a high traffic area.

3.1.18 Valve Manholes

Valve manholes shall be concrete meeting the requirements of ASTM C478. Diameters shall be as shown on plans but in no case shall they be less than 4 feet in inside diameter except for manholes for butterfly valves which shall have a minimum inside diameter of 5 feet. Manhole frame and covers meeting the requirements for sanitary manhole frame and covers shall be utilized except that the covers shall have the word "WATER" cast on them.

3.1.19 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 joint restraint system shall be installed.

Under normal conditions, the approved method of restraint shall be concrete thrust blocking per County Standard Details for dead-ends (cul-de-sacs, etc.); and horizontal bends, reducers, tees and crosses; and a joint restraint system for vertical bends, all valves, and carrier pipe through casings. Approved joint restraint systems may be substituted for concrete thrust blocking in the applications mentioned above with the prior approval of the inspector. In certain circumstances where the conditions and applications warrant, both restraint systems and concrete thrust blocking may be required at the discretion of the inspector.

All valves should be as close to a tee as possible and restrained to that tee, using approved joint restrainers. Where the valve cannot be installed and restrained at a tee, the valve must be restrained using an approved joint restraint system.

When joint restraint systems are required due to the specific application(s), 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 joint restraint system.

Joint restraint systems require that sufficient lengths of pipe be restrained, in addition to the fittings. 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 County's contractor shall be responsible for ensuring that the engineer and those individuals on the County staff responsible for plan review prior to plan approval are contacted to evaluate and/or adjust the design appropriately.

All restraint devices must be U.L. listed and F.M. approved. Restraints are acceptable for PVC and ductile iron 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 the latest revision of ANSI A21.11 and ANSI A21.53/AWWA C153. 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 ensure 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 two 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 corrosion-resistant material as approved by the County.

Restraining devices shall be as approved by the Department of Public Utilities.

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 ensure 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 C111/A21.11 and ANSI/AWWA C153/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 ductile iron pipe. The rings shall be connected with T-head bolts or rods. Rods must be protected from corrosion either by rod material or coating.

3.1.20 Markers/Witness Posts

- A. All markers shall have one of the applicable decal description to reflect the following:
 - 1. Upper decal, white and blue 2 7/8 inches x 11 inches standard, worded "CAUTION WATER PIPELINE" or,
 - 2. Upper decal, white and blue 2-7/8 inches x 11 inches standard, worded "CAUTION WATER VALVE".
- B. In addition, the lower decal shall contain the following:
 - 1. Lower decal, white and blue 2-7/8 inches x 1-3/4 inches standard, worded "BEFORE DIGGING CALL HANOVER COUNTY PUBLIC UTILITIES (804) 365-6024".
- C. Total height shall be 60 inches with the above mentioned decal on both sides of the marker.
- D. Basic markers shall be **white in color for valves** and **blue in color for lines or fittings**. See Section 4.2.21 for approved manufacturer.

3.1.21 Flushing Hydrants

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 2 inches in size.
- C. The hydrant barrel shall be 2 inches 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 inches 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.
- F. Installation shall be in accordance with Hanover County's Flushing Hydrant detail found in these Standards.

3.1.22 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 inches.

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.

3.1.23 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 0.090 inch 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 polymer. 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 inch 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 0.75 inch from the casing pipe wall at all times.

End of Section

3.2 Sanitary Sewer Systems

3.2.1 Sewer Pipe and Fittings

- A. Polyvinyl chloride (PVC) non-pressure gravity sewer pipe (6 inches-15 inches) and fittings shall meet requirements of ASTM D3034, Type PSM, SDR-35 or ASTM F1760 SDR-35 with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipe as shown in the County's Standard Details.
- B. Polyvinyl Chloride (PVC) non-pressure gravity sewer pipe (18 inches - 48 inches) and fittings shall meet requirements of ASTM F679 PS46 classification for large diameter solid wall PVC pipe with elastomeric gasket joints meeting requirements of ASTM D3212. Bedding shall be as required by the County for plastic pipes as shown in the County's Standard Details.

Cell Classification for Sewer Pipe shall be 12454 or 12364.

- C. Ultra-Corr and Corr-21 (PVC, corrugated) non-pressure sewer pipe (24 inches - 36 inches) shall be seamless profile wall and meet the requirements of ASTM F794 and ASTM F949 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 County for plastic pipes as shown in the County's Standard Details. 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 46 psi when tested at 5 percent deflection in accordance with ASTM D2412. Pipe shall be green in color.
- D. Vylon (PVC, hollow reinforced wall) non-pressure sewer pipe (24 inches - 36 inches) shall meet requirements of ASTM F1803 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 County for plastic pipes as shown in the County's Standard Details.
- E. Ductile iron pipe shall meet requirements of AWWA C151. Pipe shall be thickness Class 52.

Mechanical joints and jointing materials shall meet requirements of ANSI AWWA C111/A21.11.

Push-on joint and rubber gasket shall meet requirements of AWWA C111.

Where exposure to high levels of hydrogen sulfide is not anticipated, pipe may have cement-mortar lining and a bituminous seal coat. Thickness classes shall meet requirement of AWWA C150. Cement mortar lining with bituminous seal

coat for ductile iron pipe and fittings shall meet requirements of ANSI/AWWA C104/A21.4. Cement mortar lining shall be standard thickness.

Where exposure to high levels of hydrogen sulfide are anticipated or the installation depth (to the invert of the pipe) exceeds 20 feet, pipe shall have corrosion-resistant interior coating such as epoxy, Griffin H₂Sewer Safe sewer pipe, Protecto 401 lining, or other coating approved by the County.

Exterior, bituminous coating for iron fittings and ductile iron pipe shall meet requirements of ANSI/AWWA C106/A21.6 or ANSI/AWWA C151/A21.51 as applicable. As an alternative, fittings may be coated with 6-8 mil (nominal thickness) fusion bond epoxy lining/coating in compliance with AWWA C116.

- F. High Density Polyethylene Pipe (HDPE) will be considered for installation for sanitary sewer force mains only. Its general use will be reviewed on a case-by-case basis for all of the applicable methods of installation, i.e. normal open trench construction or horizontal directional drilling when jack and bore casing pipe with internal carrier pipe is not practical. The design engineer shall specify the particular pipe and the rating shall meet or exceed 150 psi operating pressure.

3.2.2 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 Details.
- 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. Other sealing systems will be considered and approved in writing by DPU on a case-by-case basis.

Gaskets shall comply with requirements of ASTM C361 or C443, as applicable to the application of the structure and joint being sealed, i.e. horizontal and/or vertical.

Butyl-mastic shall comply with ASTM C990.

Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure. Additional sealing material may be used on the exterior for the joints with the approval of DPU. External sealing bands (joint wraps) shall be applied with a primer and conform to ASTM C877.

- 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 degree angular deflection of the pipe and at least 1 inch of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used.

- E. Manhole steps shall be corrosion-resistant and shall be 1/2 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 Detail MAN-14.
- 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 Details. The word "SEWER" shall be cast into the cover.
- G. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" type 430 or bitumastic material.
- 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.
- J. Coal tar coating are allowed on the exterior of manholes, but not required. Coal tar coatings are not allowed in the interior of manholes.

3.2.3 Corrosion-Resistant Manholes

In addition to the requirements above, corrosion-resistant manholes shall have a lining system meeting one of the following additional requirements:

- A. Raven 405 epoxy coating as manufactured by Raven Lining Systems, Inc. applied at a thickness of 80 to 100 mils. Coating shall be applied in accordance with all requirements of the manufacturer. All defects shall be repaired in accordance with the manufacturers' recommendations.
- B. PermaForm COR+GARD lining applied in accordance with manufacturer's recommendations.

- C. Other coating systems as specifically approved by the Department of Public Utilities.

In addition to the lining systems mentioned above, all concrete utilized in acid-resistant manhole shall have ConShield admixture added in accordance with the manufacturer's recommendations. The precast supplier shall provide written certification that ConShield was added per manufacturer's recommendation to all acid resistant manholes delivered. This certification shall be given to the inspector prior to delivery. All sections of manhole with ConShield shall be clearly marked by the supplier at the plant so that the inspector and contractor can identify those manholes with ConShield admixture. The certification provided by the supplier shall indicate the method utilized for marking manholes with ConShield admixture at the plant.

HDPE and PVC lined manholes are not acceptable.

