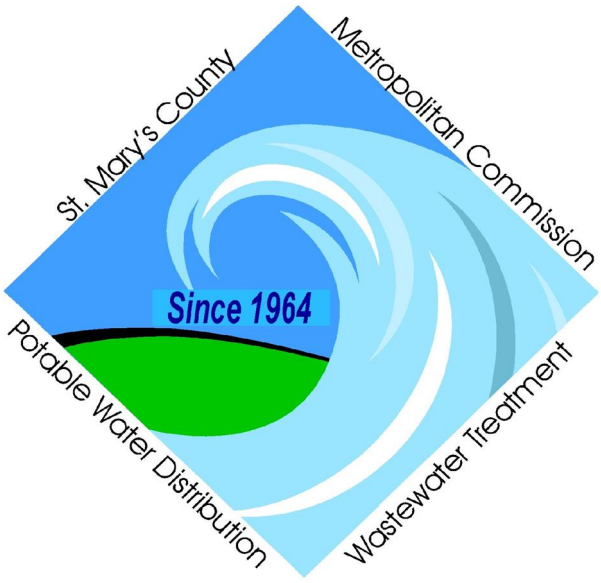
CHAPTER 2

WATER MAIN DESIGN



CHAPTER 2

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2.1 General

A. Responsibility of the Designer

This chapter addresses the selection and use of design criteria and practices applicable to the design of water system projects in St. Mary's County. The subject matter discussed includes the layout of piping systems, selection and employment of pipeline materials and the use of appurtenances. While the requirements described for the various aspects of design will include and cover the majority of conditions encountered, there is no intention to relieve the Designer of responsibility to recognize when conditions are not favorable for the application of standards. The Designer must be continually alert to conditions that cannot be satisfied by the application of these standard criteria.

B. Deviation from Design Manual

It is not possible to include in this manual all features of design and drafting, which are necessary to accomplish the development of construction documents for all projects. Although it is the Designer's responsibility to exercise professional judgment in the acceptance or use of the standards or features of design included herein, the Designer shall recognize that they are given to assist in the development of the project in the manner preferred by the Commission. Deviations from the design standards must be brought to the attention of the Chief Engineer and must be justified, in writing, from an engineering evaluation, which includes consideration of life cycle costs and maintenance requirements. Approval or denial of the waiver requests will be by return letter signed by the Chief Engineer.

2.2 Design Criteria

A. General

The water design criteria presented herein shall apply to Developer Projects as well as Commission funded Capital Projects.

B. Pre-Design Meeting

Developer Projects

Prior to commencing any work, the Designer is encouraged to schedule a pre-design meeting with the Chief Engineer to discuss any topics that are particularly important in the development of the Engineering Report and subsequent design of the project as given in Section 1.4.

For projects which require minor extensions of the public water and sewer systems, the pre-design meeting may take the form of a preliminary water and sewer plan showing the general layout of the utilities in relation to the proposed development. The plan shall be accompanied by a letter report, which shall include general information about the project, design criteria used, alternatives investigated and the cost estimates for all alternatives. The plan shall be submitted after the Planning Commission has approved the preliminary plan for the development.

Developer Projects involving more than 25 EDU's will be required to submit a comprehensive utility plan along with the engineering report unless waived by the Chief Engineer. Following the comprehensive sketch plan approval, the Designer shall submit to the Chief Engineer a comprehensive utility plan showing the location and size of the water and sewer utilities within the development. The comprehensive utility plan shall be signed and sealed by a professional engineer registered in the State of Maryland.

If the construction of the utilities within a development is to be phased, the Designer shall provide a phasing plan showing the phasing and timing of the construction of the utilities. The phasing plan shall be signed and sealed by a professional engineer registered in the State of Maryland.

During each phase of the development, the public water and sewer systems must be able to support the design flow requirements noted in the Design Manual. The Designer shall provide calculations (computer simulations) for each phase of the development. The water system must be capable of supporting the maximum day demand rate plus a two-hour fire flow while maintaining the minimum required pressure for each phase of the development.

Three copies of the preliminary utility plan, phasing plan and engineering report shall be provided to the Chief Engineer. Following approval, the comprehensive utility plan and phasing plan cannot be revised without the authorization of the Chief Engineer. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes

to the preliminary utility plan and phasing plan shall be noted in the revision blocks.

Capital Projects

In accordance with the scope of services, the Designer is encouraged to schedule a pre-design meeting with the Chief Engineer to discuss any topics that are particularly important in the development of the Engineering Report and subsequent design of the project. Pertinent topics may include any of the following:

1. Preliminary or prior reports prepared by the Commission.
2. Development of population projections and water demands.
3. Sizing of major system components.
4. Applicable plumbing codes.
5. Limit of project and future extension, if planned.
6. Route selection and location of pipe in public right-of-way.
7. Pipe materials and appurtenances.
8. Design criteria to be used.
9. Both design constraints due to and anticipated interaction with existing utilities, particularly if those utilities employ cathodic protection systems.
10. Soil conditions that may affect infiltration and inflow in pipes and appurtenances.
11. Bedding requirements.
12. Method of crossing roads, railroads and streams.
13. Special topographic conditions affecting design such as slopes, streams, floodplain and stream crossings.
14. Special permitting issues created by the presence of wetlands, rare and endangered species, historical and/or archaeological artifacts.
15. Easement requirements.
16. Conditions affecting traffic maintenance and control.
17. Identification of any storage facilities in the network that might be affected by the project.
18. Requirements for new or upgraded telemetry systems.

During each phase of the development, the public water and sewer systems must be able to support the design flow requirements noted in the Design Manual. The Designer shall provide calculations (computer simulations) for each phase of the development. The water system must be capable of supporting the maximum day demand rate plus a two-hour fire flow while maintaining the minimum required pressure for each phase of the development.

Copies, in accordance with the scope of services, of the preliminary utility plan, phasing plan and engineering report shall be provided to the Chief Engineer. Following approval, the comprehensive utility plan and phasing plan cannot be

revised without the authorization of the Chief Engineer. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes to the preliminary utility plan and phasing plan shall be noted in the revision blocks.

C. Design Calculations

1. General

   All population densities required for determining water demands are to be determined based on the St. Mary's County Metropolitan Commission Table of Equivalent Dwelling Units. The average day demand for a service area is the sum of the average day demands for the residential, institutional, commercial and industrial components within the service area. Similarly, the maximum day demand for a service area is the sum of the maximum day demands for the residential, institutional, commercial and industrial components within the service area.

2. Residential

   For residential flows, average day demands shall be determined by multiplying the applicable population densities by the average day demand indicated in the Table of Equivalent Dwelling Units as found in the Appendix. Maximum day and peak hour demands shall be determined by multiplying the applicable average day demand by a 1.5 peaking factor.

3. Institutional, Commercial and Industrial Demands

   For institutional, commercial and industrial flows, the estimation of average daily water consumption demands vary greatly dependent on the type of facility. With the exception of industries using process water, the fire demand generally is the major component of the design demand used to size distribution main extensions and service connections to buildings having sprinkler systems. The Designer shall determine the design flows based on building capacity, type of use, number of persons using the facility, projected processes, etc. Whichever estimate of design flows is greater shall be used for design purposes. When more specific information is unavailable, the Table of Equivalent Dwelling Units shall be used to determine the average day demand.

