

STAFFORD COUNTY

**DEPARTMENT OF UTILITIES**

**WATER AND SEWER**

**DESIGN AND CONSTRUCTION STANDARDS**



APRIL 2017

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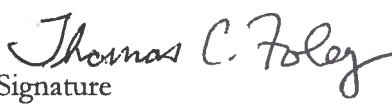
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Signature

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**TABLE OF CONTENTS**

GENERAL WATER AND SEWER STANDARDS .....	G-2
1.1 General Requirements .....	G-2
1.1.1 Introduction.....	G-2
1.1.2 Project Plans Review and Permitting.....	G-2
1.1.3 Utility Coordination.....	G-4
1.1.4 Definitions and Abbreviations.....	G-4
1.1.5 Soil Erosion and Sediment Control .....	G-5
1.1.6 Easements .....	G-5
1.1.7 Protection of Public Utilities.....	G-7
1.1.8 Inspections.....	G-7
1.1.9 Materials .....	G-9
1.1.10 Revisions of Approved Project Plans .....	G-9
1.1.11 Violations .....	G-9
1.1.12 Tentative Acceptance Inspection .....	G-10
1.1.13 Acceptance by County of Completed Facilities .....	G-10
1.1.14 Twelve Month Inspection .....	G-12
1.1.15 Final Inspection .....	G-12
1.2 Project Plans .....	G-12
1.2.1 General Instructions.....	G-12
1.2.2 Construction Drawings.....	G-13
1.2.3 Record Drawings .....	G-14
1.3 Water and Sewer Design Standards .....	G-16
1.3.1 Protection of Water Supplies .....	G-16
1.3.2 Separation of Water and Sewer Lines.....	G-17
1.3.3 House Service Separation .....	G-18
1.3.4 Relationship with Other Utilities.....	G-18
1.3.5 Protection of Roadways.....	G-18
1.3.6 Water and Sanitary Sewer Lines Under Pavements in VDOT Rights-of-Way.....	G-19
1.3.7 Installation Under Streams .....	G-19
1.3.8 Valves .....	G-19
1.4 Water and Sewer Construction Standards.....	G-19
1.4.1 Safety .....	G-19
1.4.2 Sheet piling, Shoring and Bracing.....	G-20

1.4.3	Trenching and Backfilling.....	G-20
1.4.4	Pipe Installation .....	G-21
1.4.5	Backfilling .....	G-22
1.4.6	Tunneling.....	G-25
1.4.7	Casing Pipe .....	G-25
WATER SUPPLY SYSTEMS STANDARDS .....		W-2
2.1	Water Mains and Appurtenances.....	W-2
2.1.1	Hydraulic Design .....	W-2
2.1.2	Location .....	W-3
2.1.3	Water Main Sizes .....	W-3
2.1.4	Fire Hydrants.....	W-4
2.1.5	Fire Flows .....	W-5
2.1.6	Sprinkler Systems.....	W-6
2.1.7	Flushing Hydrants .....	W-7
2.1.8	Combination Air Vacuum and Air Release Valve .....	W-7
2.1.9	Water Valves.....	W-7
2.1.10	Tapping Sleeves.....	W-7
2.1.11	Valve Boxes .....	W-8
2.1.12	Minimum Cover.....	W-8
2.1.13	Potable Water Sampling Stations .....	W-8
2.1.14	Changes of Alignment .....	W-8
2.2	Water Services .....	W-9
2.2.1	Water Service Connections .....	W-9
2.2.2	Water Meters .....	W-9
2.2.3	Backflow Preventers.....	W-10
2.2.4	Private Water Service Connections.....	W-11
2.3	Surface Water Crossings .....	W-11
2.3.1	Above Water Crossing.....	W-11
2.3.2	Under Water Crossing.....	W-11
2.4	Materials .....	W-11
2.4.1	Ductile Iron Pipe .....	W-12
2.4.2	Polyvinyl Chloride .....	W-12
2.4.3	Copper Pipe.....	W-12
2.4.4	Cross Linked Polyethylene .....	W-12
2.4.5	High Density Polyethylene (HDPE).....	W-13

2.4.6	Fire Hydrants.....	W-13
2.4.7	Water Valves and Tapping Sleeves .....	W-13
2.4.8	Valve Boxes .....	W-15
2.4.9	Fittings.....	W-15
2.4.10	Valves .....	W-15
2.4.11	Grey Iron Castings .....	W-15
2.5	Water Main Construction .....	W-16
2.5.1	Coordination.....	W-16
2.5.2	General Requirements.....	W-16
2.5.3	Installation of Pipe and Fittings.....	W-16
2.5.4	Fire Hydrant Construction.....	W-18
2.5.5	Road Crossings.....	W-18
2.5.6	Testing.....	W-18
2.5.7	Disinfection .....	W-19
2.5.8	Special Consideration for Large Diameter Pipe.....	W-20
2.5.9	Abandoning Water Service.....	W-20
2.5.10	Fire Sprinkler System .....	W-20
2.5.11	Irrigation System.....	W-20
SANITARY SEWER SYSTEMS STANDARDS .....		S-2
3.1	General Requirements.....	S-2
3.1.1	Location .....	S-2
3.1.2	Size.....	S-2
3.1.3	Depth of Sewer .....	S-2
3.1.4	Hydraulic Design Criteria .....	S-3
3.1.5	Slope Anchorage.....	S-4
3.1.6	Stream Crossing .....	S-4
3.1.7	Depressed Sewers (Inverted Siphons).....	S-5
3.1.8	Construction in Fill.....	S-5
3.1.9	Protection of Water Supplies .....	S-5
3.2	Manholes .....	S-5
3.2.1	Manhole Replacements.....	S-5
3.2.2	Drop Manholes .....	S-5
3.2.3	Manhole Frames and Covers .....	S-6
3.2.4	Manhole Connections .....	S-6
3.2.5	Ventilation.....	S-7

3.2.6	Flow Channel .....	S-7
3.2.7	Dog House Manholes .....	S-7
3.2.8	Manhole Requirements .....	S-7
3.2.9	Waterproof Manhole Inserts.....	S-7
3.2.10	Pipe Fittings.....	S-7
3.2.11	Acid Resistant Manholes .....	S-7
3.2.12	Existing Manhole Modifications .....	S-8
3.3	Sewer Services .....	S-8
3.3.1	Sewer House Connections .....	S-8
3.3.2	Cleanouts.....	S-10
3.3.3	Private Sewer Connections.....	S-10
3.4	Materials .....	S-10
3.4.1	Ductile Iron Pipe .....	S-10
3.4.2	Polyvinyl Chloride (PVC) .....	S-11
3.4.3	Manholes .....	S-11
3.4.4	Manhole Frames and Covers .....	S-12
3.4.5	Valves .....	S-12
3.5	Sewer Construction .....	S-12
3.5.1	General Requirements.....	S-12
3.5.2	Bedding .....	S-13
3.5.3	Pipe Installation .....	S-13
3.5.4	Service Connections .....	S-13
3.5.5	Manholes .....	S-14
3.5.6	Inspection and Testing.....	S-14
3.5.7	Abandoning Sewer Service.....	S-16
	SEWAGE PUMPING STATION STANDARDS .....	PS-2
4.1	General .....	PS-2
4.1.1	General Requirements.....	PS-2
4.1.2	General Design Requirements .....	PS-2
4.1.3	Capacity Design .....	PS-3
4.1.4	Power Source.....	PS-3
4.2	Materials and Equipment.....	PS-4
4.2.1	Pumps.....	PS-4
4.2.2	Motors .....	PS-4
4.2.3	Controls and Starters.....	PS-4

4.2.4	Standby Power Source .....	PS-4
4.2.5	Flow Meter.....	PS-5
4.2.6	Comminutor .....	PS-5
4.2.7	Telemetry System.....	PS-5
4.2.8	Wet Wells .....	PS-5
4.2.9	Valves .....	PS-6
4.2.10	Force Mains .....	PS-6
4.3	Low Pressure Sewer Systems .....	PS-7
4.3.1	Introduction.....	PS-7
4.3.2	Grinder Pump System.....	PS-7
4.3.3	Low Pressure Sewer Mains.....	PS-8
4.4	Vacuum Sewer Systems.....	PS-9
	STANDARD DETAILS .....	SD-2
5.1	General Details.....	SD-2
5.2	Water Details .....	SD-3
5.3	Sewer Details .....	SD-4
5.4	Pumping Station Details .....	SD-5
	APPENDIX .....	A-1
	Appendix 1 – Water Meter Sizing Form	
	Appendix 2 – Construction Permit	
	Appendix 3 – Water System Flow Analysis Application	
	Appendix 4 – Sanitary Sewer Lateral Schedule	
	Appendix 5 – Construction Notes, Water & Sewer	
	Appendix 6 – Water and Sewer Notes – Administrative	
	Appendix 7 – Reord Drawing Checklist	
	AL 1 – Approved Products List	

**SECTION 1**

**GENERAL WATER AND SEWER STANDARDS**





## **GENERAL WATER AND SEWER STANDARDS**

### **1.1 GENERAL REQUIREMENTS**

#### **1.1.1 Introduction**

The Stafford County Water and Sewer Design and Construction Standards set forth the requirements that govern the design and construction of all water mains, sanitary sewers and wastewater pumping stations that will become part of the County's public water and sewer system.

It is the County's desire to encourage qualified professionals to seek new and better solutions to complicated technical problems. However, in the interest of orderly controlled development and expediting the processing of plans and construction, certain standard procedures and the use of these design standards are necessary.

This manual is supplementary to the Virginia Waterworks Regulations and the Virginia Sewage Collection and Treatment Regulations and to the requirements of other local, State and Federal Agencies having jurisdiction. Where conflicts exist, the more stringent requirements shall apply. Nothing herein shall be deemed to waive or modify other requirements of existing regulations and law. It is encouraged that conflicts be brought to the attention of the Director of Utilities.

The Director of Utilities, in administering these standards, shall treat them as mandates rather than guidelines unless the language clearly specifies otherwise. The Director may allow for a variation of a given standard where the effect of such variation is in keeping with established engineering practice and procedure. Variations from mandatory policies or requirements will not be permitted. In all cases, deviations from these Standards must be specifically called out and shown on the project plans. Approval of the project plans by the Director of Utilities is approval of the deviation only if the deviation is identified as such on the project plans.

Users of these standards should keep in mind that it is the goal of the County to provide to its customers the best public water and sewer system available. Design engineers, material suppliers and construction contractors should consider their efforts to be no less than would be acceptable to them if they were the owner, operator and maintainer of the system. All public utility construction in Stafford County shall be equal to or better than these standards.

Comments or suggestions on this document should be submitted in writing to the Product and Design Review Committee.

#### **1.1.2 Project Plans Review and Permitting**

All project plans shall be submitted to the County for review in accordance with Section 22-76 and Article XIV of the County Code. Project plans are generally submitted to the Department of Planning for review by affected agencies and departments. The applicant shall follow Department of Planning procedures in submitting new and revised project plans

for review. After all comments have been resolved, the applicant shall submit project plans to the Department of Planning for signatures and distribution of approved project plans. Should a project involve only the Department of Utilities, the Department of Utilities may direct the applicant to submit project plans directly to the Department of Utilities for review and approval.

Detailed review will be performed by VDOT and Stafford County.

Under provisions established by the VDH, the County has local review and approval authority for water mains of twelve inch (12") diameter and smaller.

All project plans containing water mains larger than twelve-inch (12") diameter, water pumping stations, or water storage tanks must be submitted to VDH for review and approval. These plans will be submitted to the VDH by the County after review and comment by the County.

The County will review all sanitary sewer projects. No sanitary sewer project may be constructed in Stafford County without formal approval by the County. Sewer lines 12 inches and smaller in diameter are waived from the requirement for DEQ review, although the County does not have local review authority from DEQ.

All project plans containing gravity sewer mains or force mains larger than twelve-inch (12") diameter, wastewater pumping stations, low pressure sewer systems with grinder pumps maintained by the homeowner, or vacuum sewer systems, must be submitted to DEQ for review and approval. These plans will be submitted to the DEQ by the County after review and comment by the County.

Project plans approval is valid for a period of twelve (12) months from the date of approval. If the construction is not in progress at the end of that period, or if construction becomes inactive for a period of twelve (12) months, the project plan approval shall become void. Project plans then will have to be resubmitted as a new project, if deemed necessary by the County, to conform to the most current Standards.

After approved project plans are received by the Department of Utilities, the owner may apply for a water/sewer construction permit from the Department of Utilities. The construction application form will be prepared by the Department of Utilities and shall include the owner's certification that a civil engineer has been retained to certify construction as required by Section 1.1.12.E and to provide Record Drawings. A sample form is included at Appendix 2. The owner shall obtain an original form from the Department of Utilities, complete Sections I and II, and return the application form to the Department of Utilities a minimum of five working days before a construction permit is requested. The Department of Utilities will retain the form until an officially approved set of plans is received from the Planning Department, after which it will be available for payment and issue. A complete application for the construction permit (i.e. approved and paid for) shall be in the hands of the Department of Utilities a minimum of two (2) County working days prior to the commencement of construction. No construction of any kind involving water and/or sewer facilities shall be performed until all fees have been paid and the Department of Utilities has issued a construction permit.

In addition to the Department of Utilities construction permit, the owner/developer is responsible for obtaining all other required permits from all other regulatory agencies, such as VDOT, DEQ, and VDH before construction can be started. All permits and an approved set of project plans shall be available for inspection by the utility inspector at the construction site.

### 1.1.3 Utility Coordination

The design engineer shall coordinate water and sewer design with storm drains and all other utility design and construction so that there are no conflicts. The location of both future and existing utilities must be shown on the construction plans and profiles.

The design engineer shall be responsible for obtaining precise locations of all existing utilities and physical features through field surveys and current record locations. It may be necessary for the engineer to dig test holes to verify existing utility line locations. The test hole information shall be shown on the plan and profile views.

The contractor shall call "Miss Utility" at 811 at least 48 hours in advance of initiation of construction.

### 1.1.4 Definitions and Abbreviations

The following definitions and abbreviations are included for reference.

#### Definitions

Board	Stafford County Board of Supervisors.
Department Director	Stafford County Department of Utilities
Engineer	The professional engineer or qualified licensed surveyor responsible for the project plans and specifications.
Project Plans	The site plan, subdivision plan or public improvement documents containing the construction drawings and specifications for water and/or wastewater systems.

#### Abbreviations and Symbols

Reference to a technical society, institution, association, governmental authority or design parameter is made in accordance with the following abbreviations:

AASHTO	American Association of State Highway and Transportation Officials
AGC	Associated General Contractors of America, Inc.
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
DEQ	Virginia Department of Environmental Quality

fps	feet per second
gpm	gallons per minute
ISO	Insurance Services Office
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
psi	pounds per square inch
SSPC	Steel Structures Painting Council
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VUSBC	Virginia Uniform Statewide Building Code
WEF	Water Environment Federation
VESCH	Virginia Erosion and Sediment Control Handbook

All definitions of Section 25-1 of the Stafford County Code are included by reference.

### **1.1.5 Soil Erosion and Sediment Control**

The installation of water and sewer mains and the construction of water and wastewater pumping stations are subject to Chapter 11 of the Stafford County Code, Erosion and Sediment Control. No project shall begin until the proper permits are obtained and the required erosion and sediment control devices are in place and functioning. Erosion and Sediment control measures must be shown on the project plans.

### **1.1.6 Easements**

Water and sewer utilities that will become the property of the County, and that do not lie wholly within a public right-of-way, shall require exclusive easements dedicated to the County for public use. In specific cases when a 20 foot wide exclusive easement would not allow sufficient room for other parallel utilities such as electricity, gas, telephone or cable television, a 10 foot wide exclusive water-sanitary sewer easement centered on the water or sanitary sewer line may be allowed by the department with the remaining easement designated as no-exclusive.

Before site plans, subdivision construction plans, infrastructure plans, or other plans that include water and/or sewer construction can be approved by the Department of Utilities, all off-site easements for water and sewer lines to be constructed from the plans must be obtained and recorded with the grantee being the County of Stafford. Final subdivision plats cannot be filed until all easements necessary for water and sewer service for the project are obtained and recorded.

When deemed necessary by the Director and in order to assure maximum utilization of the public water and/or sewer system, easements shall be extended to adjacent properties. Sizes, elevations, and alignments of water and sewer mains and appurtenances shall be designed to include adjacent parcels. Where future water or sewer main construction may adversely affect nearby residents or will be logically required in the future, the Director may require that water and/or sewer mains also be extended to adjacent properties. It may also be necessary that appropriate easements be provided to allow adjacent properties access to

water and sanitary sewer lines. In order to assure routine and emergency maintenance, access (ingress/egress) easements shall be provided.

Water mains may be constructed on private property provided that the property owner has provided a duly recorded easement with a minimum width of 20 feet centered on the water main. Increased easement widths may be required by the Director due to line size or access requirements.

Sewer mains may be constructed on private property provided that the owner has provided a duly recorded easement with a minimum width of 20 feet centered on the sewer main. The minimum easement width between houses or other structures shall be 25 feet. Where feasible, the easement between houses or other structures shall be on common property and not on the lots where the structures are located.

Where a 25-foot easement on common property is not feasible for sewer mains located between houses or other structures, the minimum easement width shall be 25 feet with the sewer main centered within the easement. In addition, the following restrictions shall apply:

1. The 25-foot easement shall be located entirely upon one of the two adjacent properties.
2. Deed restrictions shall be recorded for the property the easement is located upon including, at a minimum:
  - a. A prohibition against the planting of any shrubs, trees, or plantings other than grass within the easement
  - b. A prohibition against the location of any structures within the easement
  - c. A prohibition against the erection of any fencing across the width of the easement that prohibits access to the easement for maintenance or repair of the sewer main.
  - d. A gate that easily opens to provide a passage of at least 20 feet in width may be installed in the easement.

Where the sewer is in excess of 10 feet deep and located in open and less-densely developed areas or between houses or other structures, the easement width shall be increased on a 1 to 2 depth to width ratio.

Where a water-sanitary sewer easement is originally intended or is planned to contain two or more pipes, the easement shall be increased 10 feet in width for each pipe exceeding one width for all pipes 10 feet from the edges of the easement.

All easements shall be restored as nearly as possible to their original condition after construction. An acceptable ground cover shall be sown or planted and necessary measures to prevent erosion shall be completed within 30 days of pipe installation.

### **1.1.7 Protection of Public Utilities**

The owner or developer of private property where water and/or sewer lines will be laid shall be responsible for ensuring that manhole covers, valve boxes, etc. are not covered or damaged. It shall be the responsibility of the owner or developer to replace pavement, sidewalks, and other improvements damaged or removed by the County while performing any maintenance functions within a dedicated easement located on private property. Examples include: Shopping centers, private roads, parking lots, or other private property.

Changes of grade, fences, buildings, and other permanent structures shall not be constructed within a water or sewer easement unless the Director grants specific permission. No shrubs, landscaping, or other obstacles shall be placed within a water or sewer easement that would render the easement inaccessible for equipment. Trees may not be placed in an easement under any circumstances. The Department of Utilities is not responsible for any damages to any structures, landscaping, or other facilities that have been placed within a water or sewer easement.

### **1.1.8 Inspections**

In accordance with Section 25-80 of the County Code, all water and sewer construction work shall be inspected by the Department of Utilities.

#### **1.1.8.1 Inspections in General**

The owner, developer, or contractor shall employ a certified testing firm to conduct laboratory soils testing and field density testing for all backfill operations. The contractor shall schedule soil sampling and laboratory testing for all backfill materials sufficiently in advance so that results are available in the field before each material is used. The contractor shall ensure that a trained soils technician is on site at all times when backfill operations are in progress. For utility trenches, each lift shall be tested at intervals not exceeding 100 linear feet. More frequent testing shall be conducted if directed by the Utilities Inspector. Field reports shall be provided to the Utilities Inspector on a daily basis. Copies reviewed by a Professional Engineer shall be provided to the Utilities Inspector on a bi-weekly basis with a statement as to whether the compaction meets project requirements. At the end of construction, the engineer shall certify that all compaction involving utility work met project requirements. Any underground construction not inspected and approved prior to backfilling will be required to be removed and reinstalled before acceptance.

#### **1.1.8.2 Testing for Construction under Pavements in VDOT Right-of-Way**

Stafford County will test the installation of waterlines, sanitary sewers, and appurtenances to be located under pavements as follows:

##### **A. Test Methods**

The following test methods will be used:

1. VTM-1: Laboratory Determination of Theoretical Maximum Density Optimum Moisture Content of Soils, Granular Subbase and Base Materials.
2. VTM-10: Determining Percent of Moisture and Density of Soils and Asphalt (Nuclear Method).
3. VTM-12: Use of One-Point Proctor Density
4. AASHTO-T191: Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.

#### B. Testing Frequency

Testing Frequency will be in accordance with VDOT Materials Division Manual of Instruction Section 309, Project Sampling Testing and Inspection Section 309.01 Density Control:

1. Section (5) Backfill for pipes. The test pattern for pipes requires the test pattern to begin at 6" above and will continue for each compacted 6" lift until the fill reaches design pavement subgrade or existing ground surface, whichever is lower. The lifts will continue until the top of the ground with select material that conforms to Sec 303 of the VDOT Materials Manual. The test frequency will be no greater than every 300 feet for fill material above the pipe. If there is less than 200 feet of pipe in a single segment or placed on a single day, then one density test for every two lifts shall be performed.
2. Section (9) Backfill for Manholes: Manholes shall have a minimum of one test (around the perimeter of the structure) every fourth 6" compacted layer until the top five feet of the structure. The test pattern after the first 4" compacted layer above the bedding will continue in 6" inches compacted lifts to the top on the structure. In the top five feet one test of every other lift around the perimeter of the structure is required.

#### C. Qualifications of Technicians

Field technicians must complete the VDOT Soils and Aggregate Compaction School for a VDOT Soils and Aggregate Certification. In addition, if there is concrete work associated with water or sanitary sewer construction, the field technician must complete the VDOT Concrete Field School for a VDOT Concrete Materials Certification.

#### D. Reporting Forms

Reporting forms shall conform to forms listed in VDOT Materials Division Manual of Instruction Section 317, Summary of Minimum Acceptable Sampling Requirement:

- a. TL-55 Report of Nuclear Test Section
- b. TL-125 (Sand-Cone Method)

c. TL-125A (One Point Proctor Method)

E. Report Submissions

Stafford County must submit the above reports, sealed by a professional engineer licensed in the Commonwealth of Virginia, to VDOT on a biweekly basis.

The county will submit one copy of all reports to:

Area Land Use Engineer (North)  
VDOT Fredericksburg District  
86 Deacon Road  
Fredericksburg, VA 22405

### 1.1.9 Materials

All materials shall be approved by the Stafford County Department of Utilities and listed on the Approved Products List where such a category exists on the list. See Chapter 6 for an explanation of the list and procedures for submitting products for approval. All materials incorporated into projects shall be new and meet the applicable manufacturing standards for each respective product.

### 1.1.10 Revisions of Approved Project Plans

In the event that an owner or developer desires to deviate from project plans that have been approved by the Director, or to make any changes or revisions therein, he shall make a request for authorization to do so to the Director, in writing, and state the reasons for the request. Revised project plans and other substantiating data shall accompany the request in such manner, form and quantity as was required for the original applications.

The Director has the authority to require the owner or developer to make changes in the types of materials and methods of construction if the actual field conditions are different from the conditions shown on the project plans.

### 1.1.11 Violations

When a utility inspector determines that a violation has occurred under the terms of these Standards, the inspector shall verbally notify the person in charge and specify what is required to correct the deficiency and when the correction is to be completed.

If the violation is not corrected in the time specified, the County may immediately serve notice of violation upon either the permittee or his agent in person or by registered or certified mail. Such notice may set forth the measures that must be completed in order to comply with these Standards and may specify a date by which such measures must be completed.

If the violation is not corrected by the specified date, the Director may take one or more of the following actions:



- A. Request the Commonwealth's Attorney to prosecute for conviction and fine or imprisonment pursuant to the appropriate statute;
- B. Request the County Attorney to obtain an injunction to cease a continuing violation;
- C. Revoke the construction permit;
- D. Issue a stop work order for that portion of the work; and/or
- E. Authorize the Department of Utilities to perform emergency corrective work at the contractor's expense.

### **1.1.12 Tentative Acceptance Inspection**

At the completion of construction of any water and/or sewer project and after all other utilities, such as electricity, gas, telephone, and cable TV, are installed, the developer or owner responsible for construction shall notify the Director, in writing, that the work has been completed and request a tentative acceptance inspection. This request shall include the requirements of section 1.1.12.E. Upon sufficient justification, the Director may waive the requirement that all other utilities be installed prior to the tentative acceptance inspection.

Prior to the tentative acceptance inspection, 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.

Tentative acceptance inspections that are postponed due to contractor's failure to properly clean up the site may result in the assessment of additional charges to the developer/owner for the inspection.

Upon receipt of the request for a tentative acceptance inspection, the Director will make a comprehensive inspection of the constructed facilities, examining in detail for conformance of the work with approved project plans, alignment of sewer lines, infiltration leakage, workmanship, operation of equipment and other factors to the satisfaction of the Director and the best interest of the County.

A responsible representative of the developer or owner must accompany the Director or his designee on the tentative acceptance inspection provided for in this section. The developer or owner shall furnish whatever is necessary for conducting the inspection.

Deficiencies that are found to exist during the tentative acceptance inspection will be pointed out to the developer or owner. Subsequent to the inspection, the developer or owner will be furnished, in writing, a summary of the deficiencies found, the correction of which is required. Upon notification that all construction deficiencies have been corrected, the Director may re-inspect all such work.

### **1.1.13 Acceptance by County of Completed Facilities**

The Director will accept newly constructed water and sanitary sewer service facilities into the public utilities system of the County upon satisfaction of the following conditions:

- A. In the opinion of the Director, all certifications required by Sections 1.1.6 and 1.1.8 have been received and all requirements of Section 1.1.11 have been fulfilled or the developer or owner has made arrangements satisfactory to the Director to have them fulfilled.
- B. A set of record drawings meeting the requirements of Section 1.2.3 has been submitted and approved by the Director.
- C. All matters relative to specific contracts between the developer or owner and the County are in order.
- D. Payment has been made by the developer or owner for all fees relative to applications and inspections.
- E. A civil engineer registered as a Professional Engineer in the Commonwealth of Virginia certifies that the work has been completed in accordance with the approved plans and specifications.
- F. Explicit written understanding exists between the developer or owner and the Director that the developer or owner shall be responsible for and obligated to correct any deficiencies in construction for a period of one year from the date of tentative acceptance of the facilities by the county. This condition will be stipulated in the written form of acceptance issued by the Director.

Acceptance of the newly constructed facilities, when approved by the Director, will be made, in writing, to the developer or owner responsible for the construction. The issuance of the written forms of acceptance of any such facilities shall constitute an irrevocable agreement between the developer or owner responsible for construction and the Director that the Board of Supervisors, acting for the County and any of its officers, agents, servants, or employees, shall be saved harmless by the developer or owner from liability and responsibility of any nature and kind for the cost of, or payment for, labor and equipment used in construction of the accepted facilities or on account of any patented or unpatented invention, process, article or appliance manufactured for, or used in construction with the intended operation of, the accepted facilities.

Certificate of occupancy permits will not be issued for any buildings within any subdivision or development until the water and sewer facilities have been accepted in accordance with this Section.

Upon tentative acceptance of the improvements, the developer's or owner's security may be reduced to ten percent (10%) of the original security amount.

Deficiencies that are found to exist during the tentative acceptance inspection will be pointed out to the developer or owner. Subsequent to the inspection, the developer or

owner will be furnished, in writing, a summary of the deficiencies and the corrective actions required. Upon notification that all construction deficiencies have been corrected, the Director may re-inspect all such work.

#### **1.1.14 Twelve Month Inspection**

Within 12 months of the date of Tentative Acceptance, the Department of Utilities will re-inspect all items covered by the Tentative Acceptance Inspection. A responsible representative of the developer or owner will be invited to accompany the Director or his designee on the inspection. Deficiencies that are found to exist will be pointed out to the developer or owner. Subsequent to the inspection the owner will be furnished, in writing, a summary of deficiencies found, the correction of which is required. Upon notification that all deficiencies have been corrected, the Director may re-inspect the work. When all deficiencies have been corrected, and upon application to the County's Security Officer, the developer's maintenance security will be returned.

#### **1.1.15 Final Inspection**

Final inspection of the constructed water and sewer facilities will occur not less than one year after acceptance of the facilities and when final road paving has been completed.

Upon receipt of the request for a final inspection, the Director will make a comprehensive inspection of the constructed facilities, examining in detail for conformance of the work with approved project plans, alignment of sewer lines, infiltration leakage, workmanship, operation of equipment and other factors to the satisfaction of the Director and the best interest of the County.

A responsible representative of the developer or owner shall accompany the Director or his designee on the final inspection provided for in this section. The developer or owner shall furnish whatever is necessary for conducting the inspection.

When the Director has determined that the final inspection has been satisfactorily completed, the Director will release all security for the water and sewer improvements within the project.

### **1.2 PROJECT PLANS**

#### **1.2.1 General Instructions**

Construction drawings shall be submitted on standard 24" x 36" sheets. Drafting media shall be bond paper. Tracing paper or sepias are not acceptable. Plans submitted for electronic plan review shall be in PDF formats.

A cover sheet is required and shall contain the Owner's name and address, project title in large, distinctive letters, a vicinity map with a minimum area of 144 square inches drawn where possible on a scale of 1 inch equals 2,000 feet to indicate the general vicinity of the contemplated construction, an index to the plan sheets, and the signed stamp of the Owner or principal of the design engineering firm.

## 1.2.2 Construction Drawings

The construction drawings shall include a set of key sheets drawn at an appropriate scale. The key sheets shall show the location of all sewer manholes, direction of flow, valves, fire hydrants, flushing hydrants, sampling stations, water main sizes, sewer main sizes, type and class of pipe, and road crossings.

When a project will be constructed in phases and/or sections, the drawings shall clearly show the phase and/or section lines.

The drawings shall include a schedule for location of sewer house connections to include the station location, length, grade, invert elevation, ground elevation and depth at the property line.

The scale to be used for all drawings shall be as follows:

Plan Views: 1" = 50' (1" = 30' for high density multi-family developments)

Profiles: 1" = 50' Horizontal  
1" = 10' Vertical (maximum)  
1" = 5' Vertical (minimum)

Generally, each sheet shall be so oriented that the north arrow points towards the top or towards the left side of the sheet.

Coordinates, based upon the Virginia State Plane Coordinate North System (NAD 83) shall be shown on all plan sheets. Vertical control shall be based on NAVD 88.

Drawings will be acceptable only if all lines and lettering thereon are concise, legible, reproducible, and are readily capable of being digitally reproduced.

Notes shall not be placed in hatched or shaded areas. Crowding of notes into a small space shall be avoided. Leaders shall be used to clarify the item referred to. Notes should not be scattered all over the drawing, but should be neatly grouped together.

All lettering for the same set of plans shall be of the same style, open, well-formed, dense black and have a consistent density throughout the entire drawing. Minimum height of letters shall be:

Notes - 1/8" and legibly spaced.

Titles - 1/4".

Each plan set shall include an existing condition sheet(s) clearly showing all existing utilities, pavements, easements, structures, and topography.

Each plan sheet shall contain one or more plan sheets showing proposed water and sanitary sewer infrastructure and easements. Proposed water mains and appurtenances, fire hydrants,

water services, sewer mains, manholes, sewer house connections (laterals) water-sanitary sewer easements shall be shown with bold lines. All water and sanitary sewer lines shall be stationed. All other existing and proposed infrastructure, including all existing and proposed easements, stormwater infrastructure, property and right-of-way lines, pavements landscaping, lighting, topography and other features as appropriate shall be shown in a legible, but greyed out lines. Excess notes not related to water or sanitary sewer construction and callouts may be deleted if shown elsewhere in the plan set.

All water and sanitary sewer lines shall be shown on a dedicated plan and profile sheets. Plan features shown on overall utility plan sheets as described above shall be shown on the plan view. For curved alignments, the radius of curvature, and the number and degree of deflection of all included deflected joints shall be shown.

The profile view for water at a minimum shall include the following features: ground profile over the waterline, all fittings, restrained lengths for all compound lengths, type of pipe, class or thickness of pipe.

The profile view for sanitary sewer at a minimum shall include: ground profile over the sewer, sewer pipe labeled with length, slope, pipe material, thickness designation and specification reference, manholes with invert elevations in and out, rim elevation, and diameter.

### **1.2.3 Record Drawings**

A complete set of Record Drawings and corrected key sheets shall be submitted by the developer or owner responsible for the construction upon completion of construction and approved by the department at least one week prior to the anticipated occupancy of any building within the project and as a condition of tentative acceptance of the water and sanitary sewer systems in the project. Construction drawings shall be digitally modified to reflect as-built conditions. Record drawings shall be determined by actual field survey and sealed by the responsible engineer. The following statement signed by the responsible design engineer shall be on the title sheet, "I hereby state, to the best of my knowledge and personal belief, that the work shown on these plans was constructed to County standards to the directions and grades shown and are either installed within the Public right-of-way or properly recorded easements dedicated to Stafford County." The record drawings shall show all revisions, substitutions, variations, omissions, and discrepancies made or discovered during construction concerning location and depth of utilities, piping, manholes, pumps, and other facilities. Revisions shall be made and shown on all drawing views with actual dimensions established to permanent points. The contractor shall keep daily as-built work plans at the construction site and shall furnish them to the design engineer for record drawing preparation.

The record drawings shall show, but may not be limited to, the following:

1. Water Line Construction:
  - a. Accurate scale location on plans of the line and all installed valves and fittings, such as elbows, tees, crosses and reducers, and all cradle encasements, restrained joints or special construction.

- b. Exact measurements to show positive locations for valves shall be taken from at least two reasonably adjacent and available, fixed and permanent objects, such as fire hydrants, centers of sanitary or storm sewer manhole casting covers, corners or lines extending from buildings, power poles, etc.
  - c. Manufacturer.
  - d. Materials, class, specification and sizes of all pipes.
  - e. Location of house service measured from the side property line.
2. Sewer Line Construction:
- a. Accurate scale location of manhole inverts and top casting elevations and numerical notations of the exact elevations of same as determined by field survey after construction. Elevations shall be in datum of the County.
  - b. Accurate scale indication of lengths and grades and direction of lines between manholes and numerical notations of the exact length and grades, as determined after construction.
  - c. Accurate scale location of concrete cradles, encasements or special construction.
  - d. Location of house services by measurement from the manhole immediately downgrade.
  - e. Manufacturer.
  - f. Materials, class, specification and sizes of all pipes.
3. Wastewater pumping stations, water pumping stations, all other comparable construction and building structures:
- a. As-built plans and specifications shall accurately indicate all approved deviations from or changes in locations or type of equipment installed and material used.
  - b. Pump curves shall be drafted onto the plan set.
  - c. Accurate listings of the names of the manufacturers of all operating equipment installed, together with model or style numbers, ratings, capacities and other pertinent information shall be provided as part of the record plans on the project.
  - d. At least three (3) complete sets of operation and maintenance manuals for all operating equipment and all certificates of inspections, warranties and guarantees of equipment, materials and the installation thereof, required by the project

specifications which are approved by the Director, shall be provided as part of the record drawings on the project.

When the record drawings information differs from the approved construction plans, a design analysis for the existing conditions may be required.

One set of record drawings shall be submitted to the Department of Utilities on 24"x36" bond paper. After the record drawings are approved in writing by the Department of Utilities, one set of full-sized prints and digital drawings in both, PDF and Autocad format, shall be submitted.

### **1.2.3.1 Submission of Record Drawings**

Digital file shall be submitted in one of the following formats:

DXF

ACAD Release 2010 or later, as the Director may require from time to time

All files shall have an organized layer scheme including easy to understand layer names. The following is the desired layout of themes: (Place existing and new construction on different layers)

Sewer

- Manholes
- Sewer (Sewer Lines)
- ARV (Air Relief Valves)
- Pump (Pump Station)
- Forcemain

Water

- Blowoff
- Hydrant
- Junction (Node at pipe intersections)
- Reducers
- Valves
- Pipe
- ARV (Air Relief Valves)

## **1.3 WATER AND SEWER DESIGN STANDARDS**

### **1.3.1 Protection of Water Supplies**

There shall be no cross connection between a drinking water supply and a sewer, or appurtenance thereto.

No sewer line shall pass within 50 feet of a drinking water supply well, source, or structure unless special construction and pipe materials are used to obtain adequate protection. The

proposed design shall identify and adequately address the protection of all drinking water supply wells, sources, and structures within 100 feet of the proposed project.

### **1.3.2 Separation of Water and Sewer Lines**

Separation shall be measured between outside of pipes.

#### **1.3.2.1 Water Lines Crossing Over Sewers**

Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. When conditions prevent an 18-inch vertical separation, the said portion of sewer shall be constructed of AWWA C900, or C905, pressure tested in place without leakage prior to backfilling.

#### **1.3.2.2 Water Lines Crossing Under Sewers**

Water lines passing under sewers shall be protected by providing a vertical separation of at least eighteen inches (18") between the bottom of the sewer and the top of the water line; adequate structural support for the sewer to prevent excessive deflection of the joints and the settling on and breaking of the water line; and the length of the water pipe shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer and the said portion of sewer shall be constructed of AWWA C900 or C905 water pipe, pressure tested in place without leakage prior to backfilling.

#### **1.3.2.3 Water and Sewer Mains Parallel**

Where water and sewer mains must run parallel, sewer mains shall be a minimum of 18 inches below the water mains. Additionally, there shall be ten feet (10') of clearance horizontally between the water and sewer mains whenever possible. This distance shall be measured edge-to-edge.

When local conditions prevent a horizontal separation of at least ten feet (10'), the water line may be laid closer to a sewer provided that:

- A. The water main is in a separate trench located on one side of the sewer.
- B. The bottom of the water line is at least 18 inches above the top of the sewer.
- C. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure tested in place without leakage prior to backfilling. The hydrostatic test shall be conducted in accordance with most recent edition of the AWWA standard, with a minimum test pressure of 30 psi.
- D. Water mains shall be at least 10 feet from septic tanks and septic drain fields.

#### **1.3.2.4 Water and Sewer Mains Crossing Other Utilities**



Water and sewer mains shall have minimum clearance of 18 inches where crossing other utilities.

#### **1.3.2.5 Manholes and Sewers**

No water pipe shall pass through or come in contact with any part of a sewer manhole. Manholes shall be placed at least ten feet (10') horizontally from a water main whenever possible. The distance shall be measured edge-to-edge of the pipes or structures. When local conditions prohibit this horizontal separation, the manhole shall be of watertight construction and tested in place and the sewer main shall be constructed of AWWA C900 or C905 water pipe, pressure tested in place without leakage prior to backfilling.

No pits, valve boxes or flushing devices shall be directly connected to a sanitary or storm sewer.

#### **1.3.3 House Service Separation**

Water service lines shall have at least ten feet (10') of clearance horizontally from the sewer service line; vertically the water service line shall be above the sewer service line with at least eighteen inches (18") of clearance.

Where conditions prohibit the separation described above, the water service may be placed in the same trench with the sewer service line provided approval is given by the Director and the conditions listed below are met:

- A. The bottom of the water service line at all points shall be at least 18 inches above the top of the sewer line at its highest point.
- B. The water service line shall be placed on a solid shelf excavated at one (1) side of the common trench and at least 18 inches horizontally from the sewer service line.
- C. The number of joints in the service pipe shall be kept to a minimum.
- D. The materials and joints of sewer and water service pipe shall be installed in such a manner and shall possess the necessary strength and durability to prevent the escape of solids, liquids, and gases therefrom under all known adverse conditions such as corrosion, strains due to temperature changes, settlement, vibrations and superimposed loads.

#### **1.3.4 Relationship with Other Utilities**

Utility lines and equipment of other utilities shall be installed no closer than five feet (5') horizontally from the County's water and sewer lines or facilities. Any utility lines crossing over or under water and sewer lines shall be no closer than 18 inches vertical distance and properly identified with a marker or other means of identification approved by the Director. If other utilities must cross water or sewer lines within 18 inches, concrete encasement of the water or sewer line shall be required.

#### **1.3.5 Protection of Roadways**

All water mains, gravity sewers, pressure sewers and force mains under major roads shall be installed in a steel casing in accordance with Detail 1.4.2-2A or 1.4.2-2B. The casing shall extend five feet (5') beyond the pavement. A major road is any four lane divided road or any other road or street with a planned vehicle count greater than 1,000 vehicles per day.

### **1.3.6 Water and Sanitary Sewer Lines Under Pavements in VDOT Rights-of-Way**

With the permission of VDOT and the Director, water and sanitary sewer lines and appurtenances may be placed under pavements in VDOT rights-of-way. Permission to place water and sewer under pavement will be limited to residential projects with a maximum lot size of 10,000 square feet and with setback limitations of 30 feet or less in the following zoning districts: A-2, R-1, R-2, R-3, R-4, PD-1, PD-2, P-TND, and UD; and only during initial construction. The design of the water or sanitary sewer utilities shall be in conformance with VDOT's Road and Bridge Standards and Stafford County's Water and Sewer Design and Construction Standards. Water and Sanitary Sewer utilities will be allowed per VDOT Road Design Manual App B1 and evaluated on a case-by-case basis. In case of a conflict, the more stringent requirement shall govern. Utilities shall be located outside the right-of-way whenever it is practical to do so.

Where permission to construct water and sanitary sewer lines under pavements is granted, sewer services and waterline services to all lots shall be installed as part of the initial construction so as to eliminate the need for future excavation in paved areas to install services. All water and sewer services shall, at a minimum, extend to the Right-of-Way line.

### **1.3.7 Installation Under Streams**

Waterlines, gravity sewers, pressure sewers and force mains shall be installed a sufficient depth under the stream bed to protect the pipe. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other materials. Less cover may be considered if the pipe is encased in concrete or steel casing.

### **1.3.8 Valves**

All Valves, including hydrants sampling station and other appurtenances shall close clockwise and open counterclockwise. Valves shall not be located in sidewalks or curb and gutter sections.

Depending on the shape, soils, characteristics of the stream and stream flow, some form of stream protection may be required. These forms may include vegetative or structural techniques as approved by the Director.

## **1.4 WATER AND SEWER CONSTRUCTION STANDARDS**

### **1.4.1 Safety**

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

#### **1.4.2 Sheeting, Shoring and Bracing**

The contractor's attention is called to Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.

The contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

The contractor shall provide sheeting, shoring and bracing as required to assure safe working conditions, maintain required excavation dimensions for proper construction, and to prevent accidents, cave-ins, and damage to adjacent structures, facilities and surfaces.

Sheeting, shoring, and bracing shall:

- A. Conform with Federal law, State law, and County ordinances.
- B. Conform with the recommendations set forth in AGC "Manual of Accident Prevention in Construction."
- C. Be used where needed to protect life, property, and the work.
- D. Be used to avoid excessively wide cuts in unstable material or along public roads.
- E. Be mandatory where construction is adjacent to existing buildings, utilities, and other structures which sloped side walls might damage or destroy.

Sheeting and shoring left in place shall be cut off to a depth of not less than 18 inches below grade.

#### **1.4.3 Trenching and Backfilling**

Trenches shall be excavated so as to provide a uniform and continuous bearing and support for the full length of the pipe. Bell holes shall be provided at each joint and coupling to permit proper joint assembly and pipe support. For waterlines smaller than 18 inches in diameter, the bottom of the trench shall be shaped to fully support the pipe. Rock shall be removed when encountered to a minimum depth of six inches (6") below the pipe, and the same depth below the bell. Material in the bottom of the trench deemed unsuitable by the Director shall be removed and replaced with compacted gravel backfill. Depth and width of removal shall be as directed by the Director.

Before the pipe is lowered in place, the trench bedding shall be prepared so that each pipe will have a firm and uniform bearing over the entire length of the barrel. Adjustments in line and grade shall be made by scraping away or filling and tamping in under the barrel of the pipe. Wedging or blocking is not permitted.

Unless otherwise authorized by the Director, no more than 100 feet (100') of trench may be open at any one time. The Director may require backfilling and subsequent re-excavation of trenches left open an unreasonable amount of time in advance of pipe installation. Trenches left open overnight, or during periods when the Contractor's forces are not present shall be so protected and enclosed and marked as to cause no danger to the public or others.

Sides of trenches in improved public rights-of-ways and adjacent to other utilities or structures shall be practically plumb. Sides of trenches in other areas may be sloped from a point one foot above the top of the pipe to grade. Slopes shall be such as will not allow displacement of material or danger to personnel. Sides of trenches from a point one foot above the top of the pipe to the bottom of the trench shall be practically plumb. Bell holes shall be excavated in the bottom of the trench wherever necessary to permit the proper assembling of joints.

Large rocks, boulders, and large stones shall be removed to provide a clearance of at least six inches (6") below and on each side of all pipe, valves and fittings for pipe twenty-four inches (24") in diameter or less, and nine inches (9") for pipes larger than twenty-four inches (24") in diameter. The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and appurtenances being laid and any part, projection or joint of such rock or stone.

Excavations shall be kept free of water once construction has begun until the trench has been backfilled. If water is encountered, the contractor must provide and maintain a dewatering system of sufficient capacity to remove water until the excavation has been made, the pipe has been placed and bedded, and the excavation has been backfilled.

#### **1.4.4 Pipe Installation**

The Contractor shall, after excavating the trench and preparing the bedding for the pipe, furnish necessary facilities for lowering and placing sections of the pipe in the trench without damage. The sections of pipe shall be fitted together in accordance with the manufacturer's requirements and shall be laid true to line and grade. The full length of the barrel of the pipe shall have a uniform bearing upon the bedding material. Care shall be exercised to prevent damage to the polyethylene encasement, if provided. PVC pipe shall be installed in accordance with ASTM D2774 and AWWA C-605 for pressure pipe and ASTM D2321 for non-pressure piping. Ductile Iron Pipe shall be installed in accordance with AWWA C600.

1. Pipe shall be laid to grade. Pipe that is not in true alignment, both vertical and horizontal, or shows undue settlement after laying shall be replaced. No pipe shall be laid which is damaged, cracked, checked, or spalled or has other defects deemed by the County to make it unacceptable, and such sections shall be permanently removed from the work.

2. When the work of installing pipe is not in progress, openings into the ends of the pipelines shall be kept tightly closed with suitable plywood or sheet metal bulkheads.
3. Keep the pipe trench free from water and take necessary precautions to prevent the pipe from floating due to water entering the trench. Damage is the Contractor's responsibility. Restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

The installation of water and sewer utilities located under pavements in VDOT Rights-of-Way, shall be in accordance to chapter three (Geotechnical Engineer) of the VDOT Materials Division Manual of Instruction

<http://www.virginiadot.org/business/resources/bu-mat-MOI-3.pdf>

(Reference Specs. 520, 401 & 309, 308, 302-305, 232, 208, 207, 205, VDOT Road and Bridge Specifications) and Stafford County Department of Utilities Water and Sewer Design and Construction Standards", which specification is most stringent or which standard is most pertinent to the method of construction in respect to VDOT field inspector or VDOT construction engineer.

#### **1.4.5 Backfilling**

Pipe backfill materials shall be as indicated in the standard details and as specified below:

##### **1.4.5.1 Backfilling in General**

**Pipe Bedding Material:** Pipe Bedding shall be VDOT size 57 per Section 203, Table II-3, VDOT Road and Bridge Standards, having a maximum 1/2" particle size. Backfilling shall be compacted in four-inch (4") layers.

**Select Backfill:** Select Backfill shall be classified as SM, SC, or better in accordance with ASTM D2487, free from rock or gravel larger than two-inches (2") in any dimension, debris, waste, frozen material, organic material, and other deleterious matter. The plasticity index shall be less than 15 and the liquid limit shall be less than 40. Backfilling shall be in 6-inch (6") layers.

**Controlled Fill:** Controlled Fill shall be placed above Select Backfill or Bedding materials in areas requiring filling to grade, road embankments and berms. Materials for Controlled Fill shall consist of any approved material imported or excavated from the cut areas and shall contain at least 40 percent of material smaller than 1/4 inch in size. No material of a perishable, spongy, or otherwise improper nature shall be used in backfilling. Backfilling shall be in six-inch layers.

**Structural Fill:** Structural Fill shall be placed in six-inch (6") layers above Select Backfill or Pipe Bedding materials in areas requiring pavement and/or vehicular traffic above the pipe trench. Structural Fill shall consist of crushed stone conforming to size 21 or 21A, VDOT specification Section 208, Table II-9.

Select Backfill, Structural Backfill and Pipe Bedding Material:

1. Each layer shall be evenly spread; the moisture content brought to near optimum conditions and then compacted to a density that is not less than 95 percent of maximum density at optimum moisture content in accordance with VDOT (1991) Specification Section 303.04.
2. The Contractor shall use appropriate compaction equipment that will not result in damage to adjacent ground, existing improvements, or newly installed improvements.
3. Flooding, jetting, or ponding will not be permitted for compaction of any backfill.

Controlled Fill:

1. Controlled Fill shall be compacted while at a moisture content near the optimum and to a density that is not less than 90 percent of the maximum density at optimum moisture content in accordance with VDOT (1991) Specification Section 303.04.
2. Potentially expansive soils may be used in fills and shall be compacted at moisture content greater than the optimum for the material. Otherwise expansive soils shall be below a depth of 24 inches.
3. When the moisture content of the fill material is below that specified, water shall be added until the moisture content is as specified.
4. When the moisture content is above that specified, the fill material shall be aerated by blading, mixing, or other satisfactory methods until the moisture content is as specified.
5. After each layer has been placed, mixed, and spread evenly, it shall be compacted to the specified density. Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic tires, or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compacting shall be continuous over the entire area, and the equipment shall make sufficient passes over the material to ensure that the desired density had been obtained.
6. Surface of fill slopes shall be compacted so that the slopes are stable and there is no excessive loose soil on the slopes.
7. The Contractor shall provide and maintain adequate erosion control facilities during the construction of the fill areas. The erosion control facilities shall be maintained in optimum condition until the permanent drainage system and vegetation is complete. The facilities shall be inspected following significant rainfall, repairs made and excess sediment removed. It shall be the Contractor's responsibility to prevent the discharge of sediment off-site or to adjacent watercourses.

Compaction beneath and within 25 feet (25') of buildings and structures, including those shown for future construction shall be 100 percent as determined by VTM-1. Compaction beneath pavements, walks, and road shoulders, including those shown for future construction shall be 95%. Compaction in all other unpaved areas shall be 90%. The

contractor shall provide the Director satisfactory test results of the backfill performed by a qualified laboratory to demonstrate compliance with the above. The plans shall specify the frequency of testing for the various areas; minimum test frequency shall be every 100 feet of trench length per lift. Backfill and replacement in existing or proposed roads to be accepted into the State Highway System shall be executed in full accordance with the requirements of the VDOT.

#### **1.4.5.2 Backfilling Under Pavements in VDOT Rights-of-Way**

Trenches shall be constructed in accordance with Stafford County details 1.5.2-1 to 1.5.2-6 as appropriate or VDOT requirements if more stringent. Materials shall conform to the following:

##### 1. Controlled Fill

- a) Materials placed with roadbed Fill soils shall consist of suitable imported or on-site soils approved by VDOT for use in the roadway prism.
- b) Materials placed in a trench excavated in the roadway prism: Fill soils shall consist of suitable imported or on-site soils as determined by the County Engineer and approved and accepted by VDOT. Suitable materials for fill shall consist of any approved material imported or excavated from the cut areas, shall contain no rocks or gravels greater than two inches (2") in size, and shall contain at least 40 percent of material smaller than one-fourth inch (1/4") in size. No material of a perishable, spongy, or otherwise improper nature shall be used in filling. Materials classified as SM or SC in accordance with ASTM D2487 shall be used.

##### 2. Select Backfill

- a) Imported materials placed under pavement: VDOT 21A
- b) All other areas in VDOT Right-of-Way: Materials classified as SM, SC, or better in accordance with ASTM D2487, free of rock or gravel larger than two inches (2") in any dimension, debris, waste, frozen materials, organic material, and other deleterious matter. The plasticity index shall be less than 15 and the liquid limit shall be less than 40.

##### 3. Bedding

- a) Watermains: VDOT 21A only where required to adjust final grades.
- b) Sanitary sewers: VDOT No. 57 stone

##### 4. Unsuitable Material

Any material that contains more than 5% by weight organic matter, or that has unstable bearing capacity, excessive moisture content, roots, mulch, debris, waste, or frozen materials.

### **1.4.6 Tunneling**

When tunneling is necessary to lay pipelines, the tunnels shall be of sufficient size to permit the proper jointing of pipes and the proper grouting or compacting of the backfill around them, if it is required. All methods of tunneling shall be subject to the approval of the Director. In general, tunnels shall be of timbered (cap and leg), steel liner plate, or jacked construction. When conditions require a specific type to tunneling, the details of such construction will be indicated by the design engineer on the construction drawings.

### **1.4.7 Casing Pipe**

Install casing pipe to the grades, and alignments shown on the project documents. The method used to advance the boring machine shall ensure correct alignment and grades at all times without binding or imposing excessive loads on the initial tunnel supports or upon the surrounding ground. Deviations from the specified line shall not exceed three inches (3") in any direction at any point in the casing.

The casing pipe shall be ASTM A53 Grade B welded and seamless steel pipe with minimum yield strength of 36,000 psi and a minimum wall thickness of 0.500 inches.

Proprietary casing systems may be considered on a case by case basis.

Upon request of the Utilities Inspector, the contractor shall provide certifications for welders and casing pipe. In all cases, the inspector shall be allowed the opportunity to inspect the inside of the casing by television or other means prior to installation of the water or sewer pipe. Seal the ends of the casing pipe using an approved end seal.



**SECTION 2**  
**WATER SUPPLY SYSTEMS STANDARDS**



## **WATER SUPPLY SYSTEMS STANDARDS**

### **2.1 WATER MAINS AND APPURTENANCES**

#### **2.1.1 Hydraulic Design**

Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire flow based upon sound hydraulic analysis. The system shall be designed to provide the following:

A maximum of 80 psi within any structure served by the system. For limited areas, individual pressure reducing valves may be used to reduce the pressure to 80 psi, a minimum of 40 psi within any structure served by the system during a peak day, peak hourly demand with the hydraulic grade line for the service area thirty feet (30') less than maximum. For limited areas, individual booster pumps may be used to increase the pressure to 40 psi, a minimum of 20 psi for fire flow during maximum daily flow period, with the hydraulic grade line for the service area thirty feet (30') less than the maximum, the ability to sustain the required fire flows for a minimum of three hours.

The hydraulic analysis shall utilize the following factors:

1. 240 gallons per day per equivalent dwelling unit average daily demand.
2. 2.5 peak hour demand factor.
3. 1.5 maximum day average hour demand factor.

The level of service of existing customers shall not be reduced. Maximum and minimum pressures shall be calculated by the Design Engineer for the dynamic and static head conditions that will occur at both the street and throughout the proposed building.

Upon receiving a written request the Utilities Department will provide computer simulation results for flow and pressure availability for the existing system to the developer or the developer's engineer. The developer or developer's engineer shall provide a report containing a detailed analysis for evaluation by the Utilities Department to ensure that the proposed water system design meets the above requirements for hydraulic design.

The minimum requirements for the report as follows:

1. Cover sheet with title of project, date and PE seal.
2. Original data provided by the Department of Utilities.
3. Network files for pipes, nodes, simulated pump curve and reservoir at point of connection. Pipe table shall contain pipe number, connecting nodes, length, C factor, diameter, and minor loss coefficient. Node table shall contain node number, elevation, and average demand.
4. Pipe and node exhibit with pipes and nodes identified.
5. Model runs at peak hour.

6. Table of fire flows at 20 psi residual pressure at maximum day average hour for all fire hydrants. Model runs may be needed with two hydrants flowing.
7. Complete node, pipe and simulated pump output for one scenario for items 5 and 6.
8. In addition to the information in item 3, the node table shall list hydraulic grade line and pressure.
9. In addition to the information in item 3, the pipe report shall include flow, unit head loss, and total head loss.

If a project will be developed in sections or phases, the fire flow calculations will indicate the available fire flows during each section or phase of the project. For small sites that propose no major water line extensions, an evaluation of the existing fire flows may be substituted for the fire flow calculations. Water lines will be interconnected wherever feasible to enhance the reliability and operation of the water system.

If the Stafford County water transmission system cannot provide the above pressures, the property owner will be required to furnish storage and/or on-site pumping systems as necessary to obtain desired service pressures. If the pressure exceeds the maximum, the property owner will be required to furnish and install a pressure-reducing valve on the premise. Construction plans shall indicate the lots that will require the installation of either an on-site booster pump or a pressure-reducing valve.

The Director may require the use of pipe and fittings with increased pressure ratings in areas where the pressure exceeds 80 psi.

### **2.1.2 Location**

Provisions shall be made for logical future extensions. In new subdivisions with curb, gutter and sidewalks, the water mains shall be constructed within one of the driving lanes of the street with VDOT approval. In all other new subdivisions, the water main shall be constructed along the shoulder of the street approximately 3 feet from edge of proposed pavement. Water mains constructed in easements shall be constructed along the center of the easement. Future extensions shall be provided with a restrained gate valve and a minimum of one length of pipe sufficient to reach beyond any pavements. This pipe shall be properly plugged, blocked, disinfected and pressure tested along with the rest of the water system. After passing inspection the gate valve shall be closed. Water lines that are allowed under the pavement of undivided roadways, shall be located in the center of travel lane unless, as determined by VDOT, there are compelling design or safety issues that would demand consideration of an alternate location. The waterline positioning will provide ten (10) feet separation from the sewer lines as required by the Virginia Department of Health (VDH).

### **2.1.3 Water Main Sizes**

The minimum size of water mains shall be as follows:

- A. As shown in the Stafford County Water and Sewer Master Plan.

- B. Sufficient to meet the fire flow requirements of Section 2.1.5.
- C. In single-family residential districts, eight inch (8") shall generally be used; six inch (6") to be used only when it completes a good hydraulic grid and, generally does not exceed six hundred feet (600') in length. Dead-ends shall be eliminated by looping when feasible.
- D. In other areas, twelve inch (12") shall generally be used; eight inch (8") to be used only when it completes a good hydraulic grid and, generally does not exceed six hundred feet (600') in length.
- E. For length of pipe runs less than 300 feet where there are no plans for extensions, 2-inch (2") pipe may be used.
- F. For areas where there are no plans to provide fire protection, pipes smaller than 6 inch (6") may be used.

Hydraulic design of water mains shall be based on pipe carrying capacities consistent with head losses determined in accordance with the Hazen-Williams Formula using a C value of 120. The maximum allowable flow velocity is 5 feet per second for domestic flow. All losses through valves, tees, and other appurtenances will be computed and added to determine total head loss through the water distribution system.

#### **2.1.4 Fire Hydrants**

Fire hydrants spacing shall be measured along lines of vehicular access. Fire hydrants shall be located as follows:

- A. At street intersections and at intermediate locations where necessary, as determined by the Fire Marshal's Office. The maximum distance between hydrants on the same main, as measured along the center line of accessible streets, shall not exceed eight hundred (800) linear feet. A fire hydrant shall be located at the end of a cul-de-sac.
- B. Within fifty feet (50') of any standpipe or sprinkler system fire department connection, where those systems are required in buildings.
- C. The maximum distance from the fire hydrant to the most remote part of the structure the hydrant will serve, as measured along the centerline of the travel way shall not exceed the following:

Industrial Buildings	250 feet
School Buildings	300 feet
Commercial, Churches, & Office Buildings	50 feet
Apartments, Multi-Family, & Townhouses	250 feet
Single Family dwellings	500 feet

- D. All hydrants shall be a minimum of fifty feet (50') away from buildings other than single-family dwellings and as required by 2.1.3.B.
- E. Hydrants not at intersections shall be located in line with the property boundary between adjacent properties in order to avoid interference with future driveways.
- F. For road sections of four lanes or more, the hydrant spacing for each side of the street shall be independent of the other.
- G. Hydrants shall be located in such a way as to minimize damage by errant or turning vehicles.
- H. In areas with curb and gutter, the center of the fire hydrant shall be not less than eighteen (18) inches nor more than eight (8) feet away from the face of the curb. Under no circumstances will any part of a fire hydrant conflict with or overhang any sidewalk, trail, or vehicular travel way. On roads with ditches, fire hydrants will be located behind the ditch.
- I. No plantings or erection of other obstructions shall be made within four (4) feet of any fire hydrant or so as to block the view of the fire hydrant from the street.
- J. When installed in parking areas, fire hydrants shall be protected by barriers that will prevent physical damage by vehicles. Clear access shall be provided to the front of and fifteen feet (15') either side of the fire hydrant.

Fire hydrants installed on private property behind fences are considered as not accessible for public use and therefore are part of the property owner's private fire protection system. Fire hydrants that provide private fire protection shall have a double check detector assembly installed at the property line in accordance with standard detail 2.2.3-1.

### **2.1.5 Fire Flows**

All new on-site and off-site water supply systems shall have adequate capacity of delivering not less than the following fire flows with a residual pressure of not less than twenty (20) pounds per square inch at any point in the County's water system to the fire hydrants required by paragraph 2.1.4 (c). If a second fire hydrant is required by Section 2.15, the second fire hydrant must be located within 500 feet (500 ft.) of the most remote part of the structure they will serve. Where multiple hydrants are used to achieve the required fire flow, they shall be flowed simultaneously and the combined flow measured at twenty (20) pounds per square inch. These fire flows shall be in addition to the peak day domestic and commercial demands. In those cases where the source of supply cannot deliver fire flows at adequate pressures, the developer shall provide building sprinklers and fire resistive construction.

<b>Distance Between Buildings</b>	<b>Single Hydrant to Meet Flow Requirements</b>	<b>Two Hydrants Within Five Hundred Feet of Structure to Meet Flow Requirements</b>
<u>One and Two Family Dwellings:</u>		
31 Ft. and greater	1,000 GPM	1,000 GPM
11 Ft. - 30 Ft.	1,250 GPM	1,500 GPM
10 Ft. or less	1,500 GPM	2,000 GPM
<u>Townhouses &amp; Multiple Units:</u>		2,500 GPM
<u>Apartments, Hotels, Motels, Offices, Hospitals, Nursing Homes:</u>		
1 - 3 Stories		2,000 GPM
Over 3 Stories		2,500 GPM
<u>Schools:</u>		2,500 GPM
<u>Mercantile, Retail Stores, Shopping Center, etc.:</u>		2,500 GPM
<u>Industrial Storage Buildings, Repair Garages, Service Stations:</u>		2,500 GPM

**Notes:**

1. In areas of mixed-use development, the higher fire flow shall govern.
2. Where the size and scope of the development exceeds these requirements, additional flow shall be provided in accordance with ISO (Insurance Services Office) requirements.

The available water storage system shall have adequate capacity to sustain required fire flows for a minimum of three (3) hours.

**2.1.6 Sprinkler Systems**

Structures protected by automatic sprinkler systems require installation of a double detector check, dedicated fire hydrant, and a Siamese connection. The double detector check valve for an automatic fire sprinkler system shall be installed at an accessible location inside the building and adjacent to an exterior door with a sprinkler room sign approved by the Fire Marshal's Office. Siamese connections must be located within 50 feet of the dedicated hydrant.

These requirements shall not apply to residential systems constructed under NFPA standard 13D, which requires the installation of a testable double check valve.

### **2.1.7 Flushing Hydrants**

Fire hydrants shall be installed on dead-end lines, significant low spots and prominent peaks in water mains six inches (6") in diameter and above.

Flushing hydrants shall be used for water mains less than six inches (6") in diameter. Below grade hydrants as shown on Detail 2.4.4-3 shall be used in subdivisions and installed no more than eighteen inches (18") from the curb. Above ground hydrants as shown on Detail 2.4.4-4 shall be used in areas without curbs and gutters. Above ground hydrants shall be factory painted safety yellow, number 13655 in accordance with Federal Standard 595A.

Temporary flushing hydrants shall be used on dead ends that will be extended in the near future. Fire hydrants and above ground flushing hydrants shall be installed at the property line between two properties whenever practical.

### **2.1.8 Combination Air Vacuum and Air Release Valve**

Combination air vacuum valves shall be installed at prominent peaks in long transmission mains and other water mains subject to collapse due to vacuum conditions.

### **2.1.9 Water Valves**

Water valves shall have the same diameter as the water main to which they are connected.

Valves shall be installed at the intersection of water lines. Four (4) valves shall be used at crosses and three (3) valves at tees and shall be located as close to the fitting as practical. A valve shall also be installed at least every eight hundred feet (800') on water mains. Fire hydrant tee shall only have one valve on hydrant lead line.

Valves sixteen inches (16") or larger shall have beveled gears in enclosed gear cases.

Butterfly valves may be permitted in water mains fourteen inches (14") in diameter and larger.

### **2.1.10 Tapping Sleeves**

Tapping 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 with mechanical joint ends with mechanical joint ends tapping sleeves may be used for any approved tap on C-900 PVC, C-905, and C909 or ductile iron water main, transite, or thin wall PVC.

- c. The cast/ductile iron tapping sleeve may be used for approved two (or more) size down taps on C-900 PVC, cast iron or ductile iron water main.

### **2.1.11 Valve Boxes**

All underground valve operators shall be equipped with valve boxes. Valve operator extensions shall be provided for operating nuts deeper than 9 feet to bring the operating nut to at least 24 inches but not more than 36 inches of the final grade. Valve box extensions shall be used to for the full depth of the valve. Valve box spaces shall be used to center the operating nut in the valve box.

Valve boxes in paved areas shall be set and adjusted so that the covers are exposed and flush with the street surface. All paving must be complete with valve boxes exposed and shall have Virginia Department of Transportation acceptance prior to final acceptance of the water line by the County.

Valve boxes in sodded and other off-street areas shall be set and adjusted so that the covers shall be exposed and flush with the immediate area. A concrete collar in accordance with detail 2.4.5-1 shall be installed. Valves should not be located in ditches.

### **2.1.12 Minimum Cover**

All water mains shall be laid to a minimum depth of forty-two inches (42") from finished grade to the top of the pipe. Greater depths shall be required when street grades will possibly be lowered in the future. Water pipe shall not be laid at excessive depths. Water lines will not be laid at depths greater than eight (8) feet without the permission of the Director.

### **2.1.13 Potable Water Sampling Stations**

Water sampling stations shall be installed in each subdivision, townhouse complex, apartment complex, and other such residential projects. Sampling stations shall be installed at the rate of one (1) station per 100 equivalent residential units, or fraction thereof. Where multiple stations are required, they shall be evenly distributed within the project.