3.2.4 Sewage Air/Vacuum Valves

All sewage air/vacuum valves shall be designed in accordance with the following standard and/or by the engineer as required:

- A. The sewage air/vacuum valve shall be designed to automatically exhaust large quantities of air during filling of a system. It shall also allow air to enter the pipe system when the line is being emptied. All this shall be accomplished through the functioning of a compound lever system in conjunction with a large and small orifice in one integral body casting.
- B. This device shall have only orifices and no mechanical leverage, other than the weight of a stainless steel float ball, unless otherwise approved.
- C. It shall automatically provide for the escape of the air to the atmosphere without the loss of water when the float ball moves away from the orifice seal.
- D. The body of the valve shall be cast iron, stainless steel, or other approved material and shall be coated with fusion bonded epoxy, Teflon, or other approved coating to withstand moist abrasion and corrosive conditions.
- E. Float with Buna-N seal shall be provided for positive seating.
- F. Rigid stainless steel valve plug shall be provided to seal off the outlet orifice.
- G. Wherever possible, valve shall have elongated bodies to minimize the problem of clogging by permitting the use of a long float stem. However, where height restrictions do not permit the use of the standard height valve, a short body valve can be applied.
- H. Sizes 1 inch through 3 inches shall have N.P.T. inlets and outlets. Larger sizes shall have flanged inlets conforming to ANSI class 125 or 250 and shall have N.P.T. outlet as standard. Flanged outlet or protective hood shall be optional. It shall have a minimum of 3/32 inch outlet orifice for an operating pressure of 0-150 psi and 1/8 inch outlet orifice for an operating pressure range of 0-300 psi.

- I. Valve shall be suitable for 300 psi working pressure at a minimum.
- J. All flushing attachments shall be provided with each valve.

3.2.5 Sewage Combination Air Release Valves

All sewage combination air release valves shall be designed in accordance with the following standard and/or by the engineer as required:

- A. Combination valve shall be designed to have the operating features of both air and vacuum valves and air release valves. It shall purge air from the system at start-up, vent small pockets of air while the system is pressurized and running, and prevent critical vacuum conditions during draining. They shall be installed at all the high points in the pipe line where air would naturally tend to rise during filling and collect during operation and/or where vacuum would tend to form when the system is drained.
- B. The device shall have only orifices and no mechanical leverage, other than the weight of a stainless steel float ball, unless otherwise approved.
- C. The body of the valve shall be cast iron, stainless steel, or other approved material and shall be coated with fusion bonded epoxy, Teflon, or approved coating to withstand moist, abrasion and corrosive conditions.
- D. Float with Buna-N seal shall be provided for positive seating.
- E. Rigid stainless steel valve plug shall be provided to seal off the outlet orifice.
- F. Wherever required, a combination of the sewer air and vacuum valve and sewer pressure air release valve shall be made with appropriate piping arrangement to accommodate the specific application.
- G. Sizes up to 3 inches shall have N.P.T. inlets and outlets. Larger sizes shall have flanged inlets conforming to ANSI class 125 or 250 and shall have N.P.T. outlet as standard. It shall have a minimum of 3/32 inch outlet orifice for an operating pressure of 0-150 psi and 1/8 inch or 1/16 inch outlet orifice for an operating pressure range of 151-300 psi.
- H. Valve shall be suitable for 300 psi working pressure.
- I. All flushing attachments shall be provided with each valve.

3.2.6 Sewage Air Release Valves

All sewage air release valves shall be designed in accordance with the following standard and/or by engineer as required:

- A. The sewage air release valve shall be designed to automatically exhaust small amounts of air accumulated at a system's high point. This shall be accomplished

while the system is in service and under pressure. They shall be installed at high points in the system where air naturally tends to collect.

- B. The device shall have only orifices and no mechanical leverage, other than the weight of a stainless steel float ball, unless otherwise approved.
- C. The body of the valve shall be cast iron, stainless steel, or other approved material with stainless steel trim and shall be coated with fusion bonded epoxy, Teflon, or approved coating to withstand moist, abrasion and corrosive conditions.
- D. Stainless steel float with Buna-N seal shall be provided for positive seating.
- E. Sizes up to 3 inches shall have NPT inlets and outlets as per ANSI B2.1. Larger sizes shall have flanged inlet conforming to ANSI B16.1 class 125 as standard. It shall have a minimum of 3/16 inch orifice for an operating pressure of 0-150 psi and 1/8 inch outlet orifice for an operating pressure range of 151-300 psi.
- F. Valve shall be suitable for a working pressure of 300 psi.

3.2.7 Sewage Plug Valves

- A. All sewage plug valves shall be of the non-lubricated, eccentric type with resilient faced plug and round ports of no less than 90 percent, or rectangular ports of no less than 80 percent, of the connecting pipe area, except valves of 24 inches or larger size shall have port areas of no less than 70 percent 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 inches and 150 psi for sizes 14 inches 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 inches and larger shall be equipped with geared actuators with a 2 inch square operating nut. Handwheel and power actuated valves shall also include a 2 inch square operating nut for emergency operation.
- D. 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.
- E. 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.

- F. Valves shall open left (counterclockwise) and shall have mechanical joint end connections or as specified by the County.
- G. 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.
- H. 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 C111 or ANSI A21.11. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets and glands).
- I. Valve bodies shall be furnished with a raised seat surface completely covered with 90 percent pure nickel to ensure 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.
- J. 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.
- K. 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.
- L. 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.

- M. Valve shaft seals shall conform to AWWA Standard C504, 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.
- N. Valve interiors and exteriors shall be coated according to AWWA Standard C550 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 - 10 mils (dft) of asphalt varnish may be substituted for the exterior coating.
- O. Valve testing shall be conducted per AWWA C504 Section 5, covering rubber seated butterfly valves. Each valve shall be performance tested per paragraph 5.2 assuring valve operation.
- P. Body seat and shell leakage testing is to be conducted on each valve as per paragraphs 5.3 and 5.4.
- Q. 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.
- R. Eccentric plug valves for wastewater service shall be as approved by the County and installed per the manufacturer's recommendation.

3.2.8 Markers/Witness Posts

- E. All markers shall have one of the applicable decal description to reflect the following:
 - 3. Upper decal, white and blue 2 7/8 inches x 11 inches standard, worded "CAUTION SEWER PIPELINE" or,
 - 4. Upper decal, white and blue 2-7/8 inches x 11 inches standard, worded "CAUTION SEWER MANHOLE".
- F. In addition, the lower decal shall contain the following:
 - 2. Lower decal, white and blue 2-7/8 inches x 1-3/4 inches standard, worded "BEFORE DIGGING CALL HANOVER COUNTY PUBLIC UTILITIES (804) 365-6024".
- G. Total height shall be 60 inches with the above mentioned decal on both sides of the marker.

- H. Basic markers shall be **green in color for all sewer lines or appurtenances**. See Section 4.2.21 for approved manufacturer.

End of Section

3.3 General

3.3.1 Tracing Wire System

A. Wire Types

1. Wire shall be #12, stranded, type THHN, thermoplastic insulated and nylon jacketed. Wire shall be color coded blue for water and green for sewer.
2. Trace-Safe by Neptco, 19 gauge conductor color coded blue for water (RT1802W) and green for sewer (RT1803W). This wire is highly recommended for horizontal directional drilling applications due to its strength and the contractor is encouraged to utilize it versus Item #1 above.

B. Acceptable Wire Connectors:

1. Set screw pressure type for use with #12 stranded wire size. Holub Industries MA-2, Ideal Industries Model 30-222, or equal.
2. C-Tap for two way splicing of tracer wire, for use with #12 stranded wire size. T&B #54705 or equal.
3. Split bolts, three wire type for splicing of tracer wire, for use with #12 stranded wire size. ILSCO Catalog #SEL-2S or equal.

C. Test Station Box – Test station boxes shall be a minimum of 18 inches tall with cast iron lid and collar and plastic body tube with flared bottom to prevent settling and pull-out. Cast iron collar shall be a minimum of 2 inches deep. Lid shall be bolted to collar with brass bolt. Lid shall be imprinted with the wording “TEST”. Test Station Box shall be Bingham & Taylor Figure Number P-200 Test, 2-1/2 inches in size.

D. Electric Tape - vinyl electric tape.

E. Electrical Coating – Scotchkote 3M electrical coating Part No. 054007 or equal.

F. Wire nut - non-conductive for #12 stranded wire size.

3.3.2 Marking Tape

- A. Tape shall be polyethylene tape with a metallic core, 2 inches in width, with appropriate continuous printed message. Tape shall be Catalog No. 2 WAT as manufactured by the Seton Name Plate Corp. or approved equal.

3.3.3 Markers/Witness Post

All markers and witness post shall be dual sided, 60 inch fiberglass composite and installed per Sections 2.3.3.4, 2.4.3.1.B.5.j, and 2.4.3.1.C.6. Materials and dimensions shall conform to the requirements of Sections 3.1.20, 3.2.8, and 4.2.21.

End of Section

4. APPROVED MATERIALS AND MANUFACTURERS

4.1 Introduction

This document represents a listing of specific manufacturers whose products have been approved for use within Hanover County's water and sanitary sewer systems.

This listing is intended to be used as a reference source for County employees, contractors and vendors. Materials produced by manufacturers not listed herein are not acceptable for use within the County's systems. Manufacturers interested in submitting products for evaluation and possible approval should communicate their interest to the Hanover County Department of Public Utilities, County of Hanover, P.O. Box 470, Hanover, Virginia 23069.