   Maximum day and peak hour demands shall be determined by multiplying the applicable average day demand by a peaking factor of 4.

4. Fire Flow Rates: The required fire flow rates shall be calculated using Table 2.1.

TABLE 2.1: FIRE HYDRANT FLOW RATES FOR DESIGN

Land Use	Design Fire Flow Rates (gpm)
Residential (one and two family)	500
Commercial, Industrial, Educational, Institutional, Residential (multi-family)	1,000*

*The special use of a property may require a higher flow rate that is to be accommodated by on site storage. Higher fire flow rates (and storage requirements) may be specified by the Owner, Fire Marshal's Office, or the Department of Land Use and Growth Management.

The water system storage facilities shall be considered at their minimum elevation when determining fire flow residual pressures.

5. Surge Pressures: Surge pressures shall be calculated using Table 2.2.

TABLE 2.2
MAXIMUM PERMISSIBLE SURGE PRESSURES

Pipe Diameter (in)	Surge Pressure (lb/in^2)
4 to 10	120
12 to 14	110
16 to 18	100
20	90
24	85
30 and above	80

The Designer shall exercise judgment in determining whether a detailed surge analysis is necessary. Conditions warranting a surge analysis may include the following:

- Impact of a power failure, pump start up or quick closure of discharge valves at water pumping station.
- Impact of water column separation.
- Rapid closure of in-line valves.
- Rapid closure of fire hydrants.
- Inadvertent, rapid closure of altitude valves at storage tanks.

6. Hydrostatic Pressure and Leak Tests

   Hydrostatic leak tests shall also be performed as stipulated in the standard specifications. Test pressures to be induced at the high point of the test section shall be based on the static gradient within the pressure zone the pipe is to be installed in, but never less than 100 psi.

   The hydrostatic test pressures for pressure and leak tests shall be in accordance with AWWA Standard C600.

D. Pipeline Alignment

1. General

   The Designer has the responsibility to identify where factors of good planning and design are in conflict with these guidelines and requirements of other agencies. The proposed alignment must be the best overall design. Failure to identify conflicts during the preliminary design may result in delays and possibly costly changes.

   Consideration must be given to space requirements for future utilities, particularly sanitary sewers and storm drains. In the absence of sewer or storm drain design, the Designer shall recommend the space requirements of the sewer or drainage facilities and provide the necessary clearances. This requirement is particularly important at roadway intersections.

   The Designer shall identify and locate all existing and underground facilities before selecting the location of the pipeline. When plans of existing facilities are insufficient to accurately locate existing underground obstructions, the designer shall request the Chief Engineer for permission to perform test pit excavations to uncover the subject facility so that the horizontal and vertical positions of existing utilities can be accurately determined. The timing and location of test pits and or soil borings should be discussed during the Pre-Design Meeting. If approved, the Designer will be responsible for providing all traffic control and public safety measures necessary to locate the utilities and restore the surface. The Designer shall coordinate the test pit operations and provide a field survey crew to physically locate the subject facility. A utility permit will be required from the Department of Public Works and Transportation for all test pit excavations in County roads. Test pits in State Highways require a SHA Utility Permit.

2. Horizontal Alignment - Location

The horizontal alignment shall take into account the following general alignment guidelines. Pipelines larger than 12 inches in diameter may have other limitations and requirements that alter these general alignment guidelines.

a. Extensions of distribution mains will normally be in a grid pattern with interconnecting nodes at street intersections. Water mains shall be extended along right-of-ways and roads the full length of the property to allow for future extension of abutting properties except in cases where the abutting property is outside of the service area (no planned service) according to the Comprehensive Water and Sewerage Plan.

b. In the layout of distribution mains, non-looped situations shall be avoided. All mains both internal to the project and external shall be continued to the nearest point of connection as directed by the Chief Engineer. Where temporary non-looped connections are appropriate, the main shall be terminated so as to facilitate connection or extension in the future with minimal inconvenience to the existing system and terminate with a hydrant to allow for flushing. In situations where non-looped mains cannot be reasonably avoided, the following criteria shall prevail:

1) The water distribution system for residential areas where fire protection is to be provided shall meet the following criteria.
   i. The maximum length of fire hydrant leads on a 6-inch main shall be 25 feet from the main.
   ii. The maximum length of non-looped 8-inch mains shall be limited to the length that will allow the required flow to all services and hydrants or 2,500 feet. However, if the Chief Engineer determines that the non-looped condition will exist for an unacceptable length of time (for example, a line extension that is dependent on future development which has not been initiated), the network must be extended to provide for immediate looping of the system or an alternate design prepared.
   iii. All easements shall be provided where required by the Chief Engineer for the looping of the public water system.

2) The water distribution mains for institutional, commercial and industrial areas where fire protection is to be provided shall meet the following criteria. The minimum size shall be 8-inch, except for fire hydrant leads less than 25 feet and service connections. The maximum lengths of non-looped 8-inch mains and non-looped 12-inch mains shall be 800 feet and 2,000 feet, respectively unless determined by the modeling to be less. The shortest length shall

govern. All easements shall be provided where required by the Chief Engineer for the looping of the public water system.

c. In existing developments where roads are paved, and without curbs, the water main is generally placed outside the edge of paving and inside the right-of-way line in a location having the least conflict with existing utilities. This alignment shall be on the high side of the street, or on the side opposite the one reserved for the sewer main. When existing underground utilities are in place such as gas, telephone, or electric, water mains are normally placed on the same side so as to preserve space for sewers clear of these obstructions.

d. The alignment within existing areas (streets or roads), shall avoid high traffic volume roads, if other options are available. The alignment shall be designed to allow the construction of the pipeline without the need to have road closings. When a water main is required to cross a St. Mary's County road, the Designer, after considering the type and condition of the road, traffic volumes, disruption to traffic, possible conflicts with existing utilities, and specific conditions on the project site, shall recommend whether to open cut, tunnel, directional drill, or jack and bore the utility across the roadway, on a case by case basis. The agency owning the roadway to be crossed shall make the final decision as to the method to be used and the approved method shall be noted on the plans by the Designer.

e. In existing areas (streets or roads) the alignment shall also try to avoid the removal of trees or landscaped areas. In parks and public rights-of-way where location of the water main would require removal of trees, the Designer shall obtain the approval of the appropriate agency or agencies for tree removal. When the pipeline must be located outside the road right-of-way, the alignment shall be located to minimize disruption to environmental features. In addition to trees, the alignment shall attempt to avoid steep slopes, wetlands and other sensitive areas. The alignment shall follow the property lines as much as possible.

f. When existing roadways are involved, the horizontal alignment of the road must be evaluated for acceptable geometry and the water main designed with respect to these possible roadway improvements to avoid costly relocations. The Designer shall evaluate the plan geometry of the road with respect to movement of traffic and available right-of-way width for the accommodation of the pipeline. If easements must be acquired for the main, a recommendation shall be provided to the Chief Engineer as to whether additional rights-of-way shall be acquired for future roadway modifications.