### **2.1.14 Changes of Alignment**

Changes of vertical and horizontal alignments shall be accomplished by the use of a combination of fittings and joint deflections. Bending of pipe lengths shall not be used. Joint deflections shall be limited to 80% of the manufacturer's recommended deflection, and shall be based upon the smaller of the recommended deflection of the pipe joint, fitting joint, or retaining gland.

Short vertical offsets to avoid conflicts with other buried objects shall be made using 45° vertical bends whenever possible.



Pipe installed on a horizontal radius using deflected joints shall be identified on the plan view with the design radius, tangent points, number of deflected joints and deflection per joint. Joints that are deflected in both the horizontal and vertical planes shall be labeled with the horizontal, vertical and total joint deflection.

## **2.2 WATER SERVICES**

### **2.2.1 Water Service Connections**

A separate water service, to include a tap to the public water main service line, isolation valve (for 2-inch and larger service lines) and meter setting, shall be provided for each parcel or lot. The minimum service line shall be 1 inch (1") in diameter. The location of each water service shall be clearly shown on the plans. The location of the water meter setting should be exterior to the structure and as near to the property line as possible and perpendicular to the water main. Where more than one water meter is provided for a building, separate meter settings shall be provided. The minimum separation between meter barrels shall be in accordance with detail 2.2.2-8.

One inch tap to water mains shall be installed using one inch corporation stops direct tapped to ductile iron and C900 DR14 PVC pipe or using a tapping saddle on cast iron, transite and all other PVC pipe. The minimum size meter setting for a non-residential structure shall be 2 inches. Taps larger than one inch (1") shall be made using a 4 inch branch tee for new work or 4" tapping sleeve and valve for existing work.

Water house connections serving a residential sprinkler system constructed under NFPA standard 13D shall conform to NFPA 13D Figure A.6.2(c) without a sprinkler control valve. The connection to the domestic water system shall be made inside the structure and protected by a testable double check valve. Flow characteristics of the water main tap, service lines, and all components of the meter setting shall be included in the design of the sprinkler system. The sprinkler system designer shall provide a signed statement regarding the adequacy of the water service planned for any residence proposing the use of a residential sprinkler system.

### **2.2.2 Water Meters**

All house services shall have a water meter installed in accordance with the standard details. In residential areas the water meter shall be installed between the curb and sidewalk where practical or one foot behind the sidewalk. When curbs and sidewalks are not required, water meters shall be installed adjacent to the right-of-way at the property line.

Service lines one inch (1") or larger, with meters larger than five-eighth inch ( $\frac{5}{8}$ "), shall be sized in accordance with AWWA Manual M-22, Sizing Water Service Lines and Meters. Water meters shall be sized in accordance with AWWA Manual M-22 or the tables below.

For non-residential facilities such as hotels, motels, commercial buildings, restaurants, industrial facilities and public buildings, the meter will generally be sized as follows:

Meter Size Inches	Combined Fixture Value Total
5/8"	0-40
1"	41-100
1 1/2"	101-624
2"	625-3600

The minimum meter size for facilities with flush valve water closets shall be 1-inch.

For residential facilities such as apartments, condominiums and trailer parks, the meter will generally be sized as follows:

Meter Size Inches	Combined Fixture Value Total
5/8"	1-36
3/4"	37-209
1"	210-549
1 1/2"	550-6900
2	6901-16300

Plumbing Fixtures Values shall be determined by using the latest edition of AWWA Manual M-22 Figure 4.6 for 35 psi.

Meter installations requiring a flow of greater than 160 gpm, or greater than the combined fixture value totals indicated above, shall be reviewed and/or approved on a case by case basis in accordance with AWWA Manual M-22.

### 2.2.3 Backflow Preventers

Each account shall have backflow prevention in accordance with Section 25-181 of the County Code. An approved cross-connection device shall be installed for each building. The device may be located in the meter barrel, in a separate meter barrel, or in the building depending on the type of backflow preventer required.

All private fire protection systems, including fire hydrants behind fences on private property, shall have a double check detector installed in a vault at the property line in accordance with detail 2.2.3-1.

Vault doors for double check detectors vaults shall be type "K" heavy-duty aluminum double leaf door designed for H2O loading. Door shall be tightly anchored to vault walls and provided with a lock satisfactory to the Director.

The double check detector assembly shall be supplied as a complete assembly consisting of the main-line double check assembly and the low flow by-pass line double check assembly complete with low flow registration meter. The main line assembly shall have two toggle-lever type, spring loaded check valves; two shut-off valves and four test cocks. The by-pass line assembly shall have two poppet type, spring loaded check valves, two shut-off valves,

three test cocks and a water meter. The by-pass checks and shut-off valves together with the water meter shall be assembled to the main line checks as an integral assembly.

Shop drawings for the double check detector assembly and vault shall be submitted to and approved by the Director prior to construction.

#### **2.2.4 Private Water Service Connections**

Private water service connections from the meter, starting at the connection to the short service line exiting the meter barrel, to the building are regulated by VUSBC and will be maintained by the property owner.

### **2.3 SURFACE WATER CROSSINGS**

Surface water crossings, both over and under water, present special problems and shall be discussed with the Director before final plans are prepared. Surface water crossings will only be approved when no other alternative exists.

#### **2.3.1 Above Water Crossing**

The pipe for above water crossings shall meet the following:

- A. Adequately supported (plans will include details of the piers and supports);
- B. Protected from damage due to freezing;
- C. Accessible for repair and replacement;
- D. Above the 100 year flood level.

#### **2.3.2 Under Water Crossing**

Under water crossings shall meet the following:

- A. The pipe shall be of special construction, having flexible watertight joints;
- B. Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair; the valves shall be easily accessible and not subject to flooding;
- C. Sample taps shall be provided at each end of the crossing and at a reasonable distance from each side of the crossing and not subject to leaks.
- D. Permanent taps shall be made for testing and locating leaks.

See Section 1.3.6 for additional requirements.

### **2.4 MATERIALS**

### **2.4.1 Ductile Iron Pipe**

Pipe shall be ductile iron meeting requirements of AWWA C151. Pipe shall be asphaltic coated outside and cement lined with double thickness and seal coated in accordance with AWWA C104. Unless otherwise indicated, the design thickness of the pipe shall be not less than the minimum shown in AWWA C150. Pipe shall be furnished in lengths of 18 to 20 feet and shall include all jointing materials. Installation shall be in accordance with AWWA C600.

All water mains either 12 inches (12") and greater in diameter or under paved areas shall be constructed of Ductile Iron Pipe unless otherwise approved by the Director.

Unwrapped ductile iron pipe shall not be used for a project unless a soil investigation in accordance with AWWA C105 is performed. Interpretation of results shall be made by the Director. If the soil investigation demonstrates that the soils would be corrosive to ductile iron pipe, the pipe shall be wrapped with polyethylene. Polyethylene encasement shall be in accordance with ASTM D1248 and AWWA C105 and shall be 8 mil thick.

### **2.4.2 Polyvinyl Chloride**

Polyvinyl Chloride pipe (PVC) four inches (4") through ten inches (10") shall be minimum Pressure Class 200 (SDR 14) PVC water with "push-on" type joints meeting all requirements of AWWA C900. Outside diameter of the PVC pipe shall be the same as the outside diameter of cast iron water pipe meeting ANSI Specifications A 21.6. Installation of water mains and services shall be in accordance with AWWA C605.

PVC pipe two-inches (2") and three-inches (3") shall be ASTM D2241 SDR 21 (200 psi) certified for the transport of potable water. Joints shall be "push-on" type joints complying with ASTM D3139.

PVC shall only be used for water mains less than twelve inches (12") in diameter.

### **2.4.3 Copper Pipe**

All water service lines less than two-inches (2") in diameter may be seamless, type K copper and meet requirements of ASTM B88. Fittings shall be bronze meeting requirements of AWWA C800. All couplings shall be made with compression joints as manufactured by Ford or approved equal. Flare fittings and sweated joints on copper tubing will not be permitted.

### **2.4.4 Cross Linked Polyethylene**

Water service lines two inches (2") in diameter and smaller may be PEX-A. PEX-A shall meet the requirement of ASTM F876 and F877. Fittings shall be no lead brass meeting the requirements of AWWA C800. All couplings shall be made with compression joints and internal sleeves. Flare fittings will not be permitted.

#### **2.4.5 High Density Polyethylene (HDPE)**

High-density polyethylene pipe shall be minimum pressure class 160 (SDR11) in accordance with AWWA C906. HDPE pipe may be used only in applications specifically approved by the Director. Approved applications will generally be limited to steel-cased crossings and specifically approved directionally drilled trenchless technologies.

#### **2.4.6 Fire Hydrants**

Fire Hydrants shall be procured from the factory painted in accordance with the color listed below. They shall be installed as part of a complete assembly in accordance with standard detail 2.4.4-1.

Hydrants to be maintained by the utilities department and installed in dry areas with open weep holes safety yellow number 13655 in accordance with Federal Standard 595A.

Hydrants shall be painted red 11140 per Federal Standard 595A when owned and maintained by private entities.” Any hydrant not in service shall be covered and secured with a black bag or other approved methods.

The bonnet (top) of each fire hydrant shall be painted to indicate the available fire flow in accordance with NFPA standards:

Fire Hydrant Bonnet (Top) Colors:

- Blue – Rated capacity of 1500 GPM or greater
- Green – Rated capacity of 1000-1499 GPM
- Orange – Rated capacity of 500-999 GPM
- Red – Rated capacity of less than 500 GPM
- Purple – Non-potable, non-pressurized water supply

Hydrants that require repainting due to a change in the above color requirements identified after the construction permit is issued shall be repainted in field using paint approved for fire hydrants in the Approved Products List.

#### **2.4.7 Water Valves and Tapping Sleeves**

Gate valves shall be of superior quality ductile iron body with double disc parallel seat with full bronze mount. All gate valves shall withstand a working pressure of at least one hundred fifty (150) psi and shall be in strict conformance with AWWA C500. The wrench nut shall turn to the left (counterclockwise) to open the valve. The valves shall be arranged to fit into pipelines having standardized “push-on” or mechanical joints.

Gate valves for 6 inch through 12 inch pipe shall be resilient-seated gate valves built and tested in accordance with AWWA C509 and be gray or ductile iron body, bronze mounted, parallel seat, double disc with non-rising stem, nut operated to open left (counter-clockwise)

with a 2-inch square operating nut. Valves 6" through 12" must withstand a 200 psi working and 400 psi test pressure.

Butterfly valves can only be used for pipe with diameters of 14 inches and larger, and shall be built and tested in accordance with AWWA C504 and have iron bodies, rubber seats, and tight closure with standard two-inch square operating nuts. The valve shall be operable with a maximum input of 150 foot-pounds on the operating nut, and capable to withstand an overload input torque of 450 foot-pounds at full open and full closed positions without damage to the operator or valve.

All interior ferrous surfaces of all valves shall be coated in accordance with AWWA C550 using a coating approved by the Virginia Department of Health for contact with potable water and shall not contain lead, coal tar resins, lampblack, carbon black or bituminous materials. The exterior surfaces shall be epoxy coated or equal.

#### Tapping Sleeves:

##### Fabricated Steel:

- a. The body of the tapping sleeve shall be of 3/8" carbon steel, ASTM grade A285.
- b. All connections shall be mechanical joints.
- 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, alkalies, mild acids and most hydrocarbon fluids, up to 212 degrees F.

##### Stainless Steel:

- a. The body of the tapping sleeve shall be of 18-8 type 304-stainless steel.
- b. All connections shall be mechanical joints.
- c. Gaskets shall be Grade 60 compounded for use with water, alkalies, mild acids and most hydrocarbon fluids, up to 212 degrees F.
- 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.

##### 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-A-36 iron or ductile iron.
- c. The gland retaining hardware (nuts, bolts and washers) to be 18-8 type 304 stainless steel.

##### 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.

Valve flange, body gaskets and clamping hardware (bolts, nuts and washers) shall be as specified for the fabricated steel tapping sleeve.

#### **2.4.8 Valve Boxes**

Valve boxes, base extensions, head and cover shall be of cast iron or locatable with metal locating devices. Valve boxes shall be two piece with 5.25 inch shaft and round head marked "Water". The shaft diameter shall not be less than five (5) inches. The valve boxes shall have a minimum range of extension to fit two (2) inch to twelve (12) inch valves inclusive, placed on mains at depths of three (3) feet to five (5) feet of cover in order that the top cover of the valve box is set to finished grade.

Valve boxes shall be centered over the valve operating nut with a valve box spacer and set plumb.

All valves in which the operating nut is greater than nine (9) feet below the normal ground or road surface shall be provided with extension stems to bring the operating nut between 24" and 36" of the finished grade. The extension stem shall be provided with a two inch square operating nut on top and a coupling to connect the extension to the operating nut of the valve. A stem guide shall be provided to keep the valve stem extensions concentric with the valve box. Extension stems shall be of the same diameter as the valve stem unless otherwise specified.

#### **2.4.9 Fittings**

Fittings shall be mechanical joint ductile iron with size, dimensions and tolerances meeting requirements of AWWA C153 or C110. Unless otherwise indicated, fittings 3 inch through 12 inch diameter shall have a pressure rating of 250 psi and all fittings larger than 12 inch diameter shall have a pressure rating of 150 psi. Mechanical joints shall meet requirements of AWWA C111. Provide all joint accessories, as required, to connect with plain end of push-on joint or cut pipe.

#### **2.4.10 Valves**

All valves on assemblies, such as vacuum air release assemblies shall be stainless steel, lever operated.

#### **2.4.11 Grey Iron Castings**

Valve boxes, water meter frames and covers, and all other gray iron castings shall conform to the patterns and dimensions shown in the Standard Details and shall meet requirements of ASTM Specification A-48, Class 30 except valve boxes shall be minimum class 20.

## **2.5 WATER MAIN CONSTRUCTION**

### **2.5.1 Coordination**

Existing County water valves shall be opened and closed only by or under the direct supervision of the Department of Utilities maintenance or inspection personnel. The only exception is an emergency situation affecting public health or safety.

Anyone found violating this provision might be subject to prosecution under the Code of Stafford for tampering with County property.

### **2.5.2 General Requirements**

Load and unload pipe, fittings, valves, hydrants and accessories by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such material be dropped. Handle pipe such that the coating and lining shall not be damaged.

The water main shall be laid and maintained to the required lines and grades with fittings, valves, hydrants and accessories set at the required locations as indicated on the approved plans for the project. All valve and hydrant stems shall be set plumb. Whenever obstructions not shown on the plans are encountered during progress of the work and interfere to such an extent that alteration in plans is required, the Director or his authorized representative shall be advised by the design engineer and/or developer in writing and approval given by the Director before such alternatives are put into effect.

The design engineer shall prepare legible cut sheets at fifty feet (50') stations indicating all pertinent construction data to include locations of service connections, fire hydrants, valves, bends, fittings, and relief valves. A set of all cut sheets shall be submitted to the Department of Utilities prior to construction.

All construction must conform to the latest regulations and safety practices specified by the Occupational Safety and Health Administration.

### **2.5.3 Installation of Pipe and Fittings**

Excavate trenches to the depth required so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes, except that it will be permissible to disturb and otherwise damage the finished surface over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. Backfill the bottom of the trench, excavated below the specified grade with approved bedding materials and thoroughly compact. The finished subgrade shall be prepared accurately.

When excavation is made in rock, boulders, or other unsuitable materials, the subgrade shall be made by backfilling with a minimum six-inches pipe bedding material. Any over



excavations shall be backfilled with pipe bedding material and compacted to 95% VTM-1 maximum dry density.

When installing pipe in the trench, proper implements, tools, and facilities satisfactory to the Director and as recommended by the material manufacturer shall be provided and used by the contractor for the safe and convenient prosecution of the work. Special care shall be taken to ensure that each length of pipe shall abut against the next in such manner that there shall be no shoulder or unevenness of any kind along the inside of the water main.

Pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work by the Department of Utilities. The open ends of the pipelines shall be provided with carefully fitted stoppers to prevent the entrance of dirt and other foreign matter. These stoppers shall be placed in the ends of pipe lines at all times when pipe laying operations are interrupted.

All tees, bends, plugs, caps, and fire hydrants shall be substantially braced, blocked and/or anchored to prevent any movements. Restrained joints shall be used at all locations except the following:

1. Tapping sleeves and inserting tees.
2. Transit pipe.
3. Where justified by the design engineer.

Thrust restraint design shall be in accordance with DIPRA Thrust Restraint for Ductile Iron Pipe, using the following design parameters:

1. Type of pipe. For PVC, use DIP with poly encasement.
2. Pressure – design static pressure plus 120 psi surge allowance.
3. Laying condition 3.
4. Soil type – cohesive granular.
5. Safety factor – 1.5

Backing for thrust blocks shall be placed between solid, undisturbed earth and the fitting to be anchored and shall be placed so that pipe and fitting joints will be accessible for repair. Thrust blocks shall meet the requirements as shown on the Standard Details. Fitting joints and/or fitting bolts shall not be encased in concrete. Polyethylene wrapping material shall be used to protect the fittings, bolts, and nuts from being in direct contact with concrete blocking.

All pipe joints shall be assembled in accordance with AWWA C-111, C-605, and C-600.

A three-inch (3") wide blue colored water marking tape shall be buried at a distance of approximately two feet (2') below the surface and directly over all water mains to alert construction and maintenance crews that a water pipe is below. The marking tape shall be continuous.

Thrust collars shall be used where neither restrained joints nor thrust blocks are suitable due to pipe material, soil conditions, system geometry or other factors. Thrust collars shall be individually designed and detailed on the project plans for each proposed location.

A conductive tracer wire, 10 gauge copper clad steel, solid and insulated with polyvinyl chloride or equal, shall be installed with and attached to the top of all non-metallic pipes. Insulation of tracer wire installed along the main shall be stripped for one (1) inch at each fire hydrant and service line, and a separate tracer wire connected. All splices of the tracer wire and connections shall be made using approved tracer wire connectors. The tracer wire shall extend to the bottom flange under the 4 ½ inch opening of all fire hydrants or blow-offs and extend 2-3 feet above the ground and be neatly attached to the hydrant or blow-off. In addition, tracer wire shall be extended into the valve box at each fire hydrant. The tracer wire shall be installed along the service connection from the water main, where it shall be attached to the pipe, and extended into the meter barrel. A length sufficient to extend a minimum of four (4) feet above ground level shall be neatly coiled and left in place. In off-site locations, tracer wire shall be terminated in tracer wire stations. All tracer wire will be tested by the utility field representative prior to acceptance.

#### **2.5.4 Fire Hydrant Construction**

Hydrants shall be set to established grade as follows:

- A. The bottom of the four and one-half (4 ½) inch nozzle shall be eighteen (18) inches above the elevation of the final grade on streets without curb and gutter and eighteen (18) inches above the elevation of the curb on streets with curb and gutter.
- B. The two and one-half (2-½) inch hose connection shall have a minimum of four (4) feet clearance on all sides.

#### **2.5.5 Road Crossings**

Where roadway crossings involve roads under the jurisdiction of the Virginia Department of Transportation, all material and operations shall conform to the requirements of the Virginia Department of Transportation. The contractor shall be responsible for obtaining all permits and permissions before work is begun, and a copy of the permit shall be provided to the Utility Inspector. The Contractor shall also furnish a release from the Virginia Department of Transportation before final acceptance of the work by the County.

#### **2.5.6 Testing**

The County will supply the water used for flushing, sterilization and testing without charge. Filling of water lines may not be performed until permission has been obtained from the utility inspector. The contractor is not permitted to operate valves on any existing water line.

All new water mains and hydrant connections shall be subject to a hydrostatic pressure test after thrust restraints have been installed, the line has been backfilled, and at least seven days after the last concrete reaction anchor has been poured and all water house connections have been installed. Testing shall be in accordance with AWWA C-600. Water mains shall be filled with clean water at a velocity of approximately one foot (1') per second while necessary measures are taken to eliminate all air. A hydrostatic pressure of not less than 150 psi or 150% of normal operating pressure, whichever is greater, shall be maintained for two (2) hours. Lines of different sizes shall be tested separately. Hydrant valves shall be in the closed position. All high points in the portion of the system under test shall be vented and air shall be expelled from the system prior to beginning the test.

After the portion of the system under test has reached the required pressure as stated herein, the pressure shall be maintained for two (2) hours. At the conclusion of the pressure test, the volume of the makeup water required to refill the pipeline shall be determined by measurement with a displacement meter or by pumping from a vessel of known volume.

All leakage must be eliminated by the contractor, regardless of the amount of leakage. Should test results show displacement, damage or leakage, the contractor shall repair the displacement and damage and eliminate the leakage. He shall re-test until the specified conditions are met to the satisfaction of the Department of Utilities.

### **2.5.7 Disinfection**

After testing and before final inspection of the completed systems, water mains shall be flushed and then chlorinated in accordance with AWWA C651. All disinfection procedures and final testing shall be carried out under the observation of a County Utility inspector. Flushing shall be accomplished at a flow velocity of not less than 3.0 feet per second. All valves, hydrants, and water house connections shall be operated during this operation. Clean water shall be flushed through the system until there is no trace of cuttings, oil, dirt, or other foreign matter flowing out of the pipe.

The disinfection concentration shall have an initial chlorine concentration of 25 mg/l per AWWA C-651. The disinfection solution shall remain in the pipeline for not less than twenty-four (24) hours, after which time a chlorine residual of 10 ppm at the extreme end of the line shall be required. The disinfection solution shall be flushed out of the pipe prior to the bacteriological samples being taken. The water remaining in the pipe after flushing shall have a total chlorine residual between 0.5- 3.0 mg/l and a free chlorine residual less than 0.5 mg/l.

Water samples for bacteriological analysis shall be taken by the Department of Utilities at regular intervals not exceeding 1,200 feet and analyzed by a certified laboratory. The sampling and testing shall then be repeated at least 16 hours later. The results of both sets of samples must indicate no coliform contamination before the pipes can be utilized. If contamination is indicated in one or both sets of samples, the entire disinfection and testing procedure must be repeated.

The contractor shall assume full responsibility for the discharge of chlorinated water during flushing. The contractor shall be responsible for any and all damages including, but not limited to, damage to vegetation, trees, streams, ponds, lakes and personal property. Further guidelines for dechlorination are explained in AWWA C651.

### **2.5.8 Special Consideration for Large Diameter Pipe**

Water mains 18-inches (18") or larger shall be bedded in accordance with details 1.5.2-1, 1.5.2-2 and 1.5.2-3. Clay dams in general conformance to detail 3.1.2-1 shall be provided at intervals of 200-feet (200').

### **2.5.9 Abandoning Water Service**

Water services shall be abandoned by the site contractor and work inspected by County as follows:

One-inch and smaller: Remove corporation stop and saddle, place repair clamps over opening.

Two-inch and larger: Remove nipple and replace with threaded plug or remove pipe from tee and replace with a restrained plug.

### **2.5.10 Fire Sprinkler System**

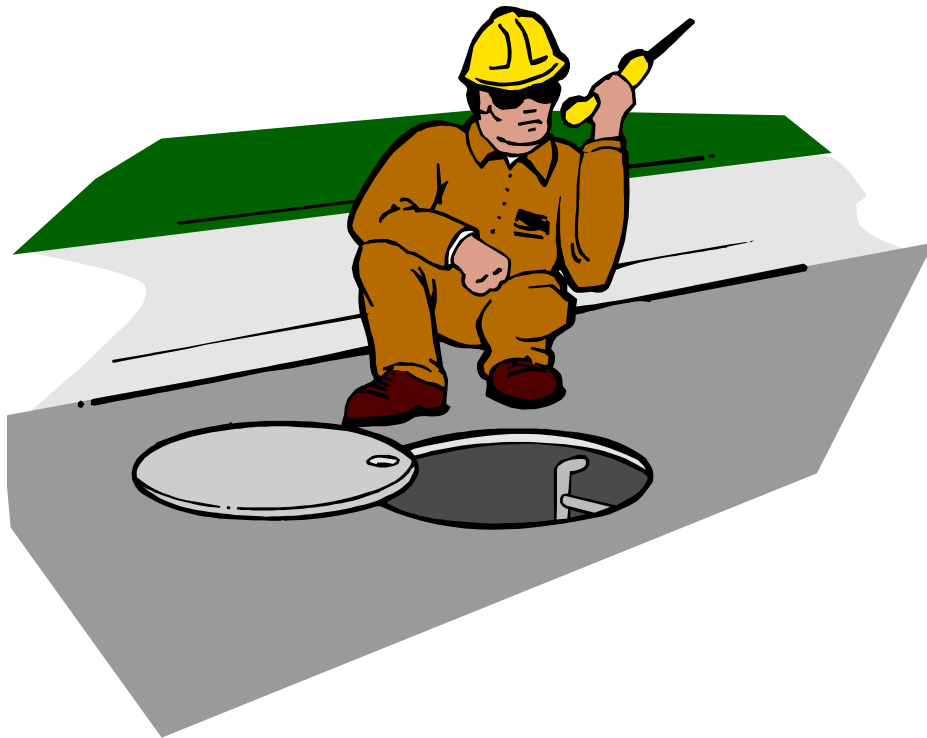
In those cases where the source of supply cannot deliver the fire flows at adequate pressures, the developer shall provide building sprinklers and fire resistive construction in accordance with Appendix B of the International Fire Code when approved by the Fire Marshal's Office.

### **2.5.11 Irrigation System**

Where lawn irrigation systems are proposed (other than single family homes), a plan of the proposed system showing the relation with respect to water, sewer, and storm sewer must be submitted to the Department of Utilities for approval. This plan must show connection point, water meter location, pumps, backflow preventer, and system demands for meter sizing.

## SECTION 3

### SEWER STANDARDS



## **SANITARY SEWER SYSTEMS STANDARDS**

### **3.1 GENERAL REQUIREMENTS**

#### **3.1.1 Location**

In new subdivisions with curb, gutter and sidewalk, sanitary sewers shall be constructed along one of the driving lanes of the street. In all other subdivisions, the sanitary sewers shall be constructed along the shoulder of the road. Sewers in easements shall be constructed along the centerline of the easement.

When the routing of the sewer intrudes into or through private and/or public property, it shall be located so as to best serve the entire drainage area. More specifically, sanitary sewer systems must be designed and constructed along rivers, creeks, and swales where adjacent property will be served by the system. When the sanitary sewer runs parallel to a stream, the top of the sewer will be a minimum of three (3) feet, plus an allowance for slope of any future sewer crossing, below the invert of the stream channel to ensure that adequate crossings can be made. The system must terminate, at specified points in new developments, at the property line of the adjacent and/or upstream properties to be served by the system in the future. Elevation of the sewer system must be designed such that future extensions are taken into consideration to allow service to all the area that naturally drains towards the system.

Where sanitary sewers are allowed under pavements and manholes are also located in paved areas, sewer manholes will be placed at the center line of a travel lane to avoid damage to vehicles due to manhole depression.

#### **3.1.2 Size**

Wastewater collection systems shall be designed for ultimate wastewater flow within the area to be served, assuming that the entire sewer shed is developed in accordance with the current Land Use Plan.

Collecting sewers shall be a minimum of 8-inch (8") diameter and shall be designed to carry present and ultimate flows, except that sewers serving six connections or fewer on cul-de-sacs or as sidewalk collector lines may be 6 inches (6" ) in diameter.

All sewers shall be sized in accordance with the Master Water and Sewer Plan and shall be designed to carry present and ultimate flows. An average daily flow of 192 gallons per day per equivalent dwelling unit shall be used. A peaking factor of 3.5 shall be used to calculate the peak hour flow, and 500 gallons per day per inch-mile of sewer shall be used to calculate groundwater influenced infiltration. Pipes six (6), eight (8), ten (10), and twelve (12) inches in diameter shall be sized at 50% of the full pipe flow. Pipes 14-inches and larger shall be sized at 85% of the full pipe flow.

#### **3.1.3 Depth of Sewer**

Generally, sewers shall be of sufficient depth to serve all existing and proposed buildings, including basements, by gravity flow, allowing for service connection grade. Greater depths may be required due to future extensions or possible lowering of existing road grade or utilities.

Sewers shall generally be installed with a minimum of four feet (4') cover below the finished street surface. Sewers with less than four feet (4') of cover below the finished street surface shall be constructed of ductile iron pipe with a concrete cradle. Sewers installed in easements with no highway traffic shall have a minimum cover of three and one-half feet (3 1/2'). Special design considerations apply when the trench load on the pipe would result in a deflection of 5% or greater. PVC SDR 35 Pipe may be used for sewers less than eighteen feet (18') deep. PVC SDR 26 shall be used to depths of 25 feet. C900 DR 18 PVC shall be used for depths between 25 feet and 30 feet. Sewers with depths greater than 30 feet may not be used.

### 3.1.4 Hydraulic Design Criteria

Sewers shall be of the same diameter and have a uniform slope and straight alignment between manholes. Sewers shall be designed to be free flowing with the hydraulic grade 50% of the pipe diameter below the crown of the pipe for 6" to 12" diameter pipes and 15% for pipe diameters 14" and greater, and with hydraulic slopes sufficient to provide a minimum velocity of 2.25 feet per second (fps) when the sewer size selected is flowing full or half full. Pipe size shall not be arbitrarily increased in order to take advantage of a flatter grade. Velocity computations shall be based on a coefficient of roughness (n) of 0.01 as used in the Kutter or Manning formulas for PVC pipe and 0.013 for DIP and concrete.

For sewer flow depth less than one-fourth full, allowance shall be made for increased value of "n" and in no case shall velocities of less than 1.3 feet per second be permitted.

Due to low flows, upper or terminal sewer reaches, for a minimum of 300 feet, shall have a minimum slope of 0.80 percent unless there is a distinct possibility of the sewer being extended in the near future. This requirement shall not apply to high density developments, such as apartment complexes.

Sewers shall be designed such that the maximum velocity is 15 fps. Suitable drop manholes shall be provided to break steep slopes to limit the velocities in the connecting sewer pipes between manholes.

Where smaller sewers discharge into larger sewers, the 0.8D flow line of the pipes shall be matched.

In general, minimum slopes for pipe flowing 1/4 of full depth to full depth should be as follows:

<u>Sewer Size</u>	<u>Minimum Slope (Ft./100 ft.)</u>
6"	0.52

8"	0.43
10"	0.32
12"	0.25
14"	0.20
15"	0.19
16"	0.17
18"	0.15
21"	0.12
24"	0.098
27"	0.084
30"	0.073
36"	0.057

Hydraulic losses in manholes shall be accounted for by providing a minimum of 0.2 feet of difference between the invert in and the invert out for sewer lines up to and including twelve (12) inches in diameter.

### 3.1.5 Slope Anchorage

Concrete anchors shall be placed on sanitary sewer lines with grades of 20 percent (20%) or greater. (Anchorage shall be shown as special detail on plans.) Minimum anchorage is as follows:

- A. Not over 36 feet (36') center to center on grades of 20 percent (20%) and up to thirty-five percent (35%).
- B. Not over 24 feet (24') center to center on grades greater than 35 percent (>35%) and up to 50 percent (50%).
- C. Not over 16 feet (16') center to center on grades greater than 50 percent (>50%).

### 3.1.6 Stream Crossing

The tops of all sewers crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other material. Less cover will be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to the stream channel. Reasons for requesting less cover shall be submitted with the construction plans. In paved channels, the top of the sewer lines should be placed below channel pavement. Sewers shall remain fully operational during the 25-year flood/wave action. 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/wave action. Sewers located along streams shall be located outside of the streambed wherever possible and should be sufficiently removed therefrom to provide for future possible channel widening. Reasons for requesting sewer lines to be located within streambeds shall be submitted with the construction plans.



Sewers crossing streams shall be constructed of watertight pipe. The pipes and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirement for sewers crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact.

### **3.1.7 Depressed Sewers (Inverted Siphons)**

Inverted siphons shall not be used.

### **3.1.8 Construction in Fill**

Sanitary sewers to include sewer house laterals cannot be constructed in fill areas unless a licensed geotechnical engineer has furnished a certification that the fill has been sufficiently compacted so that settlement of the sewer or manhole will not occur. Such certification shall apply to that area directly above and below the pipe and manholes. Pressure pipes constructed on fill shall have restrained joints.

### **3.1.9 Protection of Water Supplies**

There shall be no cross connection between a drinking water supply and a sewer, or appurtenance thereto.

## **3.2 MANHOLES**

### **3.2.1 Manhole Replacements**

Manholes shall be provided at all junctions with other sewers, at all points in change in alignment, grade, or pipe size, and at the terminal point of the sewer.

The maximum distance between manholes in paved areas accessible to vehicular traffic shall be four hundred (400) feet. When located in inaccessible areas, spacing of manholes shall not exceed 350 feet. The maximum depth for a manhole shall be twenty-five feet (25').

Manholes in easements shall extend above the 25-year flood level but not less than one foot above existing grade, wherever practical. Watertight manhole frames and covers shall be installed.

Manholes shall not be located in areas where water backs up in the street during a storm, such as the spread area in front of storm drainage inlets and gutter pans.

Under no circumstances shall manholes be located in sidewalks or other pedestrian travel ways. Manholes shall not be located in parking spaces.

### **3.2.2 Drop Manholes**

At all collector system manholes, the difference between influent and effluent inverts shall not be more than twelve inches (12"). Where this difference occurs, a smooth transition between the pipes shall be provided. No connections shall be made when the difference between the influent and effluent inverts is between twelve inches (12") and twenty-four inches (24").

An inside drop manhole shall be required whenever the invert of the incoming pipe enters the manhole at an elevation greater than 24 inches (24") above the invert of the outgoing pipe. The manhole for inside drop connections must be a minimum of 5 feet (5') in diameter and one size larger than indicated in Section 3.2.8.

### **3.2.3 Manhole Frames and Covers**

In streets, manhole frame and cover castings shall be installed so that the cover is exposed and flush with the street surface. Heavy weight lids per detail 3.2.3-1A shall be used for manholes in paved areas of major streets or as indicated on the project drawings. Thirty-six inch (36") frames and covers per detail 3.2.3-1B shall be used for manholes with sewers 24" in diameter and larger. Standard weight 24" frames and covers shall be used in all other locations. Slope adjusting rings shall be used as necessary to ensure that the cover matches the slope of the pavement. Final acceptance of sewer lines will not be made until paving is completed, all manhole covers are exposed, and the street is accepted by the Virginia Department of Transportation.

Manholes in unmaintained easements and areas subject to flooding shall have watertight manhole frames and covers installed.

All manholes shall have the manhole frame anchored to the manhole with stainless steel anchor bolts as shown on Detail 3.2.1-4.

It shall be the responsibility of the owner or developer to ensure that manhole covers are not covered or damaged due to any work being performed. All manholes shall have a positive seal between the manhole casting, adjusting rings, and cone section. An acceptable method is shown on Detail 3.2.3-8. The method of sealing shall be shown on the construction plans and is subject to the approval of the Director.

### **3.2.4 Manhole Connections**

All manholes for service with twenty-inch (20") diameter main line pipe or smaller shall be supplied with a flexible pipe connection suitable for specified pipe and manhole. Manholes for service with main line pipes larger than twenty inches (20") shall have the first joint located four feet (4') from the inside face of the manhole.

Flexible pipe connections shall conform to ASTM C443 and ASTM 923. The construction plans shall indicate any and all bearings and/or angles of deflection for all mains connecting to manholes to ensure proper location of boot connection to manholes.

Precast manholes shall be manufactured for the specified number of connections required. Manholes with more connections than needed are not acceptable.

### 3.2.5 Ventilation

Ventilation of gravity sewer systems shall be provided for continuous watertight sections greater than 1,000 feet (1000') in length.

### 3.2.6 Flow Channel

The flow channels through manholes shall consist of precast channels of such shape and slope to provide smooth transition between inlet and outlet sewers and to reduce turbulence. The depth shall be 80% of the largest pipe diameter for changes of direction of 0° - 45° and 100% of the largest pipe diameter for changes of direction of 45° - 90°. Benches shall be sloped to the channel at two-inches (2") per foot to prevent accumulation of solids. Changes in direction of flow greater than ninety degrees (>90°), are not permitted.

### 3.2.7 Dog House Manholes

Doghouse manholes shall not be allowed. If a break in the sewer pipe is necessary, a new manhole must be cut into place.

### 3.2.8 Manhole Requirements

The minimum size manholes are required for the following changes of direction:

0° - 45°		Manhole	45° - 90°	
PVC Pipe	DI Pipe	Diameter	PVC Pipe	DI Pipe
Diameter	Diameter		Diameter	Diameter
6" - 15"	6" - 15"	48"	6"-15"	6"-15"
18" - 27"	18" - 30"	60"	18"-27"	18"-30"
N/A	48"	72"	N/A	30"
N/A	54"	84"	N/A	36"
N/A	64"	96"	N/A	42"

### 3.2.9 Waterproof Manhole Inserts

Waterproof manhole inserts as shown on Detail 3.2.3-3 shall be used with all non-watertight frames and covers.

### 3.2.10 Pipe Fittings

Vertical fittings shall be used near manholes where the slope of the influent or effluent pipes exceeds 10°.

### 3.2.11 Acid Resistant Manholes

For a distance of 1200 feet downstream from a force main or low pressure sewer system discharge, acid-resistant pipes and manholes shall be used. Drop manholes and manholes where excessive turbulence from sewers entering with a high velocity shall be lined with an approved acid resistant coating. On existing systems, manholes shall receive an acid-resistant coating approved by the Director. The acid resistant coating shall cover all interior concrete surfaces of the manhole, including channels, benches, and manhole sections.

### **3.2.12 Existing Manhole Modifications**

When it becomes necessary to modify an existing manhole by making new penetrations to accommodate relocated sewer lines and/or adjusting the elevation of the manhole top, the preferred method is to replace the existing manhole with a new manhole. When it can be demonstrated to the satisfaction of the Director that the existing manhole is of modern construction and can be modified without undue risk of leaking, or that the replacement of the existing manhole is complicated by other factors, the Director may approve modification of the existing manhole provided the following steps are followed:

- The existing manhole shall be examined to determine the original manufacturer and if it was constructed with flexible manhole connectors at the pipe penetrations. If the original penetrations were grouted, and the project requires new penetrations, the manhole must be replaced.
- If it is determined that the existing manhole has flexible manhole connectors, and the proposed new lines will enter at an angle meeting the manufacturer's recommendations for adjacent penetrations, then the base may be approved for re-use. New penetration shall be made by core drilling the manhole wall and internal bench. Flow channels shall be modified to meet the requirements of paragraph 3.2.6. All core drilling shall be performed by or under the direct supervision of personnel with five years of successful experience in core drilling manholes.
- For adjustments to match revised surface elevations, new manhole sections shall be purchased with matching joint segments to ensure an accurate fit. Each manhole section shall be sealed with a O-Ring gasket, if possible, a minimum of two rows (inside and outside of joint) of butyl mastic and the exterior of the joint sealed with a six (6) inch wide band of butyl mastic sealant. The new sections shall be stable from lateral forces as well as secure from leaking.
- Following completion of the modifications, the entire manhole shall be vacuum tested for integrity in accordance with these standards and all leaks corrected regardless of whether the leaks occur in the original or the modified sections.
- Wastewater flows in the existing sewers must be addressed during vacuum testing.

## **3.3 SEWER SERVICES**

### **3.3.1 Sewer House Connections**

Sewer house connections shall be provided for each dwelling and lot to be served and shall be a minimum of 4 inch (4") diameter. All adjacent lots that are not a part of the proposed development, but that might be served by the sewer line shall also be provided with house connections. Only one (1) single family dwelling per lateral will be permitted. The location of each sewer house connection shall be clearly indicated on the construction drawings.

All new sewer construction shall include premanufactured wyes for sewer house connections. Saddles will only be allowed for connection to existing sewer lines. Sewer house connections to terminal manholes shall not exceed two (2) in number. Only two lateral penetrations of the manhole will be permitted. No house connections to non-terminal manholes will be allowed.

The lowest floor elevation of any structure to be served by gravity shall be a minimum of four feet (4') above the invert elevation of its sewer house connection at the sewer main. For existing structures, connection to the public sewer with plumbing fixtures located on a floor of the structure that is not four (4) feet or more above the sewer main as specified above shall not be allowed unless a written waiver is obtained from the Department or a pumping operation is utilized.

Sewer house connections shall not be tied directly into an interceptor sewer unless specifically approved by the Director.

The minimum and maximum slope for a sewer lateral shall be 2.08% and 100% respectively. The following are not permitted:

- 1) Attaching sewer service connections to the vertical portion of the cleanout constructed at the property line or easement line.
- 2) Drop connections on the portion of the lateral in the VDOT right of way or in a sanitary sewer easement.

The maximum depth of a sewer lateral at the property line or easement line shall be 12 feet and maximum length from the sewer main to property line or easement line shall be 75 feet. The utility contractor shall install a tracer wire from the main to the secondary stack in accordance with detail 2.4.5-4. For projects involving the construction of new sewer mains, the sewer lateral to the property line or easement line, the cleanout, and the secondary stack shall be constructed and tested with the sewer mains. After tentative acceptance by the county, the plumbing contractor shall construct the sewer lateral from the building to either the tested secondary stack or the tested stub beyond the primary cleanout and shall complete the primary cleanout at finished and the secondary cleanout, if applicable.

When specifically approved by the director, a longer portion of the sewer lateral beyond the long radius sweep tee and past any utility easements may be constructed with the sewer mains provided that a means of protecting the extended sewer lateral is provided. However, in no instance shall the cleanout be constructed closer to the structure than other utilities such as gas, electricity, telephone or cable TV.

A sanitary sewer lateral table shall be included in the construction plans. The table will include the inverts of the lateral at the main and elbow, the lowest floor elevations of the proposed buildings, the size, total length and length to property line or easement, and slope of the laterals, ground elevation at the property or easement line, invert at the property or easement line, and depth at the property or easement line. A sample sewer lateral schedule is included at Appendix 4.

Where laterals are constructed in areas congested with other utilities, the Director may require a profile of the sewer lateral.

### **3.3.2 Cleanouts**

A four-inch (4") cleanout shall be provided at the property line or easement line for each house service connection. If the sewer is located beyond the property line, the cleanout shall be located at the property line. If the sewer is located in an easement on the property being served, the cleanout shall be located at the easement line. In addition, cleanouts shall be provided in accordance with the current adopted edition of the International Plumbing Code. A cast iron cleanout cover shall be placed over every cleanout, including those cleanouts installed on the sewer house connection between the property line and the building.

Lateral backwater valves shall be installed on house sewer laterals serving buildings with basements or floors located below the top of the wetwell elevation of the nearest wastewater pumping station. Condensate drains from air conditioners, furnaces and other equipment shall not be connected to waste system piping. Connection of roof downspouts, exterior foundation drains, areaway drains, basement drains and other sources of surface runoff and groundwater directly or indirectly to a sanitary sewer is prohibited by Section 25-59 of the County Code.

### **3.3.3 Private Sewer Connections**

Sewer house connections, or portions of sewer house connections located outside of the VDOT right-of-way shall be privately owned, operated and maintained. Private sewer connections are regulated by the VUSBC.

## **3.4 MATERIALS**

### **3.4.1 Ductile Iron Pipe**

Ductile iron pipe shall meet requirements of AWWA C-151 (ANSI A21.5). Pipe and fittings shall have inside cement lining with an approved hydrogen sulfide protective coating. Pipe and fittings shall have an exterior bituminous coating meeting requirements of AWWA C-104 (ANSI A-21.51), double thickness.

Slip joint or mechanical joint pipe and fittings shall be used for gravity sewers in accordance with AWWA C-111 and C-153.

Class 50, 51, or 52 pipe as conditions require shall be used in all sewer applications.

Gaskets shall be furnished by the manufacturer and installed according to his recommendations.

Ductile iron pipe shall not be used for a project unless a soil investigation in accordance with AWWA C105 is performed. If the soil investigation demonstrates that the soils would be corrosive to ductile iron pipe, the pipe shall be wrapped with polyethylene in accordance with AWWA C105. Polyethylene encasement shall be in accordance with ASTM D1248 and AWWA C105 and shall be 8 mil. thick.

Ductile iron pipe may be used in general construction applications. Ductile iron pipe shall be used in exposed pipe installations, across major stream crossings, and for excessive depth of fills, where other pipe materials are subject to crushing. Where ductile iron pipe is used for a sewer main, ductile iron pipe shall be used for sewer house laterals.

### **3.4.2 Polyvinyl Chloride (PVC)**

PVC pipe and fittings 4 inch (4") through 15 inch (15") diameter shall meet requirements of ASTM D3034, wall thickness classification SDR-35, as modified herein. PVC pipe and fittings 18 inch (18") through 48 inch (48") diameter shall meet the requirements of ASTM F679, wall thickness T-1, as modified herein. Pipe shall be furnished in lengths of not less than 12 feet. Pipe with blisters, bubbles, cuts, or scrapes on inside or outside surfaces, or imperfections which will impair the performance or life of the pipe, will be rejected.

Joints for PVC pipe and fittings shall be the integral bell gasketed joint design so, when assembled, the elastomeric gasket inside the bell is compressed radially on the pipe spigot and provides a watertight joint. Joints shall conform to ASTM D3212. The fittings shall be made from PVC components as defined and described in ASTM standard D1784. The gasket shall meet requirements of ASTM F477.

PVC pipe and fittings shall be legibly marked in accordance with ASTM D3034 and ASTM F679, and in addition marked with the date and location of manufacture. Pipe not marked as indicated herein will be rejected and pipe manufactured more than six months before the date of the work site inspection will not be accepted.

### **3.4.3 Manholes**

Precast concrete manholes shall meet requirements of ASTM C478 except that the minimum compressive strength of the concrete shall be 5000 psi using Type II cement and a minimum compression cylinder test of 4000 psi, the variance in accordance with ASTM C478, with configurations as shown on the Standard Details and with joint gasket meeting requirements of ASTM C443. Furnish in lengths of one-foot minimum except not more than one, one-foot section shall be used in a manhole. The exterior of all manholes shall be coated with a bituminous material applied with two (2) coat application with minimum of 16 dry mils. The inside surfaces of all manholes shall be smooth. Inverts, flow channels, and benches shall be preformed by the manufacturer unless otherwise approved by the Director.

Where acid-resistant manholes are required, precast concrete manholes with an approved manhole liner shall be used. Linings shall cover all floor, wall and pipe opening surfaces, including the bottoms of flat tops, if applicable. Manhole steps shall not be installed in acid-resistant manholes.

Manhole steps shall be forged aluminum, or steel encased in corrosion resistant, non-sparking, nonconductive material of approved design. Steps shall be securely anchored to the walls of the manhole. Steps shall be uniformly spaced at 12" to 16" on center vertically and shall project evenly unless otherwise directed.

#### **3.4.4 Manhole Frames and Covers**

Grey iron castings for manhole frames and covers shall meet requirements of AASHTO M-306 and ASTM A48 Class 35B. Ductile Iron castings shall meet requirements of ASTM A536, Grade 65-45-12. Castings shall not be coated. Seating surfaces between frame and cover shall be machine ground and finished to ensure satisfactory seating and anti-rocking. Castings shall conform to the Federal Specification RR-F-6216.

Manholes, frames and covers shall be suitable for AASHTO H20/HS20 loading conditions and shall have a total weight of 320 lbs (within 5%).

Standard manhole frames with solid covers and waterproof manhole inserts shall be used in all paved areas and all maintained areas. Watertight manhole frames and covers shall be used in all other locations.

#### **3.4.5 Valves**

All valves on assemblies, such as vacuum air release assemblies shall be stainless steel, lever operated.

### **3.5 SEWER CONSTRUCTION**

#### **3.5.1 General Requirements**

All construction of sanitary sewer mains and appurtenances in Stafford County shall be in accordance with plans and specifications approved by the Department of Utilities. Prior to the construction of the approved sanitary sewer, the design engineer or surveyor shall place adequate line and grade stakes in order that the sanitary sewer and appurtenances may be constructed in accordance with the approved plans.

The design engineer shall prepare legible cut sheets at fifty feet (50') stations indicating all pertinent construction data to include service connection locations, concrete encasement or cradle, and finish grades of manhole rims. A set of all cut sheets shall be submitted to the Department of Utilities prior to construction.



If any deviation is contemplated in the location of grade line of any sewer, structure or appurtenance from the approved plans, a revision to the plans showing the proposed deviation must be submitted to the Director for review and approval before the changes are constructed.

### **3.5.2 Bedding**

Pipes up to and including eighteen inches (18") in diameter, except ductile iron, shall be bedded in compacted granular material. Pipe shall be placed on compacted granular bedding having a minimum thickness of one-fourth (0.25) of the pipe's outside diameter (4 inches minimum), and the granular bedding shall extend to the spring line of the pipe. Pipe bedding shall be VDOT size 57 per Section 203, Table II-3, VDOT Road and Bridge Specifications, having a maximum 1/2" particle size. Bedding for pipe larger than 18 inches and ductile iron pipe shall be designed on an individual basis and approved by the Director.

### **3.5.3 Pipe Installation**

All pipe and fittings shall be carefully handled with slings or other devices to prevent damage to protective coatings or joints. Lifting equipment shall be satisfactorily rated to handle the pipe sizes used. Each section of pipe shall be thoroughly inspected for defects before being lowered into the trench. Pipe shall be laid true to line and grade with bells upstream and shall be jointed together such that the completed pipe will have a smooth invert. The standard bedding shall be shaped to the curvature of both the bell and barrel of the pipe. The trench shall be kept free of water while the work is in progress. The ends of the pipe shall be brushed so that proper joints can be made. As the work progresses, the interior of the pipe shall be cleared of dirt, cement, or other superfluous material. The exposed end of all pipe and fittings shall be fully closed to prevent earth, water, or other substances from entering the pipe. During the winter season, or during periods of inclement weather, the trench shall be completely backfilled at the end of each workday.

All sewer work shall begin at the first new downstream manhole. The sewer main construction from this point shall be installed, cleaned, tested, and accepted. Upon acceptance, the section between the existing manhole and the first new manhole shall be installed and tested. Clay dams shall be installed on each reach of sewer greater than 100-feet in length, 25-feet from the downstream manhole, in accordance with detail 3.1.2-1.

The method of making joints and the material used shall be included in the specifications and the joint material and joint testing shall conform to the latest edition of the appropriate standards and specifications. Sewer joints shall be designed to prevent infiltration and prevent the entrance of roots.

### **3.5.4 Service Connections**

Service connection laterals from the sewer to the building shall be installed with the same care as the sewer main. Proper excavation, slope of pipe and standard granular bedding shall be provided throughout.

Service connection branches shall be plugged with a pipe stopper manufactured for such service. The stopper shall be capable of sustaining without failure or leakage, an internal pressure head of ten feet (10') (4.3 psi).

Grade for service connections shall be in accordance with VUSBC.

Service connections to terminal manholes must be tied in at the bottom of the manhole and channeled into the invert of the main. A standard drop may be used.

Lateral connections made into existing sewer mains shall be done by the use of tapping saddles.

Saddles shall be installed by cutting the pipe with a tapping machine. A rubber gasket shall be placed between the saddle and pipe. The saddle shall be secured to the pipe with a twenty-four (24) gage stainless steel strap and two (2) three-eighth inch (3/8") by three and one-eighth inch (3 1/8") by two and one-eighth inch (2 1/8") nickel-bronze T bolts.

### **3.5.5 Manholes**

Precast concrete manholes shall consist of precast reinforced concrete sections, an eccentric conical section, and an expanded base section, extending a minimum of six inches (6") beyond the outside vertical wall (riser section) of the manhole.

The precast base section shall be installed on a compacted stabilized foundation prepared similar to that required for the proper installation of the adjacent sewer as described elsewhere in these Design Standards.

Connections to existing manholes shall be made by coring the manhole and installing a rubber boot. Flexible manhole connectors shall be installed by manufacturer-trained personnel using proper equipment, including accurate gauges.

Manhole frames shall be set in 1/4" bed of an approved manhole joint sealer and anchored with stainless steel bolts in accordance with Detail 3.1.2-4.

### **3.5.6 Inspection and Testing**

All sewer construction shall be subject to testing and inspection, including internal television inspection by the County, prior to acceptance.

The contractor shall furnish mandrels weirs, stand pipes, pipe plugs, calibrated pressure gauges, stopwatches, air compressors, hose, and such materials and assistance as required to perform these tests. All acceptance tests shall be conducted by the contractor in the presence of a utility inspector. The contractor shall schedule all acceptance tests with the Department of Utilities at least forty-eight (48) hours in advance.

Prior to the inspection by the County, the contractor shall locate and adjust all manholes, valve boxes, etc. to final grade and clean all gravity lines and manholes.

All gravity sewer lines, to include sewer house connections, shall be tested after backfill using a low-pressure air test. The air test shall be conducted as follows: provide test plugs at each manhole and securely brace. Provide suitable means of determining depth of groundwater level above the inverts immediately before testing. The testing pressure will be increased accordingly but the total pressure including the increased amount of groundwater backpressure at the springline of the pipe shall not exceed 5.5 psi. Add air slowly to the test section until the internal air pressure, as indicated on the gauge, stabilizes at 4 psi or at the increased pressure determined for the correction of the groundwater backpressure. Do not allow personnel in manholes while the test is being performed or when test section is under air pressure. If leakage is indicated at the test plugs, relieve pressure before taking steps to eliminate the leak. When the air pressure is stabilized, disconnect the hose and compressor and allow the pressure to decrease to 3.5 psi, plus correction for groundwater backpressure. Record the time period for the pressure to drop ½ psi. Pipes failing to maintain minimum holding times set forth in the table below will not be accepted.

Should the test show displacement, damage or leakage in excess of the allowable amount, the Contractor shall repair the displacement and damage and eliminate the leakage. He shall retest until the specified conditions are met to the satisfaction of the Department of Utilities.

All gravity sewer lines shall be internally inspected by closed circuit television camera by the County prior to acceptance. The contractor shall test the pipe for excessive deflection by passing a mandrel sized for 5% deflection in each pipe type, thickness, and diameter. The contractor shall repair all deficiencies noted during the inspection.

### AIR TEST TABLE

#### Pipe Size – Diameter

Length	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"
25'	1:53	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
50'	1:53	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
75'	1:53	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
100'	1:53	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
125'	1:53	2:50	3:47	4:43	5:40	7:05	8:30	10:54	14:15	18:02
150'	1:53	2:50	3:47	4:43	5:40	7:47	11:13	15:16	19:56	25:14
200'	1:53	2:50	3:47	4:43	5:42	8:54	12:49	17:27	22:48	28:51
225'	1:53	2:50	3:47	4:43	6:25	10:01	14:25	19:38	25:38	32:27
250'	1:53	2:50	3:47	4:57	7:08	11:08	16:01	21:49	28:30	36:04
275'	1:53	2:50	3:47	5:26	7:50	12:15	17:37	24:00	31:20	39:40
300'	1:53	2:50	3:48	5:56	8:33	13:21	19:14	26:11	34:11	43:16
325'	1:53	2:50	4:07	6:26	9:15	14:28	20:50	28:21	37:02	46:52
350'	1:53	2:50	4:26	6:55	9:58	15:35	22:26	30:32	39:53	50:30
375'	1:53	2:50	4:45	7:25	10:41	16:42	24:02	32:43	42:44	54:05
400'	1:53	2:51	5:04	7:54	11:24	17:48	25:38	34:54	45:35	57:42

Minimum holding time in minutes and seconds by size and length of pipe.

Pressure drop from 4.0 psi to 3.5 psi (test pressure shall be increased by amount of groundwater backpressure at springline of pipe, but shall not exceed 5.5 psi)

All manholes shall be tested for water tightness by vacuum testing after the manhole frame and cover have been installed to final grade and prior to final acceptance.

Vacuum tests shall be conducted in accordance with ASTM C1244. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn. Vacuum equipment shall be approved by the Director prior to its use. A measured vacuum of 10 inches (10") of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches (9") of mercury shall be recorded. The following are the minimum allowable test times for manhole acceptance at the specified vacuum drop:

Depth of Manhole (feet)	Time (sec) Manhole Diameter (inches)								
	30	33	36	42	48	54	60	66	72
8	11	12	14	17	20	23	25	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	48	51	57
16	22	24	29	34	40	45	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	48	55	64	72	79	89
24	33	38	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

If manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic repaired.

Manholes that fail the vacuum test shall be repaired, and the test and repairs shall be repeated until the manhole passes the test.

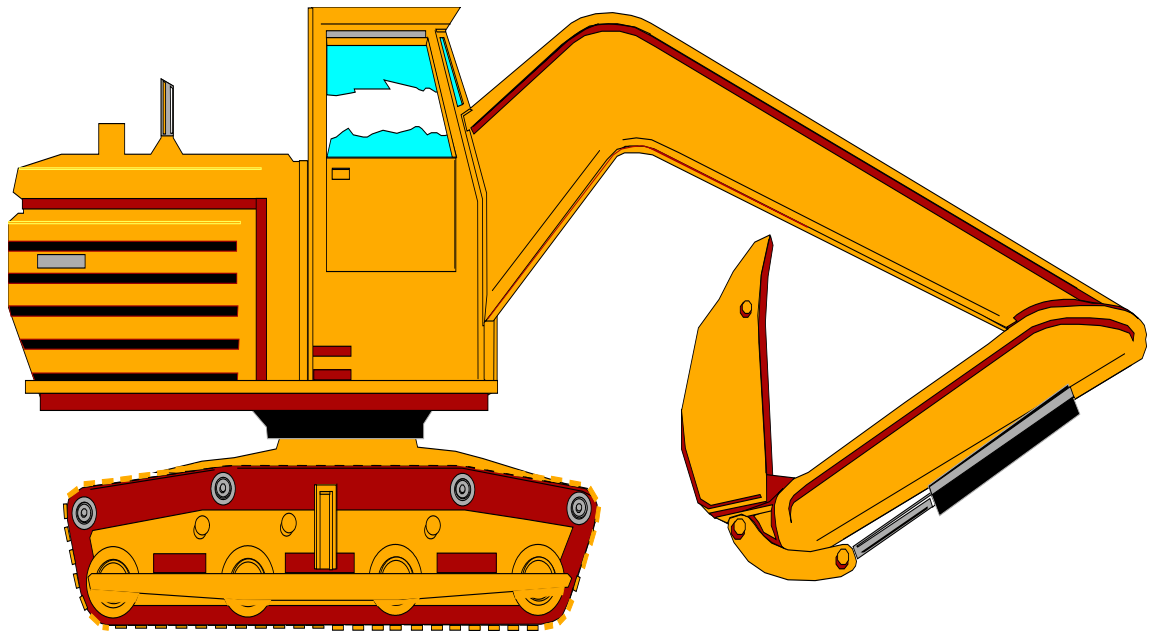
### 3.5.7 Abandoning Sewer Service

Sewer Services shall be abandoned by removing the tapping saddle and placing a repair clamp over the opening or by removing the 45° bend or pipe from the tee wye and replacing it with a capped stub.

All work shall be performed by site contractor and inspected by County.

## SECTION 4

### SEWER PUMPING STATION STANDARDS



## SEWAGE PUMPING STATION STANDARDS

### 4.1 GENERAL

#### 4.1.1 General Requirements

Public wastewater pumping stations will be used only when it has been determined by the Director that they are the only practical method to provide sanitary sewer service to the area and are consistent with the Water and Sewer Master Plan. Wastewater pumping stations shall comply with Virginia Sewage Collection and Treatment (SCAT) Regulations.

All wastewater-pumping stations shall be designed and specifications written by an Engineer registered in the Commonwealth of Virginia and qualified by experience to do such work. The plans and specifications shall contain sufficient detail so that no misunderstanding can arise as to the material to be used, the equipment to be installed, or the quality of the workmanship, all of which shall be of first grade quality. The plans and specifications, together with a design analysis, shall be submitted and approved by the Director and the Virginia Department of Environmental Quality (DEQ) prior to the start of any construction.

Prior to start of design, the engineer shall schedule a conference with the Department of Utilities to review the requirements of this standard and to determine specific requirements for equipment selection, and specific design details. The guidance in this chapter is general in nature. Specific design information will be provided by the Department of Utilities for each specific project.

No structures tributary to a proposed pumping station shall be occupied until the following items have been provided:

- a. A "Certificate to Operate" the pumping station from the DEQ.
- b. Five copies of the Operations and Maintenance Manual approved by the County and the DEQ.

Private wastewater pumping stations may be used only with approval of the Director to serve individual parcels where no other means of wastewater conveyance exists. Private wastewater pumping stations must meet the design and permitting requirements of DEQ and shall be owned and operated by the owner of the parcel they serve.

#### 4.1.2 General Design Requirements

The design engineer shall take into consideration the appearance and landscaping of the wastewater pumping station property. The design engineer shall obtain from the County approval of a site plan meeting current requirements of the County. In particular, trees, shrubs and other landscaping shall be required to present a finished appearance consistent with the zoning and general appearance of the surrounding area.

The construction plans and plats shall identify a 100-foot zone of controlled or limited use surrounding the center of the wet well. Within such zones, residential uses or high-density human activities or activities involving food preparation shall be prohibited.

The site shall be provided with a eight-foot (8') high chain link fence with a twenty-foot (20') wide vehicle gate and a man gate. A board on board fence or other approved visual screening consistent with the general appearance of the surrounding area shall be provided.

An ample, all-weather-access twelve-foot (12') wide road, including pavement, storm drainage and parking, shall be provided for easy access to the pumping station. The access road and turn-around shall be paved outside of the fenced area of the pumping station site, as well as the entrance at a VDOT road. The grade of the road shall not exceed 10 percent. On long access roads, a locking gate will be provided at the entrance to the access road from the public right-of-way.

All pumping stations shall be designed to minimize odor and hydrogen sulfide generation; odor control facilities approved by the Department of Utilities shall be installed where required. Prevention of hydrogen sulfide generation shall be an important design consideration.

Finished floor elevations, entrance hatches and all vents shall be at least one foot (1') above the 100-year flood level.

#### **4.1.3 Capacity Design**

Wastewater pumping stations shall be sized in accordance with the criteria shown in the Master Water and Sewer Plan and shall take into consideration such parameters as minimum, average, and peak station inflows as well as minimum, average, and maximum pumping rates. The capacity of the station shall be the projected ultimate flow for the drainage basin, unless a lesser capacity is approved by the Director. In that case a phasing plan shall be submitted by the design engineer.

Pump selection and force main selection shall be based on a hydraulic analysis of the required flows, pipeline velocities, and receiving gravity sewer capacities.

Consideration must be given to designs that produce minimum power requirements to accomplish the functions required. If requested, supporting data shall be furnished to the County.

#### **4.1.4 Power Source**

All stations shall be provided with three phase 60 Hz electrical power. Devices to convert single-phase power to three-phase power will not be allowed.

All stations shall be provided with an emergency by-pass pumping arrangement and a permanently installed emergency generator with an automatic transfer switch. The transfer switch shall be sized in accordance with the electrical service requirements.

## **4.2 MATERIALS AND EQUIPMENT**

### **4.2.1 Pumps**

Package pumping stations shall be supplied from a manufacturer having a minimum of 5 years experience in the manufacture of pumping stations. The pumps, motors, and controls shall be supplied by a single vendor.

Pumps shall be capable of passing a minimum of three-inch (3") solids.

Wastewater pump selection should allow for upsizing and downsizing of impellers as dictated by wastewater flows.

### **4.2.2 Motors**

The pump motors shall be submersible, close coupled with normal starting torque and low starting current. The motors shall not overload at the design condition or at any head in the operating range as specified. Motors shall be sized for both maximum and minimum head conditions as well as maximum energy efficiency. Each motor shall be in current NEMA design cast iron frame with copper windings.

### **4.2.3 Controls and Starters**

Controls and starters shall be assembled by the control panel manufacturer in a single panel and contain the following:

- a. One properly sized main circuit breaker.
- b. A step-down transformer for station voltage of over 460 volts.
- c. A circuit breaker and starter for the starting of each pump motor properly sized for motor running current and short circuit protection on all three phases of the motor.
- d. Reduced voltage starters shall be provided for 75 HP and larger motors.
- e. One control circuit to provide lead, lag, and alternate operation of pumps with provisions for hand-off-auto operation (HOA).
- f. Elapsed time meters are to be provided for each pump.
- g. An adjustable three phase voltage sensor to protect motors and motors starters from single phasing and under-voltage.
- h. Provide for individual circuit breakers for power source for lights, ventilation fans, convenience receptacles, heater, sump pumps, and RTU receptacle as required, with step-down transformer for 120 volt A.C. to control separate circuits and station auxiliaries.
- i. The panel shall be UL standard aluminum or stainless steel.
- j. All panels must have point-to-point wiring.

### **4.2.4 Standby Power Source**

All wastewater pumping stations shall be equipped with a standby power source and automatic transfer switch as follows:



- a. An automatic power transfer switch and control to sense power failure and generator running and to transfer station to emergency power source.
- b. A trickle charger for the generator starting battery.
- c. A generator sized to permit operation of all pumps and accessories with the exception of the standby pump.

#### **4.2.5 Flow Meter**

All stations operated by variable frequency drives shall have a flow meter. The unit shall have an accuracy of plus or minus 2.0% of full scale. Meters shall be magmeter type.

#### **4.2.6 Comminutor**

At a minimum, all wastewater pumping stations will be provided with a manhole or vault upstream of the wet well for a future comminutor. The Director may require that a comminutor be included in the initial construction.

#### **4.2.7 Telemetry System**

All stations shall be provided with a remote telemetry system that is the same type and compatible with the County's existing SCADA system. The unit shall have a battery backup and a NEMA-1 enclosure (for inside locations) or NEMA 4X fiberglass enclosure (for exterior locations), and a compatible antenna.

Alarm and status inputs shall be specified by the County but as a minimum the following shall be included:

- a. High water - wet well level
- b. Low water-wet well level
- c. Pump failure (due to overload or no-flow or over temperature or seal failure)
- d. Pump run status
- e. Power failure (single phase and three phase)
- f. Generator run status
- g. Pump flow rate
- h. Intrusion alarm
- i. Special points as determined by the County.

#### **4.2.8 Wet Wells**

Wet well shall be constructed of precast concrete. For waterproofing and protection against hydrogen sulfide attack, the exterior concrete surfaces shall be coated with two (2) coats of bituminous waterproofing material applied at the rate of 7 mils per dry coat or two-part epoxy with each coat being a different color. The interior surface shall have an acid-resistant high-density polyethylene acid resistant lining.

All miscellaneous metal in the wet well shall be stainless steel alloy designed for use in sewage structures. All bolts, nuts and other fasteners in wet wells shall be 316 or 304 stainless steel.

#### **4.2.9 Valves**

All valves on assemblies, such as low pressure sewer house connections shall be stainless steel, lever operated.