Hanover County reserves the right to perform a comprehensive plant and product evaluation and testing at the sole option of the County. The County also reserves the right to limit the number of approved manufacturers and products as it deems necessary to control parts inventory and maintenance/training requirements.

Revisions to this publication will be made periodically. Users should inquire with the County as to availability. Any errors or omissions should be reported to the County immediately.

End of Section

4.2 Materials for Water System

All materials used must meet AWWA and/or ASTM Standards and the requirements of the Hanover County Water and Sanitary Sewer Standards, latest revision.

4.2.1 Pipe

- A. **PVC C900.** (DR-18, CL. 150) (sizes up to 12 inches). If Class 150 pipe is not appropriate for the specific installation, appropriate ductile iron pipe shall be used.
- B. **Ductile Iron.** Ductile iron pipe shall meet the requirements of AWWA C151 and AWWA C150. 3 inches through 12 inches pipe shall be a minimum thickness of Class 52. 16 inches and larger pipe shall be a minimum thickness of Class 51. Pipe shall have cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA Standard C104. A minimum of 5 percent of the pipe furnished shall be gauged for roundness full length and so marked. Class of pipe shall be increased if the specific installation warrants it. All pipe located within a casing pipe to be thickness Class 52 unless otherwise specified. Push-on and mechanical joint types are allowed in all sizes.
- C. **Restrained Joint Pipe Ductile Iron.** Shall meet the requirements of Section 4.2.1.B above.
 - 1. U.S. Pipe TR-Flex (4 inches - 36 inches)
 - 2. Griffin Snap-Lok (4 inches - 36 inches)
- D. **High Density Polyethylene Pipe (HDPE).** Will be considered for installation for transmission lines only with no branches or taps allowed. Its general installation will be reviewed on a case-by-case basis when normal open trench construction and/or jack and bore casing pipe with internal carrier pipe is not practical. The design engineer shall specify the particular pipe and the rating shall meet or exceed 150 psi operating pressure. These installations will generally be by directional drilling.

4.2.2 Valves

- A. Resilient Seated Gate Valves (for main sizes 2 inches-12 inches only):
 - 1. American Flow Control - Series 2500, Gate Valve with Non-Rising Stem (NRS).
 - 2. Clow R/W Valve.
 - 3. M&H – AWWA C509 - Model 4067-NRS; Model 4068 OS&Y
AWWA C515 - Model 7571-NRS
 - 4. Kennedy - AWWA C509 - Model 8571-NRS
AWWA C515 - Model 7571-NRS

5. Mueller A-2360 (Resilient Wedge).
- B. Butterfly Valves (For main lines 16 inches and larger):
1. DeZurik Baw AWWA.
 2. Pratt Groundhog Class 150B.
 3. Pratt Triton HP-250.
 4. M&H Style 4500 (for 16 inches-24 inches) and Style 1450 (for 30 inches-54 inches).
 5. Val-Matic.

4.2.3 Fire Hydrants

- A. Mueller Super Centurion 250 (5-1/4 inches main valve)
- B. Kennedy Figure K-81D (5-1/4 inches main valve)
- C. U.S. Pipe - Metropolitan M-94 (5-1/4 inches main valve)
- D. American Darling - Mark B-84-B-5 (5-1/4 inches main valve)
- E. Clow Medallion (5-1/4 inches main valve)

4.2.4 Meter Setters or Yokes

- A. For 5/8 inch Meter Yokes:
 1. Ford 500 Series.
 2. Mueller (with compression connections for inlet and outlet pipe).
 3. A.Y. McDonald (with compression connections for inlet and outlet pipe).
 4. Cambridge Brass Series 460 (with compression connections for inlet and outlet pipe).

Note: County requires manufacturer to supply these connections “completely factory assembled” and tightened to proper torque.

- B. For 1 inch Meter Yokes:
 1. Ford 500 Series (with compression connections for inlet and outlet pipe).
 2. Mueller (with compression connections for inlet and outlet pipe).
 3. A. Y. McDonald (with compression connections for inlet and outlet pipe).

4. Cambridge Brass Series 460 (with compression connections for inlet and outlet pipe).

Note: County requires manufacturer to supply these connections “completely factory assembled” and tightened to proper torque.

C. For 1-1/2 inches and 2 inch Meter Setters (all with lockable bypass):

- *1. Ford - for 1-1/2 inches Meter – Series VBB76 and for 2 inches Meter – Series VBB77 (must specify with lockable by-pass)
- *2. Mueller (for both) - H-1423 (by-pass)
- *3. A.Y. McDonald - Model Series 20B
- *4. Cambridge Brass – Model Series 6020 (specify with lockable by-pass)

*These products are acceptable provided manufacturer makes the necessary modifications to comply with the County’s materials specifications for 1-1/2 inches and 2 inch water meter setters.

4.2.5 Corporation Stops

Ball type only. All rated for up to 300 psi working pressure.

3/4 inch through 2 inches with “cc” thread inlet:

A. Mueller:

1. H-15000.
2. H-15008 (3/4 inch and 1 inch corp stop with compression outlet for copper) or
H-15071 (3/4 inch and 1 inch connector only to convert a normal H-15000 corp stop to compression, to avoid using special tapping machine adapters).

B. Ford:

1. F-1000-3G (3/4 inch corp stop with compression connection for copper) or
C04-33G (3/4 inch connector only to convert a normal F-600-3 corp stop to compression, to avoid using special tapping machine adapters).
2. F-1000-4G (1 inch corp stop with compression connection for copper) or
C04-44G (1 inch connector only to convert a normal F-600-4 corp stop to compression, to avoid using special tapping machine).

- C. McDonald:
 - 1. 4701 Series with ball corporation and compression connection for copper service line.
- D. Ford FB-1000G (Ball valve with compression outlet only for 1-1/2 inches & 2 inches).
- E. Cambridge Brass Model Series 301.

4.2.6 Compression Fittings

- A. Mueller 110
- B. McDonald T-Compression
- C. Ford Grip Joint
- D. Cambridge Brass CB
- A. Cambridge Brass 1 inch 202-C4C4

4.2.7 Curb Stops

3/4 inch and 1 inch copper compression, full port, ball or plug type curb stop rated for up to 300 psi working pressure.

		<u>Compression Ball Type</u>
A.	Ford 3/4 inch	B44-333G
B.	Ford 1 inch	B44-444G
C.	Mueller 3/4 inch & 1 inch	B-25209
D.	McDonald 3/4 inch & 1 inch	6100-T
E.	Cambridge Brass 3/4 inch	202H3H3
F.	Cambridge Brass 1 inch	202-H4H4

4.2.8 Curb Stops

1-1/2 inches and 2 inches pipe threaded or compression, full port, ball type curb stop rated for up to 300 psi working pressure.

		<u>Compression Ball Type</u>	<u>Pipe Threaded Ball Type</u>
A.	Ford 1-1/2 inches	B44-666G	B11-666

B.	Ford 2 inches	B44-777G	B11-777
C.	Mueller 1-1/2 inches & 2 inches	B-25209	B-20283
D.	McDonald 1-1/2 inches & 2 inches	6100-T	6101
E.	Cambridge Brass 1-1/2 inches	202-H6H6	202-F6F6
F.	Cambridge Brass 2 inches	202-H7H7	202-F7F7

4.2.9 Vaults, Precast Concrete

Requirements and configurations as shown on plans or in the applicable DPU Standard Details. (For other approved vaults, see “Water Meter Boxes” under Section 4.2.18).

- A. Americast
- B. Bartow
- C. Elite Fire Protections, Inc.
- D. Tindall Vaults
- E. Clear Flow Company
- F. Hanover Precast
- G. Hanson Pipe & Precast

4.2.10 Tapping Sleeve

- A. Fabricated Steel Sleeves with Epoxy Coating and Stainless Steel Bolts and Nuts:
 1. Smith-Blair (Rockwell Product) #622 (4 inches – 30 inches).
 2. JCM Industries #412 ESS (4 inches – 48 inches).
 3. ROMAC # FTS 420 SS (4 inches – 30 inches).
 4. Ford FTSC (4 inches - 30 inches) w/SS bolts.
- B. Stainless Steel Sleeves:
 1. Power Seal - Model 3480 and 3490 (6 inches-24 inches).
 2. ROMAC SST and SST III (6 inches-24 inches).
 3. Ford FAST (4 inches-24 inches).
 4. Cascade - Model CST-EX, Model CST-SL.

