

**APPENDIX B**

**PUBLIC UTILITY DESIGN AND CONSTRUCTION SPECIFICATIONS FOR WATER  
DISTRIBUTION AND WASTEWATER COLLECTION**

STRASBURG SANITATION AND WATER DISTRICT

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**EXHIBIT B TO RULES AND REGULATIONS**

PUBLIC UTILITY DESIGN AND  
CONSTRUCTION SPECIFICATIONS

FOR  
WATER DISTRIBUTION  
AND  
WASTEWATER COLLECTION

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**PART I**

**WATER SYSTEM STANDARD SPECIFICATIONS  
TABLE OF CONTENT**

**DISTRIBUTION SYSTEM DESIGN AND LAYOUT**

<u>Section</u>	<u>Title</u>	
1.01	General .....	7
1.02	Quality of the Distribution System .....	7
1.03	Sizing of Distribution Mains.....	7
1.04	Fire Protection .....	7
1.05	Pumping Facilities.....	8
1.06	Storage Facilities .....	8
1.07	Layout of the Distribution System.....	8
1.08	Line Valves .....	8
1.09	Connections to Mains for Fire Sprinkler Lines .....	8
1.10	Clearance and Encasement Design for Sanitary and Storm Sewer Crossings .....	9

**MATERIALS**

<u>Section</u>	<u>Title</u>	
2.01	Materials and Testing.....	10
2.02	Size of Mains.....	10
2.03	Distribution System Piping .....	10
2.04	Pipe Fittings.....	11
2.05	Gate Valves .....	12
2.06	Valve Boxes .....	12
2.07	Fire Hydrants.....	13
2.08	Corrosion Protection Systems.....	14
2.09	Concrete Thrust Blocks, Anchors and Structures .....	14
2.10	Mechanical Joint Restraint.....	15
2.11	Casing Pipe.....	16
2.12	Responsibility for Materials.....	16
2.13	Handling of Materials .....	16
2.14	Pressure Accessories .....	16

**PIPE INSTALLATION**

<u>Section</u>	<u>Title</u>	
3.01	Approval by the District.....	17
3.02	Handling of Materials .....	17
3.03	Inspection and Preparation of Pipe and Fittings.....	17
3.04	Cutting and Fitting of Pipe.....	17
3.05	Pipe Joint Lubrication .....	17
3.06	Pipe Alignment and Grade.....	17
3.07	Deviation from Alignment and Grade Occasioned by Other Structures .....	18
3.08	Temporary Bulkheads .....	18
3.09	Frost.....	18
3.10	Earthwork .....	18
3.11	Lowering of Material into the Trench .....	20
3.12	Laying of Pipe .....	20
3.13	Ductile Iron Pipe .....	21
3.14	Polyvinyl Chloride Pressure Pipe .....	22
3.15	Installation of Valves .....	22
3.16	Valve Boxes .....	22
3.17	Installation of Fittings .....	23
3.18	Fire Hydrants.....	23

3.19	Dead Ends and Blow Offs .....	24
3.20	Thrust Blocks and Anchors.....	24
3.21	Vaults.....	25
3.22	Harness Rods.....	25
3.23	Bridging and Encasement of Pipe.....	25
3.24	Connections to the District's System .....	25
3.25	Corrosion Protection Systems.....	26
3.26	Disinfection .....	27
3.27	Pressure Testing .....	27
3.28	Acceptance and Release for Taps .....	28
3.29	Acceptance of Mains and Service Lines Including Curb Stops.....	28

#### SERVICE LINES

<u>Section</u>	<u>Title</u>	
4.01	All New Service Lines and, Where Applicable, Service Line Replacements .....	29
4.02	Water Service Line Excavations for All New and Replacement Service Lines.....	29
4.03	Service Line Installation and Material for All New and Replacement Service Lines.....	30
4.04	Curb Stop and Curb Box for All New and Replacement Service Lines.....	31
4.05	Water Meters - General.....	32
4.06	Inside Water Meter Installations Only.....	32
4.07	Water Meter Pit Installations Only .....	32
4.08	Combined Domestic and Fire Line Water Meters .....	33
4.09	Water Regulators.....	33
4.10	Inspection of Services for All New and Replacement Service Lines .....	33
4.11	Repair and Replacement of Existing Service Lines .....	33
4.12	Service Lines-General Notes .....	34

#### WATER SERVICE QUALITY CONTROL REGULATIONS

<u>Section</u>	<u>Title</u>	
5.01	General .....	35
5.02	Cross Connection Control & Backflow Prevention - Criteria List.....	38

#### STANDARD DRAWINGS

<u>No.</u>	<u>Title</u>
1	Fire Hydrant Installation
2	Valve Installation and Location
3	Valve Box Installation
4	Polyethylene Wrap
5	Bonding Joint and Anode Installation
6	Insulator Installation
7	Copper Tracer Wire on PVC Pipe
8	Thrust Block Data
9	Typical Trench Cross Section
10	Maximum Pipeline Deflection Data
11	Reverse Anchor Detail
12	Temporary & Permanent Blow Off Assemblies - 6" & 8" Mains
13	Pipe Tapping Detail
14	Applications for Mechanical Joint Restraints
15	Restrained M.J. Pipe Length Data
16	Tapping Detail - 3/4" thru 2"
16a	Typical Installation for Service Line and Stop Box
17	3" to 10" Above Ground Backflow Preventer
18	3" to 10" Below Ground Backflow Preventer
19	Standard Concrete Vault for Valve Installation (Precast)
20	Standard Concrete Vault for Valve Installation (Cast-In-Place)

21	Water Line Lowering Detail
22	Typical Meter Pit Installation
23	Typical Indoor Water Meter Loop for ¾" through 1" meters
24	Typical 1½" and 2" Indoor Meter Installation
25	¾" to 2" Backflow Preventer with Meter
26	¾" to 2" Above Ground Backflow Preventer

**PART II**

**WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS**

**TABLE OF CONTENTS**

**CHAPTER 1 - GENERAL**

<u>Section</u>	<u>Title</u>	
1.01	Authority .....	40
1.02	Effective Date of Specifications .....	40
1.03	Revisions, Amendments or Additions .....	40
1.04	District Control.....	40
1.05	Organization and Interpretation of Specifications.....	40
1.06	Definitions .....	40
1.07	Abbreviations .....	41

**CHAPTER 2 - DESIGN PROVISIONS**

<u>Section</u>	<u>Title</u>	
2.01	Planning Considerations	42
2.02	Minimum Size.....	42
2.03	Minimum Depth.....	42
2.04	Minimum Slopes .....	42
2.05	High Velocity Protection .....	43
2.06	Alignment.....	43
2.07	Pipe Alignment in Manholes .....	43
2.08	Manhole Location .....	43
2.09	Manhole Details .....	43
2.10	Relation to Water Mains .....	45
2.11	Stream and Drainage Channel Crossings .....	45
2.12	Railroad and Highway Crossings .....	45
2.13	Service Lines (Building Sewers) .....	46
2.14	Pump Station Design Parameters.....	46
2.15	Sanitary Sewerage Plan Submittal Requirements .....	47
2.16	Sewage System and Trench and Foundation Drains.....	48

**CHAPTER 3 - PIPE AND MANHOLE MATERIALS**

<u>Section</u>	<u>Title</u>	
3.01	PVC Pipe and Fittings (Polyvinyl Chloride).....	49
3.02	Ductile Iron Pipe .....	50
3.03	Manholes .....	50
3.04	Cast-in-Place Concrete.....	51
3.05	Castings .....	51
3.06	Steps	51
3.07	Cement Mortar .....	52
3.08	Cement Grout .....	52
3.09	Non-Shrink Grout .....	52
3.10	Dampproofing Material .....	52

## CHAPTER 4 - PIPE INSTALLATION

<u>Section</u>	<u>Title</u>	
4.01	Earthwork .....	53
4.02	Pipe Laying .....	55
4.03	Fittings, Couplings, Wyes and Saddles .....	55
4.04	Service Lines .....	55
4.05	Manholes .....	56

## CHAPTER 5 - TESTING OF PIPELINES AND APPURTENANCES

<u>Section</u>	<u>Title</u>	
5.01	Infiltration.....	58
5.02	Air Test.....	58
5.03	Alignment Testing.....	59
5.04	Deflection Tests.....	59
5.05	Vacuum Tests.....	60
5.06	Internal Video Inspection.....	60

## STANDARD DRAWINGS

<u>No.</u>	<u>Title</u>	
1	Pipe Bedding	
2	Standard Sanitary Sewer Manhole	
3	Shallow Sanitary Sewer Service Line Encasement	
4	Typical Precast Manhole Detail	
5	Manhole Ring and Cover Adjustment	
6	Sanitary Sewer Main Cleanout	
7	Sanitary Sewer Service Connection	
8	Grease Interceptor	
9	Sand / Oil Separator	

## PART I

### WATER SYSTEM STANDARD SPECIFICATIONS Distribution System Design and Layout

- 1.01 General. The purpose of this chapter is to provide information for the design and layout of a water distribution system acceptable to the District.
- 1.02 Quality of the Distribution System. The purpose of these Standard Specifications is to ensure that only proven high quality materials are installed using first class workmanship. Determination of the best materials and constructions methods are based upon lowest life cycle costs, not upon lower initial costs. Sizing and layout of the system are parts of the total consideration of design, operation and maintenance of a water supply system that yields optimum quality service at the lowest total cost to the customer.
- 1.03 Sizing of Distribution Mains. All mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area requesting service and shall meet the following requirements:

The District reserves the right to size mains to provide service for projected future needs. In business and industrial areas main sizes may be increased in adherence to the recommendations of the Insurance Services Organization to provide adequate fire flows.

Planned Building Groups may be treated the same as Industrial and Business areas because of the high fire risk.

All water mains shall be sized in accordance with the following criteria:

- Flow velocity shall not exceed two feet (2') per second on a peak day demand day.
- Flow velocity shall not exceed five feet (5') per second on a peak demand day during fire flow conditions. Fire flow requirements shall be determined by the Fire Protection District and submitted to the District in writing.
- Minimum design pressure shall be thirty-five (35) PSI, maximum design pressure shall be one hundred and twenty (120) PSI for all flow and static conditions.
- Minimum diameter of water mains is eight inches (8") wherever fire hydrants are connected. Smaller lines may be accepted only where no fire hydrants are located upon approval by the District Engineer.

1.04 Fire Protection.

- a. Fire Hydrants. The number and location of fire hydrants in a given area is determined by the District. Normal practice is to install fire hydrants on the corners of street intersections. If fire hydrants are to be installed at locations other than street intersections, they shall be located on lines which are established by extending property lot sidelines into the streets. Any other proposed location must be approved by the District. See Standard Drawing No. 1.

Fire hydrant branch lines shall be set at right angles to street mains. The hydrant shall be set at the end of the branch line and shall face the branch line. No horizontal or vertical bends or offsets shall be used in installing fire hydrant branch lines unless approved by the District. Under no circumstances shall any size or manner of tap be made on a fire hydrant branch line between the hydrant and hydrant valve.

- b. Private Mains. When required in business, industrial and building group areas where increased fire protection is necessary, private fire mains and hydrants may be needed. Location of these facilities to be determined and approved by the District.

Private mains shall be treated as large service lines and will require valves to be installed at the



connection point to the "District Main" and at the property line. Domestic service, irrigation and/or fire sprinkler lines may be extended to the buildings and area providing all service line and meter installation requirements are complied with.

All private main extensions shall be limited to single platted lots. Extensions will not be allowed to cross lot lines for the purpose of serving two or more platted lots and building complexes. Responsibility for a private main must remain with one property and one ownership.

Private main extensions, to include fire hydrants, shall be installed in accordance with these Specifications and shall be inspected by the District.

- 1.05 Pumping Facilities. Booster pumping facilities may be allowed on mains supplying water from the District Distribution System only where specifically authorized by the District. The District will prohibit the installation of pumping facilities where, in its opinion, such installations would be injurious to the operation, or future operation, of the District's system.

All proposed booster pumping facilities shall be considered as a special feature and will be dealt with on an individual case basis. This may include pressure testing of the total installation when determined necessary by the District.

- 1.06 Storage Facilities. Water storage reservoirs are required throughout the distribution system to maintain adequate supply during peak demand periods. Storage reservoirs may also be required adjacent to and on the suction side of pumping facilities. The size, location and type of storage reservoirs shall be determined by the District. All proposed storage facilities shall be considered a special feature and will be dealt with on an individual case basis.

- 1.07 Layout of the Distribution System.

Width Requirements for District Installations. All District mains shall be installed in dedicated public streets of 50 feet minimum width. When the District determines it is not possible or feasible for an installation to be made in a dedicated street, the installation shall be made in a right-of-way or easement. The conditions under which such an exception will be allowed will be determined for each individual case, and only rights-of-way and easements which conform to the requirements of the District will be accepted. The minimum width right-of-way or easement which will be accepted by the District is a twenty foot (20') exclusive or a forty foot (40') non-exclusive right-of-way or easement. If at the determination of the District, it is not feasible to meet the above requirements, installations may be made in streets, alleys, rights-of-way or easements of other widths when authorized by the District Manager.

Dedicated Streets. Pipe alignment shall be parallel to property lines. Normal practice is to lay the pipe on the south side or the west side of the street, 10 feet from the center line of the street. In any case, pipe alignment shall always be within an established roadway, between the limits of the curb and gutter. Minimum clearance for the edge of the gutter pan shall be 4 feet in all cases.

Fire Hydrants. All fire hydrants will be installed within dedicated streets or in the rights-of-way or easements as herein above defined. See Standard Drawing No. 1. Fire hydrants shall be installed only at location designated by the District.

- 1.08 Line Valves. Line valves are required approximately every 400 feet in the distribution system. Where blocks exceed 400 feet in length, one or more line valves may be required between intersections. Street intersections carrying heavy traffic, or containing major water distribution mains in both directions may require as many as four (4) valves, one in each direction. All tee intersections of distribution mains, with the exception of hydrant tees, will require a minimum of two (2) line valves. Where necessary, the Inspector shall require the installation of additional line valves in order to avoid exposing existing customers to high chlorine residual during disinfection of pipelines. See Standard Drawing No. 2.

- 1.09 Connections to Mains for Fire Sprinkler Lines. Sprinkler heads found in hotels, motels, public assembly places, warehouses, etc. are supplied by a fire line. The fire line shall be sized by the persons responsible for the structure it protects. The District will not size fire lines.

1.10 Clearance and Encasement Design for Sanitary Sewer Crossings. Normal design and construction practice shall provide for at least 24 inches separation between the crown of a sewer pipe and the bottom of the water main where the water main is laid over or above a sanitary sewer. Where a sewer passes over or is less than 24 inches under a water main, one of the following design and construction procedures shall be followed:

- a. One length of pipe at least 20 feet long shall be constructed in the sewer and centered over or under the water main. Joints between the sewer pipe and the special pipe should be encased in a concrete collar at least 6 inches thick and extending at least 6 inches either side of the joint. This shall be in addition to the use of a pre-manufactured adapter coupling such as a Mission, Fernco or Caulder coupling with stainless steel tightening bands.
- b. Reinforced concrete encasement shall be installed around the sewer pipe. In general, the encasement shall be a minimum of 12 inches thick and extend a distance of 10 feet either side of the center of the water main.

Where water mains pass under sewers in addition to one of the two items above, the following shall be accomplished to provide protection:

- a. A vertical separation of at least 24 inches between the invert of the sewer and the top or crown of the water main.
- b. Adequate structural support for the sewer pipe to prevent excessive deflection of joints and settling on and breaking the water main.

As previously stated in these Specifications, parallel installations of water mains with sanitary sewer shall provide for a 10 foot horizontal separation. Where special conditions exist which prohibit a horizontal separation of 10 feet, a water main may be laid closer to a sanitary sewer provided that:

- a. It is constructed in a separate trench with undisturbed soil material between the water main and the sewer main.
- b. The elevation of the crown of the sewer is at least 24 inches below the bottom of the water main pipe. Such separation shall be undisturbed or compacted soil material.
- c. Where a minimum of 24-inch vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction.

## Materials

- 2.01 Materials and Testing. Detailed technical specifications for purchase or approval of materials are included in this chapter. All materials shall conform to this Specification and to all limitations on acceptable makes and styles.

All materials furnished shall be new and undamaged. Everything necessary to complete all installations in accordance with the Standards of the District shall be furnished and installed whether shown on approved drawings or not; and all installations shall be completed as fully operable, functioning parts of the District's system.

Acceptance of materials, or the waiving of inspection thereof, shall in no way relieve the applicant of the responsibility for furnishing materials meeting the requirements of the Specifications.

New water industry products or materials will be tested, if it is the opinion of the District that the product or material has some merit. The District will establish the criteria for testing or evaluating the product. The District reserves the right to accept or reject any product or material regardless of the test results.

- 2.02 Size of Mains. The size of mains shall be in accordance with Section 1.03 of these Specifications.
- 2.03 Distribution System Piping. The District has established minimum design safety factors and materials for system piping. The following minimum AWWA pressure classes for acceptable types of pipe are required:

a. Pipe Pressure Classes/Rating

Ductile Iron Pipe (DIP)

Class 350, all system pressures up to 30"

Meet requirements of AWWA Standard C151

Polyvinyl Chloride Pipe (PVC)

AWWA C900, DR14 greater than 130 psi, less than 175 psi static pressure (12 inches or less)

AWWA C900, DR 18 less than 130 psi static pressure (12 inches or less)

AWWA C905, DR 25 (12" or greater)

b. Ductile Iron Pipe

1. General. All ductile iron pipe shall be manufactured in accordance with AWWA Standard C151 and ANSI A21.51 "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids," with the following additional requirements or exceptions.
2. Size of Pipe. This specification shall cover ductile iron pipe in 4-inch, 6-inch, 8-inch, 10-inch, 12-inch, 16-inch, 20-inch, 24-inch, and 30-inch nominal diameters.
3. Joint Type. "Push-on single gasket" type conforming with applicable requirements of AWWA Standard C111 and ANSI A21.11, "Rubber-Gasket Joints for Ductile-Iron and Cast-Iron Pressure Pipe and Fittings."
4. Class and Type. Pipe furnished under this specification shall conform to the following thickness classes as a minimum:  

4" - 30" Diameter: Class 350
5. Pipe Length. Pipe furnished under this specification shall have normal laying lengths of either 18 feet or 20 feet. Random lengths are not acceptable.
6. Material Strength. Iron used in the manufacture of pipe furnished under this specification shall have 60/42/10 physicals.
7. Cement Mortar Lining. Pipe furnished under this specification shall have standard thickness

cement mortar linings in accordance with AWWA Standard C104 and ANSI A21.4, "Cement-Mortar Lining For Ductile-Iron Pipe and Fittings for Water."

c. Polyvinyl Chloride Pipe

1. General. All polyvinyl pipe shall be manufactured in accordance with AWWA Standard C900, "Polyvinyl Chloride (PVC) Pressure Pipe, 4-Inch Through 12-Inch, For Water," with the following additional requirements or exceptions. For PVC pipe sized 15" through 24", pipe shall be manufactured in accordance with AWWA Standard C905.
2. Size of Pipe. This specification shall cover polyvinyl chloride pipe in 4-inch through 24-inch nominal diameters with ductile iron equivalent outside diameters.
3. Joint Type. Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint.
4. Pipe Length. Each length of pipe will be a standard laying length of 20 feet. Random lengths shall not be acceptable.
5. Manufacturer. The only PVC pipe approved for installation within the District's water distribution system shall be:
  - (a) JM Eagle, municipal PVC water pipe, DR-25, DR-18 and DR-14, meeting specifications AWWA C-900 & C-905, NSF 61 approved, minimum Cell Class 12454, ASTM Resin Specification D-1784.
  - (b) Diamond Plastic Corporation, municipal PVC water pipe, DR-25, DR-18 and DR-14, meeting specifications AWWA C-900 & C-905, NSF 61 approved, minimum Cell Class 12454, ASTM Resin Specification D-1784.
  - (c) North American Pipe Corporation, municipal PVC water pipe, DR-25, DR-18 and DR-14, meeting specifications AWWA C-900 & C-905, NSF 61 approved, minimum Cell Class 12454, ASTM Resin Specification D-1784.

2.04 Pipe Fittings. All ductile iron fittings used in the District's water distribution system shall meet the latest AWWA Standard C110 and ANSI A21.10 or AWWA Standard C153 and ANSI A21.53.

All fittings shall be furnished with mechanical joint ends and shall conform to the following:

- a. General. All ductile iron fittings shall be manufactured in accordance with the following AWWA Standards: C104, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water"; C110, "Ductile Iron and Gray Iron Fittings, 3-Inch Through 48-Inch for Water and Other Liquids"; C111, "Rubber-Gasket Joints for Ductile-Iron and Cast-Iron Pressure Pipe and Fittings"; C153, "Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids"; with the following additional requirements or exceptions.
- b. Cement Mortar Lining. All sizes of ductile iron fittings shall be furnished with a cement-mortar lining of standard thickness as defined in referenced specifications and given a seal coat of bituminous material and remain in accordance with AWWA standard C104
- c. Type of Joint. All fittings shall be furnished with mechanical joint ends conforming to referenced specifications.
- d. Thickness Class. All fittings shall be 350 psi pressure rating and shall conform to the dimensions and weights shown in the tables of referenced specifications.
- e. Material. All fittings shall be made from ductile iron. No PVC joints will be allowed.

2.05 Gate Valves. Gate valves shall be the same size as the main. Valves shall open to the left (counterclockwise). Gate valves shall conform to the following:

- a. General. All valves shall be manufactured in accordance with AWWA Standard C509 with the following additional requirements or exceptions.
- b. Valve Description. Valves shall be resilient wedge, ductile iron body, fully bronze-mounted, with non-rising stem, resilient seat and epoxy lined.
- c. Service. All valves shall be suitable for frequent operation as well as service involving long periods of inactivity. The operating pressure for all sizes shall be 200 psi. If valve is larger than 14", it shall meet the requirements of AWWA Standard C515 and be modified to meet 250 psi working pressure.
- d. Valve Stems. Valve stems shall be threaded so that the valve can be opened by turning to the left (counterclockwise). The stem shall be non-rising and be sealed with "O" ring packing. All valves shall be equipped with a 2-inch square wrench nut.
- e. Extension Stems. Provide wherever operating nuts are 5 feet or more below grade. The stems shall consist of solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem. Connect to valve by flexible socket coupling bolted through the extension and operating nut on the valve.
- f. Types of End Connections. All valves shall have a mechanical joint end with gasket, gland and fasteners conforming to the ANSI A21.11 (AWWA Standard C111, "Rubber-Gasket Joints for Ductile-Iron and Cast-Iron Pressure Pipe and Fittings"). Plain rubber gaskets shall be used except that in certain conditions, the District may require the use of special rubber gaskets.
- g. Manufacturer. Because of the problems associated with stocking repair parts for all makes of valves, only the following makes are acceptable for use in the District's distribution system:

New Style Mueller  
M&H  
Waterous (Series 2500)

2.06 Valve Boxes. All buried valves shall be provided with a 6-inch cast iron valve box, slip type. The valve box shall be of a design which will not transmit shock or stress to the valve and shall have enough extension capability to be raised to final street grade. Valve boxes shall conform to the following:

- a. General. The manufacturer of valve box components shall be experienced in their design and construction, shall be regularly engaged in their manufacture and shall have produced valve boxes which have given successful service for a period of at least five (5) years. See standard drawing No. 3
- b. Materials. Valve box parts shall be made of gray cast iron.  
  
Use of an aluminum alloy as a casting material is not acceptable.
- c. Approved Patterns. Valve boxes shall be the three-piece adjustable slip type and only the following pattern acceptable:  
  
Tyler Slip Type 6-Inch Cast Iron Valve Box Assembly Series 6855 or equal.
- d. Coating. Box, cover and base coated by dipping in asphalt varnish.
- e. Cover. Deep socket type with the word "WATER" cast in top for water applications.

2.07 Fire Hydrants. Within the District's distribution system where maintenance, repair, replacement, and parts stocking is the responsibility of the District, only one (1) hydrant as listed is acceptable.

a. General. All fire hydrants shall be designed and manufactured in strict compliance with AWWA Standard C502, "AWWA Standard for Dry-Barrel Fire Hydrants." All references made in this specification are to the above standard unless otherwise noted.

b. Acceptable Brand and Service Limitations:

Mueller Super Centurion 200 - Static Pressure Less than 200 PSI

c. Size of Hydrant. Hydrants shall have a main valve opening size of 5-1/4 inches and shall be ordered for a 5-foot 6-inch bury unless otherwise approved by the District or designated otherwise on the drawings.

Hydrant bury will be measured from the bottom of the hydrant lateral pipe to finish grade line. Hydrant bury shall be adjusted to provide the minimum required cover on all portions of the hydrant lateral piping.

d. Type of Hydrant. All hydrants shall be the traffic model type. Hydrants shall be the three-way type with one (1) pumper nozzle and two (2) hose nozzles all located on the same horizontal plane.

e. Inlet Connection. Hydrant base shall be provided with a mechanical joint inlet to accommodate 6-inch diameter ductile iron pipe, all in accordance with ANSI A21.11 (AWWA Standard C111, "Rubber Gasket Joints for Ductile-Iron and Cast Iron Pressure Pipe and Fittings"). Incorporated into the base shall be two (2) lugs for rodding or strapping of pipe.

f. Main Valve Assembly. The main valve of the hydrant shall be 5-1/4-inch diameter compression type which closes with the water pressure.

Gasket for valve shall be a replaceable type fabricated of a resilient material, with a threaded bottom plate or nut, complete with seal to prevent leakage of the hydrant shaft.

The valve assembly shall include one or more drain valves which will work automatically with the main valve and drain the barrel when the main valve is in the closed position.

All parts of the main valve assembly shall be so designed that removal of the assembly from the barrel is accomplished without excavation in accordance with Section 3.10 of these specifications.

g. Operating Shaft Nut. The operating nut shall have a pentagon cross section. Bushings in the bonnet shall be so constructed that it will prevent the operating nut from traveling during opening or closing operation; the bushing shall house a gasket or seal to prevent moisture or foreign material from entering the lubricant reservoir.

The hydrant shall open by turning the operating nut to the left in a counter-clockwise direction and shall have an arrow on top of the bonnet to designate the direction of opening.

h. Pumper Nozzle and Cap. The pumper nozzle shall be 4-1/2 inch nominal diameter with four threads per inch (National Standard). Threads shall be right-hand.

Nozzle cap shall be furnished with a synthetic rubber gasket installed in a retaining groove and the dimensions and shape of the nozzle cap nut shall be the same as the operating shaft nut.

Nozzle caps shall be furnished with security chains with one end of each securely attached to the upper barrel section of the hydrant.

All nozzle caps shall be removed by turning counterclockwise.

- i. Hose Nozzles and Caps. The two hose nozzles shall be 2-1/2 inch nominal diameter with seven and one-half threads per inch (National Standard). Threads shall be right-hand. Each hose nozzle shall include a nozzle cap with nut, security chain and shall be removed by turning counterclockwise.
- j. Color. The upper exposed section of the hydrant above ground shall be painted Rustoleum 1210 - Fire Hydrant Red or equal. The buried portion of the hydrant shall be given a bituminous coating in accordance with Section 681 of AWWA Standard C106.

2.08 Corrosion Protection Systems. The testing of the corrosiveness of the soil which a water main passes through may be required by the District. If so required, the testing shall be accomplished by the Applicant. The need for protection will be determined by the District based on the information submitted by the Applicant and/or other information available to the District.

a. Polyethylene Encasement Material. If determined by the District as a requirement, the pipe, fittings, rods, and appurtenances shall be wrapped in polyethylene in accordance with Section 3.26. Polyethylene Material shall conform to the following:

- (1) General. A polyethylene encasement material shall be manufactured in accordance with AWWA Standard C105, "Polyethylene Encasement For Gray and Ductile Cast-iron Piping For Water And Other Liquids," with the following additional requirements or exceptions.
- (2) Materials. The raw material used to manufacture polyethylene film shall be Type 1, Class A, Grade E-1, in accordance with A.S.T.M. Standard Designation D-1248.

Tensile Strength	1200 PSI minimum
Elongation	300% minimum
Dielectric Strength	800 V/Mil Thickness minimum
Thickness	0.008" (8 mils) minimum Nominal with minus tolerance not exceeding 10% of nominal
Melt Index	0.4 maximum

b. Cathodic Protection.

- (1) Where DIP is used the entire pipe and fitting system shall be bonded continuously. A minimum of 17 lbs (sacrificial anode) per 400 feet of distribution line is required at separation not to exceed 400 feet. Additionally fire hydrant sets and fitting and/or valve clusters must have a minimum of 9 lbs (sacrificial anode) per grouping with groupings not to exceed 4 fittings/valves. See standard drawings.
- (2) Where PVC is used each fitting requires a minimum of 1 lb (sacrificial anode) per each fitting. Additionally, fire hydrant sets must have a minimum of 9 lbs (sacrificial anode). If fitting groups are bonded, each grouping must have a minimum 9 lbs (sacrificial anode) per grouping with groupings not to exceed 4 fittings/valves. See standard drawings.

2.09 Concrete Thrust Blocks, Anchors and Structures. Concrete thrust blocks and anchors shall be sized for the internal pipe pressure and soil bearing capacity. Standard sizes and shapes of thrust blocks and anchors are shown on Sheets 8 of the Standard Drawings.

Thrust reaction blocking shall be concrete of a mix not leaner than 1 part cement to 2-1/2 parts sand and 5 parts stone, and having a compressive strength of not less than 3000 psi after 28 days. See Section 3.20 of these Specifications. The concrete and any required reinforcement shall meet the following criteria:

a. Materials:

Cement. All cement used shall be Portland Cement acceptable under the "Standard Specifications and Tests for Portland Cement," ASTM Designation C150 of the American Society for Testing and Materials. Cement used shall be Type II.

Aggregates. All the fine and coarse aggregates shall meet soundness requirements, deleterious substance limits and grading limits as set forth in the latest edition of "Standard Specifications for Concrete Aggregates" ASTM Designation C33. The limits for deleterious substances and physical property requirements of the coarse aggregates shall be selected for the applicable class designation from those listed under severe weathering regions, Table 3, ASTM Designation C33. The maximum size aggregate that is practical for the structure design and placing conditions shall be used in the concrete.

Water. The water used in all concrete shall be free from objectionable quantities of silt, organic matter, alkali, salts, and other impurities.

Admixtures. An air-entraining agent shall be used in all concrete. The agent used shall conform to "Standard Specification for Air-Entraining Admixtures for Concrete," ASTM Designation C260. The amount of air-entraining agent used shall be such as will affect the entrainment of  $5\% \pm 1\%$  of volume of the concrete.

A water-reducing admixture (WRA) may be used unless otherwise noted by the District. The admixture shall conform to ASTM Designation C494 for Type A or Type D chemical admixture, shall contain no calcium chloride, and shall be compatible with the cement being used.

The Contractor shall be responsible for any difficulties arising or damages occurring as a result of the selection and use of any admixture such as a delay or difficulty in concrete placing or damage to concrete during form removal.

b. Concrete Quality. All Concrete shall have a minimum 28-day compressive strength of 3,000 psi and a maximum slump of 4 inches.

c. Testing. When determined necessary by the District, field control tests consisting of aggregate gradation tests, slump tests, air content tests, and making compression test cylinders, shall be performed by qualified personnel in the presence of the Inspector.

d. Concrete Reinforcement. Reinforcements shall be accurately formed and shall be free from loose rust, scale and contaminants which reduce bond. Unless otherwise shown on the drawings or specified herein, all requirements shall conform to the latest ACI Standard 318 and the International Building Codes.

Reinforcements shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips.

e. Reinforcement Material. All deformed reinforcing bars shall conform to ASTM Standard A615, Grade 60.

2.10 Mechanical Joint Restraint. Mechanical joint pipe restraints may be used for restraining fittings, valves and hydrants to reduce the installation of concrete reverse anchors, thrust reaction blocks and/or steel tie rods; however, anchors, thrust blocks and/or tie rods will still be required where indicated on plans and standard drawings.

a. When mechanical joint pipe restraints are installed on ductile iron pipe, the length of pipe to be restrained shall be determined in accordance with the "Ductile Iron Pipe Research Association" (DIPRA) Recommendations, "Thrust Restraint Design for Ductile Iron Pipe." See Standard Drawings Nos. 14 and 15.

Ductile iron pipe shall be restrained with Series 1100 mechanical joint ductile iron retainer glands



manufactured by EBAA Iron Sales, Inc. or an approved equivalent.

- b. Polyvinyl chloride (PVC) pipe may be restrained with the use of mechanical joint restraints subject to approval of the District. Refer to Standard Drawings for typical installation details.

PVC pipe mechanical joint restraints shall be series 2000 PV Megalug Retainer Glands manufactured by EBAA Iron Sales, Inc. or an approved equivalent.

2.11 Casing Pipe. Installation of mains through rights-of-way or easements of others, such as highways, railroads, etc., may require casing pipes for bores. The type of casing material and its properties will be specified by the agency granting permission to cross. Such crossing shall be subject to approval by the District to avoid conflicts in requirements or standards between the District and the persons or agency granting permission to cross. See Section 3.24 of these Specifications.

2.12 Responsibility for Materials.

- a. Material Furnished by Contractor. The Contractor shall be responsible for all material furnished by him/her and shall replace at his/her own expense all such material found defective or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work and materials found defective during the warranty period.
- b. Responsibility for Safe Storage. The Contractor shall be responsible for the safe storage of material furnished by or to him/her, and accepted by him/her and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

2.13 Handling of Materials.

- a. Hauling of Materials. All materials furnished by the Contractor or to the Contractor shall be delivered and distributed at the job site by the Contractor.

All pipe, valves, fittings, hydrants and accessories shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe shall not be skidded or rolled against pipe already unloaded.

- b. Unloading at the Site of Work. When distributing the material at the site of work, each piece shall be unloaded opposite or near the place where it is to be installed in the trench.
- c. Care of Coatings and Linings. All materials shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the replacement or repair of the damaged material shall be done to the satisfaction of the District. All material handling equipment and material handling methods shall be approved by the District.

2.14 Pressure Accessories.

- a. Pressure Gauges.

- |                  |  |
|------------------|--|
| 1. Type:         | Dial, liquid filled                                |
| 2. Range:        | Downstream: 0 to 150 psi<br>Upstream: 0 to 300 psi |
| 3. Accuracy:     | 3% full scale range                                |
| 4. Dial size:    | 3-1/2" diameter                                    |
| 5. Accessories:  | Isolation ball valve on nipple; snubbers on nipple |
| 6. Design basis: | U.S. Gauge P580L-1                                 |

## **Pipe Installation**

- 3.01 **Approval by the District.** Throughout these Specifications many handling and installation procedures, tools, equipment, and materials will require approval by the District. Approval by the District shall in no manner render the District liable for any injuries suffered or equipment damaged. Approval by the District is used solely as a means to insure quality control and safety.

Safety of workers shall be provided as required by the Occupational Safety and Health Act (OSHA). The Contractor is solely responsible for job safety.

- 3.02 **Handling of Materials.** Pipe and fittings shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall such material be dropped. If, however, any part of the coating or lining is damaged, the replacement or repair of the damaged pipe shall be done to the satisfaction of the District. Any pipe or fittings that are not acceptable to the District shall be removed from the job site immediately. All pipe handling equipment and pipe handling methods shall be approved by the District in conjunction with the methods and equipment recommended by the manufacturer.

- 3.03 **Inspection and Preparation of Pipe and Fittings.** Before placing pipe in the trench, each pipe or fitting shall be thoroughly cleaned of all foreign material, kept clean at all times thereafter, and carefully examined for cracks and other defects before installation. Bell ends and spigot ends are to be examined with particular care. Defective pipe or fittings shall be laid aside for inspection by the District Inspector who will prescribe corrective repairs or rejection.

All lumps, blisters and excess coating shall be removed from the bell-and-spigot end of each pipe and fitting, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, dry and free from oil and grease before the pipe or fitting is installed. Dirt and any other material must be removed from the barrel of the pipe before installation.

- 3.04 **Cutting and Fitting of Pipe.** Pipe shall be cut, whenever necessary, to conform to location of fittings, line or grade. All cuts shall be straight and true, and in a workmanlike manner so as to leave a smooth end without damaging the pipe or its cement lining. All burrs shall be removed from the ends of cut pipe, and the end lightly rasped or filed. All tools used in cutting pipe shall be approved by the District.

- 3.05 **Pipe Joint Lubrication.** Joint lubricant shall be supplied by the pipe manufacturer, and approved by the District. Joint lubricant shall be non-toxic, and water soluble.

- 3.06 **Pipe Alignment and Grade.** In laying pipe, the intent is to lay to a set line and grade within a tolerance of 3 inches plus or minus. On slopes of zero grade, the intent is to lay to grade. Fittings, valves and hydrants shall be installed at staked locations and elevations; spigots centered in bells; and all valve and hydrant stems plumb.

In new developments, street right-of-way and/or property line and lot corner points must be set and in visible evidence before water installations can proceed. In existing areas sufficient right-of-way, property or easement delineation must be recovered or established before water installation can proceed. Offset stakes for alignment and grade shall be set by the Contractor's, Owner's or Developer's engineer. Any replacement of stakes shall be at the expense of the Contractor, Owner or Developer.