#### **4.2.10 Force Mains**

Force mains shall have a positive slope from the pumping station to the point of discharge unless unusual conditions make it impractical. Extra depth of bury shall be provided in lieu of air or air/vacuum relief valves wherever feasible. Every effort shall be expended to maintain the force main below the hydraulic gradient.

Pipe for sanitary sewer force mains shall meet all applicable requirements of Section 4.2.8.1 or 4.2.8.2 and shall be tested the same as water mains. A minimum cover of 3.5 feet shall be provided. Future regrading shall be taken into consideration.

A pig launching station shall be installed on the force main adjacent to the pumping station.

Gate valves shall be located on the force main adjacent to the pumping station, at intervals not to exceed 3,000 feet, and on both sides of water crossings or bridges.

All force mains shall be marked by a tracer wire in accordance with Section 2.5.4 and a three inch (3") marking tape installed two feet (2') above the pipe.

##### **4.2.10.1 Ductile Iron Pipe**

Ductile iron pipe shall meet requirements of AWWA C-151 (ANSI A21.5). Pipe and fittings shall have an inside approved ceramic epoxy coating. Pipe and fittings shall have an exterior bituminous coating meeting requirements of AWWA C-104 (ANSI A-21.51), double thickness.

Slip joint or mechanical joint pipe and fittings shall be used for gravity sewers in accordance with AWWA C-111 and C-153.

Class 50, 51, or 52 pipe as conditions require shall be used in all sewer applications.

Gaskets shall be furnished by the manufacturer and installed according to his recommendations.

Ductile iron pipe shall not be used for a project unless a soil investigation in accordance with AWWA C105 is performed. If the soil investigation demonstrates that the soils would be corrosive to ductile iron pipe, the pipe shall be wrapped with polyethylene in accordance with AWWA C105. Polyethylene encasement shall be in accordance with ASTM D1248 and AWWA C105 and shall be 8 mil. thick.

Ductile iron pipe may be used in general construction applications. Ductile iron pipe shall be used in exposed pipe installations, across major stream crossings, and for excessive depth of fills, where other pipe materials are subject to crushing.

#### **4.2.10.2 Polyvinyl Chloride**

Polyvinyl Chloride (PVC) pipe four inches (4") through twelve inches (12") shall be minimum Pressure Class 150 (SDR 18) PVC water main with "push-on" type joints meeting all requirements of AWWA C900. PVC Pipe fourteen inches (14") through thirty-six inches (36") shall be minimum pressure class 150 (SDR 26) PVC water main with "push-on" type joints meeting all requirements of AWWA C905. Outside diameter of the PVC pipe shall be the same as the outside diameter of cast iron water pipe meeting ANSI Specifications A 21.6. Installation of force mains shall be in accordance with AWWA C605.

#### **4.2.10.3 High Density Polyethylene**

HDPE Pipe will be considered on a case-by-case basis.

### **4.3 LOW PRESSURE SEWER SYSTEMS**

#### **4.3.1 Introduction**

Low-pressure sewer systems shall be used only when there is no reasonable way to provide gravity sewer service to the property. All grinder pumps will be owned and maintained by the property owner.

The County shall accept the maintenance responsibility for a common low pressure sewer main that serves more than one grinder pump, provided that the low pressure sewer main is installed in a public right-of-way or in a dedicated easement and built to County standards under County inspection.

#### **4.3.2 Grinder Pump System**

1. Grinder pumps accepted by the Department shall be a semi-positive displacement or centrifugal type; 15 GPM at 0 Ft. TDH; 11 GPM at 81 Ft. TDH.
2. The tank shall be 60 gallon; non-corrosive, heavy-duty, reinforced fiberglass, suitable for outdoor use; integral fiberglass access hatch included.
3. The grinder shall consist of two hardened stainless steel cutters rotating at motor speed in precision relationship to hardened alloy shredding ring to produce finely divided slurry.
4. Piping connections: Inlet for four-inch (4") lateral; discharge for one and one half inch (1 1/2") npt.
5. The minimum motor shall be 1 HP, 1725 RPM, high torque, capacitor-start, 240 volt, 60 Hertz, 8 amp, single phase; with integral, automatic reset, thermal protector.

6. The controls shall be non-fouling static sensor and pressure switch with no moving parts in contact with the wastewater; self-contained unit.
7. Two check valves shall be provided, one integral on the discharge pipe inside the tank and a second just before the building pressure sewer ties into the street pressure main. Check valves shall be full ported, non-clogging, clapper type.
8. An anti-siphon valve shall be included on the discharge pipe inside the tank.
9. Grinder pumps and control panels shall not be located inside buildings or dwellings.
10. High water level, power failure and pump alarms shall be provided. A remote panel with an alarm test function shall also be provided; as shall a remote display with audible alarm. The alarm system shall be provided with a back-up power supply. This individual alarm system for the grinder pumps will not be connected to the Department's telemetry system.
11. An electrical permit issued by the County's Department of Public Works is required.
12. The control console alarm system shall be located in an accessible and visible location as close to the grinder pump as possible.
13. A disconnect shall be provided adjacent to the pump per NEC code. The pump controls will be located in the top housing of the core unit inside a waterproof access cover. They may also be located adjacent to the disconnect, in a NEMA 4 box.
14. A transfer switch shall be provided so that the grinder pump can be powered by a generator during a prolonged power outage. The County will not provide such generators.
15. All electrical equipment must be UL listed.
16. All equipment must be tested in accordance with the NEC.
17. Battery or generator standby power supply sufficient for 2 hours of intermittent pump operation.

#### **4.3.3 Low Pressure Sewer Mains**

1. The low pressure sewer main shall be class SDR 21 PVC pipe or SDR 17 HDPE. The low pressure sewer main shall be marked by tracer wire in accordance with section 2.5.4.
2. Schedule 40 solvent welded joints shall be made in accordance with the manufacturers' recommendations and in accordance with ASTM D 1885.
3. SDR 21 pipe shall have gasket joints in accordance with ASTM 1869.

4. Thrust blocks shall be provided for gasket type piping at all bends, tees, and changes of direction.
5. Force main piping shall be tested at 60 PSI for 30 minutes. No leakage shall be permitted.
6. Flushing connections shall be provided at the beginning of each force main line, at major changes of direction, and approximately every 600 to 1000 linear feet in accordance with Details 4.3.1-1 and 4.3.1-2.
7. Pressure sewer laterals from individual grinder pumps shall be connected to a common low pressure sewer main using a low pressure sewer house connection in accordance with Detail 4.3.1-3.
8. A valve shall be provided at each change in pipe size.

#### **4.4 VACUUM SEWER SYSTEMS**

Vacuum sewer systems shall NOT be used.

## SECTION 5

### STANDARD DETAILS



## STANDARD DETAILS

### 5.1 GENERAL DETAILS

Buttresses for 11- $\frac{1}{4}$ ° Horizontal Bend	1.4.1-1	12/04
Buttresses for 22- $\frac{1}{2}$ ° Horizontal Bend	1.4.1-2	12/04
Buttresses for 45° Horizontal Bend	1.4.1-3	12/04
Buttresses for 90° Horizontal Bend	1.4.1-4	12/04
Buttresses for Tees, Plugs, & Caps	1.4.1-5	12/04
Anchorage for 11 $\frac{1}{4}$ °, 22 $\frac{1}{2}$ °, & 45° Upper Vertical Bends	1.4.1-6	12/04
Buttress for 11 $\frac{1}{4}$ °, 22 $\frac{1}{2}$ ° & 45° Lower Vertical Bends	1.4.1-7	12/04
Restrained Lengths for Horizontal Bends, Dead Ends & Valves	1.4.1-8	12/04
Restrained Lengths for 11 $\frac{1}{4}$ °, 22 $\frac{1}{2}$ °, & 45° Upper Vert. Bends	1.4.1-9	12/04
Restrained Lengths for 11 $\frac{1}{4}$ °, 22 $\frac{1}{2}$ °, & 45° Lower Vert. Bends	1.4.1-10	12/04
Restrained Lengths for Tees, Run Diameters 6" to 12"	1.4.1-11A	12/04
Restrained Lengths for Tees, Run Diameters 14" to 20"	1.4.1-11B	12/04
Restrained Lengths for Tees, Run Diameters 20" to 30"	1.4.1-11C	12/04
Restrained Lengths for Reducers	1.4.1-12	12/04
Standard Concrete Cradle & Encasement	1.4.2-1	12/04
Steel Casing Detail for PVC or DIP	1.4.2-2A	03/06
Steel Casing Detail for HDPE	1.4.2-2B	03/06
Concrete Collar for Steep Slopes	1.4.2-3	02/17
Typical Pipe Location Existing Roadways	1.5.1-1	12/04
Trench for waterlines and Force Mains in Shoulder of Road	1.5.2-1	09/16
Trench for Waterlines and Force Mains in non-paved Areas	1.5.2-2	09/16
Trench for Waterlines and Force Mains Beneath Pavement	1.5.2-3	09/16
Trench for Sewers in Shoulder of Road	1.5.2-4	10/15
Trench for Sewers in Non-Paved Areas	1.5.2-5	10/15
Trench for Sewers Beneath Pavement	1.5.2-6	10/15
Water & Sewer Trench Details for Existing Roadways	1.5.2-7	09/16
Standard Stream Crossing	1.5.3-1	12/04

## 5.2 WATER DETAILS

Water Service Connection Detail	2.2.1-1	12/04
Water Meter Setting – 5/8”, 3/4”, 1” Meters	2.2.2-1	07/16
Traffic Rated Water Meter Frame & Cover	2.2.2-3	07/16
Water Meter Setting up to and Including 2” Meter Connections	2.2.2-4	09/16
Water Meter Setting – 3” and Larger Meters	2.2.2-5	12/04
Exterior Backflow Prevention Device	2.2.2-6	12/04
Interior RPZ Device Installation	2.2.2-7	12/04
Manifold Meter Setting	2.2.2-8	03/06
Double Check Assembly and Vault – 4” & Larger	2.2.3-1	12/04
Vacuum Air Release or Air Release 2” and Smaller Off Pipe Location Dry Locations	2.3.1-1	11/16
Vacuum Air Release or Air Release 2” and Smaller Off Pipe Location Dry Locations	2.3.1-2	11/16
Vacuum Air Release or Air Release 2” and Smaller Off Pipe Location for Wet Locations	2.3.1-3	10/16
Direct Bury Vacuum-Air Release Valve Off-Pipe Installation for Wet Locations	2.3.1-4	09/16
Direct Bury Vacuum Air Release Valve On-Pipe Installation for Wet Locations	2.3.1-5	10/16
Typical Fire Hydrant Assembly	2.4.4-1	11/16
Typical Fire Hydrant Location	2.4.4-2	12/04
Below Grade Flushing Hydrant	2.4.4-3	12/04
Above Grade Flushing Hydrant	2.4.4-4	12/04
Typical Fire Hydrant Location in Island & Parking Area	2.4.4-6	12/04
Typical Fire Hydrant Post Protection	2.4.4-7	12/04
Typical Valve and Valve Box	2.4.5-1	09/16
Tracer Wire Locator Box	2.4.5-2	03/16
Typical Valve Box with Tracer Wire	2.4.5-3	03/16
Tracer Wire For Sewer Laterals	2.4.5-4	09/16
Sampling Station	2.5.1-1	12/04

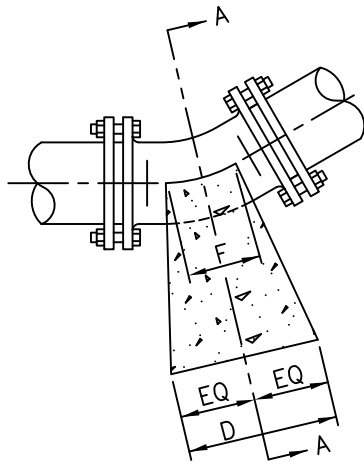


### 5.3 SEWER DETAILS

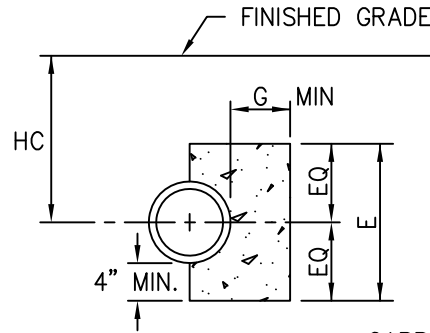
Clay Dam	3.1.2-1	12/04
Standard 4' I.D. Precast Concrete Manhole	3.2.1-1	07/16
Typical 5' and 6' and 8' I.D. Precast Manhole W/4" Stack	3.2.1-2	10/16
Typical 5' & 6' ID Precast Concrete Manhole w/ Flat Top	3.2.1-2A	10/16
Typical 8' ID Precast Concrete Manhole w/ 4" Stack	3.2.1-2B	10/16
Precast Concrete Manhole Flat Top	3.2.1-3	12/04
Manhole Anchor Bolt	3.2.1-4	12/04
Access Chamber	3.2.1-5	12/04
Typical 5' Manhole With Inside Drop Connection	3.2.2-1	09/16
Standard Manhole Frame & Cover	3.2.3-1	10/16
Heavy Weight Traffic Standard Frame & Cover	3.2.3-1A	07/16
36-Inch Frame and Cover	3.2.3-1B	10/15
Watertight Manhole Standard Weight Frame & Cover	3.2.3-2	07/16
Waterproof Manhole Insert	3.2.3-3	09/16
Internal Manhole Chimney Seal	3.2.3-8	10/16
Manhole Vent	3.2.5-1	03/06
4-Inch Sewer House Connection	3.3.3-1A	09/16
6-Inch Sewer House Connection	3.3.3-1B	09/16
Low Pressure House Service Connection to Gravity Sewer	3.3.3-2	12/04
Cleanout Cover Assembly for 4" Cleanouts in Areas Subject to Vehicle Traffic	3.3.3-3A	04/10
Cleanout Cover Assembly for 4" Cleanouts at Easements and Property Lines	3.3.3-3B	04/10
Panella-Type Cleanout Cap Assembly for 4" Cleanouts in Interior Yard Areas	3.3.3-3C	04/10
Sewer House Tap for Existing Main	3.3.3-4	10/16
Tracer Wire for Sewer Laterals	3.3.3-5	09/16

**5.4 PUMPING STATION DETAILS**

Sewage Combination Air/Vacuum Valve	4.2.5-1	12/04
Sewage Combination Air/Vacuum Short Pattern Valve	4.2.5-2	12/04
Inline Flushing Connection - LPSS	4.3.1-1	10/16
Terminal Connection - LPSS	4.3.1-2	10/16
Low Pressure Sewer House Connection	4.3.1-3	01/16
Force Main Connection to Gravity Sewer	4.4.1-1	12/04



PLAN



SECTION A-A

CARRY CONCRETE TO UNDISTURBED EARTH OR FIRM SUBGRADE

SOIL PROPERTIES	SIZE	Concrete Block Dimensions At 150 PSI Pressure				Add To Dimension D For Each Add 50 PSI Pressure Up To 300 PSI	Adjustment For Conc. Area For Different Height HC To Be Measured From Grade to $\phi$ Of Pipe			
		D	E	F	G		Up To 8'	8'-1" To 12'	12'-1" To 16'	16'-1" To 20'
CS = 1000 PSF $\phi = 15"$ SOFT SILTY CLAY & BETTER	3"	4"	1'	4"	6"	2"	CONC. BLOCK AREA 1.0 X D X E	CONC. BLOCK AREA 0.875 X D X E	CONC. BLOCK AREA 0.75 X D X E	CONC. BLOCK AREA 0.625 X D X E
	4"	4"	1'	4"	6"	2"				
	6"	6"	1'-2"	6"	7"	2"				
	8"	8"	1'-4"	8"	7"	2"				
	10"	9"	1'-6"	8"	8"	4"				
	12"	1'	1'-8"	1'	9"	4"				
	16"	1'-3"	2'	1'	9"	6"				
	20"	1'-3"	2'-6"	1'	10"	6"				
	24"	1'-6"	3'	1'	1'	6"				
30"	2'	3'-6"	1'-4"	1'-2"	9"					
CS = 0 $\phi = 15"$ LOOSE SILTY SAND	3"	10"	1'-6"	6"	9"	2"	CONC. BLOCK AREA 1.0 X D X E	CONC. BLOCK AREA 0.5 X D X E	CONC. BLOCK AREA 0.375 X D X E	CONC. BLOCK AREA 0.25 X D X E
	4"	1'	2'	6"	9"	2"				
	6"	1'-6"	2'	6"	1'	2"				
	8"	2'-4"	2'	8"	1'	2"				
	10"	2'-6"	2'-3"	8"	1'	4"				
	12"	3'-4"	2'-6"	1'	1'	4"				
	16"	4'-2"	3'	1'	1'-6"	6"				
	20"	4'-6"	3'-6"	1'	1'-6"	6"				
	24"	5'-8"	4'	1'-6"	1'-6"	6"				
30"	7'	5'	2'	1'-6"	9"					

- 1) DIMENSION D & E SHALL BE ADJUSTED FOR REQUIRED AREA.
- 2) DIMENSION F & G SHALL REMAIN SAME.
- 3) DIMENSION D SHALL BE ADJUSTED FOR REQUIRED PRESSURE IN EXCESS OF 150 PSI BEFORE MAKING ADJUSTMENT FOR HEIGHT.
- 4) THRUST BLOCKS SHALL BE INSTALLED ONLY WHERE APPROVED BY THE DEPARTMENT OF UTILITIES.

DECEMBER 2004

1.4.1-1

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

BUTRESSES FOR  
11 1/4° HORIZONTAL BEND

SOIL PROPERTIES	SIZE	CONCRETE BLOCK DIMENSIONS AT 150 PSI PRESSURE				ADD TO DIMENSION D FOR EACH ADD 50 PSI PRESSURE UP TO 300 PSI	Adjustment For Conc. Area For Different Height HC To Be Measured From Grade to $\phi$ Of Pipe			
		D	E	F	G		Up To 8'	8'-1" To 12'	12'-1" To 16'	16'-1" To 20'
CS = 1000 PSF $\phi = 15^\circ$ SOFT SILTY CLAY OR BETTER	3"	6"	1'-0"	6"	7"	2"	CONC. BLOCK AREA = 1.0 X D X E	CONC. BLOCK AREA = 0.875 X D X E	CONC. BLOCK AREA = 0.75 X D X E	CONC. BLOCK AREA = 0.625 X D X E
	4"	6"	1'-0"	6"	7"	2"				
	6"	8"	1'-2"	6"	8"	2"				
	8"	1'-0"	1'-4"	8"	8"	4"				
	10"	1'-3"	1'-6"	8"	10"	4"				
	12"	1'-6"	1'-8"	1'-0"	1'-0"	6"				
	16"	2'-0"	2'-0"	1'-0"	1'-3"	6"				
	20"	2'-6"	2'-6"	1'-0"	1'-6"	9"				
	24"	3'-0"	3'-0"	1'-0"	1'-6"	9"				
30"	4'-0"	3'-6"	1'-4"	1'-9"	1'-0"					
CS = 0 $\phi = 15^\circ$ LOOSE SILTY SAND	3"	1'-0"	1'-6"	6"	9"	2"	CONC. BLOCK AREA = 1.0 X D X E	CONC. BLOCK AREA = 0.5 X D X E	CONC. BLOCK AREA = 0.375 X D X E	CONC. BLOCK AREA = 0.25 X D X E
	4"	1'-6"	2'-0"	6"	9"	2"				
	6"	2'-0"	2'-0"	6"	1'-0"	2"				
	8"	3'-4"	2'-0"	8"	1'-0"	4"				
	10"	4'-2"	2'-3"	8"	1'-0"	4"				
	12"	4'-8"	2'-9"	1'-0"	1'-6"	6"				
	16"	5'-9"	3'-6"	1'-0"	1'-6"	6"				
	20"	7'-10"	4'-0"	1'-0"	2'-0"	9"				
	24"	9'-10"	5'-0"	1'-6"	2'-0"	9"				
	30"	11'-8"	6'-0"	2'-0"	2'-0"	1'-0"				

DIMENSION D & E SHALL BE ADJUSTED FOR REQUIRED AREA.  
 DIMENSION F & G SHALL REMAIN SAME.  
 DIMENSION D SHALL BE ADJUSTED FOR REQUIRED PRESSURE IN EXCESS OF 150 PSI BEFORE MAKING ADJUSTMENT FOR HEIGHT.

NOTES:

1. FC = 3000 PSI AT 28 DAYS.
2. CS = SOIL COHESION IN PSF AND  $\phi$  = ANGLE OF INTERNAL FRICTION.
3. CARRY ALL BEARING SURFACES TO UNDISTURBED GROUND OR FIRM SUBGRADE.
4. THRUST BLOCKS SHALL BE INSTALLED ONLY WHERE APPROVED BY THE DEPARTMENT OF UTILITIES.

DECEMBER 2004

1.4.1-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

BUTTRESSES FOR  
22-1/2° HORIZONTAL BEND

SOIL PROPERTIES	SIZE	Concrete Block Dimensions At 150 PSI Pressure				Add To Dimension D For Each Add 50 PSI Pressure Up To 300 PSI	Adjustment For Conc. Area For Different Height HC To Be Measured From Grade to $\phi$ Of Pipe			
		D	E	F	G		Up To 8'	8'-1" To 12'	12'-1" To 16'	16'-1" To 20'
CS = 1000 PSF $\phi = 15^\circ$ SOFT SILTY CLAY OR BETTER	3"	9"	1'-0"	6"	6"	4"	CONC. BLOCK AREA 1.0 X D X E	CONC. BLOCK AREA 0.875 X D X E	CONC. BLOCK AREA 0.75 X D X E	CONC. BLOCK AREA 0.625 X D X E
	4"	9"	1'-0"	6"	6"	4"				
	6"	1'-0"	1'-2"	6"	8"	4"				
	8"	1'-6"	1'-4"	8"	9"	6"				
	10"	2'-0"	1'-6"	8"	10"	6"				
	12"	2'-6"	1'-8"	1'-0"	1'-0"	9"				
	16"	3'-6"	2'-6"	1'-0"	1'-3"	9"				
	20"	4'-8"	2'-6"	1'-0"	1'-4"	1'-4"				
	24"	5'-0"	3'-0"	1'-0"	1'-9"	2'-0"				
30"	6'-0"	4'-0"	1'-4"	2'-3"	2'-0"					
CS = 0 $\phi = 15^\circ$ LOOSE SILTY SAND	3"	1'-6"	1'-6"	6"	1'-0"	4"	CONC. BLOCK AREA 1.0 X D X E	CONC. BLOCK AREA 0.5 X D X E	CONC. BLOCK AREA 0.375 X D X E	CONC. BLOCK AREA 0.25 X D X E
	4"	2'-0"	2'-0"	6"	1'-0"	4"				
	6"	3'-0"	2'-0"	6"	1'-0"	4"				
	8"	4'-0"	2'-6"	8"	1'-0"	6"				
	10"	6'-0"	2'-6"	8"	1'-0"	6"				
	12"	7'-0"	3'-0"	1'-0"	1'-6"	9"				
	16"	11'-0"	4'-0"	1'-0"	1'-6"	9"				
	20"	11'-8"	5'-0"	1'-0"	2'-0"	1'-4"				
	24"	12'-6"	6'-0"	1'-6"	2'-0"	2'-0"				
30"	20'-0"	6'-0"	2'-0"	2'-6"	2'-0"					

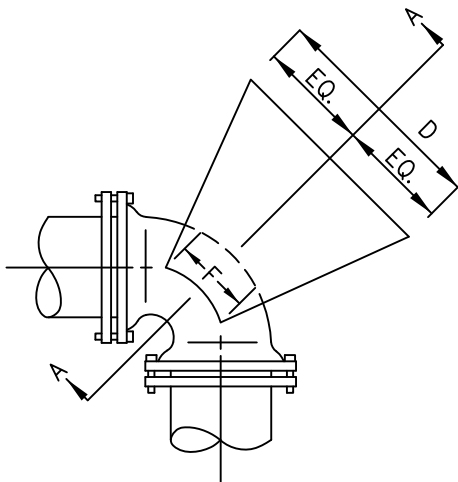
- 1) DIMENSION D & E SHALL BE ADJUSTED FOR REQUIRED AREA.
- 2) DIMENSION F & G SHALL REMAIN SAME.
- 3) DIMENSION D SHALL BE ADJUSTED FOR REQUIRED PRESSURE IN EXCESS OF 150 PSI BEFORE MAKING ADJUSTMENT FOR HEIGHT.
- 4) THRUST BLOCKS SHALL BE INSTALLED ONLY WHERE APPROVED BY THE DEPARTMENT OF UTILITIES.

DECEMBER 2004

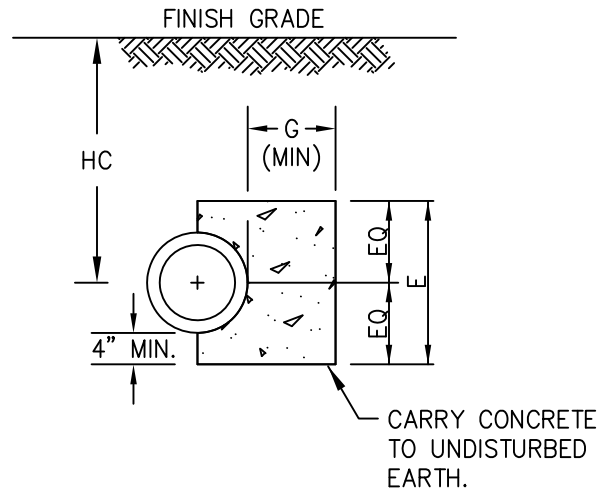
1.4.1-3

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

BUTTRESSES FOR  
45° HORIZONTAL BEND



PLAN



SECTION A-A

SIZE	Concrete Block Dimensions At 150 PSI Pressure				Add to Dimension "D" For Each Add'l 50 PSI Pressure Up To 300 PSI	Adjustment for Conc. Area For Different Height (HC) To Be Measured From Grade To C of Pipe			
	D	E	F	G		Up To 8'-0"	8'-1" To 12'	12'-1" To 16'	16'-1" To 20'
3"	2'-6"	2'-0"	8"	1'-0"	6"	CONC. BLOCK AREA 1.0 X D X E	C. B. A. 0.5 X D X E	C. B. A. 0.375 X D X E	C. B. A. 0.25 X D X E
4"	3'-4"	2'-0"	8"	1'-0"	6"				
6"	5'-2"	2'-0"	1'-0"	1'-6"	6"				
8"	6'-8"	2'-6"	1'-0"	1'-6"	9"				
10"	10'-0"	3'-0"	1'-6"	1'-6"	9"				
12"	10'-0"	4'-0"	1'-6"	2'-0"	1'-0"				
16"	12'-6"	5'-0"	2'-0"	2'-0"	1'-0"				
20"	15'-10"	6'-0"	2'-0"	2'-0"	2'-0"				

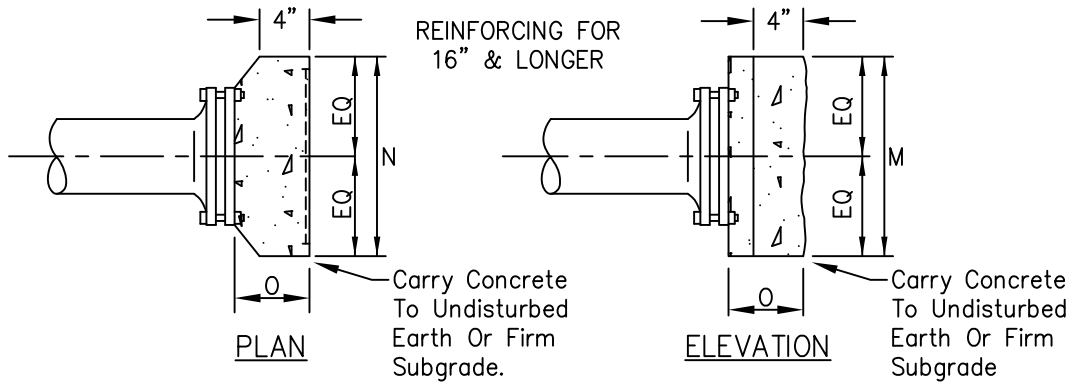
- 1) DIMENSION D & E SHALL BE ADJUSTED FOR REQUIRED AREA.
- 2) DIMENSION F & G SHALL REMAIN SAME.
- 3) DIMENSION D SHALL BE ADJUSTED FOR REQUIRED PRESSURE IN EXCESS OF 150 PSI BEFORE MAKING ADJUSTMENT FOR HEIGHT.
- 4) THRUST BLOCKS SHALL BE INSTALLED ONLY WHERE APPROVED BY THE DEPARTMENT OF UTILITIES.
- 5) SPECIAL DESIGN REQUIRED FOR LINES 24" IN DIAMETER OR GREATER.

DECEMBER 2004

1.4.1-4

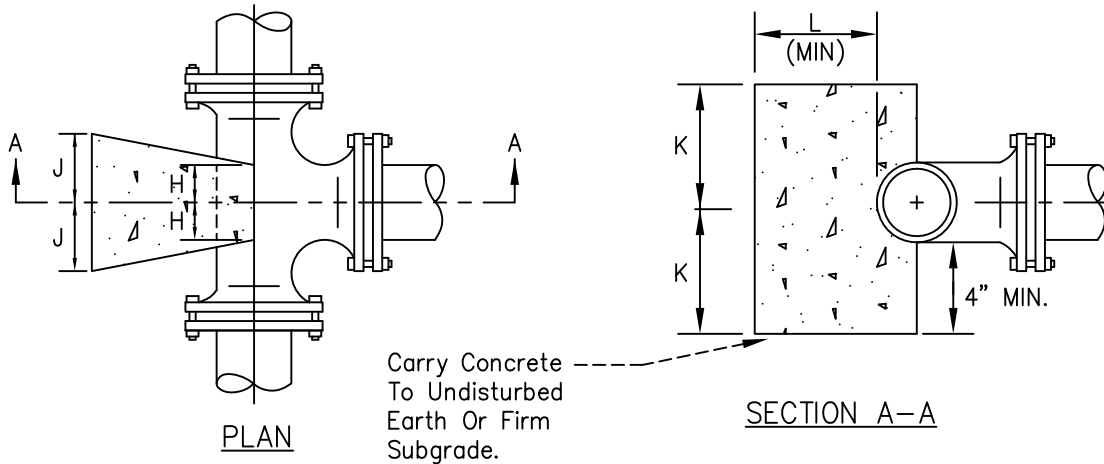
*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

BUTTRESSES FOR  
90° HORIZONTAL BEND



BUTTRESS FOR PLUGS & CAPS										
	SIZE									
	3"	4"	6"	8"	10"	12"	16"	20"	24"	30"
M	*	*	*	2'-6"	2'-8"	3'-6"	4'-8"	6'-0"	6'-8"	8'-0"
N	*	*	*	1'-6"	2'-2"	2'-6"	3'-4"	4'-0"	5'-0"	6'-8"
O	*	*	*	10"	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	2'-0"

REINFORCE WITH 66" EW



BUTTRESS FOR TEES										
	SIZE OF BRANCH									
	3"	4"	6"	8"	10"	12"	16"	20"	24"	30"
J	6"	6"	8"	9"	1'-1"	1'-3"	1'-8"	2'-0"	2'-6"	3'-4"
K	6"	8"	10"	1'-3"	1'-4"	1'-9"	2'-4"	3'-0"	3'-4"	4'-0"
L	6"	6"	8"	9"	10"	12"	1'-2"	1'-6"	1'-8"	2'-0"
H	4"	4"	6"	6"	6"	6"	8"	1'-0"	1'-0"	1'-0"

AREA OF BLOCK = 2J X 2K

NOTE: TAPPING ASSEMBLIES & SLEEVES TO BE CONCRETE BLOCKED AS COMPARABLE SIZED TEES

**NOTES:**

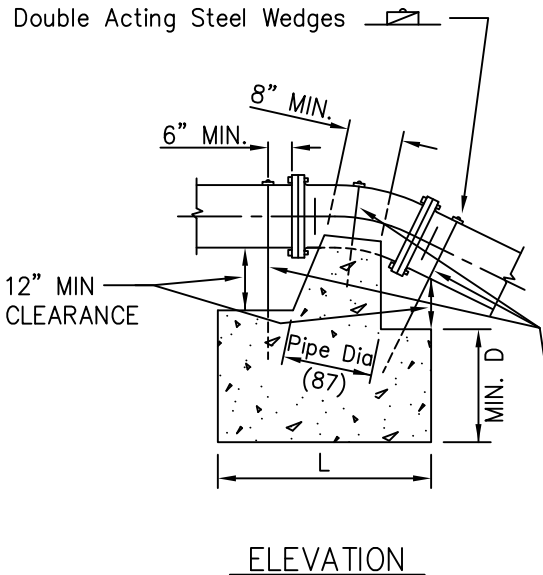
1.  $F_c = 3000$  PSI AT 28 DAYS.
2. THE BUTTRESS DIMENSIONS ARE BASED ON THE WATER PRESSURE OF 150 PSI WHERE THE PRESSURE IS DIFFERENT, THE AREA OF BLOCK SHALL BE PROPORTIONED TO REQUIRED PRESSURE
3. CARRY ALL BEARING SURFACES TO UNDISTURBED GROUND OR FIRM SUBGRADE
4. THRUST BLOCKS SHALL BE INSTALLED ONLY WHERE APPROVED BY THE UTILITY DEPARTMENT.

DECEMBER 2004

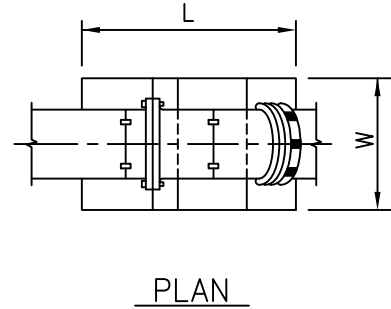
1.4.1-5

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

BUTTRESSES FOR  
TEES, PLUGS & CAPS



Embed Reinforcing Bars Minimum 36" Diameters Including The Hook  
Paint Exposed Bars With Two Coats Of Bituminous Paint.



Reinforcing Bars  
Where 4 Reinforcing Bars Used, Place 2 Symmetrically Placed Reinf Bars At Bends And Other 2 Bars As Shown In Detail.

BEND		SIZE									
		3"	4"	6"	8"	10"	12"	16"	20"	24"	30"
11 1/4°	L	1'-6"	1'-6"	2'-0"	2'-0"	2'-3"	2'-6"	3'-3"	4'-0"	4'-6"	5'-0"
	W	1'-6"	1'-6"	2'-0"	2'-0"	2'-3"	2'-6"	3'-3"	4'-0"	4'-6"	5'-0"
	D	1'-6"	1'-6"	1'-6"	2'-0"	2'-0"	2'-3"	2'-6"	2'-6"	3'-0"	3'-0"
	Reinf Bars No & Size	3 #5	3 #5	3 #5	3 #6	3 #6	3 #6	3 #6	3 #8	3 #8	3 #8
22 1/2°	L	1'-6"	2'-0"	2'-6"	2'-9"	3'-6"	4'-0"	4'-6"	5'-6"	6'-0"	7'-0"
	W	1'-6"	2'-0"	2'-6"	2'-9"	3'-6"	4'-0"	4'-6"	5'-6"	6'-0"	7'-0"
	D	1'-6"	1'-6"	2'-0"	2'-3"	2'-3"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"
	Reinf Bars No & Size	3 #5	3 #5	3 #5	3 #6	3 #6	4 #6	4 #6	3 #8	4 #8	4 #8
45°	L	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	6'-0"	7'-6"	8'-6"	10'-0"
	W	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	6'-0"	7'-6"	8'-6"	10'-0"
	D	1'-6"	2'-0"	2'-0"	2'-6"	2'-9"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
	Reinf Bars No & Size	3 #5	3 #5	3 #5	3 #6	4 #6	4 #6	4 #8	4 #8	4 #8	4 #9

- NOTES: 1.  $F_c=3000$  PSI AT 28 DAYS.  
 2. Carry All Bearing Surfaces To Undisturbed Earth Or Firm Subgrade.  
 3. The Anchorage Dimensions Are Based On The Water Pressure Of 150 PSI.  
 Where The Pressure Is Different, The Volume Of The Concrete (I.E. L x W x D)  
 Shall Be Proportioned To Required Pressure.  
 4. Thrust Blocks Shall Be Installed Only Where Approved By The Department Of Utilities.

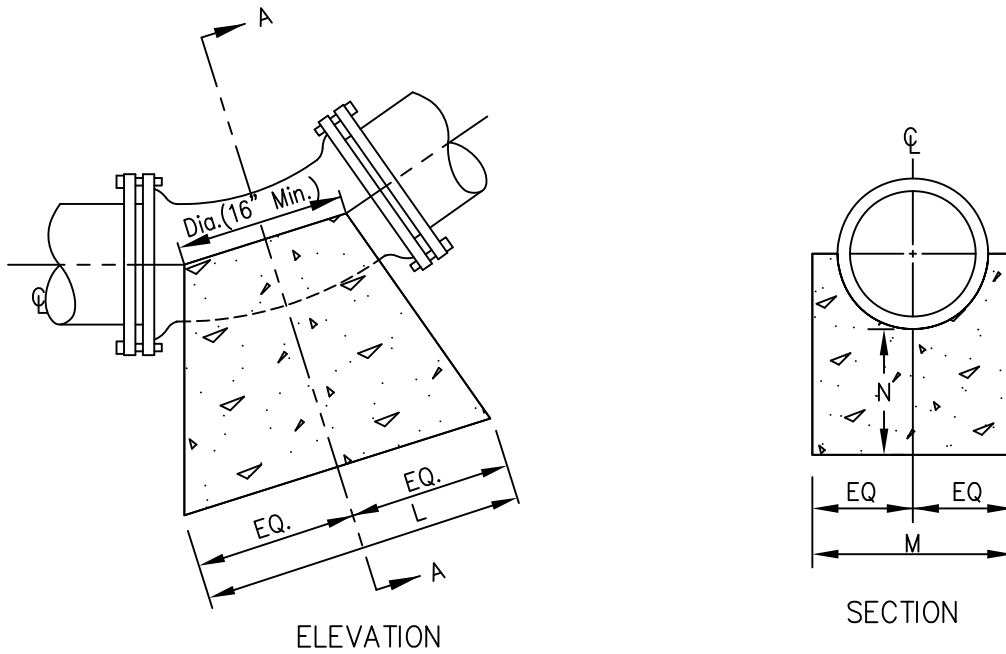
DECEMBER 2004

1.4.1-6

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

ANCHORAGE FOR  
11 1/4°, 22 1/2° & 45° UPPER VERT. BENDS





BUTTRESS FOR LOWER VERTICAL BENDS											
BEND	SIZE										
	3"	4"	6"	8"	10"	12"	16"	20"	24"	30"	
11-1/4°	L	6"	6"	6"	8"	8"	8"	1'-1"	1'-5"	1'-10"	2'-8"
	M	1'-0"	1'-0"	1'-2"	1'-4"	1'-6"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"
	N	8"	8"	8"	8"	8"	8"	9"	10"	12"	1'-2"
22-1/2°	L	6"	6"	10"	11"	1'-3"	1'-4"	2'-1"	2'-9"	3'-7"	3'-3"
	M	1'-0"	1'-0"	1'-2"	1'-4"	1'-6"	2'-0"	2'-4"	2'-8"	3'-0"	3'-2"
	N	8"	8"	8"	8"	9"	9"	12"	1'-2"	1'-4"	1'-6"
45°	L	10"	1'-0"	1'-2"	1'-9"	2'-5"	2'-8"	4'-0"	5'-6"	6'-0"	8'-2"
	M	1'-0"	1'-0"	1'-2"	1'-4"	1'-6"	2'-0"	2'-4"	2'-8"	3'-6"	4'-0"
	N	8"	8"	8"	8"	12"	1'-2"	1'-6"	2'-0"	2'-6"	3'-0"

NOTES:

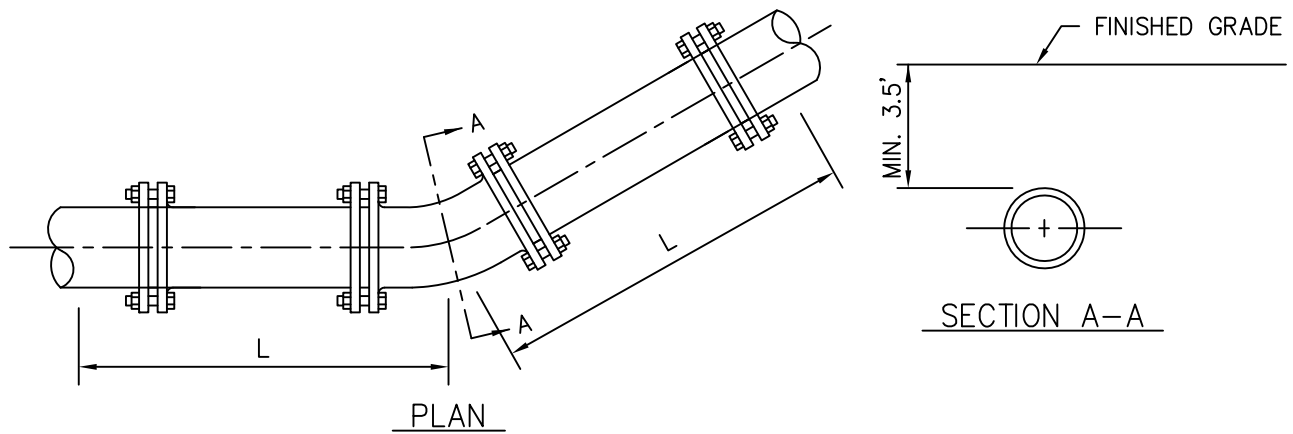
1.  $F_c = 3000$  PSI AT 28 DAYS.
2. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH OR FIRM SUBGRADE.
3. THE BUTTRESS DIMENSIONS ARE BASED ON THE WATER PRESSURE OF 150 PSI AND SOIL BEARING PRESSURE OF 2500 PSI. WHERE THE WATER PRESSURE AND SOIL BEARING PRESSURE ARE DIFFERENT, THE AREA OF CONCRETE BLOCK (I.E. L & M) SHALL BE PROPORTIONED ACCORDINGLY. AREA ADJUSTMENT FOR REQUIRED PRESSURE SHALL BE MADE FIRST BEFORE MAKING ADJUSTMENT FOR SOIL BEARING PRESSURE.
4. THRUST BLOCKS SHALL BE INSTALLED ONLY WHERE APPROVED BY THE DEPARTMENT OF UTILITIES.

DECEMBER 2004

1.4.1-7

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

BUTTRESS FOR  
11-1/4°, 22-1/2°, & 45° LOWER  
VERT. BENDS



L : RESTRAINED LENGTHS FOR PVC AND POLYWRAPPED PIPES (FEET)											
DIAMETER OF PIPE	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"	30"
11 1/4" HORIZ. BEND	2'	3'	4'	5'	6'	7'	9'	10'	11'	12'	15'
22 1/2" HORIZ. BEND	4'	5'	7'	10'	12'	14'	18'	20'	21'	25'	30'
45° HORIZ. BEND	9'	11'	15'	20'	24'	28'	37'	41'	45'	52'	63'
90° HORIZ. BEND	22'	26'	37'	48'	58'	69'	89'	98'	108'	126'	152'
DEAD ENDS & VALVES	43'	52'	75'	98'	119'	141'	184'	205'	225'	267'	326'

L : RESTRAINED LENGTHS FOR BARE DUCTILE IRON PIPES (FEET)											
DIAMETER OF PIPE	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"	30"
11 1/4" HORIZ. BEND	2'	2'	3'	4'	6'	6'	8'	8'	9'	11'	13'
22 1/2" HORIZ. BEND	4'	5'	6'	8'	10'	12'	15'	17'	19'	22'	26'
45° HORIZ. BEND	8'	9'	13'	17'	21'	25'	32'	36'	39'	46'	55'
90° HORIZ. BEND	19'	23'	32'	42'	51'	60'	77'	86'	94'	110'	133'
DEAD ENDS & VALVES	30'	37'	52'	68'	83'	99'	129'	143'	158'	187'	228'

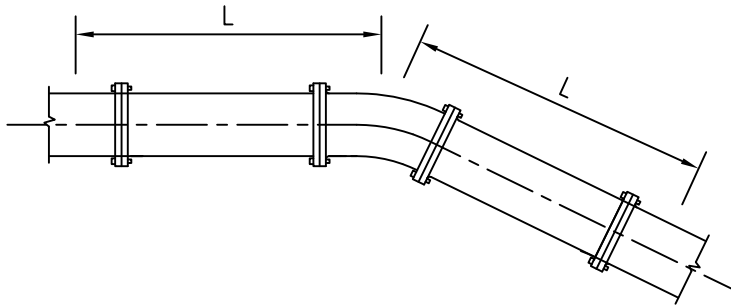
- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

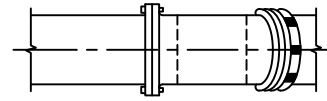
1.4.1-8

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

RESTRAINED LENGTHS FOR  
HORIZONTAL BENDS, DEAD ENDS & VALVES



ELEVATION



PLAN

**L : RESTRAINED LENGTHS FOR PVC AND POLYWRAPPED PIPES (FEET)**

DIAMETER OF PIPE	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"	30"
11 1/4° UPPER VERT. BEND	2'	3'	4'	5'	6'	7'	9'	10'	11'	12'	15'
22 1/2° UPPER VERT. BEND	4'	5'	7'	10'	12'	14'	18'	20'	21'	25'	30'
45° UPPER VERT. BEND	9'	11'	15'	20'	24'	28'	37'	41'	45'	52'	63'

**L : RESTRAINED LENGTHS FOR BARE DUCTILE IRON PIPES (FEET)**

DIAMETER OF PIPE	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"	30"
11 1/4° UPPER VERT. BEND	2'	2'	3'	4'	5'	6'	8'	8'	9'	11'	13'
22 1/2° UPPER VERT. BEND	4'	5'	6'	8'	10'	12'	15'	17'	19'	22'	26'
45° UPPER VERT. BEND	8'	9'	13'	17'	21'	25'	32'	36'	39'	46'	55'

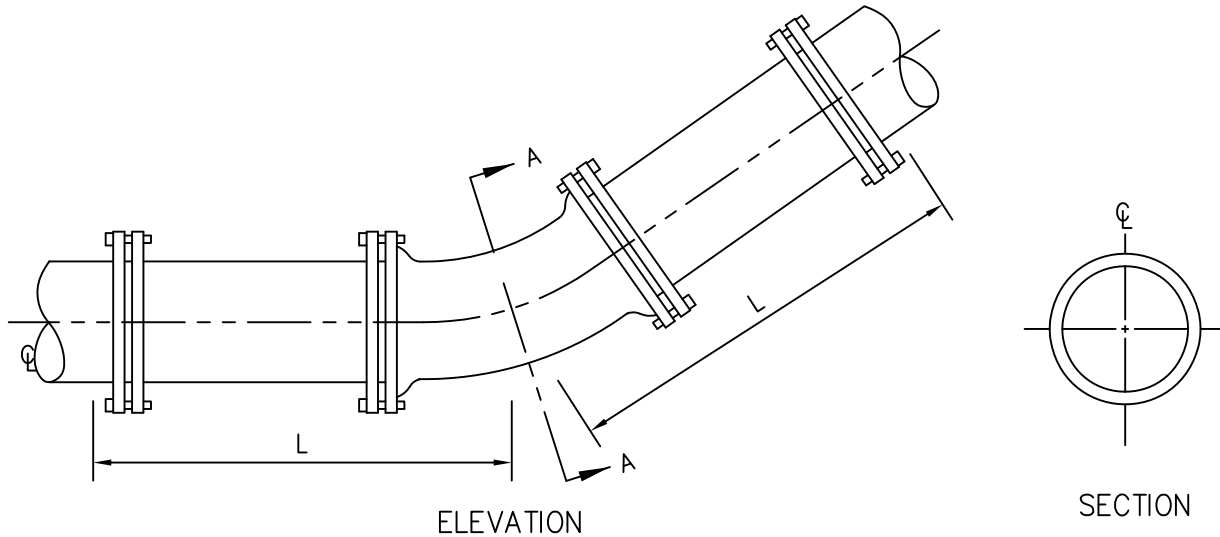
- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

1.4.1-9

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

RESTRAINED LENGTHS FOR  
11 1/4°, 22 1/2° & 45° UPPER VERT. BENDS



L : RESTRAINED LENGTHS FOR PVC AND POLYWRAPPED PIPES (FEET)											
DIAMETER OF PIPE	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"	30"
11 1/4° LOWER VERT. BEND	6'	7'	11'	14'	17'	20'	26'	29'	32'	37'	45'
22 1/2° LOWER VERT. BEND	12'	15'	22'	28'	34'	40'	52'	58'	64'	75'	91'
45° LOWER VERT. BEND	26'	31'	45'	58'	71'	84'	108'	121'	133'	156'	190'

L : RESTRAINED LENGTHS FOR BARE DUCTILE IRON PIPES (FEET)											
DIAMETER OF PIPE	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"	30"
11 1/4° LOWER VERT. BEND	4'	5'	7'	10'	12'	14'	18'	20'	22'	26'	32'
22 1/2° LOWER VERT. BEND	9'	11'	15'	20'	24'	28'	36'	41'	45'	53'	64'
45° LOWER VERT. BEND	18'	22'	31'	41'	50'	59'	76'	84'	93'	109'	133'

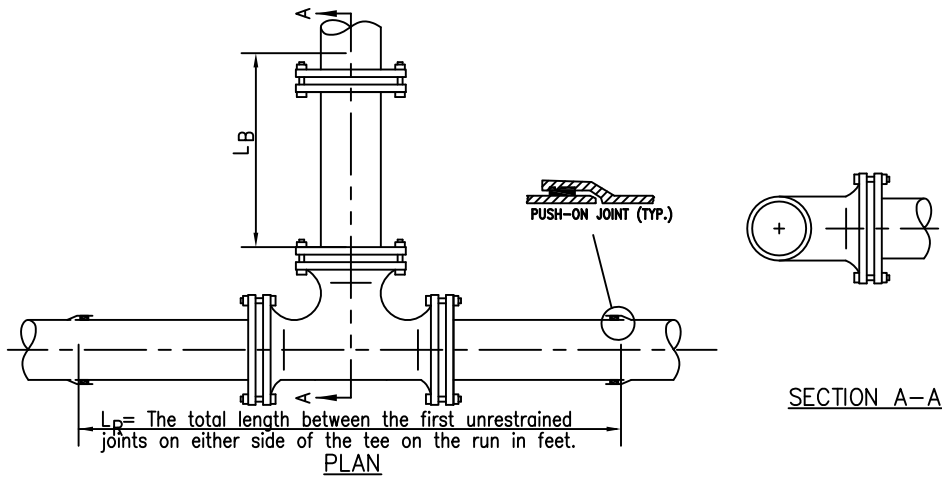
- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

1.4.1-10

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

RESTRAINED LENGTHS FOR  
11-1/4°, 22-1/2°, & 45° LOWER  
VERT. BENDS



RUN DIAMETER	BRANCH DIAMETER	L <sub>B</sub> : LENGTH OF RESTRAINED PIPE (TEE BRANCH)		L <sub>R</sub>
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)	
12"	12"	61'	87'	40'
12"	10"	38'	54'	40'
12"	8"	12'	18'	40'
12"	6"	5'	6'	26'
10"	10"	46'	65'	40'
10"	8"	22'	31'	40'
10"	6"	3'	5'	32'
10"	4"	1'	2'	16'
8"	8"	31'	44'	40'
8"	6"	3'	4'	40'
8"	4"	3'	4'	40'
6"	6"	15'	22'	40'
6"	4"	4'	6'	24'

RUN DIAMETER	BRANCH DIAMETER	L <sub>B</sub> : LENGTH OF RESTRAINED PIPE (TEE BRANCH)		L <sub>R</sub>
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)	
12"	12"	99'	141'	0
12"	10"	83'	119'	0
12"	8"	68'	98'	0
12"	6"	52'	75'	0
10"	10"	83'	119'	0
10"	8"	68'	98'	0
10"	6"	52'	75'	0
10"	4"	37'	52'	0
8"	8"	68'	98'	0
8"	6"	52'	75'	0
8"	4"	37'	52'	0
6"	6"	52'	75'	0
6"	4"	37'	52'	0

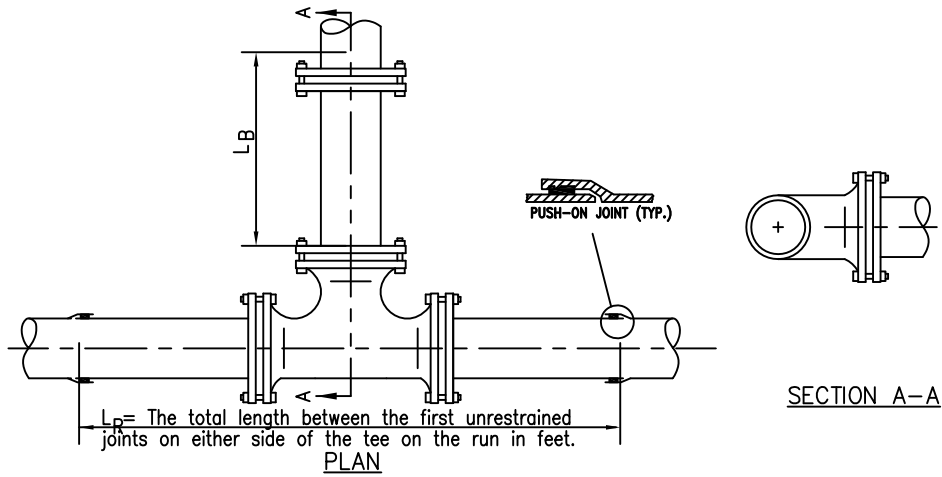
- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

1.4.1-11A

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

RESTRAINED LENGTHS FOR TEES  
SHEET 1 OF 3  
RUN DIAMETER 6" TO 12"



RUN DIAMETER	BRANCH DIAMETER	$L_B$ : LENGTH OF RESTRAINED PIPE (TEE BRANCH)		$L_R$
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)	
14"	8"	3'	4'	40'
14"	14"	76'	108'	40'
16"	6"	3'	4'	20'
16"	8"	4'	6'	34'
16"	10"	22'	32'	40'
16"	12"	47'	68'	40'
16"	16"	90'	129'	40'
18"	6"	2'	2'	18'
18"	8"	4'	6'	30'
18"	12"	41'	58'	40'
18"	18"	105'	150'	40'
20"	6"	2'	3'	16'
20"	8"	1'	2'	28'

RUN DIAMETER	BRANCH DIAMETER	$L_B$ : LENGTH OF RESTRAINED PIPE (TEE BRANCH)		$L_R$
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)	
14"	8"	68'	98'	0
14"	14"	114'	163'	0
16"	6"	52'	75'	0
16"	8"	68'	98'	0
16"	10"	83'	119'	0
16"	12"	99'	141'	0
16"	16"	129'	184'	0
18"	6"	52'	75'	0
18"	8"	68'	98'	0
18"	12"	99'	141'	0
18"	18"	143'	205'	0
20"	6"	52'	75'	0
20"	8"	68'	98'	0

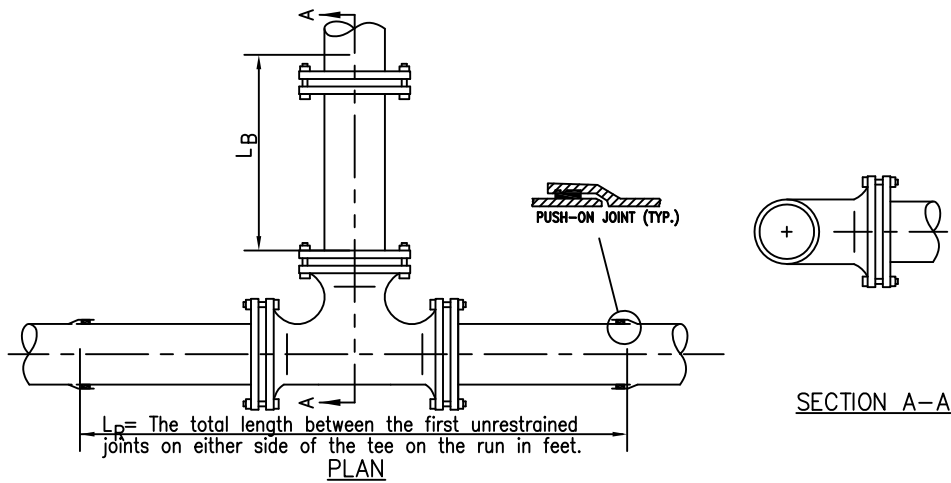
- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

1.4.1-11B

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

RESTRAINED LENGTHS FOR TEES  
SHEET 2 OF 3  
RUN DIAMETERS 14" TO 20"



RUN DIAMETER	BRANCH DIAMETER	L <sub>B</sub> : LENGTH OF RESTRAINED PIPE (TEE BRANCH)		L <sub>R</sub>
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)	
20"	12"	34'	48'	40'
20"	16"	80'	114'	40'
20"	20"	119'	170'	40'
24"	6"	0	0	14'
24"	8"	4'	6'	22'
24"	10"	3'	4'	34'
24"	12"	19'	27'	40'
24"	14"	45'	65'	40'
24"	16"	69'	98'	40'
24"	18"	90'	129'	40'
24"	20"	110'	158'	40'
24"	24"	147'	211'	40'
30"	6"	3'	4'	10'

RUN DIAMETER	BRANCH DIAMETER	L <sub>B</sub> : LENGTH OF RESTRAINED PIPE (TEE BRANCH)		L <sub>R</sub>
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)	
20"	12"	99'	141'	0
20"	16"	129'	184'	0
20"	20"	158'	225'	0
24"	6"	52'	75'	0
24"	8"	68'	98'	0
24"	10"	83'	119'	0
24"	12"	99'	141'	0
24"	14"	114'	163'	0
24"	16"	129'	184'	0
24"	18"	143'	205'	0
24"	20"	158'	225'	0
24"	24"	187'	267'	0
30"	6"	52'	75'	0

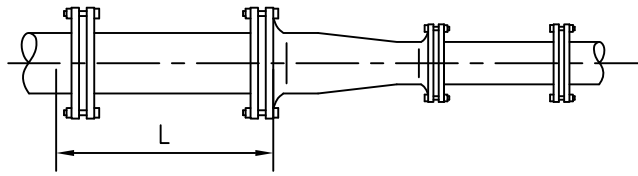
- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

1.4.1-11C

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

RESTRAINED LENGTHS FOR TEES  
SHEET 3 OF 3  
RUN DIAMETERS 20" TO 30"



PLAN

LARGE DIAMETER	SMALL DIAMETER	L : LENGTH OF RESTRAINED PIPE (LARGE DIAMETER)	
		Bare Ductile Iron Pipe (ft)	PVC & Polywrapped Pipe (ft)
24"	20"	56'	80'
24"	18"	80'	114'
24"	16"	102'	145'
24"	14"	121'	173'
24"	12"	138'	197'
20"	18"	29'	42'
20"	16"	55'	79'
20"	14"	79'	112'
20"	12"	99'	141'
20"	10"	116'	166'
18"	16"	29'	42'
18"	14"	55'	79'
18"	12"	78'	111'
18"	10"	97'	138'
18"	8"	112'	161'
16"	14"	29'	42'
16"	12"	55'	78'
16"	10"	76'	109'
16"	8"	94'	134'
16"	6"	108'	155'
14"	12"	29'	42'
14"	10"	54'	77'
14"	8"	74'	106'
14"	6"	91'	129'
12"	10"	29'	41'
12"	8"	52'	75'
12"	6"	72'	102'
10"	8"	28'	40'
10"	6"	51'	73'
10"	4"	68'	97'
8"	6"	29'	41'
8"	4"	49'	70'
6"	4"	27'	39'

- 1) SOIL DESIGNATION IS COHESIVE GRANULAR
- 2) MINIMUM DEPTH OF COVER IS 3.5 FT.
- 3) USE TYPE 3 LAYING CONDITIONS.
- 4) DESIGN PRESSURE IS 100 PSI WORKING PRESSURE + 120 PSI SURGE ALLOWANCE
- 5) SAFETY FACTOR IS 1.5
- 6) THE ENGINEER SHALL INCREASE THE ABOVE LENGTHS FOR WORKING PRESSURES GREATER THAN 100 PSI
- 7) THE ENGINEER SHALL INDIVIDUALLY EVALUATE ALL COMBINED BENDS AND INDICATE THE REQUIRED LENGTHS ON THE PROFILE VIEW.

DECEMBER 2004

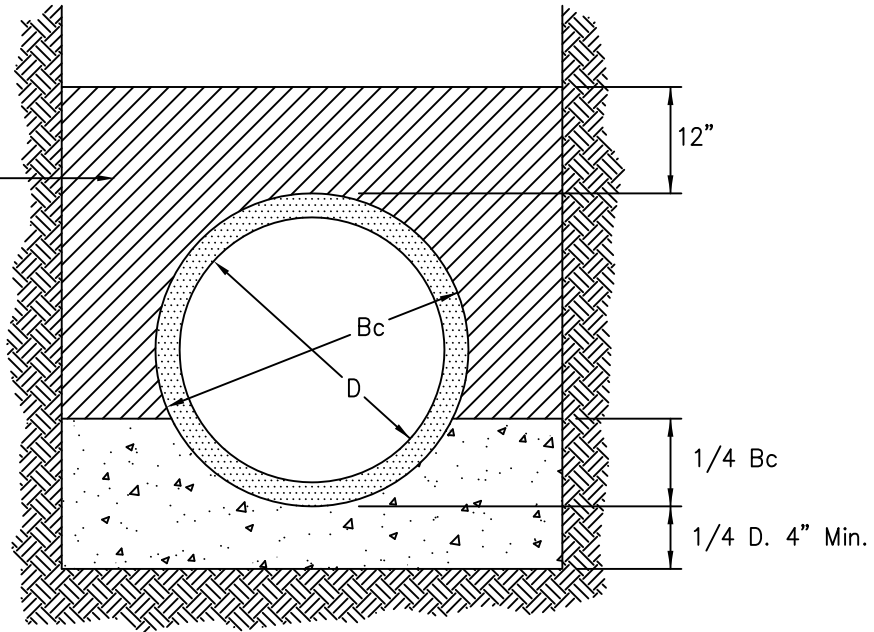
1.4.1-12

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

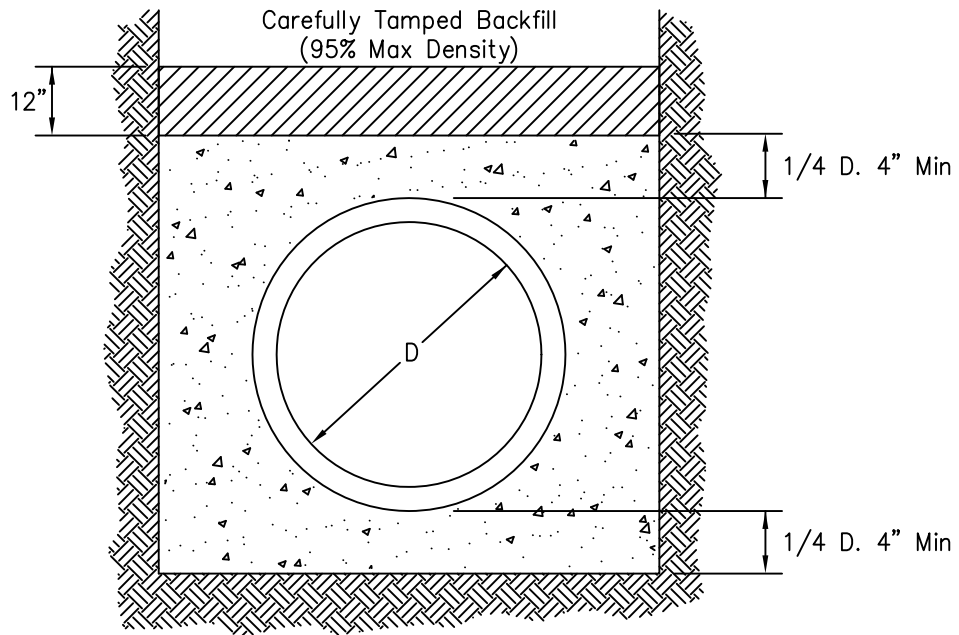
RESTRAINED LENGTHS FOR REDUCERS



Carefully Tamped Backfill  
95% max density



STANDARD CONCRETE CRADLE



STANDARD CONCRETE ENCASEMENT

NOTES:

1. Concrete To Be 3000 PSI Unless Otherwise Specified.
2. Trench Width Shall Be As Specified Or As Shown On Plans.

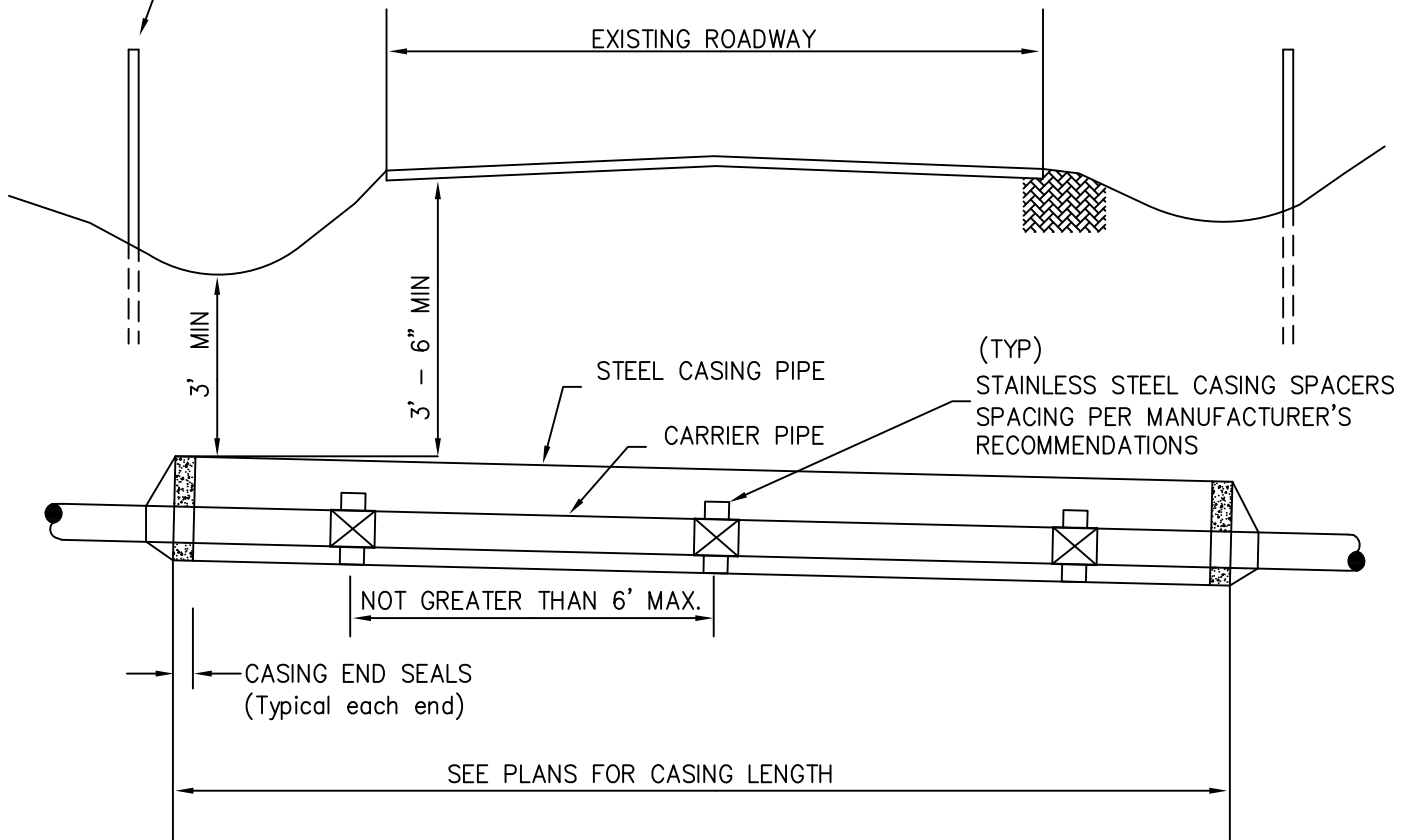
DECEMBER 2004

1.4.2-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

STANDARD CONCRETE  
CRADLE & ENCASEMENT

UTILITY MARKER: HEIGHT 5'-6" ABOVE GRADE.  
 SEE SPECIFICATIONS FOR COLOR AND LANGUAGE.  
 (TYPICAL 2 PLACES AS APPROVED BY VDOT)

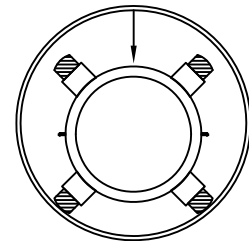


RESTRAIN ALL JOINTS INSIDE CASING.  
 PUSH OR PULL THE CARRIER PIPE THROUGH THE CASING SO THAT  
 THE CARRIER PIPE JOINTS ARE ALWAYS COMPRESSED.