5. JCM Model 432.
 6. Mueller H304.
 7. Mueller H300 (not to be used on AC or CI pipe).
 8. Dresser Style 630.
 9. Smith-Blair.
- C. M.J. Steel Sleeve:
1. JCM 414 Mechanical Joint.
 2. Smith-Blair Model 623.
- D. M.J. Cast/Ductile Iron Sleeve:
1. Mueller (H-615 for 4 inches-24 inches on Ductile Pipe and H-619 for 4 inches-12 inches AC Pipe).
 2. Clow (F-5205).
 3. American Flow Control - (Model 2800-A for A/C pipe; Model 2800-C for 4 inches-12 inches D.I. and PVC pipes; Model 1004 for PVC pipe and 16 inches and larger ductile iron pipe).
 4. U.S. Pipe D.I. T-9 MJ Sleeve.

4.2.11 RSW Tapping Valves (RSW - resilient seat wedge)

- A. Clow F6114 (16 inches and 20 inches).
Kennedy Model AWWA C509 - Model 8950 (4 inches – 12 inches)
AWWA C515 - Model 7950 (4 inches – 12 inches)
- B. American Flow Series 2500-1 (4 inches – 12 inches) & Series 2500 (16 inches – 24 inches).
- C. Mueller T-2360 (6 inches – 12 inches).

4.2.12 Fittings

Bends, crosses, tees and grade lock offset glands- ductile iron only.

- A. Ductile iron compact AWWA C153
- B. Ductile or cast iron fittings AWWA C110.

4.2.17 Water Meter Boxes

Meter box lids for all meter sizes shall be cast iron unless otherwise noted on the details or specifications and have a 1-3/4 inches diameter hole located in its center. The hole shall either be cast in place, at the foundry or, after casting, be retrofitted via a plasma arc torch.

- A. Precast Concrete Box:
1. Clear Flow Model CFLD6060 (for 3 inch and 4 inch water meters and assemblies).
 2. M&B – Model #MB1500BF/WM (for 3 inch and 4 inch water meters and assemblies).
 3. Bartow Precast Vaults (for 3 inch and larger water meters and assemblies).
- B. Round Hi-Density Polyethylene Plastic Box (for 5/8 inch and 1 inch water meters and assemblies only in areas not subject to vehicular traffic):
1. Carson Industries 2200 (18 inches depth) NDS, Inc. D-2400 (18 inches Pit), or approved equal. Meter box lids shall have a 1-3/4 inch diameter hole located in its center. The hole shall either be cast in place at the foundry or after casting be retrofitted via a plasma arc torch.
- C. 17” wide by 30” long (approximate dimensions) rectangular polymer concrete or composite material boxes for 1-1/2 inch and 2 inch water meters and assemblies only in areas not subject to vehicular traffic. All boxes are to:
- Be a minimum of “medium duty” with a Tier 8 loading rating (8,000 lb. design load) suitable for incidental, non-deliberate traffic loading.
- Lids shall be a minimum Tier 5 load rating (5,000 lb design load) and pre-drilled with a 1 3/4” diameter hole, or capable of being drilled in the field, to accept the touch read pad and have a separate hinged cast-iron flip reader (minimum 5” x 7” opening) centered in the lid.
- Lids and boxes shall bolt together with two stainless steel hex head bolts in opposite corners.
- Boxes shall have factory installed mouse holes, or capable of being modified in the field, to accept the water service line entry and exit in the sidewall of the box. Residual space between the service line and hole shall be sealed as directed by the DPU inspector.
- Box may have a precast bottom or be open. Open boxes shall have a brick base as shown in Detail MET-6, MET-7, or MET-12. All boxes shall be placed on a 4” bed of #57 stone. Boxes with bottoms cast into them shall have drainage holes installed as directed by the DPU inspector.

1. Carson Industries Fiberlyte, H1730, or Synertech (24 inches depth).
 2. Hubbell CDR
 3. Approved equal (shop drawing submission and written approval required for approved equal).
- D. Cast Iron Box (for 5/8 inch and 1 inch water meters and assemblies in areas subject to vehicular traffic):
1. Capitol Foundry Design # MBX-10 and MBX-11. Meter box lids shall have a 1-3/4 inch diameter hole located in its center. The hole shall either be cast in place at the foundry or after casting be retrofitted via a plasma arc torch.

4.2.18 Valve Boxes

(Screw Type Only):

- A. SIGMA
- B. Bingham and Taylor
- C. Capitol Foundry
- D. Star Pipe

4.2.19 Service Saddles

- A. ROMAC - Style 202NS with Stainless Steel Strap (nylon coating)
- B. Smith-Blair (Rockwell) SB 317 - (with Double Stainless Steel Straps)
- C. Ford FC 202 Series, with cc Threads
- D. PowerSeal Model No. 3417 (with double straps)
- E. Cascade - Styles CNS2 (for 12 inches and smaller pipe) and CDSL D (large diameter saddles for 16 inches and larger pipe)
- F. Mueller – Model DRS2 (with double straps for 2 inches - 12 inches)

4.2.20 Pipe Restraints

(must be UL Listed and FM Approved):

- A. For PVC Pipe (Sizes up to 12 inches):
 1. Megalug Series 2000 PV (PVC Pipe - MJ Fittings).
 2. Megalug Series 1500 (PVC Bell and Spigot Joints).

3. Romac Style 611 (PVC Bell and Spigot Joints).
 4. Uni-Flange Series 1390-C (PVC Bell and Spigot Joints) and 1500 PVC pipe – MJ fittings).
 5. Stargrip – Series 4000
 6. Smith-Blair – Cam-Lock.
 7. Tyler Union – TUF-Grip.
- B. For Ductile Iron Pipe:
1. Megalug 1100 Series (MJ Fittings) All Sizes.
 2. Uni-Flange Series 1400 Block Buster Wedge Action Retainer Glands (MJ Fittings) Sizes 4 inches - 24 inches.
 3. Uni-Flange Series 1390-C (Bell and Spigot Joints) Sizes 6 inches - 16 inches.
 4. Stargrip Series 3000 (MJ Fittings) Sizes 4 inches - 24 inches.
 5. Smith-Blair – Cam-Lock.
 6. Tyler Union – TUF-Grip.

4.2.21 Markers

- A. For All Types of Pipes
1. Carsonite Two Sided Fiberglass Composite Utility Marker Post with two factory applied decals (#CIB306201 (white), #CIB306208 (blue) or #CIB306207 (green), whichever is applicable; and Stock #P-101 decal).
 2. Approved equal (shop drawing submission and written approval required for approved equal).

4.2.22 Flushing Hydrants

- A. The Kupferle Foundry Company MainGuard Number 78 Blow off Hydrant with straight neck. (Reference Detail WAT – 3)

4.2.23 Double Check and Double Detector Check Devices

Must be U.L. listed or F.M. approved, AWWA compliant, and meet the requirements of the American Society of Sanitary Engineering and the latest applicable Building/Plumbing Code for backflow prevention devices.

4.2.24 Reduced-Pressure Principle Devices

Must be U.L. listed or F.M. approved, AWWA compliant, and meet the requirements of the

American Society of Sanitary Engineering and the latest applicable Building/Plumbing Code for backflow prevention devices.

4.2.25 Casing Spacers

- A. Cascade
- B. Advance Model SSI
- C. PSI Model No. C8G-2, Model No. C12G-2
- D. Power Seal Model No. 4810
- E. CCI Model CSS

4.2.26 Water Quality Sample Station

- A. The Kupferle Foundry Company Eclipse Model #Z88-7B1.51 Sampling Station Hydrant with removable steel enclosure. See Detail WAT-11 for installation information

End of Section

4.3 Materials for Sanitary Sewer System

4.3.1 Pipes

- A. PVC Sanitary Sewer Pipe SDR35 (ASTM D3034, 6 inches - 15 inches)
- B. PVC Sanitary Sewer Pipe PS46 (ASTM F679, 18 inches - 36 inches)
- C. Ultra-Corr (manufactured by JM Eagle) or Corr-21 (manufactured by Diamond Plastics) (ASTM F949 and F794, 24 inches - 36 inches)
- D. Prime Conduits Vylon (PVC, hollow reinforced wall) non-pressure sewer pipe (21 inches - 48 inches)
- E. Ductile Iron Pipe Class 52 Minimum or higher classification depending upon design considerations. (Push-On and Mechanical Joint, all sizes). Pipe to have an appropriate interior coating for specific application environment.
- F. High Density Polyethylene Pipe (HDPE) will be considered for installation for sanitary sewer force mains only. Its general use will be reviewed on a case-by-case basis for all of the applicable methods of installation, i.e. normal open trench construction or horizontal directional drilling when jack and bore casing pipe with internal carrier pipe is not practical. The design engineer shall specify the particular pipe and the rating shall meet or exceed 150 psi operating pressure.