g. Water main easements are routinely acquired during the subdivision process for the future extensions of the water system to serve adjacent properties. Where the future extension of the water main would undermine a foundation of a structure, a water main shall be constructed as part of the subdivision. In residential subdivisions where an easement is required between two adjacent lots for the extension of the water system, a water main shall be provided within the easement between the adjacent lots. The water main shall extend the full length of the easement between the lots. A minimum distance of ten (10) feet must be maintained from all structures.

h. In cases where only a utility easement is required to be extended to the limits of the property being developed in order to provide future service to an adjacent property, that easement shall be cleared and otherwise prepared for the future extension of the main.

i. Where water and/or sewer mains leave the public road right-of-way, an all-weather access roadway is required.

j. Within private roads, public water mains shall be located within the paved roadway sections, whenever possible, and shall have a 5-foot minimum separation from other utilities.

k. In Developer Projects where all new facilities are to be constructed, and in existing developments with curbs, water mains are usually placed 7 feet from the centerline of the street and on the side nearest the higher ground. Mains shall be located within the pavement area, wherever possible, and no less than 5 feet from face of curb or proposed curb and shall have a 5-foot minimum separation from other utilities.

l. In Developer Projects, the design of the public water, sewer and storm drain utilities within proposed developments shall be prepared concurrently to ensure compatibility of the utilities. If public water and sewer mains cannot be located within the paved roadway section, the Designer shall request a waiver of the design standards and provide reasons why the standards can not be met.

3. Vertical Alignment - Location

The vertical alignment shall take into account the following general alignment guidelines:

a. The minimum ground cover required over a water main is 3’-6” and is measured from the outside top of pipe to the actual ground surface in existing developments. In new subdivisions, when grading and paving is

to be accomplished as part of the project, the cover is measured from the top of the pipe to finished grade.

b. When existing roadways are involved, the vertical alignment of the road must be evaluated for acceptable geometry and the main designed with respect to possible roadway improvements to avoid costly relocations. Acceptable geometry shall be determined by current roadway design standards. Where existing conditions are sub-standard, the Designer shall superimpose an improved grade on the profile and shall use this grade in the vertical positioning of the main where applicable. When a centerline road grade is thus established by the Designer, the main shall be designed to maintain the necessary cover below existing ground where fills are indicated and below the proposed grade where cuts are indicated. Plan and profile realignment must be considered in a coordinated manner. When the Designer establishes or uses a proposed centerline grade by others in connection with a water main design layout, the Designer shall identify the origin of this grade on the profile.

4. Sizing

Distribution mains shall be sized to provide the required design flow rate and residual pressures as identified and approved in the Engineering Report with a minimum size of 8-inches in diameter for mains with fire hydrants. Four-inch mains may be permitted in cul-de-sacs without hydrants with the approval of the Chief Engineer.

5. Cover

Minimum final ground cover over water mains shall be 3' - 6", except at crossings over other utilities where a minimum final cover of 3' - 0"shall be maintained. The maximum ground cover permitted over distribution mains is 8' – 0" unless approved by the Chief Engineer. In areas outside of existing or planned streets, cover shall be measured from existing grade. The Designer shall thoroughly investigate, and make suitable allowances for likely changes to existing topography. Such changes include future erosion of streambeds or grading of lots.

6. Clearances

   Sewer and water line clearances shall be as specified in Recommended Standards for Water Works (Ten State Standards). If not specified in the Ten States Standards a minimum of one-foot clearance from other utilities shall be maintained except for natural gas lines. A minimum of five-feet of clearance shall be maintained between water lines and natural gas lines. Water lines shall be above sewer and storm drain lines. If this requirement is not achievable then a full segment of water main pipe shall be centered directly under the crossing and the water main shall be encased in concrete 10 feet on either side of the crossing.

E. Water Mains: Plan

1. Water main plans shall be drawn to a minimum scale of 1" = 50'. The plan set shall include an overall plan view of the entire site showing the water and sewer layout.

2. All proposed pipe shall be shown and symbolized as shown in the legend.

3. All pipe sizes shall be clearly identified. The pipeline and appurtenances shall be carefully dimensioned in the plan view of the plans, so that the horizontal alignment is clearly identified and fixed. Fittings shall be shown by symbols and identified by appropriate notation. Appurtenances shall be called by symbols and notes and dimensioned in respect to pipeline stationing.

4. Water House Connections (WHC's) shall be shown in the plan view as a pipe from the main to the property line.

5. The horizontal (and vertical) alignment changes of water mains must be made to follow changes in street alignment or to pass safely over, under or around obstructions. These changes in alignment may be made by the insertions of bends, joint deflections or beveled end pipe. The degree of deflections at joints, the length of pipe sections and the radius of the centerline curve of the pipe must be noted on the plans.

6. The overall plan must show all current and future property lines, easements and water mains associated with the project or adjoining property.

F. Water Mains: Profile

1. Profiles for water main are drawn to accompany the plan and shall be shown below the applicable plan layout on each sheet. For Developer Projects, the complete layout of the piping system may be shown in the plan view drawings. Profiles shall then be shown on a separate sheet and cross-

referenced to the appropriate plan. For small Developer Projects, the profiles may be shown below the plan views on the same sheet.

2. Profiles shall be drawn to a minimum horizontal scale of 1" = 50' and a vertical scale of 1" = 5'.
3. Water mains and services should cross over sewer and stormdrain lines at crossings. If the water must cross under any sewer or stormdrain a full segment of water pipe shall be centered directly under the crossing and the water main shall be encased in concrete for 10 feet on either side of the crossing.
4. Pipe diameters and pipe type shall be called out.
5. Stations and invert elevations shall be provided on the water line profile at fittings and at all vertical and horizontal deflections.
6. Profiles within Proposed Roads:

   In developing the profile information for water pipelines in proposed roads, the proposed centerline grade and stations of the roadway are to be used as the reference line for both the horizontal and vertical plane. Stations along the street centerline are to be established in plan and these stations and corresponding elevations are to be transferred in true scale to the profile. Water main stations are projected in plan onto the centerline of the road and plotted in respect to this projection on the profile. Following this procedure means that the plan stations of the water main cannot be accurately scaled on the profile when there is any deviation from a tangent alignment in plan. Invert elevations are set to maintain no less than 3’-6” of pipe cover.

7. Profiles Within or Outside Existing Roads:

   In developing the profile information within or outside existing roads, the centerline length of the water main in plan shall be used for the profile stationing, which will provide true length profiles. For existing roads that do not conform to Department of Public Works and Transportation guidelines, a centerline road grade conforming to the design standards is to be shown on the profile and identified as “possible future centerline road grade.” On a combined water and sewer project, the sewer shall be projected onto the water pipeline centerline.

8. Changes in vertical alignment of water mains shall be achieved by fittings, joint deflections or beveled joints. When changes in alignment are made in the horizontal and vertical plane simultaneously, the degree of change in both planes shall be indicated. The total joint deflection shall not exceed 80% of the manufacturer’s maximum recommended deflection measured from the axis of the pipe.

9. For pipelines smaller than 24-inches in diameter, the pipeline profile may be shown with curves.

10. For pipelines 24 inches in diameter and larger, the pipeline shall be shown as a series of straight lines with deflections. The deflections shall be based on twenty (20) foot intervals with stations and invert elevations given at each deflection. When the pipeline is designed with no deflections, the stations and invert elevations shall be provided at fifty (50) foot intervals.