Carrier Pipe	CASING PIPE		
	Minimum Casing Pipe O. D.	Minimum Casing Thickness *	
		Cover to 15'	Cover 15' & over
4	14	1/4"	5/16"
6	16	1/4"	5/16"
8	18	1/4"	5/16"
10	18	1/4"	5/16"
12	24	1/4"	5/16"
14	24	1/4"	5/16"
16	30	1/4"	5/16"
18	30	3/8"	3/8"
20	30	3/8"	3/8"
24	36	3/8"	3/8"
30	42	7/16"	7/16"
36	48	7/16"	7/16"
42	54	7/16"	7/16"
48	60	7/16"	7/16"
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\*NOTE: or as required by VDOT

POSITIONING



STANDARD: Carrier lays on casing bottom. Top runners maintain spacing in event of rollover.

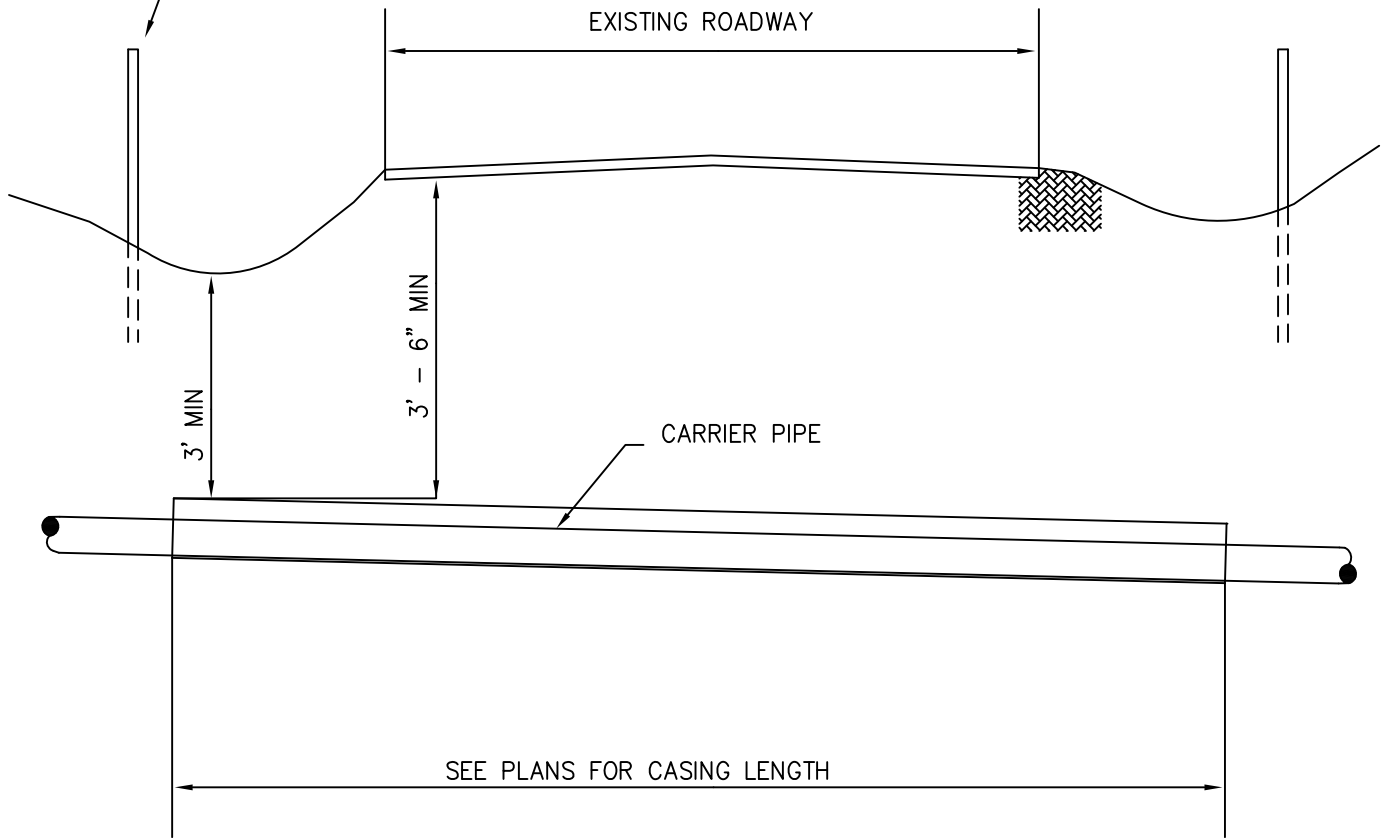
MARCH 2006

1.4.2-2A

STAFFORD COUNTY  
 DEPARTMENT OF UTILITIES

STEEL CASING  
 FOR PVC OR DIP

UTILITY MARKER: HEIGHT 5' - 6" ABOVE GRADE. SEE SPECIFICATIONS FOR COLOR AND LANGUAGE.  
(TYPICAL 2 PLACES AS APPROVED BY VDOT)



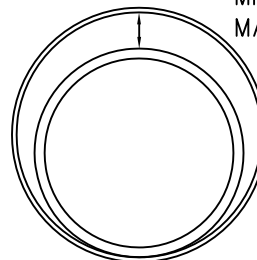
MINIMUM DR RATING  
FOR GRAVITY SEWER IS 32.5  
MINIMUM DR RATING FOR PRESSURE  
APPLICATION IS 17.0

SEAL ANNULAR SPACE AT BOTH  
ENDS WITH POLYURETHANE GROUT  
AND CASING END SEALS

Carrier Pipe	CASING PIPE	
	Minimum Casing Thickness *	
	Cover to 15'	Cover 15' & over
4	1/4"	5/16"
6	1/4"	5/16"
8	1/4"	5/16"
10	1/4"	5/16"
12	1/4"	5/16"
14	1/4"	5/16"
16	1/4"	5/16"
18	3/8"	3/8"
20	3/8"	3/8"
24	3/8"	3/8"
30	7/16"	7/16"
36	7/16"	7/16"
42	7/16"	7/16"
48	7/16"	7/16"
---	---	---

\*NOTE: or as required by VDOT

MINIMUM OF 1"  
MAXIMUM OF 3"



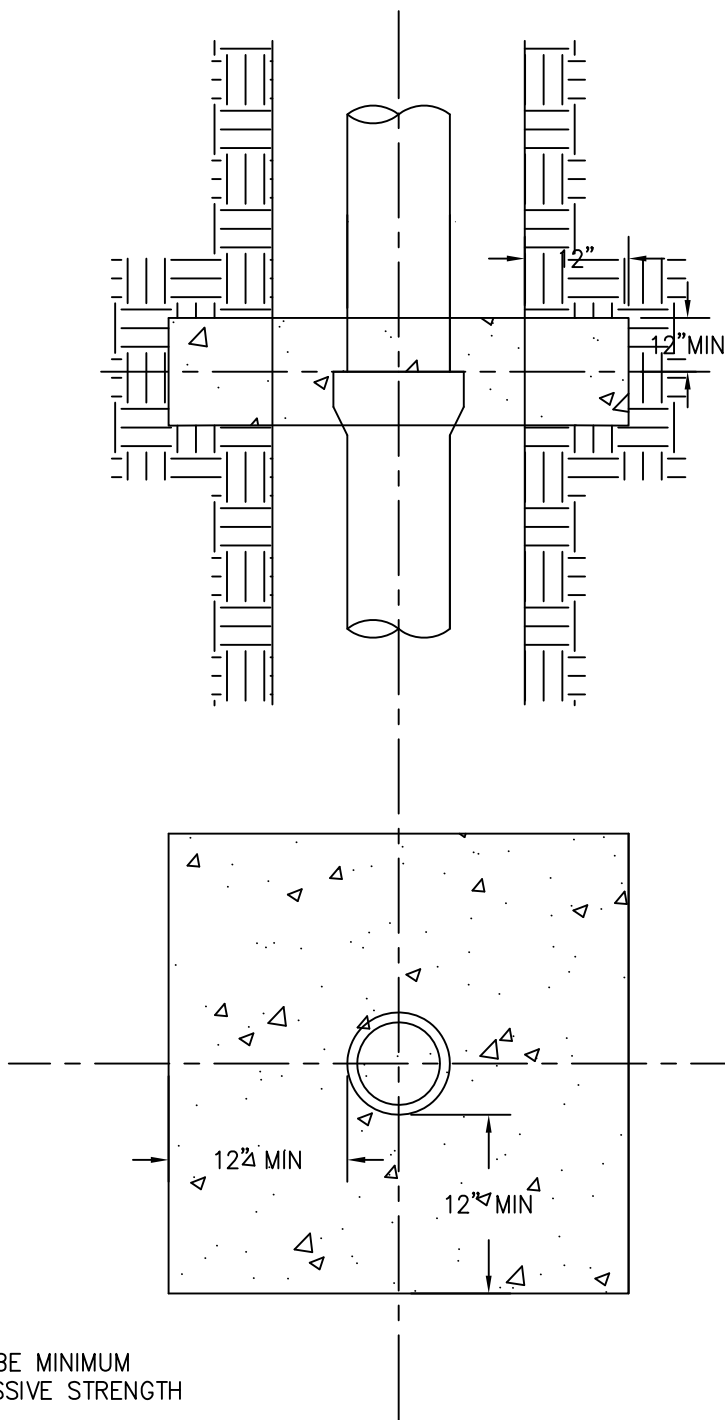
STANDARD: Carrier lays on casing bottom.

MARCH 2006

1.4.2-2B

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

STEEL CASING  
FOR HDPE

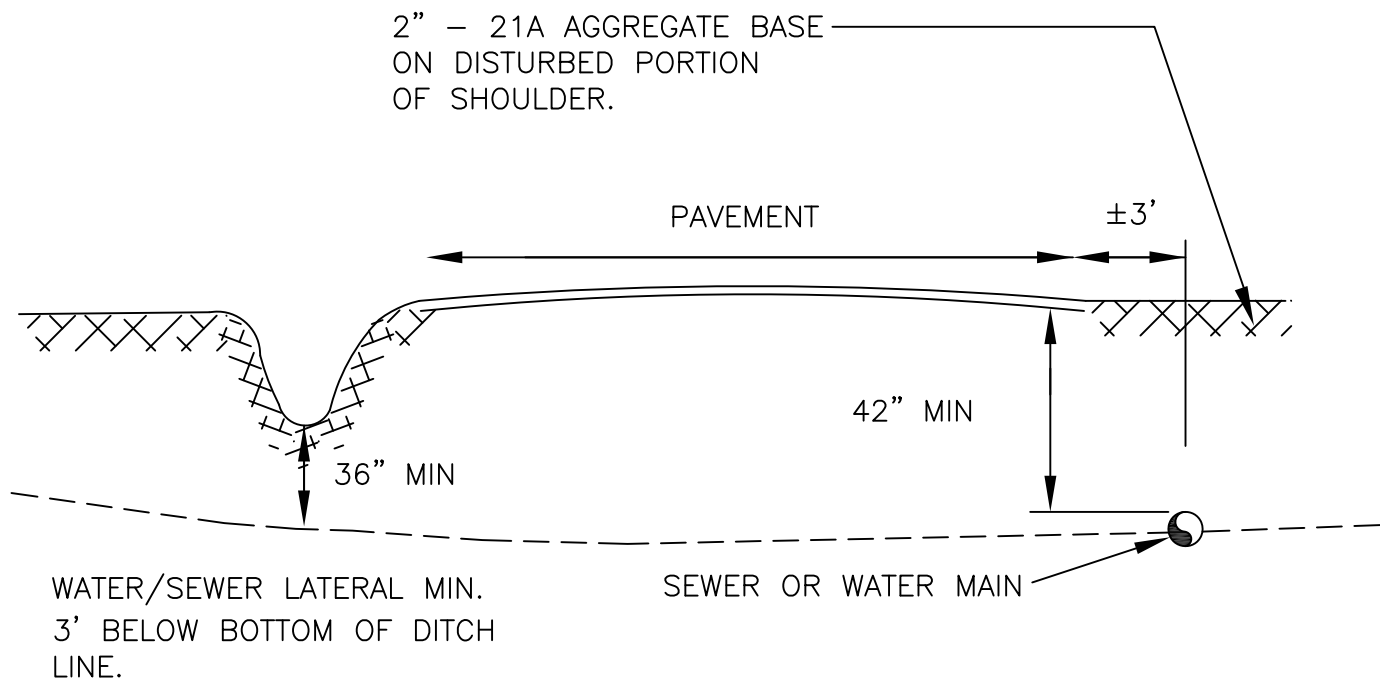


February 2017

1.4.2-3

*STAFFORD COUNTY  
 DEPARTMENT OF UTILITIES*

CONCRETE COLLAR  
 FOR STEEP SLOPES

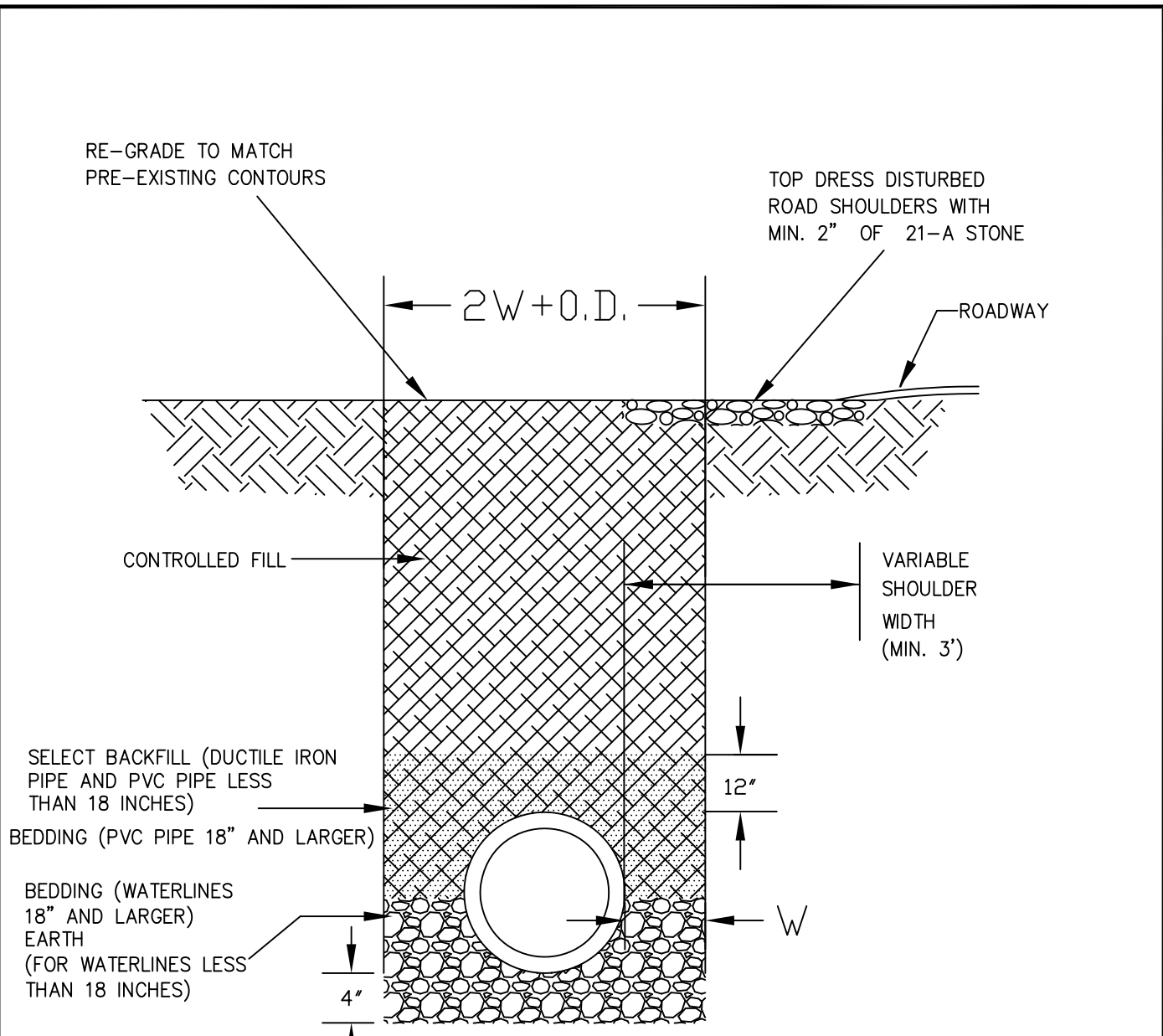


DECEMBER 2004

1.5.1-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL PIPE LOCATION  
EXISTING ROADWAYS



SELECT BACKFILL (DUCTILE IRON PIPE AND PVC PIPE LESS THAN 18 INCHES)

BEDDING (PVC PIPE 18" AND LARGER)

BEDDING (WATERLINES 18" AND LARGER) EARTH (FOR WATERLINES LESS THAN 18 INCHES)

NOTES:

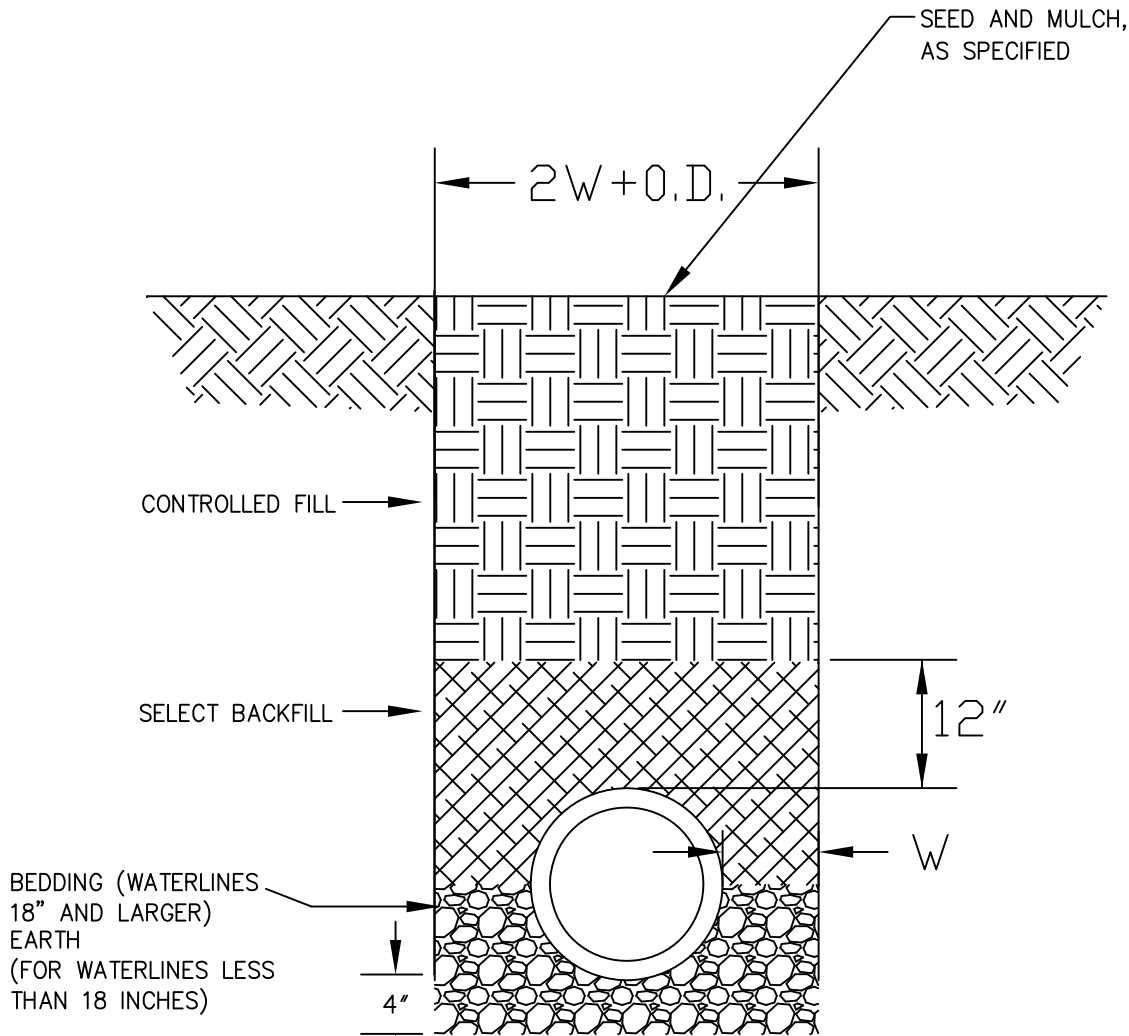
1. DIMENSION "W" SHALL BE A MINIMUM OF 6 INCHES AND A MAXIMUM OF 12 INCHES.
2. CONTROLLED FILL TO EXTEND TO GRADE.
3. SELECT BACKFILL TO EXTEND 12 INCHES OVER CROWN OF DUCTILE IRON PIPE AND PVC PIPE SMALLER THAN 18 INCHES.
4. BEDDING TO EXTEND 12" OVER CROWN OF PVC PIPE, 18" AND LARGER.
5. BEDDING SHALL BE PLACED FOR A MINIMUM OF 4" BELOW BOTTOM OF PIPE TO THE SPRING LINE OF THE PIPE, 18" AND LARGER.
6. ALL PIPES SMALLER THAN 18 INCHES SHALL BE IN HANDSHAPED UNDISTURBED OR RECOMMENDED EARTH TO THE SPRING LINE.
7. ANY OVEREXCAVATION TO BE BACKFILLED WITH SELECT BACKFILL.
8. ALL PIPE SHALL BE MARKED WITH TRACER WIRE ATTACHED TO THE PIPE AND 3-INCH MARKING TAPE, 2-INCHES ABOVE THE PIPE.
9. REFER TO WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS AND/OR PROJECT SPECIFICATIONS FOR MATERIALS AND COMPACTION REQUIREMENTS.

SEPT 2016

1.5.2-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRENCH FOR WATERLINES AND  
FORCE MAINS IN SHOULDER OF ROAD



NOTES:

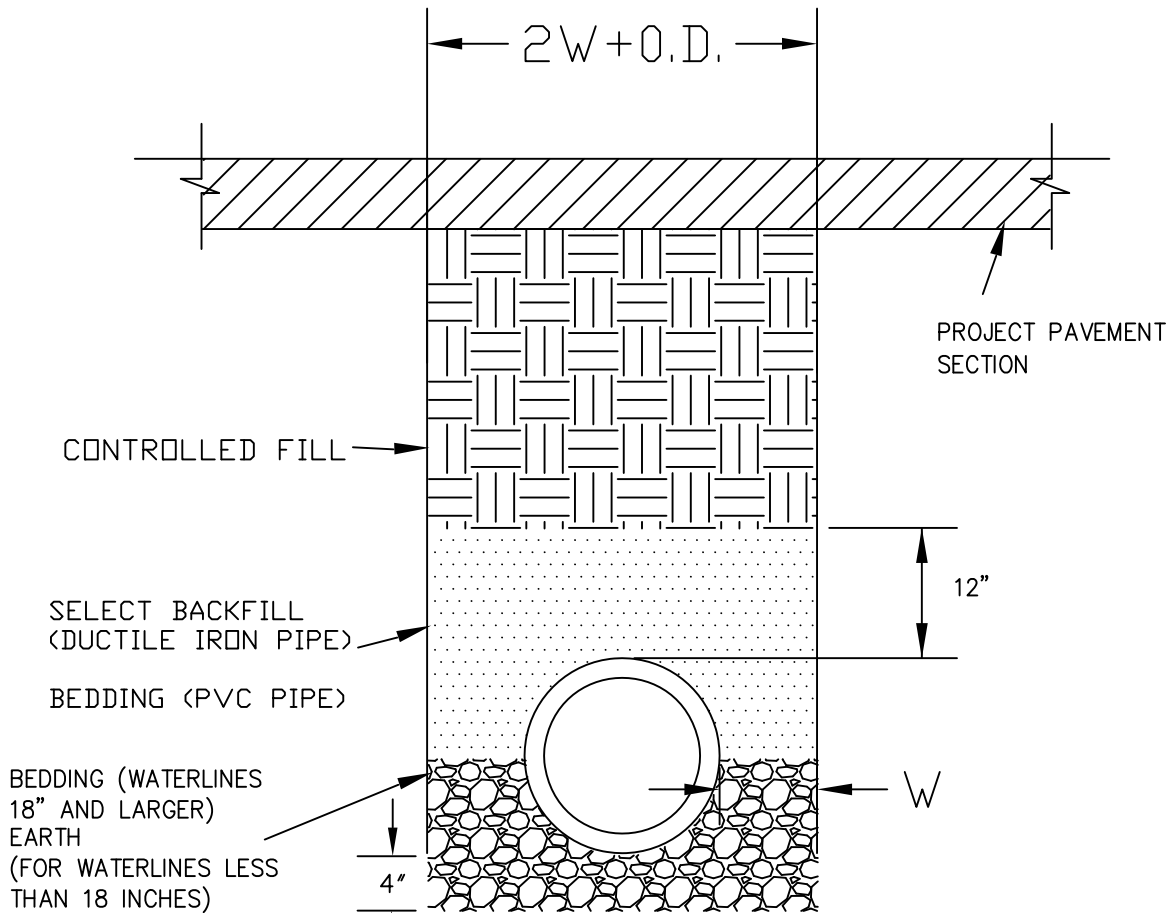
1. DIMENSION "W" SHALL BE A MINIMUM OF 6 INCHES AND A MAXIMUM OF 12 INCHES.
2. CONTROLLED FILL TO EXTEND TO GRADE.
3. SELECT BACKFILL TO EXTEND 12 INCHES OVER CROWN OF DUCTILE IRON PIPE AND PVC PIPE SMALLER THAN 18 INCHES.
4. BEDDING TO EXTEND 12" OVER CROWN OF PVC PIPE, 18" AND LARGER.
5. BEDDING SHALL BE PLACED FOR A MINIMUM OF 4" BELOW BOTTOM OF PIPE TO THE SPRING LINE OF THE PIPE, 18" AND LARGER.
6. ALL PIPES SMALLER THAN 18 INCHES SHALL BE IN HANDSHAPED UNDISTURBED OR RECOMMENDED EARTH TO THE SPRING LINE. REMOVE ROCKS & STONES A MIN. OF 6-INCHES BELOW WATER MAIN.
7. ANY OVEREXCAVATION TO BE BACKFILLED WITH SELECT BACKFILL.
8. ALL PIPE SHALL BE MARKED WITH TRACER WIRE ATTACHED TO THE PIPE AND 3-INCH MARKING TAPE, 2-INCHES ABOVE THE PIPE.
9. REFER TO WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS AND/OR PROJECT SPECIFICATIONS FOR MATERIALS AND COMPACTION REQUIREMENTS.

SEPT 2016

1.5.2-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRENCH FOR WATERLINES AND  
FORCE MAINS IN NON-PAVED AREAS



NOTES:

1. DIMENSION "W" SHALL BE A MINIMUM OF 6 INCHES AND A MAXIMUM OF 12 INCHES.
2. CONTROLLED FILL TO EXTEND TO GRADE.
3. SELECT BACKFILL TO EXTEND 12 INCHES OVER CROWN OF DUCTILE IRON PIPE AND PVC PIPE SMALLER THAN 18 INCHES.
4. BEDDING TO EXTEND 12" OVER CROWN OF PVC PIPE, 18" AND LARGER.
5. BEDDING SHALL BE PLACED FOR A MINIMUM OF 4" BELOW BOTTOM OF PIPE TO THE SPRING LINE OF THE PIPE, 18" AND LARGER.
6. ALL PIPES SMALLER THAN 18 INCHES SHALL BE IN HANDSHAPED UNDISTURBED OR RECOMMENDED EARTH TO THE SPRING LINE.
7. ANY OVEREXCAVATION TO BE BACKFILLED WITH SELECT BACKFILL.
8. ALL PIPE SHALL BE MARKED WITH TRACER WIRE ATTACHED TO THE PIPE AND 3-INCH MARKING TAPE, 2-INCHES ABOVE THE PIPE.
9. REFER TO WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS AND/OR PROJECT SPECIFICATIONS FOR MATERIALS AND COMPACTION REQUIREMENTS.

SEPT 2016

1.5.2-3

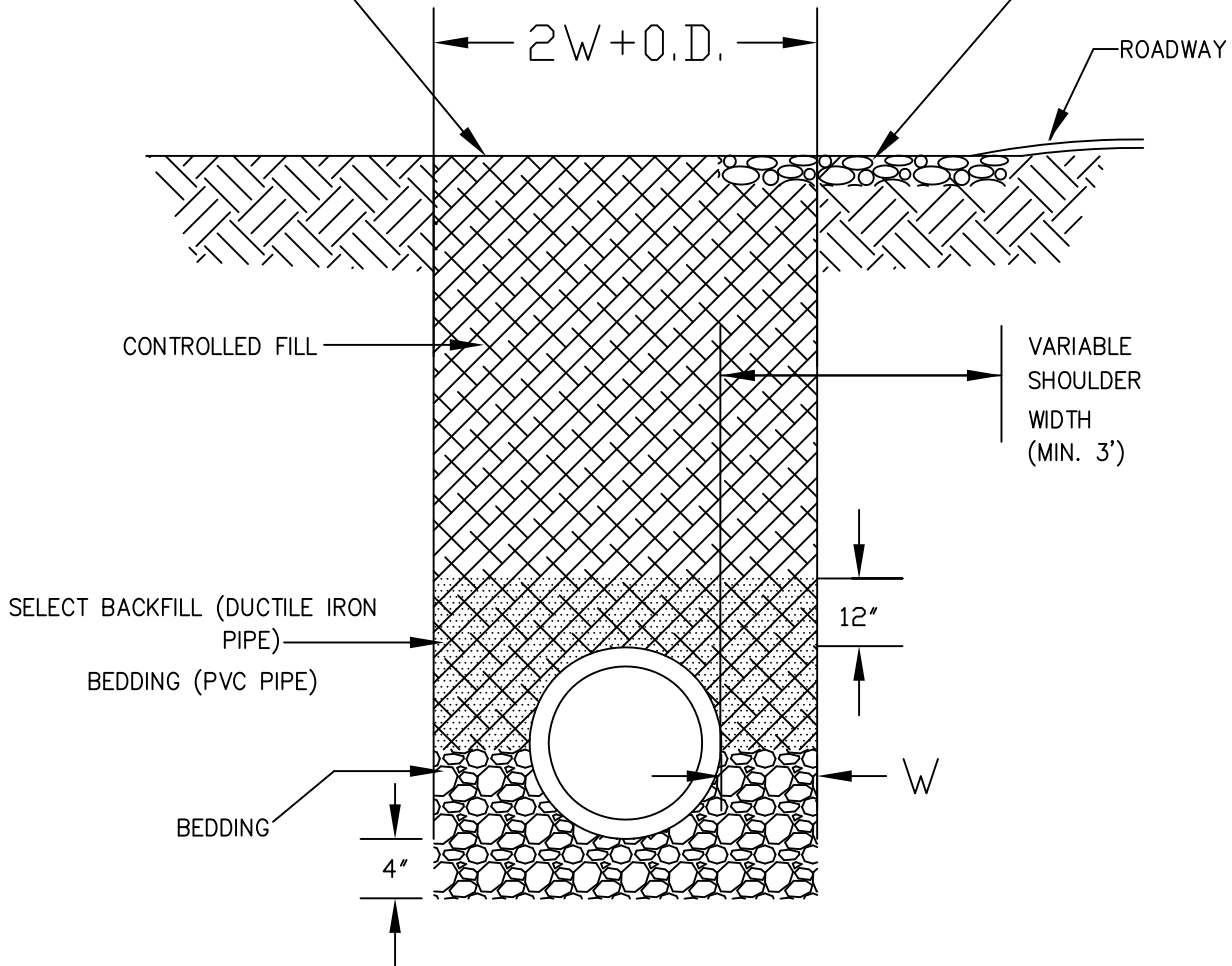
*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRENCH FOR WATERLINES AND  
FORCE MAINS BENEATH PAVEMENT



RE-GRADE TO MATCH  
PRE-EXISTING CONTOURS

TOP DRESS DISTURBED  
ROAD SHOULDERS WITH  
MIN. 2" OF 21-A STONE



NOTES:

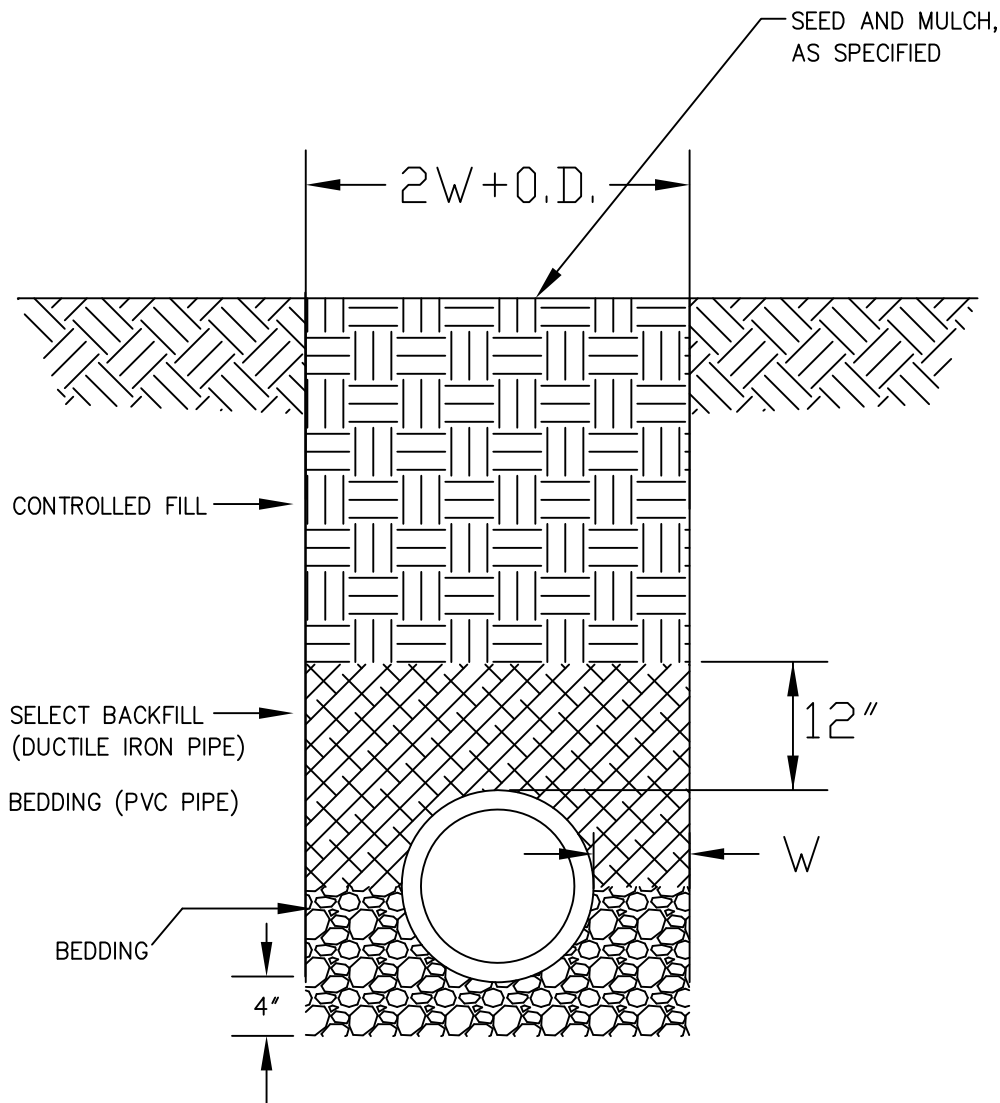
1. DIMENSION "W" SHALL BE A MINIMUM OF 6 INCHES AND A MAXIMUM OF 12 INCHES.
2. CONTROLLED FILL TO EXTEND TO GRADE.
3. SELECT BACKFILL TO EXTEND 12 INCHES OVER CROWN OF DUCTILE IRON PIPE.
4. BEDDING TO EXTEND 12" OVER CROWN OF PVC PIPE.
5. BEDDING SHALL BE PLACED FOR A MINIMUM OF 4" BELOW BOTTOM OF PIPE TO THE SPRING LINE OF THE PIPE, 18" AND LARGER.
6. ANY OVEREXCAVATION TO BE BACKFILLED WITH SELECT BACKFILL.
7. REFER TO WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS AND/OR PROJECT SPECIFICATIONS FOR MATERIALS AND COMPACTION REQUIREMENTS.

OCTOBER 2015

1.5.2-4

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRENCH FOR SEWERS  
IN SHOULDER OF ROAD



NOTES:

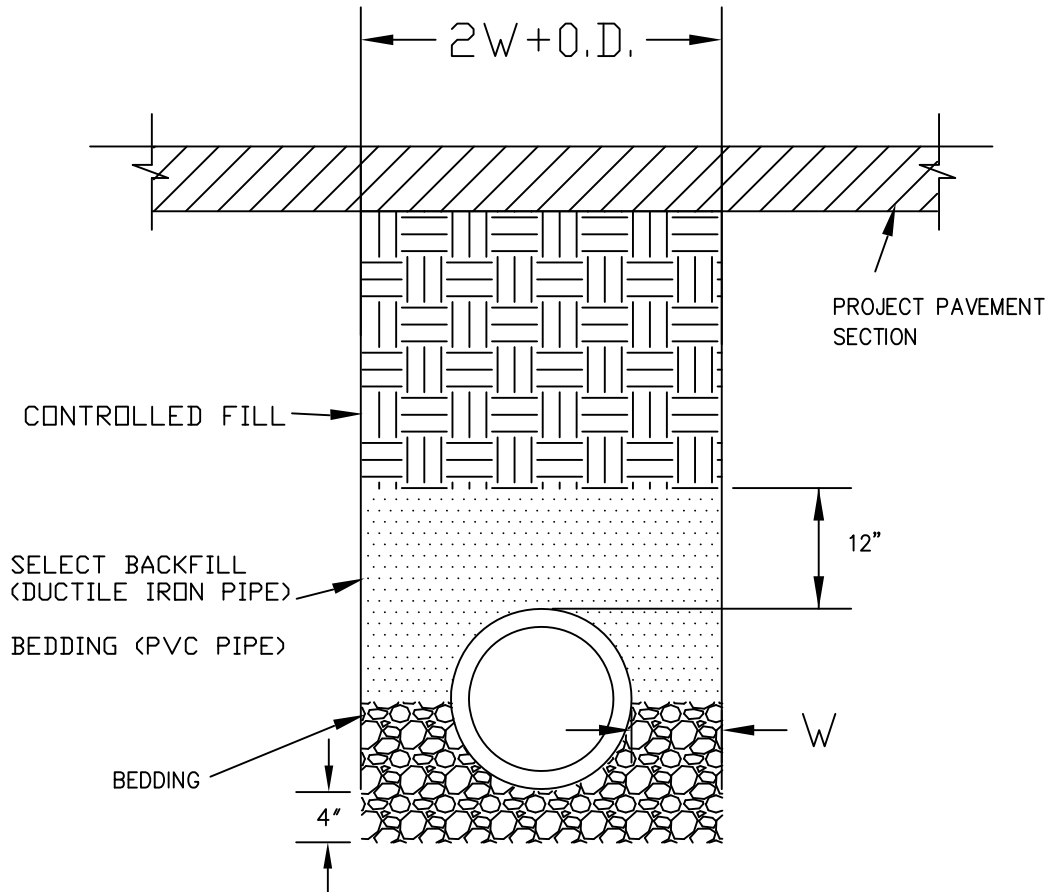
1. DIMENSION "W" SHALL BE A MINIMUM OF 6 INCHES AND A MAXIMUM OF 12 INCHES.
2. CONTROLLED FILL TO EXTEND TO GRADE.
3. SELECT BACKFILL TO EXTEND 12 INCHES OVER CROWN OF DUCTILE IRON PIPE.
4. BEDDING TO EXTEND 12" OVER CROWN OF PVC PIPE.
5. BEDDING SHALL BE PLACED FOR A MINIMUM OF 4" BELOW BOTTOM OF PIPE TO THE SPRING LINE OF THE PIPE, 18" AND LARGER.
6. ANY OVEREXCAVATION TO BE BACKFILLED WITH SELECT BACKFILL.
7. REFER TO WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS AND/OR PROJECT SPECIFICATIONS FOR MATERIALS AND COMPACTION REQUIREMENTS.

OCTOBER 2015

1.5.2-5

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRENCH FOR SEWERS  
IN NON-PAVED AREAS



NOTES:

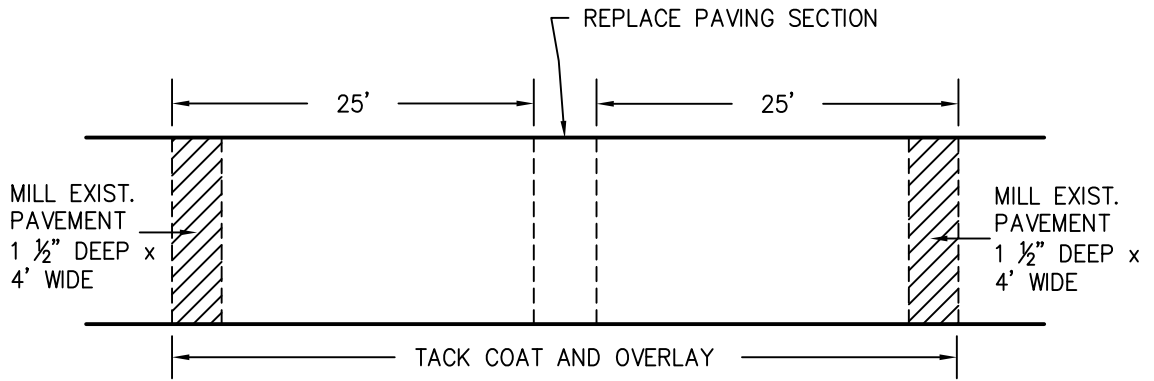
1. DIMENSION "W" SHALL BE A MINIMUM OF 6 INCHES AND A MAXIMUM OF 12 INCHES.
2. CONTROLLED FILL TO EXTEND TO GRADE.
3. SELECT BACKFILL TO EXTEND 12 INCHES OVER CROWN OF DUCTILE IRON PIPE.
4. BEDDING TO EXTEND 12" OVER CROWN OF PVC PIPE.
5. BEDDING SHALL BE PLACED FOR A MINIMUM OF 4" BELOW BOTTOM OF PIPE TO THE SPRING LINE OF THE PIPE, 18" AND LARGER.
6. ANY OVEREXCAVATION TO BE BACKFILLED WITH SELECT BACKFILL.
7. REFER TO WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS AND/OR PROJECT SPECIFICATIONS FOR MATERIALS AND COMPACTION REQUIREMENTS.

OCTOBER 2015

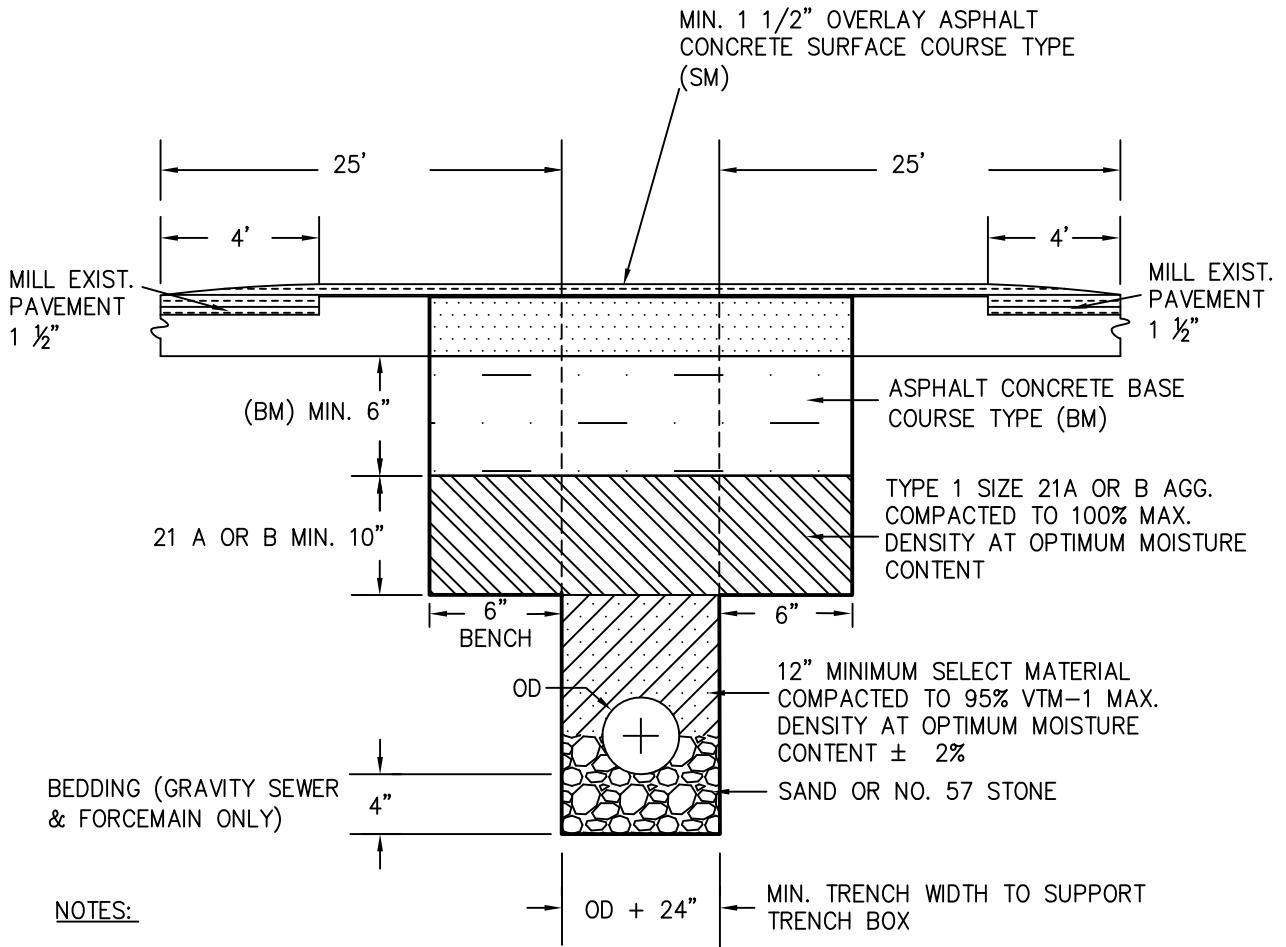
1.5.2-6

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRENCH FOR SEWERS  
BENEATH PAVEMENT



PLAN VIEW



SECTION VIEW

**NOTES:**

1. REGRADE SHOULDERS TO MATCH PAVEMENT ELEVATION.
2. RE-STRIPE PAVING TO MATCH PRE-CONSTRUCTION CONDITION.

\* FOR PIPE LESS THAN 12" THE TRENCH WIDTH MAY BE 36" MAXIMUM  
SEE UB-1 (VDOT ROAD AND BRIDGE STANDARDS VOLUME II)

SEPT 2016

1.5.2-7

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

WATER & SEWER TRENCH DETAIL  
FOR EXISTING ROADWAYS

SILT FENCE  
(TYP. EACH BANK)

EC-1 (JUTE MESH) OVER  
DISTURBED STREAM BANK AREA  
AND RESEED. (TYP. EACH BANK)

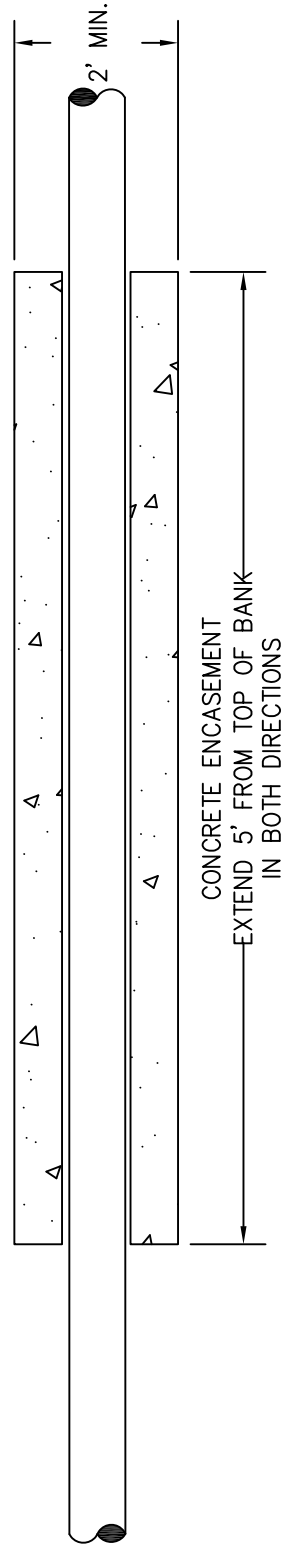
EXISTING AND PROPOSED  
STREAM BANK PROFILE  
(EXISTING STREAM CROSS-  
SECTION SHALL BE MAINTAINED)  
BACKFILL WITH CONTROLLED FILL.

1' CLASS I TYPE A RIP RAP  
(TYP.) SURROUNDING STREAM  
BANK EXTENDING FOR 8' IN  
EACH DIRECTION FROM CENTER-  
LINE OF PIPE.

8" COMPRESSED ORIGINAL  
SOIL MATERIAL

2' MAX. ABOVE OHW

WETLAND MITIGATION AND  
RESTORATION REQUIREMENTS SHALL  
BE IN ACCORDANCE WITH THE  
PERMITS ISSUED FOR STREAM  
CROSSINGS.

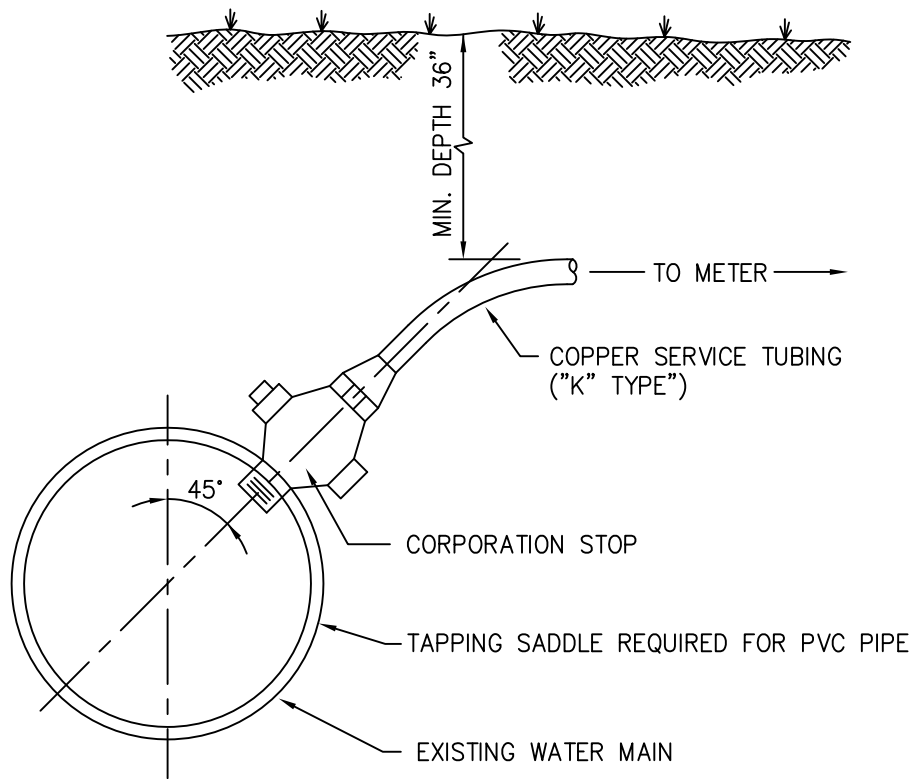


DECEMBER 2004

1.5.3-1

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

STANDARD STREAM CROSSING  
DETAIL

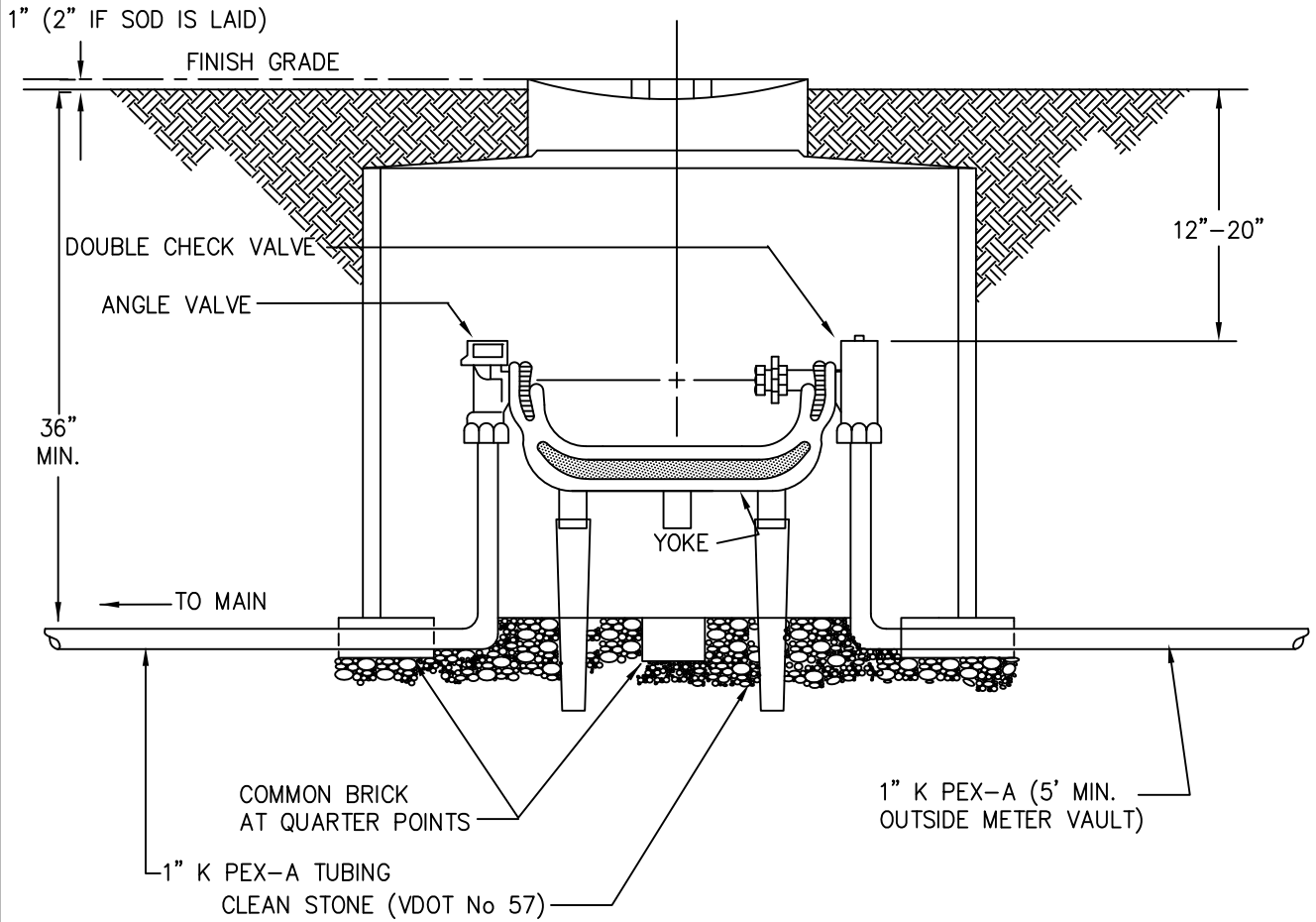


DECEMBER 2004

2.2.1-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

WATER SERVICE  
CONNECTION DETAIL



NOTES:

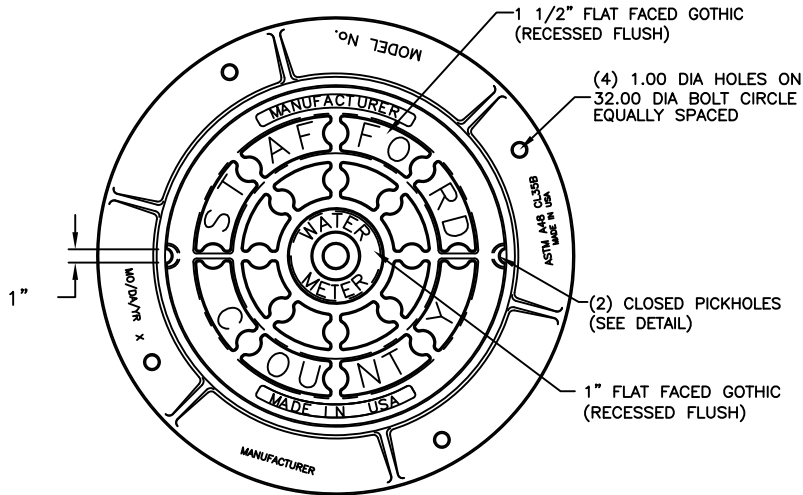
1. THE SERVICE LINE BETWEEN THE MAIN AND THE METER WILL BE ONE CONTINUOUS PIECE OF PIPE.
2. ONE PIECE METER BARREL 24" x 30" HIGH DENSITY POLYETHELENE.
3. LID SHALL HAVE PENTAGON NUT AND 1 3/4 " HOLE.
4. THE GRADE AT TOP OF BARREL SHALL CONFORM TO THE GENERAL CONTOUR OF FINISH YARD GRADE. NO MOUNDS OR DEPRESSIONS AROUND THE BARREL WILL BE PERMITTED.
5. 1" SERVICE SADDLE AND COMPRESSION STOP REQUIRED FOR CONNECTION TO C900 SDR 18, THIN WALL PVC AND TRANSITE MAINS, DIRECT TAP C900 SDR 14, DIP AND CIP MAINS.
6. USE 18" LID WITH EXTENSION RING IN GRASSED AREAS OR 24" MONITOR STYLE LID IN PAVED AREAS.
7. SUPPORT YOKE BAR AT TWO PRONGS WITH 3/4 INCH PIPE DRIVEN INTO GROUND.

JULY 2016

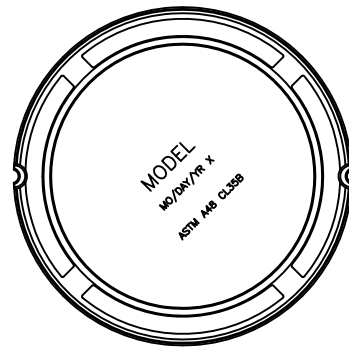
2.2.2-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

WATER METER SETTING  
5/8", 3/4" METERS

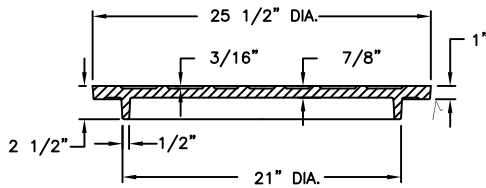


PLAN VIEW TOP

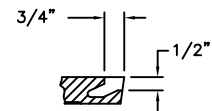


PLAN VIEW  
BOTTOM OF COVER

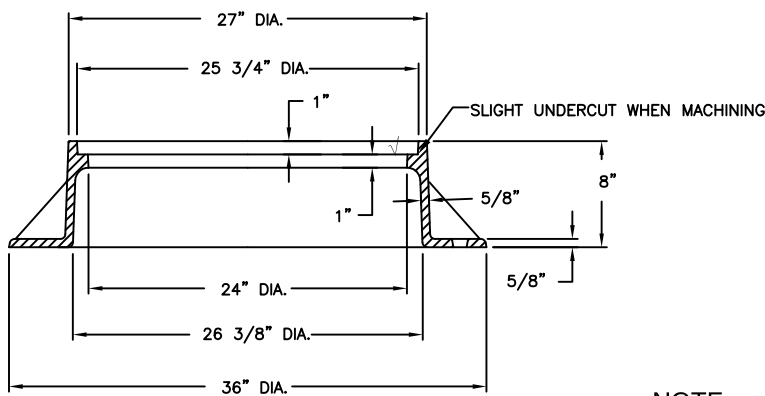
WEIGHT: FRAME, 215 LBS  
COVER, 125 LBS  
TOTAL, 340 LBS



SECTION OF COVER



PICKHOLE DETAIL



SECTION OF FRAME

√ MACHINED SURFACE

NOTE:  
FOR REQUIREMENTS ON SECURING FRAME  
TO CONE, SEE DETAIL 3.2.1-4

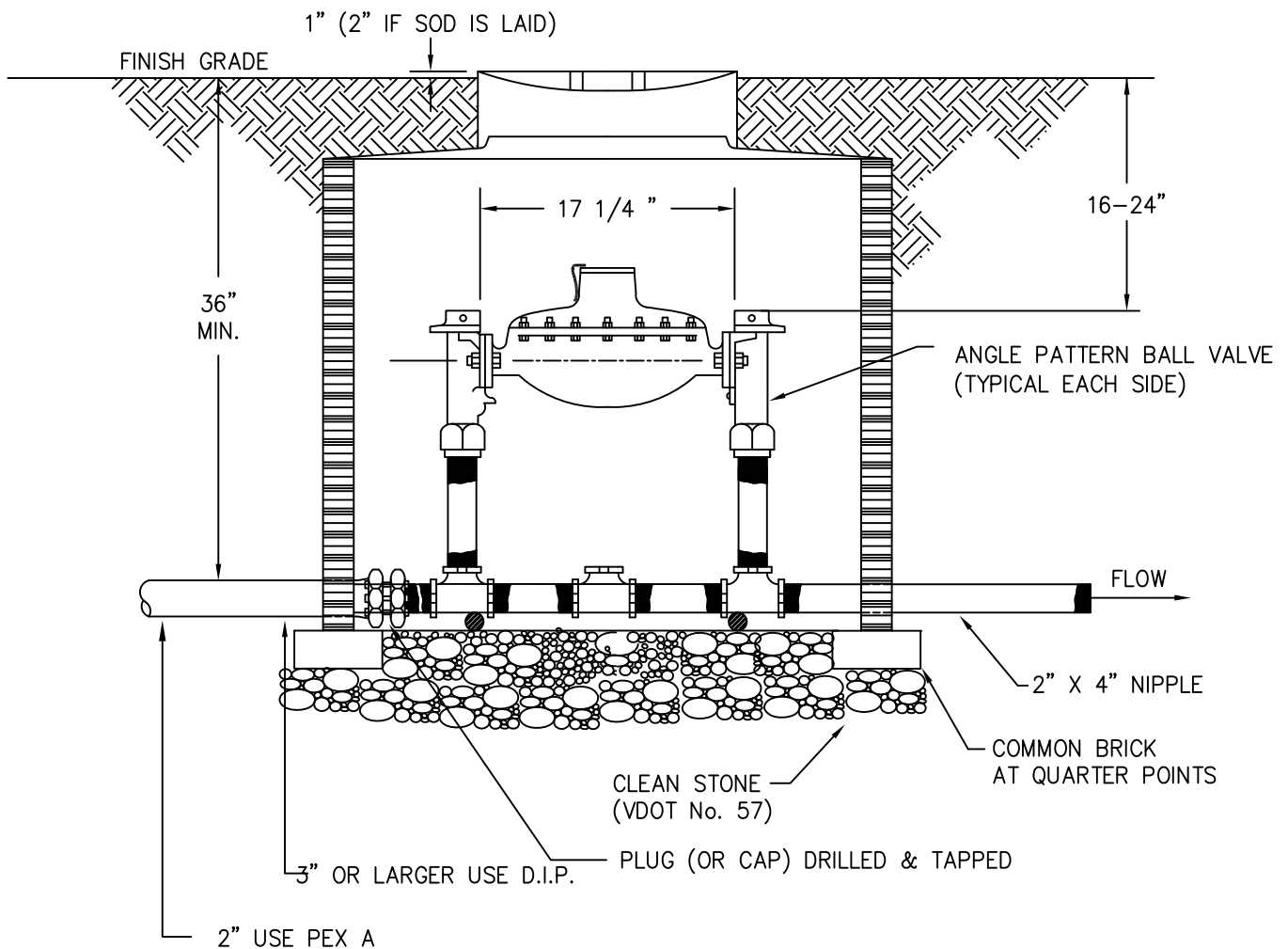
JULY 2016

2.2.2-3

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRAFFIC RATED WATER METER  
FRAME & COVER





NOTES:

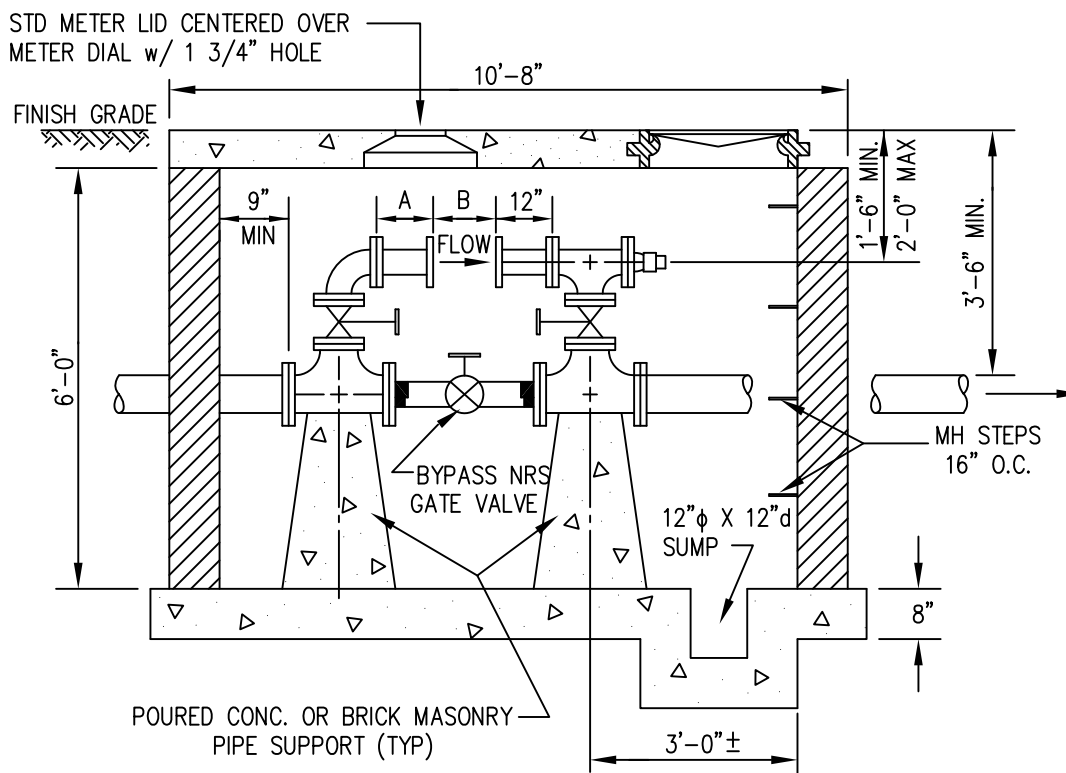
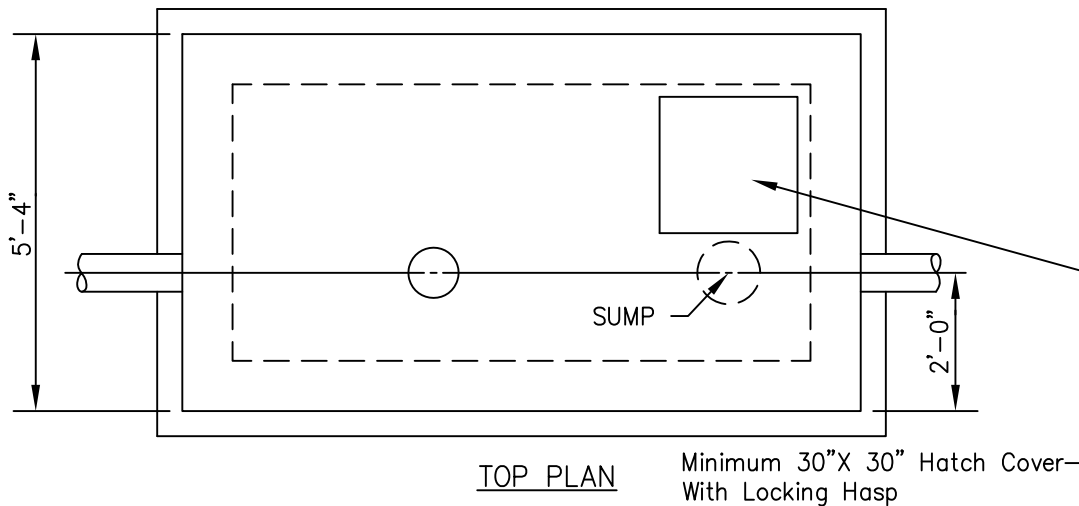
1. ONE PIECE BARREL 36" X 36" HI-DENSITY POLYETHYLENE.
2. LID SHALL BE EQUIPPED WITH PENTAGON NUT AND 1 3/4" HOLE.
3. USE SERVICE SADDLE FOR CONNECTION TO MAIN (BOTH PVC AND DIP).
4. GATE VALVE AND VALVE BOX REQUIRED ON 2" AND LARGER SERVICE LINES.  
USE 2" BRASS OR DUCTILE IRON NIPPLES BETWEEN SERVICE SADDLE AND GATE VALVE.
5. SCHEDULE 80 PLASTIC PIPE (2) EACH 16" LONG TO BE USED IN BRACE PIPE EYELETS.
6. IF AN APPROVED BACKFLOW DEVICE IS NOT INSTALLED ON THE SERVICE LINE IMMEDIATELY INSIDE THE BUILDING, DOUBLE CHECK VALVES SHALL BE SUBSTITUTED FOR THE ANGLE PATTERN BALL VALVE ON THE DOWNSTREAM SIDE OF THE METER & ADDED TO THE BYPASS.
7. THE GRADE AT THE TOP OF THE BARREL SHALL CONFORM TO THE GENERAL CONTOUR OF FINISH YARD GRADE. NO MOUNDS OR DEPRESSIONS AROUND THE BARREL WILL BE PERMITTED.