4.3.2 Manholes, Precast Concrete (ASTM C478)

- A. Hanson Pipe & Precast
- B. Tindall Concrete Products
- C. Americast

4.3.3 Frames and Covers

- A. Manhole:
 - 1. Street Type (per Detail MAN-11):
 - a) Neenah Foundry
 - b) Capitol Foundry (MH-1-S)
 - c) Sigma Corporation
 - d) East Jordan Iron Works
 - 2. Watertight (per Detail MAN-12):
 - a) Capitol Foundry MH 1-S/WT

- b) East Jordan Iron Works
- 3. Vandal-Proof (per Detail MAN-18):
 - a) Capitol Foundry
 - b) East Jordan Iron Works

4.3.4 Fittings (Gasketed)

- A. Concrete:
 - 1. Circular Reinforced (ASTM C76):
 - a) Hanson Pipe & Precast
 - 2. Kor-N-Tee
 - 3. Inserta Tee
- B. PVC Sanitary Sewer Fittings (ASTM D3034, SDR35 6 inches - 15 inches; ASTM F679, PS-46 18 inches – 36 inches):
 - 1. J-M Eagle
 - 2. The Harrington Corporation (HARCO)
 - 3. GPK Products, Inc.
 - 4. Multi-Fittings.
 - 5. Plastic Trends, Inc.
 - 6. Nyloplast USA, Inc.

4.3.5 Adapters

- A. Fernco Pipe Adapters - (Used only when installing 6 inch connections where 6 inch connection is of Ductile Iron material)
- B. GPK Manhole Adapters (See Detail MAN-16):
 - 1. GPK manhole adapter adapting PVC pipe to concrete with Quikrete for manholes with bricked up openings.
 - 2. GPK PVC drop manhole cross with manhole adapters (6 inches and 8 inches only) strapped to manhole.

4.3.6 Gaskets and Flexible Manhole Connectors

- A. Kor-n-seal Connector, NPC Systems, Inc.

- B. O-Ring Gasket
- C. Flat Gasket for Watertight Manholes
- D. Press-Boot Connector, Press-Seal Gasket Corp.
- E. Profile RS Gasket or Type 4G Gasket, Press-Seal Gasket Corp.

4.3.7 Saddles

- A. The General Engineering Company (GENECO) Sealtite Model H with Bell End for SDR-35 PVC
- B. ROMAC CB Sewer Saddle
- C. Inserta-Tee

4.3.8 Steps, Manhole and Vault

- A. MA Industries, Inc. Style No. PS1-PF
- B. Bowco Industries, Inc.:
 - 1. Model #93810 (48 inches and 54 inches Dia. M.H.'s).
 - 2. Model #93813 (60 inches Dia. M.H.'s and Larger).
- C. Press Seal:
 - 1. Model #P-10938 (48 inches and 54 inches Dia. M.H.'s).
 - 2. Model #P-14850 (60 inches Dia. M.H.'s and Larger).
- D. Cosmos North America Model #US-10-OH
- E. American Step Company Model #ML-10

4.3.9 Stoppers (Plugs)

- A. For PVC Sanitary Sewer Pipe (with wing nuts and ears):
 - 1. Certain-Teed Products Corporation
 - 2. Cherne
- B. For D.I. Pipe (Slip Joint Plug):
 - 1. Griffin Pipe Products
 - 2. Tyler
 - 3. Union Foundry

4. American Cast Iron
5. U. S. Pipe and Foundry.

4.3.10 Valves

- A. Sewage Air/Vacuum Release Valves:
 1. Crispin "Silverline"
 2. APCO (400 Series only)
 3. ARI
- B. Sewage Combination Air Valves:
 1. Crispin
 2. APCO (400 Series only)
 3. ARI
- C. Plug Valves:
 1. DeZurik Model PEC or PEF
 2. Val-Matic Series 5900 or 5800 Cam-Centric
 3. Milliken - Millcentric (Eccentric Plug Valve)
 4. Clow Eccentric Plug Valve (3 inches - 24 inches)

4.3.11 Manhole Adjusting Rings

- A. Concrete Reinforced

4.3.12 Casing Spacers

- A. Same as for water pipe. See Section 4.2.26.

4.3.13 Backwater Valves for Manhole Vents

- A. Wager 1700
- B. Josam 67100

End of Section

5. DEVELOPERS CHECKLIST FOR UTILITY PROJECTS

The following steps must be completed before the County will permit the Utilities contractor to start construction:

- ___ 1. For subdivisions, all off-site easements and on-site easements not to be recorded on the subdivision plat must be dedicated to the County prior to plan approval. In addition, the recordation information for these easements must be noted on the construction drawings prior to plan approval.

For site plans, all off-site easements must be dedicated to the County prior to plan approval. In addition, the recordation information for these easements must be noted on the plans prior to plan approval. On-site utility easements may be recorded before or after the site plan is approved however, before a full building permit can be issued for the project, all on-site easements must be recorded and the recordation information added to the approved plans in both the Planning Department and the Department of Public Utilities.
- ___ 2. The Department of Public Utilities has reviewed and approved the plan.
- ___ 3. The project plan has been approved by all appropriate agencies (i.e. Public Works; Virginia Department of Transportation; Virginia Department of Health and Department of Environmental Quality, Planning).
- ___ 4. The developer has entered into an Utility Service Agreement (USA) with the County. If the standard form of the USA is utilized, approval of the USA can be completed administratively. Allow one week for this to occur from the time that the USA has been submitted to the Department of Public Utilities in a form acceptable to the County. If a non-standard form of the USA is desired, the Board of Supervisors must approve the USA. At least one to two months should be allowed for processing a non-standard USA as the County Attorney's office must approve the non-standard USA prior to it being submitted to the Board of Supervisors for approval. An Utilities Agreement can be completed once the plans are close to being ready for approval. Typically it is appropriate to submit the agreement shortly after revised plans have been submitted for review and approval. Contact the Department of Public Utilities' Utility Agents to obtain a copy of the County's current standard Utilities Agreement.
- ___ 5. All review and inspection fees have been paid. All bonds have been posted.
- ___ 6. Erosion control measures have been installed and approved by the County Department of Public Works.
- ___ 7. A pre-construction conference between the contractor and the Department of Public Utilities has occurred. This meeting must be requested at least 48 hours prior to it occurring. The construction permit will be given to the contractor at this meeting.

6. ENGINEERS CHECKLIST FOR WATER AND SEWER PLANS

6.1 Title Page

- _____ A. Project Name
- _____ B. Engineer's or Class B Surveyor's Seal and Original Signature
- _____ C. Vicinity Sketch (complete in detail)
- _____ D. Title Block
- _____ E. GPIN Number and/or Tax Map and Parcel Number
- _____ F. Magisterial District
- _____ G. Name, Address, and Phone Number of developer/owner
- _____ H. Legend of sanitary sewer and water mains, other utilities and structures existing and proposed ground and pavement profile.

6.2 General

- A. For phased development, include an overall utility plan of the water and sewer layout. A separate Utility Master Plan may be submitted to meet this requirement for large developments.
- _____ B. Engineer and/or Surveyor has notified all property owners prior to performing any off-site design and/or surveying work.
- _____ C. Table of Estimated Quantities (including breakdown of type of pipe).
- _____ D. All sheets in set bear an appropriate signed and dated seal.
- _____ E. Water and Sewer Notes (DES- 2 & 3) included on the plan set.
- _____ F. Vertical scale is 1 inch = 5 feet or 1 inch = 10 feet; and horizontal scale is no greater than 1 inches = 50 feet, unless otherwise approved by the Department of Public Utilities. A "bar" scale is shown on each sheet.
- _____ G. All water and sewer designs conform to the latest County, State and Federal regulations or standards.
- _____ H. Plan and Profile sheets are on 24 inches x 36 inches paper unless otherwise approved by the County.
- _____ I. Survey and drawings were performed and prepared utilizing NAD 83 and NGVD 29.

6.3 Plans

A. Utility Plans:

- _____ 1. All water, sewer, road, and drainage structures are shown on one plan sheet.
- _____ 2. All plans include:
 - _____ a. Existing water and/or sewer lines are properly labeled with size and with horizontal and vertical distances referenced on the plan.
 - _____ b. At least two vertical bench marks are shown on the plan.
 - _____ c. Horizontal and vertical scale shown on each sheet (scale should be same on plan and profile).
 - _____ d. All existing easements are shown accurately including the recordation information where they were granted to the County and proposed utility easements are shown on plans. The existing easements reflect accurate recordation information.
 - _____ e. All existing and proposed storm sewer lines, gas, telephone, power, and other utility lines, which cross or run parallel to the sewer or water mains, are shown with horizontal and vertical separations given, where applicable.
 - _____ f. Adjacent road and drainage projects are shown as required.
 - _____ g. Consideration has been given to areas where roads and drainage structures may be lowered in the future.
 - _____ h. Road names, State route numbers, and right-of-way widths are shown.
 - _____ i. Plan and profile are drawn in the same direction. Stations shall ascend from left to right.
 - _____ j. Proposed water and/or sewer lines are shown with reference distances from right-of-way, boundary, buildings, other utility lines, etc.
 - _____ k. All property lines and property markers (stones, rods, pins, pipes, monuments, etc.) are shown.
 - _____ l. Location of existing houses, buildings, fences, wells and other structures are shown on plans. In lawn or kept areas, trees

and shrubs in the easements are shown (size and type).