11. Utilities that cross water mains shall be plotted to horizontal and vertical scale and identified so as to advise the Contractor of their specific locations. Stations and invert elevations shall be provided at every pipeline crossing for each pipe shown. If the elevation of the existing pipeline to be crossed is unknown and it is likely to have a significant impact on the water main vertical alignment, the Designer shall arrange to have a test pit excavated to determine the exact horizontal and vertical location of the existing utility or utilities.

12. The type of fitting, the stationing of the fitting and the fitting invert elevation shall be shown on the profile if plan and profile are on separate sheets.

13. Vertical deflections required to facilitate crossing of irregularities in terrain, such as rivers, streams, ditches, swales, etc. and to maintain clearance at other underground obstructions, shall be detailed at a larger scale showing existing and/or proposed grade, horizontal station, and invert elevations at each vertical fitting and joint deflection point and shall be with the approval of the Chief Engineer.

14. Existing and proposed ground lines shall be shown where applicable as well as the source from which the information was acquired. The following information as minimum requirements shall be shown on the profile.

    a. Road names – when plan and profile are on separate sheets
    b. Existing ground elevation line
    c. Proposed ground elevation line

G. Pipeline Materials

1. Pipeline materials and installation practices employed by the Commission are based on providing the maximum service capability with the least costs of installation and maintenance. Pipelines have a prolonged service life when properly designed and installed. There are many factors which must be considered in the selection and employment of design principles to reduce or eliminate failure and resulting costly repairs.

2. In the interest of fair and open competition, the Designer shall make recommendations and prepare plans to permit the widest range of employment of different materials and appurtenances consistent with the principles of economy and performance. The Designer is responsible for recommending specific materials and appurtenances required to correct potentially detrimental effects due to adverse site conditions that would render some products unacceptable.

3. Allowable water pipe materials for routine projects are Ductile Iron Pipe (DIP), Prestressed Concrete Cylinder Pipe (PCCP), Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE) and Copper Pipe meeting the requirements of the Standard Specifications. Generally, for pipelines smaller than 36", only DIP, PVC, HDPE and copper tubing are used in the public water system. Fittings for PVC shall be DIP. PCCP, in addition to DIP, will be considered for transmission mains. The following tabulation shows the types of pipe that may be employed within the range of sizes or uses noted:

TABLE 2.3 PIPE MATERIALS

Pipe Material (Abbreviation) (Specification)	Diameter (in)
Distribution & Transmission Mains	
Ductile Iron Pipe & Fittings (DIP) Class 52 (AWWA C-151, C-153, C-110)	4" and larger
HDPE w/ Copper wire (AWWA C906)	1¼ " – 10"
PVC w/ Copper wire (Class 150 AWWA C900) (PVC 1120 ASTM D2241)	4" -10" <4"
Service Lines – House Connections	
Copper Pipe (Federal Specification) (WW-T-Type K)	1¼ " through 2"
HDPE w/ Copper wire (AWWA C906)	1¼" through 3"
Ductile Iron Pipe & Fittings (DIP) (AWWA C-151, C-153)	4" through 12"
PVC w/ Copper wire (Class 150) (AWWA C900)	4" through 10"

Ductile iron pipe shall have a double standard thickness cement lining. Pipe materials other than those listed in the above table may be selected when specialized functions are to be satisfied. The use of alternate pipe materials must be approved by the Chief Engineer. When alternate pipe materials are to be used, the appropriate specifications shall be adhered to in the design.

4. HDPE mains shall be given a relaxation period of 24 hours.

5. The Designer shall indicate the pipe class designation in the General Notes on the plans and in the Special Provisions. Changes in the pipe class shall be shown with the limits defined on the pipeline profile. Selection of pipe class and wall thickness shall be as follows:

   a. Copper Tubing, Type K

      The copper tubing in the Standard Specifications is suitable for normal system pressures and earth cover.

   b. DIP

      The Standard Specifications use the "special" wall thickness classes of DIP (e.g. class 50, 51, etc.), given in AWWA C150. A special thickness class of 52 shall be used unless the Designer determines that an alternate special thickness class is required due to a special application (see below). The alternate must be calculated in accordance with the method given in AWWA Standard C150/ANSI A.21.50. The thickness of the selected class shall be equal to or greater than class 52, as the calculations require. In no case shall the pipe thickness be less than class 52. Pipe thickness, in combination with the pipe bedding, must be sufficient to resist excess deflection and bending stress, compensate for negative manufacturing tolerances and withstand internal operating and surge pressures.

      Calculations shall be performed conservatively, based on using a Type 1 Laying Condition as defined in AWWA C-150. Where field conditions are expected to be moderate, the unit weight of soil shall be 120 pounds per cubic foot (pcf) and the truck load shall be a single AASHTO H-20 truck on unpaved road or flexible pavement with a 1.5 impact factor. A trench/bedding detail shall be placed on the plans.

   c. DIP Wall Thickness for Special Applications

      The wall thickness of DIP for the following special applications is not covered by the Standard Specifications. Additional consideration/calculations are required as indicated above and Special Provisions shall be included to specify the appropriate pipe:

      1) Shallow cover, less than three feet six inches (3' – 6").
      2) Vehicular or equipment loading greater than AASHTO H-20 or HS-20 load configuration.
      3) Operating pressures greater than those normally encountered in the water distribution system.
      4) Excessive surge pressures. Pressures given in Table 2.3, "Maximum Permissible Surge Pressures," shall be considered excessive and should be avoided if possible:

H. Types of Joints

1. General

   Pipe joints shall be in accordance with the Standard Specifications.

2. Ductile Iron Pipe (DIP)

   a. Pipe joints shall be push-on bell, unless otherwise noted on the plans or the Standard Details.

      1) Allowable pipe joints for buried DIP shall be mechanical joint bell, plain end (for mechanical joint or push-on), push-on bell, or push-on bell with proprietary restrained joints as approved by the Chief Engineer.

      2) Buried flange joints are generally not allowed because of the rigidity of the joint; however, the use of buried insulated flanged joints is permissible for corrosion control on a case-by-case basis. This type of joint requires a minimum DIP special thickness class 53 DIP and the flanges are threaded and screwed on the pipe by the manufacturer. When the design requires insulating joints, a short piece of flanged pipe (flanged x plain end) shall be used. A detail for insulated joints shall be included on the plans.

   b. Joints for fittings shall be in accordance with the Standard Specifications and AWWA C153/C110. Allowable joint ends on fittings shall be mechanical joint bell, plain end (for mechanical joint or push-on), push-on bell or push-on bell with proprietary restrained joints as approved by the Chief Engineer.

   c. When laying out a pipeline alignment, the Designer shall design the pipeline using push-on joint pipe, with mechanical joint fittings.

   d. When the design requires special restrained joints, the Designer shall submit the design of joints used for restraining the pipeline for review by the Chief Engineer.

   e. All mechanical joints shall be secured by mega-lugs.

3. HDPE

   a. Pipe joints shall be fused in accordance with AWWA C900 and C905.

I. Fittings

1. General

    a. The employment of properly designed concrete thrust blocks (buttresses and anchors) at fittings is of great importance. Details of these buttresses and anchors are shown in the Standard Details and are to be employed in all cases compatible with the design conditions. Where field conditions will not permit the use of buttresses and anchors, restrained joints using tie rods or harnessing may be employed, as approved by the Chief Engineer.