SEPT 2016

2.2.2-4

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

WATER METER SETTING UP TO  
AND INCLUDING 2" METER CONNECTIONS



**NOTES:**

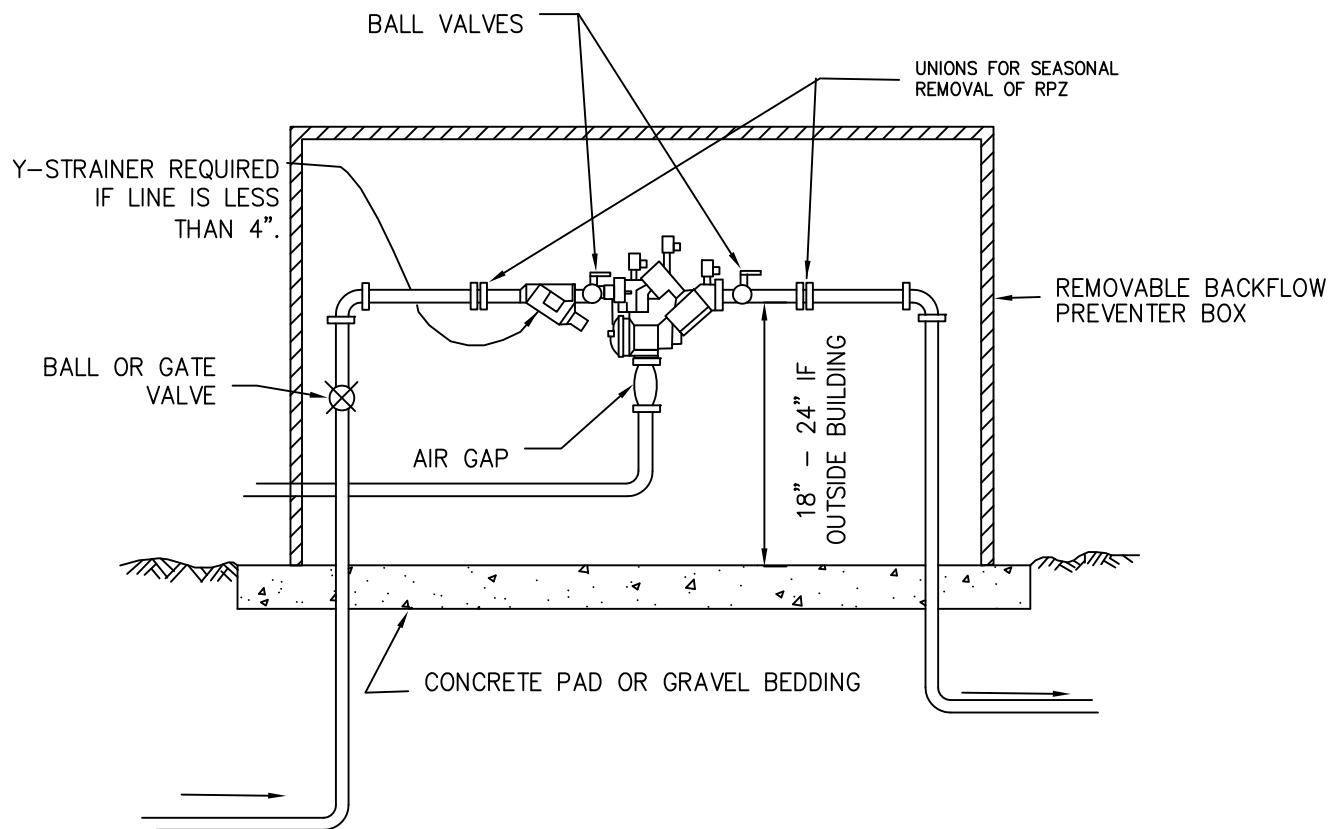
1. DIM. "A" EQUALS 8 TIMES NOMINAL METER SIZE.
2. DIM. "B" TO ACCOMMODATE METER & STRAINER.
3. BYPASS DIAMETER ONE SIZE SMALLER THAN METER.
4. BYPASS OF BRASS OR D.I. PIPE W/MATCHING VALVE.
5. ALL PIPE JOINTS SHALL BE EITHER SCREWED (UNDER 3"φ) OR FLANGED (3"φ AND OVER).
6. SHOP DRAWINGS SHALL BE SUBMITTED TO DEPARTMENT OF UTILITIES FOR APPROVAL.
7. SUMP AREA MUST BE DAY LIGHTED OR FURNISH AND INSTALL A PUMP.
8. WALL PENETRATIONS SHALL BE SEALED WITH MODULAR WALL SEAL.

DECEMBER 2004

2.2.2-5

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

WATER METER SETTING  
3" AND LARGER METERS



NOTES:

1. ALL PIPING THROUGH CONCRETE TO BE SLEEVED.
2. RPZ DEVICE SHALL BE READILY ACCESSIBLE FOR INSPECTION AND TESTING.
3. NO CONNECTION WILL BE PERMITTED ON SUPPLY LINE BETWEEN METER AND RPZ.
4. INSTALLATION OF ASSE 1013 IN A PIT IS NOT PERMITTED.
5. GATE VALVES MAY BE USED IF DEVICE IS 2" OR LARGER.
6. BACKFLOW PREVENTER BOX SHALL BE HEATED AND INSULATED, AND APPROVED IN STAFFORD COUNTY.

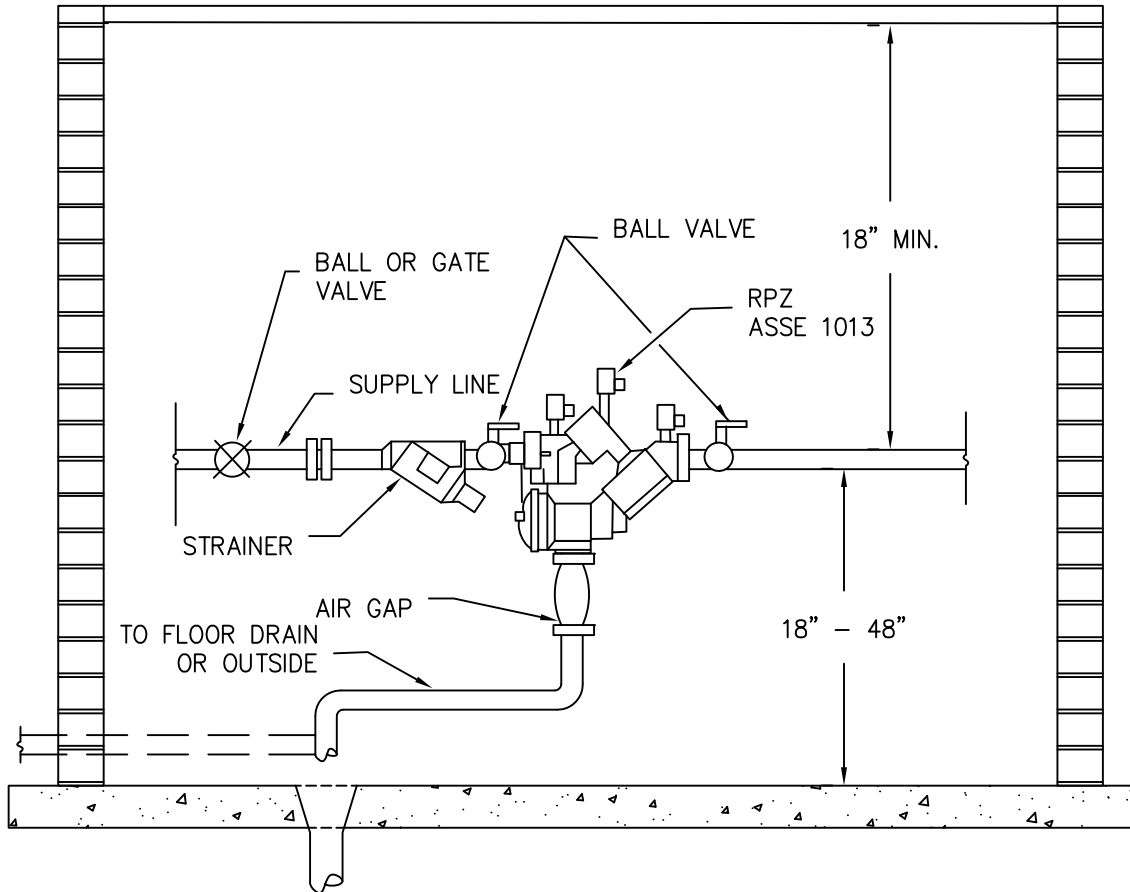
DECEMBER 2004

2.2.2-6

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

EXTERIOR BACKFLOW PREVENTION DEVICE

MECHANICAL ROOM



NOTES:

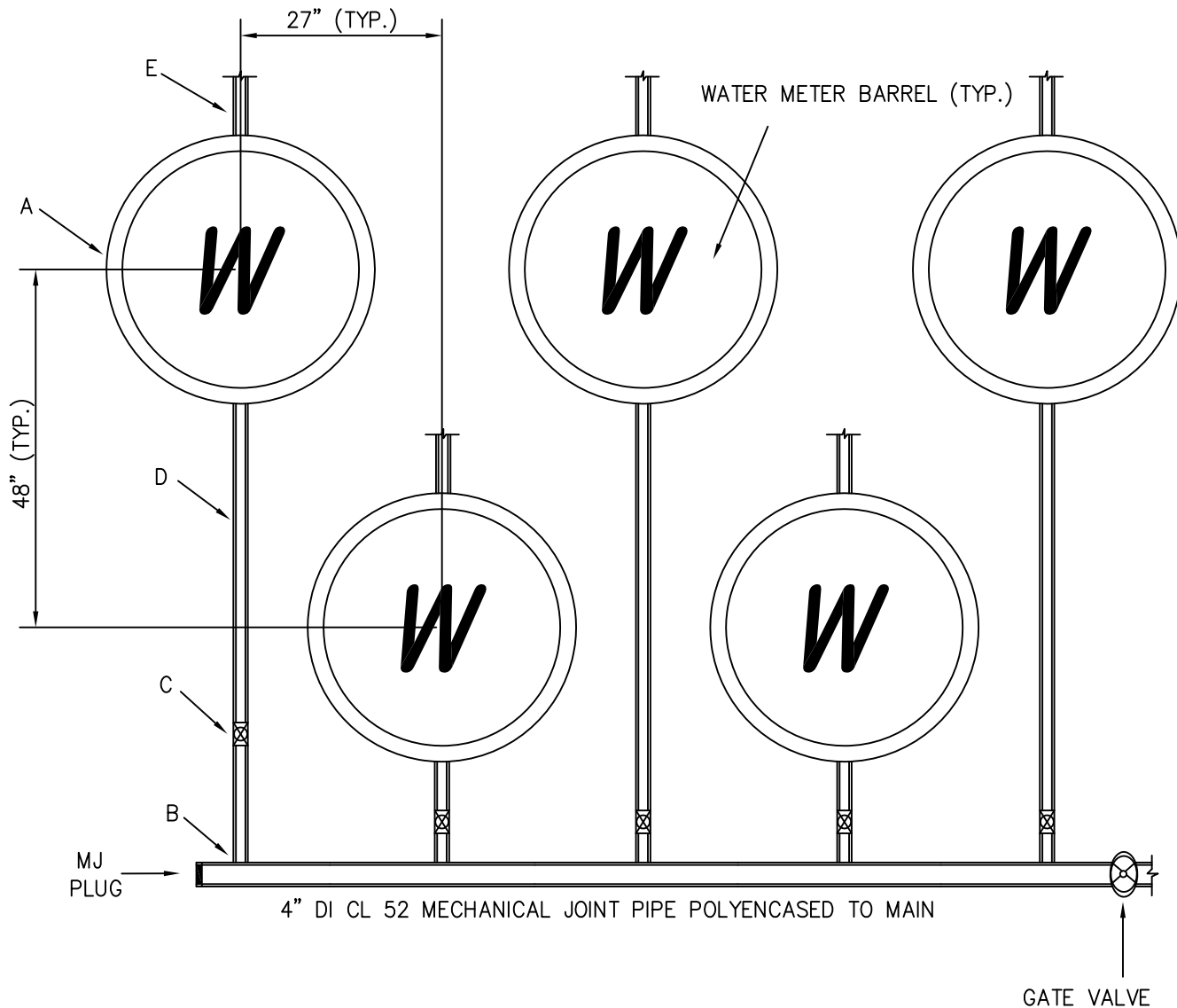
1. ALL PIPING THROUGH CONCRETE TO BE SLEEVED.
2. RPZ DEVICE SHALL BE READILY ACCESSIBLE FOR INSPECTION AND TESTING.
3. NO CONNECTION WILL BE PERMITTED ON SUPPLY LINE BETWEEN METER AND RPZ.
4. INSTALLATION OF RPZ DEVICE IN PIT IS NOT PERMITTED.
5. 2" AND OVER – GATE VALVES MAY BE USED WHERE BALL VALVES INDICATED.
6. 30" OF FREE SPACE IN FRONT OF BACKFLOW.

DECEMBER 2004

2.2.2-7

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

INTERIOR RPZ DEVICE INSTALLATION



A (Meter Setting)	1"	2"
Detail	2.2.2-1	2.2.2-4
B	1" Corp Stop	2" Threaded Brass Nipple
C	N/A	2" Threaded Gate Valve
D	1" K COPPER	2" Threaded Brass Nipple
E	1" K COPPER	2" Threaded Brass Nipple

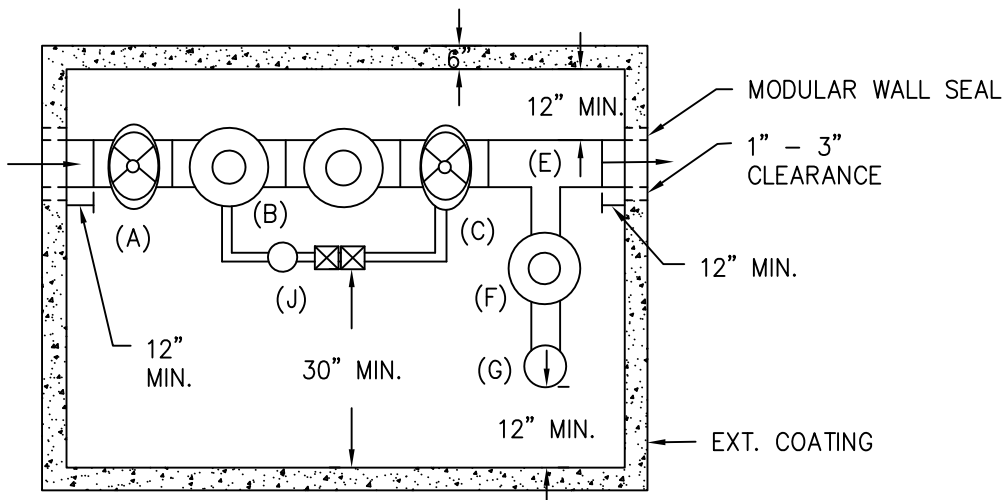
- 1) ALL JOINTS MUST BE RESTRAINED WITH MJ PIPE RESTRAINTS
- 2) MAY BE REDUCED TO 24" BETWEEN ADJACENT 1" METER SETTINGS

MARCH 2006

2.2.2-8

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

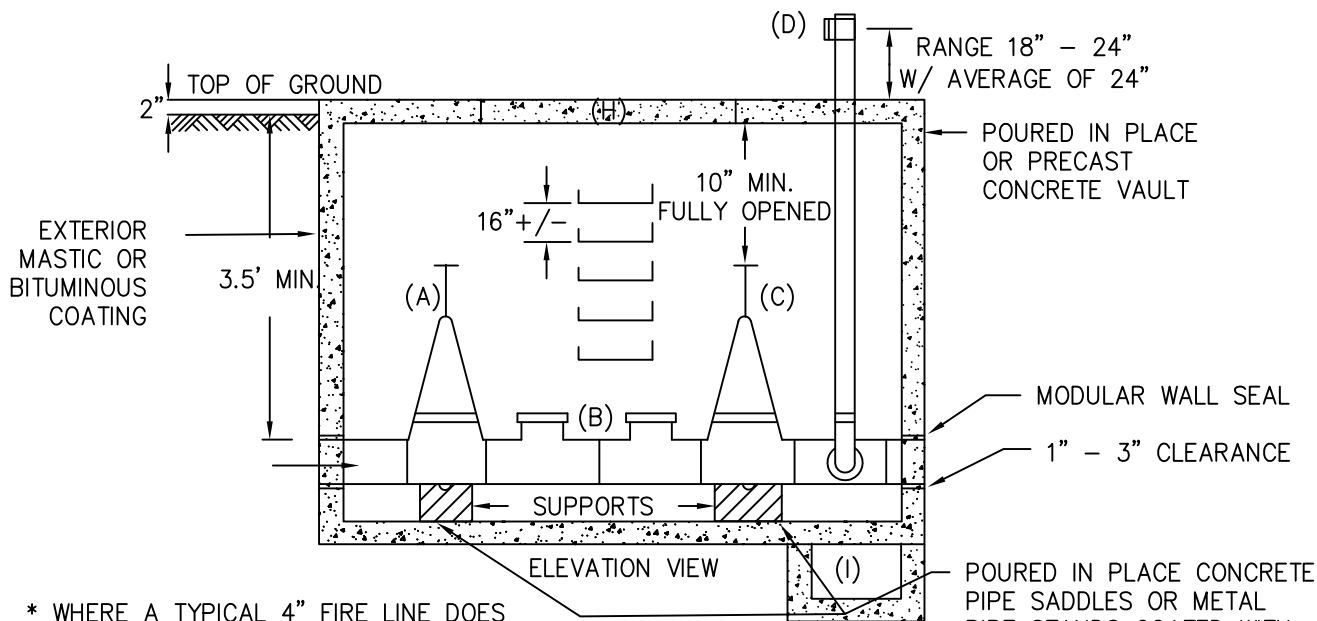
MANIFOLD METER SETTING



PLAN VIEW

- (A) OUTSIDE STEM AND YOKE GATE VALVE
- (B) DOUBLE CHECK VALVE ASSEMBLY
- (C) OUTSIDE STEM AND YOKE GATE VALVE
- \*(D)  $2\frac{1}{2}$ " THREADED N.S.T. SIAMESE CONNECTION FOR FIRE DEPARTMENT W/ AUTOMATIC BALL DRIP
- \*(E) REQUIRED (MAIN LINE SIZE)" X 4"
- \*(F) 4" CHECK VALVE

- \*(G) 4" - 90° BEND
- (H) 4' X 6" HATCH DOOR OR APPROVED EQUAL
- (I) SUMP: DRAIN TO DAYLIGHT OR FURNISH AND INSTALL PUMP
- (J) LOW FLOW BYPASS LINE W/ DETECTOR METER & DOUBLECHECK BACKFLOW PREVENTOR
- (K) SUBMIT SHOP DRAWINGS TO DEPARTMENT OF UTILITIES FOR APPROVAL



\* WHERE A TYPICAL 4" FIRE LINE DOES NOT REQUIRE A SIAMESE CONNECTION, ITEMS (D) THRU (G) DO NOT APPLY.

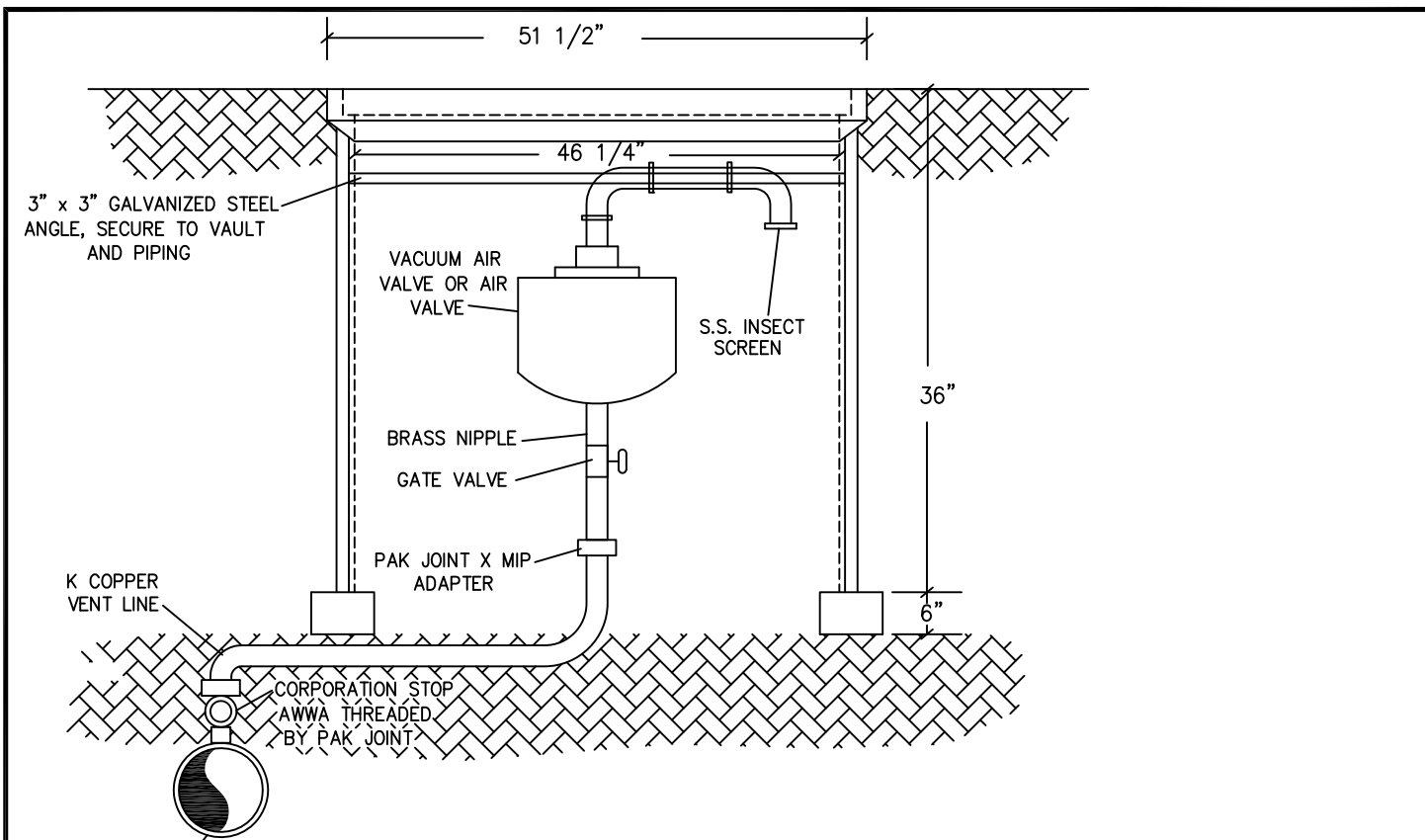
POURED IN PLACE CONCRETE PIPE SADDLES OR METAL PIPE STANDS COATED WITH RUST RETARDANT COATING.

DECEMBER 2004

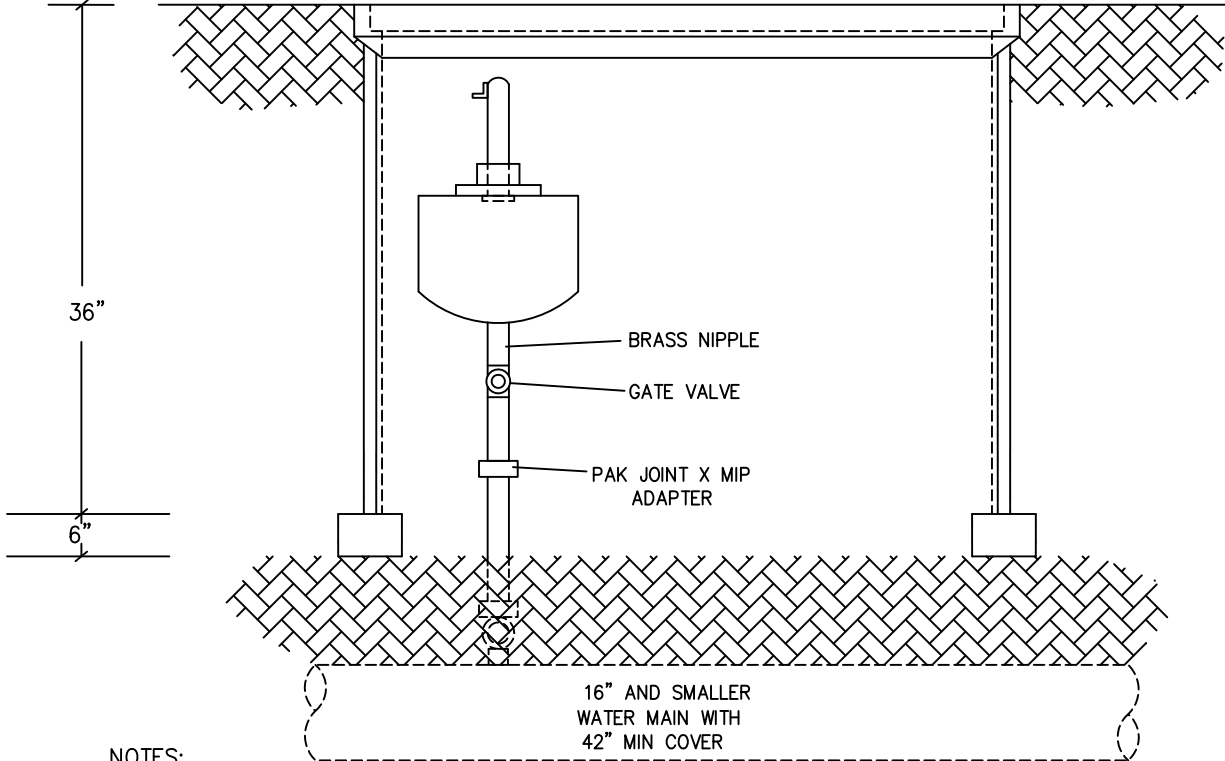
2.2.3-1

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

DOUBLE CHECK ASSEMBLY  
AND VAULT - 4" & LARGER



16" AND SMALLER  
WATER MAIN WITH  
42" MIN COVER



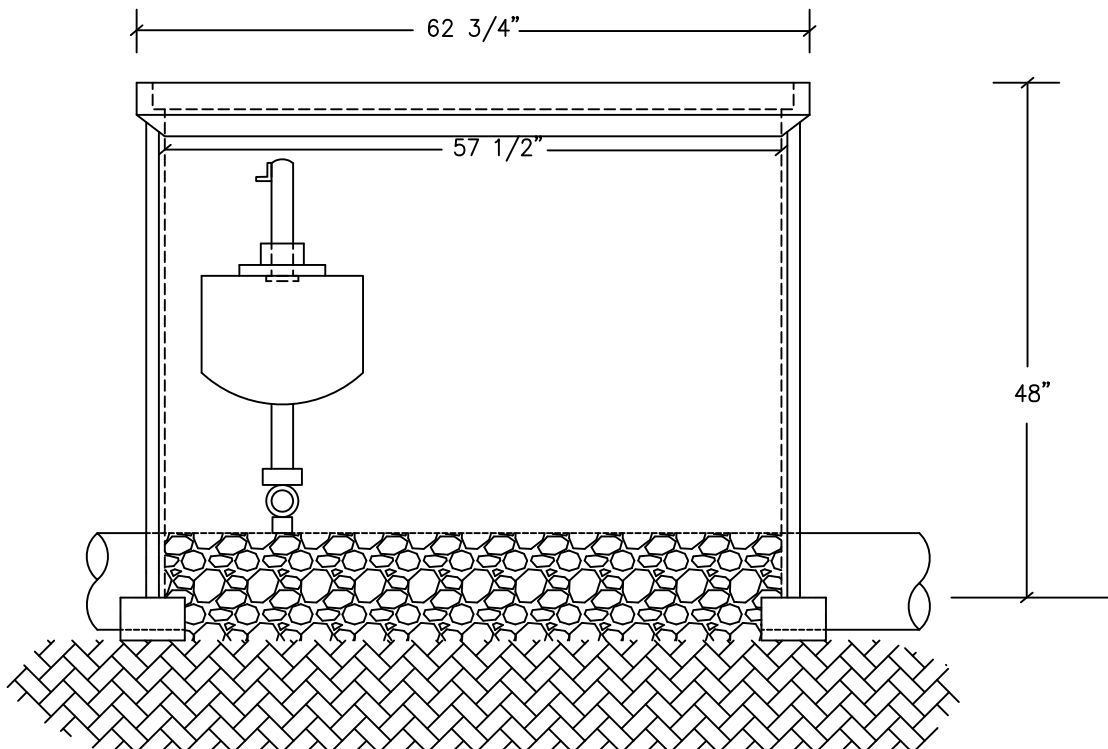
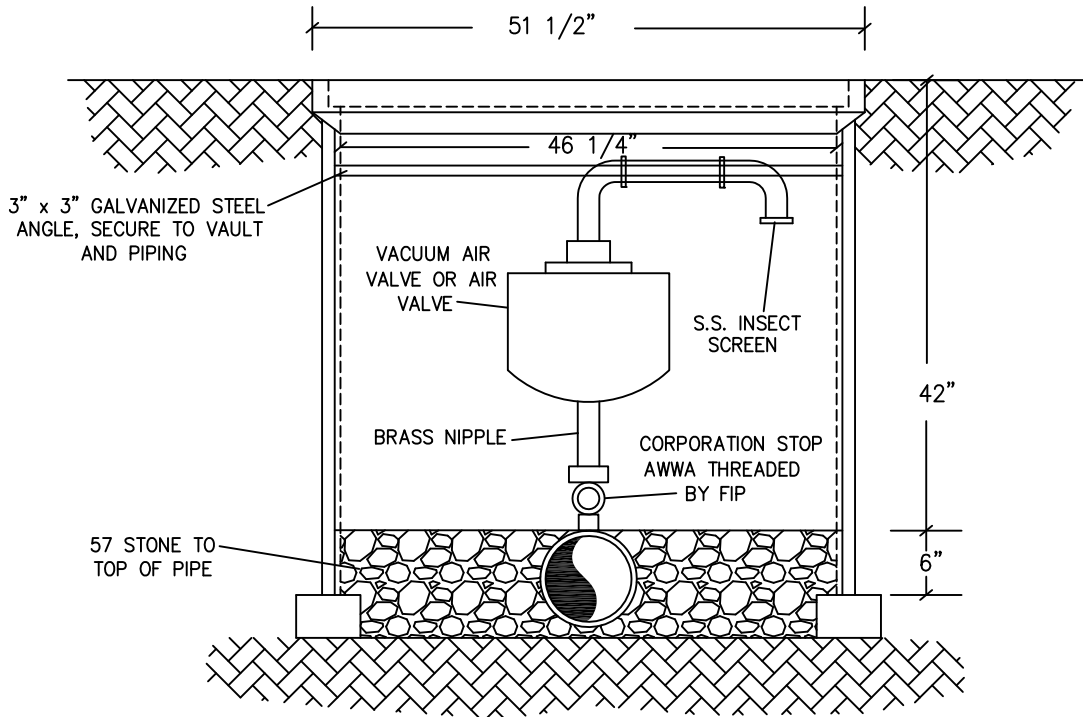
- NOTES:**
1. 48"W x 60"L x 48"D POLYMER CONCRETE VAULT WITH BOLT DOWN LID.  
DRILL 4 - 1" DIA. HOLES IN LID.
  2. USE FOR 1"DIA. OR 2"DIA. VALVES AND PIPING, 2" VALVES AND PIPING ILLUSTRATED.
  3. ALL FITTINGS TO BE BRASS IPS THREADED.
  4. DIRECT TAP TO DIP OR C900 DR14, OTHERWISE SADDLE REQUIRED.
  5. SLOPE VENT LINE CONTINUOUSLY UP TO VALVE.
  6. FOR DRY LOCATIONS.

NOVEMBER 2016

2.3.1-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

VACUUM AIR RELEASE OR AIR  
RELEASE 2" AND SMALLER  
OFF PIPE LOCATION  
DRY LOCATIONS



**NOTES:**

1. 48"W x 60"L x 48"D POLYMER CONCRETE VAULT WITH BOLT DOWN LID.  
DRILL 4 - 1" DIA. HOLES IN LID.
2. USE FOR 1"DIA. OR 2"DIA. VALVES AND PIPING, 2" VALVES AND PIPING ILLUSTRATED.
3. ALL FITTINGS TO BE BRASS IPS THREADED.
4. DIRECT TAP TO DIP OR C900 DR14, OTHERWISE SADDLE REQUIRED.
5. FOR DRY LOCATIONS.

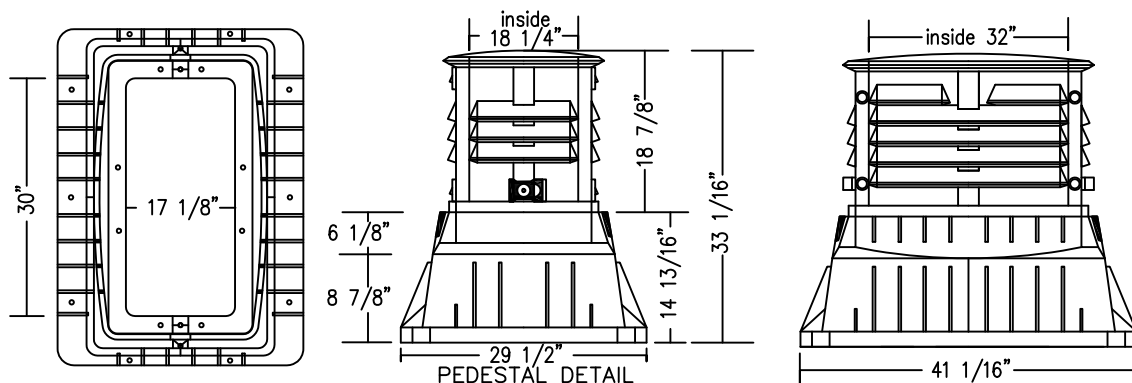
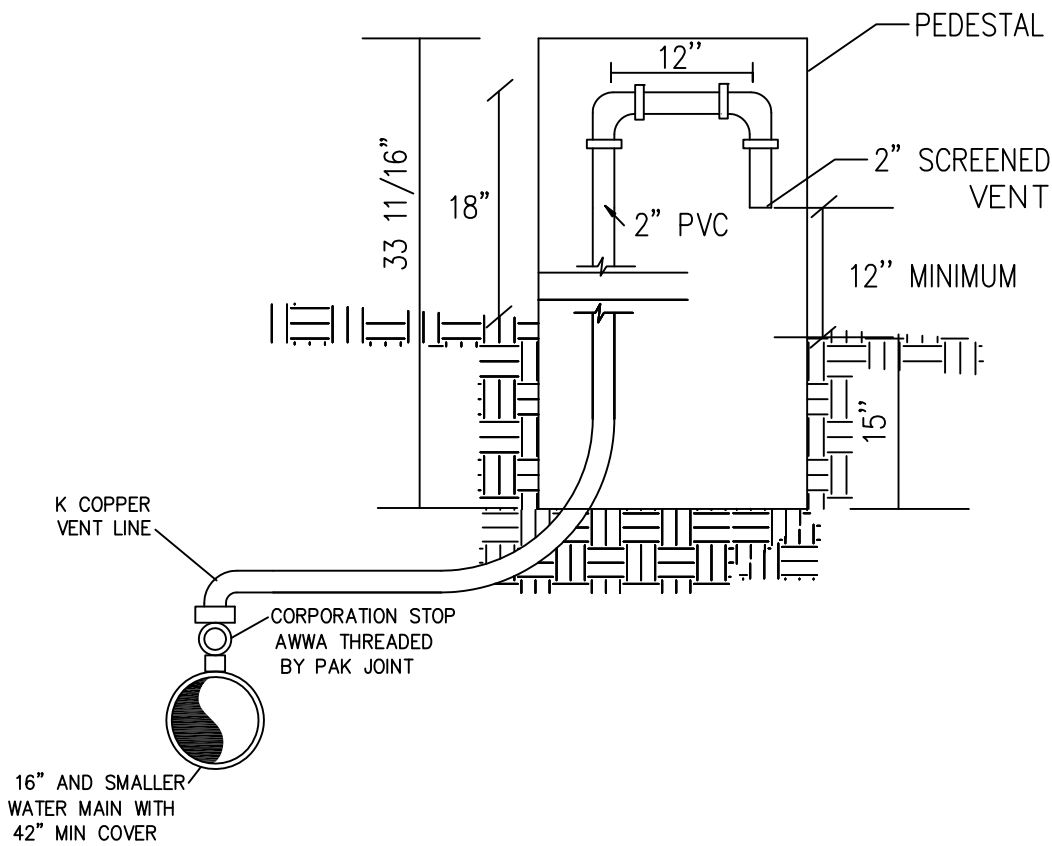
NOVEMBER 2016

2.3.1-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

VACUUM AIR RELEASE OR  
AIR RELEASE 2" AND SMALLER  
ON PIPE LOCATION  
DRY LOCATIONS





1. USE FOR 1" DIA. OR 2" DIA. VALVES AND PIPING, 2" VALVES AND PIPING ILLUSTRATED.
2. ALL FITTINGS TO BE BRASS IPS THREADED.
3. DIRECT TAP TO DIP OR C900 DR14, OTHERWISE SADDLE REQUIRED.
4. SLOPE VENT LINE CONTINUOUSLY UP TO VALVE.
5. FOR WET LOCATIONS.

OCTOBER 2016

2.3.1-3

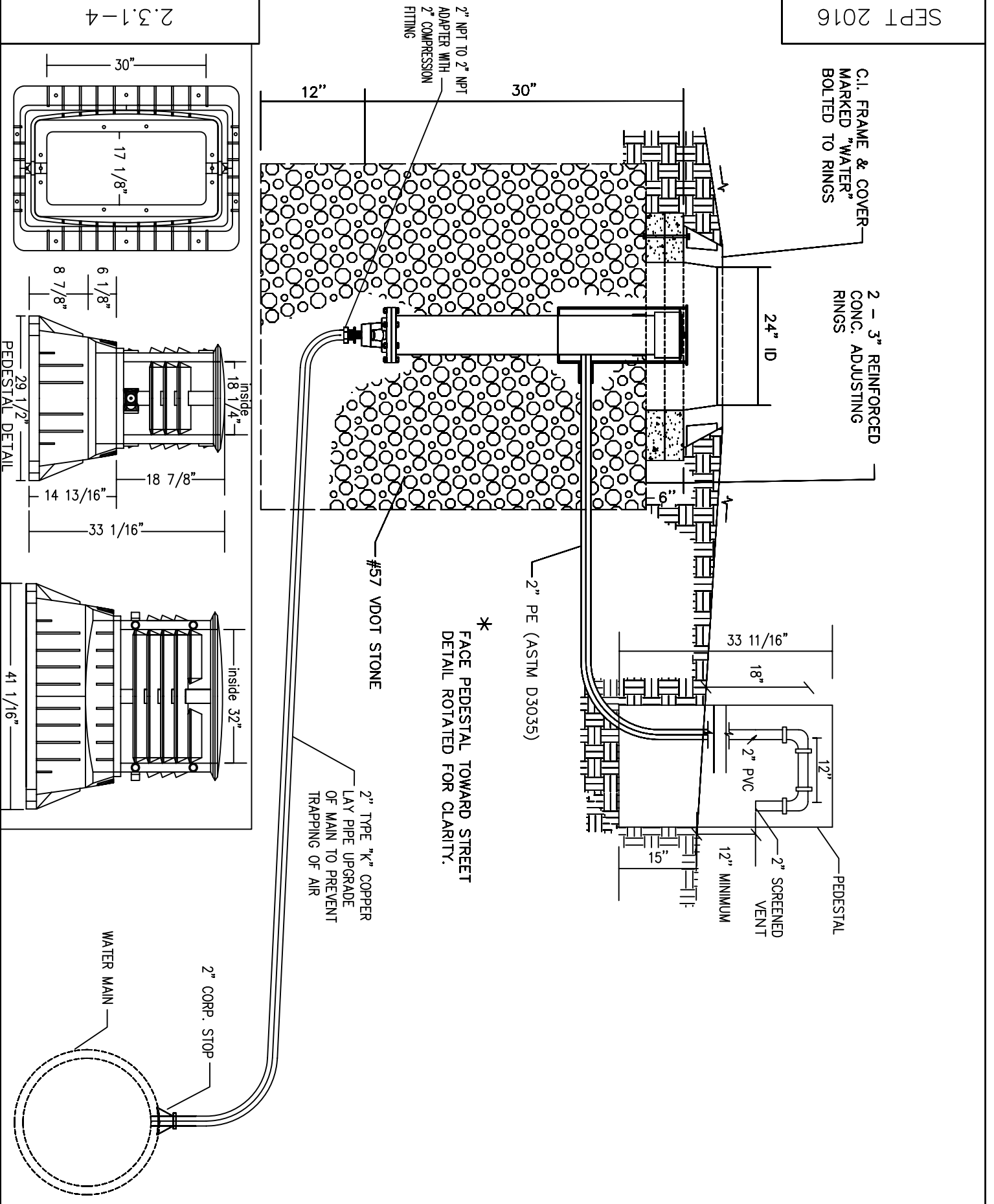
*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

VACUUM AIR RELEASE OR AIR  
RELEASE 2" AND SMALLER  
OFF PIPE LOCATION  
WET LOCATIONS

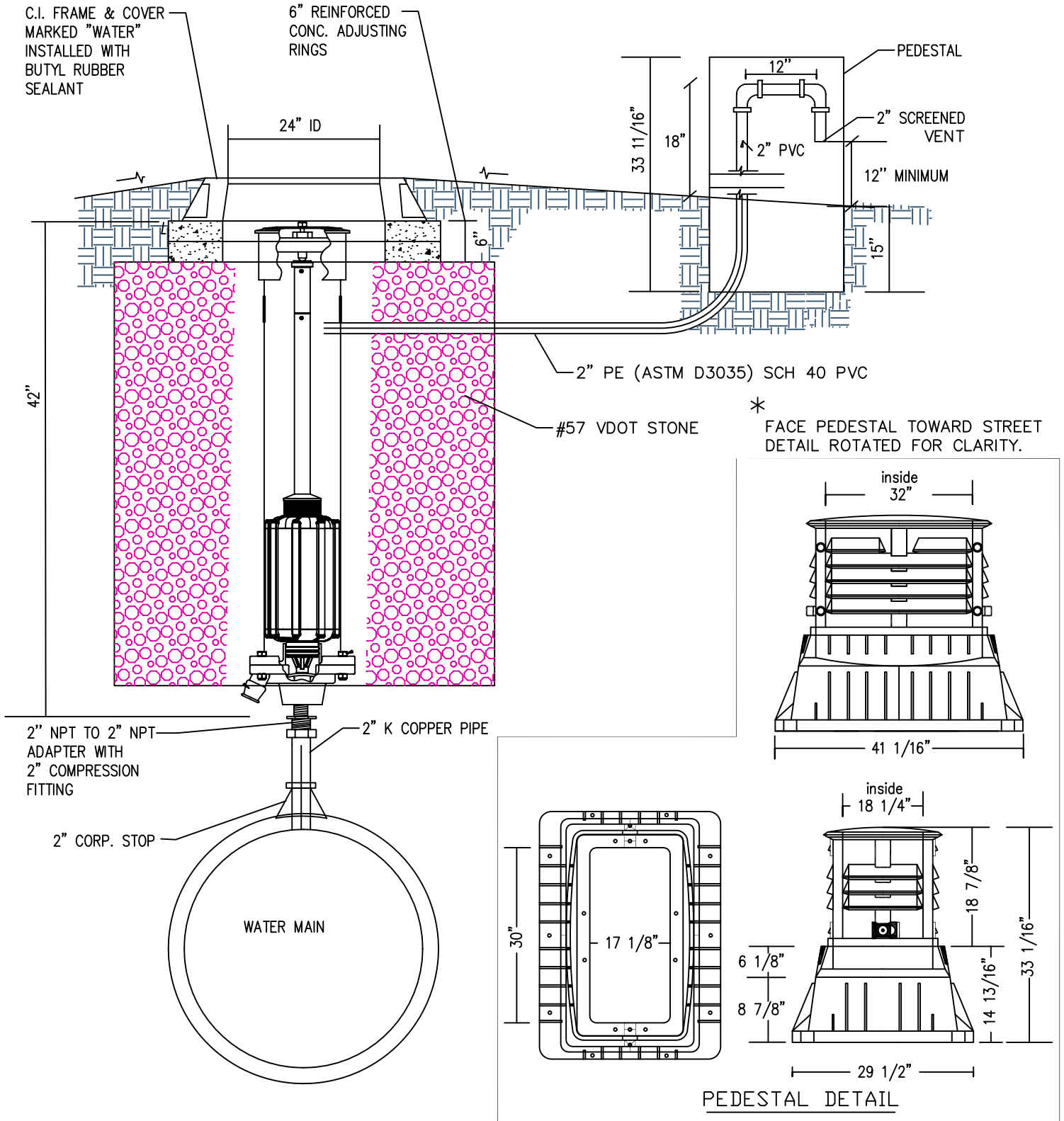
STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

SEPT 2016

DIRECT BURY VACUUM-AIR RELEASE  
VALVE OFF-PIPE INSTALLATION  
FOR WET LOCATIONS



AUTOMATIC AIR AND VACUUM VALVE  
ASSEMBLY W/ 2" FNPT BASE



OCTOBER 2016

Not to Scale

2.3.1-5

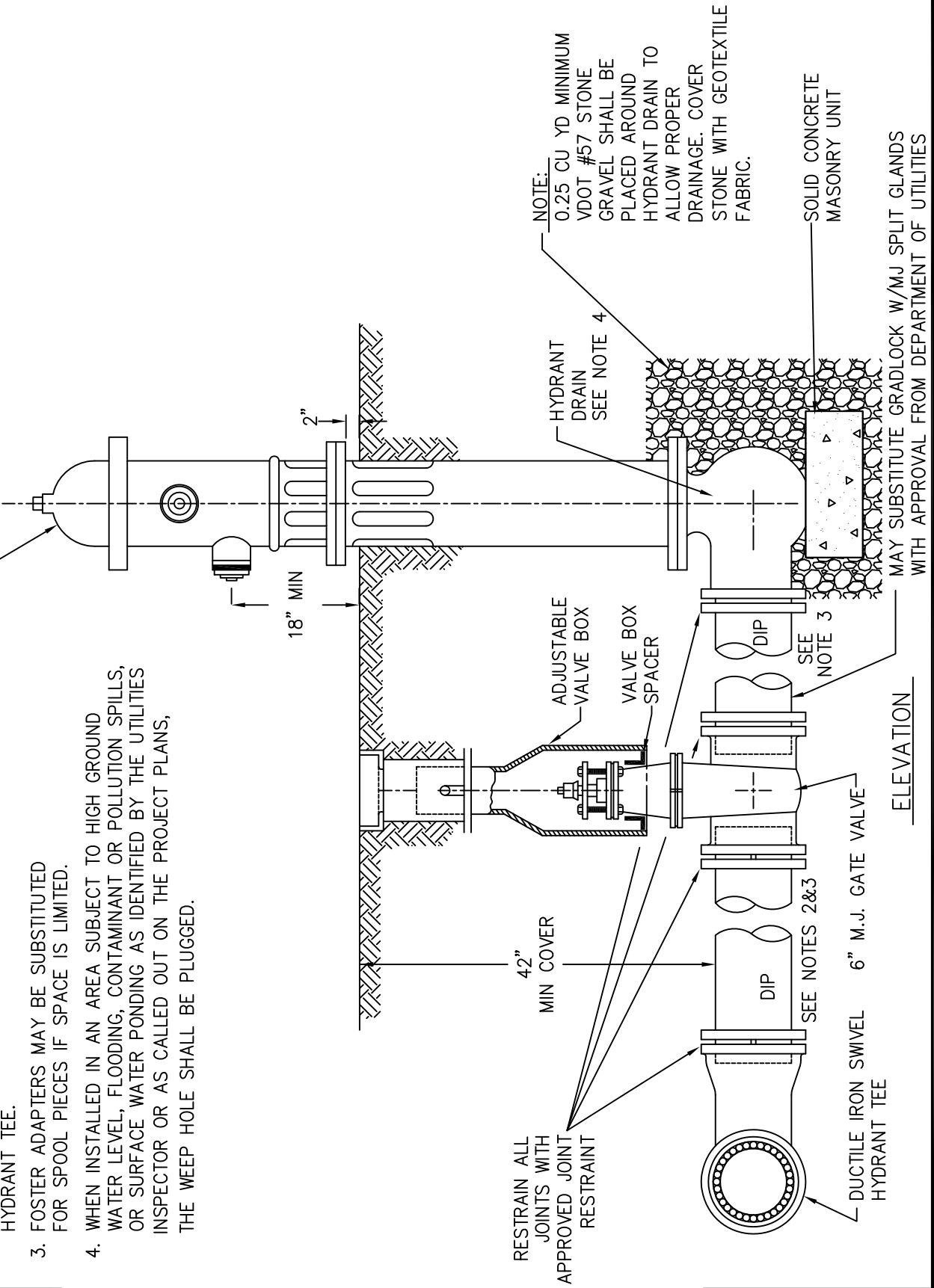
STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

DIRECT BURY VACUUM AIR RELEASE  
VALVE ON-PIPE INSTALLATION  
FOR WET LOCATIONS

NOTES:

1. FIRE HYDRANT MUST BE PLUMB.
2. MAY BE OMITTED IF GATE VALVE IS CONNECTED DIRECTLY TO SWIVEL HYDRANT TEE.
3. FOSTER ADAPTERS MAY BE SUBSTITUTED FOR SPOOL PIECES IF SPACE IS LIMITED.
4. WHEN INSTALLED IN AN AREA SUBJECT TO HIGH GROUND WATER LEVEL, FLOODING, CONTAMINANT OR POLLUTION SPILLS, OR SURFACE WATER PONDING AS IDENTIFIED BY THE UTILITIES INSPECTOR OR AS CALLED OUT ON THE PROJECT PLANS, THE WEEP HOLE SHALL BE PLUGGED.

SEE APPROVED PRODUCTS LIST FOR ACCEPTABLE MANUFACTURERS



NOTE:  
0.25 CU YD MINIMUM  
VDOT #57 STONE  
GRAVEL SHALL BE  
PLACED AROUND  
HYDRANT DRAIN TO  
ALLOW PROPER  
DRAINAGE. COVER  
STONE WITH GEOTEXTILE  
FABRIC.

SOLID CONCRETE  
MASONRY UNIT

HYDRANT  
DRAIN  
SEE NOTE 4

18" MIN

2"

ADJUSTABLE  
VALVE BOX  
VALVE BOX  
SPACER

SEE  
NOTE 3

ELEVATION

42"  
MIN COVER

RESTRAIN ALL  
JOINTS WITH  
APPROVED JOINT  
RESTRAINT

SEE NOTES 2&3

DUCTILE IRON SWIVEL  
HYDRANT TEE

6" M.J. GATE VALVE

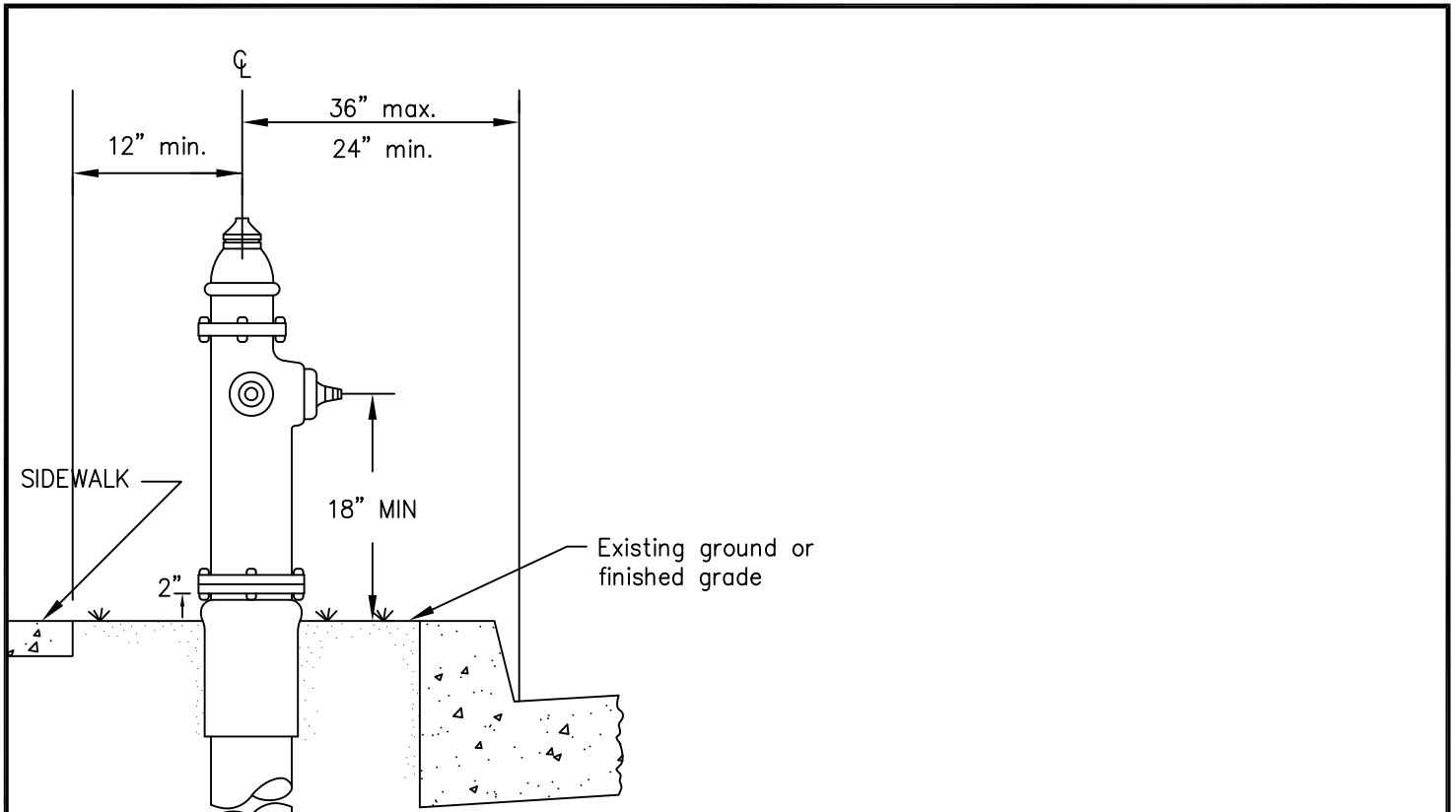
2.4.4-1

NOVEMBER 2016

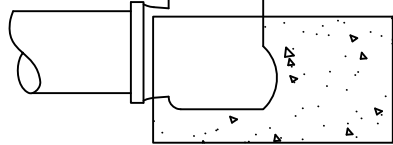
STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

TYPICAL  
FIRE HYDRANT ASSEMBLY

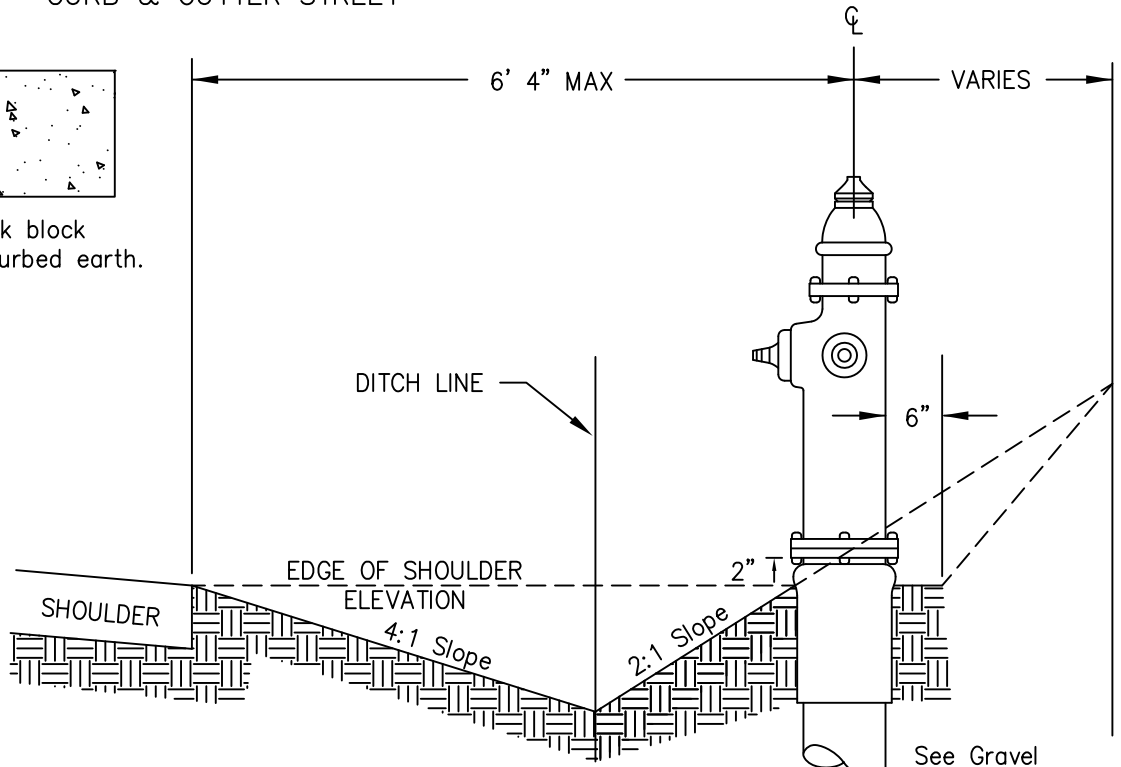
MAY SUBSTITUTE GRADLOCK W/MJ SPLIT GLANDS  
WITH APPROVAL FROM DEPARTMENT OF UTILITIES



TYPICAL SECTION  
CURB & GUTTER STREET



Concrete support & kick block  
to be carried to undisturbed earth.