When laying pipe on curves, the intent is to lay to the staked alignment. The pipe shall be kept in alignment by placing all deflecting joints or bends on the curve. Short lengths shall be used as necessary to accomplish the curvature without exceeding individual deflections specified by the District. See Standard Drawing No. 10. Bends shall be used whenever individual deflections exceed those specified by the District.

For pipes with an internal diameter of 10 inches or less, the depth of fill over the pipe measured from the proposed finish grade over the pipeline to the top of the pipe shall be a minimum of 4.5 feet and maximum of 5.5 feet unless otherwise specified. All pipes with an internal diameter of 12 inches or more shall be installed to the depth shown on the required plan and profile drawings.

If difficulties arise when crossing an interference and where specifically approved by the District or its Inspector, deviations from the above minimum and maximum depths of cover may be permitted.

Any changes in alignment and grade must be authorized by the Inspector and shall be accomplished by the installation of additional fittings. "Breaking" of joints is permitted only when installing pipe on horizontal or vertical curves.

Pipe shall be laid with the bell ends facing in the direction of laying, unless directed otherwise by the District. Where pipe is to be installed on a grade of ten percent (10%) or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.

3.07 Deviation From Alignment and Grade Occasioned by Other Structures. Whenever obstructions not shown on the plans interfere to such an extent that alteration in the plans is required, the District shall have the authority to determine the best method of correction. The District may order a deviation from the line and grade of the structures and/or removal, relocation and reconstruction of the obstructions.

3.08 Temporary Bulkheads. Whenever the pipe is left unattended, temporary plugs shall be installed at all openings. Temporary plugs shall be of such design as to prevent water, debris, children and animals from entering the pipe. All temporary plugs shall be provided by the Contractor and approved by the Inspector.

3.09 Frost. No pipe or appurtenant structure shall be installed upon a foundation into which frost has penetrated, or at any time when the Inspector deems there is danger of ice formation or frost penetration at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

3.10 Earthwork. See standard drawing No. 9 for typical pipe trench and earthwork requirements.

a. Embedment Materials. All water and sanitary sewer mains are to receive one of the following embedment materials extending from the bottom of the excavation to 12 inches over the pipeline.

- (1) Concrete. The pipeline embedment with concrete shall utilize concrete having a 28-day compressive strength of a minimum of 3000 psi and other characteristics as set forth in these Specifications.
- (2) Granular Material. Well-graded, crushed stone or gravel meeting the requirements of ASTM C33, Gradation 67 (3/4" to No.4).
- (3) Fine Granular Material. Natural or manufactured sand meeting the following requirements:

**Well-Graded Sand**

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	10 – 30
No. 100	2 - 10

(4) **Squeege Sand**

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8 inch	100
No. 200	0 - 5

- (5) **Selected Backfill.** Selected soil free from rocks, clods or stones greater than 1-1/2" in any dimension as approved by the District's representative. Granular material, fine granular material or squeege sand may be substituted for selected backfill.

b. **Backfill Materials**

- (1) **Suitable Material.** Soil obtained from the excavation that is free of frozen material, stumps, roots, brush, other organic matter, debris and other items. In addition, suitable material shall meet the following requirements:
- (2) **Upper Portion of Trench.** Material placed within one (1) foot of pavement subgrade or finished surface in unimproved areas shall be soil free from rocks, greater than 6 inches in nominal diameter.
- (3) **Other Portions of Trench.** Material within 6 inches below and 12 inches above the pipe shall contain particles of a size to conform to the embedment class required but in no case shall it contain rocks greater than 1-1/2 inches in any dimension. From a point 12 inches above the pipeline to within one (1) foot of the pavement subgrade or finished surface in unimproved areas, maximum size of any rock in the trench backfill shall be 18 inches nominal diameter.
- (4) **Public Highways.** Provide and install material in conformance with the Colorado Department of Transportation requirements where they do not conflict with other provisions of these regulations. Should a conflict exist, submit a request for clarification to the District in writing prior to proceeding with work.
- (5) **Flowable Fill.** At the District's option, or if required by the right-of-way's governing body, utility trench backfill meeting the following requirements (flowable fill), may be used in lieu of native backfilling in any excavation regardless of width or depth. Concrete slurry type full depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

**FLOWABLE FILL SPECIFICATIONS**

<b><u>Ingredient</u></b>	<b><u>lbs / cubic yard</u></b>
Cement	43 (0.47 sack)
Water	325 (39 gallons or as needed)
Coarse Aggregate (Size #57)	1700
Sand (ASTM C-33)	1845

c. **Trench Backfilling and Compacting**

- (1) Place backfilled material above embedment materials in a manner to prevent damage or misalignment of the pipeline. Place in lifts of a thickness necessary to acquire the specified backfill density or in conformance with other regulatory requirements. Backfilled material shall conform to the requirements of Section 3.10.b of these specifications.
- (2) **Backfill Density Requirements.** Unless otherwise specified or required by local governing authority, all backfill should be placed in a manner to achieve the density specified below.

- State Highway  
100% of maximum in shoulder areas  
Flowable Fill within all paved areas
- Paved roadways, sidewalks and other areas to receive pavement  
95% of maximum density for entire trench depth
- Gravel roadways  
95% of maximum density for entire trench depth
- Sodded or lawn areas over a dedicated easement or right-of-way  
90% of maximum density
- Zone 6" below to 12" above pipe  
95% of maximum density for all pipelines
- Adams / Arapahoe County  
100% of maximum in paved areas parallel to traffic  
95% in shoulder areas  
Flowable Fill in paved areas perpendicular to traffic

d. Field Quality Control

- (1) Density Testing and Control. Density testing as may be required by the District's representatives shall be the responsibility of the Contractor and/or Developer. Results of such density testing shall be reported directly to the District by the testing agency. All reports shall be submitted with the seal and signature of a registered professional engineer experienced in the testing of soil materials.
- (2) Soil Compaction Tests. Conduct in accordance with the requirements of ASTM D698-07 or AASHTO T99, "Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb. Rammer and a 12 inch Drop." Use method A, B, C or D as appropriate on soil condition and judgment of the testing laboratory. Samples tested shall be representative of materials to be placed (or altered). Obtain optimum moisture density curve for each type of material or combination of materials encountered or utilized. Use test results as a basis for compaction control. Testing includes Atterberg Limits, grain size determination and specific gravity.

3.11 Lowering of Material Into the Trench. Proper implements, tools and facilities satisfactory to the District shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and their protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fitting, valve, hydrants or water main accessories in handling, the damage shall be immediately brought to the attention of the Inspector. The Inspector shall prescribe corrective repairs or rejection of the damaged items.

3.12 Laying of Pipe. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, the Inspector may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home with a slow steady pressure without jerky or jolting movements and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space. No wooden blocking shall be left at any point under the pipeline.

No pipe shall be laid when, in the opinion of the District, trench conditions are unsuitable.

3.13 Ductile Iron Pipe. There is only one nominal dimension of the spigot outside diameter and the bell inside diameter for each size of push-on joint pipe. In some existing older pipelines, some variation in outside spigot diameter may exist. When connecting to an existing line, care should be exercised to ensure that the outside diameter of the existing line is the same as the outside diameter of the push-on joint or mechanical joint pipe being installed, otherwise a special adapter to join the two lines may be necessary.

a. Push-On Joint. Immediately before joining two lengths of ductile iron pipe, the inside of the bell, and the outside of the spigot end, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. The rubber shall be flexed inward and inserted in the gasket recess of the bell socket. Since different manufactured brands of pipe require different types of gaskets, the Contractor shall exercise caution to ensure that the correct type of gasket is used.

A thin film of approved gasket lubricant shall be applied to either the inside face of the gasket, or the spigot end of the pipe, or both.

The spigot end of the pipe shall be placed in the bell end with care to prevent the joint from contacting the ground. Pipe furnished without a depth mark on the spigot end shall be marked before assembly to assure insertion to full depth of the joint. The pipe shall be kept in straight alignment and the joint shall be completed by pushing the pipe home with a slow, steady pressure without jerky or jolting movements by using a forked tool or jack-type tool or other device approved by the District. If pipe is pushed home with a backhoe bucket, a wooden shield must be placed between the backhoe bucket and the end of the pipe. The spigot end of field cut pipe lengths shall be filed, or ground to resemble the spigot end of such pipe as manufactured.

Upon completion of joining push-on joint pipe, an inspection shall be made to assure that the gasket is correctly aligned in the gasket recess of the bell socket and not twisted or turned.

Whenever it is necessary to deflect push-on joint pipe, the amount of deflection shall not exceed the maximum deflections specified by the District. See Standard Drawing No. 10.

b. Mechanical Joint Pipe. Before joining mechanical joint cast or ductile iron fittings to ductile iron pipe, the outside of the spigot, the inside of the bell and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter.

Normal practice is to lubricate the joint with a soap solution; however, in cold weather the joint may be assembled dry if approved by the Inspector. Extreme care should be exercised in making dry joints.

The cast iron gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland.

The pipe shall be pushed in until the spigot end fully penetrates the bell. The gasket shall then be pressed into place within the bell evenly around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting; the bolts inserted and the nuts screwed finger tight, then tightened with a torque limiting wrench. Torques for the various sizes of bolts shall be as follows:

<u>Bolt Size</u>	<u>Ft. Lbs.</u>
5/8 inch	45-60
3/4 inch	75-90
1 inch	85-100
1-1/4 inch	105-120

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce equal pressure on all parts of the gland.

Whenever it is necessary to deflect mechanical joint pipe, the amount of deflection shall not exceed the maximum deflections specified by the District. See Standard Drawing No. 10.

### 3.14 Polyvinyl Chloride Pressure Pipe.

- a. Elastomeric Gasket Joint. Immediately before joining two lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot and the elastomeric gasket shall be thoroughly cleaned to remove all foreign material.

Lubrication of the joint and rubber gasket shall be done in accordance with the pipe manufacturer's specifications.

Care shall be taken that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell or coupling must be in accordance with the manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint.

The spigot and bell or coupling shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion. Upon completion of joining the pipe, an inspection shall be made to assure that the gasket is correctly aligned in the gasket recess of the bell socket and not twisted or turned.

Deflection may not be allowed at the joints of some PVC pipe. When these types of pipe are to be installed, bends shall be used where deflection is required.

Installation of PVC pipe will be in accordance with the manufacturer's recommendation. A solid No. 12 coated copper wire will be attached to all PVC pipe for the purpose of future location. See Standard Drawing No. 7.

- b. Pipe Storage. Pipe stored outside, and exposed to sunlight for more than thirty (30) days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering.
- c. Handling of Pipe in Cold Weather. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling and installing PVC pipe during cold weather.

### 3.15 Installation of Valves. Valves shall be handled in such a manner as to prevent any injury or damage. All joints shall be thoroughly cleaned before installation.

Valves shall be located at the points on the main as indicated on Standard Drawing No. 2, unless specified otherwise by the District.

Valves shall be set and joined to the pipe in the manner previously specified for cleaning, laying and joining push-on and mechanical joint pipe. Valves shall be set in such a manner that the valve stems are plumb. If necessary to provide a firm subgrade or surface on which to install a valve, solid precast concrete blocks or a cast-in-place concrete pad may be placed beneath the valve body. If cast-in-place concrete is used, extreme care shall be taken to assure that flange bolts are not constrained by the concrete. No wood blocking will be allowed.

Valves shall be operated prior to installation to ensure good operating condition.

Where necessary, the Inspector shall require the installation of additional valves not shown on the plans. See Section 1.08 of these Specifications.

### 3.16 Valve Boxes.

- a. Installation. A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve, and shall be centered and plumb over the operating nut of the valve, with the box cover set to the required elevation. It will be the responsibility of the Developer to insure that valve

boxes are plumb and raised to the proper elevation.

Paving of any street requires that all existing valve boxes be located and prepared for final raising to the finish street surface as shown on Standard Drawing No. 3.

- b. Inspection. Prior to paving, a final inspection is required and can be arranged by contacting the District. Inspections should be requested twenty-four (24) hours in advance of need.

- 3.17 Installation of Fittings. All fittings in the District's Water Distribution system shall be mechanical joint in compliance with the material specification. Fittings shall be set and joined in the manner described in Section 3.13.b of these Specifications.

The use of "wyes" in main extensions or private pipe extensions is strictly prohibited except in special installations as directed by the District.

- 3.18 Fire Hydrants.

- a. Installation. All hydrants shall be staked for location and grade. Final location and grade shall be in accordance with the approved drawings. Offset stakes not further than 12 feet from the fire hydrant are acceptable. All hydrants shall stand plumb and be installed as indicated on Standard Drawing No. 1.

Each hydrant shall be connected to the main by a 6-inch branch line. An independent 6-inch gate valve shall be installed on each fire hydrant branch.

No service line connections shall be installed between the fire hydrant and the fire hydrant control valve.

- b. Anchorage. The bowl of each hydrant shall be well braced against the unexcavated earth at the end of the trench with a concrete thrust block. The bottom of the hydrant bowl and the hydrant valve shall be supported with eighteen by eighteen by four inch (18"x18"x4") pre-cast concrete blocking slabs. The hydrant shall be tied to the hydrant valve and the hydrant valve tied to the tee with anchor pipe or with two, 3/4-inch all thread galvanized rods as shown on Standard Drawing No. 1.

Mechanical joint pipe restraints in conformance with Section 2.10 of these Specifications may be used in lieu of all-thread rods.

Whenever a fire hydrant is installed at the termination point of a main extension (such as in a cul-de-sac), then tie rods and concrete reverse anchors will be required for both the fire hydrant valve (which in this case is also a line valve on the main) and the fire hydrant lateral or branch line connected to the fire hydrant. See Standard Drawing No. 1. Additional concrete anchors or tie rods may be required at the direction of the Inspector.

If bends are needed to bring a hydrant to a desired horizontal or vertical position, special concrete reverse anchors, anchor pipe, mechanical joint pipe restraints or all thread tie back rods, or a combination of all these along with a riser may be required. In any case, a riser no longer than 2 feet will be acceptable and it will be the Contractor's responsibility to set the safety flange at the proper grade.

- c. Drainage. Whenever a hydrant is set, drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench, to at least 12 inches above the barrel flange of the hydrant, and to a distance of 12 inches around the elbow. The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be 6 inches. The minimum of rock placed shall be 1/3 cubic yard. The rock shall be a well-graded gravel, cobble, or crushed rock, free of dirt.
- d. Hydrant Protection in Corrosive Soils. In areas where soil resistivity requires corrosion protection, all ductile iron branch lines and hydrants shall be protected. All pipe, rods and fittings, from finished ground level on the hydrant barrel up to and including the tee, shall be encased in polyethylene wrap. The type of polyethylene and manner in which it is to be installed shall conform to Section 3.26 of these Specifications. Bedding material shall be as specified in Section 3.10 of these Specifications. All fire



hydrants to be cathodically protected with a 9 lb anode.

- 3.19 Dead Ends and Blow Offs. All dead ends on new mains shall be closed with cast iron plugs or caps; such dead ends shall be equipped with suitable concrete anchors and blow off facilities.

The Contractor shall furnish, install or remove temporary blow offs at locations shown on the drawings or designated by the District. See Standard Drawing No. 12.

The Contractor shall install permanent blow offs where indicated on the drawings. A permanent blow off is defined as one which will be left in place at the completion of all proposed installations. Refer to Standard Drawing No. 12.

- 3.20 Thrust Blocks and Anchors.

- a. Installation. Thrust blocks and/or anchors shall be constructed at all bends, tees, plugs and fittings which require reaction support due to unbalanced line thrust. Care shall be taken not to block outlets or to cover bolts, nuts, clamps or other fittings or to make them inaccessible. The Standard Drawing No. 8, shows the size and shape of thrust blocks and anchors. Bearing surface areas are minimum areas to bear against the undisturbed trench wall. If in the opinion of the District, the soil bearing capacity is not sufficient to provide adequate restraint based on minimum bearing areas shown on the Standard Drawings, then the minimum bearing area shall be increased to a size that will ensure adequate restraint. In every instance, the thrust block or anchor shall bear against undisturbed earth. When it is impossible, through over excavation or other cause, to pour a thrust block or anchor against undisturbed earth, harness rods or mechanical joint pipe restraints shall be required to anchor the fittings to the main.

Thrust blocks will be required on large taps regardless of whether a tapping sleeve or tapping saddle is used.

All debris, water or ice shall be removed from the place to be occupied by the concrete. Concrete shall not be placed on frozen subgrade. Concrete shall be placed in the presence of the Inspector unless inspection has been waived prior to the placement.

- b. Form Work for Thrust Blocks and Anchors. All forming for concrete thrust blocks and anchors will be done by bulkheading around the shape of the thrust block or anchor with burlap or reinforced paper sacks filled with sand or earth. Sacks shall be of a size easily handled when full, and shall be left in place in the trench. Wood forms may be used in some cases; however, all wood will be removed before backfilling.

No horizontal struts or braces required for trench shoring shall remain in the concrete thrust blocks. Prior to placing concrete, the forms and ditch bank shall be inspected and approved by the Inspector.

- c. Concrete and Curing Time. Thrust blocks shall be concrete of a mix not leaner than 1 part cement to 2-1/2 parts sand and 5 parts stone, and having a compressive strength of not less than 3,000 psi after 28 days.

Minimum curing time for concrete thrust blocks regardless of additives shall be thirty-six (36) hours for anchors containing 2 cubic yards or less, forty-eight (48) hours for anchors containing more than 2 cubic yards but less than 6 cubic yards, and seventy-two (72) hours for anchors containing more than 6 cubic yards but less than 12 cubic yards. Anchors containing more than 12 cubic yards will be cured as directed by the District Inspector. Curing time for anchors having flanged rods or other accessories embedded in them for the purpose of tying pipe and/or fittings directly to the anchor will require approximately twenty-five percent (25%) additional curing time.

No water main will be charged or pressurized without the approval of the Inspector. All thrust blocks and anchors must meet the minimum curing time unless, under certain circumstances, the Inspector may elect to shorten or extend the time of curing.

- d. Compaction of Fill Over Thrust Blocks and Anchors. Backfill may be placed over thrust blocks and anchors once the surface has set sufficiently to resist the weight of the backfill. However, no tamping or compacting shall be allowed above the thrust block or anchor for a minimum of thirty-six (36) hours after placement or as directed by the Inspector.

- 3.21 Vaults. Vaults may be precast or poured-in-place and shall be constructed in accordance with these Standard Specifications. Precast vaults shall be so designed that all joints and corners are waterproof. Precast and poured-in-place vaults shall be made waterproof after construction by use of sealants, epoxies or other approved methods. All dimensions, locations and elevations shall be coordinated by the Developer and Contractor and meet the requirements of the District.

Concrete footers shall be required as indicated on the drawings.

All vaults shall be constructed to meet H.S. 20-44 traffic loading conditions and 300 psf surcharge load.

- 3.22 Harness Rods. Harness rods and lugs shall be used at all bends and fittings where thrust blocks cannot be used due to existing field conditions or where harness rods and lugs are specifically required by these Specifications, installation plans, or the Inspector.

- 3.23 Bridging and Encasement of Pipe. Under certain conditions when the water main is to be installed over or under an existing or proposed utility or structure, the District may require bridging or encasement of the pipe.

If, in the opinion of the District, there exists the possibility of settlement of the pipe being installed over an existing utility or structure, then bridging of the pipe shall become necessary. This condition shall also apply to other underground utilities or structures being installed over existing water mains. The District shall determine the size and location of the concrete bridging. 3.24 Encasement or Sleeve Pipe. Wherever it is necessary to provide an encasement or sleeve for the water main, the water main shall not be inserted into the encasement or sleeve pipe without providing insulating skids for each joint of the water main. Insulating skids shall be of a type such as the "P.S.I. Model A12 Steel Casing Insulators" or equivalent. In addition, no encasement or sleeve pipe shall be installed without protecting the ends of the pipe with adequate open joint masonry which will deter dirt and debris from entering, but at the same time will allow water to escape from the encasement or sleeve pipe. Encasement pipes shall be protected both inside and out with corrosion resistant materials having a bituminous base. Encasement or sleeve pipe, size, length, type and sidewall thickness will be determined by the District.

- 3.24 Connections to the District's System.

- a. Connections. Connections to the District system shall be in a neat and workmanlike manner. An Inspector shall be present at all times during the construction of the connection. The connection is subject to approval by the District. Under no circumstances shall a non-disinfected main, which cannot be isolated, be connected to an existing distribution main in service.
- b. Tapping Existing Mains. The Contractor shall be responsible for making or arranging for all taps for main extensions. Permits for service taps shall only be issued to a master plumber unless otherwise approved by the District. The Contractor shall notify the District a minimum of twenty-four (24) hours prior to tapping. Once the tap is complete, the Contractor shall be responsible for protection of the tapping sleeve or saddle and the tapping valve against freezing or other damage. The Contractor shall also be responsible for all backfill, compaction, paving, curb and gutter, etc.
- c. Operation of Valves. In connecting to the District's system, it may be necessary to operate existing valves.

Valves on the District's system that must be operated to make a connection shall be operated by District personnel only. The Contractor shall give the Inspector forty-eight (48) hours' notice to arrange for operating valves. Both the Contractor and the Inspector shall be present when the valves are operated.

- d. Interruption of Service. Installation of a connection that will require closing existing valves may cause an interruption of water service to existing District customers. Affected customers must be notified twenty-four (24) hours in advance.

The District Inspector will arrange for all notification to both residential customers and the fire department; however, the Contractor will be responsible to furnish the Inspector all necessary information as to the date and time the interruption will begin and the total time required to complete the installation.

A normal interruption shall be a maximum of two hours. If the interruption will be greater than two hours, the work shall be done in a manner to minimize the inconvenience to customers, such as working at night in a continuous operation until service is restored. A connection which will require an interruption longer than two hours shall be subject to review by the District as to the appropriate timing of the connection.

If, in the process of installing a connection, there exists an industry or building in the area that cannot be out of water, such as a hospital or other special customer, appropriate means shall be taken to provide and convey water. The water and means of conveyance shall be approved by the District.

### 3.25 Corrosion Protection Systems.

- a. Dissimilar Materials. Insulation shall be installed as required by the District. Particular care shall be taken to insulate between dissimilar materials.
- b. Insulating Joints. Whenever it is necessary to join pipe of dissimilar metal, or when designated by the District, a method of insulating against the passage of electrical current shall be provided. Special care shall be exercised during the installation of these joints to prevent electrical conductivity across the joints. See Section 2.08 of these Specifications.
- c. Polyethylene Encasement Material. Whenever designated by the District, the metallic pipe and all appurtenances shall be wrapped in polyethylene. The polyethylene encasement shall prevent contact between the pipe and bedding material, but is not intended to be a completely air-tight and water-tight enclosure.

Prolonged exposure to sunlight will eventually deteriorate polyethylene film. Exposure to sunlight shall be kept at a minimum. See Standard Drawing No. 4.

The polyethylene shall have a minimum wall thickness of eight (8) mils and conform to the specification set forth in this part.

A 2-inch wide, ten-mil thickness polyethylene pressure-sensitive tape shall be used to close seams, secure to pipe or hold overlaps.

Polyethylene pipe wrap material shall be applied to line pipe in the manner shown on Standard Drawing No. 4.

Damage to polyethylene wrapped pipe in the trench prior to and during backfill shall be repaired to the satisfaction of the District.

Before the Contractor taps a water main, the trench, pipe and polyethylene wrapping shall be in a state of readiness. The Contractor digging the trench shall repair or replace any damaged polyethylene prior to tapping.

- d. Insulating from Concrete. Areas of metal pipe and appurtenances which are to be in contact with concrete thrust blocks, bridging blocks, anchors or encasement may be required by the District to be protected against corrosion prior to installing concrete. The following types of protection systems are acceptable:
  - (1) Application of cold-applied mastic coating with high electrical resistivity, similar to Roskote Mastic A-51, manufactured by Royston Laboratories.
  - (2) Application of a cold-applied primer and corrosion resistant pipe wrap, similar to the primer and pipe tape manufactured by the Protecto Wrap Company.

Other proposed protection systems may be accepted following review and approval of the District.

3.26 Disinfection. The following procedure shall apply to all main extensions within the District's water service area. Pipe extensions shall be chlorinated in accordance with AWWA C651, "Disinfecting Water Mains." The Contractor shall provide material for disinfection of all water mains.

Calcium hypochlorite granules with a minimum of 65 percent available chlorine or 5-g calcium hypochlorite tablets shall be used for disinfection. Application rates shall comply with AWWA C651.

The following table denotes the amount of calcium hypochlorite granules to be placed at the beginning and end of the main and at 500-foot intervals to obtain disinfection.

<u>Pipe Size</u>	<u>Calcium Hypochlorite Granules (ozs.)</u>
4"	0.5
6"	1.0
8"	2.0
12"	4.0

The following table denotes the number of 5-g calcium hypochlorite tablets required per 20-foot joint for dose of 25 mg/l. Chlorine tablets shall be attached to the inside top of the pipe using a water based, non-toxic glue (DOW 78) just prior to the pipe installation of the trench.

<u>Pipe Size</u>	<u>No. of Tablets</u>
4"	1
6"	2
8"	4
10"	6
12"	7
16"	13

After the calcium hypochlorite has been placed in the pipeline by the Contractor, disinfection must be completed within ten (10) calendar days.

After the pipe is filled with water and chlorine, and unless approved otherwise by the District, the chlorinated water shall be held in contact with the pipe for twenty-four (24) hours. At the end of the twenty-four (24) hour period, the water in the pipeline shall be tested by the District to ensure a residual chlorine content of not less than twenty-five (25) mg/l.

The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public.

Samples of water will be collected for bacteriological examination and residual chlorine content testing before the pipe is put into service. Testing of residual chlorine and sampling will be done by the District.

No main which has been disinfected and flushed shall stand stagnant for more than fifteen (15) days without being reflushed.

3.27 Pressure Testing. All mains and appurtenances shall be subject to pressure testing performed by the Contractor. All mains shall be subjected to a test pressure of 150 psi at the lowest point in the portion of the system being constructed. The test pressure shall be placed on the pipeline and the line isolated from other water sources. After a two (2) hour period, water shall be added to the line to return the pressure to the specified test pressure. The quantity of water required to return the pressure to the specified level will be measured.

The maximum allowable leakage at the specified test pressure shall not exceed ten (10) gallons per day per inch of pipe diameter (inside diameter) per mile of pipe.

ALLOWABLE LEAKAGE

Pipe	Diameter Allowable leakage in 2 hours, Gallons				
	250 psi	225 psi	200 psi	175 psi	150 psi
4"	0.47	0.45	0.95	0.40	0.37
6"	0.71	0.68	0.64	0.59	0.55
8"	0.95	0.90	0.85	0.80	0.74
12"	1.42	1.35	1.28	1.19	1.10
16"	1.90	1.80	1.70	1.59	1.47
20"	2.37	2.25	2.12	1.98	1.84
24"	2.85	2.70	2.55	2.38	2.21

3.28 Acceptance and Release for Taps. A new main shall be accepted by the District and released for taps when the following conditions have been met:

- a. The main and all appurtenances have been installed to the satisfaction of the Inspector and all pertinent notes and measurements have been made.
- b. Disinfection has been completed and the main has been flushed, charged and received a passing bacteriological test.
- c. Pressure testing has been completed satisfactorily.
- d. All tapping methods have been approved by the District.
- e. As constructed record drawings and other supporting information shall be furnished to the District within two weeks of the completion of construction of any pipeline segment. The District shall find the record documents satisfactory before permitting the main to be put in service and accepted for maintenance.

3.29 Acceptance of Mains and Service Lines Including Curb Stops.

- a. Preliminary Acceptance. Preliminary acceptance of mains will be granted by the District following the Developer's completion of all curbs, gutters, grading and paving, plus all curb stop and street valve boxes being set at proper grade.
- b. Final Acceptance. Approximately one year following the preliminary acceptance, the District will reinspect the curb stop and street valve boxes for centering, plumb and grade. The Contractor and Developer will be notified of any defects in materials and workmanship and these defects must be promptly corrected in accordance with these Specifications. Corrections must be made immediately. If no defects are found or corrections are made as required by the Inspector, a letter of acceptance will be issued, following receipt of proper documents giving clear title to all mains and appurtenances. Service lines beyond the corporation stop on the main are the property of the Developer and/or Owner. Preliminary and final acceptance can be granted in phases of development after all the conditions of current specifications have been met.

The Developer shall be responsible for repairing any deficiencies in the workmanship for a period of one year after preliminary acceptance. This shall include but not necessarily be limited to removal and replacement of surfacing materials (pavement, curb and gutter, sidewalk) which are damaged due to soil settlement.

- c. Repair and Maintenance prior to Final Acceptance. Repair and maintenance of mains and services prior to final acceptance by the District will be the sole responsibility of the Developer and/or Contractor. Repair and maintenance will be accomplished to the current specifications of the District.
- d. Meters. Meters will be maintained by the District from the time of installation.

## **Service Lines and Meters**

### 4.01 All New Service Lines and, Where Applicable, Service Line Replacements.

- a. Required water plans must be approved by the District and all water connection and tapping charges due must be paid before water taps will be made. All replacement water taps are subject to the water tap fee unless otherwise approved by the District.
- b. Tapping permits must be applied for at the District Office and paid for at least 24 hours prior to tapping.
- c. All service taps on water mains within the water distribution system shall be accomplished by the Contractor, who shall notify the District a minimum of 48 hours prior to tapping.
- d. No water taps shall be made unless property corners are clearly marked so measurements of taps and curb boxes can be made at the time of tapping.
- e. Excavation of the tapping hole is the responsibility of the Contractor and shall be done in accordance with these Standard Specifications.
- f. Minimum normal size tap for a water service is 3/4 inch. The Contractor shall be responsible for furnishing all necessary materials. For service line sizes in excess of 2 inches, the corporation shall be a tapping valve and the curb stop shall be a gate valve.
- g. Cribbing, sheeting or sloping of the banks of tapping holes is the responsibility of the Contractor and will be in accordance with the rules and regulations of the Colorado Department of Public Health and Environment, Water Quality Control Division, 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530, and OSHA as applicable.
- h. Barricading of tapping holes is the responsibility of the Contractor and shall be in accordance with construction, installation and repair of right-of-way openings for subsurface utilities for work within the Strasburg Sanitation and Water District or other applicable regulatory agency.
- i. Backfilling and compaction of tapping holes shall meet the specifications of the governing body in whose jurisdiction work is being done; i.e., Strasburg Sanitation and Water District, Adams County, Arapahoe County, or State of Colorado.
- j. Replacement of Existing Corporation Stops: Where an existing corporation stop is to be replaced with a new corporation stop of equal or larger size, the Owner of the property shall be responsible, at his/her expense, to have the old corporation stop excavated and shall contact the District which will shut off the old corporation at no expense to the Owner. Backfill, compaction and replacing of the corporation stop following shut off by the District is the responsibility of the property Owner at his/her expense.
- k. Abandoning Existing Taps: Where an existing water tap is to be abandoned, the Owner of the property shall be responsible, at his/her expense, to have the corporation stop excavated and then contact the District which will shut off the corporation at no expense to the Owner. Backfill and compaction will be the responsibility of the property Owner at his/her expense.
- l. Multiple Service Taps: No service line within the District's water service area will serve more than one customer. Each house, building or business shall have an individual tap and service line from the water main to the house, building or business, and an individual meter.

### 4.02 Water Service Line Excavations for All New and Replacement Service Lines.

- a. Excavation, safety and backfilling to include proper compaction of water service line ditches are the responsibility of the Contractor all in accordance with the specifications of the governing body in whose jurisdiction the work is being done; i.e., Strasburg Sanitation and Water District, Adams County, Arapahoe County, or State of Colorado.

- b. Water service line ditches must enter the lot as near ninety degrees (90°) to the property line as is practical and not at an extreme angle unless otherwise approved.
- c. Water Service Line Ditches and Separation of Water Service and Building Sewer: Except as permitted below, the water service line and the building drain or building sewer shall be not less than 10 feet apart horizontally and shall be separated by undisturbed or compacted earth. Such a separation shall be maintained in all public rights-of-way and easements. The water service line may be placed in the same trench with the building drain or building sewer provided approval is given by the District and the following conditions are met:
  - (1) 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. The water service line and building sewer shall be separated by a clear horizontal distance of no less than 24 inches.
  - (2) The water service line shall be placed on a solid shelf excavated at one side of the common trench.
  - (3) No joints in the water service line shall be permitted between the corporation stop and the curb stop without prior approval of the District. In no case will soldered joints be allowed.
  - (4) The materials and joints of sewer and water service lines shall be installed in such a manner and shall possess the necessary strength and durability to prevent the escape of solids, liquids and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlement, vibrations and superimposed loads.

4.03 Service Line Installation and Material for All New and Replacement Service Lines.

- a. An expansion loop as shown in Standard Drawing No. 16 must be left in the service line where it is connected to the corporation stop at the water main to allow for expansion and contraction. Existing water services or taps which are not 3/4-inch or larger and do not consist of polyethylene or that will not meet the specifications referred to in this section will not be permitted. If the existing tap has been deleted from the water system at the time of demolition, under no circumstances will the District allow a service to be reconnected. It would constitute a new tap and service.
- b. Water service lines shall conform to the following minimum diameter.
  - 1) 3/4-inch diameter for townhomes (attached single family) and patio homes, single family residential.
  - 2) Multi-family and commercial service lines shall be sized in accordance with the applicable local building code and subject to the review and approval of the District.
  - 3) Minimum diameters described above may be increased to provide for satisfactory delivery pressures as determined by the District.
- c. Water service line material between the corporation and the curb stop shall be as follows:  
 Plastic pipe will be Pure-Core Blue or Driscoplex 5100 Ultra-Line HDPE pipe Dr7, two hundred (200) PSI with stainless steel stiffeners.
- d. Water service line joints – all joints shall be comprised of flared compression fittings. However, now joints will be allowed between the corp stop and the curb stop, curb stop and meter, and then meter to residence.
  - (1) Copper tubing shall have flared fittings as manufactured by the Mueller Co.
  - (2) No sweat or welded joints shall be allowed underground.
  - (3) Dissimilar type of material - copper tubing to galvanized iron
    - (a) Iron pipe O.D. x copper tube size O.D.
    - (b) Insulating coupling
    - (c) Romac Industries, Inc., Style 702 compression coupling
    - (d) Rockwell/Smith Blair adapter gasket for steel pipe to copper tubing
    - (e) Equivalent product of other manufacturers

- e. All water service lines shall have a minimum cover of 5 feet except at the expansion loop and will be determined by the street cut and/or by the finished grade of the property.
- f. Water service lines from the corporation to the curb stop shall have a maximum cover of 6 feet unless otherwise approved.
- g. Where a 1-1/2-inch or larger water service line crosses another utility or any underground structure, the water service line shall preferably pass over the other utility or structure, but in no instance shall there be less than 6 inches clearance between the water service and the other utility or structure. The space between the water service line and the utility or structure shall be backfilled with sand when the clearance is less than 12 inches.

Where any water service line passes under a sewer main, the sewer main shall be constructed of cast iron or Schedule 40 polyvinyl chloride (PVC) pipe for 6 feet each side of the water service line.

- h. HDPE service lines shall be the same size from the corporation stop to the curb stop or secondary valve. Then, if necessary, the size of the service line may be increased or reduced only after the curb stop or secondary valve to the meter by one size. HDPE service lines shall be installed horizontally in a “snake-like” laying configuration to allow for both expansion / contraction movement of the pipe in the trench. The HDPE service line shall consist of one (1) piece of continuous pipe from the corporation stop to the curb stop / secondary valve with no fittings or connections allowed. The curb stop / secondary valve may not be placed under concrete or paved driveway areas. If the service line needs to be extended to accommodate moving the curb stop / secondary valve out of a concrete or paved area, the valve must be abandoned, poly wrapped in full open position and the new valve will be routed to the closes edge of the concrete.
- i. 12 gauge insulated solid core tracer wire, as specified herein, shall be extended from the main to the foundation of the house / structure. Tracer wire shall be extended up the outside of the curb stop box, as specified herein and approximately eighteen inches (18”) at foundation.
- j. Tapping saddle: A tapping saddle shall be used on all service line connections to the water distribution system. Tapping saddles shall have the following characteristics:
  - (1) Double strap
  - (2) Brass body
  - (3) Brass straps
  - (4) AWWA tapered thread pattern (cc)
  - (5) Acceptable manufacturer: Mueller Co., Typical Catalog No. BR-2-B-0684-CC-100 for 6" pipe, 3/4" tap; Romac 202 BS; same series for larger sizes
- k. Corporation stop
  - (1) Conform to AWWA C800
  - (2) AWWA tapered thread pattern inlet (cc)
  - (3) Flared compression fitting outlet for PE tubing
  - (4) Same size inlet and outlet
  - (5) Acceptable manufacturers: Mueller Co., Catalog No. H-15000; Ford FB-1001-NL; McDonald 74701 B
- l. New service lines on single family units will be installed to enter the property 10 feet inside the front property line farthest from the garage and/or driveway unless otherwise approved by the District.