2. Bends

    a. The water main alignment shall minimize the use of bends. The Designer shall try to align the pipeline by deflecting the pipe joints. Deflecting the joints on bends is not permitted, unless design calculations for restraining the bend for the additional joint deflections are submitted.

    b. Allowable bends are as follows: 1/8th or 45 degrees, 1/16th or 22.5 degrees and 1/32th or 11.25 degrees. 1/4th or 90 degree bends in the horizontal plane shall be used only upon approval. 1/4th or 90 degree bends are not permitted in the vertical plane.

    c. Bends designed to be rotated in both the horizontal and vertical plane require special pipe restraint. The Designer must submit design calculations to the Chief Engineer for review and approval.

3. Tees

    a. The connecting branch pipe must be perpendicular ninety degrees (90°) to the mainline pipe.

    b. The Designer shall use a tapping sleeve and valve (TS&V) when connecting to an existing main having more than ten (10) domestic services that would be placed out of service during the installation of a tee.

    c. No joint deflections are permitted at the branch connection of the tee.

    d. Tees that are designed to be rotated greater than five degrees (5°) in the vertical plane may require special pipe restraint.

4. Cross

    a. A cross is required for two perpendicular extensions, in close proximity, from the main pipeline. Tees shall not be used in lieu of crosses, unless the

connections are spaced far enough apart. If the design requires connections on both sides of the pipeline and a cross cannot be used, the spacing between the tees shall be a minimum of ten (10) feet apart.

b. A valve shall be installed on each branch, strapped to the cross. The branch connections of the cross must be extended a minimum of one full length of pipe on both sides of the cross, with the required standard thrust blocking on the ends. If a branch connection of a cross cannot be extended, the Designer shall utilize two tees, properly spaced, with valves strapped to the tees and the required standard thrust blocking.

c. If the alignment from the cross requires using a reducer on one side of the cross, the Designer shall provide special pipe restraints for any unbalanced forces due to the reducer.

5. Reducers

a. Reducers are required for reducing the pipeline size. The Designer shall avoid using reducers on short runs of pipe, if the cost of downsizing the pipeline, which includes the reducer, pipe restraints for reducer, house connection taps with saddles, etc., exceeds the cost of the larger diameter pipeline.

b. Reducers may require special pipe restraint for unbalanced forces.

c. When reducing the pipe size on 16-inch and larger diameter pipelines, the profile must be examined to determine if the reducer will create a high point at the large end of the reducer. This must be corrected with the use of an eccentric reducer.

6. Solid Sleeves and Mechanical Couplings

a. Generally, mechanical joint solid sleeves shall be used for burial conditions and mechanical couplings with tie rods shall be used in vaults and structures. Any sleeve 12” in diameter or greater shall have a ground penetrating radar test completed to locate any voids.

J. Connections

1. General

Where connections to existing mains are to be made, the Chief Engineer will determine during the preliminary review whether the main shall remain in service necessitating the use of a TS&V or whether a specific shut down period can be accommodated for making the connections.

2. Tapping Sleeve and Valve (TS&V)

In general, a TS&V will be used for connections 8-inches and larger in diameter, if the existing line serves more than 10 dwellings. The main being tapped must be at least one pipe size larger than the branch main. If the branch main is the same size as the main line, then a tee shall be cut into the main line. The as-built plans and contract files shall be checked to ascertain the existing pipe class or thickness to design the appropriate compatible tapping sleeve and gasket. If the class or thickness of the existing pipeline cannot be identified, the Contractor shall be required to test pit the pipeline to determine the pipe outside diameter. The location of the tapping sleeve on DIP shall be designed so that the centerline of the connecting pipeline is a minimum of five (5) feet from the face of any existing bell joints. TS&V's shall be restrained or blocked in the same manner as a tee.

K. Relocation of Water Pipelines – Capital Projects

1. General

When designing the relocation of a water main, the Designer shall consider such matters as environmental impact, maintenance of pedestrian and vehicular traffic, maintenance of existing and proposed utility services, constructability and system maintenance. In addition to the following, the design shall follow the requirements for water pipelines as stated elsewhere in this manual.

2. Alignment - Horizontal and Vertical

a. When selecting an alignment, the existing pipeline and services must be maintained and stay in service until the relocated pipeline is ready for final connection to the existing main. The final connection must be designed to allow a quick shutdown and transfer of services, so that water service is not disrupted for an extended period.

b. The relocated pipeline shall have a minimum ten (10) feet, centerline to centerline, horizontal clearance from the existing main, if the existing main is to remain in service during construction of the new main.

c. The relocated pipeline shall have a minimum one (1) foot vertical clearance between the existing pipeline that will be abandoned by the relocation.

d. The relocated alignment shall not disturb the existing blocking/restraints on the existing pipeline that is in service. Pipe restraints shall be designed for the relocated pipeline. If the shutdown time is limited, the design will require a quick-type blocking for restraining the relocated pipeline.

e. The design of the relocated pipeline must provide for continuous service until the relocated pipeline is placed in service. At that time all tie-ins and transfer of WHCs between the existing temporary bypass pipeline and the relocated pipeline shall be made.

f. The Designer must contact the Chief Engineer for limitations on shutdowns of the existing pipeline. Conceptual approval from the Chief Engineer must be obtained if the Designer determines the existing pipeline must be replaced in the same location/alignment, which may require an extended shutdown period or provisions for temporary service.

g. Abandonment of the existing pipeline, structures and/or appurtenances shall be shown on the plans, indicating the limits of abandonment and description of the facility to be abandoned and the method of abandonment.

h. When large portions of the service area will be affected by the relocation or when service will be interrupted for extended periods, the Chief Engineer may require the use of linestops to reduce or eliminate the disruption time.

2.3 Appurtenances

A. General

There are numerous appurtenances incorporated in pipelines to ensure satisfactory and trouble-free performance and to provide a measure of control when emergency conditions prevail.

B. Valves

1. The placement of valves in a water distribution system at strategic locations is foremost in the control of the system. It is the responsibility of the Designer to ensure that the valves are located so that minimal disruption of water service will occur during maintenance, emergency conditions and future extension work.

2. Valves shall be provided at the intersection of water mains. A valve shall be placed on the outlet side of any cross or any tee. In a grid network, normally the number of valves will be the same as the number of pipes at the

intersection. Where there are one or more dead ends, a valve on each pipe at an intersection shall be provided.

A sufficient number of valves shall be installed so that a break or other failure will not affect more than one-quarter of a mile (1/4 mile) of arterial mains, five hundred feet (500') of mains in commercial districts, or eight hundred feet (800') of mains in other districts.

3. For high traffic volume intersections, to avoid disturbance to traffic flow and for ease of operation, valves shall be located outside the intersection on the projection of the street right-of-way line. The exception to this is where a branch main is considerably smaller, 4-inches or more than the major main, in which case the branch valve is placed as close as possible to the larger main and strapped. When a branch pipeline is not extended or stops at the road right-of-way line, the valve shall be located at the connection to the mainline pipeline. Valves on mains located in places other than street intersections are to be placed near fire hydrants for ease of location by field personnel.