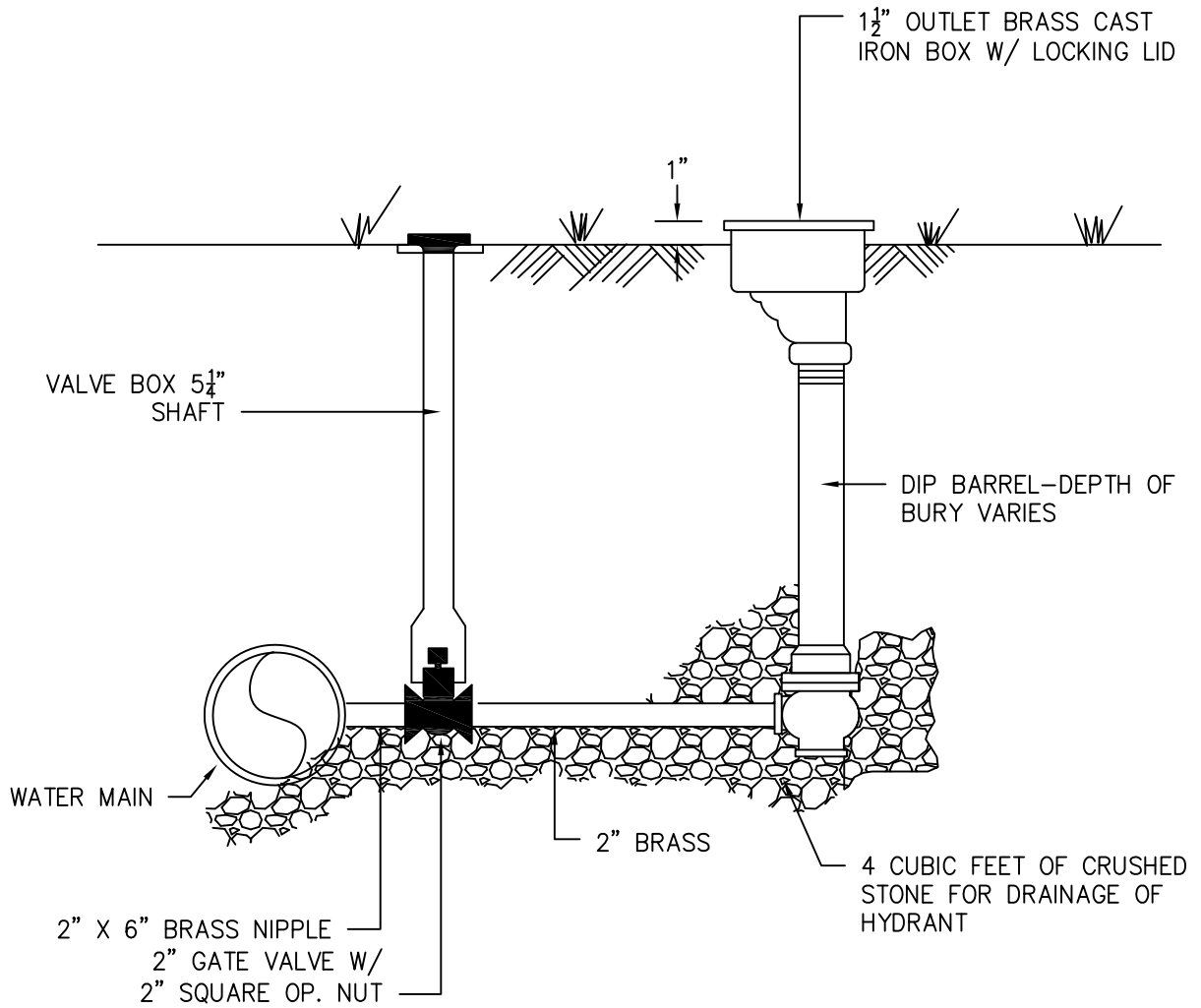


TYPICAL SECTION  
STREET WITHOUT CURB & GUTTER

See Gravel  
Drain Detail  
ON 2.4.4-1

DECEMBER 2004

2.4.4-2



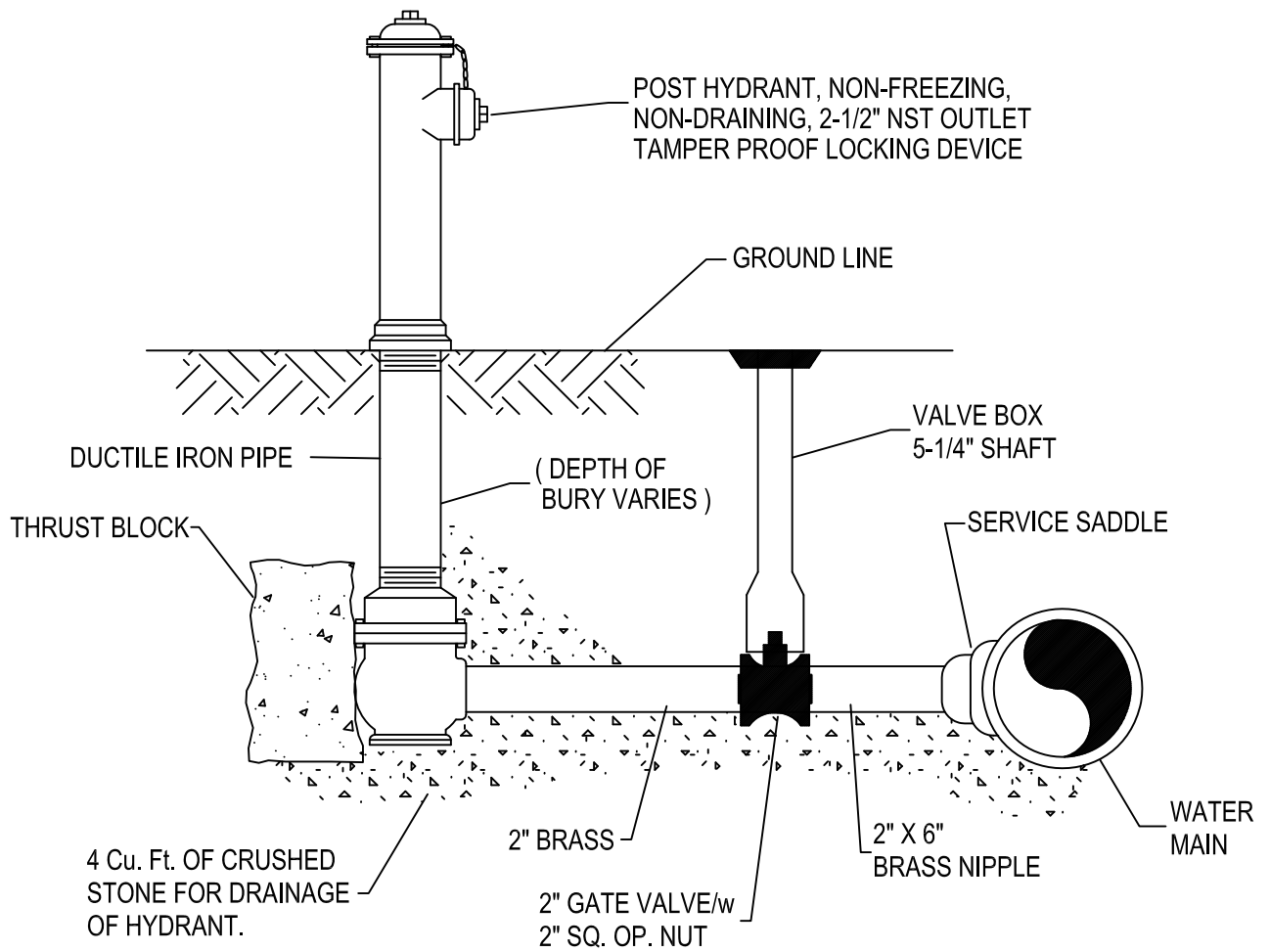
1. FOR DEAD END LINES INSTALL FLUSHING HYDRANT ON RESTRAINED END CAP.

DECEMBER 2004

2.4.4-3

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

BELOW GRADE  
FLUSHING HYDRANT



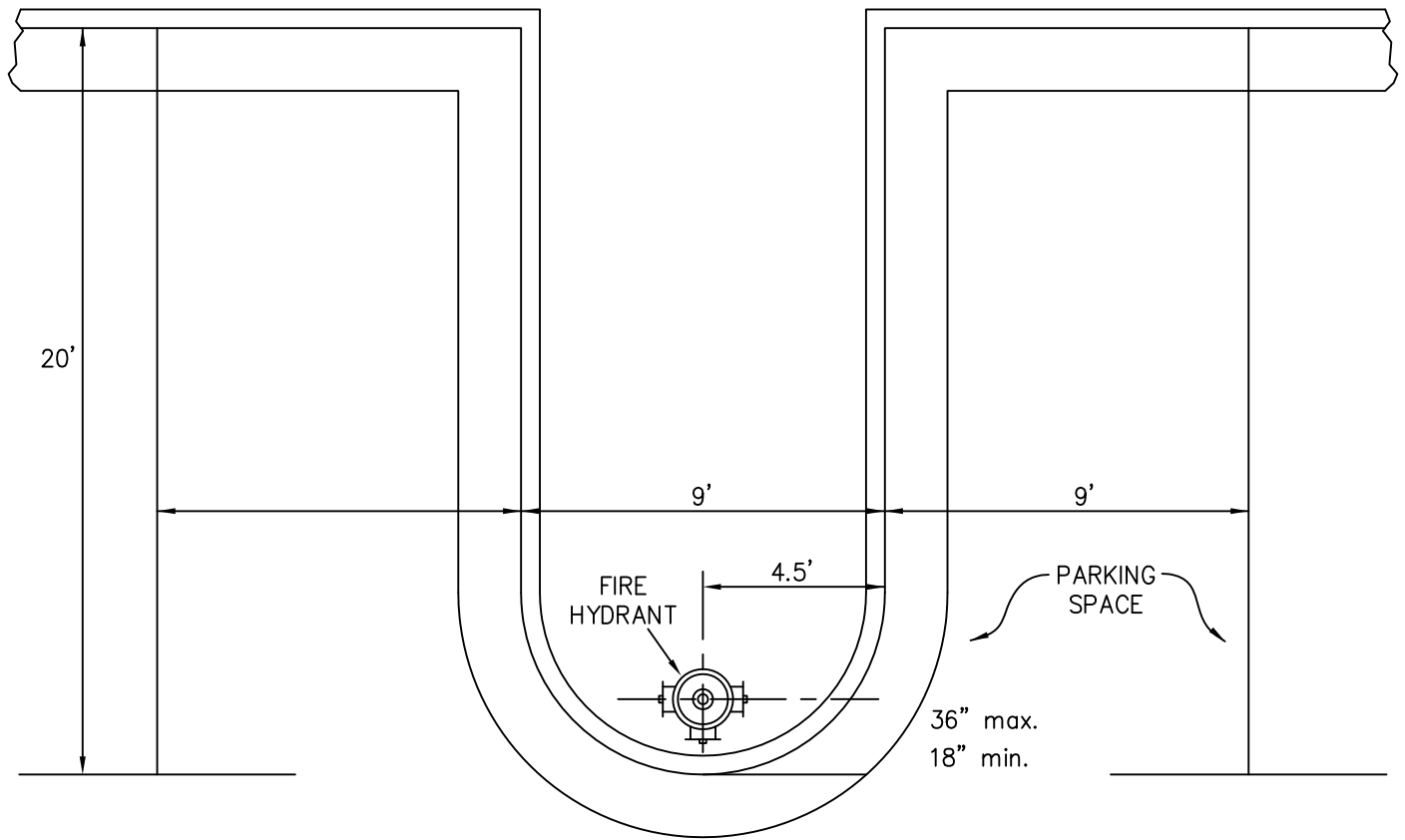
1. FOR DEAD END LINES DELETE SERVICE  
SADDLE AND INSTALL FLUSHING HYDRANT  
ON RESTRAINED END CAP

DECEMBER 2004

2.4.4-4

*STAFFORD COUNTY*  
*DEPARTMENT OF UTILITIES*

ABOVE GRADE  
FLUSHING HYDRANT



DECEMBER 2004

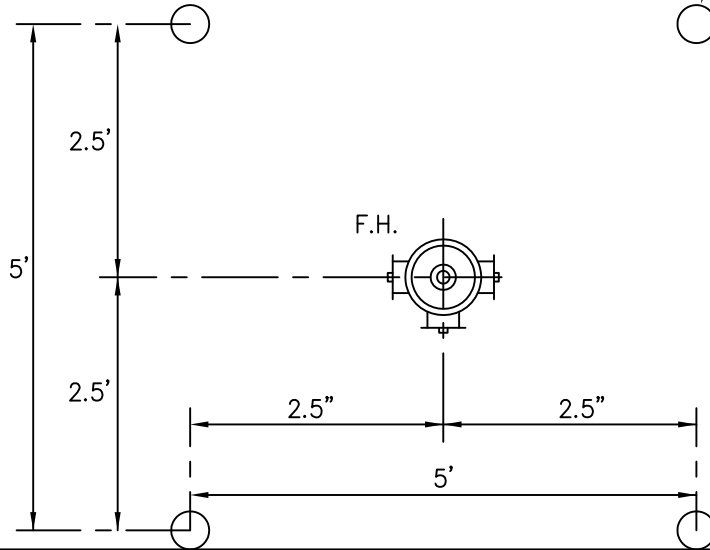
2.4.4-6

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL FIRE HYDRANT  
LOCATION IN ISLAND & PARKING AREA



4' STEEL POSTS 6' LONG  
4" DIA. FILLED WITH  
CONCRETE BURIED 3'  
IN CONCRETE (PAINTED YELLOW)



THIS AREA TO BE  
DESIGNATED FIRE LANE  
AS REQUIRED BY THE  
FIRE MARSHAL

5'

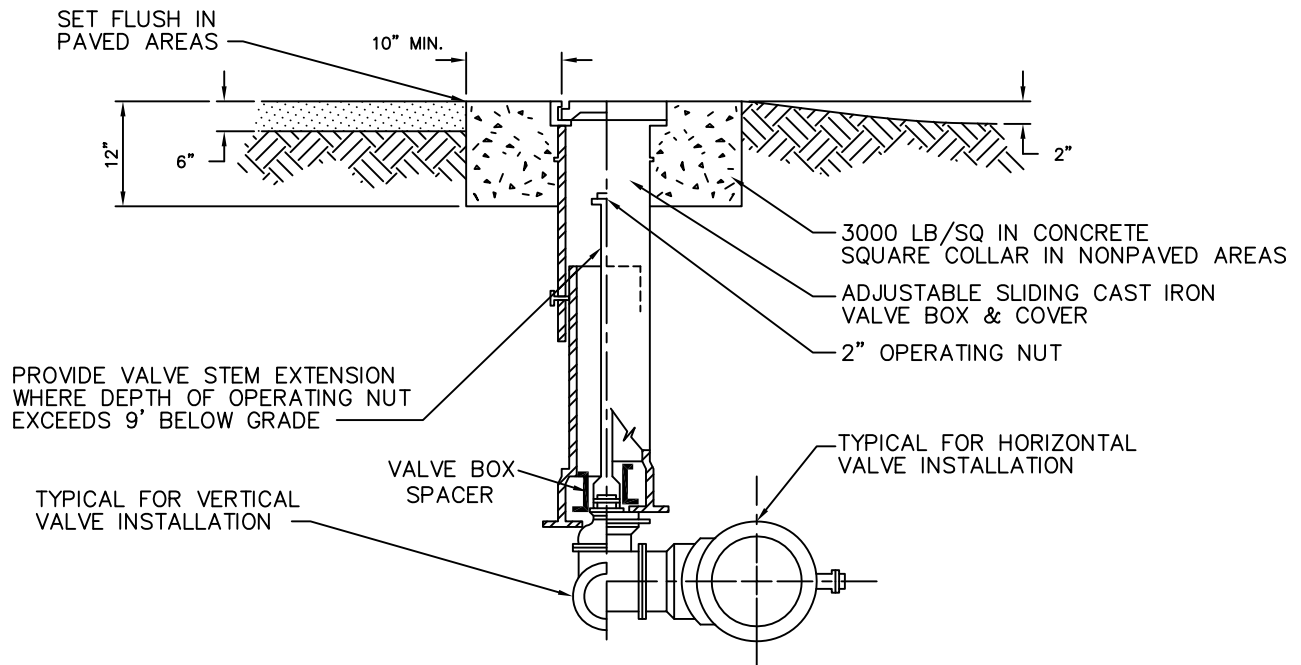
30'

DECEMBER 2004

2.4.4-7

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL FIRE HYDRANT  
POST PROTECTION



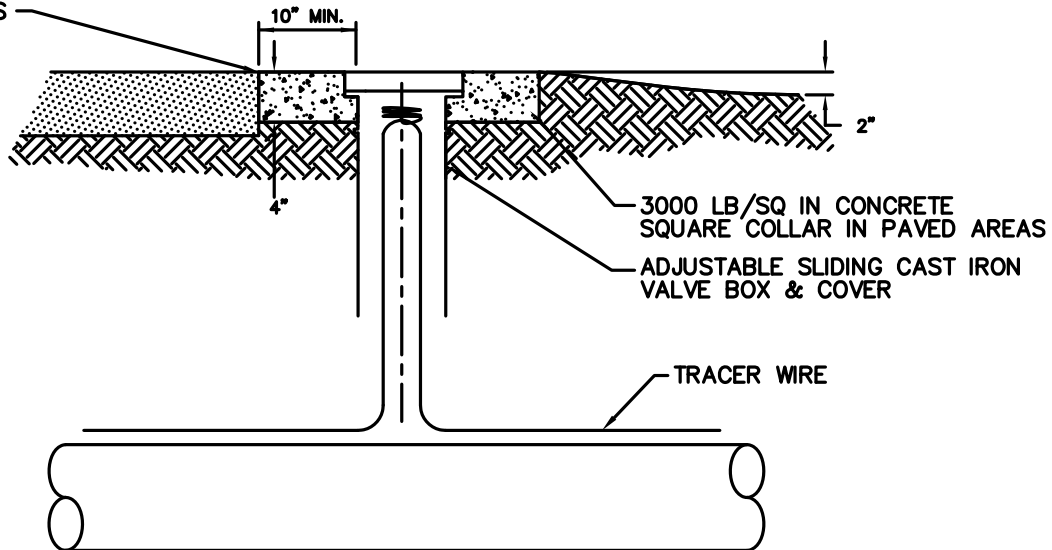
SEPT 2016

2.4.5-1

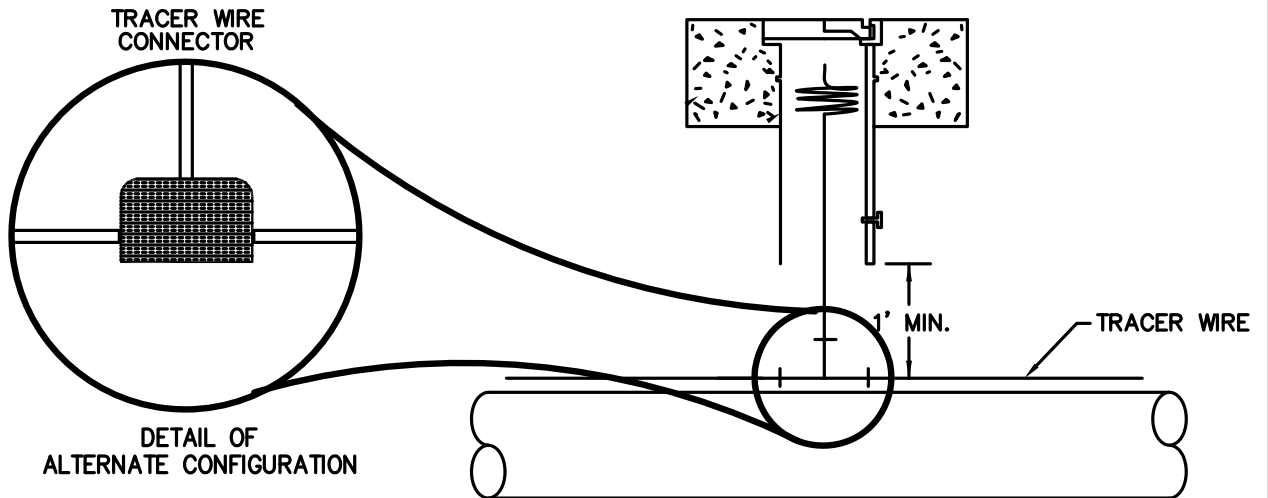
*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL VALVE  
AND VALVE BOX

SET FLUSH IN  
PAVED AREAS



PREFERRED CONFIGURATION



ALTERNATE CONNECTION CONFIGURATION  
WITH DEPARTMENT APPROVAL ONLY

**NOTES:**

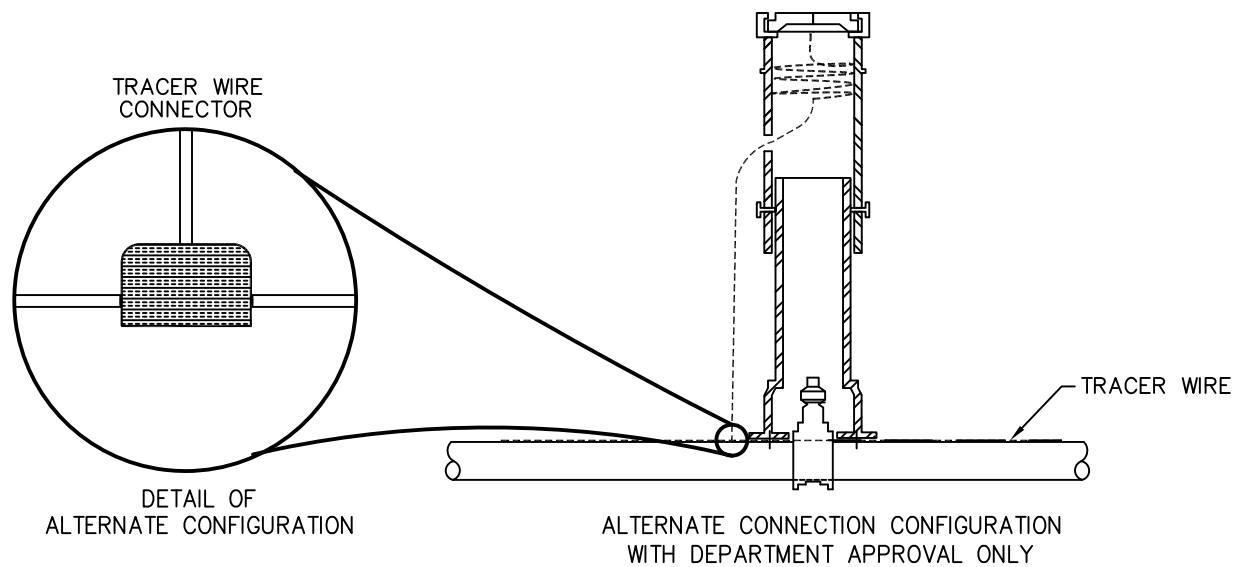
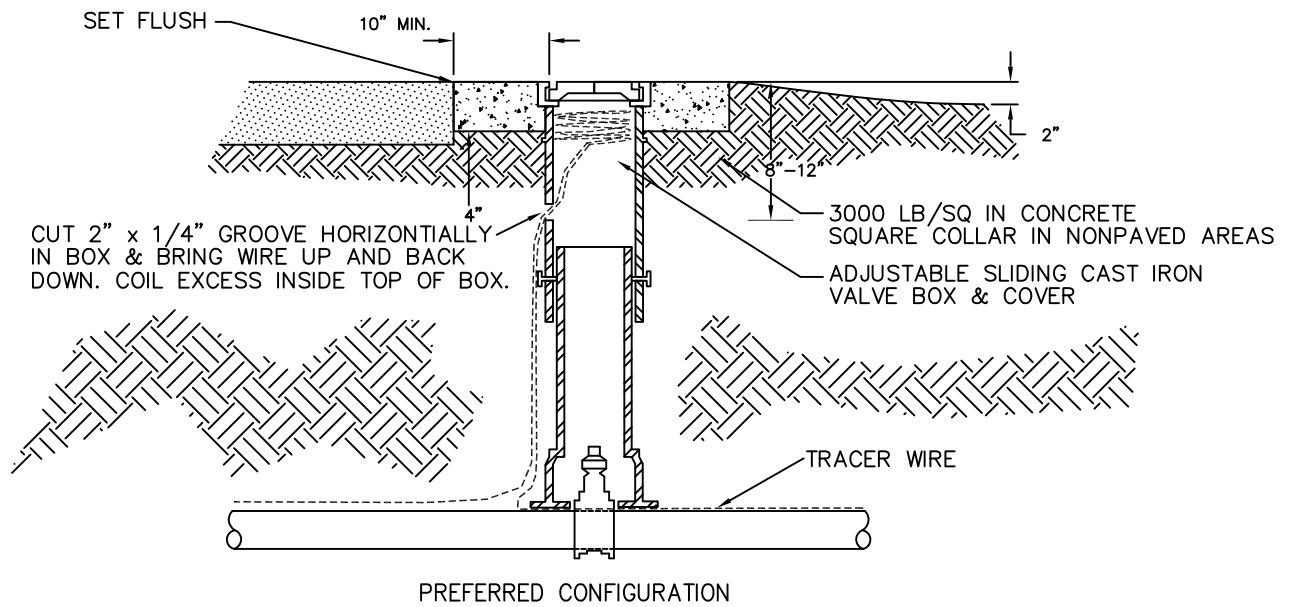
1. MAXIMUM TRACER WIRE BOX SPACING, 300 FEET.
2. TRACER WIRE, 10 GAUGE COPPER CLAD STEEL CORE HDPE INSULATED.
3. CONNECTED WITH APPROVED TRACER WIRE CONNECTOR FOR ALTERNATE CONFIGURATION.
4. PROVIDE SUFFICIENT TRACER WIRE TO EXTEND 3 FEET BEYOND THE VALVE BOX COVER. COIL UP WIRE AND PLACE UNDER COVER.
5. ATTACH TRACER WIRE TO PIPE EVERY 10 FEET WITH DUCT TAPE.
6. COUNTY MAY TEST TRACER WIRE FOR CONTINUITY PRIOR TO ACCEPTANCE.

MARCH 2016

2.4.5-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TRACER WIRE  
LOCATOR BOX



NOTES:

1. MAXIMUM TRACER WIRE BOX SPACING, 300 FEET.
2. TRACER WIRE, 10 GAUGE COPPER CLAD STEEL CORE HDPE INSULATED.
3. CONNECTED WITH APPROVED TRACER WIRE CONNECTOR FOR ALTERNATE CONFIGURATION.
4. PROVIDE SUFFICIENT TRACER WIRE TO EXTEND 3 FEET BEYOND THE VALVE BOX COVER. COIL UP WIRE AND PLACE UNDER COVER.
5. ATTACH TRACER WIRE TO PIPE EVERY 10 FEET WITH DUCT TAPE.
6. COUNTY MAY TEST TRACER WIRE FOR CONTINUITY PRIOR TO ACCEPTANCE.

MARCH 2016

2.4.5-3

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

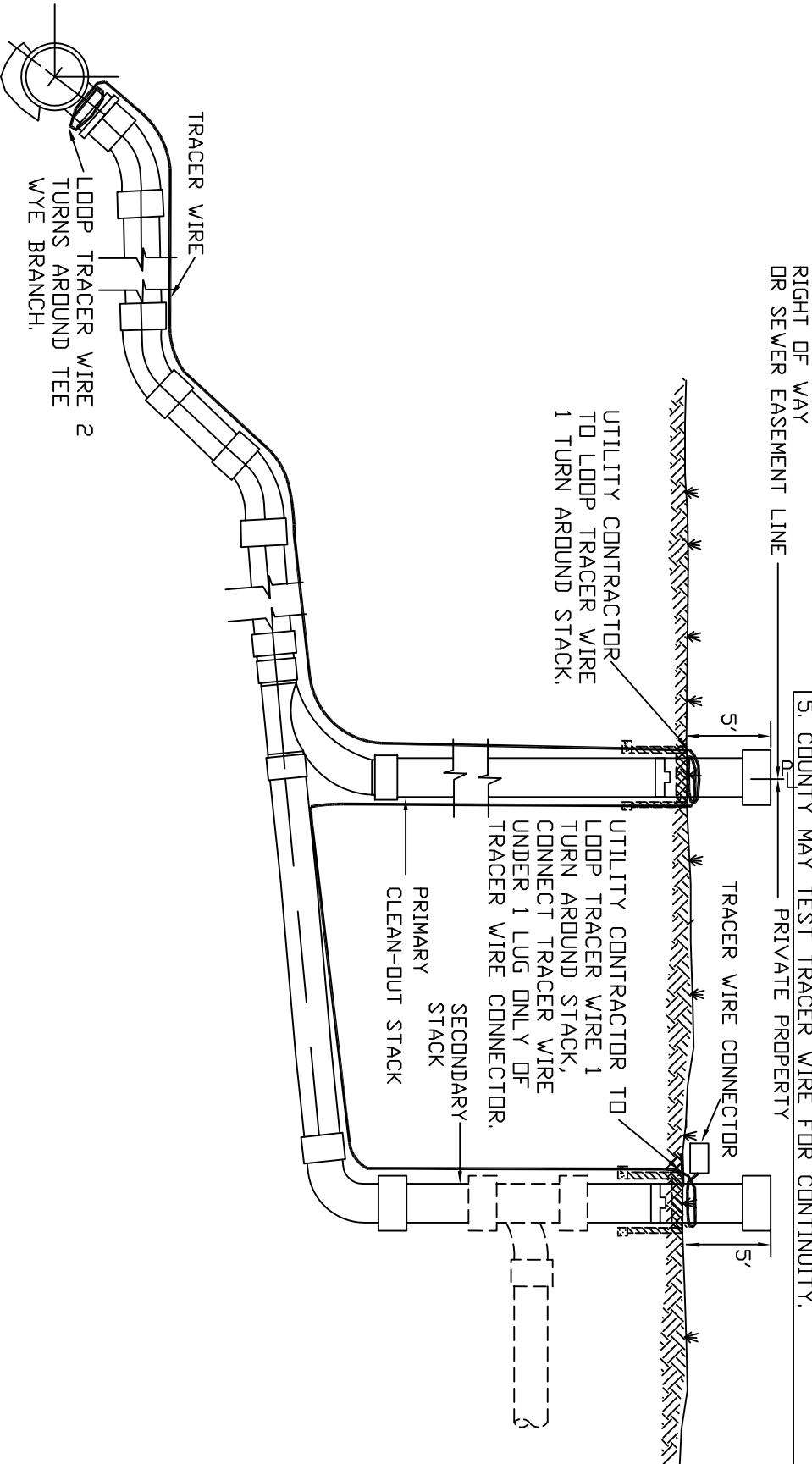
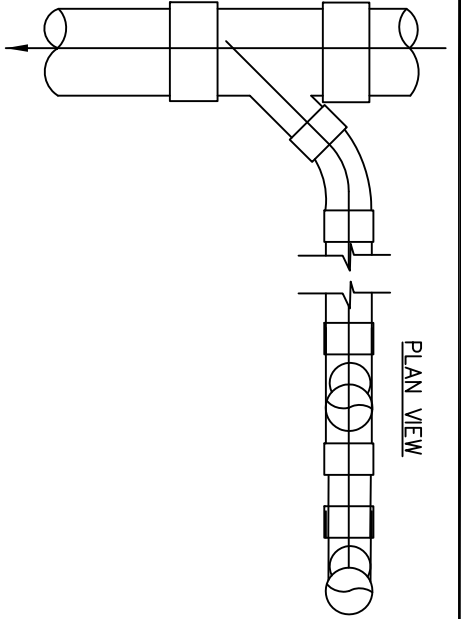
TYPICAL VALVE BOX  
WITH TRACER WIRE

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

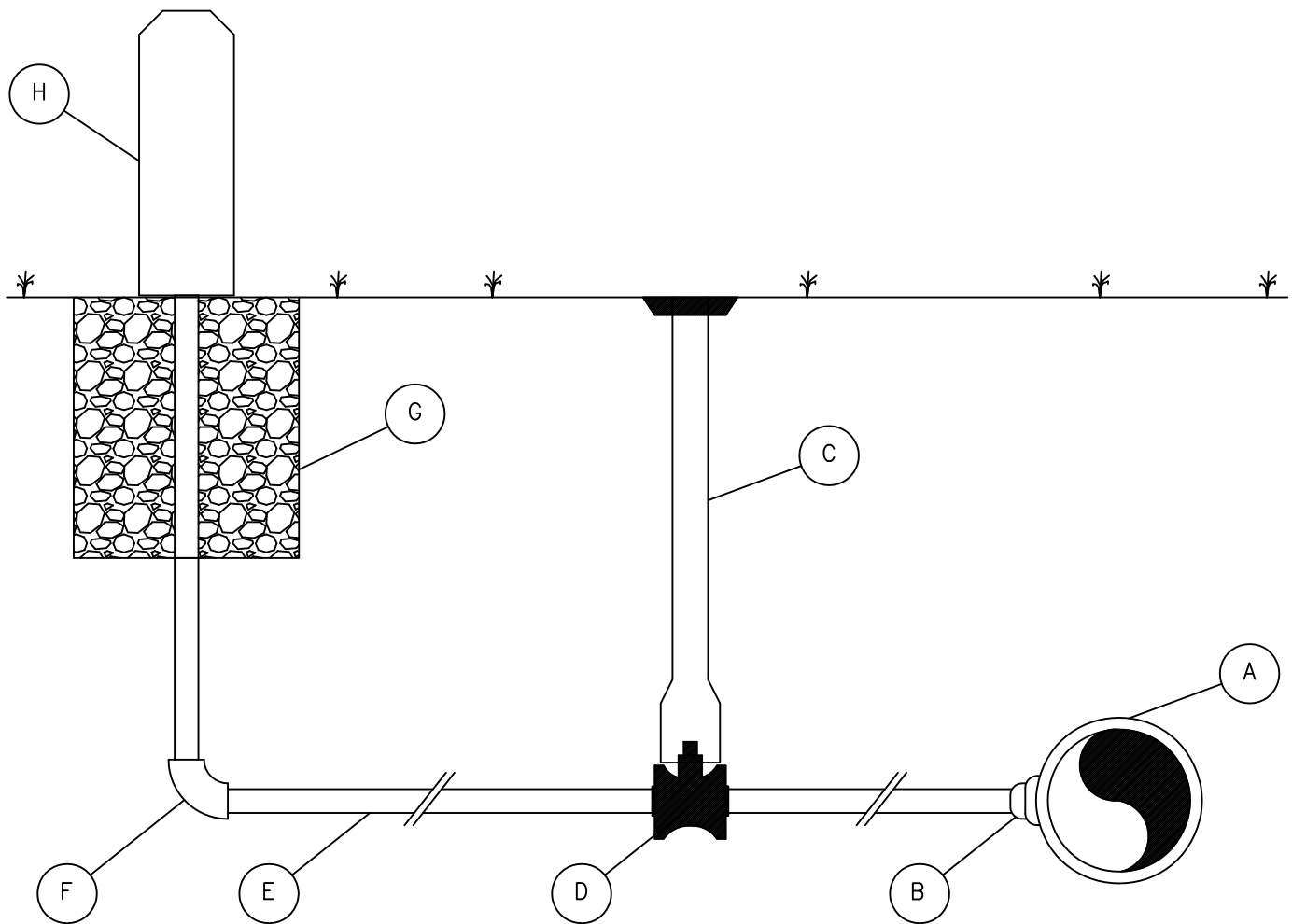
SEPT 2016

TRACER WIRE FOR SEWER LATERALS

2.4.5-4



- NOTES:
1. ALL SEWER LATERALS SHALL HAVE TRACER WIRE TAPED TO PIPE AND STACKS.
  2. UTILITY CONTRACTORS SHALL WRAP TRACER WIRE AROUND BRANCH OF THE WYE, TAPE TO LATERAL AND PRIMARY STACK, CONTINUE TO SECONDARY STACK AND TERMINATE WITH TRACER WIRE CONNECTOR UNDER 1 LUG, LEAVE CONNECTOR UNSEALED, PROTECT WITH PLASTIC BAG AND TAPE TO STACK.
  3. PLUMBER SHALL MOVE MOST OF TRACER WIRE TO SAND BETWEEN STACK AND CLEANOUT COVER; LEAVE 6" OF WIRE EXPOSED IN CLEANOUT COVER.
  4. PLUMBER SHALL DETACH TRACER WIRE AS NECESSARY FROM SECONDARY STACK OR STRAIGHT PIPE BEYOND PRIMARY STACK, ATTACH TRACER WIRE TO UNUSED LUG OF TRACER WIRE CONNECTOR, SEAL TRACER WIRE CONNECTOR AND EXTEND TRACER WIRE ALONG SEWER LATERAL TO STRUCTURE IN ACCORDANCE WITH 703.6 OF THE VIRGINIA PLUMBING CODE.
  5. COUNTY MAY TEST TRACER WIRE FOR CONTINUITY.



SAMPLING STATION

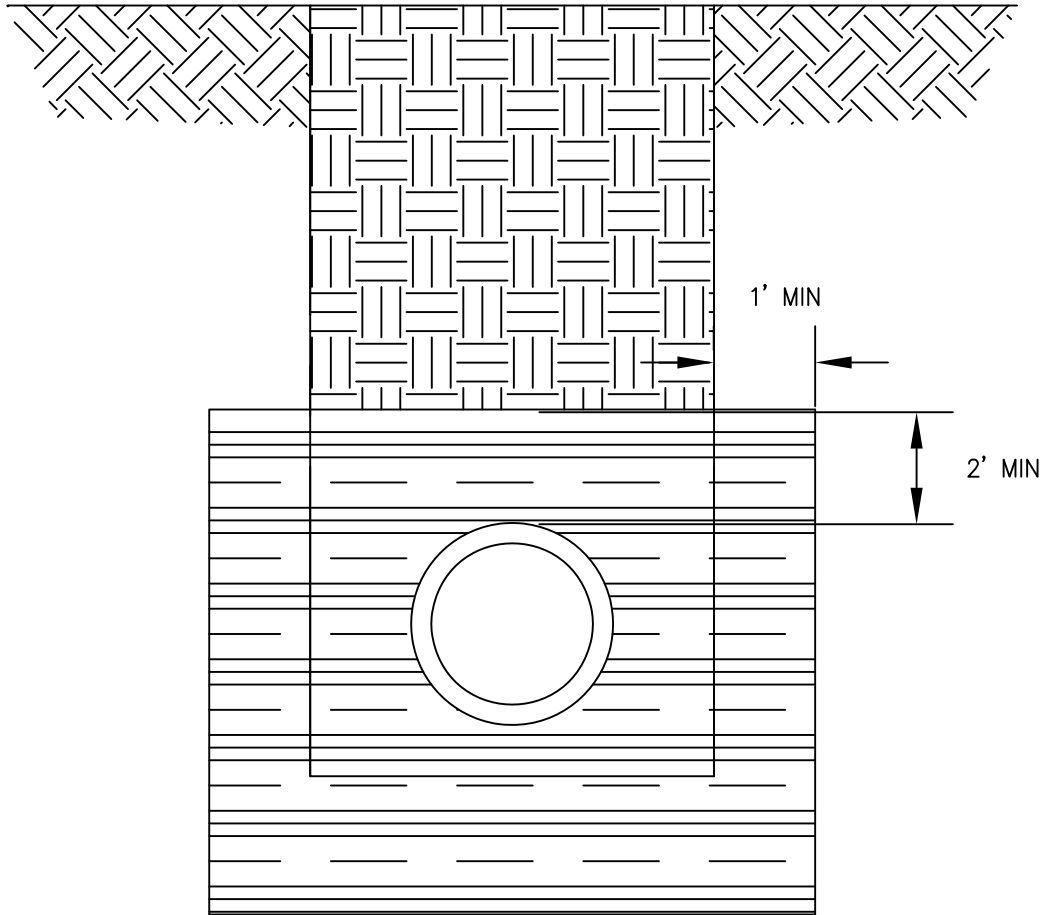
- A. SERVICE SADDLE
- B. 3/4" CORPORATION STOP
- C. VALVE BOX WITH 5 1/4" C.I. SHAFT
- D. CURB STOP VALVE
- E. 3/4" K COPPER
- F. ELL
- G. 24" X 30" POLYETHYLENE METER BARREL (FILL WITH #57 GRAVEL)
- H. SAMPLE STATION
- I. SEE APPROVED PRODUCTS LIST FOR ACCEPTABLE MANUFACTURERS

DECEMBER 2004

2.5.1-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

SAMPLING STATION



NOTES:

1. NATIVE SOIL USED FOR CLAY DAMS SHALL BE CLASS CL, ML, CH, OR SC, OR SHALL HAVE A VERIFIED IMPERVIOUSNESS OF 0.001 CM/SEC. AS PER ASTM D5084.
2. THE USE OF SOIL CEMENT (270# CEMENT/CU.YD.) OR BENTONITE SLURRY IS ACCEPTABLE IN LIEU OF SUITABLE NATIVE SOIL.
3. ALL MATERIAL TO BE APPROVED BY INSPECTOR PRIOR TO PLACING.
4. CLAY DAM EXTENDS 1 FOOT BELOW BEDDING UNLESS ROCK IS ENCOUNTERED.
5. CLAY DAM TO BE MINIMUM OF 2 FEET THICK.
6. CLAY DAMS TO BE INSTALLED ON EACH REACH OF SEWER GREATER THAN 100 FEET IN LENGTH, 25' UPSTREAM FROM THE DOWNSTREAM MANHOLE.

DECEMBER 2004

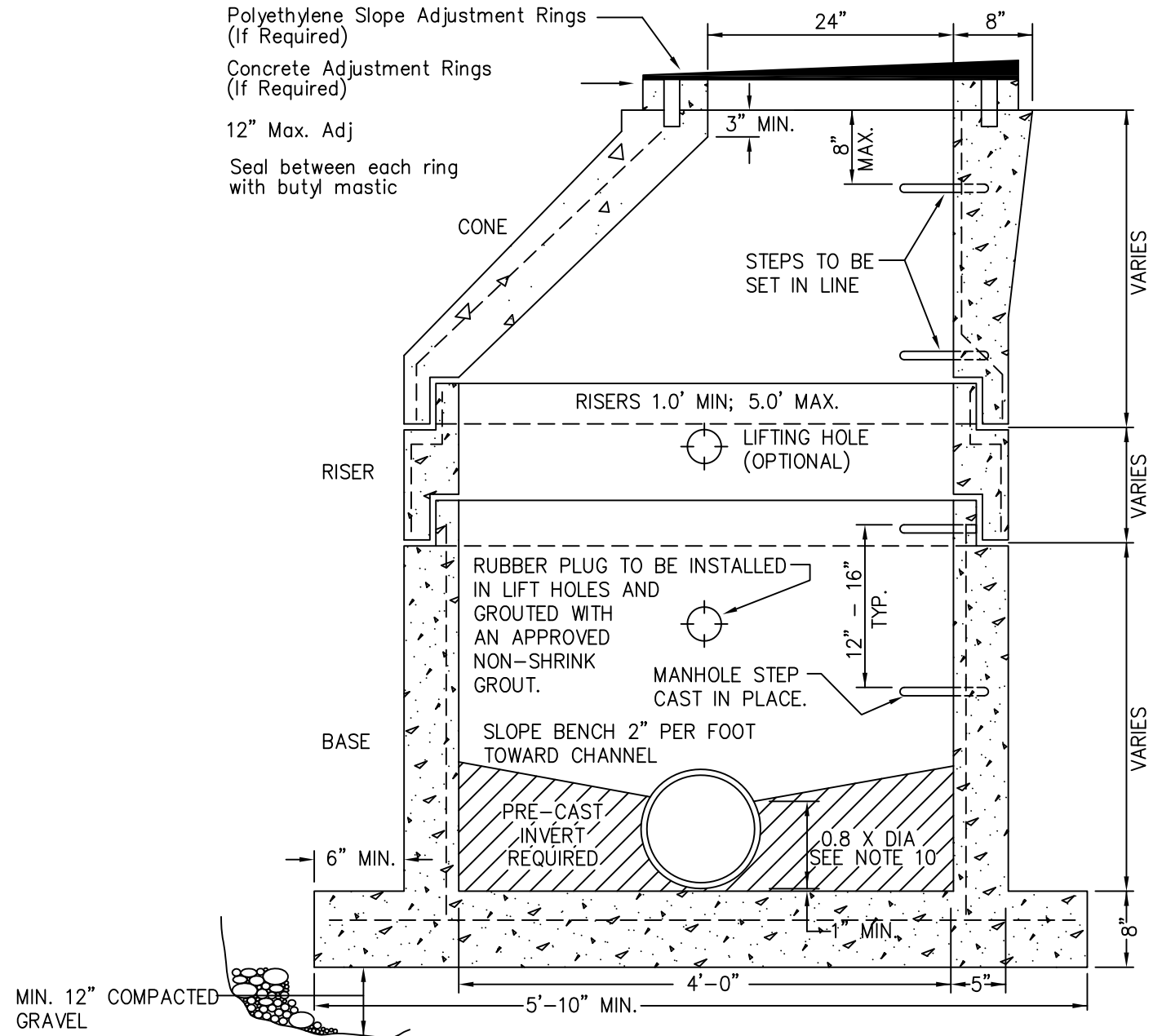
3.1.2-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

CLAY DAM DETAIL

NOTES:

1. MANHOLE TO MEET CURRENT REQUIREMENTS OF ASTM SPEC. C-478.
2. ALL REINFORCING STEEL TO MEET CURRENT REQUIREMENTS OF ASTM SPEC. A-615.
3. CONCRETE TO BE 4000 PSI MINIMUM COMPRESSIVE STRENGTH.
4. TAPERED JOINT WITH O-RING GASKET JOINT SEAL TO MEET CURRENT REQUIREMENTS OF ASTM C-361 & C-443.
5. BUTYL MASTIC OR APPROVED EQUAL SHALL BE USED IN ADDITION TO THE GASKET SPECIFIED.
6. EXTERIOR JOINTS SHALL BE SEALED WITH AN APPROVED MANHOLE JOINT WRAP.
7. APPROVED FLEXIBLE JOINT REQUIRED ON ALL PIPE CONNECTIONS TO MANHOLES. INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
8. THE EXTERIOR OF ALL MANHOLES SHALL BE COATED WITH BITUMINOUS MATERIAL APPLIED WITH TWO COAT APPLICATION WITH MINIMUM 16 DRY MILLS.
9. MANUFACTURER'S NAME TO BE ON THE INSIDE OF CONE.
10. INTERIOR COATING SHALL BE INSTALLED WHERE REQUIRED.
11. FOR CHANGES IN DIRECTION OF 45°-90°, THE DEPTH OF THE BENCH SHALL BE 100% OF THE LARGEST PIPE DIAMETER.



JULY 2016

3.2.1-1

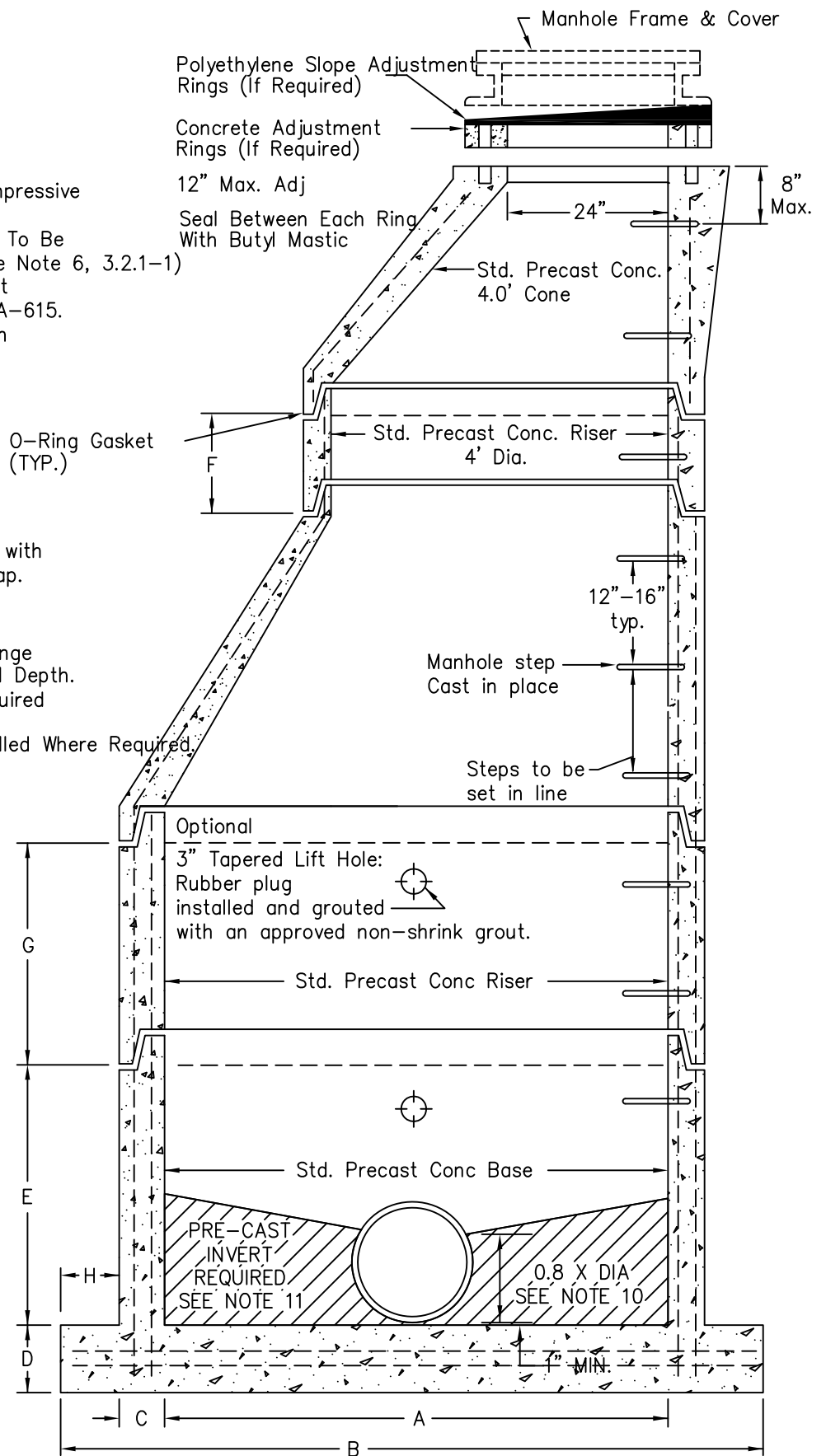
STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

STANDARD 4' I.D. PRECAST  
CONCRETE MANHOLE



NOTES:

1. Concrete To Be 4000 PSI Compressive Strength, Minimum.
2. Pipe Connections To Manholes To Be Approved Flexible Sleeves. (See Note 6, 3.2.1-1)
3. All Reinforcing To Meet Current Requirements Of ASTM Spec. A-615.
4. Manufacturer's Name To Be On Inside Face Of Cone.
5. Manhole To Meet Current Requirements Of ASTM Spec. C-478.
6. Min. 12" Compacted Gravel Under Base Sections.
7. Joint Configuration May Be Cast Bell-Up Or Spigot-Up.
8. Exterior joints shall be sealed with an approved manhole joint wrap.
9. See Note 5, 3.2.1-1
10. See Note 8, 3.2.1-1
11. Inverts For Manholes With Change Of Direction >45 Shall Be Full Depth.
12. Pre-Cast Inverts Are Not Required For Manhole Diameters >5'.
13. Interior Coating Shall Be Installed Where Required.



		Manhole Diameter In Feet	
		5'	6'
Dimensions	A	60"	72"
	B	84"	98"
	C	6"	7"
	D	8"	
	E	Varies	
	F	13" min.	
	G	Varies	
	H	6"	6"

OCTOBER 2016

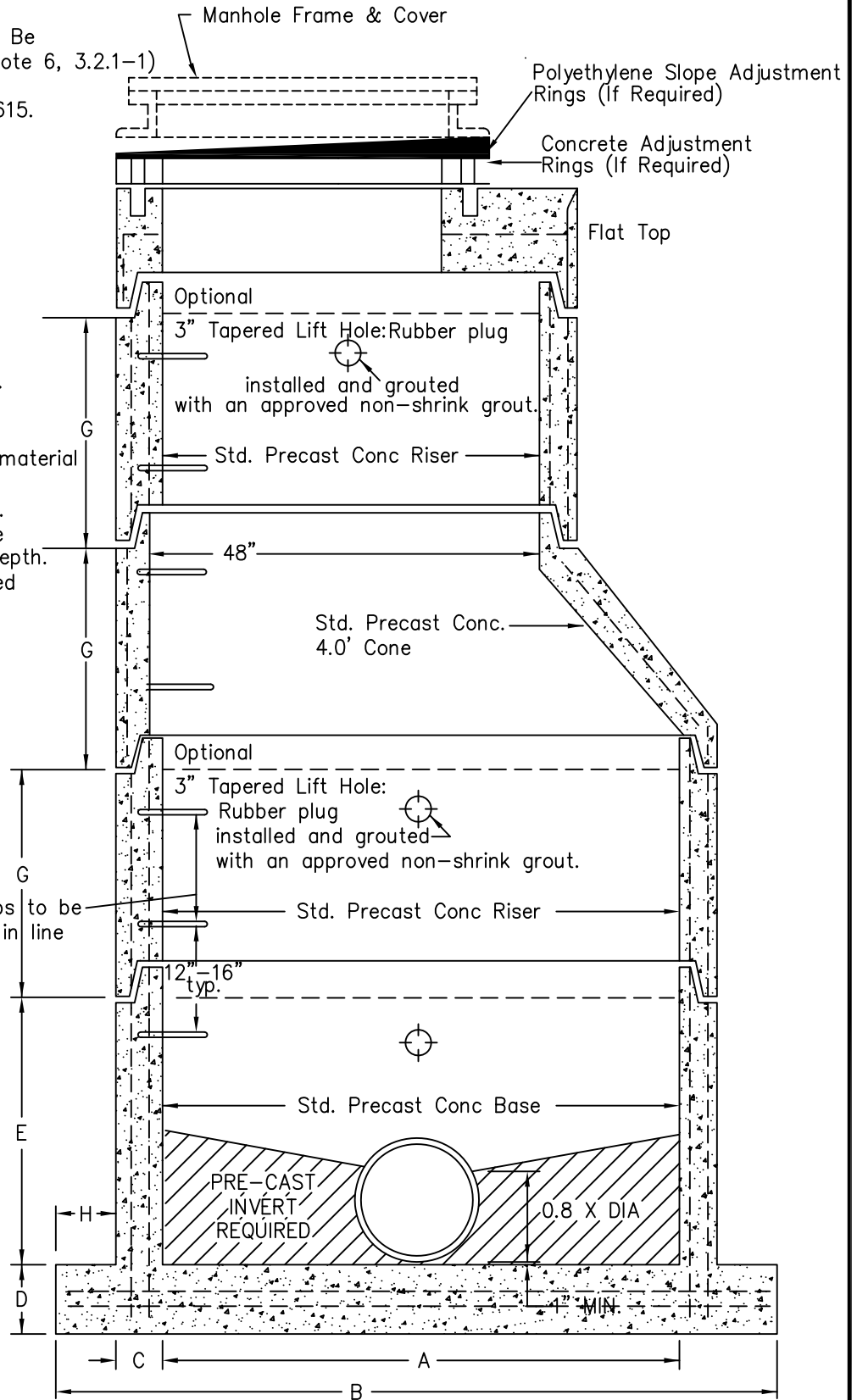
3.2.1-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL 5' & 6' ID PRECAST  
CONCRETE MANHOLE W/4' STACK

NOTES:

1. Concrete To Be 5000 PSI Compressive Strength, Minimum.
2. Pipe Connections To Manholes To Be Approved Flexible Sleeves. (See Note 6, 3.2.1-1)
3. All Reinforcing To Meet Current Requirements Of ASTM Spec. A-615.
4. Manufacturer's Name To Be On Inside Face Of Cone.
5. Manhole To Meet Current Requirements Of ASTM Spec. C-478.
6. Min. 12" Compacted Gravel Under Base Sections.
7. Joint Configuration May Be Cast Bell-Up Or Spigot-Up.
8. Butyl mastic or approved equal shall be used in addition to the gasket specified.
9. The exterior of all manholes shall be coated with bituminous material
10. Steps shall not be installed in manholes requiring hdpe lining.
11. Inverts For Manholes With Change Of Direction >45 Shall Be Full Depth.
12. Pre-Cast Inverts Are Not Required For Manhole Diameters >5'.
13. Interior Lining Shall Be Installed Where Required.



		Manhole Diameter In Feet	
		5'	6'
Dimensions	A	60"	72"
	B	84"	98"
	C	6"	7"
	D	8"	
	E	Varies	
	F	13" min.	
	G	Varies	
	H	6"	6"

OCTOBER 2016

3.2.1-2A

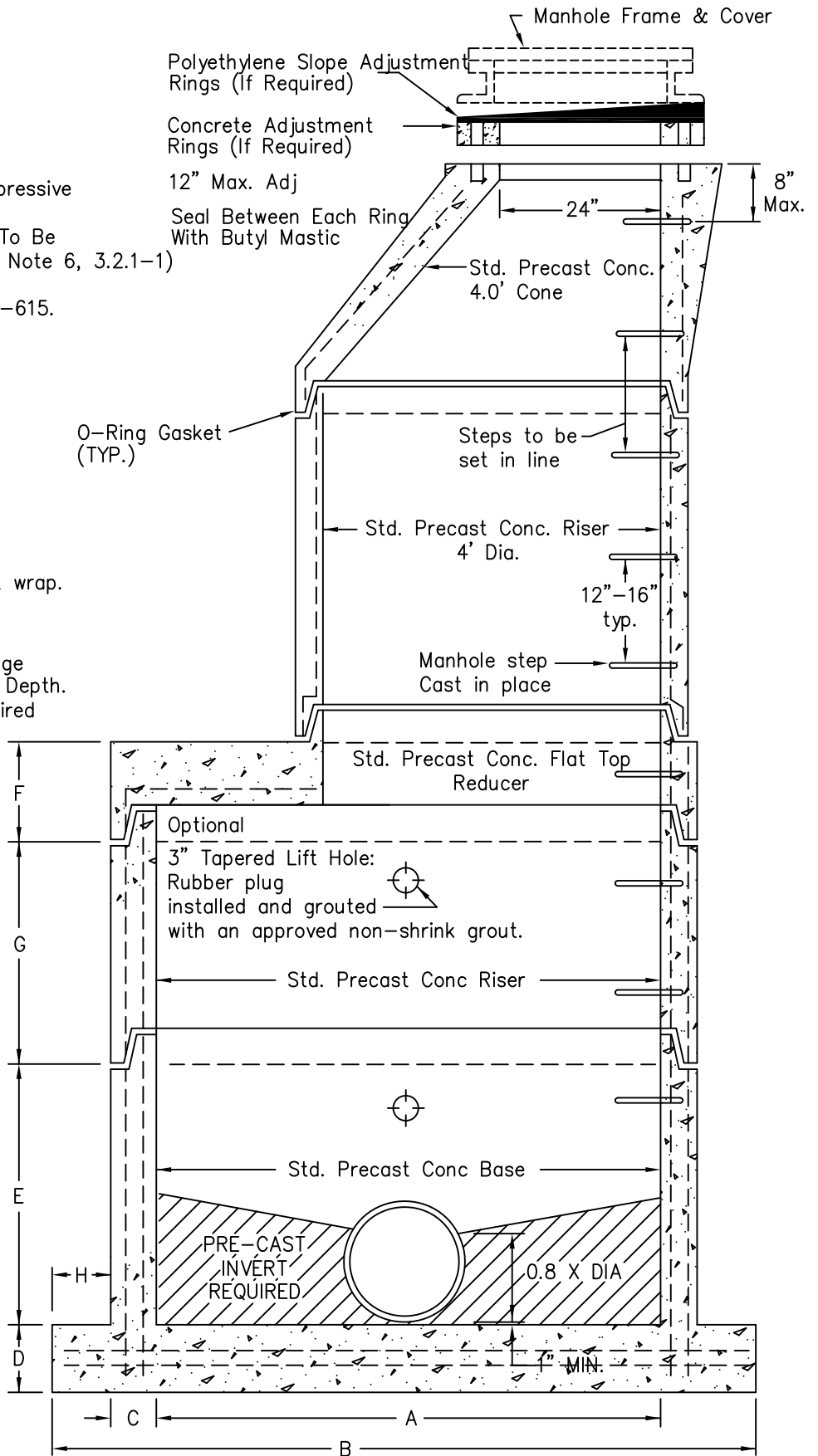
*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL 5' & 6' ID PRECAST  
CONCRETE MANHOLE W/FLAT TOP

NOTES:

1. Concrete To Be 4000 PSI Compressive Strength, Minimum.
2. Pipe Connections To Manholes To Be Approved Flexible Sleeves. (See Note 6, 3.2.1-1)
3. All Reinforcing To Meet Current Requirements Of ASTM Spec. A-615.
4. Manufacturer's Name To Be On Inside Face Of Cone.
5. Manhole To Meet Current Requirements Of ASTM Spec. C-478.
6. Min. 12" Compacted Gravel Under Base Sections.
7. Joint Configuration May Be Cast Bell-Up Or Spigot-Up.
8. Exterior joints shall be sealed with an approved manhole joint wrap.
9. See Note 5, 3.2.1-1
10. See Note 7, 3.2.1-1
11. Inverts For Manholes With Change Of Direction >45 Shall Be Full Depth.
12. Pre-Cast Inverts Are Not Required For Manhole Diameters >5'.
13. Interior Coating Required.

Dimensions	A	96"
	B	113"
	C	9"
	D	
	E	
	F	
	G	
	H	8"



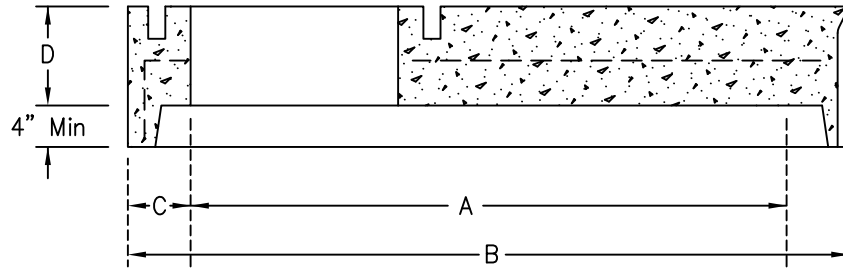
OCTOBER 2016

3.2.1-2B

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL 8' ID PRECAST  
CONCRETE MANHOLE W/4' STACK

SECTION A-A

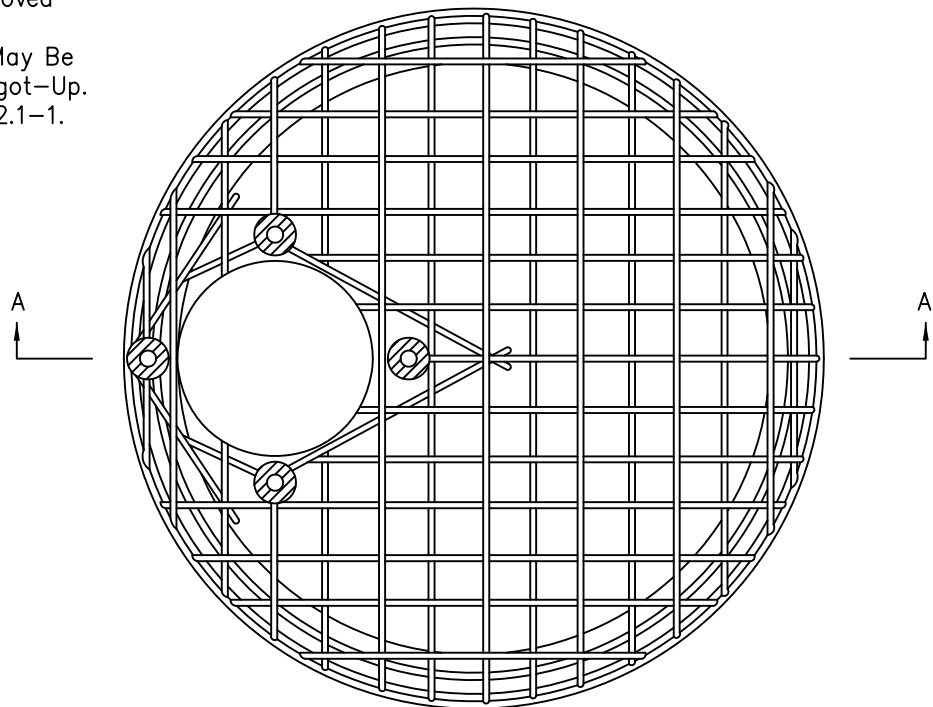


NOTES:

1. Concrete To Be 4000 PSI Compressive Strength, Min.
2. All Reinforcing Steel To Meet Current Requirements Of ASTM Spec. A-615.
3. Manhole Sections To Meet Current Requirements Of ASTM Spec. C-478.
4. Flat Top Shall Be Used Only When Specifically Required By The Plans Or Where There Is Height Or Invert Conflict As Determined By The Contractor And Approved By The County.
5. Joint Configuration May Be Cast Bell-Up Or Spigot-Up.
6. See Note 5, Sec. 3.2.1-1.

MANHOLE SIZE

	4'	5'	6'
A	48"	60"	72"
B	58"	72"	86"
C	5"	6"	7"
D	6"	8"	8"



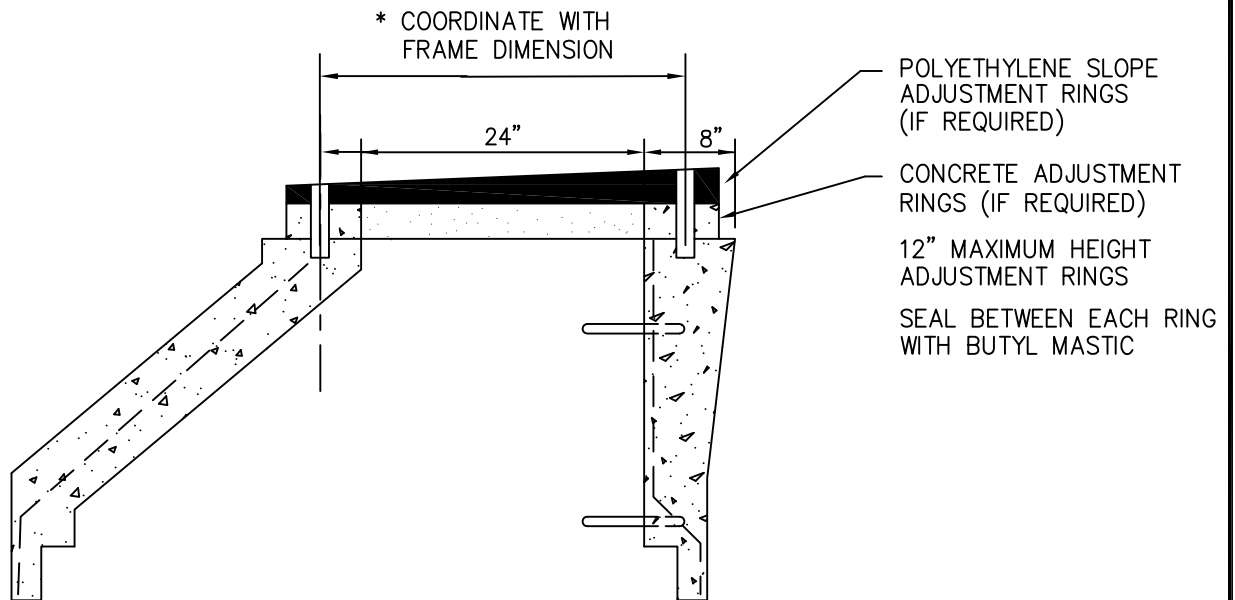
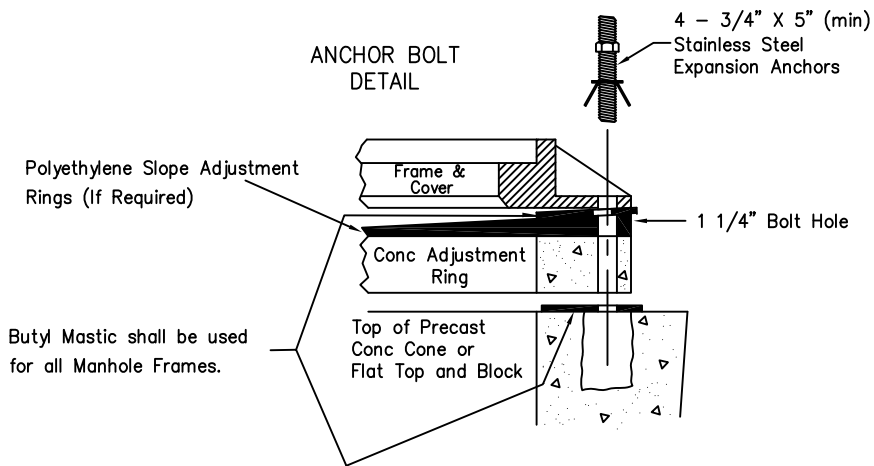
TOP VIEW

DECEMBER 2004

3.2.1-3

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

PRECAST CONCRETE  
MANHOLE FLAT TOP



NOTE:  
 1. STAINLESS STEEL ALL-THREAD ROD WITH EPOXY GROUT CAPSULES MAY BE USED IN LIEU OF EXPANSION ANCHORS WITH APPROVAL OF COUNTY.