#### 4.04 Curb Stop and Curb Box for All New and Replacement Service Lines.

- a. All service lines, regardless of size, must have a curb stop and curb box installed in accordance with the Standard Drawings. The curb box shall be centered over the curb stop and shall be plumb. The following location will be accepted by the District:

All curb stop boxes will be installed 6 inches from the public right-of-way line unless designated



otherwise by the District.

- b. The curb stop supplied by the Contractor shall be installed in accordance with of these Specifications.
- c. The responsibility of the Contractor for the curb box ends only when sidewalks, curbs, driveways, etc. have been installed and all backfilling and compaction has been completed. They are subject to review for alignment at the end of the one-year warranty period.
- d. Curb stops: Mueller Co. Model H-15204; McDonald 6100-33 (for each respective line size), Ford B46 Series (333 through 777 for ¾" through 2").
- e. Curb boxes: Tyler series or equal. Enlarged bases required for 1-1/2-inch and 2-inch curb stops.

#### 4.05 Water Meters - General

- a. All water supplied by the District to a newly developed property must be metered except for fire lines. All water meters shall become the property of the District.
- b. All water meters are supplied and installed by the Owner or customer. If repair or replacement is necessary during the warranty period, the replacement meter will be accomplished by the District at the builder's expense. If repair or replacement is necessary after expiration of the warranty period, the District shall accomplish such repair or replacement.
- c. Acceptable locations for ¾-inch water meters shall be limited to outside water meter pits, basement, utility room or utility closets unless otherwise approved. Locations for 1-1/2-inch or larger water meters shall be approved by the District prior to installation of the water meter loop.
- d. Water meter locations selected shall provide adequate protection against freezing.
- e. Water meters installed in the District shall be the Invensys SR II
  - (1) ¾-inch diameter:
  - (2) Other sizes: As approved by District
  - (3) Bronze body

#### 4.06 Inside Water Meter Installations Only

- a. Inside residential water meter locations must be in the basement or other lowest level of the residence. When installed in a crawl space with an earth floor, a rock-filled sump, 1-1/2' deep, 1-1/2' in diameter shall be installed beneath the meter location. Where plastic pipe is used for inside installations, plastic will not be used within 3 feet of the meter loop.
- b. Inside ¾-inch water meter locations shall be such that the water meter is unobstructed on one side, easily accessible for reading or servicing, with a minimum of 8 inches clearance around the remainder of the meter with a minimum of 3 feet of clearance above the meter. Meter locations shall not require stooping or crawling to gain access to the meter. Meters will not be installed in attic spaces and shall be on or near the floor. Approval prior to construction for crawl space installation may be granted by the District.
- c. Inside ¾-inch water meter loop installations shall include an inlet and outlet valve as shown on Standard Drawings. Inlet and outlet valves shall be full opening water way, straight or angle body meter ball valves.
- d. Water main installations shall incorporate necessary backflow prevention devices as specified herein.

#### 4.07 Water Meter Pit Installations Only

- a. The locations of the meter pit for ¾-inch through 1-inch water meters will be one foot (1') inside of the curb stop. If a problem arises on the location, the location will be determined by the District.

- b. The Standard Drawings may be used as a guide for planning of meter pit installations.

#### 4.08 Combined Domestic and Fire Line Water Meters

- a. Only meters approved by the National Board of Fire Underwriters shall be installed in water lines providing both domestic and fire service. Requests to install a meter in a water line providing both domestic and fire demands should be made to the District a minimum of 90 days in advance of construction.
- b. Unless otherwise approved by the District, a combined domestic and fire line meter must be installed in a pit large enough to accommodate the meter, meter bypass and all valves and piping, all in accordance with Standard Drawings.
- c. The location of the meter pit must be approved by the District in advance of construction.
- d. Meter pits must have an approved ring and cover of sufficient size (25-1/2 inches minimum) opening for installation and removal of the meter.
- e. The meter loop (3-inch through 6-inch) must set on the floor of pit, not the riser. The maximum depth of the meter pit (inside dimension) shall be 8 feet. The minimum depth of the meter pit (inside dimension) shall be 7 feet.
- f. Water meter loops for combined domestic and fire line water meters must have both inlet and outlet valves.
- g. Water meters must have a bypass around the meter of sufficient size to supply the property while the meter is being serviced.

#### 4.09 Water Regulators

- a. Where required by the District, a water regulator designed for 150 psi shall be installed in all domestic service lines. Refer to the Standard Drawings.
- b. One regulator must be installed upstream of the water meter. The customer may also install another regulator downstream of any irrigation supply branch line, downstream of the meter.

#### 4.10 Inspection of Services for All New and Replacement Service Lines

- a. Water service lines shall be inspected by the District and the inspection shall include an inspection of the service line from the curb stop to the foundation and an inspection of the meter installation to include all of those items contained within Sections 4.01 through 4.10 of these Specifications. The trench backfill compaction shall meet the requirements of these Specifications.

#### 4.11 Repair and Replacement of Existing Service Lines

- a. Responsibility. The property Owner is responsible for the repair and maintenance of the water service line from the curb stop to the house or other building.
- b. Leaks occurring on a water service line between the curb stop and the house or building shall be repaired as necessary to include backfilling and restoration of property at the property owner's expense. However, the District will, if requested to do so, shut off the water service line at the curb stop. To preclude unnecessary waste of water, if repairs are not initiated within a reasonable period of time, the District may, at its discretion, shut off the water service until repairs have been affected.
- c. The property owner is responsible for all damages that may occur to other property, real or personal, including property of the District, that were caused by failure to repair and maintain the water service line, or from leaks occurring on a water service line or from bursting or other failure of the water line.
- d. Leaks occurring between the curb stop and the corporation shall be repaired by the District.
- e. When a doubt exists concerning the location of a leak, the District will determine the general location of the leak. This will be done by turning off the service at the curb stop. When this action causes the leak to stop flowing, the homeowner or property Owner will be responsible for repair of the line at a location

between the curb stop and the structure served. When the leak continues to flow after turn off, the District will be responsible for repair of the line at a location between the curb stop and the main.

4.12 Service Line - General Notes

- a. All work on fabrication and installation of meter boxes shall conform to the following codes, latest edition:

International Building Code  
Building Code for Reinforced Concrete (ACI)  
American Welding Society Specifications

All material or components considered defective by the District shall be rejected and immediately removed from the site at no expense to the District.

The Contractor shall verify and coordinate the dimensions of all openings, meters, inserts, etc., with the District and manufacturer.

## **Water Service Quality Control Regulations**

- 5.01 General. This document is adopted by the Strasburg Sanitation and Water District to promote and sustain the high quality of drinking water furnished to the District's water customers; to protect the public potable water supply system of the District from the possibility of contamination or pollution by backflow, back-siphonage or backpressure; to promote the elimination or control of existing cross connections, actual or potential; and to provide for the maintenance of a continuing program of cross connection control.
- a. The authority to implement and maintain this program of cross connection control is contained in the following legislative actions:
    - (1) Colorado Revised Statute, Title 25
    - (2) Colorado Department of Health and Environment Cross Connection Control Rule 11.39.
    - (3) Colorado Primary Drinking Water Regulation Section 39 of 5 CCR 1002-11.
    - (4) CDPHE Safe Drinking Water Program Policy Number DW-007
    - (5) U.S. Environmental Protection Agency, Cross Connection Control Manual (1973) E.P.A. - 43070-73-002 Section 3.
    - (6) Uniform Plumbing Code of the International Plumbing and Mechanical Officials, Chapter 10, Sections 1001, 1002, 1003.
    - (7) Safe Drinking Water Act of 1974 (Amended 1986 and 1996).
    - (8) Strasburg Sanitation and Water District Resolution
  - b. Reference manuals adopted for guidelines on cross connection control:
    - (1) Manual of Cross Connection Control, Foundation for Cross Connection Control and Hydraulic Research, University of California.
    - (2) CDPHE Colorado Cross Connection Control Manual – May 2016
    - (3) Cross Connection Control Committee, Pacific Northwest Section AWWA Manual of Accepted Procedures and Practices.
    - (4) Recommended Practice for Backflow Prevention and Cross Connection Control AWWA Manual M-14.
    - (5) Definitions of terms used in this regulation are those contained in "Manual of Cross Connection Control," Foundation for Cross Connection Control and Hydraulic Research, University of California.
    - (6) CDPHE Water Quality Control Division Safe Drinking Water Program Policy Backflow Prevention and Cross-Connection Control Rule Implementation Policy DW-007, June 2018
  - c. General Requirements
    - (1) Backflow prevention devices are to be installed in an accessible location to facilitate maintenance, testing and repair. Standard Drawings show various installations.
    - (2) All backflow devices shall be installed immediately downstream of the water meter.
    - (3) Before installing the backflow prevention device, pipelines should be thoroughly flushed to remove foreign material.
    - (4) In no case will it be permissible to have connections or tees between the meter and service line backflow prevention device.
    - (5) In no case will it be permissible to connect the relief valve discharge on reduced pressure zone devices into a sump, sewer, drainage ditch, etc.
    - (6) Backflow prevention valves are not to be used for the inlet or outlet valve of the water meter.

Backflow preventer test cocks should never be used as supply connections and should be plugged except when being tested.

- (7) In order to ensure that backflow prevention devices continue to operate satisfactorily, it will be necessary that they be tested at the time of installation. Testing shall be required on reduced pressure zone devices and all testable devices. Such tests will be conducted in accordance with the Colorado Cross-Connection Control Manual (May 2016). The contractor accomplishing installation shall be responsible for initial testing of the new equipment. Reporting of testing procedures and results shall be made by the contractor to the District on forms provided by the District.

Refer to the section titled "Testing and Maintenance" in these Standard Specifications for periodic testing of all testable devices.

- (8) See Section 5.02 for guidance on different backflow applications as to where Double Check Valve vs. Reduced Pressure Zone Device are applicable

d. Standards for Backflow Prevention Devices

- (1) Any backflow prevention device required herein shall be of a model and size approved by the District. The term "APPROVED BACKFLOW PREVENTION DEVICE" shall mean a device that has been manufactured in full conformance with the standards established by the American Water Works Association (AWWA) entitled:

AWWA C506-Standards for Reduced Pressure Principle and Device, current edition, and have met completely the laboratory and field performance specifications of the Foundation for Cross Connection Control and Hydraulic Research (FCCC & HR) of the University of Southern California established by:

Specifications of Backflow Prevention Devices, 7th Edition, August 1985; Revised, or the most current issue.

AWWA and FCCC & HR Standards and Specifications have been adopted by the District. Final approval shall be evidenced by a "Certificate of Approval" issued by an approved testing laboratory certifying full compliance with said AWWA Standards and FCCC & HR Specifications.

- (2) Only "Approved Backflow Prevention Devices" shall be used. In general, the District will consider acceptance of devices manufactured by the following manufacturers:

Reduced Pressure Zone Device / Double Check Valve

Zurn Wilkins  
Ford Meter Box Company  
FEBCO  
Mueller Co.  
Watts

- (3) Backflow devices used on fire lines shall have O.S. & Y. valves and be listed by the National Fire Protection Association.

e. Installation

- (1) Backflow prevention devices shall be installed in accordance with manufacturer's recommendations.
- (2) Backflow prevention device installations shall be inspected and approved for use by the District. Inspections can be scheduled by calling (303) 622-4443.
- (3) All reduced pressure zone backflow devices shall be installed in a horizontal position. Double check valves on residential diameter services may be installed in any position provided the device is accessible for maintenance, removal and replacement. Other installations shall be subject to the individual review and approval of the District.
- (4) A pressure vacuum breaker shall only be used where the device is never subjected to backpressure

and installed a minimum of 12 inches above the highest piping or outlet downstream of the device in a manner to preclude backpressure.

- (5) An atmospheric vacuum breaker shall be used only where the device is:
  - (a) never subjected to continuous pressure, and
  - (b) installed on the discharge side of the last control valve and above the point of usage, and
  - (c) installed with the air inlet in a level position and a minimum of 6 inches above the highest piping on outlet it is protecting.
- (6) A single check valve is not considered to be a backflow prevention device.
- (7) Double check valve assemblies may be installed in below grade vaults when these vaults are properly constructed in accordance with Standard Drawings.
- (8) Reduced pressure backflow preventers will be installed above ground. Below ground reduced pressure backflow preventers will only be allowed with prior **written** approval from the Colorado Department of Health and Environment's Cross Connection Control Department Head. The unit should be placed at least 12 inches to 24 inches above the finish grade to allow clearance for the repair work. A concrete slab at finish grade is recommended. Proper drainage should be provided for the relief valve and may be piped away from the location, provided it is readily visible from above grade and the relief valve is separated from the drain line by a minimum of double the diameter of the supply line. A modified vault installation may be used if constructed with ample side clearances. Freezing is a major problem in this area. Precautions should be taken to protect above ground installations and additional accommodations for heat may be required.
- (9) Reduced pressure zone backflow preventer may be installed in a basement provided with an adequate drain with an effective opening of twice the diameter of the device.

f. Testing and Maintenance

- (1) It will be the duty of the customer/user at any premises where the backflow prevention devices are installed to have certified inspections and operational tests made of the devices at least once per year. In those specific instances where the District deems the hazard to be great enough, it will require certified inspections at more frequent intervals. These inspections and tests shall be at the expense of the water user and shall be performed by water utility personnel or by a certified technician approved by the District, the Colorado Department of Health, or the Water Distribution and Wastewater Collection Systems Certification Council.
- (2) The customer shall notify the District 48 hours in advance of when the tests are to be performed so that the District's representative may witness the tests if so desired. The devices shall be repaired, overhauled or replaced at the expense of the customer/user whenever the device(s) are found to be defective. Records of all such tests, repairs and overhauls shall be kept, with a copy sent to the District.
- (3) The customer is required to schedule a private certified tester to perform the annual test and furnish the District with a copy of the test, pursuant to the aforementioned stipulation.
- (4) Existing devices shall be sealed by the technician performing the test at the completion of the test.
- (5) All testing gauges shall be checked for accuracy and be kept in good operating condition.
- (6) The District retains the authority to check the installation and operation of any backflow device. However, the District will not test the installation for compliance of the backflow prevention installation and will rely upon the results of the independent inspection scheduled and paid for by the customer.

g. Right of Entry

The District water utility representative(s) assigned to inspect premises relative to possible hazards shall carry proper credentials of his/her office, upon exhibit of which he or she shall have the right of entry during usual business hours to inspect any and all buildings and premises for cross connections in the performance of his or her duties.

This right of entry shall be a condition of water service in order to provide assurance that the continuation of service to the premises will not constitute a menace to health, safety and welfare of the people throughout the District's potable water distribution system. Where building security is required, the backflow device should be located in an area not subject to security.

h. Violations

- (1) Failure of the customer to cooperate in the installation, maintenance, testing or inspection of backflow prevention devices required by this regulation shall be grounds for the discontinuance of water service to the premises or the requirement for an air-gap separation from the public potable water system.
- (2) Service of water to any premises may be discontinued by the District after written notification if unprotected cross connections exist on the premises, or if any defect is found in an installed backflow prevention device, or if a backflow prevention device has been removed or bypassed. Service shall not be restored until such conditions or defects are corrected.
- (3) Discontinuance of service may be summary, immediate and without written notice whenever, in the judgment of the General Manager, such action is necessary to protect the purity of the public potable water supply or the safety of the water system.

5.02 Cross Connection Control & Backflow Prevention - Criteria List

a. Abbreviations

A/G - Air Gap Separation  
 R/P - Reduced Pressure Zone Device  
 D/C - Double Check Valve Assembly  
 P.T.V.B. - Pressure Type Vacuum Breaker

b. Type of Establishment

Device Required

Apartments and condominiums - 4 stories or more	R/P
Apartments and condominiums - 4 stories or less	R/P
Auxiliary water systems	R/P
Belted meter installations	R/P
Buildings - 4 stories or more	R/P
Cafeteria, restaurant, or any food handling establishment	R/P
Car Wash	R/P
Child day care center	R/P
Fire Line (toxic chemicals added)	R/P
Fire Line (no chemicals)	D/C
Food processing/packing plant	R/P
Greenhouse	R/P
Hospital, dental or medical facility	R/P
Hotels and motels - single and multi-structures, 3-stories & less	R/P
Irrigation System	R/P - P.T.V.B.
Kennels - dog/cat	R/P
Laboratory- chemical or medical	R/P
Laundromat	R/P
Lease space (shopping centers, warehouse, main water supply)	D/C, R/P
Manufacturing/Processing Plant	R/P
Mobile equipment (landscape, lawn, tree	A/G variance

spraying, water hauling)	by review only
Morgue, mortuary, or autopsy facility	R/P
Nursing home/retirement home	R/P
Office or warehouse except as otherwise described herein	D/C, R/P
Pet shops	R/P
Photo developing lab	R/P
Planned Unit Development	R/P
Plating facilities	R/P
Printing shop	R/P
Private well supply	A/G
Storage tanks for fire water	D/C

Type of Establishment

Device Required

Recirculated water	R/P
Reflecting ponds, swimming pools, fountains, open ponds, etc.	R/P
Residences, single-family including townhomes	R/P
Schools - Colleges w/Lab	R/P
Sewage treatment plant	R/P
Solar system	R/P by review
Transportation terminal	R/P
Veterinary Services	R/P

NOTE: Other types of establishments may require protection via air gaps or backflow prevention devices depending on the equipment and/or plumbing arrangements utilized therein. These shall be considered individually, at the discretion of the District. All of the establishments listed below will require review by the District and a determination made as to the need for a backflow prevention device.

- Barber shop or college
- Beauty shop or college
- Buildings - three stories or less
- Department store



## PART II

### WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS

#### Chapter 1 - General

- 1.01 Authority. These Specifications are promulgated by the Strasburg Sanitation and Water District. The interpretation, enforcement, and revision of these Specifications is hereby delegated to the General Manager of the District.
- 1.02 Effective Date of Specifications. These Specifications shall be in effect fifteen (15) calendar days after adoption by the District board and shall supersede all former standard specifications for installation of sanitary sewer mains within the District.
- 1.03 Revisions, Amendments or Additions. These Specifications may be revised, amended or added to. Such revisions, amendments and additions shall be binding and in full force and effect when adopted in the manner set forth in Section 1.02.
- 1.04 District Control. These Specifications will apply to the installation, operation and maintenance of all wastewater collection facilities under the control of the Strasburg Sanitation and Water District.
- 1.05 Organization and Interpretation of Specifications. These Specifications are composed of written Standards of Engineering Practice, Material Specifications and Standard Drawings. The interpretation of any section or of differences between sections, when appropriate, shall be made by the General Manager of the District and his/her interpretation shall be binding and controlling in its application.
- 1.06 Definitions. As used in these Specifications, or in any of the drawings where these Specifications govern, unless the context shall otherwise require, the following words defined shall have the meanings herein ascribed:
- a. District Manager. The Manager of the District or his/her designated representative.
  - b. Engineer. The Engineer or consultant of the District, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.
  - c. Collection System. Sewer mains, together with all appurtenant and necessary manholes, clean outs, taps, service pipes, and associated materials, property and equipment collecting sanitary sewage from individual customers.
  - d. Wastewater Main or Sanitary Main. That portion of the wastewater system which collects sewage from users to the District wastewater treatment plant, excluding service lines.
  - e. Service Line. The sewage collection pipeline extending from the premises down to and including the connection to the wastewater or sanitary main.
  - f. Applicant for System Extension. Any person, association, corporation, entity, or government agency desiring sanitary sewer service for premises under their control, often a subdivider, a developer or an owner.
  - g. Main Extension. Extensions to the existing collection system network.
  - h. Contractor. In the context of these Specifications a person or persons, co-partnership or corporation employed by an applicant for the purpose of installing wastewater system extensions or replacements.
  - i. Inspector. The authorized representative of the District assigned to the project.
  - j. Standard Drawings. District Standard Drawings are a part of these Specifications.
  - k. District. The Strasburg Sanitation and Water District responsible for overseeing the wastewater system's operations.

1.07 Abbreviations. All references to documents or specifications shall be the latest edition or revision thereof:

- a. ASTM American Society for Testing and Materials
- b. ANSI American National Standards Institute
- c. NSF National Sanitation Foundation
- d. OSHA Occupational Safety and Health Act
- e. USGS United States Geological Survey
- f. CIP Cast Iron Pipe
- g. DIP Ductile Iron Pipe
- h. PVC Polyvinyl Chloride-Plastic Pipe

**Design Provisions**

- 2.01 Planning Considerations. The land use and population densities approved for the District shall be used to determine wastewater facility design parameters. Where approved master plans do not exist, the following criteria shall be used unless specific approval for other criteria has been given by the District.
- a. Design Period: The sewer systems shall be designed for the estimated ultimate tributary population. The tributary areas shall be studied to determine the area for each projected land use.
  - b. Population densities including public use lands:
    - (1) Single-family units at 2.8 persons per unit.
    - (2) Multi-family and condominiums at 2.1 persons per unit.
    - (3) Four (4) single-family units per acre.
    - (4) Sixteen (16) multi-family cluster housing or condominiums per acre.
  - c. Per capita flows: Sewer systems shall be designed on the basis of not less than the following unless other values are specifically authorized by the District:
    - (1) One hundred (100) gallons per person per day.
    - (2) Three hundred (300) gallons per capita per day peak flow for submains and laterals.
    - (3) Two hundred fifty (250) gallons per capita per day peak flow for main trunk, interceptor or outfall sewers.
    - (4) Infiltration of 100 gallons per day per inch of diameter per mile per manhole run for new systems. New system installations which will service a portion of the existing collection system will require an infiltration/bleeding allowance as established by the District.
    - (5) Commercial land uses at 1400 gallons per acre per day with a peak factor of 2.
    - (6) Industrial land uses at 1600 gallons per acre per day with a peak factor of 3.
    - (7) Public use, park and open space at 1000 gallons per day with a peak factor of 2.
- 2.02 Minimum Size. No public sewer shall be less than 8 inches in diameter. No building sewer shall be less than 4 inches in diameter.
- 2.03 Minimum Depth. In general, sewers shall be designed deep enough to drain basements and to prevent freezing. No public mains shall be less than 5 feet deep measured from the top of pipe unless special protection is required. Special protection shall consist of:
- (a) Less than 5 feet but more than 3 feet of cover requires ductile iron, cast iron, reinforced concrete encasement or arch.
  - (b) Less than 3 feet of cover requires ductile iron or cast iron with reinforced concrete encasement.
- No building sewer shall be less than 5 feet deep in traffic areas without similar special protection listed above except that concrete driveways may be substituted for protection of service lines.
- 2.04 Minimum Slopes. All sewers shall be designed to transport average sewage flows at mean velocities of 2 feet per second based on a Manning's roughness factor of 0.013. The slope between manholes shall be uniform. In no case shall the slope be less than the following for sewer mains and services:

**MINIMUM GRADE TABLE**

<u>Services</u>	
<u>Pipe Diameter</u>	<u>Slope</u>
4 Inches	2% or 1/4 inch per foot
4 Inches	Ductile iron or cast iron pipe - 1% or 1/8 inch per foot
6 Inches	1% or 1/8 inch per foot

## Mains and Services

<u>Pipe Diameter</u>	<u>Slope</u>
8 Inches	.50%
10 Inches	.35%
12 Inches	.29%
15 Inches	.23%
18 Inches	.17%
24 Inches	.13%

2.05 High Velocity Protection. In the case of sewers where the slopes are such that over 15 percent grades are attained, special provisions as determined by the District shall be made to prevent excessive erosion of material surfaces or displacement by impact. Such high velocity protection shall be shown on detail drawings and approved by the District on a case-by-case basis.

2.06 Alignment. Standard location for sewers, unless some major interference prevents, is along the centerline of the street, easement or right-of-way. In streets less than 36 feet wide and alleys, the standard location shall be parallel to but removed 2 feet from the center line. Manholes shall be located so as to prevent storm water entrance. Proposed sewer lines which may conflict with the placement of other underground facilities will require prior approval of the sewer placement location by the controlling agencies whose facilities are affected. Locations other than those specified will require specific approval of the District.

### 2.07 Pipe Alignment in Manholes

- a. Intersections. All pipes shall have free discharge into the collection system. Where possible, the flow line of the intersecting pipe shall be the spring line (horizontal center of pipeline) of the collection sewer. All manhole inverts shall be designed with a 0.1 foot drop except for changes in alignment in excess of 30° shall have a 0.3 foot drop in the invert through the manhole. Changes in direction at intersections shall not be greater than 90°.

When the intersecting pipe is smaller in diameter than the pipe exiting the manhole, the crown or inside-top of the intersecting pipe shall match the crown or inside-top of the main pipe entering the manhole. In no case shall the difference in elevation between the flowline of the pipe exiting the manhole and the flowline of the intersecting sewer be less than 0.3 feet.

- b. Increasing Size. When sewers are increased in size with no intersecting sewers, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient.

2.08 Manhole Location. Manholes shall be installed at the end of each line, at all pipeline intersections, changes in grade, size, alignment and at distances not greater than 400 feet. Manholes must be located to allow unassisted and unrestricted access by District maintenance vehicles. Lines and manholes located in areas where access, in the opinion of the District, is not possible, will not be approved for construction.

### 2.09 Manhole Details

- a. Manhole Sizes. The inside diameter of the manhole shall not be less than 4 feet on lines 8 inches through 10 inches in diameter; not less than 5 feet on lines 12 inches through 18 inches in diameter; not less than 6 feet on lines in excess of 24 inches in diameter for standard design manholes (see Drawing No. 2 for standard manhole design).
- b. Drop Manholes. External drop manholes will be permitted only in extreme and special conditions where approval has been granted by the District. As a general criteria, a minimum difference in elevation of 4 feet between the inlet and outlet is required before considering use of external drop manhole design. The external drop sections must be totally encased in reinforced concrete and placed on an adequate foundation. Developer shall submit design of proposed drop manhole to District for approval.

- c. Manhole Channels. The flow channel shall be made to conform to the slope and shape of the sewer pipe entering and exiting the manhole. The channel shall be formed from cast-in-place concrete to a cross-section matching the circular pipes. The channel shall be constructed with vertical walls from a point one-half the pipe diameter above the channel flowline as shown in the standard drawings. At intersections with other lines, channels shall be formed with a curve to minimize turbulence. The flow channel shall be constructed to have a depth equal to the pipe diameter. Refer to Drawing No. 2.
- d. Manhole Gaskets. The pipes entering and exiting the manhole shall be equipped with a manhole gasket placed around the pipe and cast in the base. If a precast base is used, a watertight seal shall be obtained by use of a premanufactured rubber gasket in the precast base section equal to a Kor-N-Seal boot.
- e. Rings and Covers. The ring and cover shall be constructed of cast iron for traffic bearing conditions and cast aluminum or cast iron for non-traffic bearing conditions. All manholes located outside of dedicated street or alley rights-of-way will be designed and constructed with a locking type cover and the ring bolted to the concrete cone. Grade adjustment rings or blocks between the ring and cover and the concrete cone cap shall not exceed 6 inches. See Standard Drawings Nos. 4 and 5.
- f. Watertightness. Precast concrete manhole joints shall be made watertight. Manholes of brick or segmented block shall not be used in the sanitary sewer system.
  - (1) Each precast manhole segment shall be joined with a rubber "O" ring, Ram-Nek, Con-Seal or similar approved material. A double application of Ram-Nek, or equal, is required in areas where groundwater is present or could be present.
  - (2) All interior concrete manhole surfaces above the flow channel shall receive a 3/8" to 1/2" thick coating of cement grout. Concrete surfaces shall be thoroughly wetted and damp prior to the application of cement grout. Liquid membrane curing compound shall be applied to the finished cement grout surface to facilitate proper curing. Where exterior cement grouting is required, it shall be applied prior to the application of dampproofing material and the liquid membrane curing compound shall be deleted. Exterior cement grout shall be film cured utilizing polyethylene sheets.
  - (3) All exterior concrete manhole surfaces shall be coated with coal tar dampproofing material. Where ground water is present or, in the opinion of the District, groundwater could be present, all exterior concrete manhole surfaces shall also receive a 3/8" to 1/2" thick coating of cement grout. The need for exterior cement grouting will be determined by the District.
  - (4) Dampproofing materials shall be applied to clean, dry surfaces in accordance with the coating manufacturer's written instructions/recommendations and the following:
    - 1. Preparation
      - a. Examine surfaces to receive dampproofing to assure conditions are satisfactory for application of materials
      - b. Remove dirt, dust, sand, grit, mud, oil, grease and other foreign matter
      - c. Brush down surfaces to remove all loose scale, fins, dust, etc.
      - d. Complete surface preparation in accordance with manufacturer's recommendations
    - 2. Application
      - a. General
        - 1) Apply in three (3) coats with high pile rollers or by spray equipment
          - a) Minimum air pressure: 90 psi
          - b) Spray apply in a fine mist
        - 2) Provide adequate forced ventilation when applying coating in enclosed spaces
        - 3) Do not use benzol or other volatile solvents for thinning coating
      - b. First coat
        - 1) Apply only when surface of concrete is dry and at a suitable temperature for adequate penetration
        - 2) Thin as recommended by manufacturer
        - 3) Apply for maximum penetration
        - 4) Absorbed by concrete within 5 to 30 minutes of application so no continuous

film remains on surface

- c. Second coat: Cover surface with 5 mil film
  - d. Third coat: Produce a high gloss 5 mil film
  - e. Cure material as recommended by manufacturer
  - f. Do not cover with backfill until installation is accepted by inspector
- g. Stub Outs from Manholes. Stub outs from manholes shall not exceed 40 feet except for lines which will be extended in the future. Whenever practical, designs to complete the manhole run shall be submitted to the District Superintendent for review to insure proper grade and alignment for future construction. Future extension of stub outs shall be of like material using the same grade and alignment.
- h. Design Features for Deep Manholes. Manholes which are more than sixteen (16) feet from the finished cover to the pipe invert shall be considered deep manholes subject to special design. The items given below shall be given special attention and subject to approval by the District.
- (1) Intermediate platforms constructed with manhole shaft offsets shall be governed by the OSHA regulations. Regardless of the application of OSHA regulations, an offset intermediate platform will be required on any manhole greater than 24-feet in depth at no more than 12-foot intervals.
  - (2) Structural integrity of precast or cast-in-place concrete structures shall be verified and certified by the responsible design professional for all manholes in excess of 16-feet in depth. Specific attention shall be given to concrete thickness, reinforcing design and concrete strength.
- 2.10 Relation to Water Mains. Sewer lines shall be located a minimum of 10 feet horizontally from existing or proposed water mains and the sewer lines shall be a minimum of 18 inches clear distance vertically below the water main. If this clear distance is not feasible, the crossing must be designed and constructed so as to protect the water main from potential cross connections and minimize the potential for structural damage to either pipeline. Minimum protection shall consist of the installation of an impervious and structural sewer as follows:
- a. Where the sewer pipe is above the water main, regardless of separation, one length of ductile iron pipe at least 18 feet long centered over the water main and jointed to the sanitary sewer pipe with a manufactured adapter specifically for such jointing shall be installed. It shall include rubber gasketed fittings with stainless steel tightening bands. The joints shall be enclosed in a concrete collar at least 6 inches thick and extending at least 6 inches either side of the joint.
  - b. Where the sewer is beneath the water main but less than 18 inches clear distance vertically, the sewer pipe of any material shall be encased in reinforced concrete. Encasement shall be at least 6 inches thick and extend a distance of 10 feet on either side of the water main crossing. Reinforcing shall consist of a minimum of four No. 4 bars placed at quarter points around the pipe being encased.
- The above-described protection from potential cross connections shall apply to service lines as well as sanitary sewer mains where the above described protection and special installation is required.
- 2.11 Stream and Drainage Channel Crossings
- a. All stream and drainage channel crossings shall be ductile iron pipe encased in reinforced concrete where the installation is below the flow line of the stream or drainage channel.
  - b. Crossings less than 4 feet below existing or proposed channel bottoms shall be supported by reinforced concrete caissons constructed in accordance with the approved special design.
  - c. Where the pipeline crossing will be above the stream or drainage channel flow line, special approval and design will be required by the District. All details of the design shall be submitted to the District for review and approval.
- 2.12 Railroad and Highway Crossings
- a. All work shall be accomplished in accordance with the appropriate permit issued by the responsible agency having jurisdiction over the work.
  - b. Crossings under railroads and highways shall consist of polyvinyl chloride (PVC), ductile iron or coal tar enamel lined steel pipe (carrier pipe) laid inside a steel pipe conduit (casing pipe), which is placed

beneath the track or roadway. The steel conduit pipe (casing pipe) shall be jacked horizontally through the ground on substantially the grade of the sewer, with due allowance for the bells or joints of the carrier pipe. As the pipe is jacked along, the earth shall be excavated from the face and removed so that it will not be necessary to force the pipe through solid ground. Specifications for materials and installation of the railroad or highway agency shall govern.

- c. The casing pipe diameter for 16-inch and smaller carrier pipes shall be a minimum of 8 inches larger than the carrier pipe and the casing pipe diameter for larger than 16-inch diameter carrier pipe shall be a minimum of 12 inches larger than the carrier pipe.
- d. After the conduit has been completed, the carrier pipe shall be placed inside and blocked in exact position and grade with a support at least every 8 feet and behind each bell or coupling. A minimum of three blocks or other points of support shall be installed to prevent displacement by floating.
- e. Each end of the casing pipe shall then be plugged tight around the carrier pipe and inside the casing pipe. The plug may consist of an 8-inch brick wall laid up with Portland cement mortar or a prefabricated rubber boot with stainless steel tightening bands specifically for sealing casing pipe ends.

#### 2.13 Service Lines (Building Sewers)

- a. Service lines and stub outs from main sewers shall be extended to each property at a point 5 feet inside the property line and generally 5 feet above the low lot corner.
- b. Stub outs from a sewer main may be made to an unoccupied lot provided it is part of an officially platted and recorded subdivision. Such stubs shall be extended to 5 feet inside property line and plugged with a watertight and airtight cap or plug insert. Plugging or capping shall be sufficient to perform air testing of the pipeline. Records of the depth and location of the end of the service stub shall be recorded by party responsible for construction and submitted to the District for future reference.
- c. Four-inch diameter service lines shall have a maximum length of 250 feet. A 4-inch diameter cleanout shall be installed on the service lines where the total length exceeds 100 feet and at 75 foot intervals thereafter up to a maximum of 250 feet in length. The cleanout shall have a proper waterproof cap. For cleanout access, a prefabricated formed wye with a riser pipe shall be installed to the finished grade.

Service lines projected to be longer than 250 feet in length shall have pipe 6 inches in diameter or as otherwise required by the District. Provisions for cleanouts shall also apply to pipelines 6 inches in diameter.

- d. No service line within the District's service area will serve more than one property or customer. Each house, building or business shall have an individual connection to the sewer main and service line from the main to the structure served.
- e. All service lines for commercial buildings or multi-family buildings shall be no less than 6-inches in diameter.
- f. Any service line requiring 3 or more bend fittings between the sewer main line and building served shall be constructed with a cleanout at intervals specified above. If 3 or more bend fittings are required in a service line with a length less than 100 feet, a cleanout shall be installed at the midpoint of that section.

#### 2.14 Pump Station Design Parameters. Design of pump stations within the District's collection system shall be accomplished on a case by case basis. Pump stations shall not be used wherever gravity sewer service is available. Preliminary considerations and a rationale for the need of the pump station shall be reviewed in detail with the District's Manager and Engineer prior to proceeding with preliminary and final design. Lift station design shall be in accordance with the Colorado Department of Health and Environment's latest design criteria manual. As general guidelines for planning purposes, any pump station considered by the District must include, but is not necessarily limited to the following design features:

- a. Dry pit or wet well mounted pumping equipment.
- b. Multiple pumps.
- c. Standby power generation or dual source of power supply.
- d. Ventilation, heating and dehumidification equipment.
- e. Automatic controls.

- f. Remote alarm system for operating functions.

## 2.15 Sanitary Sewerage Plan Submittal Requirements

- a. Plans and Specifications. Three (3) copies of all plans and specifications for facilities to be installed under these rules and regulations shall be furnished to the District. One (1) copy will be returned to the applicant when approved by the District and bear evidence of such approval or comments requiring correction.
- b. Plan Content. As a minimum, the following information shall be required on all plans.
  - (1) Plan View: The plan view shall show streets, alleys, rights-of-way and utility easements with the location and size of the sewers, locations and distance between manholes, the slope and other appurtenances indicated. It is desirable for plans to show the proposed size and location of service stubs and the location of all existing or proposed underground utilities and structures located within 20 feet horizontally or vertically, of the centerline of the proposed sewer extension. (The scale is optional, however, 1"=50' is commonly used.)
  - (2) Profile View: The profile view with vertical and horizontal grids shall show the existing ground surface (grey scale) and proposed surface (solid). Also, show the proposed sewer with elevations of manhole rims and inverts, the distance and grade between manholes and elevations of utility crossings.
  - (3) Detail drawings: Special detail drawings, made to scale, shall clearly show the nature of design and construction of the following :
    - (a) Special sewer appurtenances such as non-standard manholes, inverted siphons and elevated sewers.
    - (b) Special joints and utility or storm sewer crossings.
    - (c) Stream and drainage channel crossings with elevations of normal high and low water levels.
- c. Supporting Data: Submit with the plans and specifications all necessary supporting data to fully describe the proposed installation. This data shall include but not necessarily be limited to a copy of the recorded plat of the subdivision in which the improvements are proposed to be installed and copies of dedicated rights-of-way and easements in which improvements are proposed to be installed. Submit copies of necessary permits from other governmental or private agencies having jurisdiction in the area of the proposed work.