4. Water valves shall be mechanical joint.

5. Valves shall be provided on mains between intersections and on dead end mains as noted below:

Main Size	Maximum Valve Spacing
6"to 12" (Residential Use)	800 feet
8" to 12" (Residential Land Use)	1,000 feet
8" to 12" (Other Land Use)	1,200 feet
14" to 16" (with WHCs)	1,200 feet
14" to 16" (no WHCs)	2,000 feet
Over 16"	3,000 feet

On dead end mains for which no extension will be made in the future (cul-de-sacs), valves shall be provided after the last fire hydrant (except when the fire hydrant is within 200 feet of the end of the water main).

6. When the existing system requires a number of domestic services to be shut down during the installation of a connection, an additional valve shall be installed next to the connection on the mainline pipeline to reduce the number of domestic services placed out of water during any future shutdown.

7. All valves 4-inches to 24-inches in diameter shall be resilient seated gate valves and comply with the Standard Specifications. Valves larger than 16-inches in diameter may be direct buried butterfly valves where the depth of

cover precludes the use of vertically installed gate valves. All butterfly valves shall conform to AWWA C504.

8. Valve stem extensions are required when the top of the valve's operating nut exceeds three and one half (3 ½) feet of cover. The Designer shall provide a note on the drawings that valve stem extensions shall be provided.

9. The pipeline vertical alignment at the valve shall be designed as nearly parallel with the road grade as possible so that the valve may be installed upright and perpendicular to the road grade. The adjusted vertical alignment at the valve shall be shown on the profile. When a valve is to be located on a pipeline that is not level, the Designer shall check the pipe slope and depth of the valve to verify that the buried valves will be operable.

C. Valve Vaults

1. Valve vaults are required on a case-by-case basis.

2. During the preliminary design, the Designer shall submit the vault layout for approval by the Chief Engineer.

3. All piping within the vault shall have flanged joints.

4. A mechanical coupling or mechanical joint solid sleeve shall be included in the vault piping, for the removal of the valve, pipe, and fittings within the vault. A mechanical coupling requires special pipe restraints. A mechanical joint solid sleeve requires the joints to be restrained, using Megalugs or retainer glands. The Designer shall determine the appropriate form of restraint based on the pressure rating requirements for each type of restraining joint.

5. The inside dimension of the vaults shall be determined by the dimensions of the piping assembly (valves, pipes, and fittings) that is required in the vault.

6. On the profile, the Designer must determine the invert of the pipeline using the design depth shown on the details for the valve vaults.

7. The valve shall be restrained in the closed position.

D. Fire Hydrants

1. The Commission has adopted standard details for fire hydrant installation. These requirements are shown in the Standard Details and include the size of hydrant, valve, and lead, location of the hydrant with respect to the edge of the curb or road, valve location, bury length and joint restraint.

2. Normally, hydrants placed within developed sites are part of the public system; however, in certain instances, hydrants become part of the internal fire protection system and require specific arrangements and/or agreements with the Commission.

3. All hydrant barrels shall be a minimum of five and one quarter (5 1/4) inches in diameter and the connection (lead) from the main to the hydrant and the valve shall be six (6) inches in diameter. Six-inch fire hydrant leads shall be no more than twenty-five feet (25') in length unless otherwise approved by the Chief Engineer.

4. No services are to be tapped from the fire hydrant lead.

5. Hydrants shall be located three (3) feet behind the back of the curb or two (2) feet behind the sidewalk on curbed streets. Hydrants shall be located within twelve (12) feet of the limit of stabilized shoulder or pavement of open section roads. Where the location behind the sidewalk or on an open section road places the hydrant less than five (5) feet from the road right-of-way/property line, the Designer shall obtain a utility easement from the property owner.

6. Hydrant valves shall be located next to the tee on all fire hydrant leads.

7. The bury length required for each fire and blow-off hydrant shall be noted on the plans. The bury length shall be determined by the vertical distance from the applicable existing or proposed grade at the hydrant to the invert of the branch of the tee in the main line. The accuracy of this length is to be given to the nearest half (0.50) of a foot. The main line tee elevation shall be designed to provide for a level run from the main to the hydrant and maintain adequate cover over the hydrant lead. For this reason, the minimum bury length is four (4) feet. The maximum bury length is eight (8) feet and additional length will require the Chief Engineer's approval. The invert elevation and station of the hydrant tee on the main line shall be noted on the profile. The bury line elevation and bury length of the hydrant shall be noted in the plan view. For installation on existing grades, bury lengths shall be determined from field surveys.

8. Profiles will be required in the following cases:

    a. When the fire hydrant lead crosses other utilities, except when it is clear from the profile of the water main that the hydrant lead has sufficient clearance.

    b. When the grade/ground line at the hydrant location and over the hydrant lead is not the same as the mainline pipe.

c. Fire hydrant leads should not have bends, offsets, etc. between the fire hydrant tee and the fire hydrant if at all possible.

9. Where bends are required for fire hydrant leads, the Designer shall use smooth transition, restrained, s-bends specifically designed for hydrant use.

10. Hydrants shall be restrained at every joint with mechanical joint restraints from the tee through to the hydrant or by a combination of mechanical joint restraints, ¾-inch threaded steel bars, and concrete buttresses.

11. Hydrants shall be located along roadways with a spacing of 450 feet in one and two-family dwelling unit areas and a hydrant spacing of 300 feet in all other areas. Hydrant spacing is measured along the water main. Hydrants may be required to be located at closer intervals if the existing or proposed buildings are located at a distance greater than normal from the roadway.

12. A fire hydrant shall be located at the neck of all cul-de-sacs or tee turnarounds where the water main terminates within the roadway. When planning fire hydrant placement, the Designer shall first position a fire hydrant at the neck of each cul-de-sac having a terminating water line; and then, measure the required distance for the next fire hydrant placement. As always, fire hydrants shall be located at intersections whenever possible. In many cases, it will be necessary to place a fire hydrant at both the neck of the cul-de-sac and at a nearby intersection, even if the distance between the two fire hydrants is closer than the required spacing.

13. Fire hydrants must be carefully placed to prevent interference with pedestrian and vehicular movement and to be accessible to Fire Department vehicles. Hydrants are usually located at the point of curvature of curbs at intersections and at common property lines, clear of driveway entrances.

14. Fire hydrants, if not placed behind a protective curb, shall be protected by bollards in areas such as parking lots, where they are exposed to damage by vehicular traffic.

E. Blow-off Connections

1. Flush type hydrants, for use as a blow-off for maintenance activities, flushing and periodic removal of accumulated sediments shall be installed at the lowest elevation point of a water main system. They shall also be placed at the end of all dead-end mains that do not have a fire hydrant. A witness post shall be located near all blow-off connections.

2. Fire hydrants may be utilized for permanent blow-offs when the location requirements for both types of hydrants are accommodated. If a fire hydrant

is used in lieu of a blow-off, the hydrant lead must be set within two feet of the end of the water main.

3. If possible, the blow-off shall be located as close as possible to an existing/proposed sanitary sewer manhole to allow for the disposal of the chlorinated water into the manhole. Under no conditions can the blow-off discharge piping be connected directly to a storm drain pipe or sanitary sewer pipe and/or any type of storm drain or sanitary sewer structure (inlet, manhole, etc.).