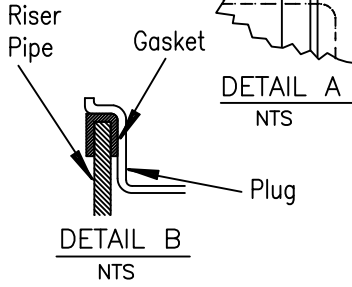
DECEMBER 2004

3.2.1-4

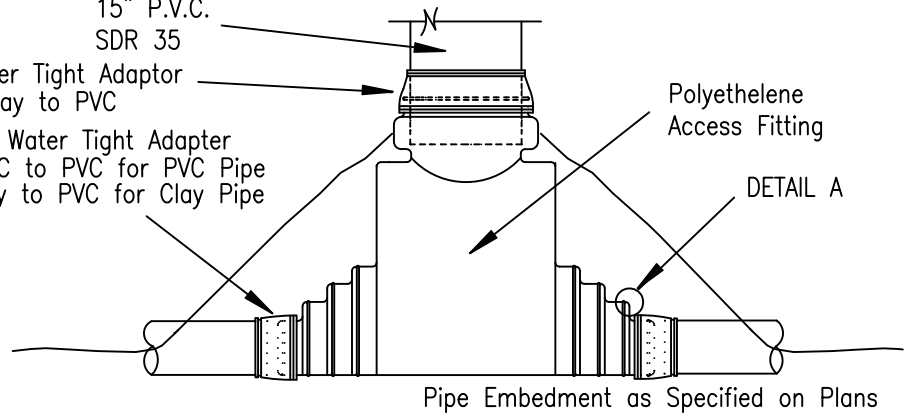
*STAFFORD COUNTY  
 DEPARTMENT OF UTILITIES*

MANHOLE ANCHOR BOLT

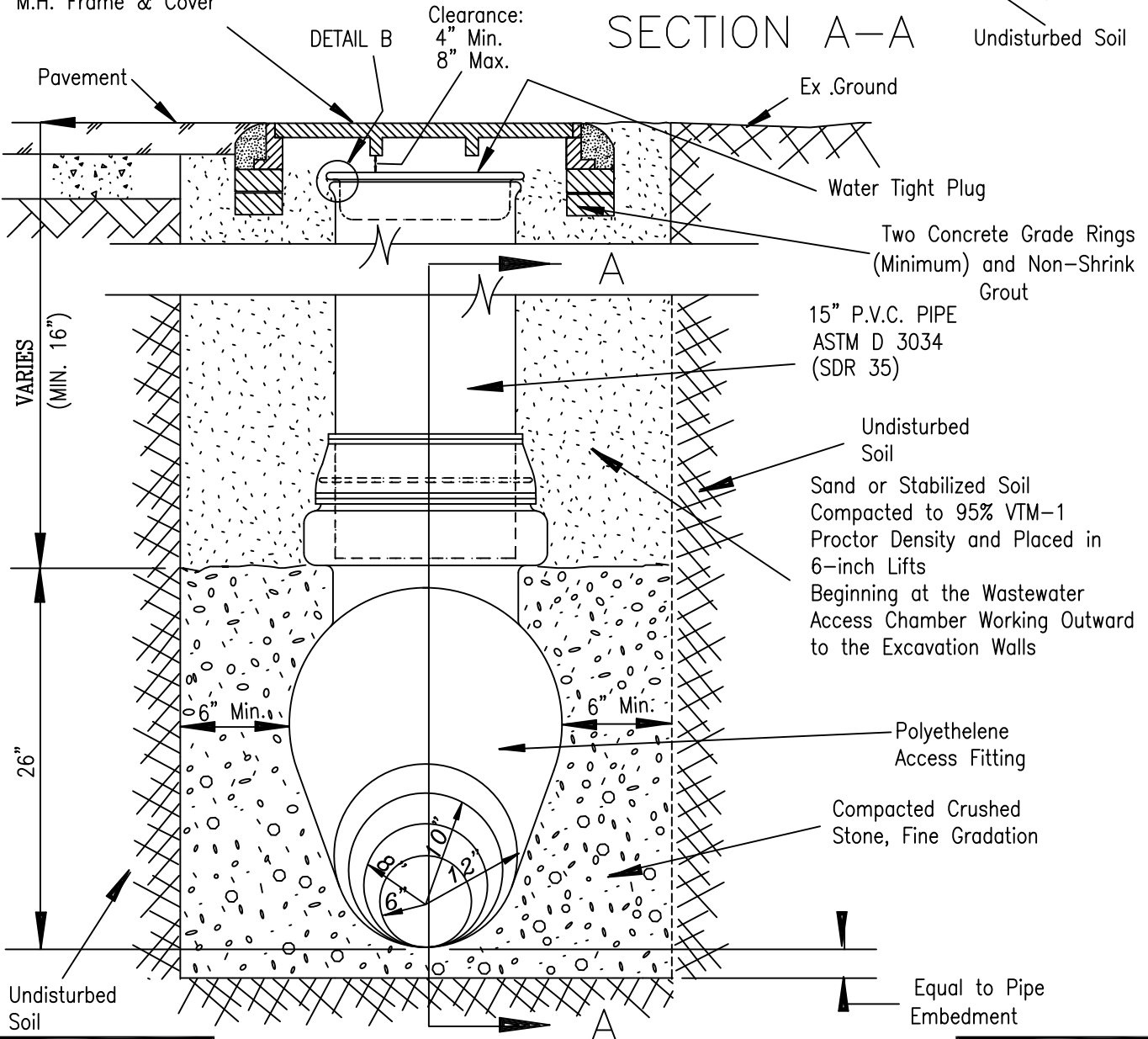
Cut as Required for  
6, 8, 10, 12 inch Pipe  
Along Cutting Groove



15" P.V.C.  
SDR 35  
Water Tight Adaptor  
Clay to PVC  
Water Tight Adapter  
PVC to PVC for PVC Pipe  
Clay to PVC for Clay Pipe



M.H. Frame & Cover

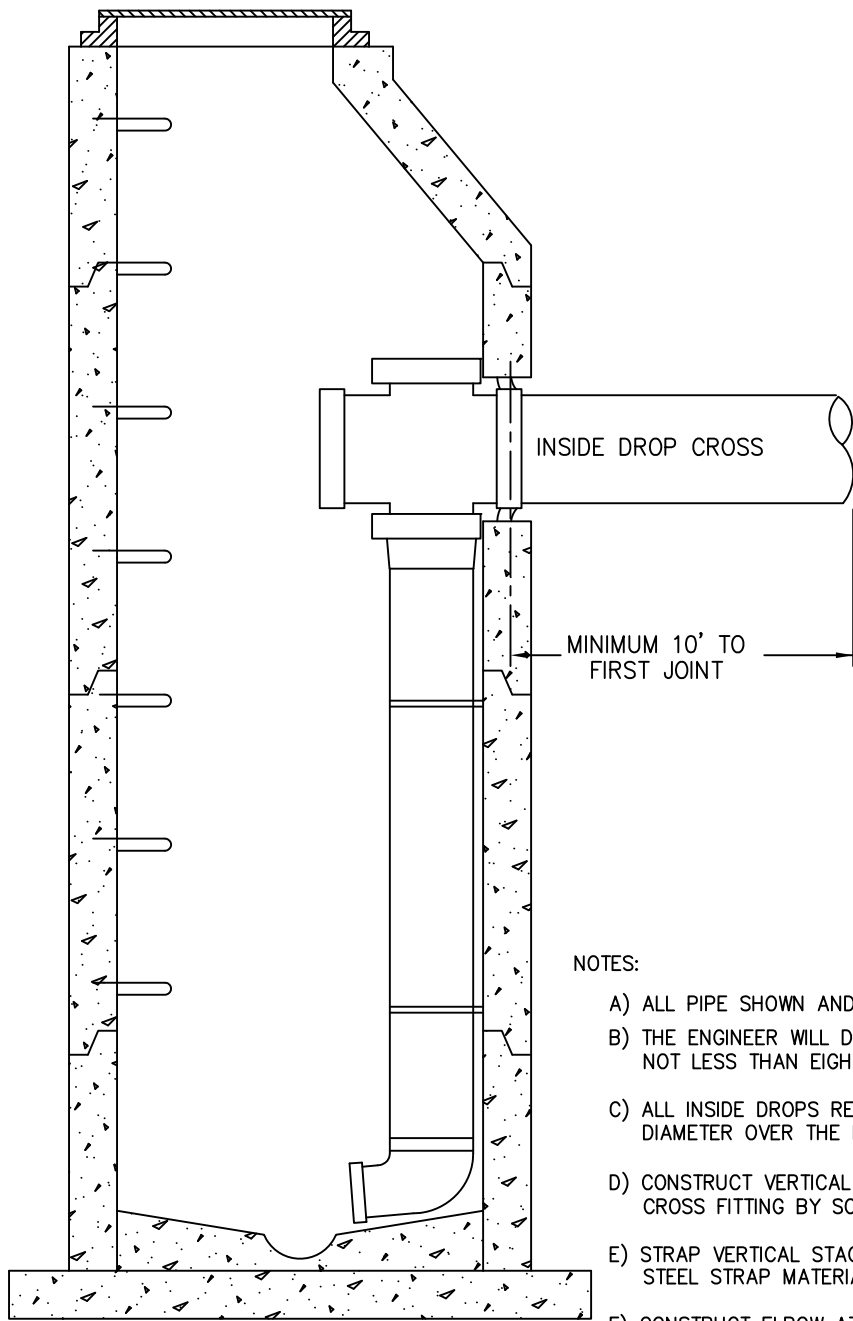


DECEMBER 2004

3.2.1-5

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

ACCESS CHAMBER



NOTES:

- A) ALL PIPE SHOWN AND CROSS TO BE AWWA C900 SOLVENT WELDED.
- B) THE ENGINEER WILL DETERMINE THE SIZE OF THE VERTICAL STACK, BUT NOT LESS THAN EIGHT (8) INCHES IN DIAMETER.
- C) ALL INSIDE DROPS REQUIRE ONE (1) FOOT INCREASE IN MANHOLE DIAMETER OVER THE MIN. DIAMETER FOR REQUIRED PIPE DIAMETER.
- D) CONSTRUCT VERTICAL STACK OF SDR C900 PIPE CONNECTED TO CROSS FITTING BY SOLVENT WELD.
- E) STRAP VERTICAL STACK TO MANHOLE WALL. USE STAINLESS STEEL STRAP MATERIAL.
- F) CONSTRUCT ELBOW AT BOTTOM OF THE STACK FROM EITHER 45° OR 90° C900 BEND PLACED IN THE DIRECTION OF FLOW IN THE MANHOLE WITH BENCH CONSTRUCTED TO CONFORM TO MANHOLE BENCH.

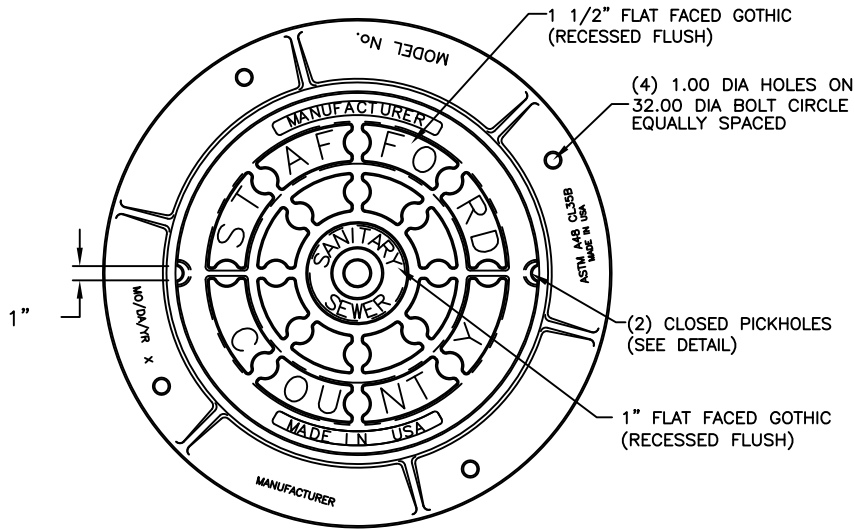
NOT TO SCALE

SEPT 2016

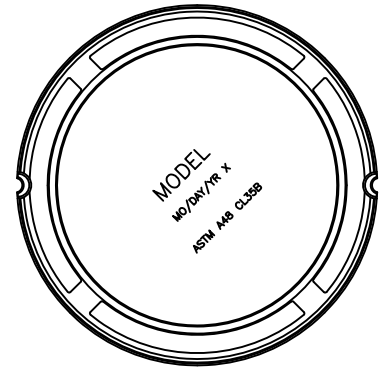
3.2.2-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TYPICAL MANHOLE WITH  
INSIDE DROP CONNECTION

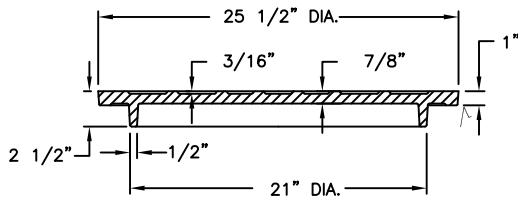


PLAN VIEW TOP

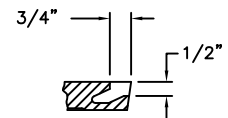


PLAN VIEW BOTTOM OF COVER

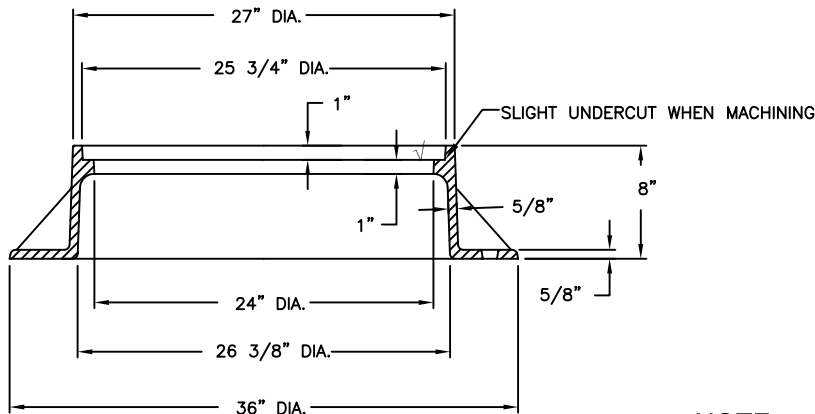
WEIGHT: FRAME, 215 LBS  
 COVER, 125 LBS  
 TOTAL, 340 LBS



SECTION OF COVER



PICKHOLE DETAIL



SECTION OF FRAME

√ MACHINED SURFACE

NOTE:  
 FOR REQUIREMENTS ON SECURING FRAME TO CONE, SEE DETAIL 3.2.1-4

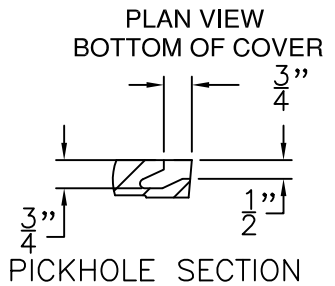
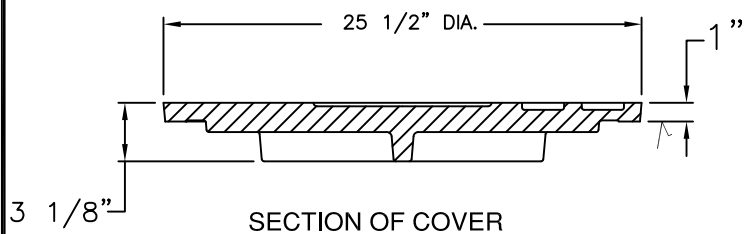
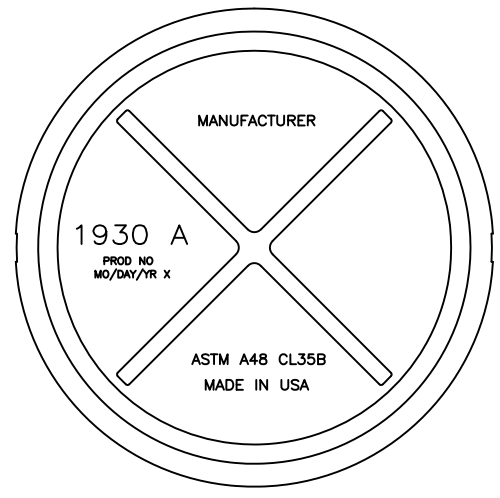
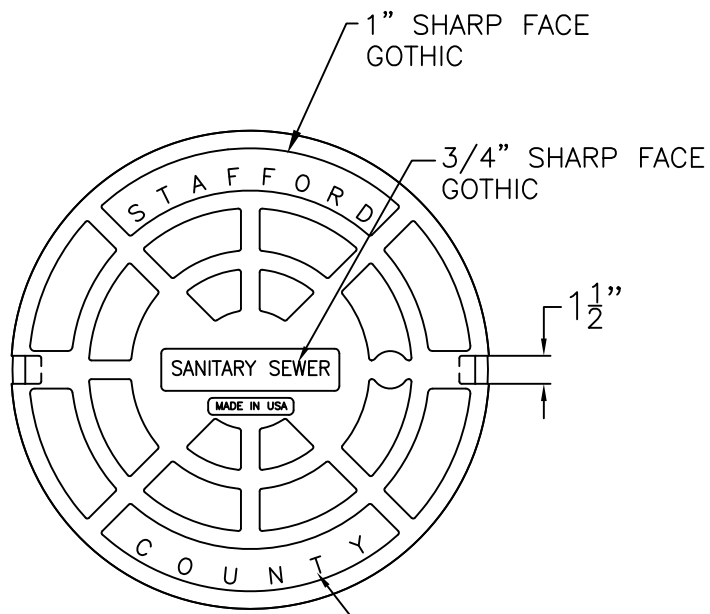
OCTOBER 2016

3.2.3-1

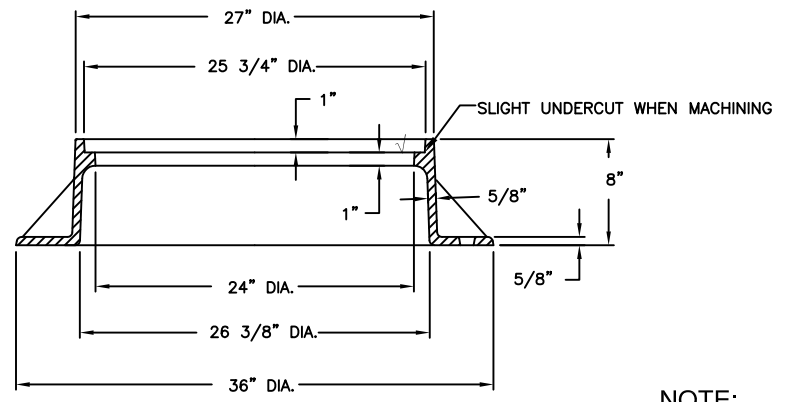
STAFFORD COUNTY  
 DEPARTMENT OF UTILITIES

STANDARD MANHOLE  
 FRAME & COVER





√ MACHINED SURFACE



WEIGHT: FRAME, 215 LBS  
COVER, 180 LBS  
TOTAL, 395 LBS

√ MACHINED SURFACE

NOTE:  
FOR REQUIREMENTS ON SECURING FRAME  
TO CONE, SEE DETAIL 3.2.1-4

JULY 2016

3.2.3-1A

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

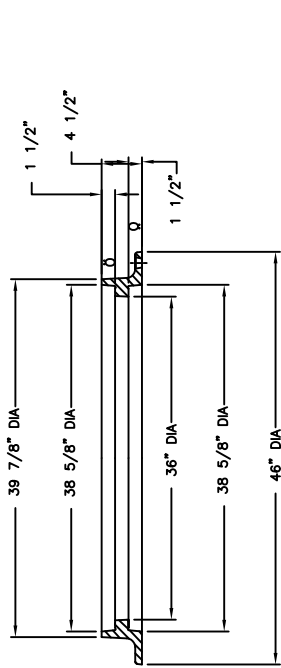
HEAVY WEIGHT TRAFFIC STANDARD  
FRAME & COVER

OCTOBER 2015

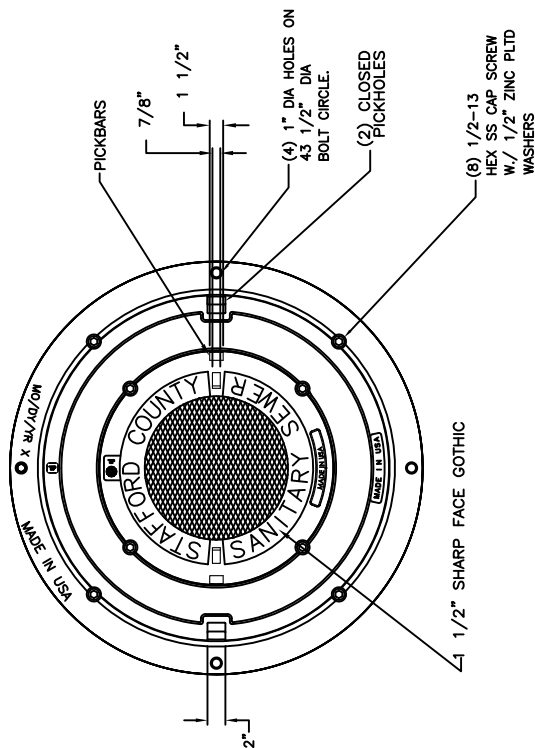
STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

36-INCH FRAME AND COVER

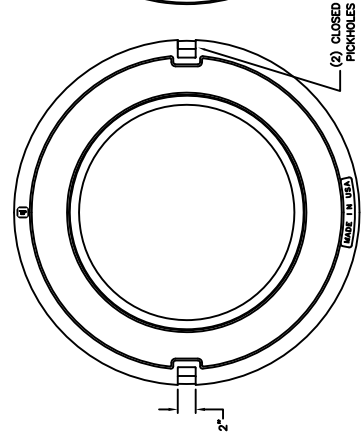
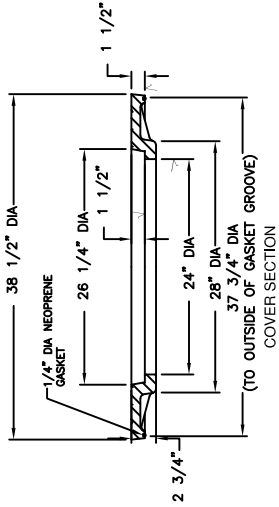
3.2.3-1B



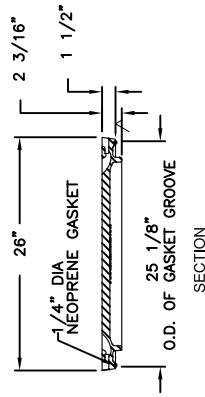
FRAME SECTION  
NOTE: FRAME IS REVERSIBLE.



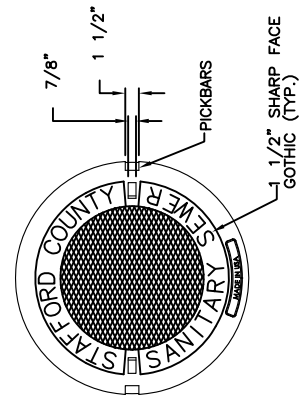
NOTE:  
WEIGHT: FRAME 247 LBS  
36" OUTER COVER 245 LBS  
24" INNER COVER 125 LBS  
TOTAL WEIGHT: 617 LBS



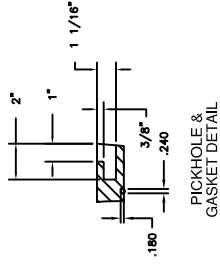
BOTTOM VIEW



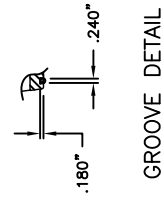
SECTION



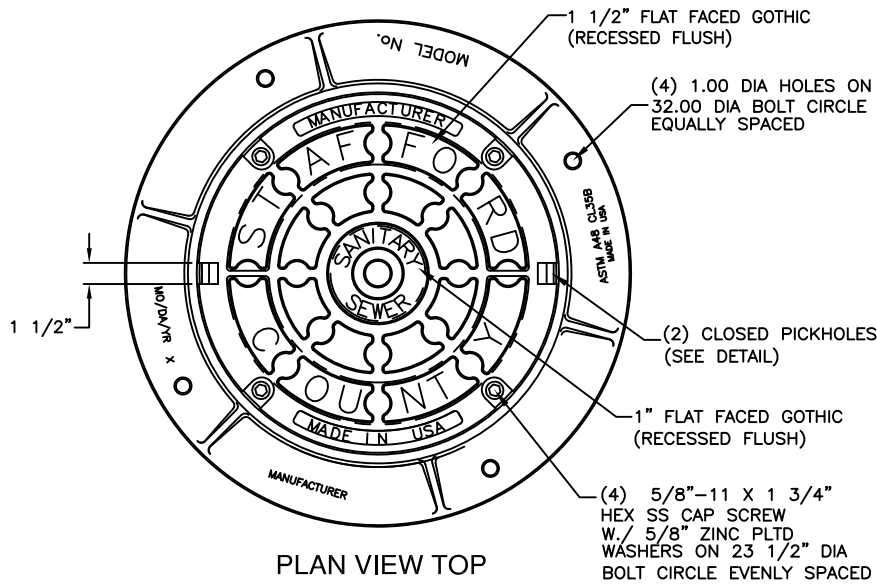
BOTTOM VIEW



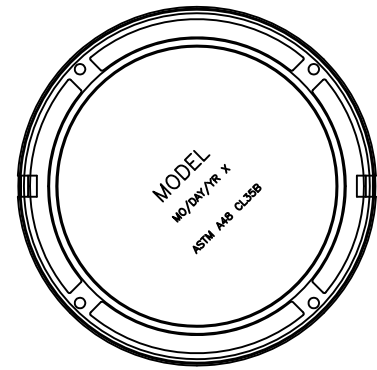
PICKHOLE &  
GASKET DETAIL



GROOVE DETAIL

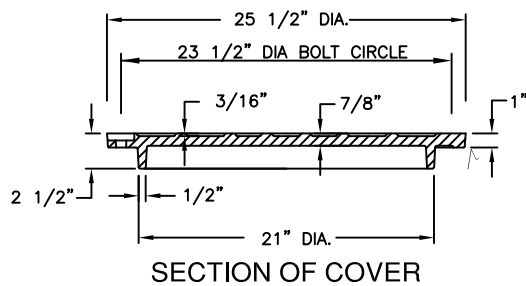


PLAN VIEW TOP

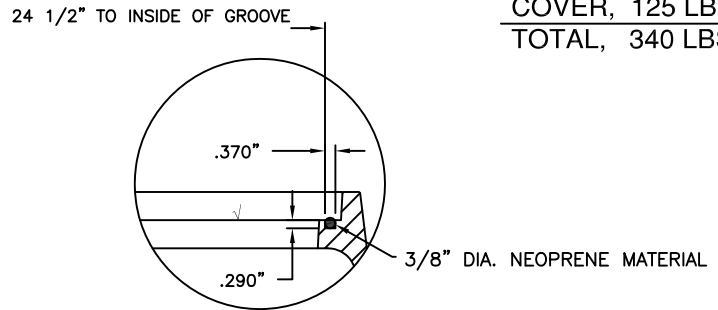


PLAN VIEW  
BOTTOM OF COVER

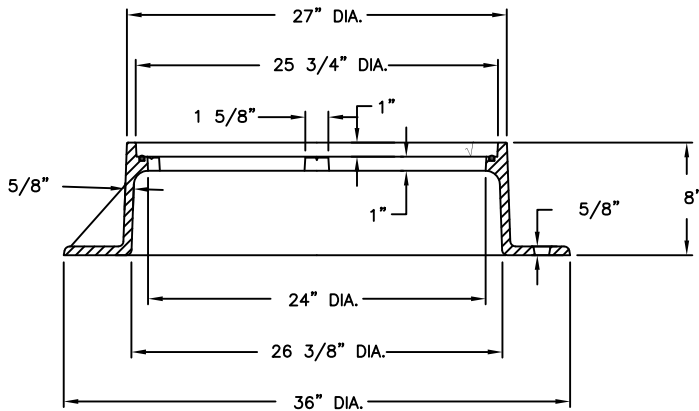
WEIGHT: FRAME, 215 LBS  
COVER, 125 LBS  
TOTAL, 340 LBS



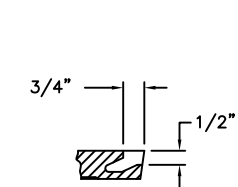
SECTION OF COVER



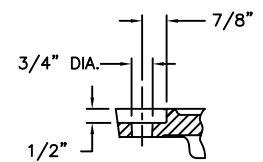
GROOVE DETAIL



SECTION OF FRAME



PICKHOLE DETAIL



BOLT HOLE SECTION

√ MACHINED SURFACE

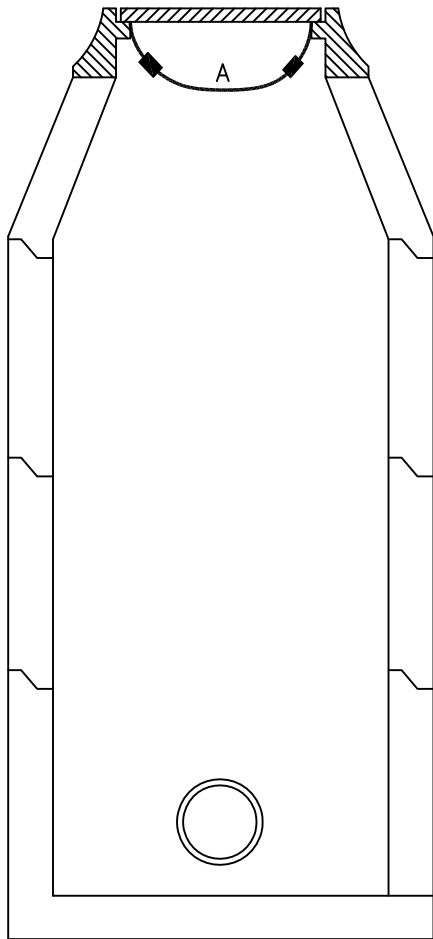
NOTE:  
FOR REQUIREMENTS ON SECURING FRAME  
TO CONE, SEE DETAIL 3.2.1-4

JULY 2016

3.2.3-2

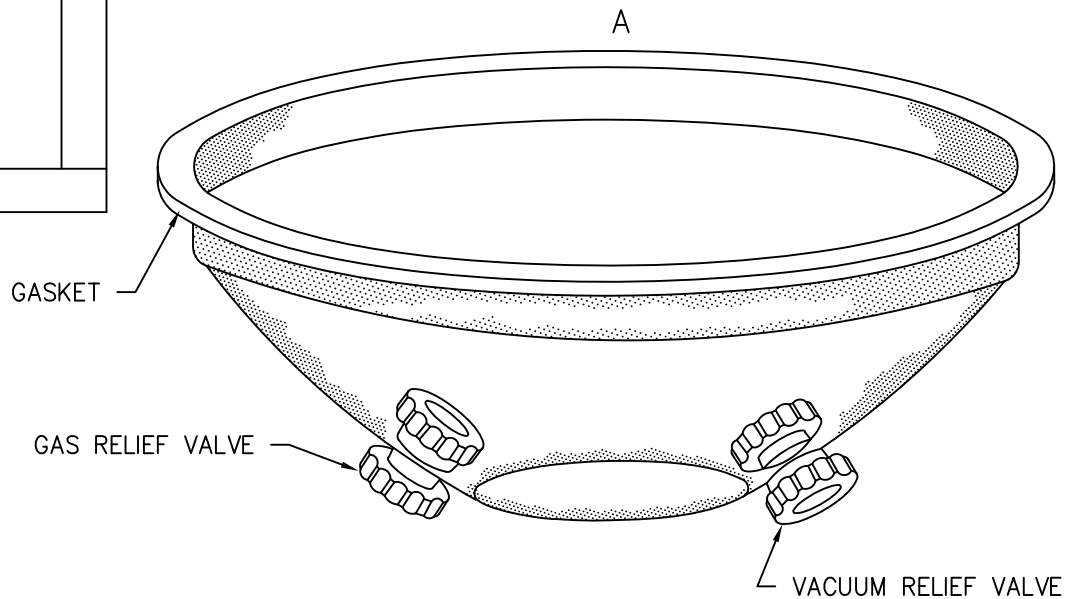
STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

WATERTIGHT MANHOLE  
STANDARD WEIGHT  
FRAME & COVER



NOTE:

1. The insert will be deep enough to prevent the manhole cover from coming in contact with the valves when the manhole cover is removed or installed.
2. The insert will restrict inflow to no more than 5 gal. in 24 hrs.
3. Manhole inserts shall be installed in all non-watertight manhole frames installed at grade or at the direction of the utility inspector.



NOTES:

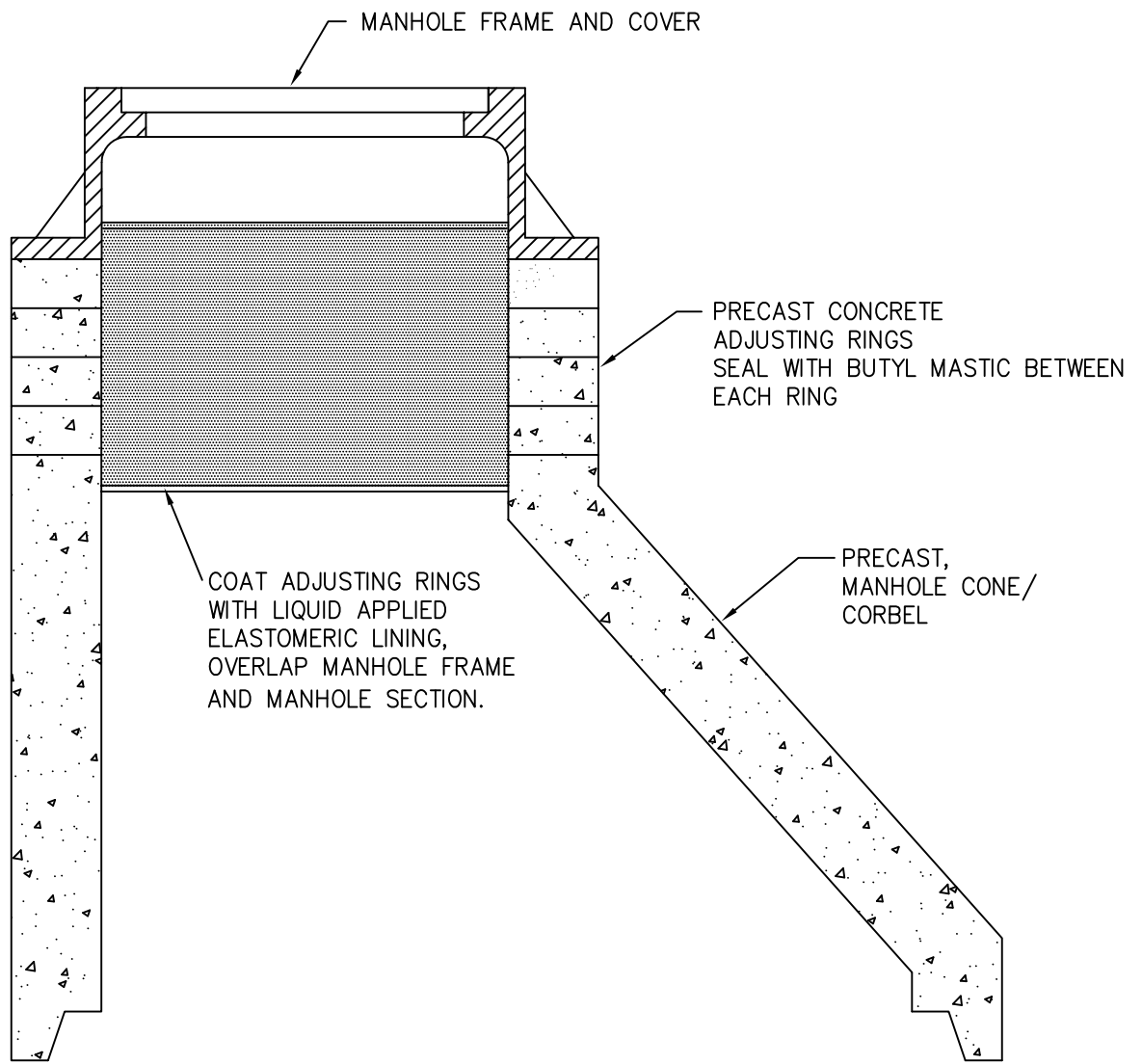
1. The manhole insert will be made of non-corrodible materials and will not be damaged by sewer gases or road oil.
2. Both the gas relief and the vacuum relief valves will be self-cleaning and made of non-corrodible materials.
3. The gas relief valve will be automatically activated at a pressure differential of approx. 0.5 TO 1.5 psi.
4. The vacuum relief valve will be automatically activated at a pressure differential of approx. 2.25 psi.
5. A gasket will be installed under the lip of the insert to ensure a tight seal between the insert and the manhole frame.

SEPT 2016

3.2.3-3

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

WATERPROOF MANHOLE  
INSERT

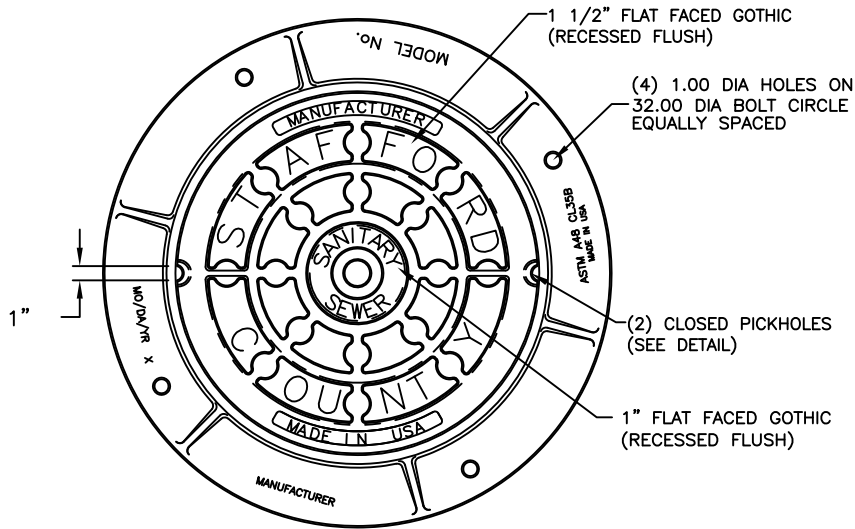


OCTOBER 2016

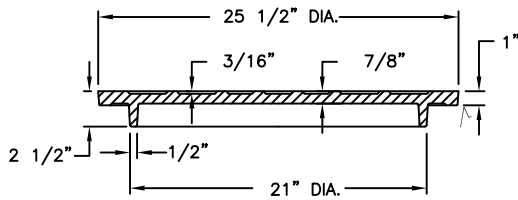
3.2.3-8

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

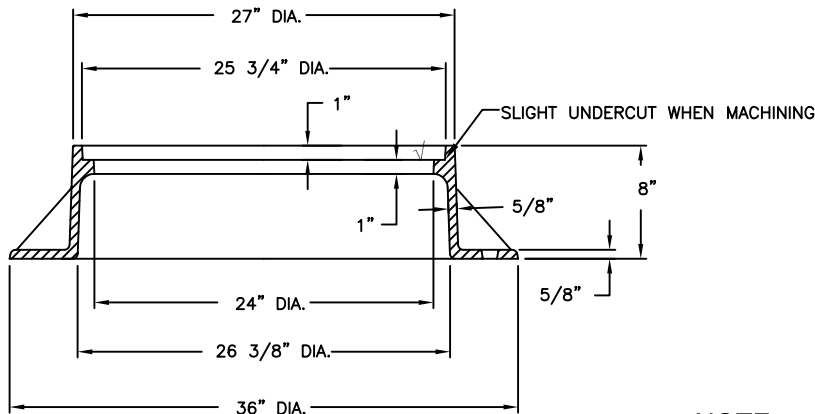
INTERNAL MANHOLE  
CHIMNEY SEAL



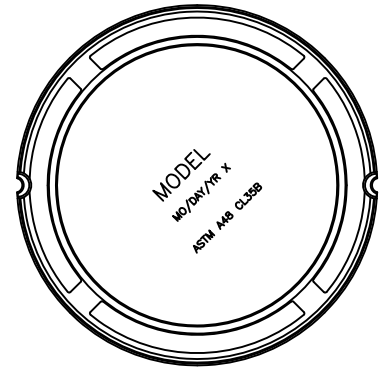
PLAN VIEW TOP



SECTION OF COVER

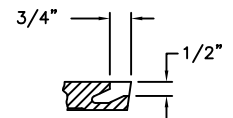


SECTION OF FRAME



PLAN VIEW  
BOTTOM OF COVER

WEIGHT: FRAME, 215 LBS  
COVER, 125 LBS  
TOTAL, 340 LBS



PICKHOLE DETAIL

√ MACHINED SURFACE

NOTE:  
FOR REQUIREMENTS ON SECURING FRAME  
TO CONE, SEE DETAIL 3.2.1-4

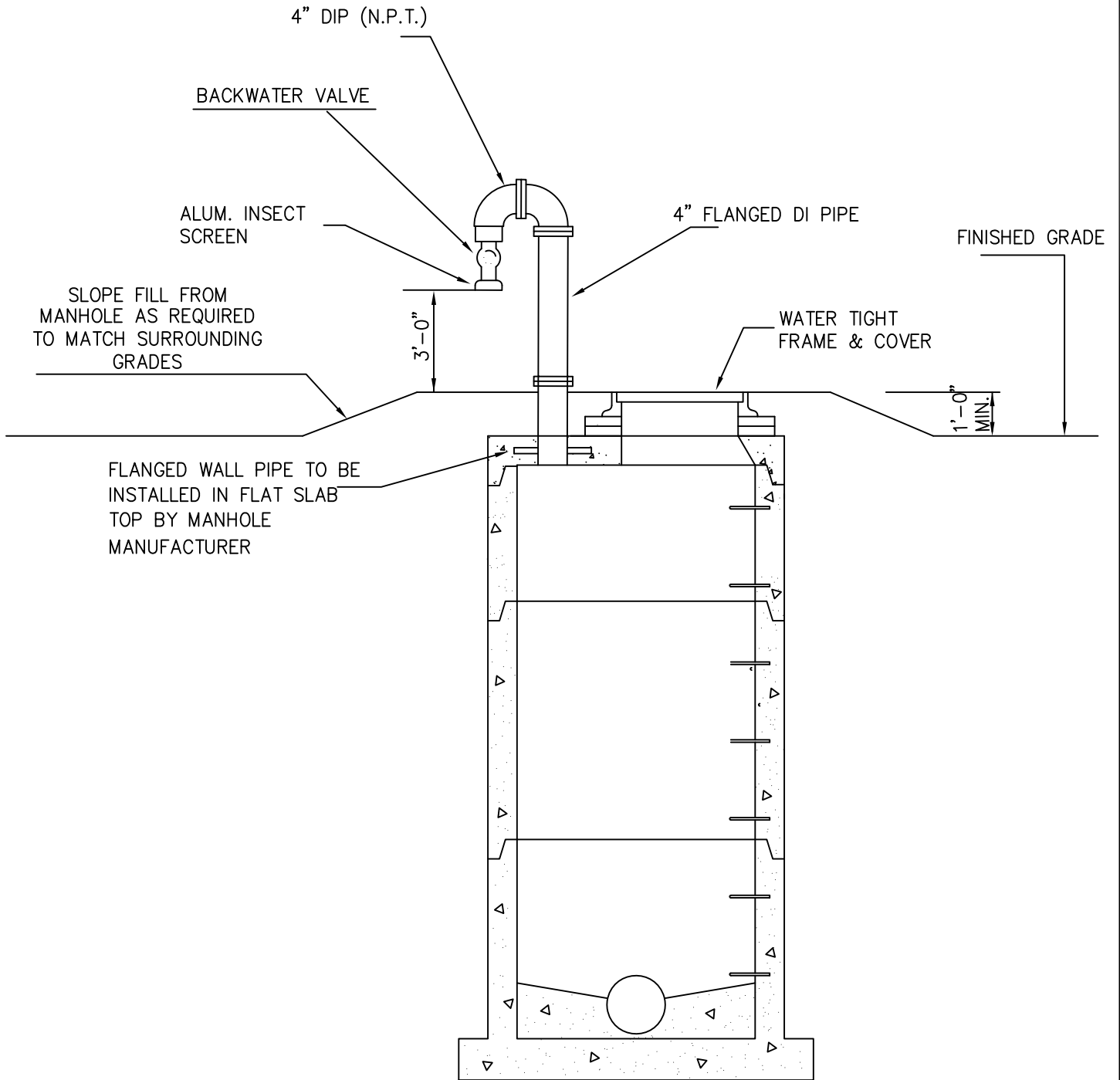
OCTOBER 2016

3.2.3-1

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

STANDARD MANHOLE  
FRAME & COVER

NOTE: PAINT EXPOSED  
PORTION OF PIPE  
GREEN RUST INHIBITIVE  
PAINT.



MARCH 2006

3.2.5-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

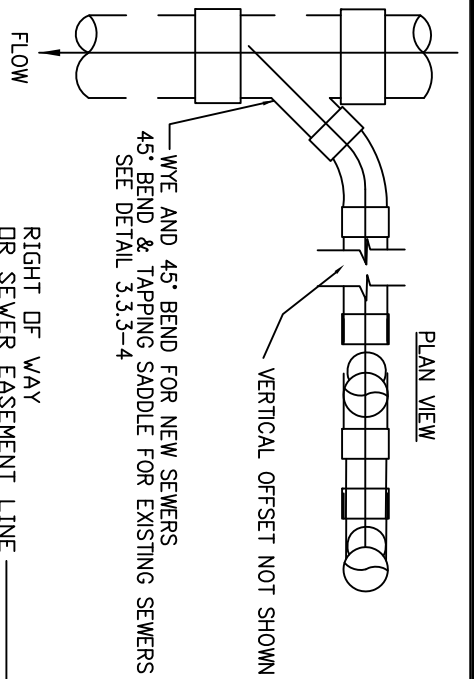
MANHOLE VENT

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

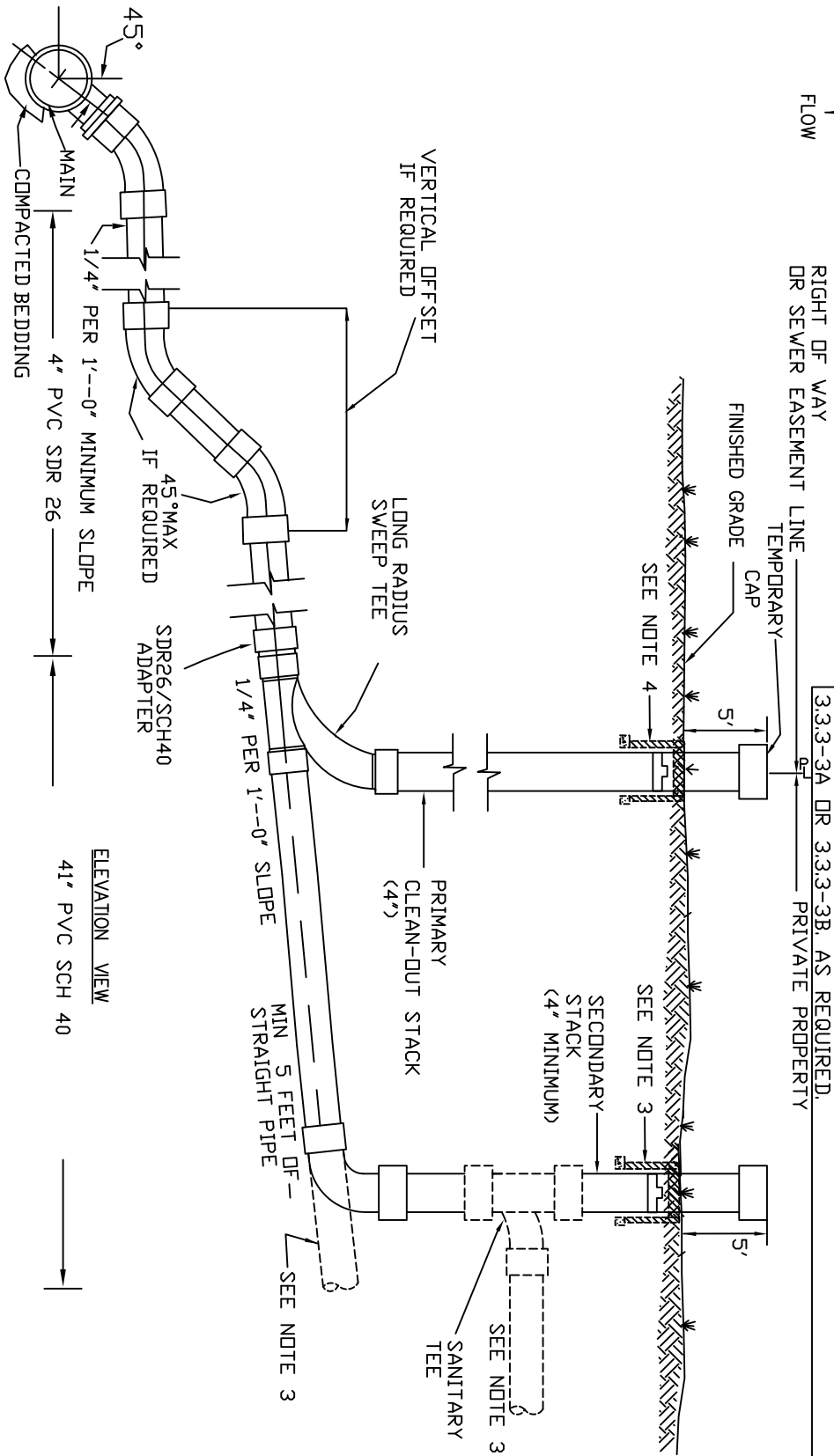
4-INCH SEWER HOUSE CONNECTION

SEPT 2016

3.3.3-1A



- NOTES:
1. ALL LATERAL MATERIAL BETWEEN THE TEE-WYE LOCATED ON THE MAIN AND THE LONG RADIUS SWEEP TEE AT THE FIRST CLEANOUT SHALL BE ASTM D 3034 SDR 26, OR DIP IF REQUIRED.
  2. ALL LATERAL MATERIAL BEGINNING WITH THE LONG RADIUS SWEEP TEE AT THE FIRST CLEANOUT TO THE BUILDING SHALL BE SCHEDULE 40 WITH SOLVENT WELDED JOINTS.
  3. PLUMBERS MAY CONNECT TO ANY POINT ON THE SECONDARY STACK BY INSTALLING A SANITARY TEE, EXTEND THE LATERAL TO THE STRUCTURE, EXTEND THE STACK TO GRADE AND INSTALL CLEANOUT COVER ASSEMBLY 3.3.3-3A OR 3.3.3-3C AS REQUIRED. PLUMBERS MAY ALSO REMOVE THE SECONDARY STACK AND CONNECT TO THE STRAIGHT PIPE BEYOND THE LONG RADIUS SWEEP TEE AND EXTEND THE LATERAL TO THE STRUCTURE.
  4. PLUMBERS SHALL REMOVE ABOVE GROUND PORTION OF PRIMARY CLEANOUT STACK AND INSTALL CLEANOUT COVER ASSEMBLY 3.3.3-3A OR 3.3.3-3B AS REQUIRED.



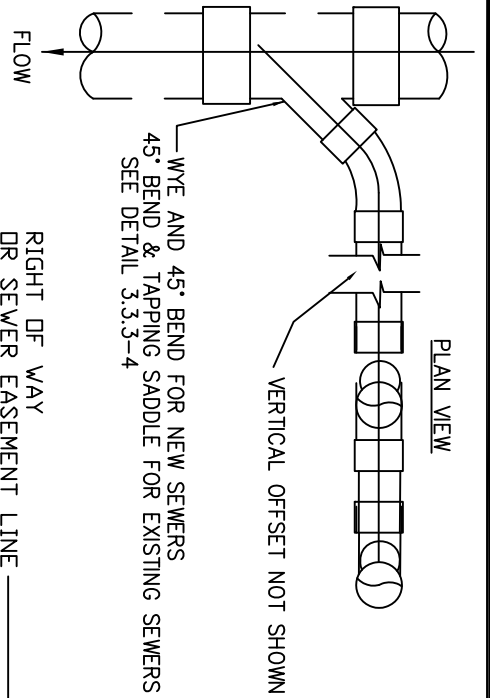


STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

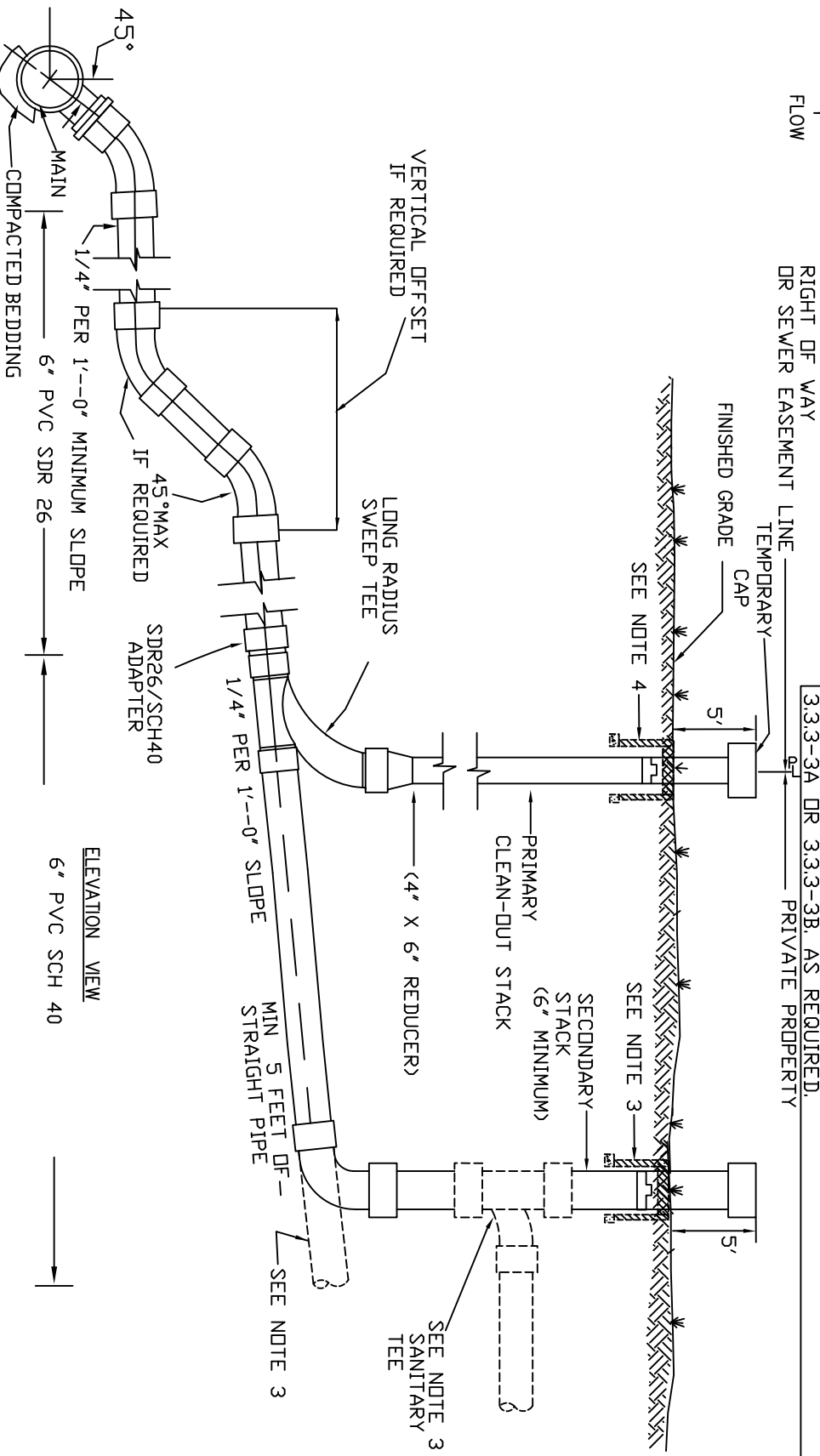
SEPT 2016

6-INCH SEWER HOUSE CONNECTION

3.3.3-1B

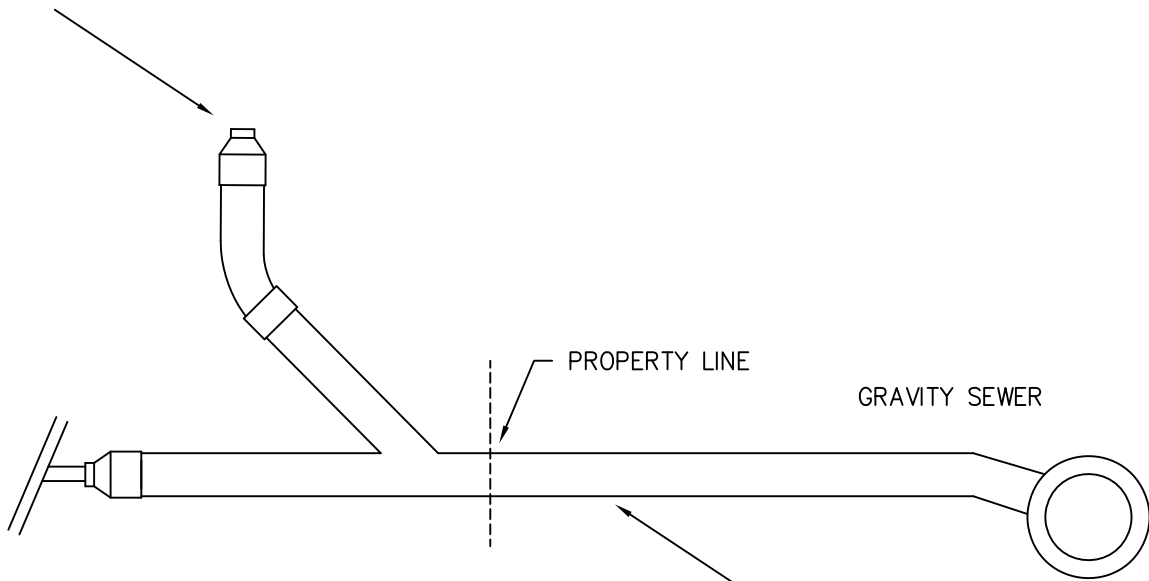


- NOTES:
1. ALL LATERAL MATERIAL BETWEEN THE TEE-WYE LOCATED ON THE MAIN AND THE LONG RADIUS SWEEP TEE AT THE FIRST CLEANOUT SHALL BE ASTM D 3034 SDR 26, DR DIP IF REQUIRED.
  2. ALL LATERAL MATERIAL BEGINNING WITH THE LONG RADIUS SWEEP TEE AT THE FIRST CLEANOUT TO THE BUILDING SHALL BE SCHEDULE 40 WITH SOLVENT WELDED JOINTS.
  3. PLUMBERS MAY CONNECT TO ANY POINT ON THE SECONDARY STACK BY INSTALLING A SANITARY TEE, EXTEND THE LATERAL TO THE STRUCTURE, EXTEND THE STACK TO GRADE AND INSTALL CLEANOUT COVER ASSEMBLY 3.3.3-3A OR 3.3.3-3C AS REQUIRED. PLUMBERS MAY ALSO REMOVE THE SECONDARY STACK AND CONNECT TO THE STRAIGHT PIPE BEYOND THE LONG RADIUS SWEEP TEE AND EXTEND THE LATERAL TO THE STRUCTURE.
  4. PLUMBERS SHALL REMOVE ABOVE GROUND PORTION OF PRIMARY CLEANOUT STACK AND INSTALL CLEANOUT COVER ASSEMBLY 3.3.3-3A DR 3.3.3-3B, AS REQUIRED.