Should a site application for a collection system extension be required by the Colorado Department of Health , the individual party responsible for construction of the facility shall also be responsible for obtaining this site approval.
- d. Upon completion of construction and prior to acceptance by the District, two (2) copies of "as-constructed" plans shall be submitted to the District for record. The two (2) copies shall be complete with all "as-constructed" information together with a certification by the party responsible for construction that all data thereon is accurate and represents actual "as-constructed" conditions. One (1 ) copy shall be a transparency suitable for reproduction. "As-constructed" plans shall be submitted within two weeks of completion of the sanitary sewer construction in any identifiable phase of a development. No authorization to connect to the system or discharge to the system will be allowed until the "as-constructed" documents have been received and accepted by the District.
- e. All plans, specifications and supporting documents shall be prepared by or under the direct supervision of a professional engineer registered to practice in the State of Colorado. All plans and specifications shall bear the seal and registration number and name of said registered professional engineer.



2.16 Sewage System and Trench and Foundation Drains

- a. In no case shall any trench drains, foundation drain or other drainage fixture be connected to the District's system which may introduce any wastewater other than sanitary sewage into the system.
- b. All piping material incorporated into the District's sanitary sewage system shall not be white unless utilizing Schedule 40 PVC. At the time of the preparation of these specifications, the predominant pipe color is green. All trench or foundation drainage piping shall be white to preclude accidental cross-connection of the drainage systems.

## **Pipe and Manhole Materials**

### 3.01 PVC Pipe and Fittings (Polyvinyl Chloride)

#### a. Conformance

ASTM 3034; Standard Dimension Ratio (SDR) shall be maximum of 35.

#### b. Joints

ASTM D3212; Bell and spigot, push-on with single rubber gasket.

Jointing of dissimilar pipe materials shall be accomplished with a specially manufactured rubber connection with stainless steel tightening bands (Mission Rubber Company, Fernco or equivalent).

Solvent Cement Joints may be used for 4-inch and 6-inch pipe.

#### c. Length of Joints

The length of joints for flexible conduits shall not exceed 12-1/2 feet for grades less than one percent.

#### d. Criteria for Acceptance. Pipe which has any of the following visual defects will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.
- (2) Pipe which is out-of-round to prohibit proper jointing.
- (3) Improperly formed bell and spigot ends or bells which are less than 1-1/2 inches in length.
- (4) Pipe which is fractured, cracked, chipped or damaged in any manner.
- (5) Pipe that has been damaged during shipment or handling.
- (6) Pipe or fittings not properly marked as required by the following specifications.

#### e. Marking of Material. The following shall be clearly shown on the exterior of the pipe:

- (1) Manufacturer's name.
- (2) Appropriate ASTM designation.
- (3) Appropriate SDR number of 4-inch and 6-inch pipe.
- (4) Homemark.

#### f. Material Handling and Storage. Avoid damage to pipe from impact, bending, compression or abrasion during handling and storage.

Store pipe on flat surface which provides even support for the pipe barrel with bell end overhanging. Do not stack pipe higher than 5 feet. Do not store pipe and fittings in direct sunlight for extended periods (greater than two to three weeks). Any discoloration of the pipe material shall be evidence of ultraviolet damage and shall be reason for rejection and the removal from the project.

Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.

Use only nylon protected sling to handle pipe. The use of hooks, bare cables or chains will not be permitted.

For pipe slopes less than one percent, the maximum pipe joint length shall be 13 feet.

#### g. All PVC pipe installed in the District's sanitary sewer system including mains and services shall be non-white in color. White sewer pipe shall not be acceptable as trench and foundation drain piping used in the District shall be white to better assure that there is no accidental connection between the two separate drainage systems.

- h. PVC pipe shall not be installed at depths in excess of fourteen (14) feet without specific approval of the District.

3.02 Ductile Iron Pipe

a. Conformance

ANSI 21.51; Thickness Class 50, unless otherwise required for internal or external loading.

Fittings shall conform to ANSI 21.10 for flanged, mechanical joints and push-on joints (AWWA C110 or C153).

b. Joints

- (1) Mechanical Joint: ANSI A21.11
- (2) Push-On: ANSI A21.11
- (3) Flanged: ANSI B16.1, 125 lb. drilling
- (4) Rubber Gaskets: AWWA C111 (ANSI A21.11)

c. Protective Coatings

- (1) Exterior Coating: Manufacturer's standard coating approximately 1 mil thick.
- (2) Interior Lining: Interior lining shall consist of standard thickness, cement mortar in conformance with ANSI A21.4 standards.

d. Criteria for Acceptance. In addition to any deficiencies covered by the reference specifications above, any of the following visual defects will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.
- (2) Pipe which is out-of-round to prohibit proper jointing.
- (3) Pipe which is fractured, cracked, chipped or damaged in any manner.
- (4) Pipe that has been damaged during shipment or handling.
- (5) Pipe which has lining which is fractured, cracked, chipped or damaged in any manner and would not provide satisfactory service under the conditions intended.

e. Marking of Material & Certification of Manufacturer. All materials shall be marked with the name of the manufacturer of origin. Manufacturer will provide a certification to the District that all products supplied to the project site are in conformance with these specifications.

f. Material Handling and Storage. Handle pipe fittings and accessories using lifting hoist or skidding to avoid shock or damage. Do not drop such materials. Do not allow pipe unloaded on skidways to be skidded or rolled into pipe previously unloaded. Protect the pipe coatings and linings from damage during delivery and handling.

3.03 Manholes. Except as otherwise specifically approved by the District, manholes shall be precast concrete and manufactured in accordance with the referenced specifications. See standard drawing No. 4.

a. Conformance

Precast concrete in conformance with ASTM C478.

b. Size of Manholes

<u>Size of Sewer Main</u>	<u>Inside Diameter of Manhole</u>
Up to 10 inches	4'
12 through 18 inches	5'
24 inches and above	6'

c. Cement

All cement used in manhole construction shall be Type II or Type IIIA. All concrete shall have a 28-day compressive strength of at least 4,000 pounds per square inch (psi).

Rubber gasketed joints for pre-cast manhole sections shall be an R-4 joint and designed in accordance with ASTM C443.

Manhole joints may be joined with flexible plastic/rubber gaskets constructed of Ram-Nek, Rubber-Nek, Con-Seal or equivalent.

3.04 Cast-in-Place Concrete. All cast in place concrete utilized in sanitary sewer construction shall have a minimum compressive strength of 3000 psi at 28 days unless specifically required otherwise by the project.

a. Aggregates

Conform to ASTM C33, maximum size shall be 3/4 inch nominal diameter.

b. Cements

Portland Cement in accordance with ASTM C150, Type II or IIIA will be used for all concrete.

c. Admixtures

Air entraining admixtures will be permitted in conformance to ASTM C260. Maximum entrained air shall be 6.5% and minimum shall be 5.0%. Water reducing and retarding admixtures may be utilized with the specific approval of the District. Such admixtures shall be in conformance with ASTM C493. Flyash or calcium chloride are not permitted for use.

d. Water/Cement Ratio

Maximum water cement ratio shall be 0.45.

e. Slump

Maintain within the following limits:

1" minimum, 3" maximum for all concrete to be incorporated in sanitary sewerage facilities.

3.05 Castings

a. Cast Iron

(1) Conformance: ASTM A48

(2) Applicable Items: Manhole rings and covers with non-slip surface with "SEWER" cast in the cover. Combined weight will not be less than 300 pounds. Ring shall be a minimum of 4 inches in height.

3.06 Steps. All manholes shall have steps at a maximum of 16 inches vertical spacing unless otherwise specifically directed by the District.

a. Conformance: Federal Spec. QQ-A-200/8.

b. Material: Aluminum with drop front design or safety nosing and non-skid grooves.

- c. Width: 12 inches.
- d. Capacity: 1000 pounds at 6 inches from wall.  
1500 pounds at 4 inches from wall.

OR

- a. Material: Plastic (co-polymer polypropylene) with 1/2" diameter Grade 60 steel reinforcement as manufactured by M.A. Industries, Inc.
- b. Design Equipment: PS-2-PFS Manhole Step with non-skid grooves and safety nosings or drop front design.

3.07 Cement Mortar

Conformance: ASTM A270, Type M.

3.08 Cement Grout

- a. Cement

Portland Cement in accordance with ASTM C150, Type II or II LA

- b. Sand

Clean, well-graded, natural sand in accordance with ASTM C33

- c. Proportioning

One part Portland Cement, 2½ parts sand, by weight, with minimum water required for placement and hydration

3.09 Non-Shrink Grout

Approved commercial factory mix product made especially for intended use. Utilize non-metallic chemical grout for non-shrink applications.

3.10 Dampproofing Material

Coal tar solution type coating; Tnemec "47-461 Foundation Coating," International "Intertuf 100," Carbolite "Bitumastic Super Service Black" or similar approved material

## **Pipe Installation**

4.01 **Earthwork.** See Standard Water Distribution Drawing No. 9 for typical pipe trench detail. See Standard Wastewater Collection System drawing No. 1 for bedding detail.

a. **Embedment Materials.** All water and sanitary sewer mains are to receive one of the following embedment materials extending from the bottom of the excavation to 12 inches over the pipeline.

- (1) **Concrete.** The pipeline embedment with concrete shall utilize concrete having a 28-day compressive strength of a minimum of 3000 psi and other characteristics as set forth in these Specifications.
- (2) **Granular Material.** Well-graded, crushed stone or gravel meeting the requirements of ASTM C33, Gradation 67 (3/4" to No.4).
- (3) **Fine Granular Material.** Natural or manufactured sand meeting the following requirements:

### **Well-Graded Sand**

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	10 – 30
No. 100	2 – 10

(4) **Squeeze Sand**

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8 inch	100
No. 200	0 - 5

(5) **Selected Backfill.** Selected soil free from rocks, clods or stones greater than 1-1/2" in any dimension as approved by the District's representative. Granular material, fine granular material or squeeze sand may be substituted for selected backfill.

b. **Backfill Materials**

- (1) **Suitable Material.** Soil obtained from the excavation that is free of frozen material, stumps, roots, brush, other organic matter, debris and other items. In addition, suitable material shall meet the following requirements:
- (2) **Upper Portion of Trench.** Material placed within one (1) foot of pavement subgrade or finished surface in unimproved areas shall be soil free from rocks, greater than 6 inches in nominal diameter.
- (3) **Other Portions of Trench.** Material within 6 inches below and 12 inches above the pipe shall contain particles of a size to conform to the embedment class required but in no case shall it contain rocks greater than 1-1/2 inches in any dimension. From a point 12 inches above the pipeline to within one (1) foot of the pavement subgrade or finished surface in unimproved areas, maximum size of any rock in the trench backfill shall be 18 inches nominal diameter.
- (4) **Public Highways.** Provide and install material in conformance with the Colorado Department of Transportation requirements where they do not conflict with other provisions of these regulations. Should a conflict exist, submit a request for

clarification to the District in writing prior to proceeding with work.

- (5) Flowable Fill. At the District's option, or if required by the right-of-way's governing body, utility trench backfill meeting the following requirements (flowable fill), may be used in lieu of native backfilling in any excavation regardless of width or depth. Concrete slurry type full depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

**FLOWABLE FILL SPECIFICATIONS**

<b><u>Ingredient</u></b>	<b><u>lbs / cubic yard</u></b>
Cement	43 (0.47 sack)
Water	325 (39 gallons or as needed)
Coarse Aggregate (Size #57)	1700
Sand (ASTM C-33)	1845

c. Trench Backfilling and Compacting

- (1) Place backfilled material above embedment materials in a manner to prevent damage or misalignment of the pipeline. Place in lifts of a thickness necessary to acquire the specified backfill density or in conformance with other regulatory requirements. Backfilled material shall conform to the requirements of Section 3.10.b of these specifications.
- (2) Backfill Density Requirements. Unless otherwise specified or required by local governing authority, all backfill should be placed in a manner to achieve the density specified below.
- State Highway  
100% of maximum in shoulder areas  
Flowable Fill within all paved areas
  - Paved roadways, sidewalks and other areas to receive pavement  
95% of maximum density for entire trench depth
  - Gravel roadways  
95% of maximum density for entire trench depth
  - Sodded or lawn areas over a dedicated easement or right-of-way  
90% of maximum density
  - Zone 6" below to 12" above pipe  
95% of maximum density for all pipelines
  - Adams / Arapahoe County  
100% of maximum in paved areas parallel to traffic  
95% in shoulder areas  
Flowable Fill in paved areas perpendicular to traffic

d. Field Quality Control

- (1) Density Testing and Control. Density testing as may be required by the District's representatives shall be the responsibility of the Contractor and/or Developer. Results of such density testing shall be reported directly to the District by the testing agency. All reports shall be submitted with the seal and signature of a registered professional engineer experienced in the testing of soil materials.
- (2) Soil Compaction Tests. Conduct in accordance with the requirements of ASTM D698-07 or AASHTO T99, "Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb. Rammer and a 12 inch Drop." Use method A, B, C or D as appropriate on soil condition and judgment of the testing laboratory. Samples tested shall be representative of

materials to be placed (or altered). Obtain optimum moisture density curve for each type of material or combination of materials encountered or utilized. Use test results as a basis for compaction control. Testing includes Atterberg Limits, grain size determination and specific gravity.

#### 4.02 Pipe Laying

- a. Begin pipe laying at the lowest point, unless directed otherwise by the District, and install the pipe with the spigot ends pointing in the direction of flow.
- b. Unless required or directed otherwise by the District, lay all pipe straight between changes in alignment and at uniform grade between changes in grade or slope.
- c. As each length of pipe is placed in the trench, the joint shall be completed in accordance with the pipe manufacturer's recommendations and the pipe shall be brought to the correct line and grade. The offset at the invert shall be less than 1% of the inside pipe diameter.
- d. The length of joints for curvilinear sewer shall be determined by the radius using joint deflection not exceeding the manufacturer's recommendations, three degree couplings or a combination of both. Bending of the pipe material to achieve the curvature shown on the plans shall not be permitted.
- e. Secure the pipe in place with Class B bedding material tamped under and around the pipe. Do not walk on small diameter conduit or otherwise disturb any conduit after jointing has been completed.
- f. All foreign matter or soil shall be removed from the inside of the pipe before it is lowered into its position in the trench and shall be kept clean at all times during and after laying. All openings along the line of the sewer shall be securely closed and during suspension of work at any time, suitable pipe plugs or closures shall be placed to prevent water, soil or other materials from entering the pipeline.

#### 4.03 Fittings, Couplings, Wyes and Saddles

- a. Fittings, couplings, wyes and saddles shall be the same material as the pipeline or as specifically manufactured for a particular installation.
- b. Jointing of dissimilar materials shall be permitted only with approval of the District representative. Jointing of such dissimilar materials shall be through the use of fittings, couplings, wyes, saddles, adapters or adhesives specifically manufactured for such transitions.

#### 4.04 Service Lines. See Standard Drawing No. 7

- a. Prepare subgrade in accordance with Part III of these regulations.
- b. Connect all service lines to mains with a tee or tee saddle in the top one-half of the sewer main. Connections made in the lower half or at mid-point of the main shall have prior approval of the District and may require the installation of a backflow prevention device.
- c. Connection of service lines to mains
  - 1) Tee saddles with rubber gaskets to be placed between the saddle and the main line of pipe, secured in place with stainless steel bands are required.
  - 2) Connection to the main line piping shall be made by cutting a hole using the appropriate hole template, tapping machine or hole saw no more than ¼-inch larger in diameter than the template outline.
  - 3) A 1/8 or 1/16 bend shall be used from the tee fitting to attain the desired grade and slope for the service line piping.
  - 4) The tee saddle shall be furnished with an intergal rubber gasketed bell.
  - 5) All service line piping between the main line and the property line of the property to be serviced shall be pipe in accordance with these specifications with intergal rubber gasketed pushon joints.
  - 6) In general, no change in horizontal alignment will be permitted between the connection at the main line and the property line of the property being serviced.



- d. Service line connections shall be separated by a minimum of 3 feet measured center to center along the main.
- e. Plug all service line stubs with water and air tight cap or plug unless the service line will be immediately connected to a building sewer.

Where new street construction is proposed immediately following construction of sanitary sewer facilities, extend the service line to 5 feet inside the property line, install the appropriate plug and mark with a vertical wood marker extending above the surface and having dimensions of 2" x 4" minimum.

- f. The Contractor and/or Developer shall provide complete as-built information on each service line connection installed within his/her work. As a minimum this information shall include the location of the connection to the main referenced to the nearest manhole or other permanent improvement, the location of the end of the service line stub, the direction of the service line as it relates to surrounding permanent surface improvements, the size, the material of construction and the date and name of the installer. All such information shall be provided to the District's representatives for incorporation into the District's permanent records.
- g. Connection of service lines and service line construction shall be accomplished by experienced, qualified personnel with adequate equipment. The District's representative shall have authority to reject work and may not permit work to be accomplished unless done by qualified personnel.

#### 4.05 Manholes

- a. Cast-in-place concrete manhole base
  - 1) Prepare the subgrade and excavation in accordance with the specifications.
  - 2) Provide reinforcing, grade 60 reinforcing bar, No. 4 at 12-inches on center each way for manholes 12-feet or less in depth. Place steel at 8-inches on center each way on manholes in excess of 12 feet in depth.
  - 3) Place concrete against undistributed soil to the depth, thickness and other dimensions shown on detailed drawings.
  - 4) Finish and cure the cast-in-place concrete for a minimum period of 24 hours prior to placing precast manhole sections on the cast-in-place base.
  - 5) Maintain ground water below the bottom of the cast-in-place concrete for a minimum period of 24 hours following placement of concrete by maintaining pumping equipment in operation below the subgrade of the manhole base.
  - 6) Concrete shall contain a minimum of 564 lbs of Type 2 portland cement per cubic yard (6 sacks mix), be placed with a maximum slump of 2 inches with maximum size course aggregate of ¾-inch (ASTM C33).
- b. Provide segmental precast concrete barrel sections a maximum of 4 feet in length with preformed flexible gasket material between each barrel section as jointing material or install rubber gaskets in precast R-4 joint grooves per manufacturer's recommendations.
- c. Provide dampproofing of all manhole joints.
  - 1) Provide interior dampproofing consisting of a 3/8" to 1/2" thick layer of cement grout extending a minimum of 4" each side of all manhole segment joints. Work the cement grout in the joint to completely fill all voids.
  - 2) Provide exterior dampproofing consisting of a 3/8" to 1/2" thick layer of cement grout extending a minimum of 4" each side of all manhole segment joints. Work the cement grout in the joint to completely fill all voids.
  - 3) When ground water is present or potentially present in the opinion of the District representatives, a double application of Ram-Nek, or equal, and an application of cold tar epoxy dampproofing material shall be applied to the completed manhole structure after installation of cement grout and prior to backfilling. During construction of all dampproofing measures ground water shall be maintained below the subgrade elevation in the manhole excavation during the time sufficient for all materials to properly cure, no less than 24 hours.

- d. Provide one, one (1) foot high barrel section beneath a reducing ring or cone cap to bring the manhole ring and cover to within 6 inches of desired grade.
- e. Provide precast concrete 2-inch-high grade adjustment rings to bring the ring and cover to desired grade. A maximum of three grade adjustment rings are permitted. A maximum dimension of 2 feet shall be permitted between the manhole ring and the top manhole step.
- f. Where the manhole base is constructed from cast-in-place concrete, the sewer pipes entering the base shall be cut to length to match the inside of the manhole barrel and set to grade. Manhole gaskets shall be placed over the pipe and centered between the end of the pipe and the outside of the cast-in-place base. The cast-in-place base shall then be constructed to the lines and grades required by the District's standard specifications and the accepted plans. Sewer pipe shall not be laid through the manhole base and the concrete base and/or invert placed around the pipe.

Where preformed rubber "boots" such as Kor-N-Seal boots are used in precast manhole bases, manhole gaskets on the pipe are not required.

- g. Where intersecting pipelines or pipelines requiring deflections at manholes require that the invert of the manhole be shaped to match the pipe cross sections, such construction shall be accomplished in accordance with the detail drawings of these specifications. Form the flow line configuration of intersecting pipes to allow for free uninterrupted flow of sanitary sewage through and out of the manhole. All channel inverts shall be finished smooth by steel troweling. All inverts shall be placed and finished with a single pour of cast-in-place concrete. Placement of grout and/or other material to repair and/or reshape the manhole invert shall not be permitted unless specifically approved by the District's representative.
- h. Cast-in-place bases for manholes shall be constructed in a manner to provide for a smooth level surface on which vertical barrel sections shall be placed. Completely watertight joints shall be made utilizing preformed flexible gasket material or a precast concrete base section may be utilized. The manhole shall be constructed such that no single section varies from true vertical by more than two percent of the section length.
- i. All manholes constructed in the District shall have the ring and cover elevations set at final street grades or at a point not more than 6 inches above the existing ground in non-traffic areas unless directed otherwise by the District. The Developer/Contractor shall be responsible for adjusting the manhole rings and covers to the final elevations.
- j. In areas where street paving will be placed, the manhole ring adjustment shall be accomplished in a two-step process prior to placement of pavement. The manhole ring shall be constructed 0.5 feet below finished pavement surface elevation. Pavement shall then be placed in accordance with the applicable rules, regulations and specifications. Following completion of paving, the sanitary sewer manhole rings will be raised by the Developer/Contractor to finished grade in accordance with the specifications of the District.
- k. The ring shall be adjusted with precast concrete rings a maximum of 0.5 feet in height. Cement grout shall be placed to adjust the ring to conform to the surface. A concrete collar shall be placed around the adjusting rings and the ring of the manhole up to a point 2 inches below finished grade. Paving material shall then be placed over the concrete and match the surrounding pavement surface. Tack coat material shall be placed between new and existing asphaltic concrete surfaces, the manhole casting and the concrete collar.

## **Testing of Pipelines and Appurtenances**

5.01 **Infiltration.** Use where ground water may be above the pipeline invert.

- a. Infiltration tests shall be conducted on each segment of the sanitary sewer system where it could be anticipated that ground water may rise above the flow line of the pipeline. Tests shall be conducted by placing an approved calibrated V-notch weir in the line just above the next lower manhole and plugging the line just above the next higher manhole. Sufficient time will be allowed to permit the water level behind the weir to stabilize before reading. Any foreign material hanging to the weir will be dislodged before reading. Successive readings shall be taken until consistent results are obtained.
- b. The maximum allowable infiltration shall be 100 gallons per day per inch of pipe diameter per mile of pipe.
- c. Each segment of pipeline between manholes or other major appurtenances must satisfy and pass the infiltration tests.
- d. Should it be determined that the infiltration rate is in excess of that permitted by these regulations, any repair and/or replacement of pipelines, manholes or other appurtenances shall be at the Contractor's and/or Developer's expense. Satisfactory repair and replacement shall be accomplished prior to the consideration of acceptance of any facility by the District.
- e. The Contractor and/or Developer will furnish all labor, equipment and materials required to accomplish such testing.

5.02 **Air Test.** All segments of sanitary sewer mains shall be subjected to an air pressure test. Where ground water levels are above the conduit, increase the test pressures given below to compensate for the pressure on the conduit from the ground water.

- a. The Contractor may conduct an initial air test of the sewer main line after compaction of the backfill but prior to the installation of any service lines. Such tests shall be considered for the Contractor's convenience in quality control of the project construction. Final consideration for acceptance of the sanitary sewer by the District shall be based on satisfactory completion of testing with all service line stubs installed.
- b. Preparation of Tests: Flush and clean the sewer line prior to testing in order to wet the pipe surfaces and produce more consistent results. Plug and brace all openings in the main sewer line and the upper end of any connections. Check all pipe plugs with a soap solution to detect any air leakage. If leaks are found, release the air pressure, eliminate the leaks and start the test procedure over again.
- c. Procedure of Test: Add air until the internal pressure of the sewer line is raised to approximately 4.0 psi gage at which time the flow of air shall be reduced and the pressure maintained between 3.5 and 4.5 psi gage for a sufficient time to allow the air temperature to come to equilibrium with the temperature of the pipe.
- d. After the temperature has stabilized the pressure shall be permitted to drop to 3.5 psi gage at which time a stop watch or a sweep second hand watch shall be used to determine the time lapse required for the air pressure to drop to 3.0 psi gage.
- e. If the time lapse is less than that shown in the table, the Contractor shall make the necessary corrections to reduce the leakage to acceptable limits.
- f. If the time lapse exceeds that shown in the table, the pipe shall be presumed to be within acceptable limits for leakage.

Pipe Dia.(in.)	Minimum Time (min:sec)	Length For Minimum Time (ft.)	Time for Longer Length (L, ft.) (sec)	LENGTH (ft.)			
				100	200	300	400
4	1:53	597	0.190L	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:51
8	3:47	298	0.760L	3:47	3:47	3:48	5:04
10	4:43	239	1.187L	4:43	4:43	5:56	7:54
12	5:40	199	1.709L	5:40	5:42	8:33	11:24
15	7:05	159	2.671L	7:05	8:54	13:21	17:48
18	8:30	133	3.846L	8:30	12:49	19:14	25:38
21	9:55	114	5.235L	9:55	17:27	26:11	34:54
24	11:20	99	6.837L	11:24	22:48	34:11	45:35
27	12:45	88	8.653L	14:25	28:51	43:16	57:42

Safety: The air test may be dangerous if proper precautions are not taken. All plugs must be sufficiently braced to prevent blowouts and the pipeline must be completely vented before attempting to remove the plugs.

As a safety precaution, pressurizing equipment shall be provided with a regulator setting of 5 psi to avoid over-pressurizing and damaging an otherwise acceptable line.

#### 5.03 Alignment Testing

- a. Each section of pipeline on a linear alignment between manholes will be subject to testing by lamping by the District's representatives to determine where proper alignment has been accomplished and whether any displacement of the pipe has occurred during construction.

The Contractor and/or Developer shall provide suitable assistance to the District's representative in accomplishing this work. The Contractor and/or Developer shall be responsible for repairing any alignment, displaced pipe or other defects discovered during this testing in accordance with these specifications.

- b. For pipelines installed at grades less than 1%, a minimum of 90% of the full pipe cross section shall be visible at the opposite end of the segment being observed.
- c. For pipelines installed at grades greater than 1%, a minimum of 75% of the full pipe cross section at the opposite end of the segment shall be observed.
- d. The determination of the acceptability of the pipeline alignment by lamping shall rest solely with the District's representative and his decision shall be final.
- e. Pipelines not meeting the requirements of the alignment tests shall be completely excavated, removed, and re-laid on prepared bedding material, backfilled and compacted in accordance with these specifications and then subjected to infiltration, air pressure and alignment testing.

#### 5.04 Deflection Tests

- a. Proper construction in accordance with these specifications and the manufacturer's recommendations should result in a vertical deflection of the pipe less than 5% of the internal diameter. At the option of the District, the Contractor and/or Developer may be required to perform testing to determine conformance with this requirement.
- b. Should the District determine that deflection testing is required, the Contractor and/or Developer shall provide all necessary equipment, labor and other facilities. Data supplied by the pipe manufacturer's

representative for dimensional quality shall be utilized.

- c. Should the vertical deflection of the pipe be found to exceed 5% of the internal diameter, the Contractor will remove the pipe, install proper bedding, replace the pipeline material and properly place and compact all backfill material in accordance with these specifications. Any areas removed and replaced shall be subject to infiltration, air pressure and alignment testing.

5.05 Vacuum Tests

- a. All manholes shall be vacuum tested prior to CCTV inspection operation and acceptance by the District Engineer.
- b. All lift holes and pipes penetrating the manhole are to be plugged, sealed, braced, and secured. A vacuum will be drawn and the vacuum drop over a specified time period will be reported.
- c. An effective seal is required between the vacuum base and the manhole rim.
- d. The test head gauge should be placed at the top of the manhole or per the manufacturer's recommendations.
- e. A vacuum of 10 inches of mercury should be drawn within the manhole, vacuum line valve closed, and vacuum pump shut off. The time should be recorded for the vacuum to drop to 9 inches of mercury.
- f. The manhole vacuum test is considered passing if the time for the vacuum drop in mercury exceeds the values indicated in the following table.

Depth of Manhole (ft.)	Diameter of Manhole (ft.)		
	Time (sec.)		
	4'	5'	6'
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

- g. If a manhole fails the initial vacuum test, then the District Engineer shall be informed of repairs, the manhole supplier should be notified of defects, repairs shall be made, and the manhole retested until a satisfactory test is obtained.

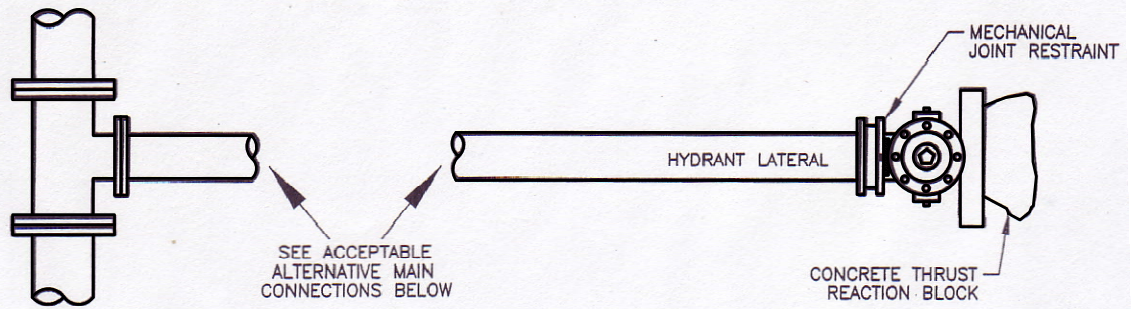
5.06 Internal Video Inspection

- a. All sewer main construction in the District shall be inspected with internal video camera and recording equipment.

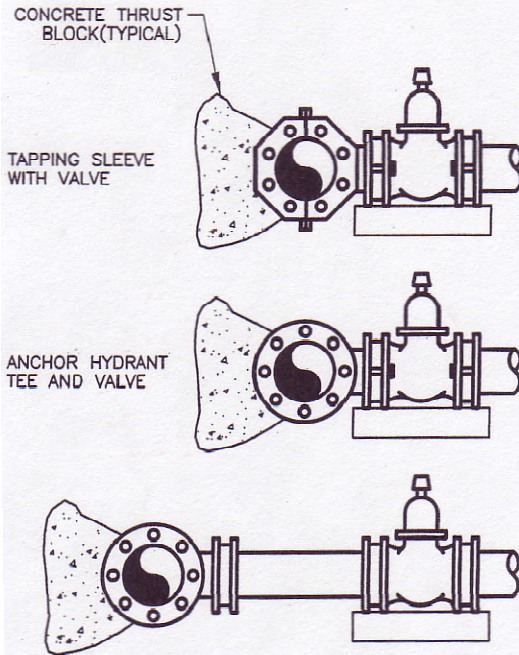
- 1) Coordination with the District shall be required as to cleaning and/or flushing prior to any internal video inspection.
- b. All costs of the internal video inspection shall be borne by the Contractor and/or Developer.
- c. The individual and/or company and permanent video tape recording shall be subject to the acceptance and approval of the District.

**PART I**

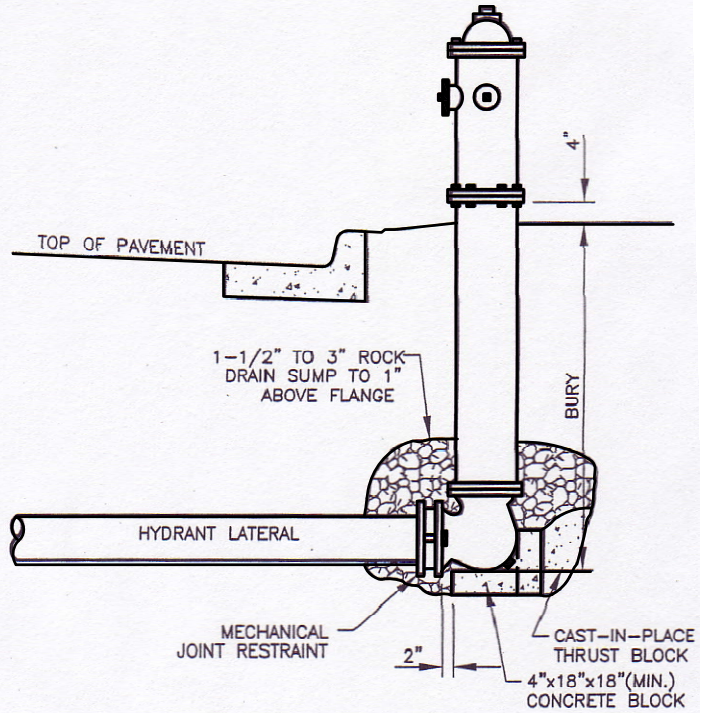
**WATER DISTRIBUTION  
STANDARD DRAWINGS**



**PLAN**



MJ HYDRANT TEE WITH 30" SPACER PIPE AND VALVE. USE MECHANICAL JOINT RESTRAINT AT EACH MECHANICAL JOINT.



**NOTES:**

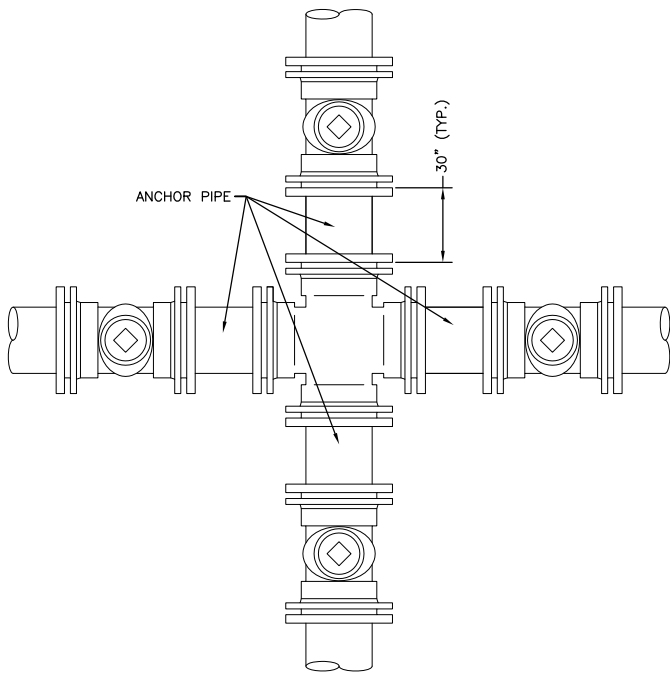
1. TIE BACK RODS:  
MAX. ROD LENGTH = 10'  
MIN. ROD LENGTH = 4'
2. MECHANICAL JOINT RESTRAINTS SHALL BE USED WITH ANCHOR & TIE RODS AND CONCRETE THRUST BLOCKS.