- _____m. All designs conform to the latest County and State erosion control and sedimentation rules, regulations, and ordinances. An erosion control and sedimentation plan must be approved by the County Department of Public Works.
- _____n. The engineer understands that he/she is responsible for coordinating the utility design and construction work with other engineers where their projects connect or are affected by other projects.
- _____o. Locations of special features (conc. encasement, rip-rap stabilization at creek crossings, clay dams, etc.) are shown on the plans. Details have been provided as appropriate or reference is made to Standard Details.
- _____p. Detail drawings of all stream crossings and storm sewer outlets, with elevations of the streambed and high (100-year flood elevation) and normal water elevations.
- _____q. Proper labeling of subdivision (lot, block, street names, subdivision boundaries, etc.).
- _____r. Adjacent property owner name(s) are shown on plans.
- _____s. All fill and cut areas are shown within the area of existing and proposed sewer and/or water mains.
- _____t. Necessary easement plats have been recorded. Deed Book and Page numbers where easements are recorded is shown for each easement as appropriate.
- _____u. Pavement replacement detail, boring detail, etc. are shown on all plans or reference is made to Standard Details.
- _____v. Location and dimensions of all water and sewer service connections are shown.
- _____w. Proposed, and original ground elevations are shown on profiles.
- _____x. Municipal, subdivision and/or drainage area boundaries are shown.
- _____y. North Arrow is reflected on all plan sheets.

- _____ z. Miss Utility notation is shown.
 - _____ aa. Engineer understands that any changes made to the road, drainage, water and/or sewer design will require a submittal to the Department of Public Utilities for review and approval of the revised water and sewer plans reflecting those changes.
 - _____ bb. All revisions include an explanation either on the plans or by separate transmittal.
 - _____ cc. Plans have been submitted to State Health Department and/or the Department of Environmental Quality for review and approval where applicable. A copy of transmittal letter is attached to plans when they are submitted for approval.
 - _____ dd. If horizontal bore is required, bore location, length of bore, casing size and thickness, pit location (average 10 feet x 40 feet) are shown and shown in relation to all existing and/or proposed utilities on plan and profile.
 - _____ ee. Clay dams or other acceptable designs are shown at the appropriate locations to avoid water from creek and/or lake being diverted along pipe bedding.
 - _____ ff. Utility plans reflect those conditions as approved by the Planning Commission/Board of Supervisors.
- _____ 3. Sanitary Sewer Plans:
- _____ a. All sanitary sewer plans are labeled with size, grade, length, and type & class of pipes (with backup calculations on the type & class pipe needed, where applicable).
 - _____ b. Manholes are labeled with top and invert elevations, and locations, size and inverts of drop stacks when a vertical drop exceeds 2 feet.
 - _____ c. Deflection angles at all manholes and bearings of all lines are shown on the plans.
 - _____ d. Minimum finished floor elevations and basement elevations are to be shown on plans, where applicable. If gravity sewer service cannot be provided to a lot it should be noted on the plans.
 - _____ e. A sewerage drainage area map with hydraulic analysis is included in plans.

- _____ f. The engineer has field verified the inverts of existing manhole(s).
- _____ g. 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 Utilities Department.
- _____ j. Ground coverage over sewer pipe meets minimum criteria.
- _____ k. 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.
- _____ h. 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.
- _____ i. All pipe between manholes are of like material and class.
- _____ j. All temporary and/or permanent silt basins or BMP facilities are shown and the sewer lines and manholes have been designed around these structures.
- _____ k. All existing sewer laterals are shown on the plans, with station, length and depth, as depicted on the as-built plans.
- _____ l. All sewer lines are designed with the entry into the manhole by the proposed sewer lines at an angle of 90 degrees or greater to the downstream line, unless an exception is given.
- _____ m. Whenever connecting a sewer lateral to an existing sewer line, engineer has put on the plans the proper notation that “the contractor must use a mechanical hole cutter when tapping the existing sewer line and that an approved saddle, Kor-n-Tee, or Inserta-Tee shall be used” and the appropriate lots affected by this have been identified in the note.
- _____ n. 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.
- _____ o. Where future extensions are necessary, these lines are reflected on the plan.

_____p. Monitoring manholes are required for new facilities currently regulated by local or federal industrial waste pretreatment laws. Examples of these commercial facilities include restaurants, carwashes, auto repair shops, and laundromats. A private monitoring manhole shall be provided to facilitate random sampling.

_____4. Water Plans

_____a. Plans show all fittings, fire hydrants, and valves including sizes. Each appurtenance is properly labeled in plan view and profile.

_____b. All conflicts with storm sewers and other utility lines are shown with appropriate design changes shown.

_____c. A minimum 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 Utilities Department.

_____d. All water mains have a minimum of 3.5 feet of cover.

_____e. Fire hydrants and air relief valves are shown on plans and profile.

_____f. 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.

_____g. Flushing hydrants or fire hydrants are designed at the end of all lines. Fire hydrants are strongly preferred where appropriate and feasible.

_____h. All water services are shown.

_____i. Plans show all connections to the existing mains, etc.

_____j. Engineer has designed water system in accordance with available pressures and has provided fire flow and pressure calculations.

_____k. Pipe sizes noted on plans.

_____l. Ditch lines are shown on the plan and depth of ditch(s) are shown on the profile at the fire hydrant locations and service lines, where necessary.

- _____m. Water main stubs for future extensions are designed to be installed beyond the edge of pavement.
- _____n. Location of water meter boxes are shown outside of 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 for 5/8" and 1" meters. Larger meters will require special box design capable of withstanding vehicle loads.
- _____o. For water main tie-ins, the engineer has shown the valve to be used for cut off during the tie-in. Where tapping the main line versus cutting in a tee is applicable, the engineer has evaluated which method will be used as outlined in the County's Design Standards.
- _____p. 2 inch Domestic Meters are specified as compound and Detail MET-12 is shown on the plan.
- _____q. Sequence of Construction, Testing, and Flushing of New Waterlines Notes are on the plan.
- _____r. Backflow prevention devices, including size, type and location are included on the plan.
- _____s. Water Meter Sizing Form is included in the plan set (commercial).
- _____t. Water services for commercial development are one standard size larger than the proposed water meter.
- _____u. Adequate fire protection is met, i.e. hose lay and amount of fire hydrants.

7. SITE PLAN REQUIREMENTS

(For plans that involve utility connections only). See Checklist of Water and Sewer Plans for site plans also requiring utility extensions.

7.1 General Requirements

1. The location and size of the existing sewer line and water mains must be shown on the site plan. The top and invert elevation of all existing manholes must be given.
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. Also show a clean-out on the sewer service at the property line or easement line as appropriate.
3. Existing and proposed utility easements must be shown on the site plan. Recordation information for all existing and off-site easements must be noted on the plans. On-site easement recordation information must be added to the plans at the Department of Public Utilities and the Planning Department prior to a full building permit being issued. The 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 be shown.
5. When the site plan reflects the installation of a new sewer connection, the appropriate notes outlining the Utilities Department'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.
7. Adjustment of water and sewer appurtenances will require notes. Examples might include notifying the Inspection Section 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 feet wide utility easement) easement width for future water and/or sewer extensions.
9. Where additional road right-of-way and/or widening is proposed, the site plan needs to reflect the extension of the existing sewer (lateral) connection and/or existing water service and meter box just inside the new R/W line or utility easement, as appropriate.
10. A water meter sizing form must be included on the plan set for commercial, industrial and multi-family residential properties connecting to public water where existing and/or new services are proposed.

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 County to either replace the existing meter with a smaller meter or remove the meter at developer's expense. The meter may also remain at the option of the County.
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. The developer should be aware that additional water and sewer capacity fees may be required if additional fixtures are added to and existing facility.
13. Engineer shall provide all calculations necessary to show that both fire and domestic demands being placed on the site can be met.
14. If an underground fire line is proposed, engineer must show the proposed water main tie-in and the proposed location of the double detector check valve assembly. The double detector check valve assembly is to be owned and maintained by the owner and shall not be in a utility easement unless otherwise approved by the Hanover Department of Public Utilities. If a sump pump is to be provided for the double detector check vault to provide drainage, the plans shall schematically show electric power being provided to the vault.
15. Required Standard Utility Notes are included on plans.
16. If sealed by an engineer or surveyor, all seals should be signed and dated by the engineer or surveyor with original signature on the cover sheet.