ELEVATION VIEW  
6" PVC SCH 40

CLEANOUT



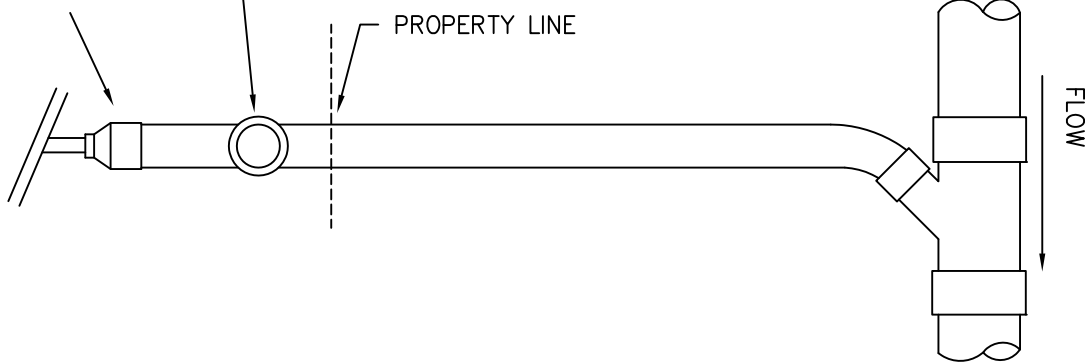
SECTION VIEW

GRAVITY SEWER

4" OR 6" LATERAL  
AS REQUIRED

CLEANOUT

REDUCER



PLAN VIEW

FLOW

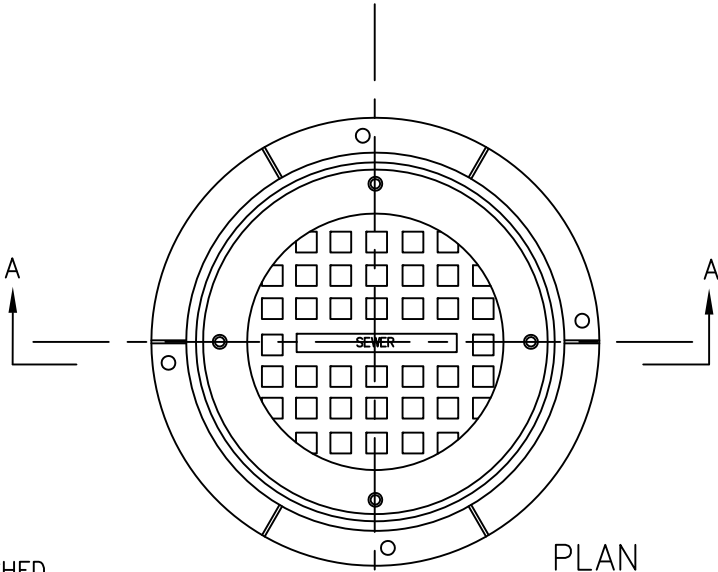
DECEMBER 2004

NOTE: PLACE CLEAN OUT AT PROPERTY LINE  
OR EDGE OF EASEMENT

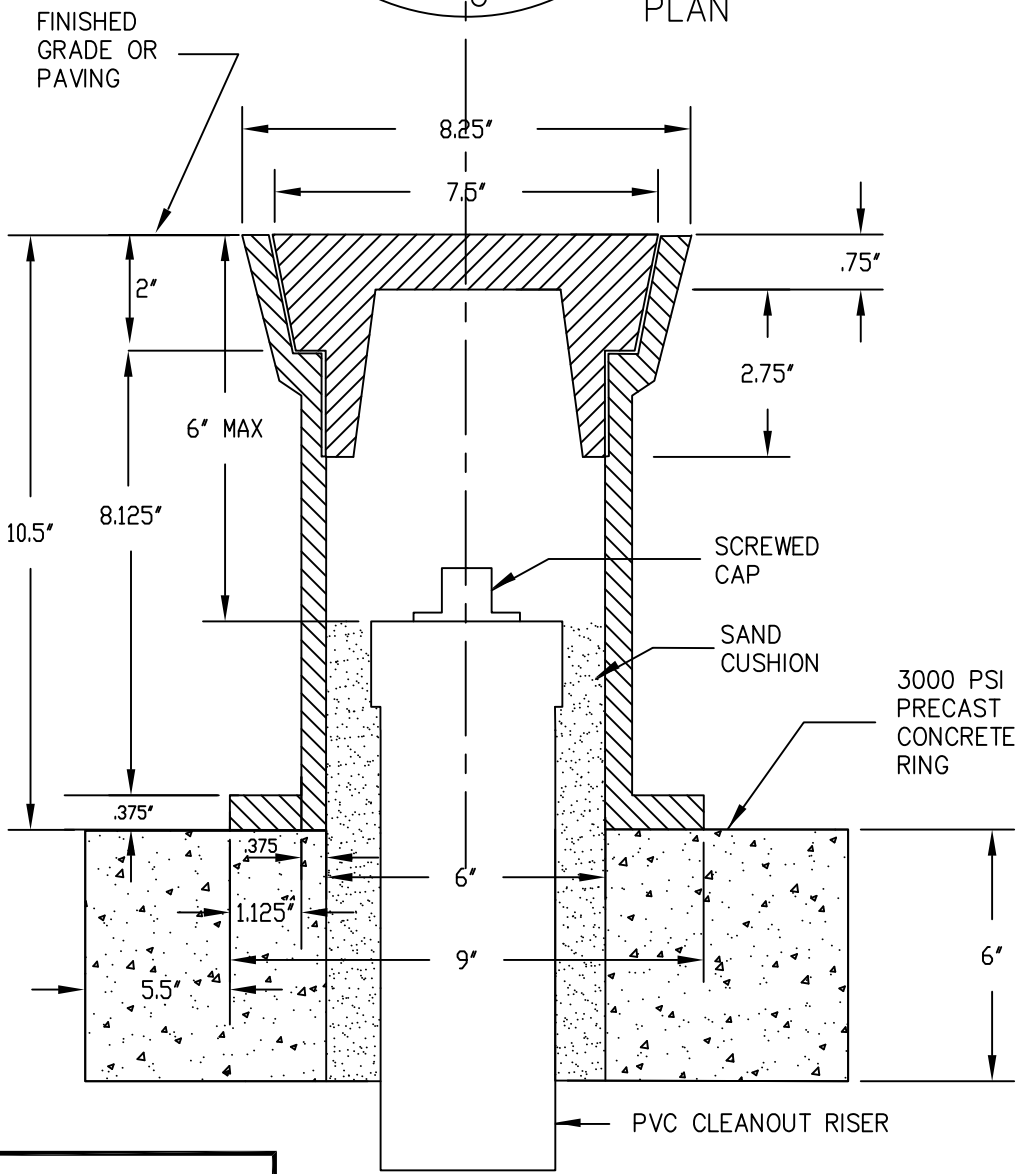
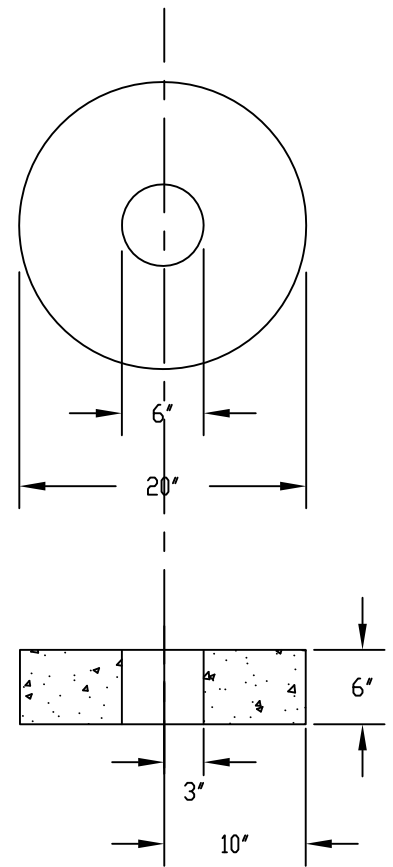
3.3.3-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

LOW PRESSURE HOUSE  
SERVICE CONNECTION  
TO GRAVITY SEWER



CONCRETE RING

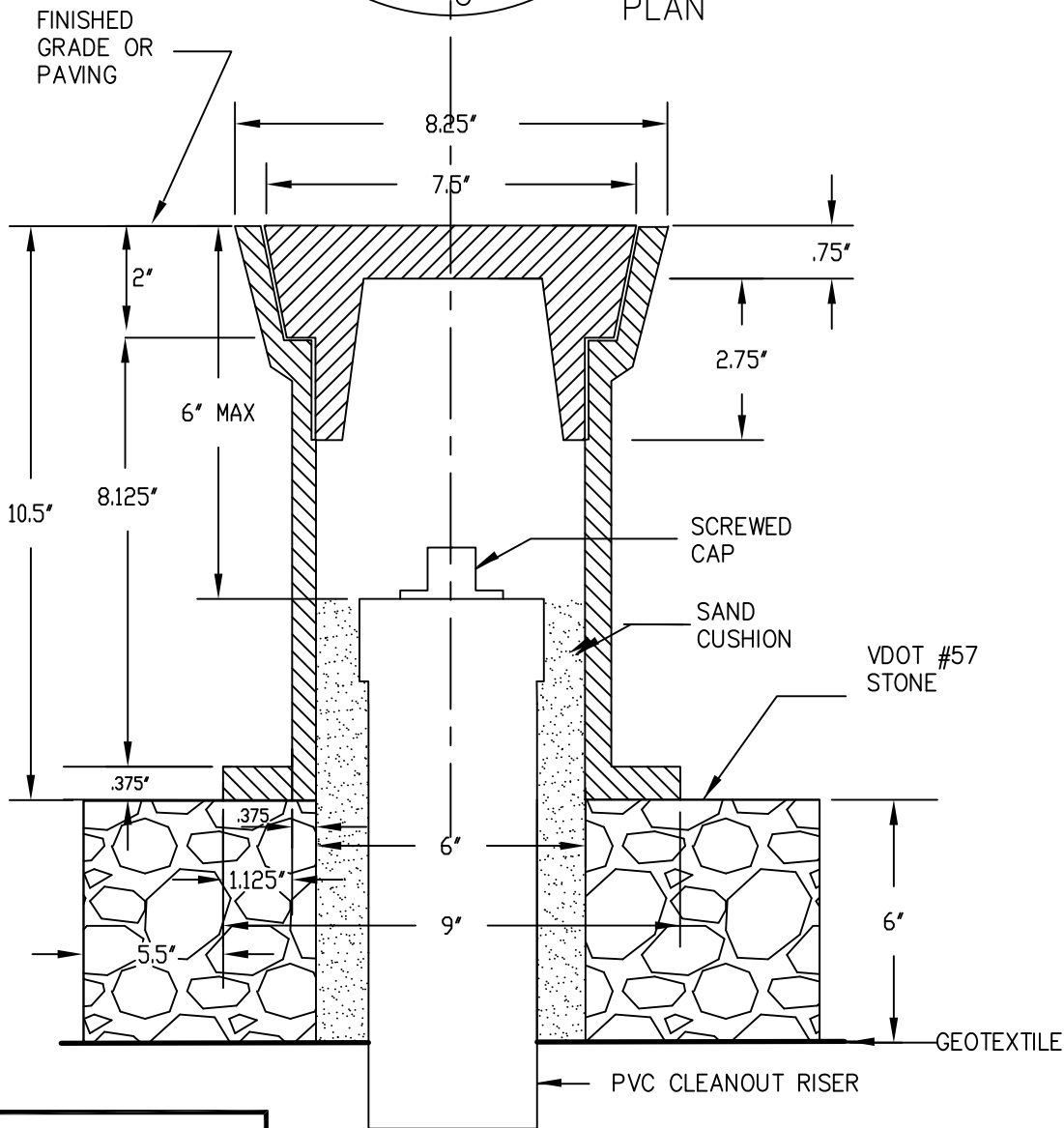
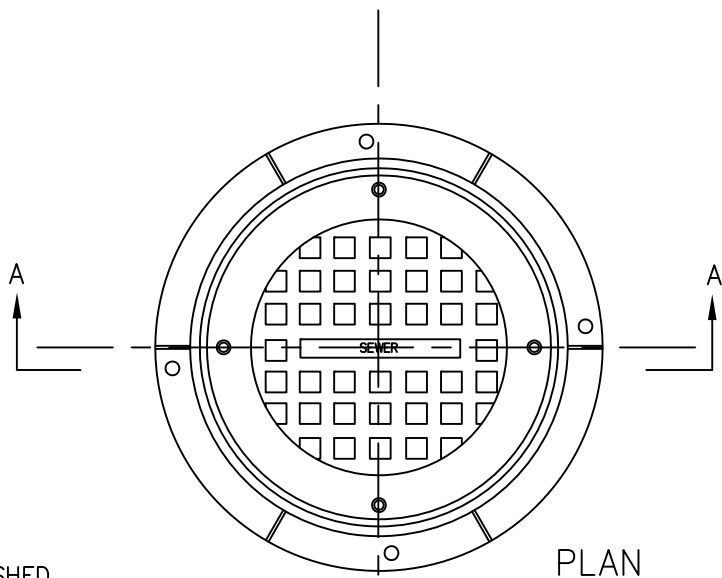


APRIL 2010

3.3.3-3A

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

CLEANOUT COVER ASSEMBLY  
FOR 4" CLEANOUTS IN AREAS SUBJECT  
TO VEHICLE TRAFFIC

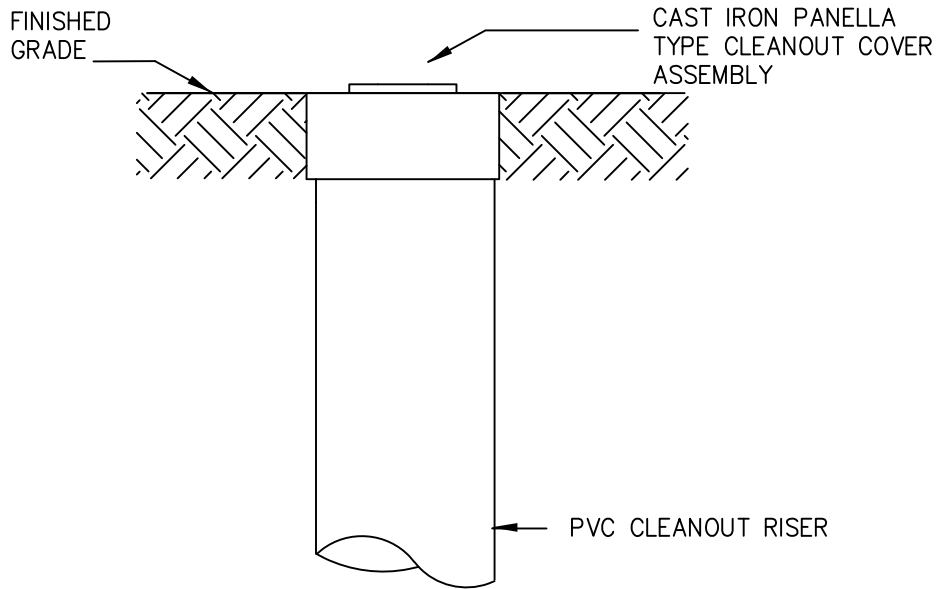


APRIL 2010

3.3.3-3B

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

CLEANOUT COVER ASSEMBLY  
FOR 4" CLEANOUTS AT EASEMENTS AND  
PROPERTY LINES



ASSEMBLY NOTE:

LUBRICATE CAP THREADS WITH  
ANTI-SIEZE LUBRICANT

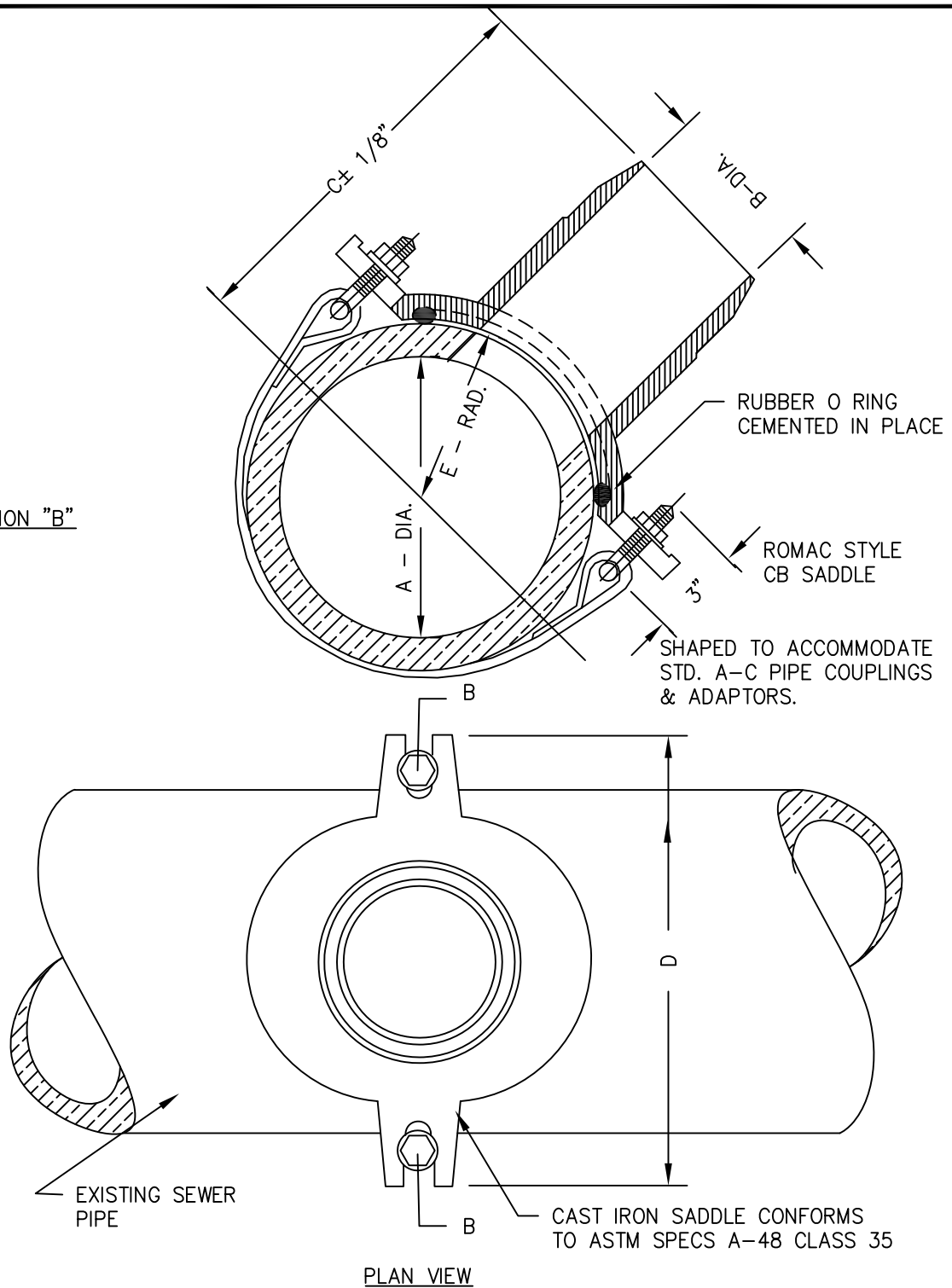
APRIL 2010

3.3.3-3C

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

PANELLA-TYPE CLEANOUT CAP ASSEMBLY  
FOR 4" CLEANOUTS IN INTERIOR  
YARD AREAS

SECTION "B"



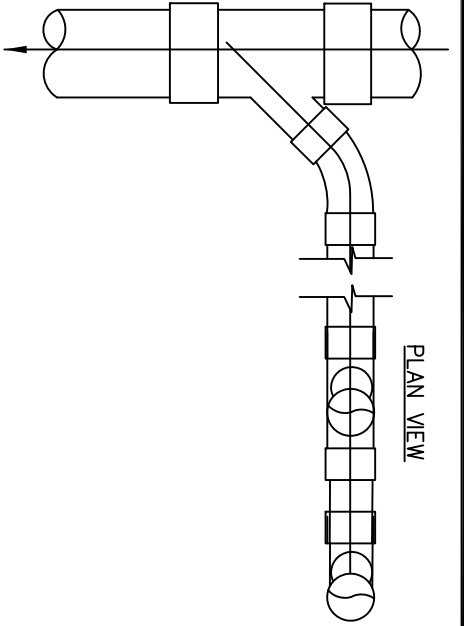
OCTOBER 2016

3.3.3-4

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

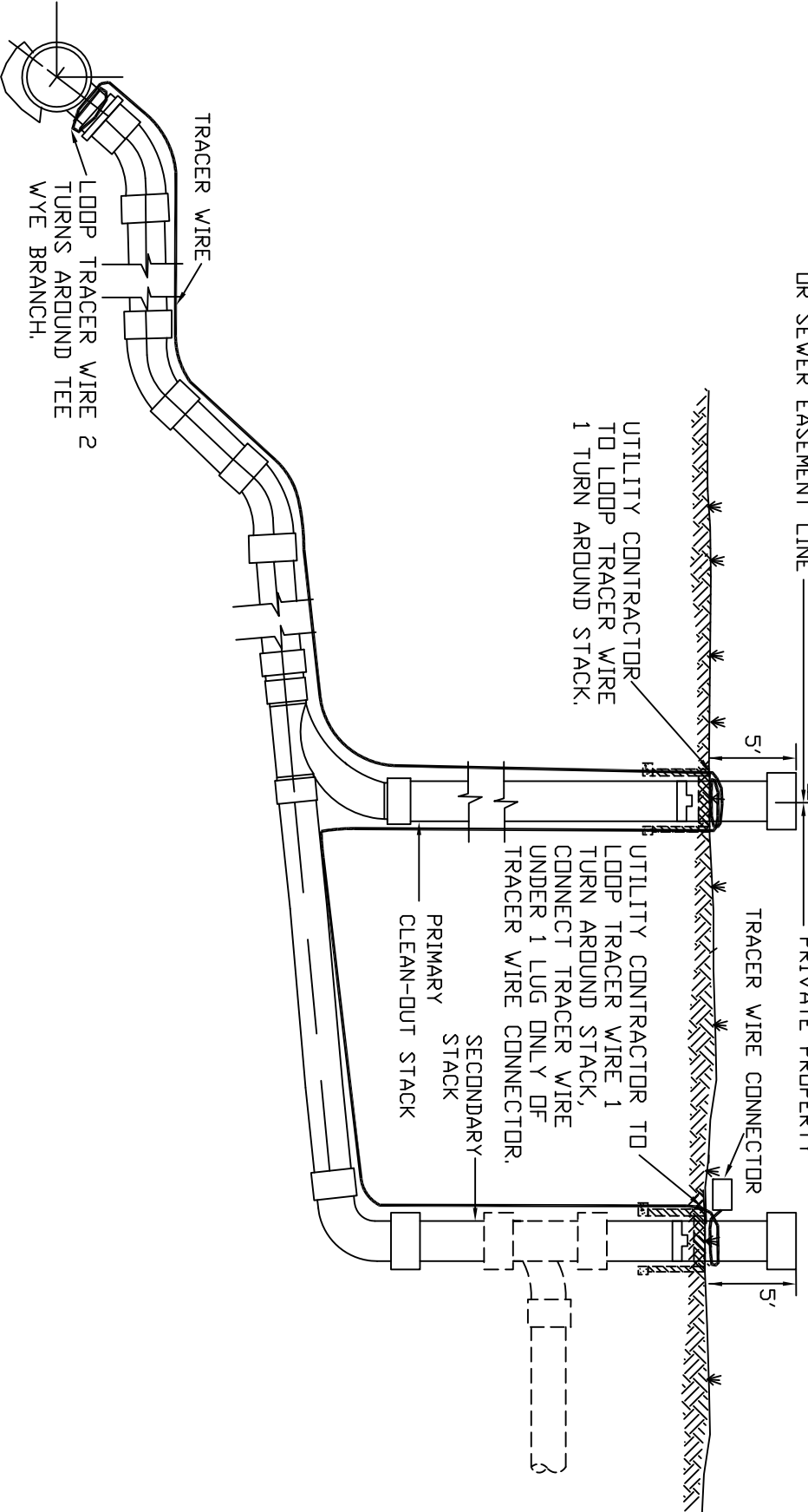
SEWER HOUSE TAP FOR  
EXISTING MAIN

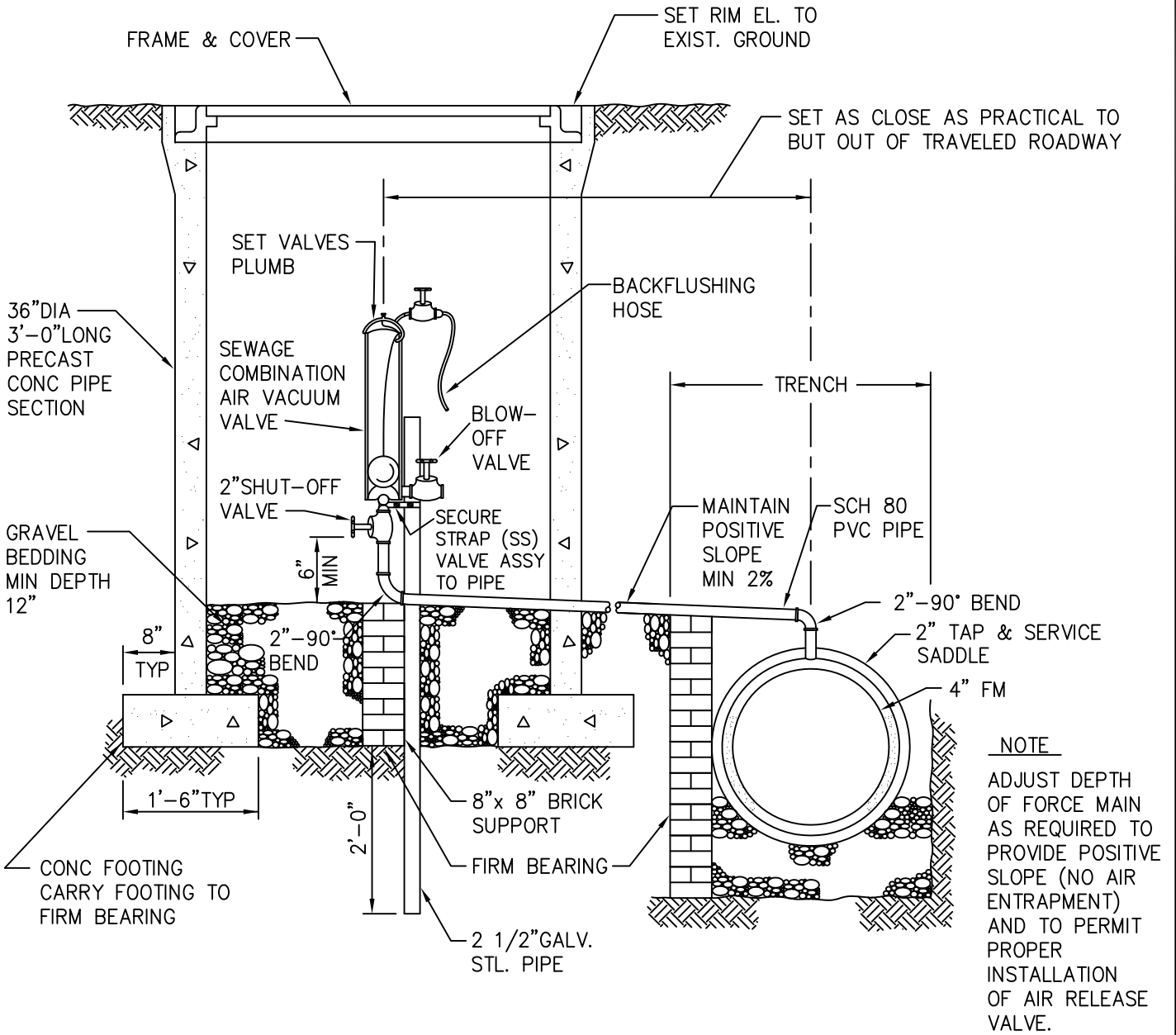
PLAN VIEW



RIGHT OF WAY  
OR SEWER EASEMENT LINE

- NOTES:
1. ALL SEWER LATERALS SHALL HAVE TRACER WIRE TAPED TO PIPE AND STACKS.
  2. UTILITY CONTRACTORS SHALL WRAP TRACER WIRE AROUND BRANCH OF THE WYE, TAPE TO LATERAL AND PRIMARY STACK, CONTINUE TO SECONDARY STACK AND TERMINATE WITH TRACER WIRE CONNECTOR UNDER 1 LUG, LEAVE CONNECTOR UNSEALED, PROTECT WITH PLASTIC BAG AND TAPE TO STACK.
  3. PLUMBER SHALL MOVE MOST OF TRACER WIRE TO SAND BETWEEN STACK AND CLEANOUT COVER; LEAVE 6" OF WIRE EXPOSED IN CLEANOUT COVER.
  4. PLUMBER SHALL DETACH TRACER WIRE AS NECESSARY FROM SECONDARY STACK OR STRAIGHT PIPE BEYOND PRIMARY STACK, ATTACH TRACER WIRE TO UNUSED LUG OF TRACER WIRE CONNECTOR, SEAL TRACER WIRE CONNECTOR AND EXTEND TRACER WIRE ALONG SEWER LATERAL TO STRUCTURE IN ACCORDANCE WITH 703.6 OF THE VIRGINIA PLUMBING CODE.
  5. COUNTY MAY TEST TRACER WIRE FOR CONTINUITY.





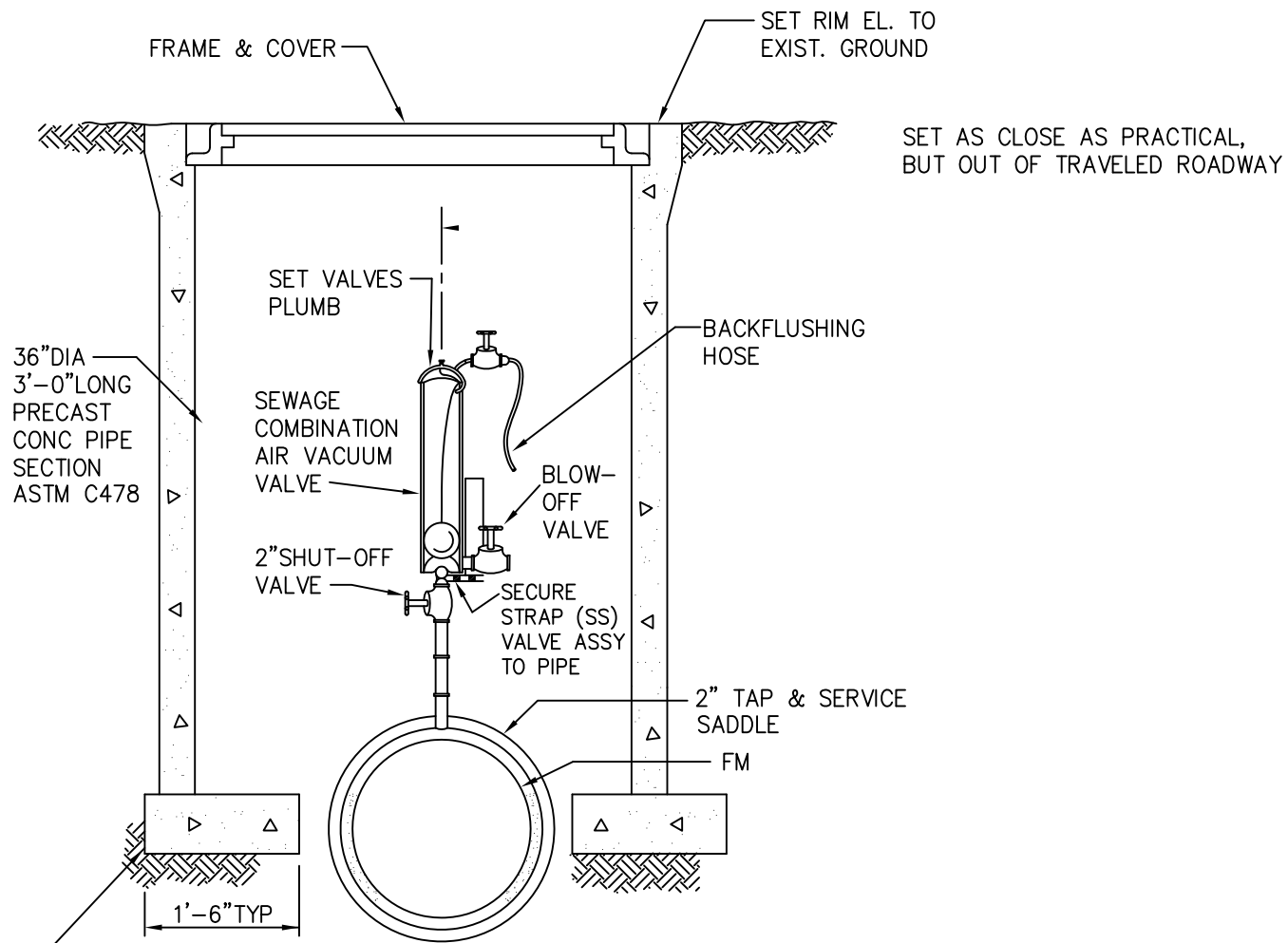
DECEMBER 2004

4.2.5-1

STAFFORD COUNTY  
DEPARTMENT OF UTILITIES

SEWAGE COMBINATION  
AIR/VACUUM VALVE





SET AS CLOSE AS PRACTICAL,  
BUT OUT OF TRAVELED ROADWAY

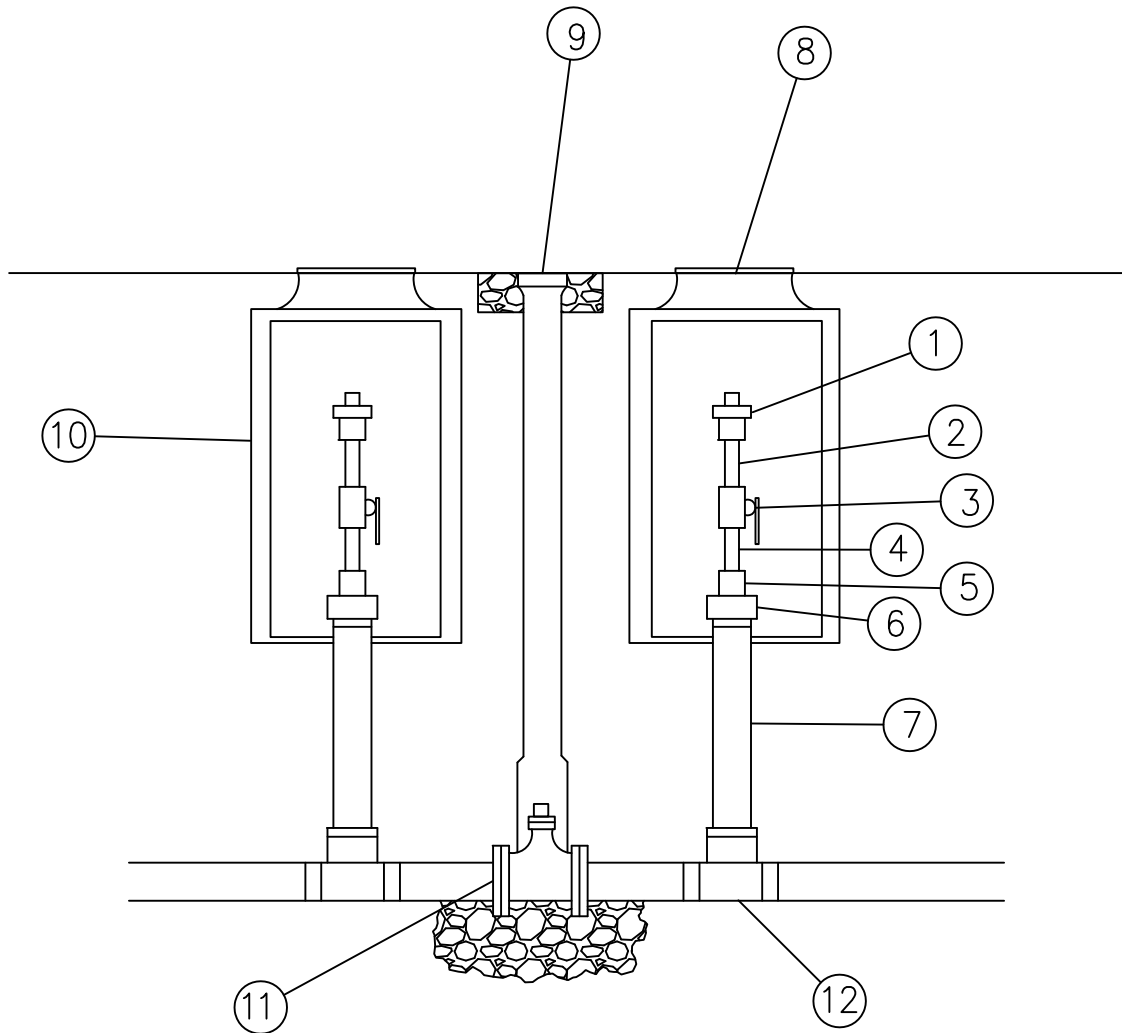
**NOTE:**  
ADJUST DEPTH OF FORCE MAIN AS REQUIRED TO  
PROVIDE POSITIVE SLOPE (NO AIR ENTRAPMENT)  
AND TO PERMIT PROPER INSTALLATION OF AIR  
RELEASE VALVE.

DECEMBER 2004

4.2.5-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

SEWAGE COMBINATION AIR/VACUUM  
SHORT PATTERN VALVE



INLINE FLUSHING CONNECTION

for

Low Pressure Sewer Systems

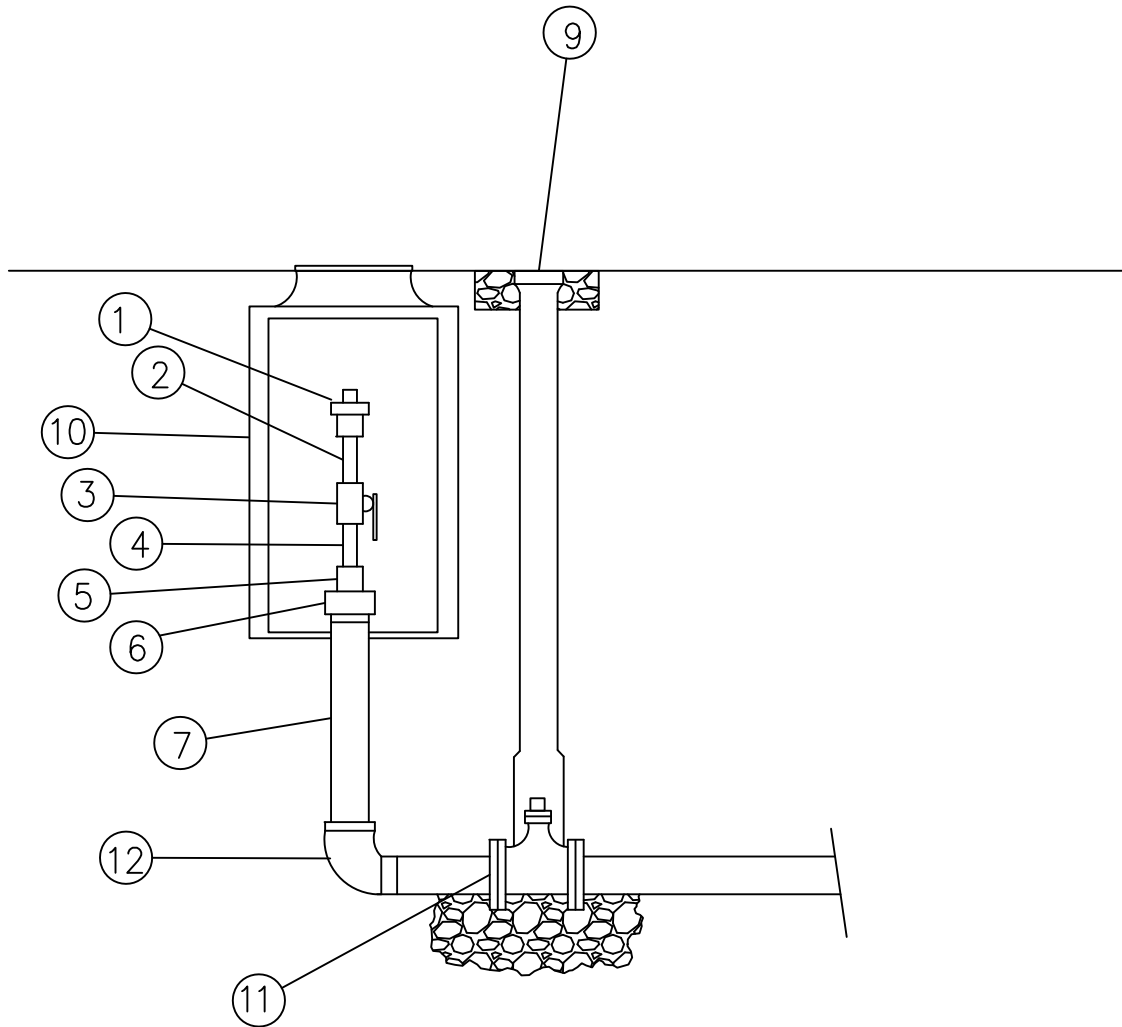
1. Brass Union.....1 inch
2. Brass Nipple.....1 inch x 4 inch
3. S.S Hand Valve.....Ball Valve – lever operated 1 inch
4. Brass Nipple.....1 inch x 4 inch
5. Brass Reducer.....2 inch to 1 inch
6. Brass Coupling.....2 inches
7. Brass Nipple.....2 inch x 18 inch
8. Lid – Traffic type if in road way or VDOT right-of-way.  
24 inch Monitor Type – "Sewer on Lid"
9. Valve Box.....5¼ shaft – sliding adjustable  
Lid Must Have The Word SEWER On Top
10. Meter Barrel.....24 inch x 30 inch
11. Valve.....Gate Valve, fully ported size of main line
12. Tee.....size of main line

OCTOBER 2016

4.3.1-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

IN-LINE FLUSHING CONNECTION  
LOW PRESSURE SEWER SYSTEM



**FLUSHING CONNECTION**

for Low Pressure Sewer Systems

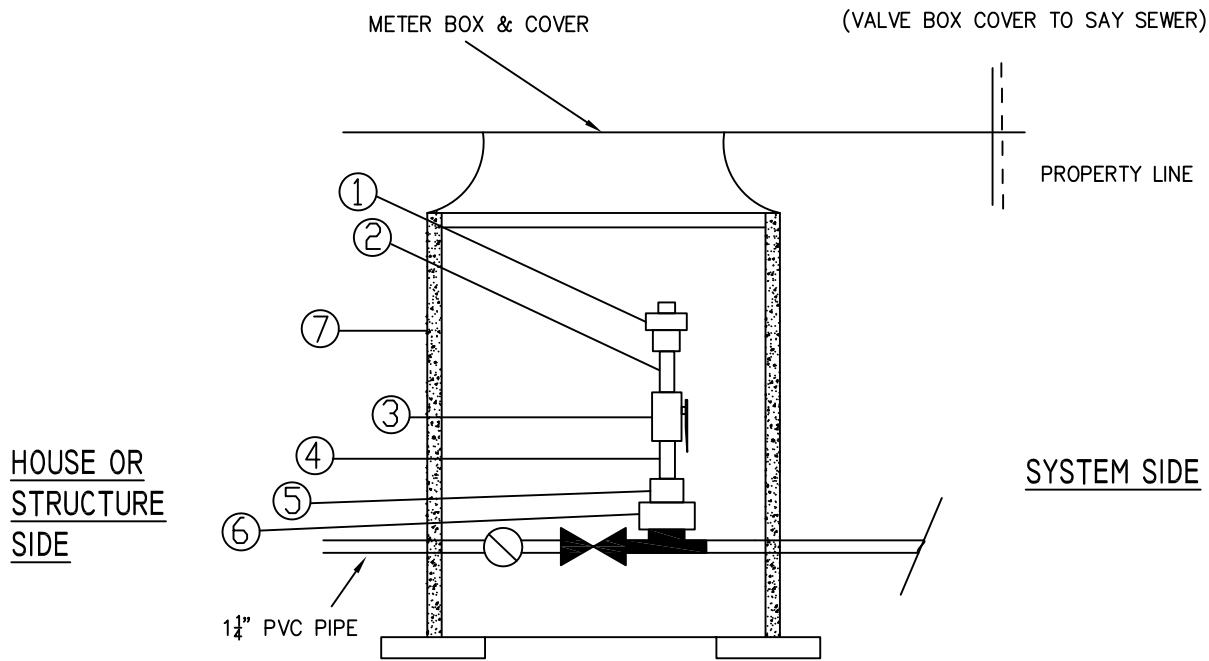
- 1. Brass Union.....1 inch
- 2. Brass Nipple.....1 inch x 4 inch
- 3. S.S. Hand Valve.....Ball Valve – lever operated 1 inch
- 4. Brass Nipple.....1 inch x 4 inch
- 5. Brass Reducer.....2 inch to 1 inch
- 6. Brass Coupling.....2 inches
- 7. Brass Nipple.....2 inch x 18 inch
- 8. Lid – Traffic type if in road way or VDOT right-of-way.  
24 inch Monitor Type – "Sewer on Lid"
- 9. Valve Box.....5¼ shaft – sliding adjustable  
Lid Must Have The Word SEWER On Top
- 10. Meter Barrel.....24 inch x 30 inch
- 11. Valve.....Gate Valve, fully ported size of main line
- 12. Tee.....size of main line

OCTOBER 2016

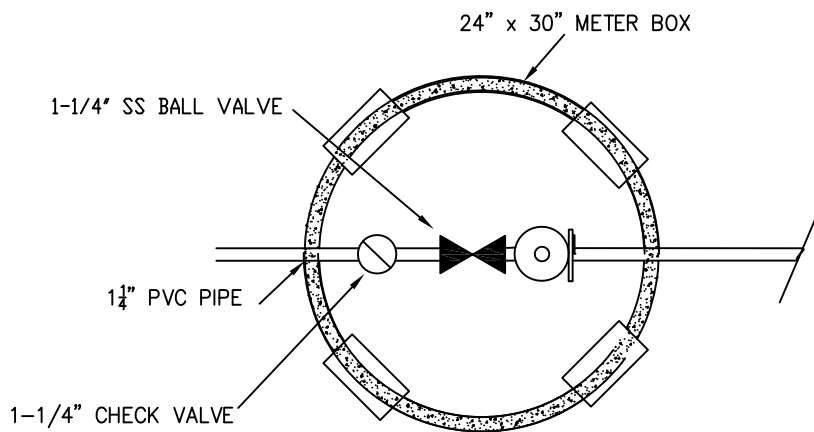
4.3.1-2

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

TERMINAL CONNECTION FOR  
LOW PRESSURE SEWER SYSTEM



SECTION VIEW



PLAN VIEW

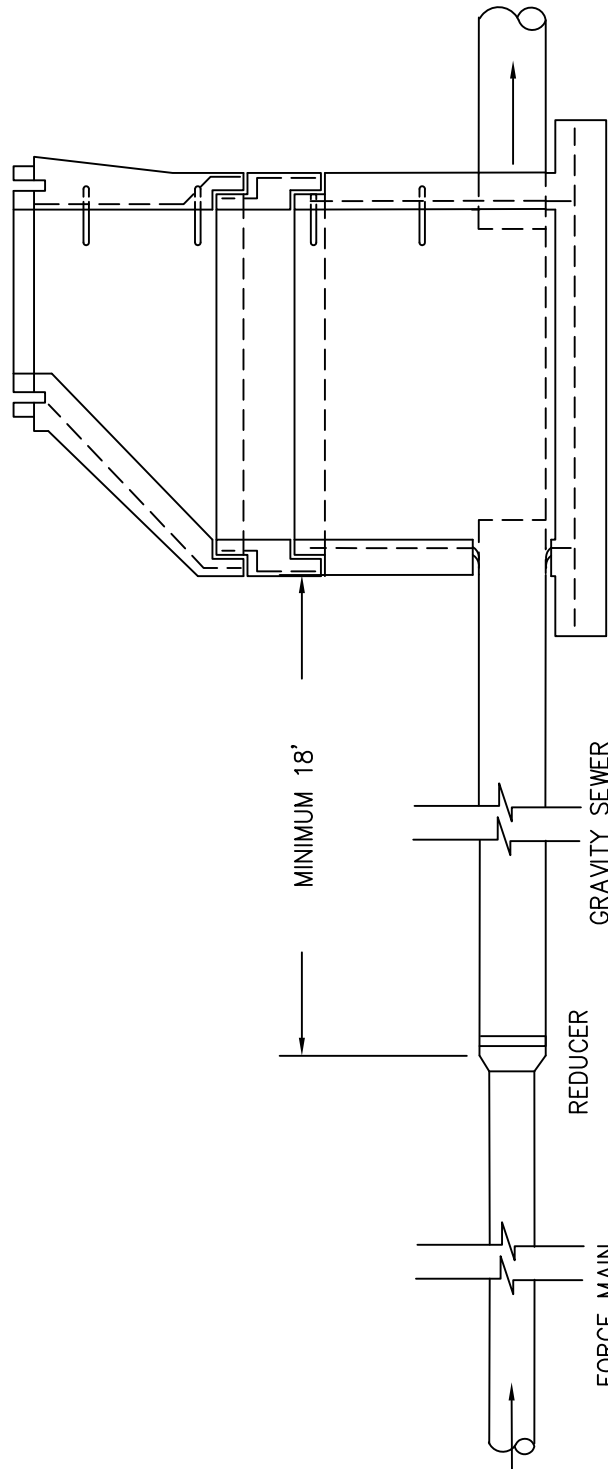
FLUSHING CONNECTION FITTINGS

- 1. Brass Union.....1"
- 2. Brass Nipple.....1" x 4" long
- 3. SS Hand Valve.....Ball Valve - lever operated 1-1/4"
- 4. Brass Nipple.....1" x 4" long
- 5. Brass Reducer.....1 1/4" to 1"
- 6. Brass Coupling.....1 1/4"
- 7. Meter Barrel.....24" x 30"

JANUARY 2016

4.3.1-3

FORCE MAIN DIAMETER	GRAVITY SEWER DIAMETER
1 1/2" - 3"	6"
4"	8"
6"	8"
8"	10"
10"	12"
12"	15"



DECEMBER 2004

4.4.1-1

*STAFFORD COUNTY  
DEPARTMENT OF UTILITIES*

FORCE MAIN CONNECTION  
TO GRAVITY SEWER

## **APPENDIX**



**WATER METER SIZING FORM**  
**STAFFORD COUNTY, VIRGINIA DEPARTMENT OF UTILITIES**  
**(P) 540-658-8616 (F) 540-658-4599**

Project Name:		Project Address:	
Project Engineer:	Tax Parcel:	Site Plan/Project Number:	
Form Completed By:  Address:		Company:  Telephone:  Fax:  Email:	
I certify that the information on this form is true and correct.			
Owner Name (Print) _____		Telephone: _____	
Signature: _____		Date: _____	
Email: _____			

Failure to return this form will delay processing of your permit application. This form is provided as a means to properly size the water meter(s) serving your property. Please complete this form and fax or email it to attention of:

Aref Etemadi at [aetemadi@staffordcountyva.gov](mailto:aetemadi@staffordcountyva.gov) or  
Claudia Wright at [cwright@staffordcountyva.gov](mailto:cwright@staffordcountyva.gov)

Utilities Department staff will review the form to determine the adequacy of the water meter for the intended use.

A separate form is required for each individual building or space in a building served by a single water meter.

**Fill out either Part A or B**

For part A enter the number of fixtures. Multiply by the fixture value @ 35psi and enter the result in the fixture valve columns. Sum the results and enter on the combined fixture valve total.

**Part A**

Fixture	Fixture Value @ 35 psi		No. of Fixtures	Fixture Value
Bathtub	8	x	_____	= _____
Bedpan Washers	10	x	_____	= _____
Combination Sink and Tray	3	x	_____	= _____
Dental Unit	1	x	_____	= _____
Dental Lavatory	2	x	_____	= _____
Drinking Fountain	Cooler	1	x	_____
	Public	2	x	_____
Kitchen Sink	1/2" Connection	3	x	_____
	3/4" Connection	7	x	_____
Lavatory	3/8" Connection	2	x	_____
	1/2" Connection	4	x	_____
Laundry Tray	1/2" Connection	3	x	_____
	3/4" Connection	7	x	_____
Shower Head (Shower Only)		4	x	_____
Service Sink	1/2" Connection	3	x	_____
	3/4" Connection	7	x	_____
Urinal	-Pedestal Flush Valve	35	x	_____
	-Wall Flush Valve	12	x	_____
	-Trough (2 Ft. Unit)	2	x	_____
Wash Sink (Each Set of Faucets)		4	x	_____
Water Closet	Flush Valve	35	x	_____
	Tank Type	3	x	_____
Dishwasher	1/2" Connection	5	x	_____
	3/4" Connection	10	x	_____
Washing Machine	1/2" Connection	5	x	_____
	3/4" Connection	12	x	_____
	1" Connection	25	x	_____
Hose Connection (Wash Down)	1/2"	6	x	_____
	3/4"	10	x	_____
Hose (50 Ft. Wash Down)	1/2"	6	x	_____
	5/8"	9	x	_____
	3/4"	12	x	_____
Combined Fixture Value Total				= _____

**OR**

**Part B**

- (1) Domestic Demand (Verification by County Staff) = \_\_\_\_\_ gpm
- (2) Fixed Load = \_\_\_\_\_ gpm
- (3) Irrigation Demand (From Data Supplied by Site Engineer) = \_\_\_\_\_ gpm
- (4) Total Demand = \_\_\_\_\_ gpm
- (5) Meter Size based on Total Demand (Verification by County Staff) = \_\_\_\_\_

COUNTY USE ONLY:

Ex Meter Size \_\_\_\_\_ Account \_\_\_\_\_ Required Meter Size \_\_\_\_\_

Sized By: \_\_\_\_\_ Date \_\_\_\_\_





# Construction Permit

Department of Utilities  
Administration 540-658-8630  
Field Operations 540-658-8695

## I. Project Information

Project Name: \_\_\_\_\_

Project Number: \_\_\_\_\_

Owner: \_\_\_\_\_

WatSew Number: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

## II. Owners Application

I, \_\_\_\_\_, owner of the above project, hereby petition the Stafford County Department of Utilities for permission to construct water and sewer facilities as shown on the approved project documents. I certify that all construction will be in strict conformance with the Stafford County Department of Utilities Water and Sewer Standards and all materials to be used are on the Approved Materials and Manufacturer's List contained therein, unless a deviation is specifically approved in the project documents. I also certify that I have retained \_\_\_\_\_, P.E. No \_\_\_\_\_, to certify construction and to provide record drawings.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## III. Water and Sewer Utilities Contractor Information

Company \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Project Manager or Superintendent  
Name: \_\_\_\_\_  
Office Telephone: \_\_\_\_\_  
Cell Number: \_\_\_\_\_

## IV. Inspection Fees

Sewer Permit	\$ 50.		\$
Water Permit	\$ 50.		\$
Sewer Mains	>= 8" \$150. First 100 Ft Plus	feet at \$1.50	\$
Water Mains	>= 3" \$125. First 100 Ft Plus	feet at \$1.25	\$
Force Mains	>= 3" \$125. First 100 Ft Plus	feet at \$1.25	\$
Internal T.V. Inspection	Sewer Mains	feet at \$1.00	\$
		<b>Total Fees Due</b>	<b>\$</b>

## V. Approval

The Stafford County Department of Utilities hereby grants the project owner permission to construct the water and sewer facilities shown in the approved project documents for the project identified above. This permit shall become void 12 months from the date of issue if construction has not started or if construction is suspended for a period of 12 months or more. This permit is valid only if signed below and receipted by the County Treasurer's Office in the amount of the construction fees listed above.

\_\_\_\_\_  
Director of Utilities

\_\_\_\_\_  
Date

**COUNTY OF STAFFORD  
DEPARTMENT OF UTILITIES  
WATER SYSTEM FLOW ANALYSIS APPLICATION**

Requests for water system flow analysis must be made using this form. The following information must be submitted:

Project Name: \_\_\_\_\_

Project Location: \_\_\_\_\_

Proposal Type (SF, TH, MF, C): \_\_\_\_\_

Distance between Buildings (if residential): \_\_\_\_\_

Point(s) of Connection: \_\_\_\_\_

Attach a vicinity map indicating the location of the proposed connection(s) to the existing County Water System.

The County will provide computer modeled flows and pressures at the proposed location based upon the existing pip network and existing peak day water demands. The design engineer is responsible for calculating the available flows within the proposed project.

The flow analysis must include the allocation for required domestic demands plus fire demands. For fire demands, the pressure at the demand hydrant cannot be less than 20 psi at any point within the on- or offsite nodes. For domestic demands, the system must be able to supply a minimum of 45 psi to the first floor of each building of the proposed project during a peak hour demand. The analysis must be signed and sealed by a professional engineer.

Requested by: \_\_\_\_\_

Firm Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

E-Mail: \_\_\_\_\_

Please forward your request to: [aetemadi@staffordcountyva.gov](mailto:aetemadi@staffordcountyva.gov) or [cwright@staffordcountyva.gov](mailto:cwright@staffordcountyva.gov)



# CONSTRUCTION NOTES

## WATER & SEWER

1. A WATER AND SEWER CONSTRUCTION PERMIT MUST BE OBTAINED FROM THE STAFFORD COUNTY DEPARTMENT OF UTILITIES AT LEAST 48 HOURS PRIOR TO START OF WATER AND SEWER CONSTRUCTION, INCLUDING TAPS TO EXISTING LINES.
2. CONTACT THE DEPARTMENT OF UTILITIES AT 540-658-8630, 48 HOURS BEFORE BEGINNING WORK ON WATER OR SANITARY SEWER UTILITIES, INCLUDING SERVICE TAPS.
3. INSPECTION AND APPROVAL OF ALL WORK AND MATERIALS PERTAINING TO WATER SHALL BE UNDER THE JURISDICTION OF STAFFORD COUNTY, VIRGINIA.
4. ALL WATER LINES AND CONSTRUCTION THEREOF SHALL COMPLY WITH THE STANDARDS AND SPECIFICATIONS OF STAFFORD COUNTY, VIRGINIA AND THE VIRGINIA DEPARTMENT OF HEALTH. ALL SEWER LINES AND CONSTRUCTION THEREOF SHALL COMPLY WITH THE STANDARDS AND SPECIFICATIONS OF STAFFORD COUNTY VIRGINIA AND THE VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY.
5. USE APPLICABLE STANDARD DETAILS FROM STAFFORD COUNTY WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS.
6. WHEN THE STAFFORD COUNTY WATER AND SEWER DESIGN AND CONSTRUCTION STANDARDS CONTAINS A PROJECT CATEGORY IN THE APPROVED MATERIALS AND MANUFACTURERS LIST, ONLY THOSE PRODUCTS SPECIFICALLY LISTED MAY BE USED.
7. AFTER A DEPARTMENT OF UTILITIES CONSTRUCTION PERMIT HAS BEEN ISSUED, ALL CHANGES TO WATER AND SEWER FACILITIES TO BE CONSTRUCTED USING THESE PLANS MUST BE SUBMITTED TO THE DEPARTMENT OF UTILITIES IN WRITING AND APPROVED PRIOR TO CONSTRUCTION. CONTACT THE UTILITIES INSPECTION STAFF AT (540) 658-8630.
8. THIS PROJECT IS IN THE \_\_\_\_ PRESSURE ZONE. ANY STRUCTURE THAT HAS A FIRST FLOOR ELEVATION OF LESS THAN \_\_\_\_ WILL REQUIRE A PRESSURE REDUCING VALVE. ANY STRUCTURE THAT HAS A FIRST FLOOR ELEVATION ABOVE \_\_\_\_ WILL REQUIRE A BOOSTER PUMP.

9. CONTACT THE DEPARTMENT OF UTILITIES CROSS CONNECTION/BACKFLOW INSPECTOR AT 540-373-2535 TO COORDINATE THE REQUIREMENTS FOR BACKFLOW PREVENTION.
10. DEVELOPER/OWNER IS RESPONSIBLE TO RESPOND TO MISS UTILITY REQUESTS UNTIL WATER AND SEWER LINES ARE ACCEPTED BY COUNTY. ANY DAMAGE TO WATER AND SEWER MAINS MUST BE REPAIRED BEFORE ACCEPTANCE BY THE COUNTY.
11. THE CONTRACTOR WILL BE RESPONSIBLE FOR DAILY AS-BUILT INFORMATION ON ALL CONSTRUCTION. ALL LATERALS AND APPURTENANCES WILL BE REFERENCED FROM THE CLOSEST MANHOLE. THE CONTRACTOR SHALL MAINTAIN DAILY AS-BUILT DRAWINGS AT THE CONSTRUCTION SITE.
12. WATER AND SEWER IMPROVEMENTS WILL NOT BE ACCEPTED UNTIL THE COUNTY APPROVES AS-BUILT DRAWINGS AND EASEMENTS ARE RECORDED.
13. ALL SERVICES INTERRUPTIONS TO EXISTING WATER AND SEWER CUSTOMERS SHALL BE APPROVED BY AND COORDINATED WITH THE UTILITY INSPECTOR. ALL SERVICE INTERRUPTIONS TO EXISTING CUSTOMERS WILL REQUIRE A MINIMUM OF 48 HOURS NOTICE. CERTAIN SERVICE INTERRUPTIONS MAY REQUIRE WORK AT NIGHT.
14. ALL BACTERIOLOGICAL SAMPLES OF WATER LINES SHALL BE TAKEN BY DEPARTMENT OF UTILITIES PERSONNEL. A MINIMUM OF 48 HOURS NOTICE IS REQUIRED TO SCHEDULE THESE SAMPLES.
15. PVC WATERLINES UP TO 10" DIA MAY BE USED IN NON-PAVED AREAS. PVC WATERLINES SHALL BE CLASS 200 (SDR-14) POLY-VINYL CHLORIDE PIPE MEETING THE REQUIREMENTS OF AWWA C900. WATER PIPE OVER 10" AND ALL WATER PIPE IN PAVED AREAS SHALL BE DUCTILE IRON (CLASS 52) PIPE MEETING THE REQUIREMENTS OF AWWA C151 WITH PUSH-ON OR RESTRAINED MECHANICAL JOINTS. DIP MUST BE POLY ENCASED. PVC PIPE SHALL BE INSTALLED WITH INSULATED 10 GAUGE COPPER CLAD STEEL TRACING WIRE SECURED TO THE TOP OF THE PIPE. ALL PIPE SHALL HAVE BLUE WARNING TAPE BURIED 2' (TWO FEET) BELOW GRADE OVER THE TOP OF THE PIPE.
16. ALL WATER MAINS SHALL HAVE MINIMUM 42" COVER.
17. ALL SEWER PIPE AND FITTINGS 4" THROUGH 15" DIAMETER SHALL MEET ASTM D3034, SDR 35, MINIMUM. ALL SEWER PIPE AND FITTINGS 18" THROUGH 40" DIAMETER, SHALL MEET ASTM F679.

18. ALL SEWER LINES UNDER PAVEMENT SHALL HAVE A MINIMUM OF 48" COVER. ALL SEWER LINES INSTALLED IN EASEMENTS WITH NO VEHICULAR TRAFFIC SHALL HAVE A MINIMUM OF 36" COVER.
19. DUCTILE IRON SANITARY SEWER PIPE SHALL HAVE INTERIOR LINING OF PROTECTO 401 OR EQUAL AND BE POLY ENCASED, UNLESS NOTED OTHERWISE.
20. ALL MANHOLES IN PAVED AREAS, KEPT LAWNS AND OTHER GREEN AREAS SHALL HAVE STANDARD FRAMES AND SOLID COVERS UNLESS NOTED OTHERWISE. ALL OTHER MANHOLES SHALL HAVE WATERTIGHT FRAMES AND COVERS UNLESS NOTED OTHERWISE.
21. ALL MANHOLES SHALL HAVE FRAMES BOLTED TO CONE, UNLESS DIRECTED OTHERWISE BY THE UTILITIES INSPECTOR
22. TAPERED ADJUSTING RINGS SHALL BE USED TO ADJUST THE SLOPE OF THE MANHOLE FRAME AND COVER TO THE SLOPE OF PAVEMENT.
23. ALL MANHOLES SHALL HAVE A LIQUID APPLIED ELASTOMERIC INTERNAL CHIMNEY SEALING MATERIAL APPLIED.
24. A WATERPROOF MANHOLE INSERT IN CONFORMANCE WITH DETAIL 3.2.3-3 SHALL BE INSTALLED IN EACH MANHOLE WITH A STANDARD FRAME AND COVER.
25. A CLEANOUT COVER ASSEMBLY IN CONFORMANCE WITH DETAIL 3.3.3-3A OR 3.3.3-3B SHALL BE INSTALLED ON EACH SEWER LATERAL CLEANOUT.
26. THERE SHALL BE A 10' HORIZONTAL SEPARATION BETWEEN WATER LINES AND SEWER LINES, AND A VERTICAL SEPARATION OF 18" BETWEEN THE BOTTOM OF THE WATER MAIN AND THE TOP OF THE SEWER. THIS APPLIES TO HOUSE SEWER LATERALS ALSO.
27. ALL WATERLINE AND SEWER SELECT BACKFILL, STRUCTURAL BACKFILL, AND PIPE BEDDING MATERIAL SHALL BE COMPACTED TO 95% VTM-1 MAXIMUM DRY DENSITY. ALL CONTROLLED FILL IN TRENCHES UNDER PAVEMENT SHALL BE COMPACTED TO 95% VTM-1 MAXIMUM DRY DENSITY.
28. WATER AND SANITARY SEWER DESIGN ELEMENTS, DETAILS AND PRODUCTS SHOWN ON THIS PLAN ARE VALID FOR A PERIOD OF 12 MONTHS AFTER PLAN APPROVAL, AFTER WHICH TIME CURRENT WATER AND SEWER STANDARDS WILL APPLY.
29. WATER AND SANITARY SEWER INFRASTRUCTURE IS SUBJECT TO COMPREHENSIVE INSPECTION AT TENTATIVE ACCEPTANCE, 12 MONTH ANNIVERSARY, AND FINAL ACCEPTANCE.

## Water and Sewer-Notes-Administrative

### 1. Final Inspection

- a. At the completion of this project, the developer or engineer responsible for construction shall notify the Public Utilities Administrator, in writing, that the work has been completed and request a final inspection. This request shall include the requirements of Note 2.
- b. On receipt of the request for final inspection, the Administrator shall make a final comprehensive inspection of the constructed facilities, examining in detail for conformance of the work with approved plans and specification, alignment of sewer lines, infiltration leakage, workmanship, operation of equipment and other factors to the satisfaction of the Administrator and the best interest of the County.
- c. It shall be required that a responsible representative of the developer accompany the Administrator or his designee on the final inspection. The developer shall furnish whatever is necessary for conducting the final inspection.
- d. Deficiencies, which are found to exist during the final inspection, shall be pointed out to the developer. Subsequent to the inspection, the developer shall be furnished, in writing, a summary of the deficiencies found, the correction of which is required. On notification that all construction deficiencies have been completed, the Administrator shall re-inspect all such work.

### 2. Acceptance by County of Completed Facilities

- a. The Administrator shall accept newly constructed water and sanitary sewer service facilities to become a part of the public utilities system of the County, upon satisfaction of the following conditions.
  1. That, in the opinion of the Administrator, all requirements of Note 1 have been fulfilled or the developer has made arrangements satisfactory to the Administrator to have them fulfilled.
  2. A set of record drawings meeting the requirements of Note 3 has been submitted and approved by the Administrator.
  3. That all matters relative to specific contracts between the developer and the County are in order.
  4. That payment has been made by the developer for all fees relative to applications and inspections.
  5. That a civil engineer registered as a Professional Engineer in the State of Virginia certifies that the work has been completed in accordance with the approved plans and specifications.
  6. That explicit understanding exists between the developer and the Administrator that the developer shall be responsible for and obligated to correct any deficiencies in construction for a period of one year from the date of acceptance of the facilities by the County. This condition shall be stipulated in the written form of acceptance issued by the Administrator.

- b. Acceptance of the newly constructed facilities, when approved by the Administrator shall be made, in writing, to the developer responsible for the construction. The issuance of the written forms of acceptance of any such facilities shall constitute and irrevocable agreement between the developer responsible for construction and Administrator that the Board of Supervisors, acting for the County and any of its officers, agents, servants, or employees, shall be saved harmless by the developer from liability and responsibility of any nature and kind for the cost of, or payment on, labor and equipment used in construction of the accepted facilities or on account of any patented or unpatented invention, process, article or appliance manufactured for, or used in construction with, or the intended operation of, the accepted facilities.
- c. Certificate of occupancy permits will not be issued for any buildings within the development until the water and sewer facilities have been accepted in accordance with this note.

### 3. Record Drawings

- a. A complete set of Record Drawings and corrected key sheets shall be submitted by the developer responsible for the construction upon completion of construction and at least one week prior to the anticipated occupancy of any building within the project. Record drawings must be determined by actual field survey and sealed by the responsible surveyor or engineer shall be on each sheet, "I hereby state, to the best of my knowledge and personal belief, that the work shown on these plans was constructed to the direction and grades shown and are either installed within the Public right-of-way or properly recorded easements dedicated to Stafford County." The record drawings shall show all revisions, substitutions, variations, omissions, and discrepancies made or discovered during construction concerning location and depth of utilities, piping, manholes, pumps, and other facilities. Revisions shall be made and shown on all drawing views with actual dimensions established to permanent points. The contractor shall keep daily as-built work plans at the construction site and shall furnish them to the design engineer or record drawing preparation.

The record drawings shall show, but may not be limited to, the following:

#### 1. Water Line Construction:

- a. Scale accuracy location in plans of the line and all installed valves and fittings, such as elbows, tees, crosses and reducers, and all cradle encasements or special construction.
- b. Exact measurements to show positive locations shall be taken from at least two reasonably adjacent and available, fixed and permanent objects, such as fire hydrants, centers of sanitary or storm sewer manhole casting covers, corners or lines extending from buildings, power poles, etc.
- c. Type and sizes of all pipes.

#### 2. Sewer Line Construction:

- a. Scale accuracy location of manhole inverts and top casting elevations and numerical notations of the exact elevations of same as



determined by field survey after construction. Elevations shall be in datum of the County.

- b. Scale accuracy indication of lengths and grades and direction of lines between manholes and numerical notations of the exact length and grades, as determined after construction.
  - c. Scale accuracy location of concrete cradles, encasements or special construction.
  - d. Location of house services by measurement form the manhole immediately downgrades.
  - e. Type and sizes of all pipes
3. Wastewater treatment facilities and pumping stations, water pumping stations, all other comparable construction and building structures:
    - a. As-built plans and specifications shall accurately indicate all approved deviations from or changes in locations or type of equipment installed and material used.
    - b. Accurate listings of the name of the manufacturer of all operating equipment installed, together with model or style numbers, ratings, capacities and other pertinent information shall be provided as part of the record plans on the project.
    - c. At least three (3) complete sets of operation and maintenance manuals for all operating equipment, materials and the installation thereof, required by the project specifications which are approved by the Administrator, shall be provided as part of the record drawings on the project.
  4. When the record drawing information differs from the approved construction plans, a design analysis for the existing conditions may be required.
  5. After the record drawings are approved in writing by the Department of Utilities, a set reproducible Mylar and two blue line prints shall be submitted. Projects that include water and/or sewer facilities, which are located within a VDOT right-of-way, will require four additional sets of blue line prints for the remain-in-place permit.

### Record Drawing Check Sheet

Record Plan Name \_\_\_\_\_

A/P Number \_\_\_\_\_

		Check Items		
		Yes	No	N/A
1.	Record Plan submitted is 24 x 36 with cover sheet?			
2.	PE or LS Seal?			
3.	All inspector punch list items resolved?			
4.	Record plan redrafted with no hand written entries?			
5.	Record conditions conform to approved plans, revisions and field changes?			
6.	Scale consistent with approved plans?			
7.	Connections clearly visible to existing utilities?			
8.	County project AP number on cover sheet?			
9.	Stations labelled on water line plan?			
10.	Contractor name and address on cover sheet?			
11.	Water-Sanitary Sewer deed of easement recording information on cover sheet?			
12.	Phasing map with correct lots and water and sewer lines indicated provided as sheet 2?			
13.	North arrow on plans facing up?			
14.	County coordinates listed on two property corners for each plan sheet?			
15.	New utilities clearly visible as dark bold continuous lines?			
16.	Existing sewer and water lines are bold dashed lines?			
17.	View ports for all above ground W&S apparatuses are shown with measurements to two fixed objects?			
18.	Details viewports for all valves, hydrants, meters, sample stations, manholes, cleanouts?			
19.	Profile on sewer lines show actual length, rim elevation, all inverts and ground elevation?			
20.	Pipe material, material class, and manufacturer listed on water and sewer profiles?			
21.	Sewer lateral – list diameter, material, class and manufacturer, include schedule?			
22.	List in table the XY coordinate locations to all MHs, hydrants, valves Cos, meters and sample stations.			
23.	Plans show easement lines with width labeled, dashed and deed record and plat labeled?			