**STRASBURG SANITATION AND WATER DISTRICT**

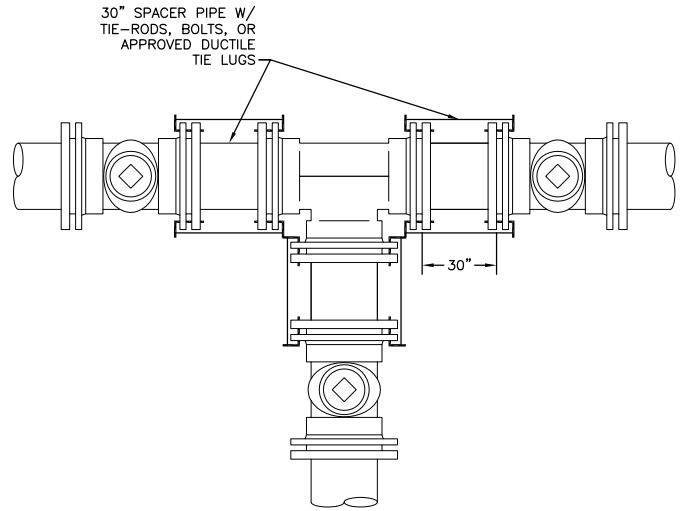
**FIRE HYDRANT INSTALLATION**

APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET OF	Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED L. OTTO	DATE: 11/82	PA NO.	
REVISION	2/86, 7/90, 10/31/16		

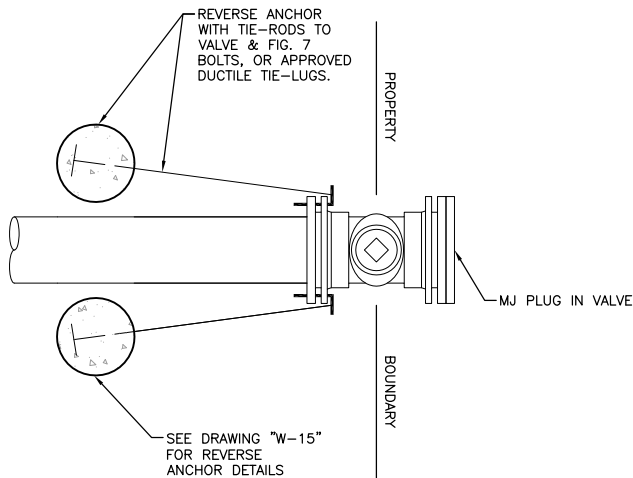




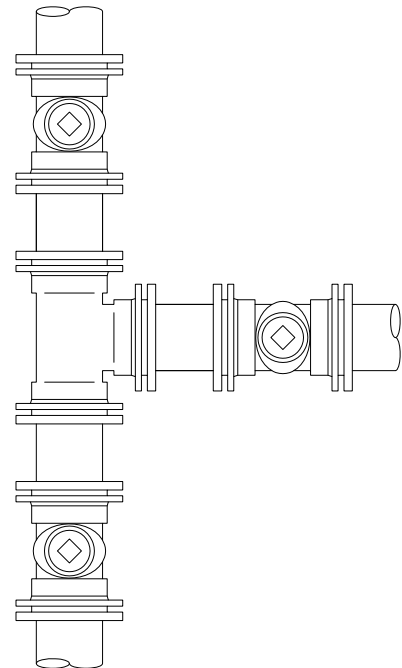
CROSS OR TEE W/  
ANCHOR PIPES



CROSS OR TEE W/  
SPACER PIPE & TIE-RODS



AT END OF LINE USE  
REVERSE ANCHOR WITH  
TIE BACK RODS

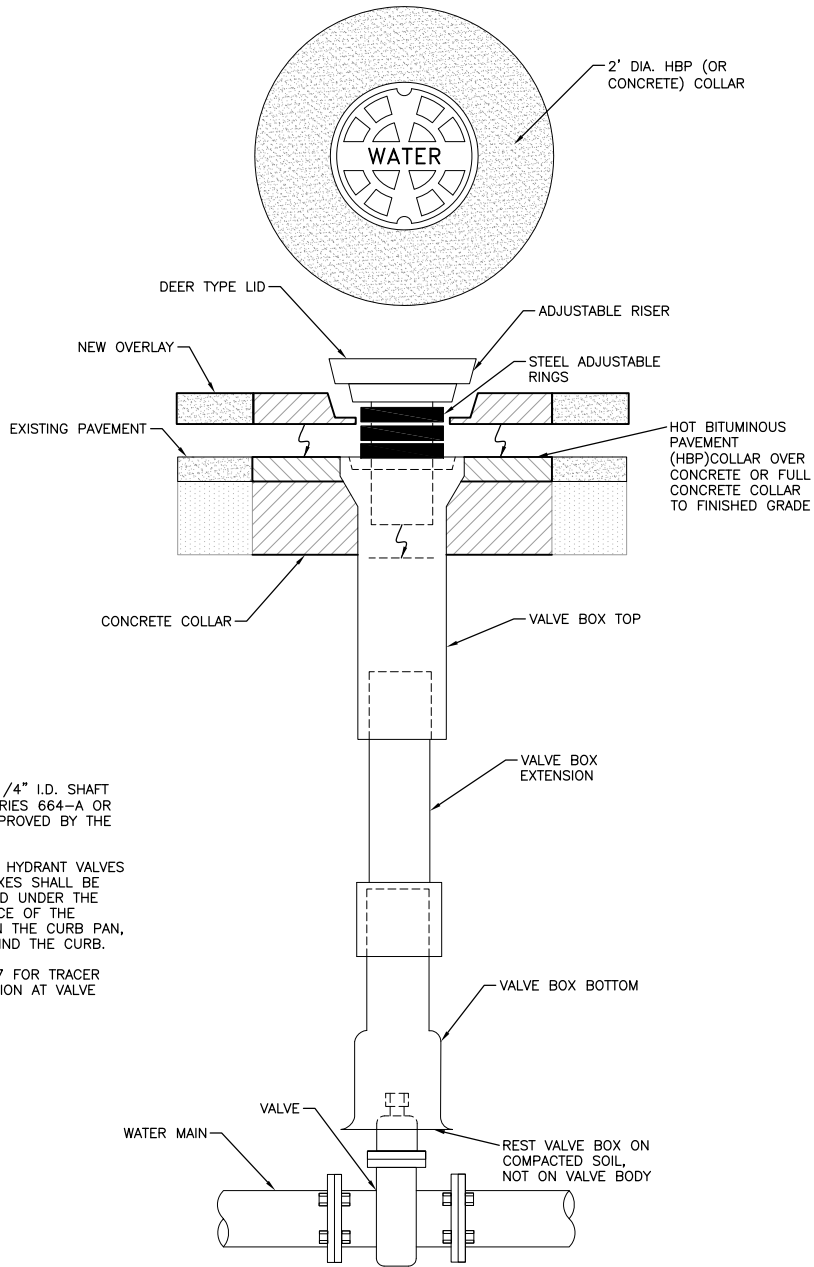


WITH MJ ANCHOR TEE

GENERAL NOTES:

1. ON ANY VALVE INSTALLATION NEAR A FITTING, THE VALVE SHALL BE ANCHORED BY RODS, REVERSE ANCHOR, AND MECHANICAL JOINT RESTRAINTS. 3/4" ALL-THREAD RODS SHALL BE USED WITH FIG. 7 BOLTS OR APPROVED DUCTILE TIE-LUGS FOR DEAD-END VALVES AND/OR PLUGS. ALL METALLIC COMPONENTS SHALL BE WRAPPED IN POLYETHYLENE TUBING.
2. ANCHOR PIPE OR FOSTER COUPLINGS MAY BE SUBSTITUTED FOR SPACER PIPE AND RODS.
3. THE CONCRETE REVERSE ANCHORS USED SHALL BE SIZED AS INDICATED ON DRAWING 11.
4. SEE DRAWING 14 FOR APPLICATION OF MECHANICAL JOINT RESTRAINTS.
5. SEE DRAWING 3 FOR VALVE BOX INSTALLATION.

<b>STRASBURG SANITATION AND WATER DISTRICT</b>			
<b>VALVE INSTALLATION AND LOCATION</b>			
APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED L. OTTO	DATE: 1/83	PA NO.	
REVISION	10/31/16		



**NOTES:**

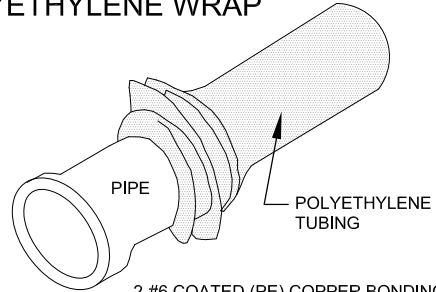
1. SLIP-TYPE 5-1/4" I.D. SHAFT TYLER PIPE SERIES 664-A OR EQUIVALENT APPROVED BY THE DISTRICT.
2. MAIN AND FIRE HYDRANT VALVES AND VALVE BOXES SHALL BE LOCATED IN AND UNDER THE DRIVING SURFACE OF THE STREET, NOT IN THE CURB PAN, CURB, OR BEHIND THE CURB.
3. SEE DRAWING 7 FOR TRACER WIRE INSTALLATION AT VALVE BOXES.

<b>STRASBURG SANITATION AND WATER DISTRICT</b>			
<b>VALVE BOX INSTALLATION</b>			
APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED B. MAC	DATE: 11/82	PA NO.	
REVISION	2/86, 10/31/16		<b>3</b>

## FIELD INSTALLATION OF POLYETHYLENE WRAP

### STEP 1:

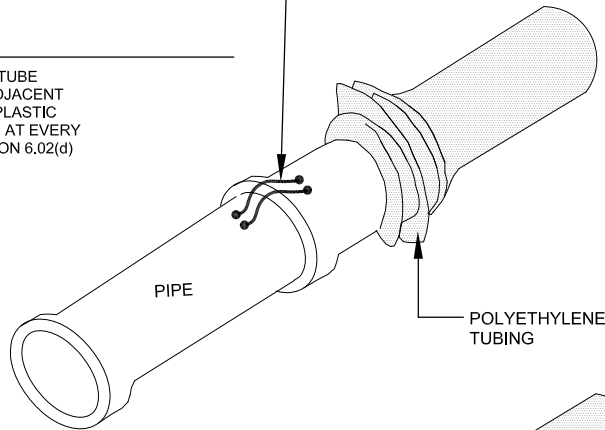
PLACE TUBE OF POLYETHYLENE MATERIAL ON PIPE PRIOR TO LOWERING IT INTO TRENCH.



2-#6 COATED (PE) COPPER BONDING WIRE THERMOWELDED TO PIPE, BOTH ENDS, OR BONDING STRAP THERMO WELDED TO PIPE. NO COMMON WELDS ALLOWED

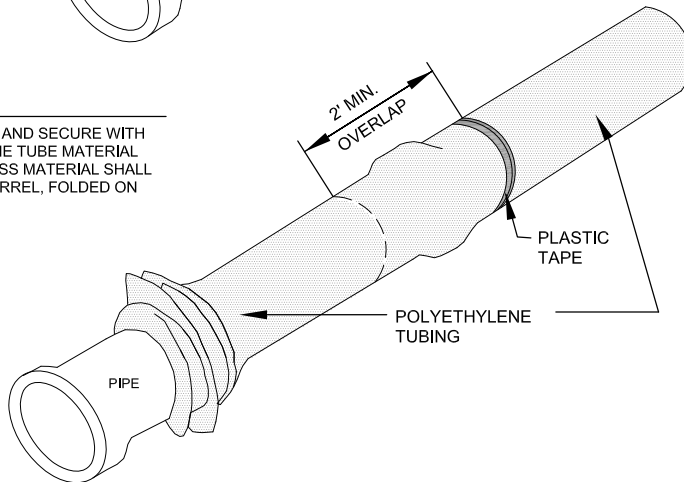
### STEP 2:

PULL TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO END AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE. INSTALL BONDING STRAP OR WIRE AT EVERY JOINT OF PIPE PRIOR TO WRAPPING AS PER SECTION 6.02(d) OF THE STANDARD SPECIFICATIONS.



### STEP 3:

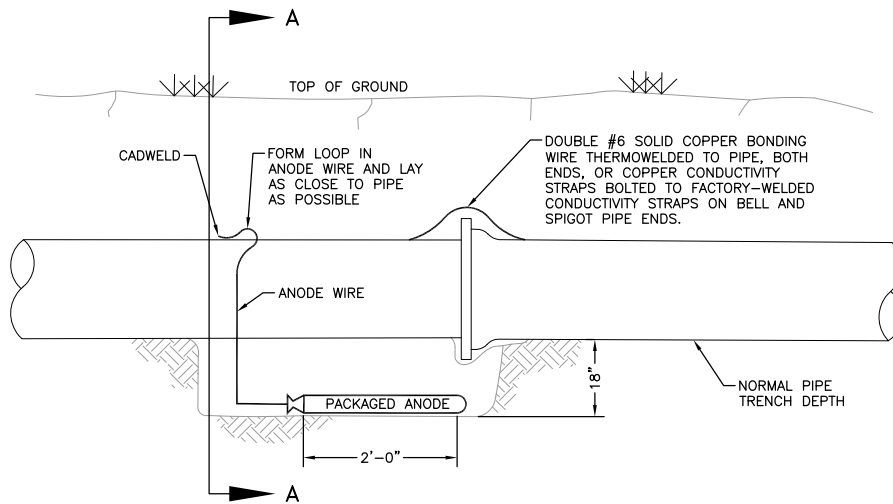
OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF PIPE AND TAPED IN PLACE.



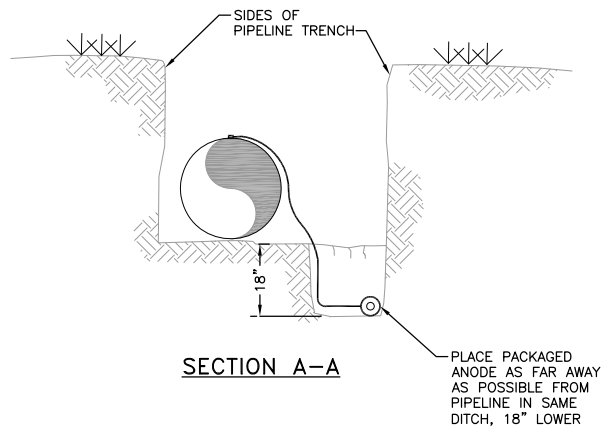
**STRASBURG SANITATION  
AND WATER DISTRICT**

**POLYETHYLENE WRAP**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF <small>Scale: NONE</small>
DESIGN	DATE:	JOB NO.	
PLOTTED	L. OTTO	DATE: 12/82	PA NO.
REVISION	10/31/16		



**ELEVATION**

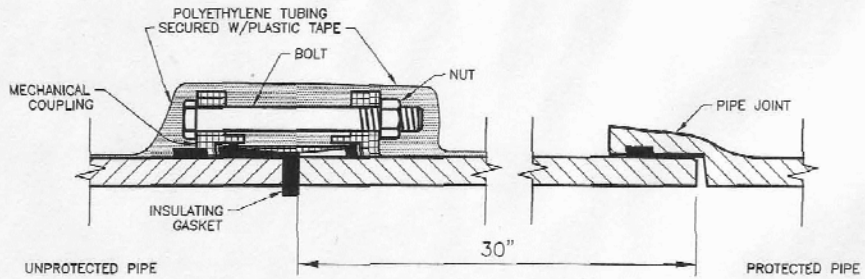


**SECTION A-A**

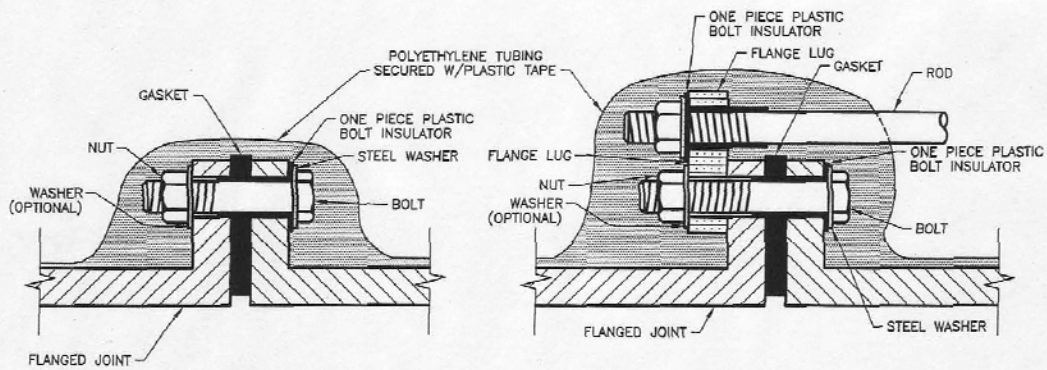
**NOTES:**

1. CADWELD CONNECTION TO BE PRIMED AND COATED CAREFULLY. PACKAGED ANODE SHOULD BE COVERED WITH FINE SOIL CONTAINING NO ROCKS OR DIRT CLUMPS, TAMPED.
2. WHEN ANODES ARE REQUIRED WITH METAL FITTINGS AND APPURTENANCES TOGETHER WITH PVC PIPE INSTALLATION, THE ANODES SHALL BE PLACED AND ATTACHED TO THE METAL IN SAME MANNER AS SHOWN ON THIS DRAWING. 9LB. ANODES CAN BE USED ON METAL FITTINGS 12" AND LESS IN DIAMETER AND 17LB. ANODES FOR METAL FITTINGS GREATER THAN 12" DIAMETER WHEN USING PVC PIPE.
3. PACKAGED ANODE TO BE WETTED AND COVERED WITH SOIL PRIOR TO BACKFILLING.
4. CADWELD COATING TO BE PRE-PACKAGED PILL OR FIELD APPLIED ROSKOTE A-51.

<b>STRASBURG SANITATION AND WATER DISTRICT</b>			
<b>BONDING JOINT AND ANODE INSTALLATION</b>			
APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED L. OTTO	DATE: 2/83	PA NO.	
REVISION	7/90, 10/31/16		<b>5</b>



**INSULATED MECHANICAL COUPLING**



**INSULATED FLANGE JOINT**

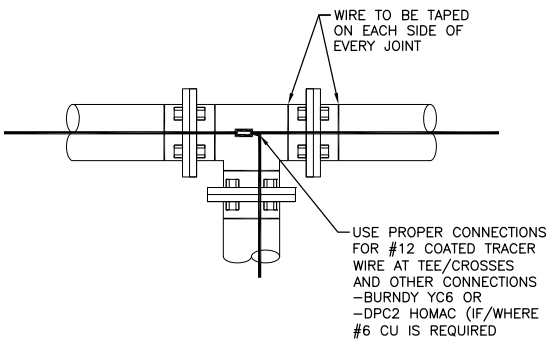
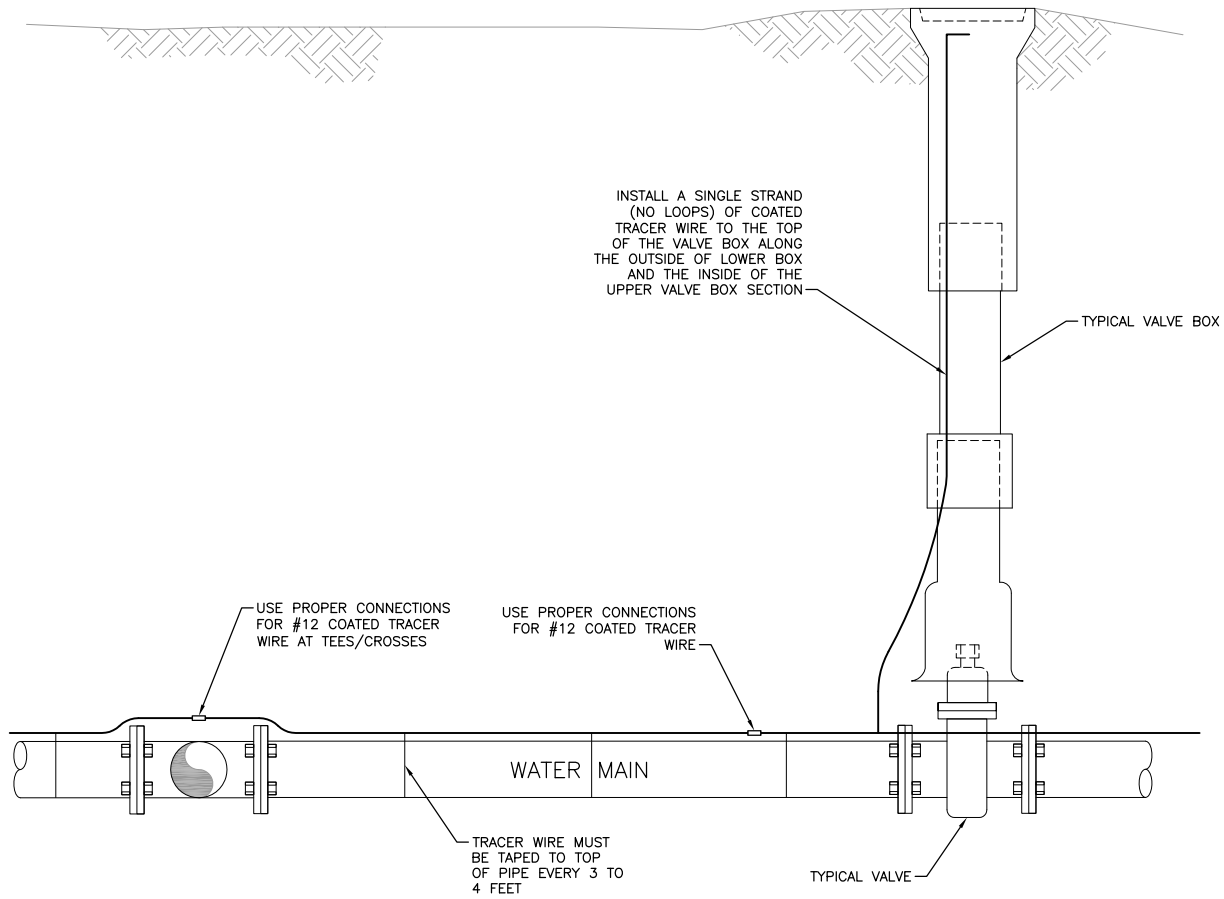
**INSULATED TIE BACK ROD**

**NOTE:**  
TEST WIRES TO BE USED WHEN REQUIRED.

**STRASBURG SANITATION  
AND WATER DISTRICT**

**INSULATOR INSTALLATION**

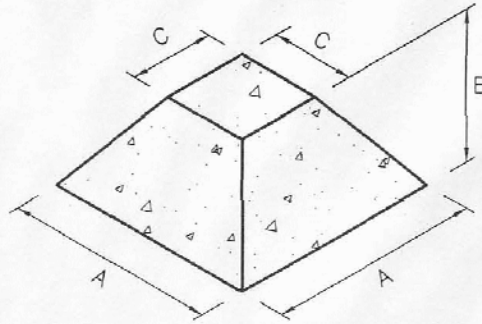
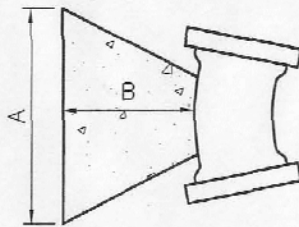
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CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED	L. OTTO	DATE: 3/83	PA NO.
REVISION	10/31/16		



**STRASBURG SANITATION  
AND WATER DISTRICT**

**COPPER TRACE WIRE ON PVC PIPE**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED	E. BUCK DATE: 2/83	PA NO.	
REVISION	2/96, 10/31/16		



NOTE: USE THE FOLLOWING VALUES FOR 'C'

PIPE SIZE =	C =
12" & UNDER	1'-6"
16" TO 24"	2'-0"
30" TO 36"	3'-0"
OVER 36"	A, B & C WILL BE GIVEN IN EACH INSTANCE

VOL. (yds)	A	B if C=1'-6"	B if C=2'-0"	B if C=3'-0"
1/8	2'-6"	0'-10"	0'	0'
1/4	2'-8"	1'-7"	0'	0'
1/2	3'-2"	2'-5"	2'-0"	0'
3/4	4'-0"	2'-6"	2'-2"	0'
1	4'-4"	3'-0"	2'-7"	2'-0"
1 1/4	4'-10"	3'-1"	2'-9"	2'-2"
1 1/2	5'-3"	3'-3"	2'-11"	2'-4"
1 3/4	5'-7"	3'-5"	3'-1"	2'-6"
2	5'-10"	3'-7"	3'-3"	2'-8"
2 1/4	6'-3"	3'-8"	3'-4"	2'-9"
2 1/2	6'-4"	3'-11"	3'-7"	3'-0"
2 3/4	6'-9"	3'-11"	3'-7"	3'-0"
3	6'-10"	4'-1"	3'-9"	3'-2"
3 1/4	7'-3"	4'-1"	3'-9"	3'-2"
3 1/2	7'-4"	4'-3"	3'-11"	3'-4"
3 3/4	7'-7"	4'-4"	4'-0"	3'-5"
4	7'-11"		4'-0"	3'-5"
4 1/4	8'-1"		4'-0"	3'-6"
4 1/2	8'-4"		4'-0"	3'-6"
4 3/4	8'-8"		4'-1"	3'-7"

VOL. (yds)	A	B if C=1'-6"	B if C=2'-0"	B if C=3'-0"
5	8'-8"		4'-2"	3'-8"
5 1/4	8'-11"		4'-2"	3'-8"
5 1/2	9'-1"		4'-3"	3'-9"
5 3/4	9'-3"		4'-4"	3'-10"
6	9'-4"		4'-5"	3'-11"
6 1/4	9'-6"		4'-6"	4'-0"
6 1/2	9'-8"		4'-6"	4'-0"
6 3/4	9'-11"		4'-6"	4'-0"
7	10'-2"		4'-6"	4'-0"
7 1/4	10'-3"		4'-7"	4'-1"
7 1/2	10'-4"		4'-8"	4'-2"
7 3/4	10'-5"		4'-8"	4'-3"
8	10'-6"		4'-10"	4'-4"
8 1/4	10'-8"		4'-10"	4'-4"
8 1/2	10'-9"		4'-11"	4'-5"
8 3/4	10'-11"		4'-11"	4'-5"
9	11'-1"		4'-11"	4'-5"
9 1/4	11'-2"		5'-0"	4'-6"
9 1/2	11'-4"		5'-0"	4'-6"
9 3/4	11'-6"		5'-0"	4'-6"
10	11'-8"		5'-0"	4'-6"

ALL WATER MAINS GREATER THAN 12 - INCHES IN DIAMETER SHALL HAVE THRUST BLOCK DESIGNED & SHOWN ON THE CONSTRUCTION DOCUMENTS.

SEE VOLUMES ABOVE FOR A, B & C DIM.

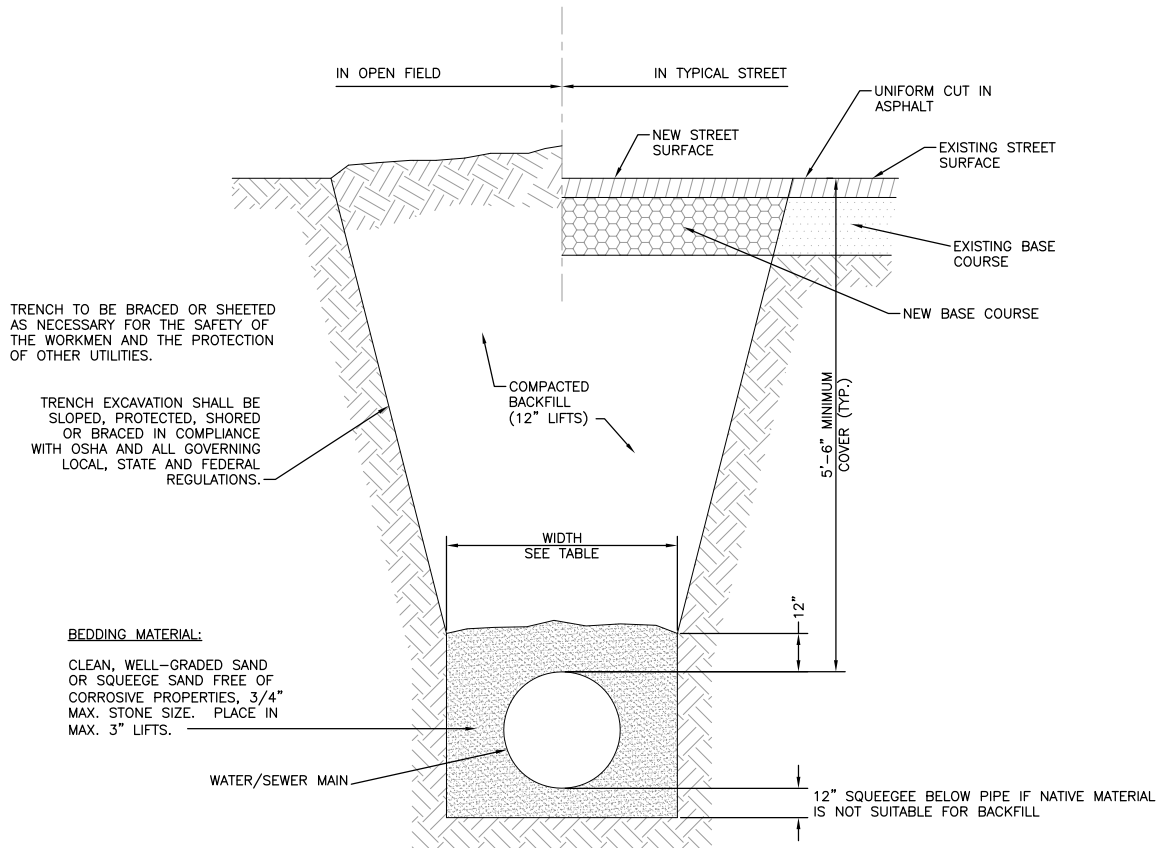
FITTING	4"	6"	8"	12"
TEE	1/8 yd.	1/2 yd.	3/4 yd.	2 yd.
90° BEND	1/8 yd.	3/4 yd.	1 1/4 yd.	3 yd.
45° BEND	1/8 yd.	1/2 yd.	3/4 yd.	1 1/2 yd.
22-1/2° BEND	1/8 yd.	1/8 yd.	1/4 yd.	3/4 yd.
11-1/4° BEND	1/8 yd.	1/8 yd.	1/8 yd.	1/4 yd.

DO NOT COVER NUTS AND/OR BOLTS WITH CONCRETE

## STRASBURG SANITATION AND WATER DISTRICT

### THRUST BLOCK DATA

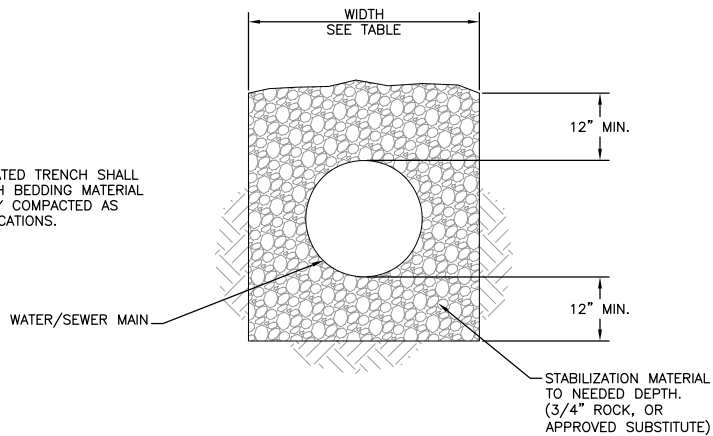
APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED	L. OTTO	DATE:	PA NO.
REVISION	10/31/16		



**TYPICAL TRENCH SECTION**  
SCALE: N.T.S.

PIPE DIAMETER	MINIMUM WIDTH	MAXIMUM WIDTH
4"	2'-2"	3'-0"
6"	2'-2"	3'-0"
8"	2'-2"	3'-0"
10"	2'-4"	3'-0"
12"	2'-6"	3'-6"
18"	2'-10"	3'-9"
24"	3'-2"	4'-3"

**NOTE:**  
AN OVER-EXCAVATED TRENCH SHALL BE REFILLED WITH BEDDING MATERIAL AND THOROUGHLY COMPACTED AS PER THE SPECIFICATIONS.



**UNSTABLE TRENCH BEDDING DETAIL**  
SCALE: N.T.S.

**STRASBURG SANITATION AND WATER DISTRICT**

**TYPICAL TRENCH CROSS SECTION**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET OF	Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED B. MAC	DATE:	PA NO.	
REVISION	10/31/16		

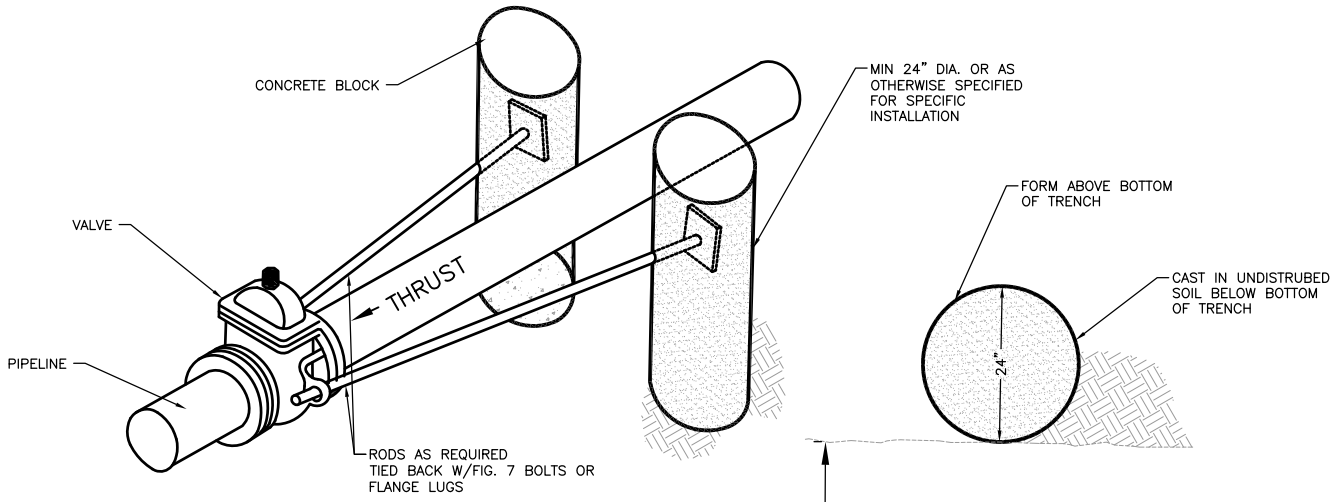


MAXIMUM DEFLECTION  
PER SLIP JOINT OF D.I.P.