End of Section

7.2 Site Plan Checklist

PROJECT: _____

GPIN NUMBER: _____ Date: _____

UTILITIES

1. _____ The site plan shows the existing water and sewer lines and how this project will connect to the public water and sewer systems.
2. _____ Industrial and Strong Waste Form has been submitted.
3. _____ The plan needs to show the as-built location and information of the existing six inch sewer connection if one exists or a proposed six inch sewer connection if one does not exist.
4. _____ The site plan designates that a utilities contractor will install the six inch connection to the edge of the VDOT right-of-way or sewer easement and show the plumber starting his work from that point.
5. _____ A water meter sizing form is prepared for each proposed meter or existing meter and included in the plan set.
6. _____ If the existing water service on this property is to be abandoned, the owner/developer has submitted a letter authorizing this service to be removed and if appropriate, to pay any costs associated with abandoning the meter.
7. _____ The site plan reflects any necessary adjustment of the existing manhole tops.
8. _____ The site plan shows the location of utility easements and with the Deed book and Page number for existing easements noted on the plans and space for the recordation information for on-site utility easements which must be added to the plans at the Department of Public Utilities and Planning prior to a full building permit being issued.
9. _____ The engineer has completed his calculations on fire flow and domestic water demands and has verified that the public water system will support these demands. The engineer must submit these calculations if requested by the County.
10. _____ Where industrial waste is a possible influent to the public sewer system, the engineer has incorporated appropriate measures on the plans, i.e., monitoring manhole per Detail MAN-17.
11. _____ Monitoring manholes are required for facilities currently regulated by local or federal industrial waste pretreatment laws. Examples of these commercial facilities include restaurants, carwashes, auto repair shops, and laundromats. A private monitoring manhole shall be provided to facilitate random sampling.
12. _____ For water meters two inches and larger: type of meter, standard or compound is noted on the plans. Typically a compound meter is required.
13. _____ Water meters for irrigation systems properly labeled "irrigation" or "water only" meter.

7.3 Industrial and Strong Waste Form



County of Hanover
Department of Public Utilities
Industrial and Strong Waste Survey Form

Facility Name: _____

Facility Contact Name: _____

Mailing Address: _____

Facility Address: _____

Contact Phone Number: _____

E-mail (optional): _____

DPU Account #: _____

Hours/Days of Operation: _____

1. What is the nature of the business at this service address?

Account Sub-classification Code (see code sheet): _____

2. Do you have a Back Flow Prevention Device(s)? Yes ____ No ____ Unsure ____

If Yes, What type(s)? _____

Location? _____

3. Do you have an irrigation or fire sprinkler system? Yes ____ No ____ Unsure ____

4. Does your operation provide Food Service to customers or employees? Yes ____ No ____
(If No, skip question 5)

5. Do you have a grease trap or interceptor? Yes ____ No ____ Unsure ____

If Yes, How many? _____

Where are they located in relation to your building? _____

6. Do you have an Oil/Water Separator? Yes ____ No ____ Unsure ____

7. Does your business discharge or have the potential to discharge a waste liquid to the sewer system other than from restroom toilets, sinks, showers, and other potable water fixtures? Yes ____ No ____ Unsure ____

If Yes, describe:

8. What is your Standard Industrial Classification (SIC) Code (if known)? _____

9. Do you currently treat any of your wastewater onsite? Yes ____ No ____ Unsure ____

If Yes, describe:

10. Additional Comments:

I certify that the information provided is true and represents, to the best of my knowledge, full disclosure of the information requested.

Signature _____
(Authorized Representative)

Title _____ Date _____

7.4 Procedure for Sizing Meters

1. Determine the domestic fixture count for the facility utilizing the following procedure:
 - a. Determine the number and type of water fixtures and list on the Meter Sizing Form found on page 7-9. For those water utilizing fixtures which are not included on the form, include water use in gallons per minute at 35 psi pressure.
 - b. For each type of fixture, multiply the fixture value times the number of fixtures to obtain the Total Fixture Value for each type of fixture. Add the totals for each type of fixture and place the total in the space provided near the bottom of the form.
 - c. Fixture counts for items not listed on the Meter Sizing Form shall be added by the person completing the form. These counts must be substantiated with data furnished by the owner and/or his agent.
 - d. If fixed demands (i.e. irrigation systems, process water, etc.) are not present, utilize the following table to size the water meter. If fixed demands are present, go to 2. below.

<u>Meter Size</u>	<u>Fixture Count Value</u>
5/8 inch	0 - 50
1 inch	51 - 100
1-1/2 inches	101- 650
2 inches	651 – 3,500

Meters 3 inches and larger shall be sized by a professional engineer. Meter sizing shall be in accordance with the requirements AWWA M22 utilizing fixture counts in the Meter Sizing Form found later in this section. If utilizing AWWA M22 gives a meter size smaller than 3 inches, the meter size shall be 3 inches.

2. If fixed demands are present (i.e. irrigation systems, process water, etc.) continue as outlined below.
 - a. Provide information on fixed demands in the appropriate location on the Meter Sizing Form and documentation of fixed demands as appropriate. Flows should be in gallons per minute (gpm). The sum of all fixed flows should be entered in the field labeled **Sum of Fixed Flows (A)** on the Meter Sizing Form.
 - b. Convert the Combined Fixture Value Total calculated in 1. above to a flow, in gallons per minute (gpm), using the appropriate figure from Chapter 4 of the AWWA M22 Manual and enter this flow in the field labeled **Equivalent Fixed Flow for Fixture Count (B)** on the Meter Sizing Form. The lower curve on the figures in AWWA M22 may only be utilized for apartment buildings, condominiums, and trailer parks.
 - c. Add the **Sum of Fixed Flows (A)** to the **Equivalent Fixed Flow for Fixture Count (B)** and place this sum in the field labeled **Total Flow (A + B)** on the Meter Sizing Form.

- d. Based on **Total Flow (A + B)** or the **Sum of Fixed Flows (A)** calculated select the appropriate size meter from the chart below. The criteria that results in the largest meter shall be utilized. In no case shall the meter size be less than that required by 1.d. above based on the domestic fixture count alone.

<u>Meter Size</u>	<u>Total Flow (A + B)</u>	<u>Sum of Fixed Flows (A)</u>
5/8 inch	0 – 20	0 – 15
1 inch	21 – 50	16 – 38
1-1/2 inches	51 – 100	39 – 75
2 inches	101 – 160	76 – 120
3 inches	161 – 320	121 – 240

3. Complete meter sizing forms should be included on plans for review and approval by the Department of Public Utilities.

7.5 Meter Sizing Form



COUNTY OF HANOVER
DEPARTMENT OF PUBLIC UTILITIES
P.O. BOX 470
HANOVER, VIRGINIA 23069
METER SIZING FORM

Customer _____ Address _____

Building Address _____ Type of Occupancy _____

Development Name _____ GPIN Number _____

Applicant _____

Title/Company _____ Daytime Phone # _____

I certify that the information on this form is true and correct to the best of my knowledge.

Domestic Demand Fixture		Fixture Value	No. of Ex. Fixtures	No. of Prop. Fixtures	Fixture Value
Bathtub			8 x (_____)	+ (_____)	= _____
Dental Unit			2 x (_____)	+ (_____)	= _____
Dishwasher			2 x (_____)	+ (_____)	= _____
Drinking Fountain			2 x (_____)	+ (_____)	= _____
Hose Connection/Spigot	1/2"		5 x (_____)	+ (_____)	= _____
Hose Connection/Spigot	5/8"		9 x (_____)	+ (_____)	= _____
Hose Connection/Spigot	3/4"		12 x (_____)	+ (_____)	= _____
Kitchen Sink			2.2 x (_____)	+ (_____)	= _____
Lavatory/Faucet			1.5 x (_____)	+ (_____)	= _____
Shower Head			2.5 x (_____)	+ (_____)	= _____
Toilet/Water Closet	flush valve		10 x (_____)	+ (_____)	= _____
Toilet/Water Closet	tank type		4 x (_____)	+ (_____)	= _____
Urinal	flush valve		5 x (_____)	+ (_____)	= _____
Utility Sink/Service Sink			4 x (_____)	+ (_____)	= _____
Washing Machine			6 x (_____)	+ (_____)	= _____
Other: _____			_____ x (_____)	+ (_____)	= _____
Other: _____			_____ x (_____)	+ (_____)	= _____
Other: _____			_____ x (_____)	+ (_____)	= _____
Combined Fixture Value Total					= _____

Domestic plus Fixed Demands: **Flow (gpm)**

Fixed Flow _____ = _____

Fixed Flow _____ = _____

Sum of Fixed Flows (A): = _____

Equivalent Fixed Flow for Fixture Count (B): = _____

Total Flow (A + B): = _____

Required Water Meter Size: = _____

8. UTILITY MASTER PLAN CHECKLIST

			Project Title
Yes	No	N/A	
_____	_____	_____	1. Plan scale is either 1 inch = 200 feet, 1 inch = 100 feet or 1 inch = 50 feet.
_____	_____	_____	2. Plan sheet is on 24" x 36" paper.
_____	_____	_____	3. Project vicinity map is provided.
_____	_____	_____	4. Owner/developer and consultant names and addresses are shown on plan.
_____	_____	_____	5. Water system is designed to provide adequate domestic service and fire protection.
		_____	a. Average Domestic Design Flow
		_____	b. Maximum Day Design Flow
		_____	c. Fire Flow
		_____	d. Peak Hour Design Flow
		_____	e. Design Flow
		_____	f. Residual Pressure at Design Flow
_____	_____	_____	6. Sanitary sewer service area map with topography is submitted with plan. Sanitary sewer analysis is shown on sewer shed map.
		_____	a. Average Design Flow
		_____	b. Equivalent Residential Units
_____	_____	_____	7. Any and all existing connections to property are shown on plan.
_____	_____	_____	8. Proposed water and sewer lines connect to existing facilities which have been previously accepted by the County for operations and maintenance.
_____	_____	_____	9. Off-site easements necessary for the completion of project identified.