F. Air Valves

1. General

   a. Under normal operating pressures within the distribution system encountered in St. Mary's County, very little air is expected to accumulate.

      Fire hydrants set at summits can be manually operated to release or admit air under filling or emptying conditions. Furthermore, since the collapse of water lines from negative pressures resulting from draining or a main break is normally not a factor with the type of pipe ordinarily employed, air vacuum valves may not be required under ordinary conditions in the distribution system.

   b. Air release valves and air vacuum valves are two basic types of air valves that are utilized to prevent or reduce the occurrence of air pockets and vacuum conditions, respectively, within pipelines. The two types of valves can be joined together to form a combination air valve that performs the functions of both. Air release valves contain a small discharge orifice (1/2 inch or less) that allows the escape of accumulated air under normal pipeline operating conditions. Air vacuum valves contain a large discharge orifice (1/2 inch or larger) that allows the escape of large quantities of air during line filling and permits air to enter during line draining, with relatively small pressure differentials across the valves.

   c. Air valves shall be stainless steel as noted in the specifications.

2. Connecting the air release valve, air vacuum valves or combination air release and vacuum valve to the main pipeline shall be as follows:

   a. For a valve with a 2-inch inlet or smaller, use a tapped corporation stop.

b. The air release valve or combination air release and vacuum valve shall be centered on a twenty (20) foot length of pipe, with both ends of the pipe section having the same elevation.

3. For air valve manhole and valve construction, details see the Standard Details. The following shall be shown on the plans for air valves: the size of valve and orifice size. The following shall be shown on the plans for combination air release and air vacuum valves:

   a. Size of both valves
   b. Orifice size of the air release valve
   c. Model numbers
   d. Piping layout
   e. Pressure rating of the gate valve which shall be provided between the air vacuum valve and the air release valve.

   The water main and manhole shall be designed at sufficient depth to accommodate access and maintenance of the air release, air vacuum or combination air release and air vacuum valve.

G. Specialty Valves

1. Water zone division valves shall be provided when directed by the Chief Engineer. The following information shall be provided on the drawings:

   a. Label the valve as a division valve and indicate size.
   b. Show the pressure zone lines and indicate the zone pressure on each side of the valve.
   c. Indicate if the valve shall be normally closed or open.

2. Altitude Valves

   a. Altitude valves are designed for installation at water storage facilities (elevated tanks, standpipes or reservoirs) to control the water level at a specified level and prevent overflow.

   b. The Chief Engineer shall determine the need for and the type of altitude valve required for a facility. The Designer shall design a vault to house the valve and appurtenances and shall locate the vault outside of a traffic area. The vault shall contain a watertight, H-20 load sustaining, equipment access hatch designed directly over the center of the altitude valve, large enough to permit the removal of the valve. A watertight, H-20 load sustaining, personnel access hatch shall also be provided, with a minimum 36" by 36" opening.

c. Gate valves shall be provided on each side of the altitude valve for maintenance or removal of the altitude valve. A bypass shall also be provided around the altitude valve with a gate valve, which will normally be closed in service.

3. Pressure Reducing Valves (PRV)

a. A pressure reducing valve shall be designed whenever a water pipeline of high working pressure needs to be reduced to lower working pressure. The Commission utilizes individual PRV's and system PRV's. Individual PRV's are designed to reduce the incoming pressure on a single WHC for a single property. System PRV's are publicly owned and operated and are designed to reduce the pressure within the public water system. The Designer shall determine if the project requires installation of individual PRV's or the installation of a system PRV and vault.

b. Individual PRV's

The St. Mary's County Plumbing and Gas Code require the installation of an individual PRV and an approved relief device after the meter when the static pressure is over eighty-five (85) psi. The Designer shall identify on the plans, all lots where the static pressure will exceed eighty-five (85) psi. The location of the PRV shall be in the service line after its entrance to the building.

c. System PRVs

Under normal operating pressures within the distribution system in St. Mary's County, system PRV's are not needed. If a system PRV is required, the Designer shall determine the appropriate location for the PRV and submit the hydraulic analysis and proposed PRV location to the Chief Engineer for approval. After approval, the Designer shall determine the required sizes, type and pressure setting for the PRV.

For system PRV's, two PRV's are installed, one to handle peak fire flows and the other to handle low flows. Usually, the smaller PRV is adjusted for a discharge pressure setting of five (5) psi above the setting of the larger PRV so that the smaller PRV will handle the low flow requirements. The large PRV opens only when demands exceed the capacity of the smaller PRV and the pressure drops to the pressure setting of the large PRV.

A vault shall be designed to house the system PRV and appurtenances. An equipment access opening of sufficient size shall be designed directly over the center of the PRV. Where two PRV's are required, the hatch shall be

placed over the larger of the two PRV's. A personnel access hatch shall be provided with a 36-inch by 36-inch opening. The hatches shall be designed as watertight hatches and capable of sustaining an H20 load.

Gate valves shall be provided on each side of the PRV, for maintenance or removal of the PRV. Typically, the PRV is located on a branch line off of the primary water main between two tee connections. The branch from the first tee extends through the PRV vault and back to the second tee connection at the primary main. A divisional (gate) valve, normally closed, is installed between the two tee connections on the primary main, which act as a bypass line to the PRV and vault.

Three (3) inch and larger PRV's shall have flanged ends and the pressure rating shall be designed similar to gate valves, class 125 ANSI valves. PRV's, smaller than 3-inches, shall have threaded ends (National Pipe Threads). The setting information for the PRV's shall be noted on the plans.

In most cases, when PRV's are required, the installation of a pressure relief valve will also be required.

4. Pressure Relief Valves

   a. Pressure relief valves are designed to protect the water pipeline against excessive pressure and shall be used in conditions where the water pipeline has a pressure reducing valve connection from a higher pressure zone. The Chief Engineer will notify the Designer if the project requires the installation of a pressure relief valve and vault.

   b. A vault shall be designed to house the valve and appurtenances with hatches for equipment and personnel. The vault shall be similar to that required for the pressure reducing valve.

   c. An isolation gate valve shall be installed on the pressure side of the pressure relief valve at the branch connection to the mainline water pipe. The discharge of the pressure relief valve shall be designed to discharge to the atmosphere. The discharge piping shall not connect directly into a storm drain inlet, manhole or structure. The discharge end of the pipe shall have a flap valve to eliminate any potential cross-connection condition. Provide an end wall for the discharge piping in the location of the flap valve.

   d. The pressure setting information for the pressure relief valves shall be noted on the plans.

5. Post Indicator Valve (PIV)

    a. Post Indicator Valves are above ground extensions for Fire Department use and are required on all commercial, industrial, and multi-family sprinkler systems. The PIV shall be located at least 25 feet from the building in a grassed area.

H. Tunnels and Casing Sleeves

1. Water mains are placed in tunnels or casing sleeves under railroads and highways or in other locations where open cut excavation is not allowed or is excessive in cost.

2. Steel liner plates shall be hot dipped galvanized and coated with bitumastic material according to the Standard Specifications. Steel casing sleeves shall be lined with bitumastic material, on the inside only, according to the Standard Specifications.