PIPE DIAMETER			MFRS. DEFL.	DESIGN DEFLECTION (80% MAX.)			APPROX. RADIUS FOR DEFLECTING CURVES WITHOUT BENDS	
I.D. (IN)	O.D. (IN)	O.D. (FT)		MAX. DEFL. DIST.		20'L	18'L	
				(1)	(2)			
4"	4.80"	.400'	5'00"00"	4'00"00"	16"	15"	286'	258'
6"	6.90"	.575'	5'00"00"	4'00"00"	16"	15"	286'	258'
8"	9.05"	.754'	5'00"00"	4'00"00"	16"	15"	286'	258'
10"	11.10"	.925'	5'00"00"	4'00"00"	16"	15"	286'	258'
12"	13.20"	1.100'	5'00"00"	4'00"00"	16"	15"	286'	258'
14"	15.30"	1.275'	3'00"00"	2'24"00"	10"	9"	477'	430'
16"	17.40"	1.450'	3'00"00"	2'24"00"	10"	9"	477'	430'
18"	19.50"	1.625'	3'00"00"	2'24"00"	10"	9"	477'	430'
20"	21.60"	1.800'	3'00"00"	2'24"00"	10"	9"	477'	430'
24"	25.80"	2.150'	3'00"00"	2'24"00"	10"	9"	477'	430'
30"	32.00"	2.666'	2'30"00"	2'00"00"	8"	7"	573'	516'
36"	38.30"	3.192'	2'00"00"	1'36"00"	6"	6"	716'	645'
42"	44.50"	3.708'	2'00"00"	1'36"00"	6"	6"	716'	645'

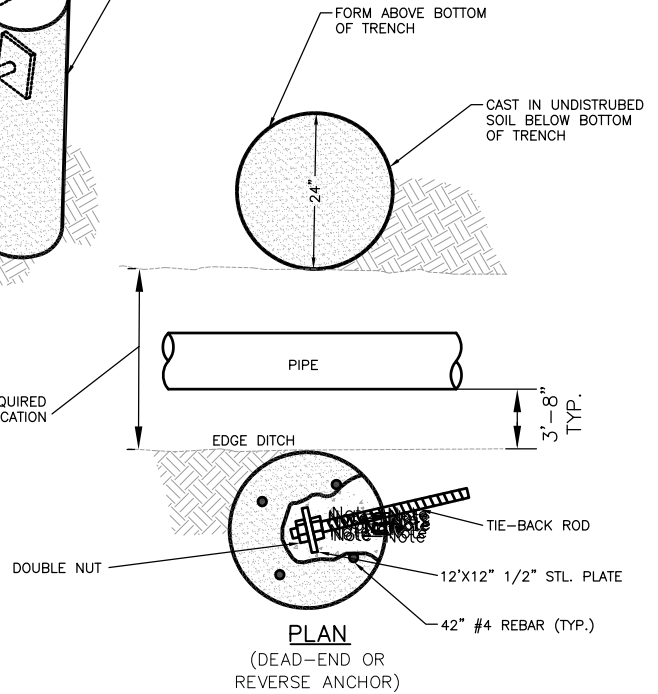
- (1) 20'L = NORMAL 20-FOOT JOINT LAYING LENGTH  
(2) = NORMAL 18-FOOT JOINT LAYING LENGTH

<b>STRASBURG SANITATION AND WATER DISTRICT</b>			
<b>MAXIMUM PIPELINE DEFLECTION DATA</b>			
APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED L. OTTO	DATE: 3/83	PA NO.	
REVISION	10/31/16		



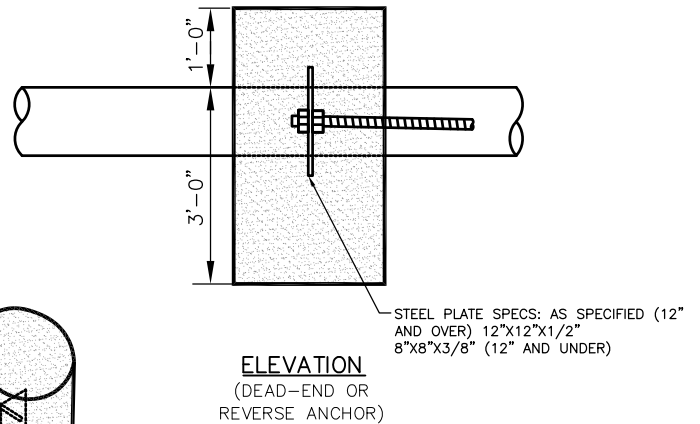
**TYPICAL VALVE ANCHOR**

NOTE: NARROW DITCH REQUIRED AT ANCHOR LOCATION



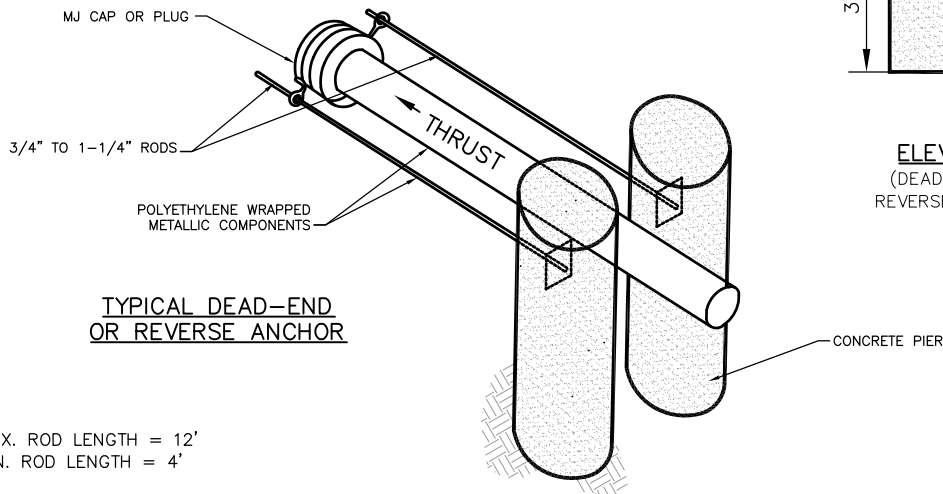
**PLAN**

(DEAD-END OR REVERSE ANCHOR)



**ELEVATION**

(DEAD-END OR REVERSE ANCHOR)

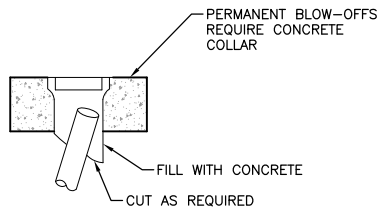


**TYPICAL DEAD-END OR REVERSE ANCHOR**

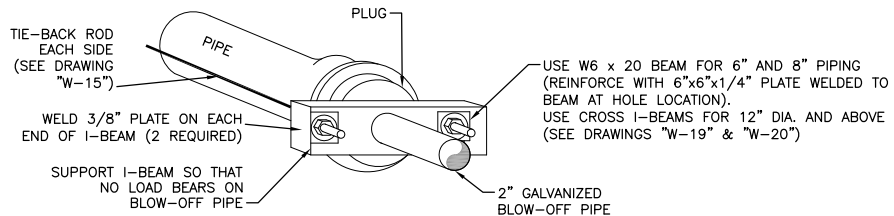
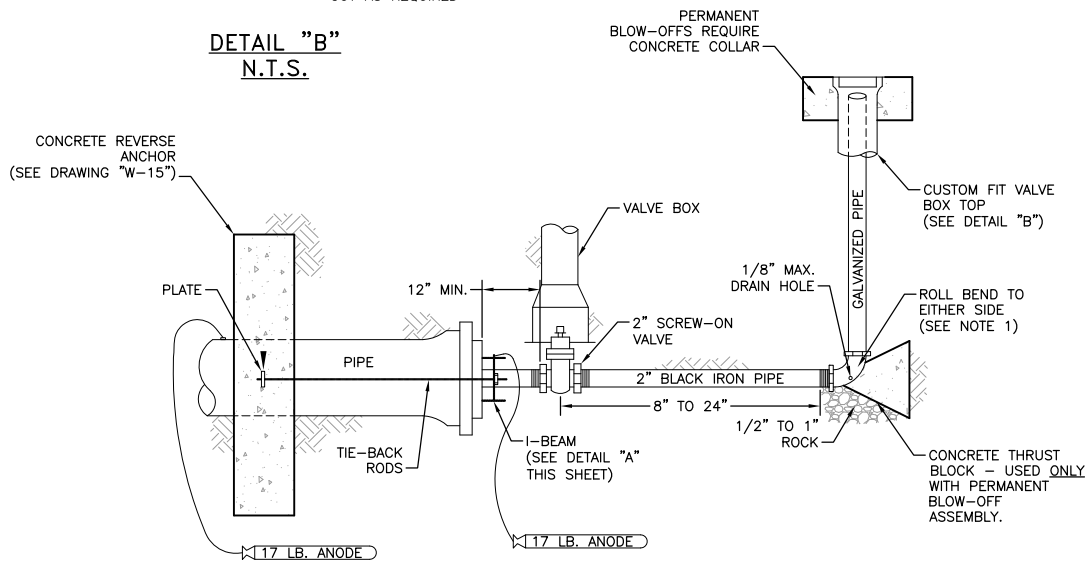
**NOTES:**

1. MAX. ROD LENGTH = 12'  
MIN. ROD LENGTH = 4'
2. ALL METALLIC COMPONENTS TO BE ENCASED IN CONCRETE OR POLYETHYLENE TUBING.

STRASBURG SANITATION AND WATER DISTRICT			
REVERSE ANCHOR DETAIL			
APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET OF	Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED L. OTTO	DATE: 2/83	PA NO.	
REVISION	2/86, 7/90, 10/31/16		



**DETAIL "B"**  
N.T.S.



**DETAIL "A"**  
N.T.S.

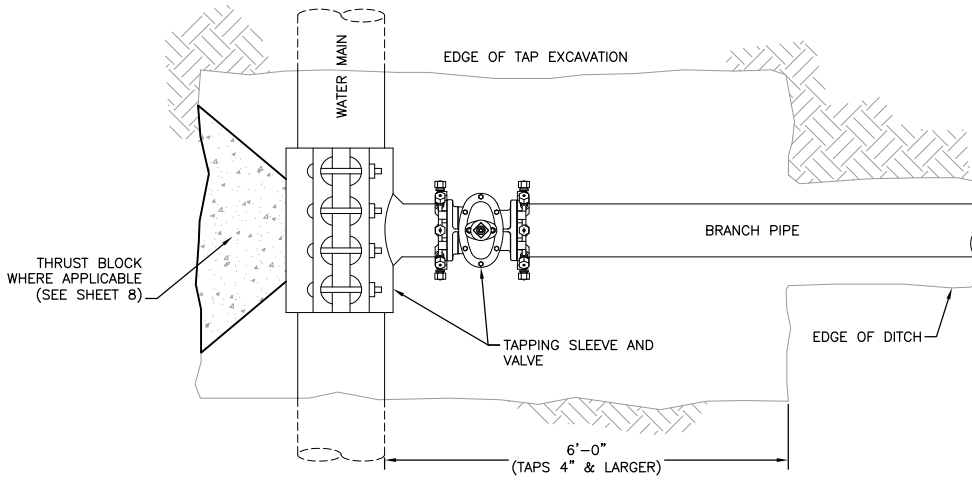
**NOTES:**

1. IF APPROPRIATE LOCATION FOR DISCHARGED WATER CANNOT BE REACHED BY ROLLING THE BEND, ADDITIONAL BENDS MAY BE REQUIRED BY THE INSPECTOR.
2. COAT TIE RODS, BEAM AND BLACK IRON PIPE WITH EPOXY POLYAMIDE COATING, 10 MILS MIN.
3. ENTIRE BLOW OFF ASSEMBLY MUST BE FULLY SUPPORTED, CONCRETE STEPPING STONES MAY BE REQUIRED.
4. PIPE DOPE APPROVED FOR USE IN POTABLE WATER SYSTEMS MUST BE USED ON ALL THREADED JOINTS.
5. SSWD CAN PROVIDE A SEPARATE DETAIL FOR BLOW OFFS ON MAINS LARGER THAN 8".

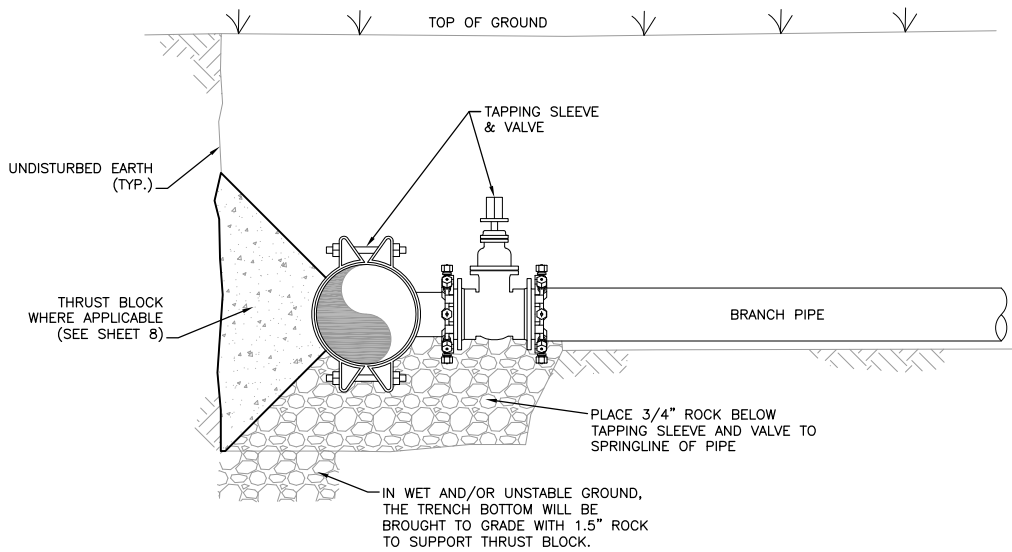
**STRASBURG SANITATION  
AND WATER DISTRICT**

**TEMPORARY & PERMANENT BLOW-OFF  
ASSEMBLIES - 6" & 8" MAINS**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED	L. OTTO	DATE: 2/83	PA NO.
REVISION	4/84, 7/90, 10/31/16		



PLAN VIEW  
N.T.S.

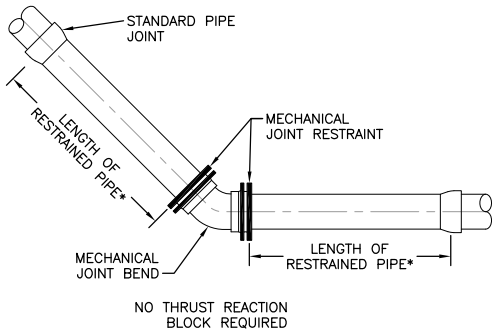


PROFILE VIEW  
N.T.S.

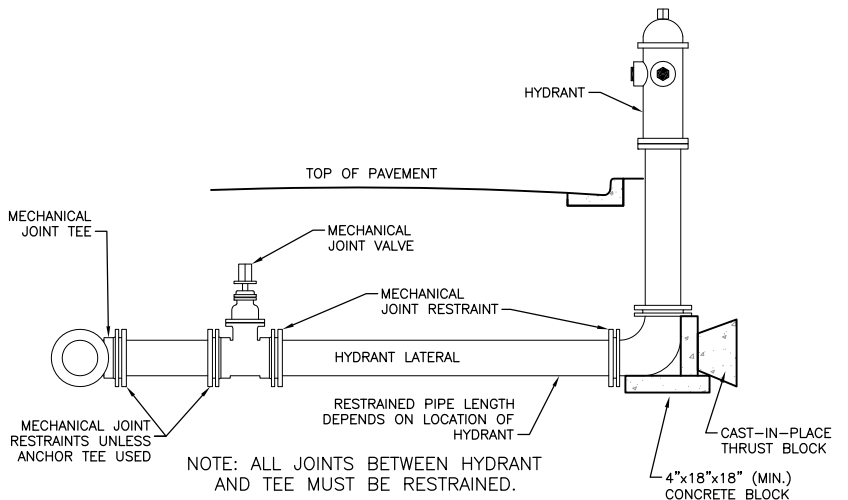
**STRASBURG SANITATION  
AND WATER DISTRICT**

**PIPE TAPPING DETAIL**

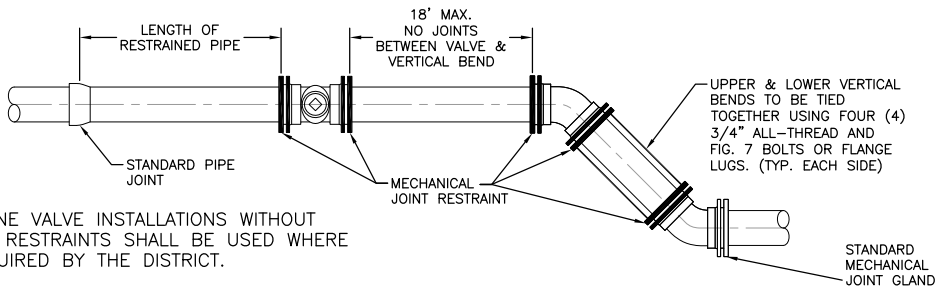
APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED L. OTTO	DATE:	PA NO.	
REVISION	2/86, 7/90, 10/31/16		



**INSTALLATION FOR BENDS**

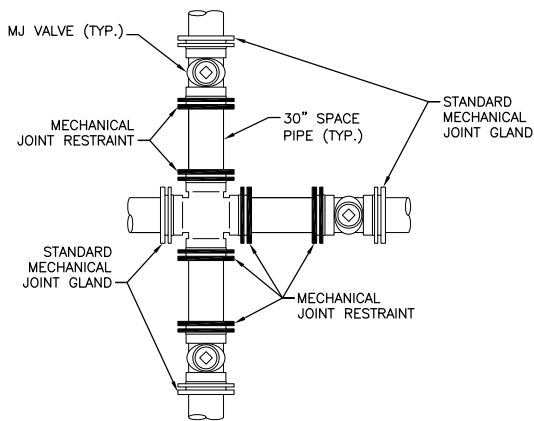


**INSTALLATION FOR BENDS**

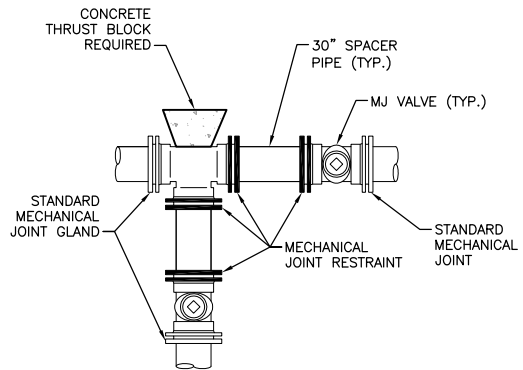


NOTE: FOR LINE VALVE INSTALLATIONS WITHOUT LOWERING, JOINT RESTRAINTS SHALL BE USED WHERE REQUIRED BY THE DISTRICT.

**INSTALLATION FOR LINE VALVE & LOWERING**



**CROSS INSTALLATION**



**TEE INSTALLATION**

**NOTES:**

1. MECHANICAL JOINTS SHALL BE APPROVED ACCORDING TO MATERIAL SPECIFICATION FOR DIP AND PVC PIPE.
2. LENGTH OF PIPE REQUIRING JOINT RESTRAINT SHALL BE DETERMINED FROM CHART ON DRAWING 15.
3. RESTRAINED JOINT PVC PIPE SHALL NOT BE USED FOR LOWERINGS.

**STRASBURG SANITATION AND WATER DISTRICT**

**APPLICATIONS FOR MECHANICAL JOINT RESTRAINTS**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED	E. BUCK DATE: 89	PA NO.	
REVISION	7/90, 10/31/16		

## RESTRAINED M.J. PIPE LENGTH (FT)

### 6-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	12	18	24
45° BEND	5	8	10
22-1/2" BEND	2	4	5
11-1/4" BEND	1	2	2

### 16-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	29	43	58
45° BEND	12	18	24
22-1/2" BEND	6	9	12
11-1/4" BEND	3	4	6

### 8-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	16	24	32
45° BEND	7	10	13
22-1/2" BEND	3	5	6
11-1/4" BEND	2	2	3

### 18-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	32	48	64
45° BEND	14	20	27
22-1/2" BEND	7	10	13
11-1/4" BEND	3	5	7

### 12-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	23	34	45
45° BEND	9	14	19
22-1/2" BEND	5	7	9
11-1/4" BEND	2	3	4

### 20-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	35	52	70
45° BEND	15	22	29
22-1/2" BEND	7	10	14
11-1/4" BEND	3	5	7

### 24-INCH DUCTILE IRON AND PVC

TYPE OF FITTING	STATIC PRESSURE (PSI)		
	<100	100-150	150-200
90° BEND, TEE, VALVE OR PLUG	41	61	81
45° BEND	17	25	34
22-1/2" BEND	8	12	16
11-1/4" BEND	4	6	8

**NOTES:**

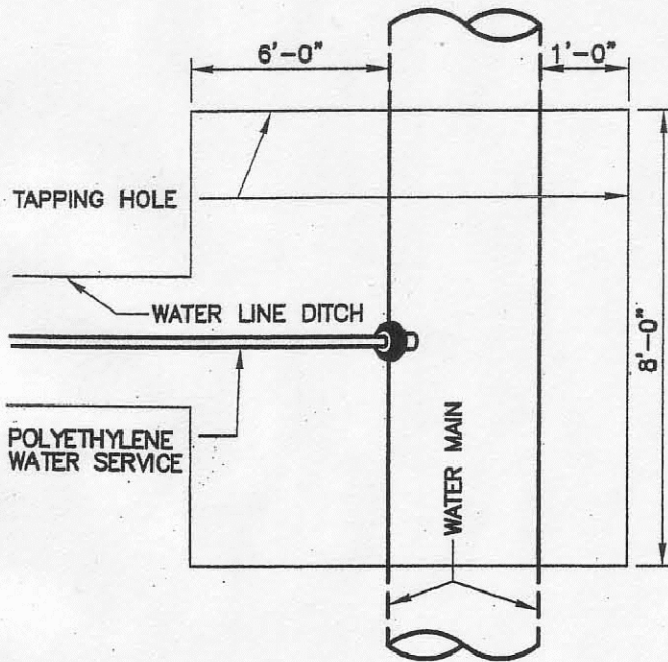
1. PRESSURES GREATER THAN 200 PSI REQUIRE SPECIAL DESIGN APPROVED BY THE DISTRICT.
2. LENGTH IS BASED ON MINIMUM 5'-0" OF GROUND COVER AND SOIL COMPACTED ACCORDING TO SECTION 5.15 OF THESE SPECIFICATIONS.
3. APPROVED METHODS OF RESTRAINED PIPE BEYOND INITIAL FITTING SHALL BE:
  - A. FOR DUCTILE IRON PIPE, 1100 SERIES MEGALUG BY EBAA IRON OR EQUAL ON MECHANICAL JOINT PIPE OR DOUBLE 1100 SERIES MEGALUG BY EBAA IRON OR EQUAL ON PUSH ON JOINT PIPE.
  - B. FOR PVC PIPE, SERIES 1500 OR SERIES 2800 RESTRAINTS BY EBAA IRON OR EQUAL.

## STRASBURG SANITATION AND WATER DISTRICT

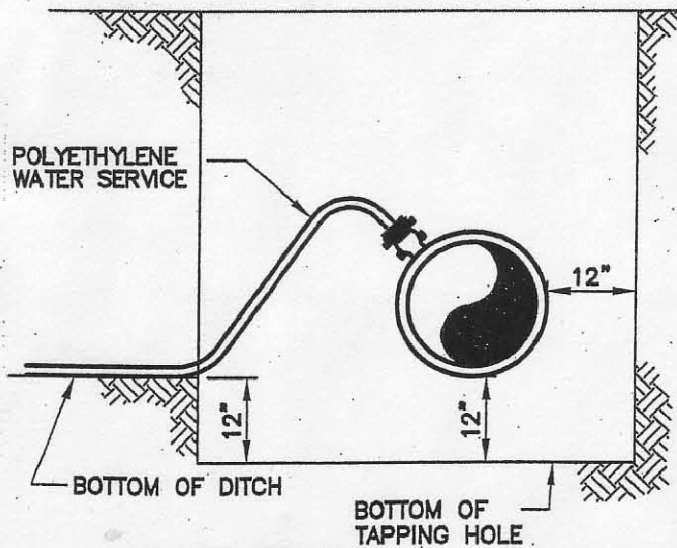
### RESTRAINED M.J. PIPE LENGTH DATA

APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED	E. BUCK	DATE: 89	PA NO.
REVISION	10/31/16		

**SERVICE TAPS 1-1/2" & 2" TAPPING SADDLE**



**PLAN**

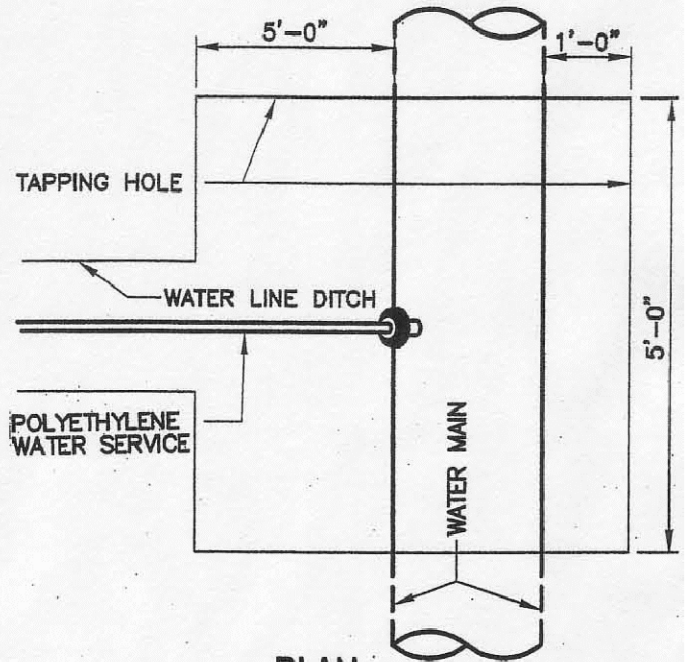


**ELEVATION**

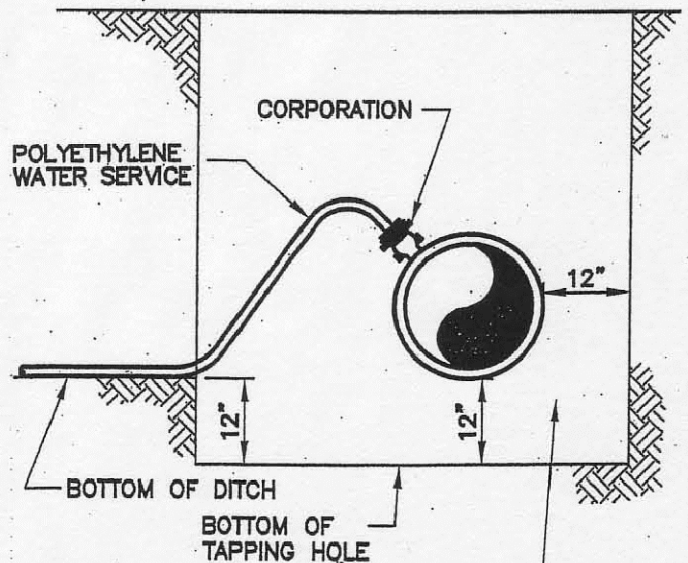
**NOTE:**

DIRECT TAPS TO THE WATER MAIN SHALL BE MADE ONLY WHEN APPROVED BY THE DISTRICT. ALL TAPS SHALL USE TAPPING SADDLES, TAPPING SADDLES SHALL HAVE TWO BRASS BANDS AND A BRASS CORPORATION CONNECTION.

**SERVICE TAPS 3/4" & 1" CORPORATION ONLY**



**PLAN**



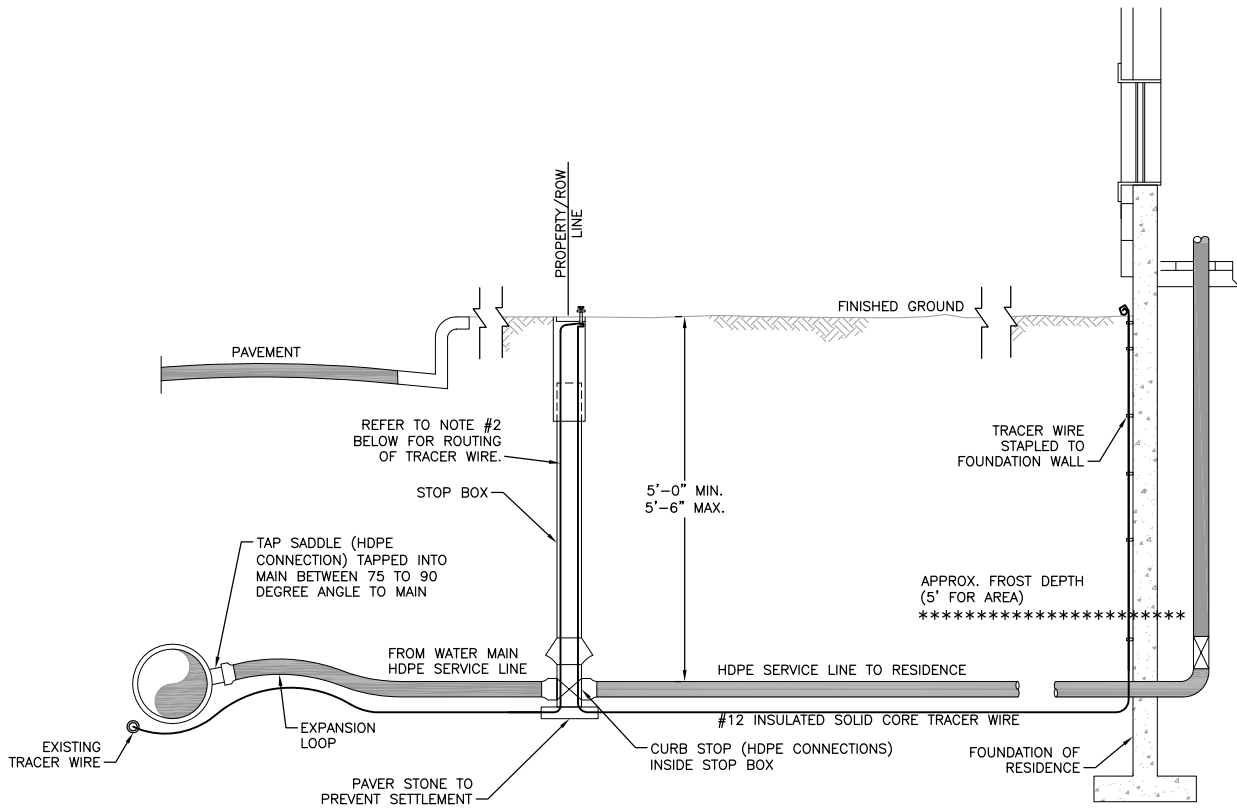
**ELEVATION**

ALLOW 12" CLEARANCE SURROUNDING MAIN FOR TAPPING MACHINE

**STRASBURG SANITATION AND WATER DISTRICT**

**TAPPING DETAIL - 3/4" THRU 2"**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED L. OTTO	DATE: 3/83	PA NO.	
REVISION	5/96, 10/31/16		



**NOTES:**

1. REFER TO STANDARD DRAWINGS FOR METER, PRESSURE REGULATION AND BACKFLOW PREVENTION DEVICE INSTALLATION DETAILS.
2. SERVICE LINE FROM CURB STOP TO THE STRUCTURE BEING SERVED IS THE RESPONSIBILITY OF THE CUSTOMER/OWNER FOR OPERATION AND MAINTENANCE. ONLY THE DISTRICT IS AUTHORIZED TO OPEN AND CLOSE THE CORPORATION AND CURB STOP ONCE IN SERVICE.

<b>STRASBURG SANITATION AND WATER DISTRICT</b>			
<b>TYP. INSTALLATION FOR SERVICE LINE AND STOP BOX</b>			
APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET	OF Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED TLM	DATE: 10/16	PA NO.	
REVISION			



## INSTALLATION OF 3" TO 10" BACKFLOW PREVENTERS

BACKFLOW PREVENTER ASSEMBLY WILL BE INSTALLED ABOVE GROUND. (FIG. A) THE UNIT SHOULD BE PLACED AT LEAST TWELVE INCHES (24") ABOVE THE FINISH GRADE TO ALLOW CLEARANCE FOR REPAIR WORK. A CONCRETE SLAB AT FINISH GRADE IS RECOMMENDED. PROPER DRAINAGE SHOULD BE PROVIDED. IF A RELIEF VALVE IS REQUIRED, IT MAY BE PIPED AWAY FROM THE LOCATION, PROVIDED IT IS READILY VISIBLE FROM ABOVE GRADE AND THE RELIEF VALVE IS SEPERATED FROM THE DRAIN LINE BY A MINIMUM OF DOUBLE THE DIAMETER OF THE SUPPLY LINE. A MODIFIED VAULT INSTALLATION MAY BE USED IF CONSTRUCTED WITH AMPL SIDE CLEARANCES. (FIG. B)

1	GATE VALVE
2	BACK FLOW PREVENTER ASSEMBLY
3	90° ELBOW

### ABOVE GROUND INSTALLATION

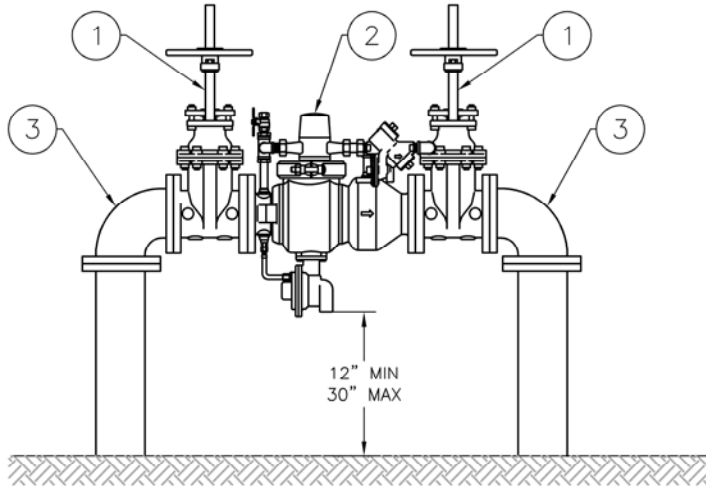


FIG. A

#### NOTES:

1. ENCLOSURE DESIGN SHALL BE SUBMITTED TO SSWD FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
2. ENCLOSURE SHALL BE HEATED.
3. DRAIN SHALL ENSURE THAT AIR GAP IS MAINTAINED AT ALL TIMES.
4. SEE SECTION 5.01 OF THE SSWD PUBLIC UTILITY DESIGN AND CONSTRUCTION SPECIFICATIONS FOR BACKFLOW PREVENTION DEVICE STANDARDS.
5. ALL PIPING SHALL BE FLANGED DIP OR GALVANIZED STEEL.

### ABOVE GROUND INSTALLATION W/ ENCLOSURE

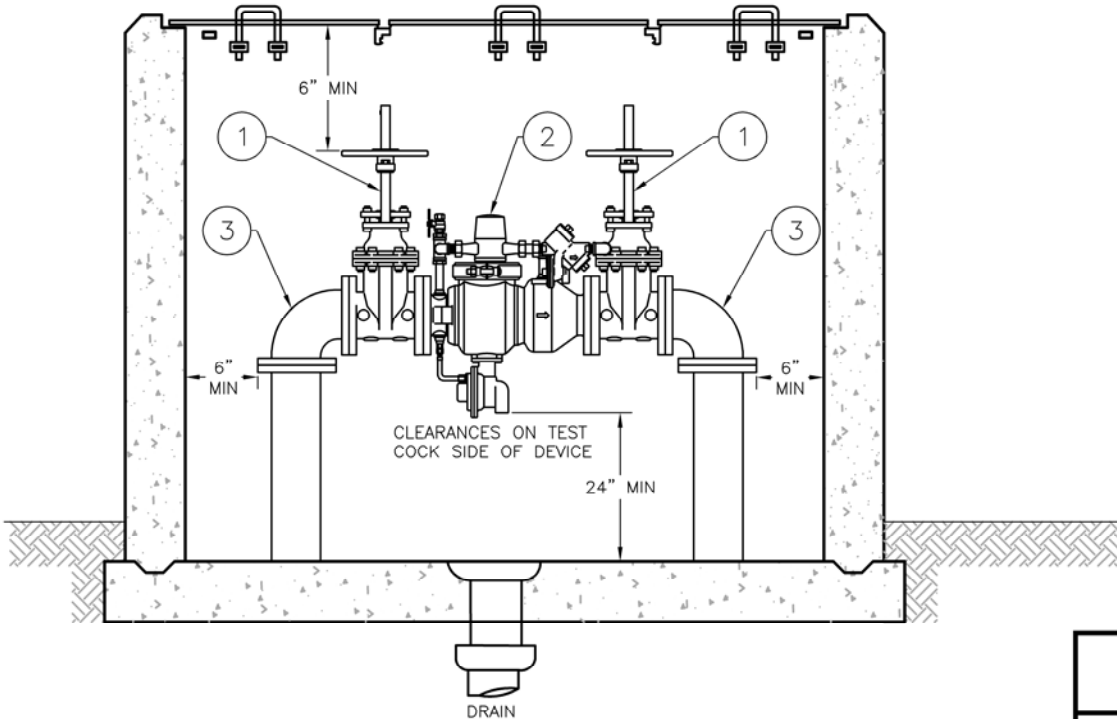


FIG. B

## STRASBURG SANITATION AND WATER DISTRICT

### 3" TO 10" ABOVE GROUND BACKFLOW PREVENTER

APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DES	DATE:	JOB NO.
PLOTTED	ACH	DATE: 05/18	PA NO.
REVISION			

## INSTALLATION OF 3" TO 10" BACKFLOW PREVENTER

ALTHOUGH BACK FLOW PREVENTER ASSEMBLIES CAN BE INSTALLED ABOVE GROUND, THESE BACKFLOW PREVENTERS ARE ALSO READILY ADAPTABLE FOR VAULT INSTALLATIONS, SPECIAL NOTICE SHOULD BE GIVEN TO THE SIDE CLEARANCES FOR ACCESSIBILITY TO PROPERLY TEST AND REPAIR THE DEVICE. NOTE SIDE CLEARANCES. FOR UNDERGROUND INSTALLATIONS, A REDUCED PRESSURE BACKFLOW PREVENTER WILL ONLY BE ALLOWED IF THE CUSTOMER OBTAINS PRIOR WRITTEN APPROVAL FROM THE COLORADO DEPARTMENT OF HEALTH AND ENVIROMENT'S CROSS CONNECTION CONTROL DEPARTMENT HEAD.

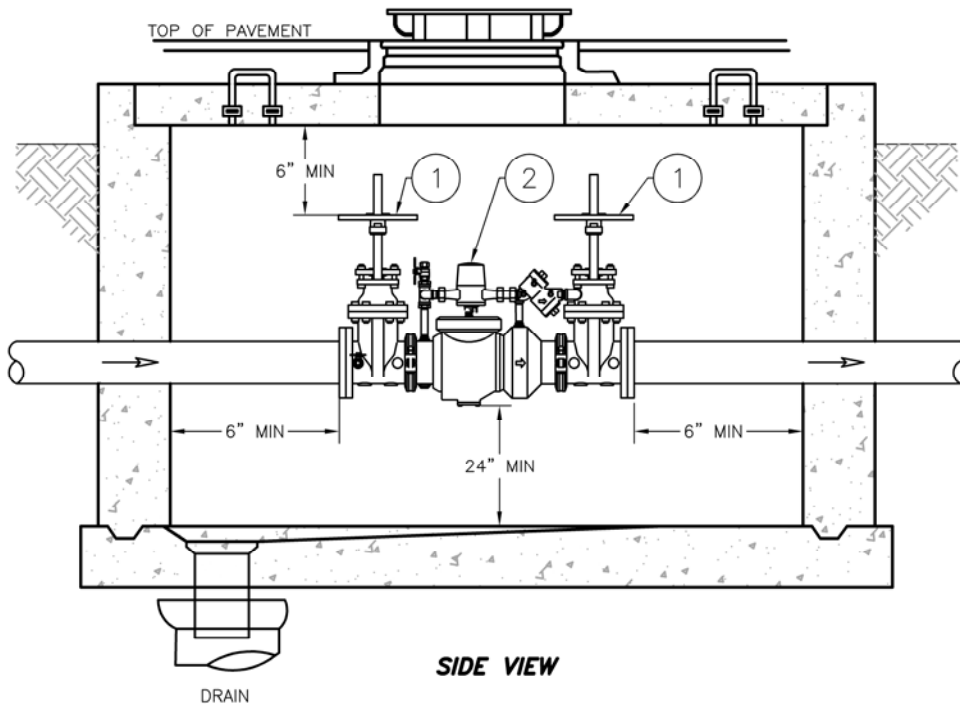
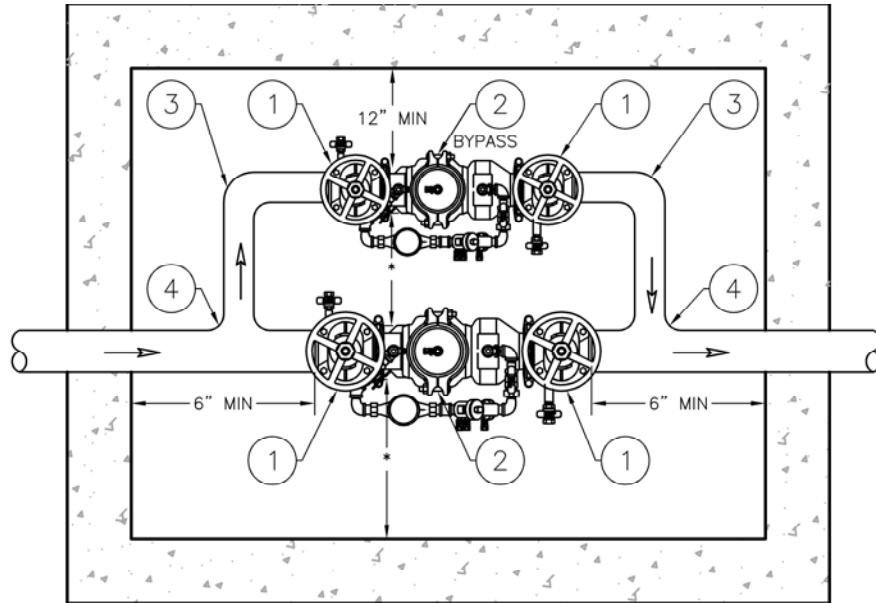
1	GATE VALVE
2	BACK FLOW PREVENTER ASSEMBLY
3	90° ELBOW
4	TEE

### UNDERGROUND VAULT INSTALLATION

VAULTS WILL BE CONSTRUCTED IN COMPLIANCE WITH STANDARD WATER SPECIFICATIONS FOR METER PITS OF THE SAME SIZE.