Yes	No	N/A	
_____	_____	_____	10. Existing easements and road rights-of-way identified.
_____	_____	_____	11. Proposed construction and permanent utility easements and widths.
_____	_____	_____	12. North arrow is shown.
_____	_____	_____	13. Sanitary sewer system layout complete with pipe sizes, invert elevations, and manholes.
_____	_____	_____	14. Provisions to serve adjoining undeveloped properties with water and sanitary sewer made.
_____	_____	_____	15. Hydraulic computations for interceptor sewers which will extend through the project to serve off-site areas.
_____	_____	_____	16. Estimated construction sequence by subdivision section.
_____	_____	_____	17. Approximate location of service laterals and water meters shown.
_____	_____	_____	18. Water distribution system layout complete with pipe sizes and valves.
_____	_____	_____	19. Fire hydrants.
_____	_____	_____	20. Flushing hydrant appurtenances.
_____	_____	_____	21. Water quality monitoring stations.
_____	_____	_____	22. Project is consistent with DPU's Facility Master Plan.
_____	_____	_____	23. Sewer shall be deep enough to serve the entire sewer shed.

9. DEDICATED CAPITAL ASSETS LIST

HANOVER COUNTY PUBLIC UTILITIES DEDICATED CAPITAL ASSETS LIST

(Subdivision/W/S System)

COST

LAND

Land (Donated) _____ \$ _____ A
Description Acreage

Easement (off-site only) \$ _____ B

FACILITIES

Description (to include capacity) _____ \$ _____
(i.e. Structures, Storage & Pressure Tanks, Pumping Stations, Pumps, Controls)

Credits (Oversized) \$ _____

Sub-Total \$ _____ C

WATER LINES & APPURTENANCES

	Pipe Diameter	Linear Footage	COST	
Onsite	_____	_____	\$ _____	1
Onsite	_____	_____	\$ _____	2
Onsite	_____	_____	\$ _____	3
Offsite	_____	_____	\$ _____	4
Miscellaneous	_____		\$ _____	5
	<small>(Description)</small>			
Credits (Oversized)			\$ _____	6
			Sub-Total	\$ _____ D
			<small>(1 + 2 + 3 + 4 + 5 - 6)</small>	

SEWER LINES & APPURTENANCES

	Pipe Diameter	Linear Footage	COST	
Onsite	_____	_____	\$ _____	1
Onsite	_____	_____	\$ _____	2
Onsite	_____	_____	\$ _____	3
Offsite	_____	_____	\$ _____	4
Miscellaneous	_____		\$ _____	5
	<small>(Description)</small>			
Credits (Oversized)			\$ _____	6
			Sub-Total	\$ _____ E
			<small>(1 + 2 + 3 + 4 + 5 - 6)</small>	
			Total Cost for all Dedicated Assets	\$ _____
			<small>(A+B+C+D+E)</small>	

To the best of my knowledge, the above actual costs figures are correct and I can provide documentation to support the numbers upon request by Hanover County.

Date

Owner's Signature

Date

Assigned Utility Agent

**10. UTILITY CONSTRUCTION PERMIT AND BACKFLOW PREVENTION DEVICE
CERTIFICATION FORM**



COUNTY OF HANOVER

PERMIT # _____

DEPARTMENT OF PUBLIC UTILITIES
P. O. BOX 470
HANOVER, VIRGINIA 23069

UTILITY CONSTRUCTION PERMIT APPLICATION

APPLICANT requests a construction permit as indicated below and shown on the attached approved plans or sketch and/or described on the attachment to this permit application. Applicant understands that Applicant is responsible for all damages to any other installations already in place as a result of work covered by this permit application. Applicant agrees to indemnify Hanover County and its employees and/or agents from responsibility, damage, or liability arising from the exercise of the privileges granted in this permit.

If applicable, APPLICANT must provide Applicant's Land Use Permit Application number issued by the Virginia Department of Transportation (or Town of Ashland Right-of-Way Permit Application number) in the space below and attach a copy of Applicant's Land Use Permit (or Town of Ashland Right-of-Way Permit Application) to this permit application. Applicant agrees to comply with all applicable Land Use Permit Regulations.

APPLICANT requests permission to construct the public utilities shown on the approved plans dated _____ and titled _____ as shown on the attached plan and sketch and/or described on the attachment to this permit application. Said work is to be completed in a manner satisfactory to the County within _____ days from the date of issuance of the permit and if not so completed, the County may, in its discretion, complete the work at the expense of the applicant. Applicant grants permission for access to Hanover County and its employees and/or agents for the purpose of inspecting and/or completing the construction covered by this permit application.

DEVELOPER

ADDRESS OF APPLICANT

AGENT/DEVELOPER (APPLICANT)

TELEPHONE NUMBER OF APPLICANT

VDOT LAND USE OR ASHLAND PERMIT NUMBER

SIGNATURE OF APPLICANT

VDOT RESIDENCY POLICY FOR UTILITIES UNDER PAVEMENT RECEIVED BY:

SIGNATURE OF APPLICANT AND DATE

NOTE: THIS PERMIT APPLICATION AND STAMPED APPROVED PLANS AND SPECIFICATIONS MUST BE KEPT ON THE WORK SITE AND SHOWN WHEN REQUIRED. PLEASE NOTIFY DPU INSPECTIONS AT 365-6709, 48 HOURS BEFORE CONSTRUCTION BEGINS.

Application must be returned to the Department of Public Utilities in duplicate.

(TO BE COMPLETED BY DEPARTMENT OF PUBLIC UTILITIES)

By: _____
Engineer Manager/Deputy Director

Date Permit Issued: _____

Time Limit expires: _____

Date work completed: _____

Inspected by: _____

Phone number _____

11. CONSTRUCTION RECORD

Water & Wastewater Construction Record – Page 1

Project: _____

Developer

Submit plans for review

Public Utilities

Review plans

Forward comment letter to project contact

Developer

Submit revised plans

Submit off-site easement deeds/plats

Record off-site deeds/plats of easement

Pay plan review fee

Public Utilities

***APPROVE PLANS**

New Commercial Account Form

Developer

Post performance surety

Pay inspection fee

Submit executed agreement

Record agreement after County executes

Submit VDOT Land Use Permit

Submit construction permit request

Schedule pre-construction conference

Public Utilities

Conduct pre-construction conference

***ISSUE CONSTRUCTION PERMIT**

Water & Wastewater Construction Record - Page 2

Developer

- Provide documentation that all work covered by VDOT Land Use Permit is complete _____
- Submit on-site easement deeds/plats (if applicable) _____
- Record on-site deeds/plats of easement _____
- Bring roads and ditches to final grade (curb & gutter) _____
- Request tentative acceptance in writing _____
- Submit capital cost data _____

Public Utilities

- Record Drawing markups rec'd from inspector _____
- Send markups to Development Engineer _____
- Inspect for tentative acceptance _____

Developer

- Provide as-builts and shop drawings _____
- Correct operational deficiencies _____
- Disinfect completed system, flush & submit bacteriological samples when authorized by Inspector _____

- Remove jumper when authorized by Inspector _____

Developer

- Record Subdivision _____ Deed/Plat Book _____ Page _____
- Subdivision Bonded (Planning Dept) _____

***GRANT TENTATIVE ACCEPTANCE** _____

Public Utilities/Planning Department

- Reduce performance bond _____
- Meter Installation _____
- Backflow Certification Received _____

Water & Wastewater Construction Record - Page 3

Developer

Pave roads & adjust valves & manholes _____

Correct remaining deficiencies _____

Submit construction completion certificate
to VDH (if necessary) _____

Submit letter stating system is paid
for in full _____

Request final acceptance in writing _____

Public Utilities

TV Sewer Lines _____

Inspect system for deficiencies _____

Developer

Correct any deficiencies in system _____

Post 10% Defect Bond _____

Public Utilities

***GRANT FINAL ACCEPTANCE** _____

Release Performance Bond _____

Inspect for defects after 9 months _____

Developer

Correct any defects _____

Public Utilities

Close record after expiration of defect bond _____