3. HDPE casings may be used with the approval of the State Highway Administration.

4. The ends of casing sleeves shall be bulkheaded to prevent the entry of foreign objects. The water main included within the casing or tunnel shall be anchored and designed for all internal and external forces, which can be transmitted without consideration of the casing pipe. The water main within the casing shall have restrained joints. The annular space between the casing pipe and the water main shall be filled with sand. Joints in the main shall be placed immediately outside the bulkhead to allow flexibility and to relieve shear stresses on the pipe.

5. Grouting plugs shall be provided in tunnel liners and steel casing sleeves 36 inches in diameter and larger, to facilitate pressure grouting of the annular space outside of the tunnel.

6. Water mains under state roads shall be installed in a sleeve as required by the State Highway Administration.

I. Horizontal Directional Drilling

1. Horizontal directional drilling (HDD) may be required to be used to minimize traffic disruption, restoration or as a requirement of an approving agency.

2. The contractor must perform subsurface investigations to determine the applicability of HDD and to determine groundwater depths.

2.4 Water House Connections

A. General

Water house connections (WHC's) provide the connections from the distribution main to the consumer's system at a convenient point along the property line. Small WHC's extend from the main to the property line using flexible pipe, terminating with a valve at the property line. All services are metered and the current practice for the Commission on new services is to place meters at the property line for single family homes; individual meters for each townhome and condo unit shall be placed in a meter room; a meter for each multi-family apartment building shall be placed in a meter room; and in a mechanical room for commercial property. Except for the meters, the Commission's construction work, as well as its liability for the WHC, stops at the property line.

B. Single Family Residences

1. WHCs shall be shown in the plan view as a pipe off of the mainline pipe to the front property line of the dwelling or building and shall be within the roadway right-of-way. Occasionally, water mains may be constructed within public easements abutting or extending through a property. WHCs may be provided to properties abutting the public easement in which the water main is constructed. In this case, the public WHC extends from the water main to the edge of the public easement.

2. The location for a single WHC is generally at the center of the lot frontage unless the existing well location permits a more accurate setting, and must be a minimum of 10 feet from the location selected for the sewer house connection. If possible, the WHCs shall be no closer than ten (10) feet to the edge of the side property lines. The water service connection shall originate at the water main with the installation of an appropriate saddle, corporation stop, one and one-quarter-inch (1¼"), or larger, (size will vary based on sprinkler requirements) Type K copper tubing and the in-ground meter installation (at the property line). The in-ground meter installation shall consist of a Ford coppersetter with angle ball valve, angle dual check valve, pit setter and frame, and cover.

3. All adjacent improved lots which are not a part of the proposed development but which could be served by the water main shall be provided with an appropriately sized service connection. The location of each service connection shall be clearly shown on the engineering plans.

4. All WHCs shall be designed a minimum 5' - 0" clear horizontally from permanent structures and other utility appurtenances such as storm drain

inlets, street lighting poles, transformers, etc. and adjacent parallel piping, with the exception of SHCs.

5. All water meters shall be encased in concrete when located within 3 feet of a paved driveway.

C. Multi-family, Commercial and Industrial Facilities

1. The size of the WHC is based on the usage requirements of each building as determined by the Designer. The St. Mary's County Plumbing and Gasfitting Code shall be used for estimating demands.

2. The Designer shall submit computations to justify the sizing of the WHC. Automatic sprinkler systems shall be installed in all buildings in accordance with LUGM requirements and shall be in accordance with the plumbing code. Sprinkler lead design and construction shall be in accordance with NFPA 13 and NFPA 13R. Dual one-way check valves shall be placed in the sprinkler leads so that under no circumstance can water from the building sprinkler system piping reverse flow into the domestic service pipelines.

3. WHCs or service connections for on-site water systems (3-inch and larger) must be located based on the design of the on-site system. The design of the connection will be typical of a small diameter water pipeline and shall be based on the design requirements for water pipelines.

4. Where large meters (1 1/2-inch to 12-inches in size) are required, the Designer will be required to submit the flow calculations to substantiate the meter sizing to the Chief Engineer.

5. WHCs or service connections to accommodate fire flows require a special design for each installation. Approved backflow preventers with metered bypass or compound meters are required when fire flows are included in the WHC. Compound meters are employed when design flow rates to a building, or groups of buildings, are high enough to require their installation to obtain accurate meter readings under all flow rates.

D. Limits of Public Water House Connections (in Public Rights-of-Way)

1. WHCs 2-inch and smaller

    a. The WHC for inside meter settings shall terminate at the property line with a curb stop and a two-foot stub. The curb stop must not be located within a curb or gutter section, and it must be located in a public easement

or right-of-way. The Designer shall avoid locating the curb stop within a sidewalk, driveway or any other paved surfaces.

b. On rural roads, when the right-of-way limit ends at the edge of the paving or at the curb or gutter lines, the Designer will be required to provide the Commission with a right-of-way or easement for the WHC.

c. The WHC for outside meter settings shall terminate within the roadway right of way at the location shown in the Standard Details with an outside meter vault containing all internal piping and a two-foot stub.

d. On private roads, water easements shall be sufficiently wide to accommodate curb stops outside the paved area and within the public easement.

2. WHCs 4-inch and larger

a. The WHC for inside meter settings shall terminate within the roadway right-of-way or public easement at the location shown and in the manner illustrated in Standard Details.

b. The WHC for outside meter settings shall terminate within the roadway right-of-way or public easement at the location shown in the Standard Details with a pre-cast or cast-in-place concrete vault with all internal piping (see Standard Details for piping layout and vault dimensions).

E. Location of Meters

Any water meter located within 3 feet of any traffic-bearing surface shall be encased with concrete. Please refer to the detail for more information.

1. WHCs 2-inch and smaller

a. WHCs 2" and smaller shall be designed to accommodate outside meter settings unless otherwise specified by the Chief Engineer during the preliminary design phase. The Designer must obtain approval from the Chief Engineer for any or all outside meter settings that are not specified by the Commission.

b. The Designer shall avoid locating the outside meter setting within driveways or other paved surfaces whenever possible. The preferred location of the outside meter setting is in a grass area within the road right-of-way and outside of traffic bearing areas.

c. Provide a minimum 5' - 0" horizontal clearance between meter setting and all permanent structures such as storm drain inlets, street light poles, other utility appurtenances and pipelines.

d. Properties with private on-site water house connections longer than 200 feet shall require an outside meter vault located at the property line.

2. WHCs 4-inch and larger

a. During the preliminary design phase, the Designer shall coordinate the location of the meter with the Chief Engineer (Inside or outside the dwelling/building). Also, see the requirements for large water meters in the St. Mary's County Plumbing and Gas Code.

3. All meters larger than 5/8-inch x ¾-inch must be purchased by the owner from a Commission-approved vendor.

F. Allowable Pipe Material for WHCs (See Table 2.3 Pipe Materials)

1. For WHCs 2-inch and smaller, the pipe material shall be copper or PVC with tracer wire.

2. For WHCs 4-inch and larger, the pipe material shall be DIP or PVC copper tracer wire.

G. Cover

The normal minimum cover over WHC's shall be 3'-6" except at crossings over other utilities, where a minimum cover of 3'-0" shall be maintained. The maximum ground cover permitted over WHCs is 6'-0."

END OF CHAPTER 2