**NOTES:**

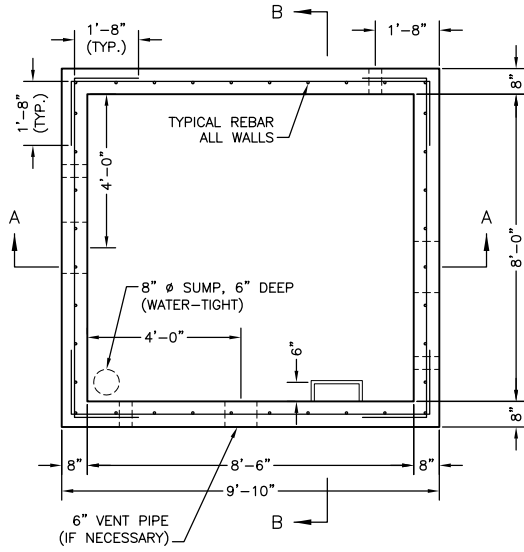
1. CONCRETE VAULT DRAWINGS AND SPECIFICATIONS SHALL BE SUBMITTED TO SSWD FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
2. FLOOR DRAIN SHALL ENSURE THAT AIR GAP IS MAINTAINED AT ALL TIMES.
3. SEE SECTION 5.01 OF THE SSWD PUBLIC UTILITY DESIGN AND CONSTRUCTION SPECIFICATIONS FOR BACKFLOW PREVENTION DEVICE STANDARDS.
4. \*NOTE-CLEARANCES ON TEST COCK SIDE OF DEVICE  
3" AND UP .....24"
5. ALL PIPING SHALL BE FLANGED DIP OR GALVANIZED STEEL.



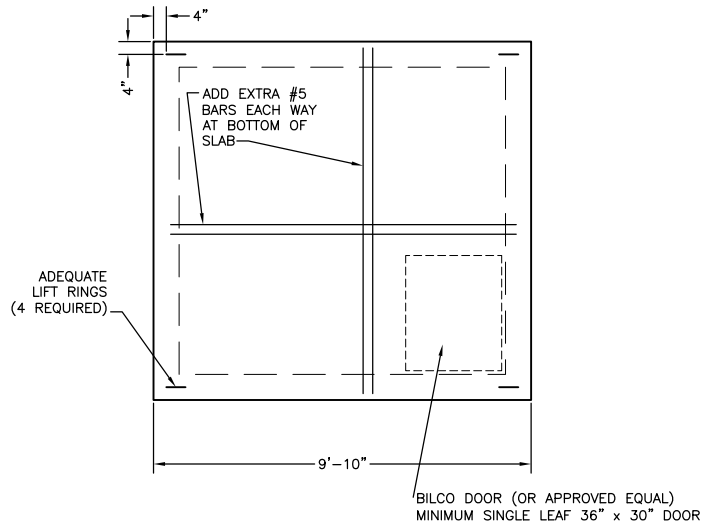
### STRASBURG SANITATION AND WATER DISTRICT

#### 3" TO 10" BELOW GROUND BACKFLOW PREVENTER

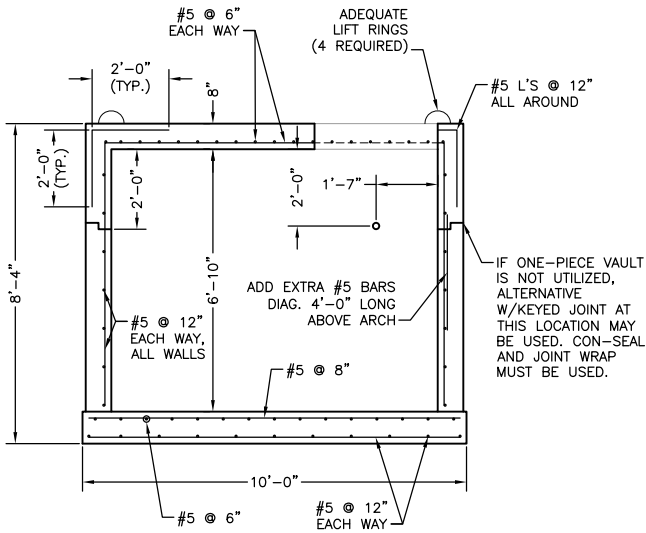
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CHECKED	DATE:	SHEET	OF
DESIGN	DES	DATE:	JOB NO.
PLOTTED	ACH	DATE: 06/18	PA NO.
REVISION			



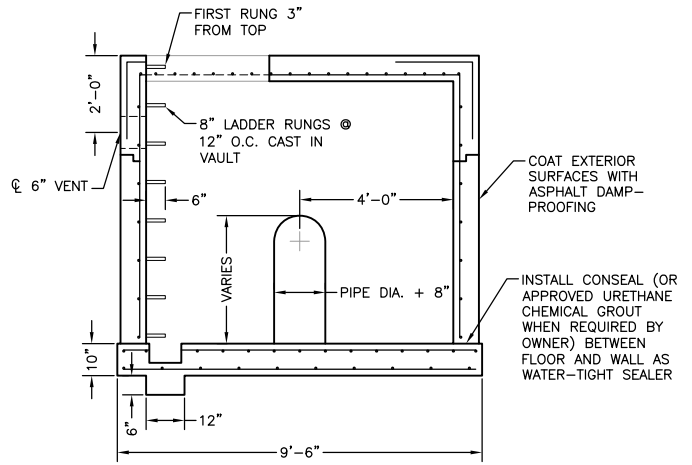
PLAN VIEW  
N.T.S.



ROOF PLAN  
N.T.S.



SECTION A-A  
N.T.S.



SECTION B-B  
N.T.S.

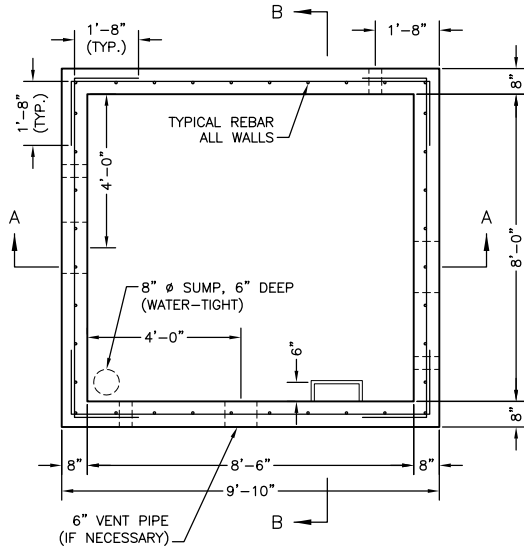
NOTES:

- ALL CONCRETE WORK SHALL COMPLY WITH DISTRICT STANDARD SPECIFICATIONS AND LATEST A.C.I.-318 CODE.
- MINIMUM CONCRETE CLEARANCES FOR REBAR:
  - 3" WHERE POURED AGAINST EARTH
  - 2" WHERE FORMED AND THEN EXPOSED TO GROUND OR WEATHER FOR #6 OR LARGER. 1.5" FOR #5 AND SMALLER.
  - 1" WHERE EXPOSED TO INTERIOR SURFACES
- ALL VAULTS SHALL BE CONSTRUCTED TO MEET HS20-44 TRAFFIC LOADING CONDITIONS AND 300 PSF SURCHARGE LOAD.

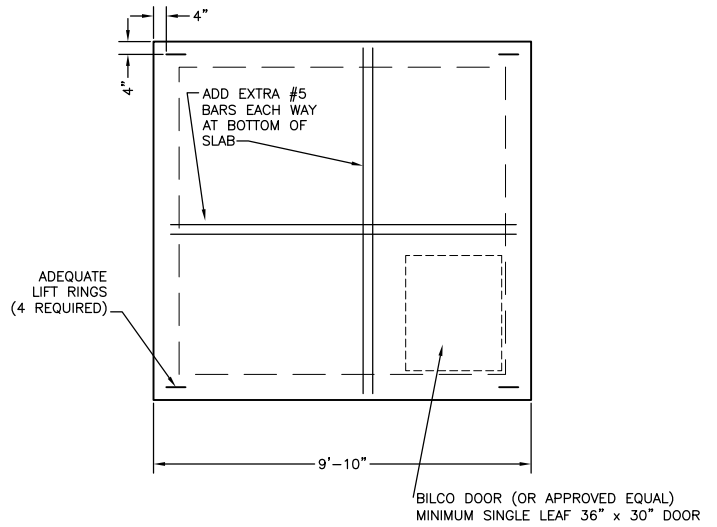
STRASBURG SANITATION  
AND WATER DISTRICT

STANDARD CONCRETE VAULT FOR  
VALVE INSTALLATION (PRECAST)

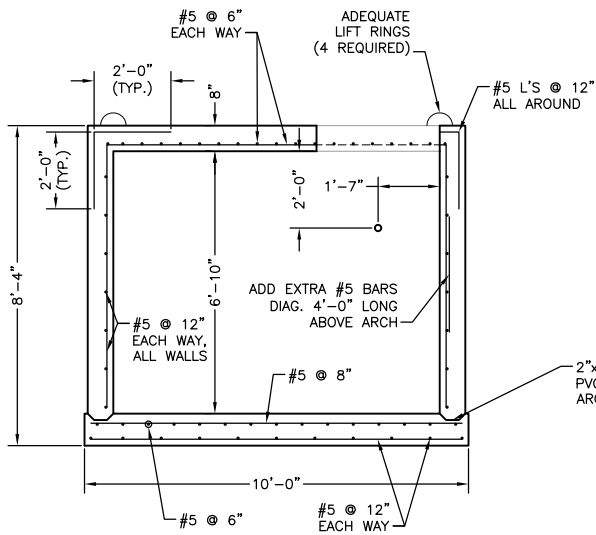
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CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB NO.	Scale: NONE
PLOTTED TLM	DATE: 10/16	PA NO.	
REVISION			



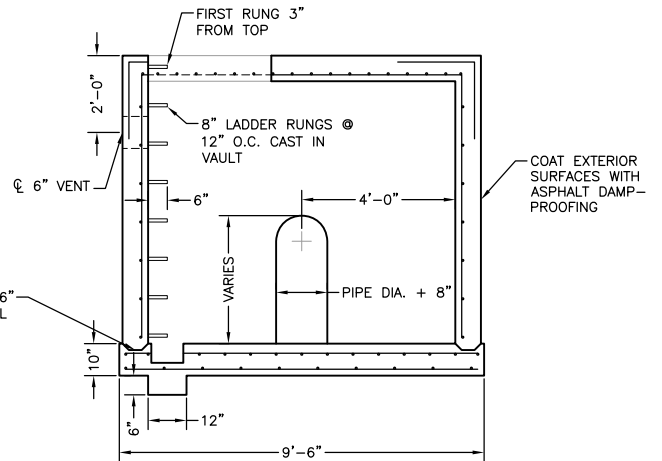
PLAN VIEW  
N.T.S.



ROOF PLAN  
N.T.S.



SECTION A-A  
N.T.S.



SECTION B-B  
N.T.S.

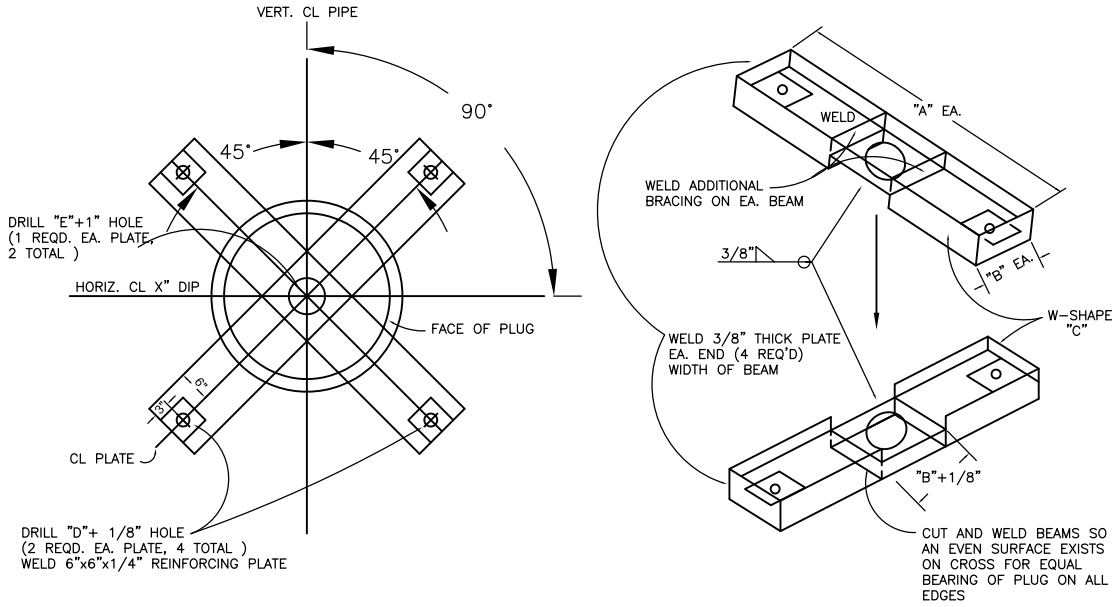
NOTES:

- ALL CONCRETE WORK SHALL COMPLY WITH DISTRICT STANDARD SPECIFICATIONS AND LATEST A.C.I.-318 CODE.
- MINIMUM CONCRETE CLEARANCES FOR REBAR:
  - 3" WHERE POURED AGAINST EARTH
  - 2" WHERE FORMED AND THEN EXPOSED TO GROUND OR WEATHER FOR #6 OR LARGER. 1.5" FOR #5 AND SMALLER.
  - 1" WHERE EXPOSED TO INTERIOR SURFACES
- ALL VAULTS SHALL BE CONSTRUCTED TO MEET HS20-44 TRAFFIC LOADING CONDITIONS AND 300 PSF SURCHARGE LOAD.

STRASBURG SANITATION  
AND WATER DISTRICT

STANDARD CONCRETE VAULT FOR  
VALVE INSTALLATION (CAST-IN-PLACE)

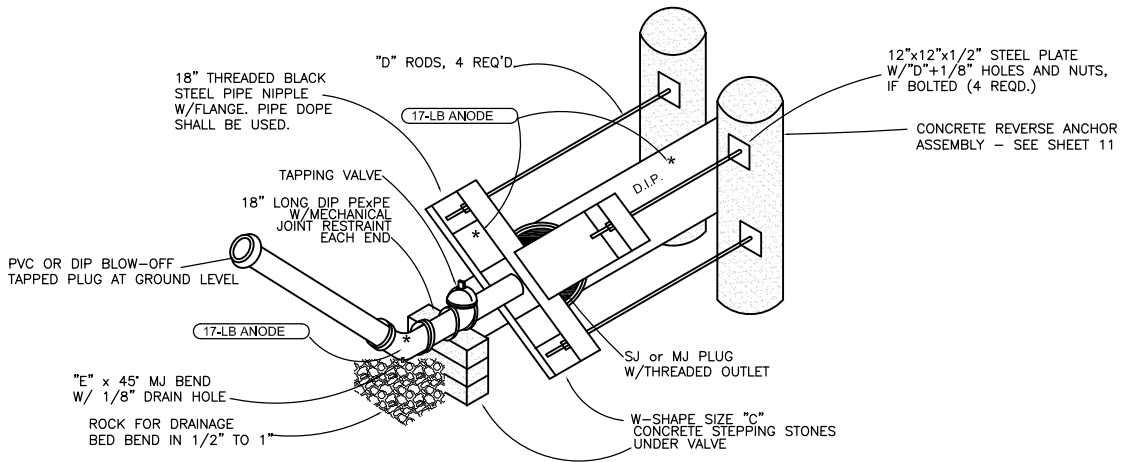
APPVD.	DATE:	SUYVD.	DATE:
CHECKED	DATE:	SHEET	OF
DESIGN	DATE:	JOB	NO.
PLOTTED	TLM	DATE:	10/16
REVISION		PA	NO.



REFER TO SSWD FOR ALL DIMENSIONS AND SIZES

"E" = SIZE OF BLOW-OFF ASSEMBLY

(WHERE "E" = 2", USE STANDARD BLOW-OFF ASSEMBLY SHEET 12)



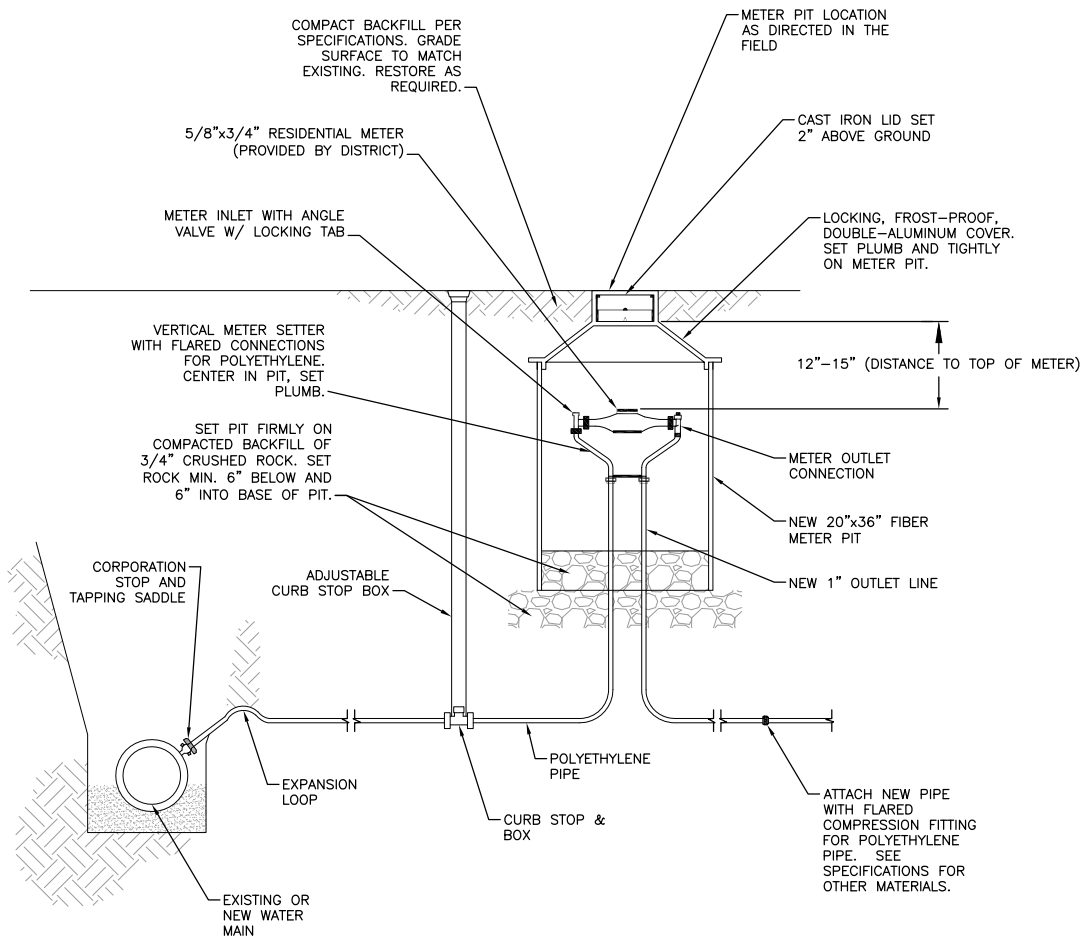
**NOTES:**

1. PIPE DOPE APPROVED FOR USE IN POTABLE WATER SYSTEMS MUST BE USED ON ALL THREADED JOINTS.
2. ENTIRE BLOW OFF ASSEMBLY MUST BE FULLY SUPPORTED SO NO LOAD BEARS ON BLOW-OFF PIPING.
3. IF APPROPRIATE LOCATION FOR DISCHARGED WATER CANNOT BE REACHED BY ROLLING THE BEND, ADDITIONAL BENDS MAY BE REQUIRED.
4. COAT TIE RODS, BEAMS AND BLACK IRON PIPE WITH EPOXY POLYAMIDE COATING, 10 MILS MIN.

**STRASBURG SANITATION AND WATER DISTRICT**

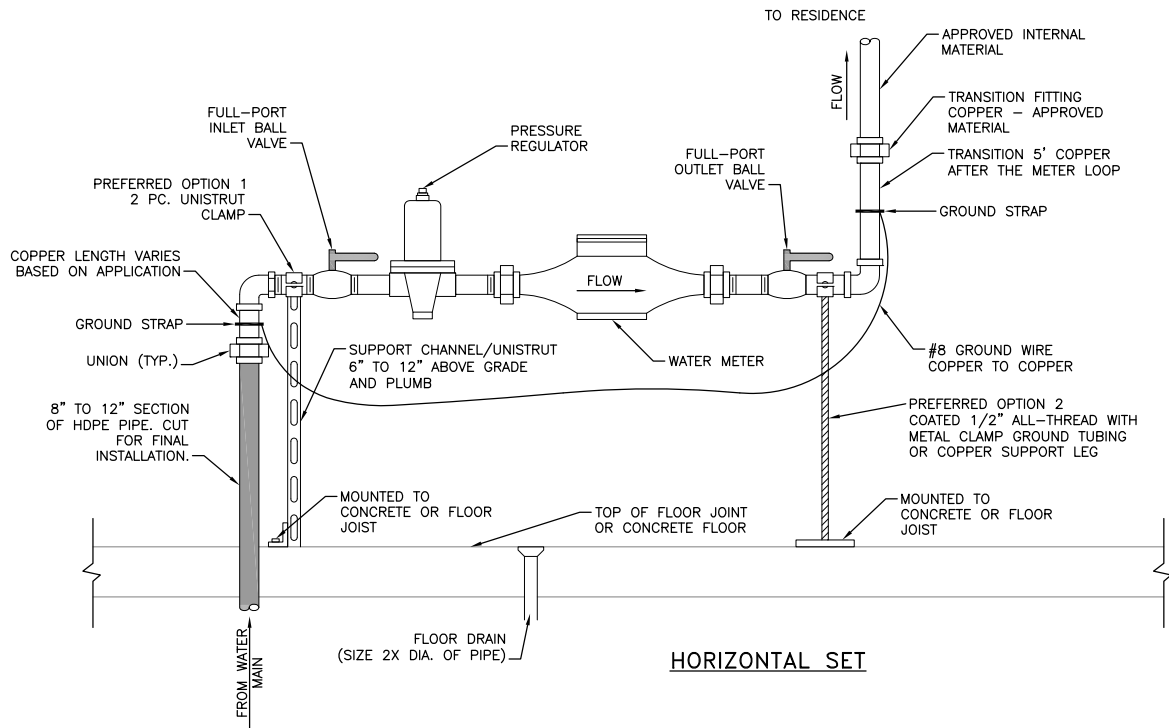
**WATER LINE LOWERING DETAIL**

APPVD.	DATE:	SUVYD.	DATE:
CHECKED	DATE:	SHEET OF	Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED TLM	DATE: 10/16	PA NO.	
REVISION			



METER PIT SETUP  
N.T.S.

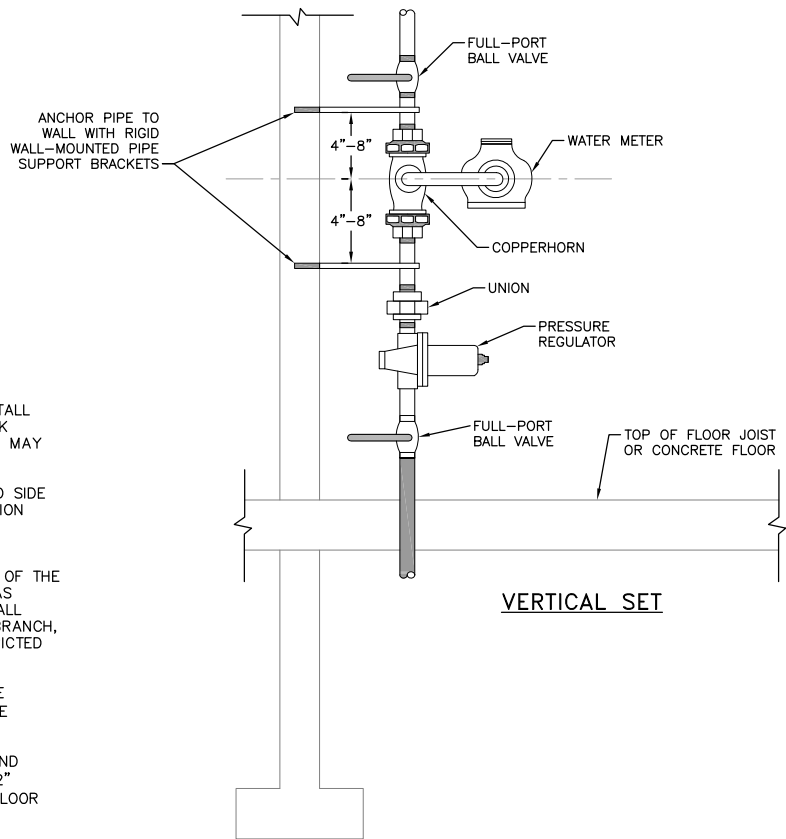
<b>STRASBURG SANITATION AND WATER DISTRICT</b>			
<b>TYPICAL METER PIT SETUP</b>			
APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET	OF <small>Scale: NONE</small>
DESIGN	DATE:	JOB NO.	
PLOTTED TLM	DATE: 10/16	PA NO.	
REVISION			



**HORIZONTAL SET**

METER SIZE	METER LENGTH*	WITH TAIL PIECE
5/8" (3/4" SHORT) METER	7.5"	12"
3/4" METER	9"	13-1/2"
1" METER	10-3/4"	15"
1-1/2" METER	12-5/8"	
2" METER	15-1/4"	

\* CHECK METER LENGTH BEFORE INSTALLATION



**VERTICAL SET**

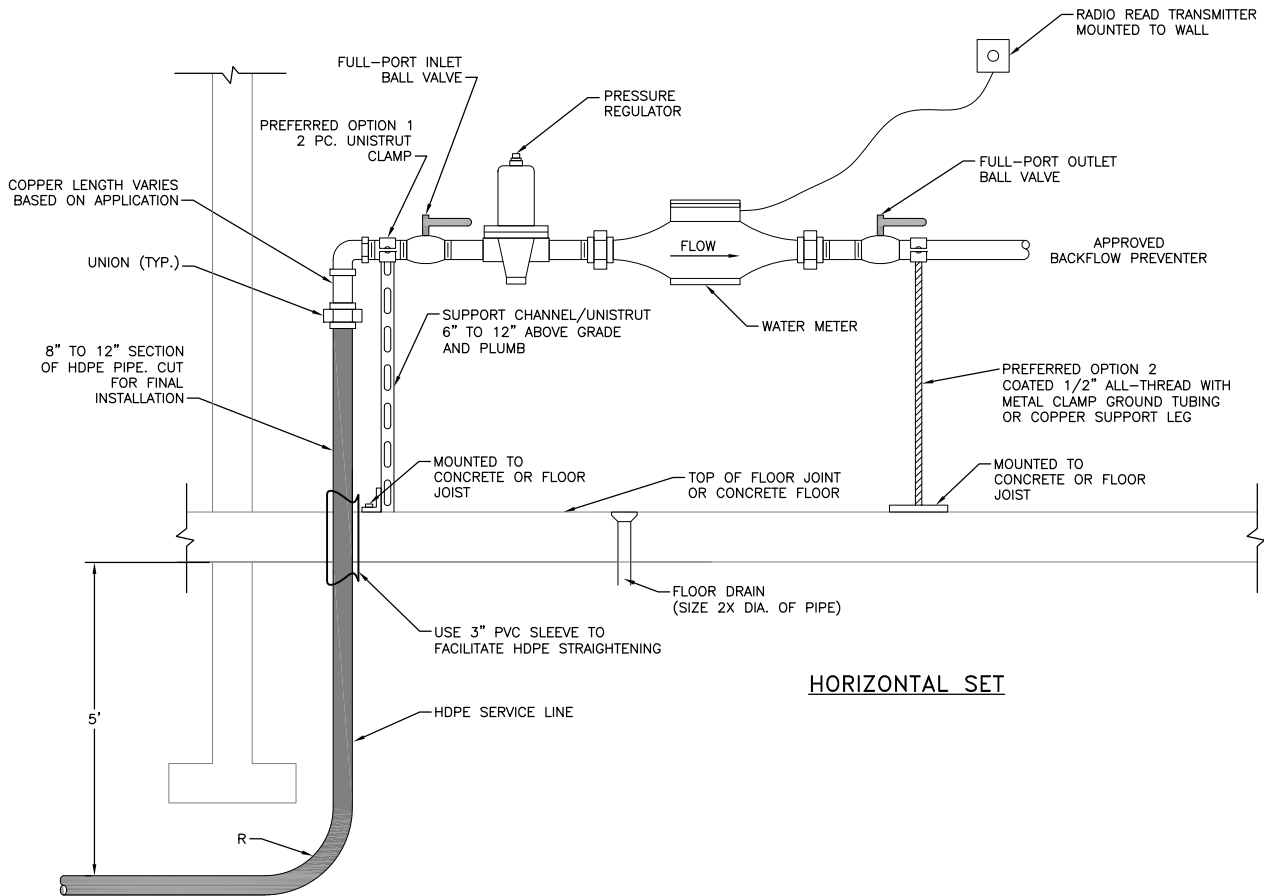
**NOTES:**

1. IN THE INTEREST OF SPACE CONSERVATION IT IS PERMISSIBLE TO INSTALL PIPING VERTICALLY DOWNSTREAM OF THE PIPING INCLUDING THE CHECK VALVE. THE PRESSURE REGULATOR ON THE INLET SIDE OF THE METER MAY BE INSTALLED IN A HORIZONTAL OR VERTICAL POSITION.
2. A SECOND PRESSURE REGULATOR MAY BE INSTALLED ON THE DEMAND SIDE OF THE METER DOWNSTREAM FROM A BRANCH SUPPLYING AN IRRIGATION SYSTEM IF REQUIRED. THE IRRIGATION SYSTEM BRANCH MUST BE DOWNSTREAM OF THE METER, CHECK VALVE AND BALL VALVE.
3. ONLY MINIMAL SEPARATION IS ALLOWED BETWEEN FITTINGS UPSTREAM OF THE METER TO ALLOW PROPER INSTALLATION OF THE REQUIRED FITTINGS AS DEPICTED IN THESE DRAWINGS AND SPECIFICATIONS. IN NO CASE SHALL SEPARATION BE GREATER THAN NECESSARY WHICH COULD ALLOW A BRANCH, TEE, OR OTHER FITTING UPSTREAM OF THE METER THAN WHAT IS DEPICTED AND SPECIFIED HEREIN.
4. AN APPROVED TRANSITION FITTING FROM HDPE TO COPPER INSIDE THE CRAWL SPACE/BASEMENT CAN BE USED ONCE THE HDPE SERVICE LINE ENTERS THE STRUCTURE.
5. THE METER PIPE MUST BE SECURED BEFORE AND AFTER THE INLET AND OUTLET VALVES TO A SOLID UPRIGHT SUCH AS THE UNISTRUT OR 1/2" ALL-THREAD (OR MOUNTED BI-LATERALLY) AND ANCHORED TO THE FLOOR AND CLAMPED TO THE HORIZONTAL PIPING.
6. BANDING OR GROUND STRAPS MUST BE INSTALLED AROUND METER LOOP ON COPPER LINES (COPPER TO COPPER).
7. IF HDPE ENTERS STRUCTURE THROUGH SLAB, IT MUST BE ANCHORED AFTER THE TRANSITION FITTING ON THE COPPER TUBING.
8. MINIMUM SIZE = 1" HDPE CTS PIPE PER DISTRICT SPECIFICATIONS.

**STRASBURG SANITATION AND WATER DISTRICT**

**WATER METER LOOP FOR 3/4" THROUGH 1" METERS**

APPVD.	DATE:	SUVD.	DATE:
CHECKED	DATE:	SHEET OF	Scale: NONE
DESIGN	DATE:	JOB NO.	
PLOTTED TLM	DATE: 10/16	PA NO.	
REVISION			



**NOTES:**

1. IN THE INTEREST OF SPACE CONSERVATION IT IS PERMISSIBLE TO INSTALL PIPING VERTICALLY DOWNSTREAM OF THE METER INCLUDING THE CHECK VALVE. THE PRESSURE REGULATOR ON THE INLET SIDE OF THE METER MAY BE INSTALLED IN A HORIZONTAL OR VERTICAL POSITION.
2. A SECOND PRESSURE REGULATOR MAY BE INSTALLED ON THE DEMAND SIDE OF THE METER DOWNSTREAM FROM A BRANCH SUPPLYING AN IRRIGATION SYSTEM IF REQUIRED. THE IRRIGATION SYSTEM BRANCH MUST BE DOWNSTREAM OF THE METER, CHECK VALVE AND BALL VALVE.
3. ONLY MINIMAL SEPARATION IS ALLOWED BETWEEN FITTINGS UPSTREAM OF THE METER TO ALLOW PROPER INSTALLATION OF THE REQUIRED FITTINGS AS DEPICTED IN THESE DRAWINGS AND SPECIFICATIONS. IN NO CASE SHALL SEPARATION BE GREATER THAN NECESSARY WHICH COULD ALLOW A BRANCH, TEE, OR OTHER FITTING UPSTREAM OF THE METER THAN WHAT IS DEPICTED AND SPECIFIED HEREIN.
4. AN APPROVED TRANSITION FITTING FROM HDPE TO COPPER INSIDE THE STRUCTURE CAN BE USED ONCE THE HDPE SERVICE LINE ENTERS THE STRUCTURE.
5. THE METER PIPE MUST BE SECURED BEFORE AND AFTER THE INLET AND OUTLET VALVES TO A SOLID UPRIGHT SUCH AS THE UNISTRUT OR 1/2" ALL-THREAD (OR MOUNTED BI-LATERALLY) AND ANCHORED TO THE FLOOR AND CLAMPED TO THE HORIZONTAL PIPING.
6. BANDING OR GROUND STRAPS MUST BE INSTALLED AROUND METER LOOP ON COPPER LINES (COPPER TO COPPER).
7. THE LOCATION OF THE HDPE PENETRATION SHALL BE A MINIMUM OF 12" FROM ANY WALL OR FOUNDATION. A 30" CLEAR SPACE SHALL BE PROVIDED IN FRONT OF METER FOR ACCESS AND MAINTENANCE.
8. THE HDPE SERVICE LINE SHALL BE CONTINUOUS FROM THE CURB STOP THROUGH THE FLOOR WITH NO JOINTS.
9. THE DIAGRAM SHOWS A THREADED METER CONNECTION. A 2-BOLT ECCENTRIC FLANGE METER CAN ALSO BE ORDERED. A THREADED UNION MUST BE INSTALLED AT LEAST ON ONE SIDE OF THE METER AT EITHER THE DOWNSTREAM BALL VALVE OR UPSTREAM REGULATOR IF A FLANGE METER IS USED.

METER SIZE	METER LENGTH*	MIN. R
1-1/2" METER	12-5/8"	30"
2" METER	15-1/4"	48"

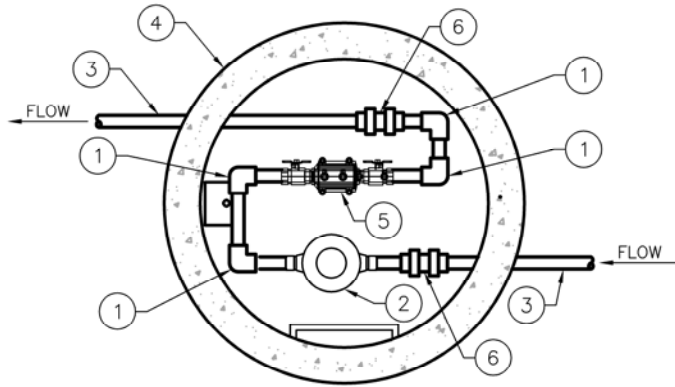
\* CHECK METER LENGTH BEFORE INSTALLATION

**STRASBURG SANITATION AND WATER DISTRICT**

**1 1/2" AND 2" INDOOR METER INSTALLATION**

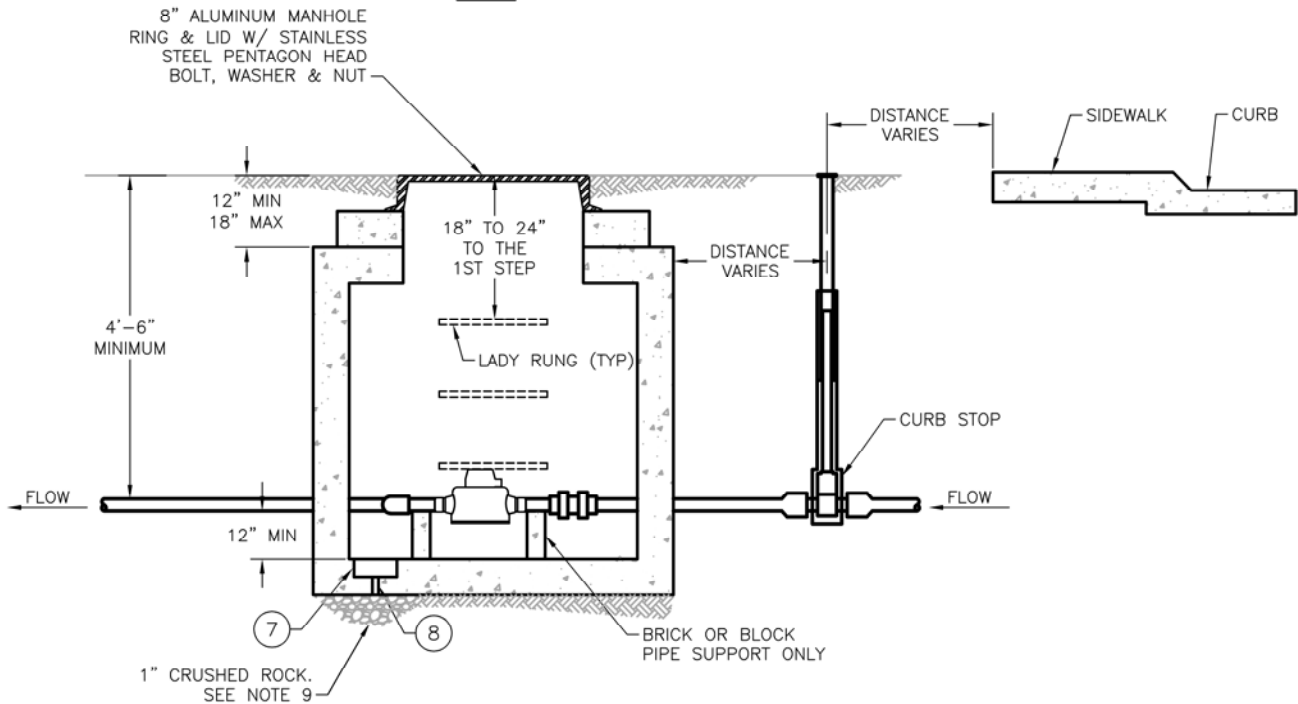
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DESIGN	DATE:	JOB NO.	
PLOTTED TLM	DATE: 10/16	PA NO.	
REVISION			





1	90 DEG ELBOW
2	METER UNIT
3	TYPE K SOFT COPPER TUBE
4	48" DIA CONCRETE VAULT
5	BACKFLOW PREVENTER
6	BALL VALVE
7	1" DRAINHOLE WITH EXPANSION PLUG AND DRAINAGE PIT
8	SUMP

**PLAN**



**ELEVATION**

**NOTES:**

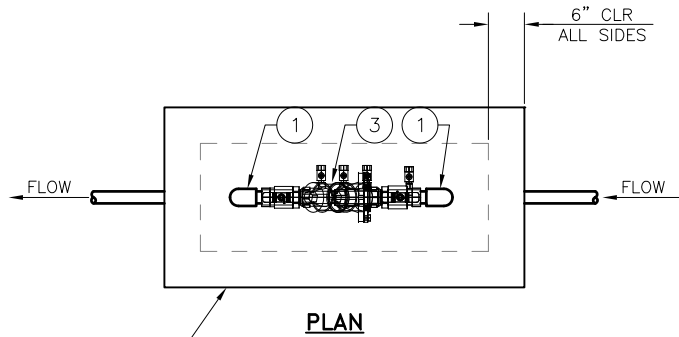
1. BASE AND BOTTOM BARREL SECTION SHALL BE PRECAST AS A SINGLE UNIT. THE VAULT SHALL BE WATERTIGHT. USE APPROVED GASKET MATERIALS TO SEAL PIPE PENETRATIONS.
2. JOINTS INSIDE METER VAULT SHALL BE EITHER THREAD. COMPRESSION SILVER SOLDERED OR 95-5 TIN ANTIMONY SOLDER.
3. THE ONLY METER APPROVED IN STASBURG IS THE INVENSYS SR2 WITH A BRONZE BODY.
4. METER SETTER SHALL BE AS INDICATED IN CITY STANDARDS.
5. NO CONNECTIONS OR CHANGES IN PIPE DIAMETER SHALL BE MADE IN THE METER OR IN THE DISTANCE OF FIVE FEET ON EITHER SIDE OF THE METER VAULT.
6. HALF INCH OR LARGER CONDUIT MUST BE RUN FROM THE PIT TO THE CLOSET BLDG AND UP THE EXTERIOR OF THE BUILDING WALL A MIN. OF 4 FEET.
7. WHEN THE BACKFLOW DEVICE IS INSTALLED INSIDE THE BUILDING. THE PLUMBING WITHIN THE VAULT WILL BE MODIFIED TO ACCOMMODATE THE METER ONLY.
8. THE INSTALLATION OF WATER METER VAULTS IN STREETS, ROADWAYS, DRIVEWAYS, ALLEYS OR PARKING LOTS WILL NOT BE ALLOWED UNLESS APPROVED BY THE WATER ENGINEER.
9. PLACE A MINIMUM OF 2 CUBIC YARDS OF 1" CRUSHED ROCK UNDER THE SUMP.
10. VAULT CAN BE INSTALLED WITHOUT A BOTTOM ON TOP OF 3/4" CRUSHED ROCK. A SUMP THEN WOULD NOT BE NECESSARY.
11. SEE SECTION 5.01 OF THE SSWD PUBLIC UTILITY DESIGN AND CONSTRUCTION SPECIFICATIONS FOR BACKFLOW PREVENTION DEVICE STANDARDS.
12. LADDER RUNGS SHALL BE 12" O.C. CAST IN VAULT.
13. FOR UNDERGROUND INSTALLATIONS, A REDUCED PRESSURE ZONE BACKFLOW PREVENTER WILL ONLY BE ALLOWED IF THE CUSTOMER OBTAINS PRIOR WRITTEN APPROVAL FROM THE COLORADO DEPARTMENT OF HEALTH AND ENVIROMENT CROSS CONNECTION CONTROL DEPARTMENT HEAD.

**STRASBURG SANITATION AND WATER DISTRICT**

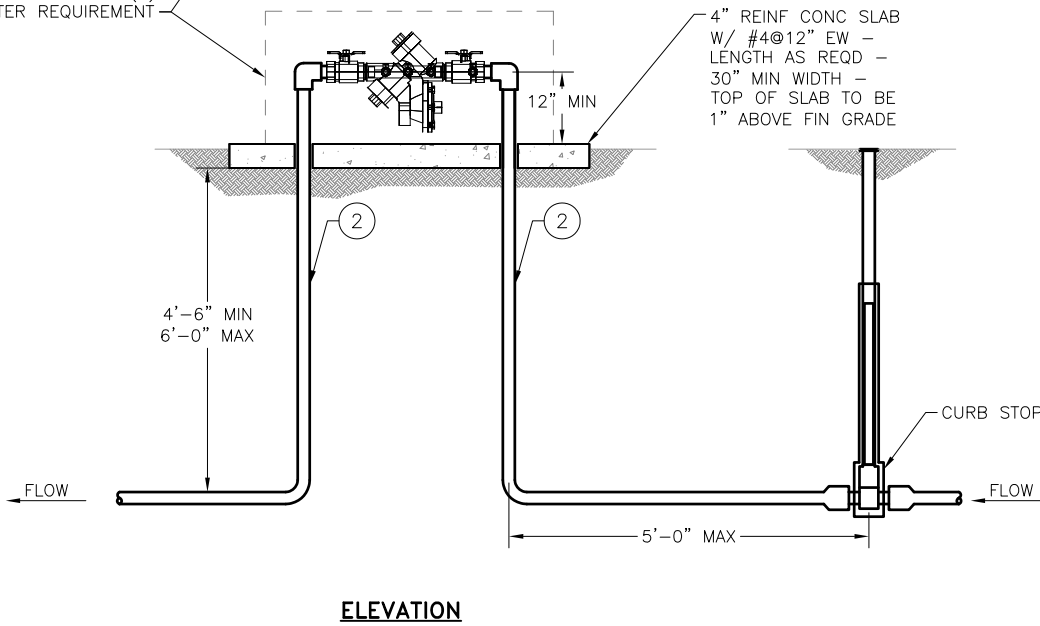
**3/4" TO 2" BACKFLOW PREVENTER WITH METER**

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PLOTTED ACH	DATE: 06/18	PA NO.		
REVISION				

1	90 DEG ELBOW
2	TYPE K SOFT COPPER TUBE
3	BACKFLOW PREVENTER



HINGED ACCESS OR  
REMOVABLE INSULATED  
ENCLOSURE. ENCLOSURE  
TO INCLUDE DRAIN PORT(S)  
PER CLT WATER REQUIREMENT



**NOTES:**

1. CONCRETE PAD PENETRATIONS SHALL BE 1" LARGER THAN PIPE DIAMETER.
2. DIAMETER OF FITTINGS, NIPPLE, & TUBING SHALL BE EQUAL IN DIAMETER TO THE BACKFLOW PREVENTER.
3. HEATED ENCLOSURE SHALL HAVE SEPERATE APPROVED ELECTRICAL SERVICE & SHALL BE SIZED TO ALLOW ADEQUATE ROOM FOR TESTING AND MAINTENANCE.
4. REFER TO LOCAL CODES & MANUFACTURER REQUIREMENTS FOR INSTALLATION INSTRUCTIONS.
5. SEE SECTION 5.01 OF THE SSWD PUBLIC UTILITY DESIGN AND CONSTRUCTION SPECIFICATIONS FOR BACKFLOW PREVENTION DEVICE STANDARDS.
6. LADDER RUNGS SHALL BE 12" O.C. CAST IN VAULT.

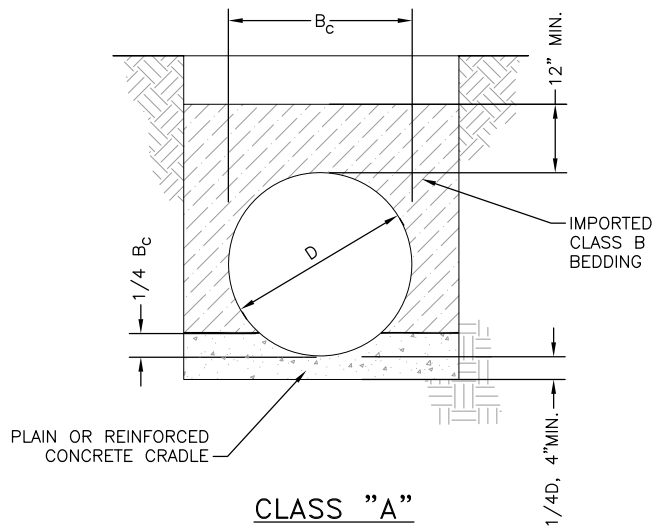
**STRASBURG SANITATION  
AND WATER DISTRICT**

**3/4" TO 2"  
ABOVE GROUND BACKFLOW PREVENTER**

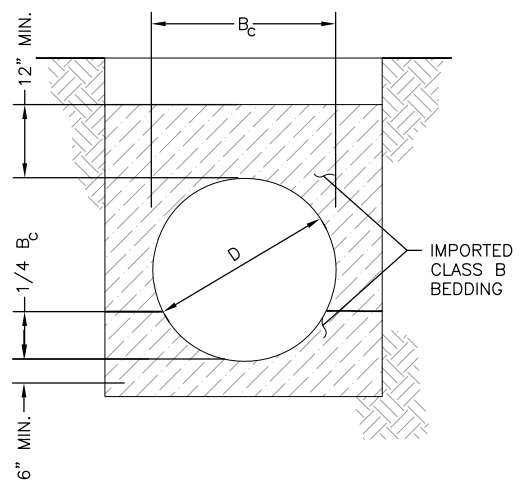
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REVISION			

**PART II**

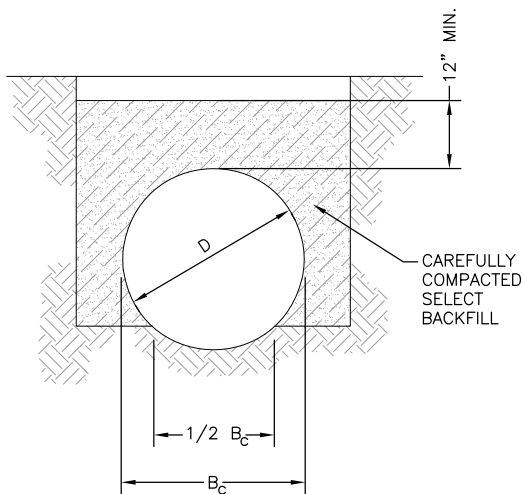
**WASTEWATER COLLECTION SYSTEM  
STANDARD DRAWINGS**



**CLASS "A"**  
**(CONCRETE CRADLE)**  
 L.F.=2.8



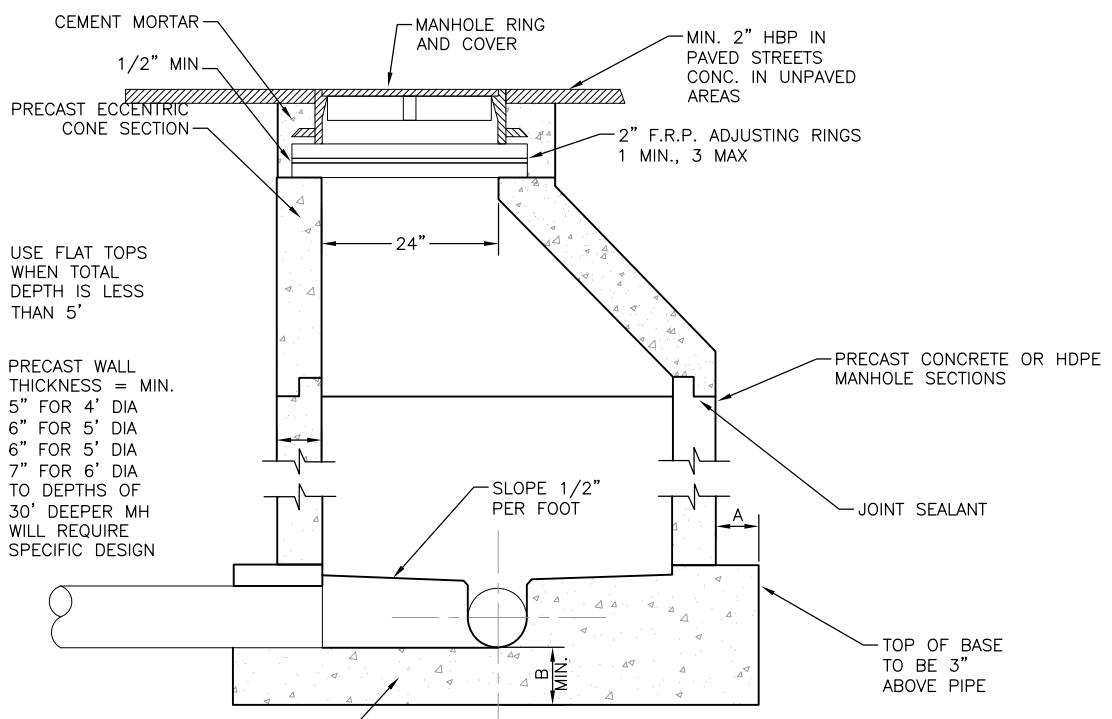
**CLASS "B"**  
**STANDARD BEDDING DETAIL**  
**(GRANULAR BASE)**  
 L.F.=1.9



**CLASS "C"**  
**(SHAPED BOTTOM)**  
 L.F.=1.5

**NOTES:**

1. FOR ROCK OR OTHER INCOMPRESSIBLE MATERIALS, THE TRENCH SHALL BE OVEREXCAVATED A MINIMUM OF 6" AND REFILLED WITH GRANULAR BEDDING MATERIAL AS DEFINED BY CLASS "B" BEDDING.
2. L.F. = LOAD FACTOR
3. MINIMUM DENSITY FOR CAREFULLY COMPACTED SELECT BACKFILL SHALL BE 95% OF STD. PROCTOR DENSITY OR AS SPECIFIED FOR THE TRENCH BACKFILL WHICHEVER IS GREATER.



USE FLAT TOPS  
WHEN TOTAL  
DEPTH IS LESS  
THAN 5'

PRECAST WALL  
THICKNESS = MIN.  
5" FOR 4' DIA  
6" FOR 5' DIA  
6" FOR 5' DIA  
7" FOR 6' DIA  
TO DEPTHS OF  
30' DEEPER MH  
WILL REQUIRE  
SPECIFIC DESIGN

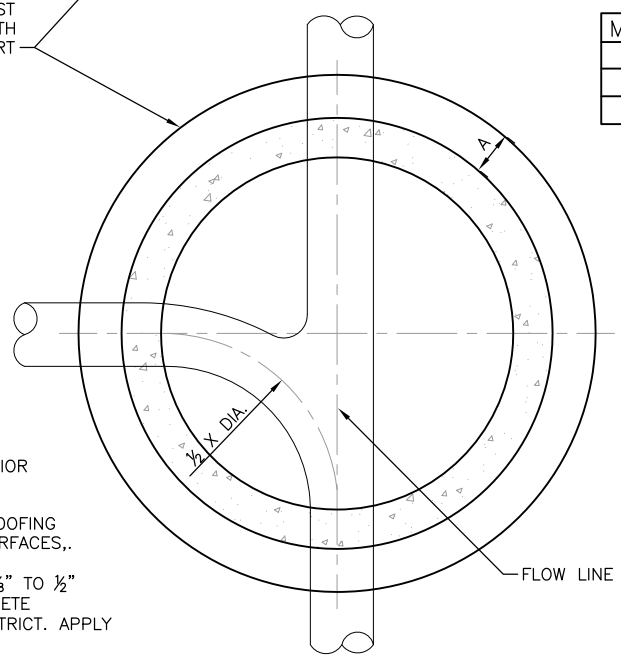
BASE MAY BE PRECAST  
CONCRETE WITH  
CAST-IN-PLACE INVERT

SEE WW-3 FOR OTHER  
DETAILS

M.H. DEPTH	DIMENSION	
	A	B
0' TO 30'	6"	8"
OVER 30'	12"	12"

WATERPROOFING REQUIREMENTS

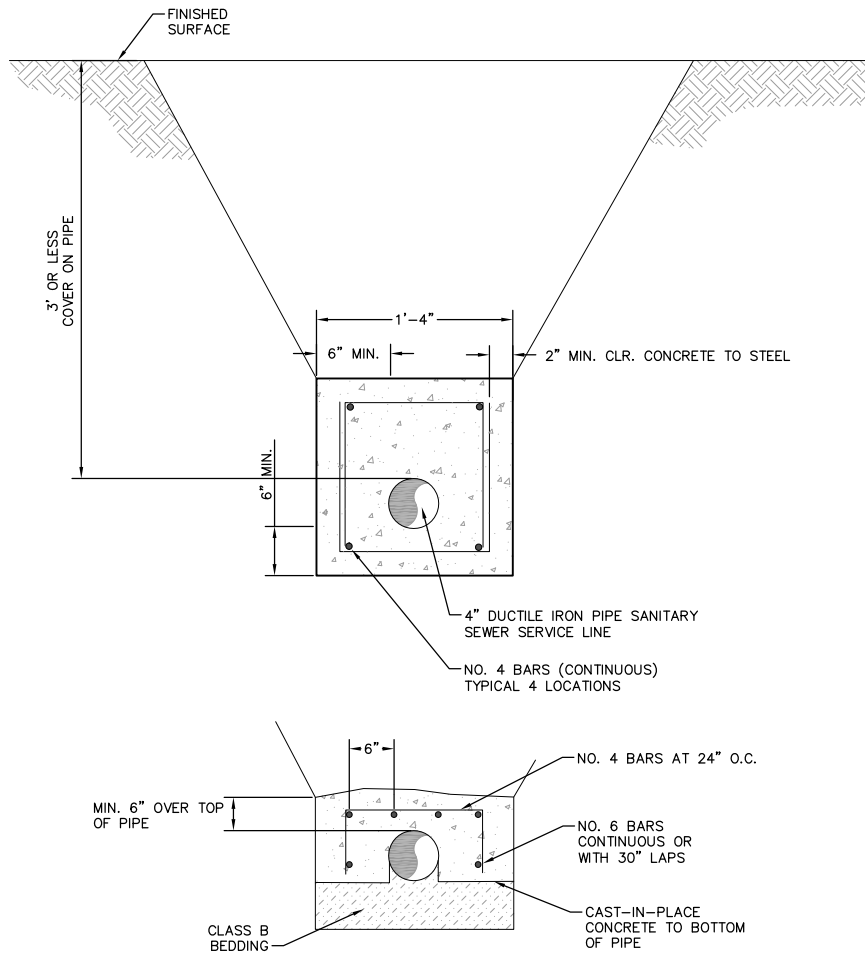
1. APPLY CEMENT GROUT LAYER ( $\frac{3}{8}$ " TO  $\frac{1}{2}$ " THICK) TO ALL INTERIOR JOINTS ABOVE FLOW CHANNEL.
2. APPLY COAL TAR EPOXY DAMPROOFING TO ALL EXTERIOR CONCRETE SURFACES,.
3. APPLY CEMENT GROUT LAYER ( $\frac{3}{8}$ " TO  $\frac{1}{2}$ " THICK) TO ALL EXTERIOR CONCRETE SURFACES, AS DIRECTED BY DISTRICT. APPLY PRIOR TO DAMPPROOFING.



# SANITARY SEWER MANHOLE

STRASBURG SANITATION  
AND WATER DISTRICT

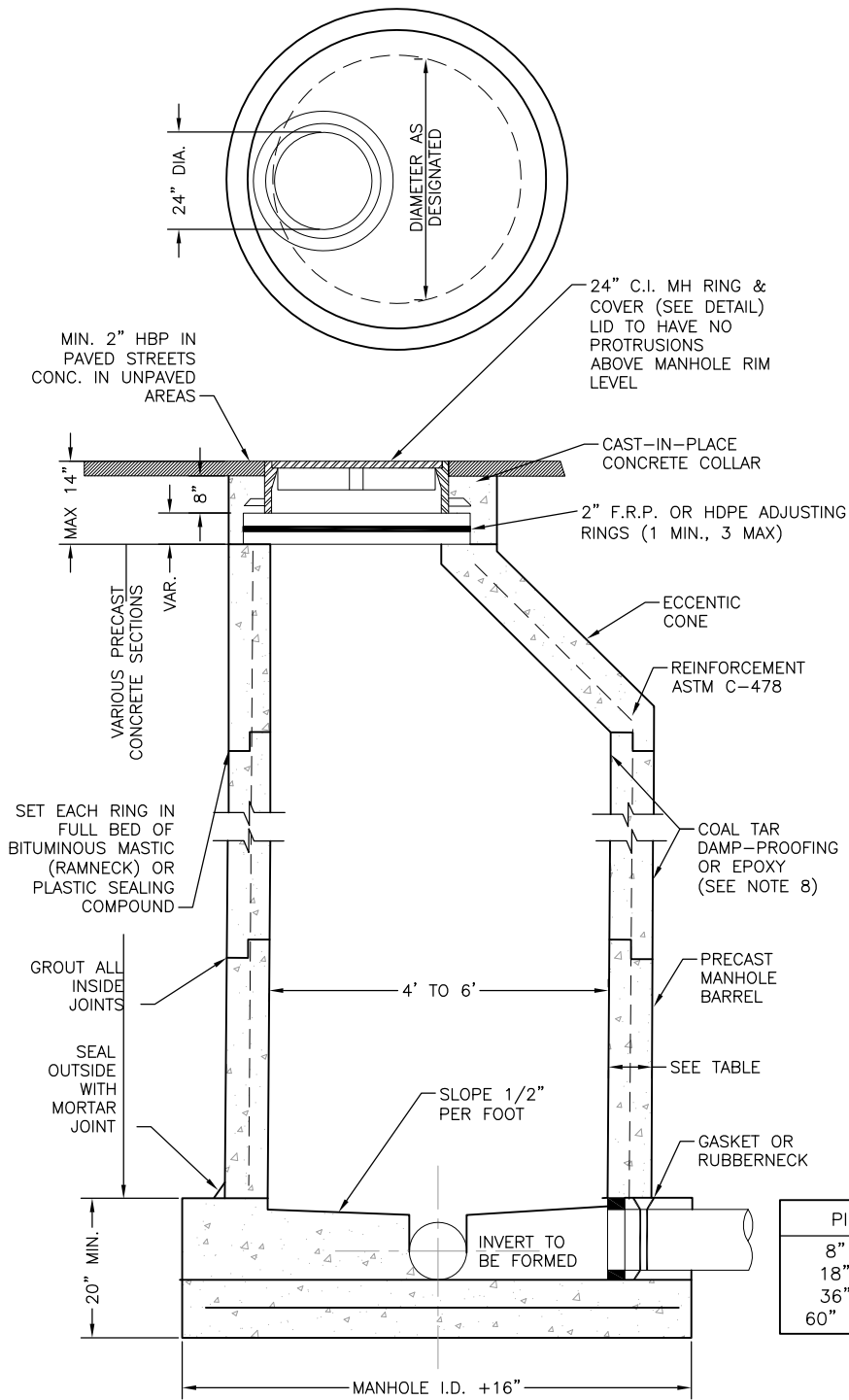
WASTEWATER COLLECTION SYSTEM  
STANDARD DRAWINGS



**REINFORCED CONCRETE PIPE CAP**

**NOTES:**

1. DUCTILE IRON PIPE WITHOUT CONCRETE ENCASEMENT MAY BE PERMITTED BY THE DISTRICT IF FINAL PIPE COVER IS MORE THAN 3 FEET.
2. CONCRETE ENCASEMENT PER THIS DRAWING IS REQUIRED WITH DUCTILE IRON PIPE WHERE FINAL PIPE COVER IS 3 FEET OR LESS.
3. IF THE CONCRETE ENCASEMENT IS REQUIRED ON A SANITARY SEWER SERVICE LINE, THE PROPERTY OWNER/CUSTOMER IS COMPLETELY RESPONSIBLE FOR OPERATION, MAINTENANCE AND REPLACEMENT OF ANY SEWER SERVICE LINE FROM THE DISTRICT'S SEWER MAIN TO THE STRUCTURE SERVED.
4. THE DISTRICT MAY ACCEPT CONCRETE CAP FOR PIPE PROTECTION IN SPECIAL CONDITIONS.



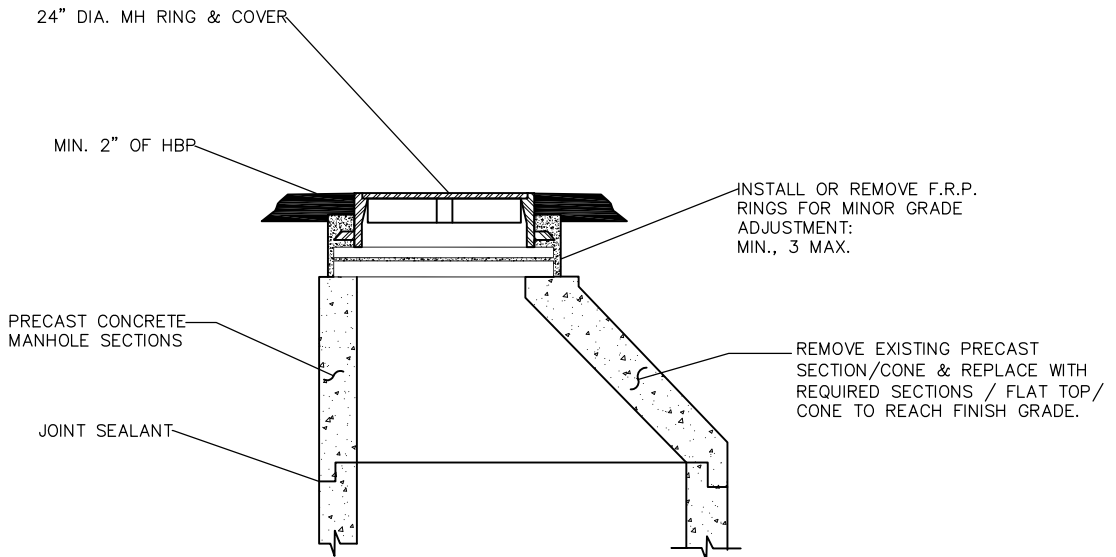
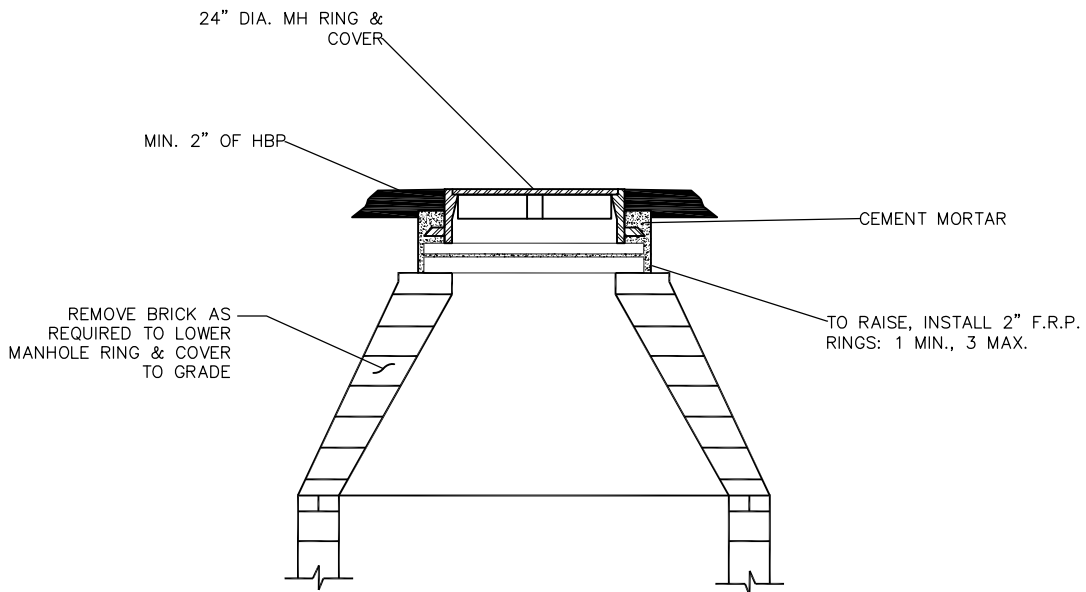
1. MANHOLE BARREL MINIMUM DIAMETER SHALL CONFORM TO TABLE.
2. SHAPING FOR SMOOTH MANHOLE INVERTS MUST BE DONE BY FORMING/SHAPING CONCRETE BASE.
3. PRECAST SECTIONS TO CONFORM TO ASTM C-478.
4. STUB-OUTS SHALL EXTEND A MINIMUM OF 6' PAST MANHOLE O.D. AND BE SATISFACTORILY PLUGGED.
5. CONCRETE MANHOLES MAY BE POURED IN PLACE ONLY WITH PRIOR DESIGN AND INSPECTION APPROVAL.
6. ALL MORTAR GROUT SHALL BE MIXED WITH THE TYPE V CEMENT.
7. APPLY COAL TAR EPOXY DAMP-PROOFING TO ALL EXTERIOR AND INTERIOR CONCRETE SURFACES.
8. CENTER REINF. IN BASE POUR BELOW PIPE O.D. AT FL.
9. ALL EXTERIOR JOINTS SHALL RECEIVE BUTYL RUBBER JOINT WRAP. REFER TO SPECIFICATIONS.

PIPE I.D.	MANHOLE I.D.	WALL
8" TO 15"	4'-0"	5"
18" TO 30"	5'-0"	6"
36" TO 54"	6'-0"	7"
60" & LARGER	SPECIAL DESIGN	

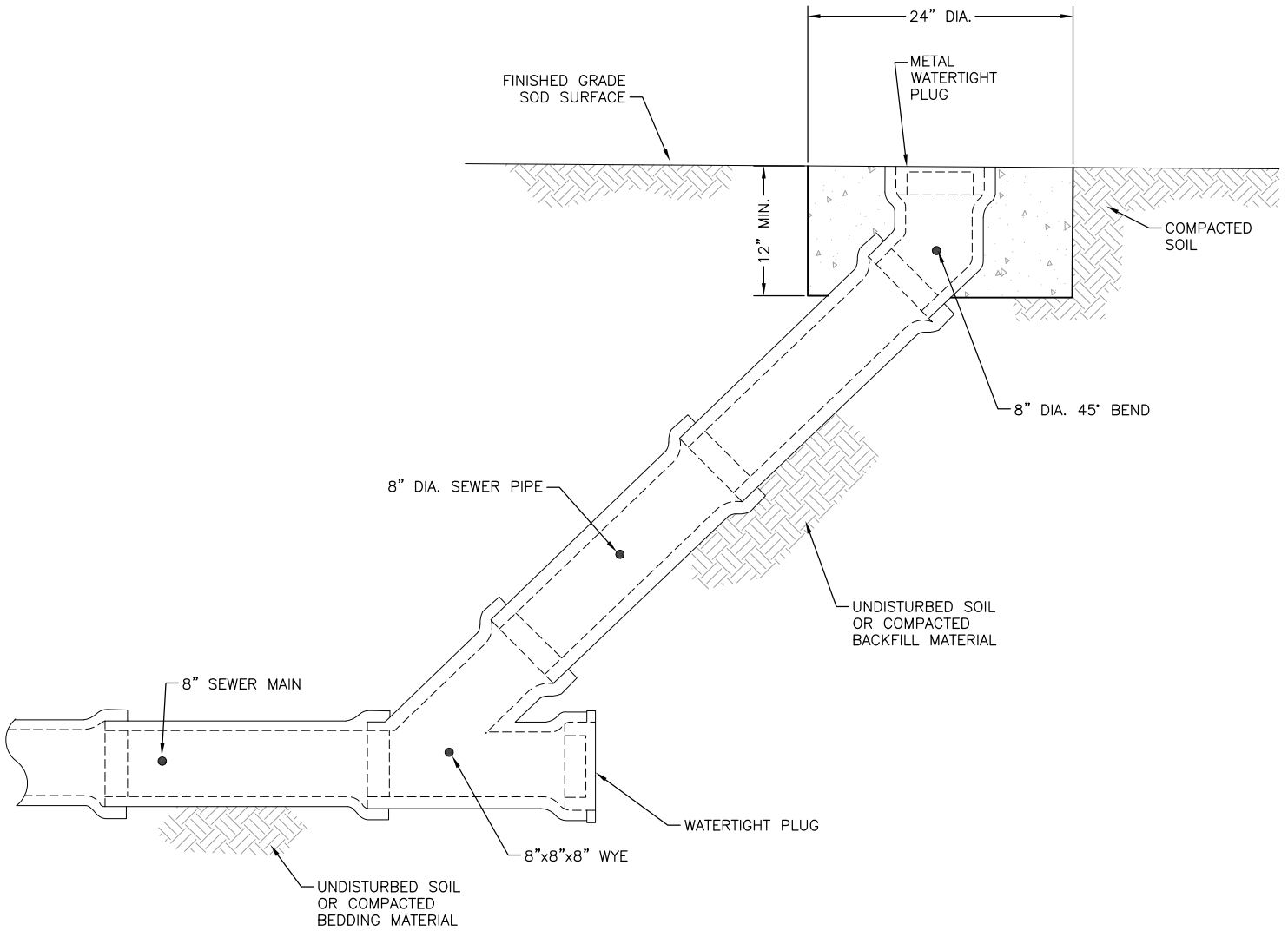
## TYPICAL PRECAST MANHOLE DETAIL

STRASBURG SANITATION  
AND WATER DISTRICT

WASTEWATER COLLECTION SYSTEM  
STANDARD DRAWINGS



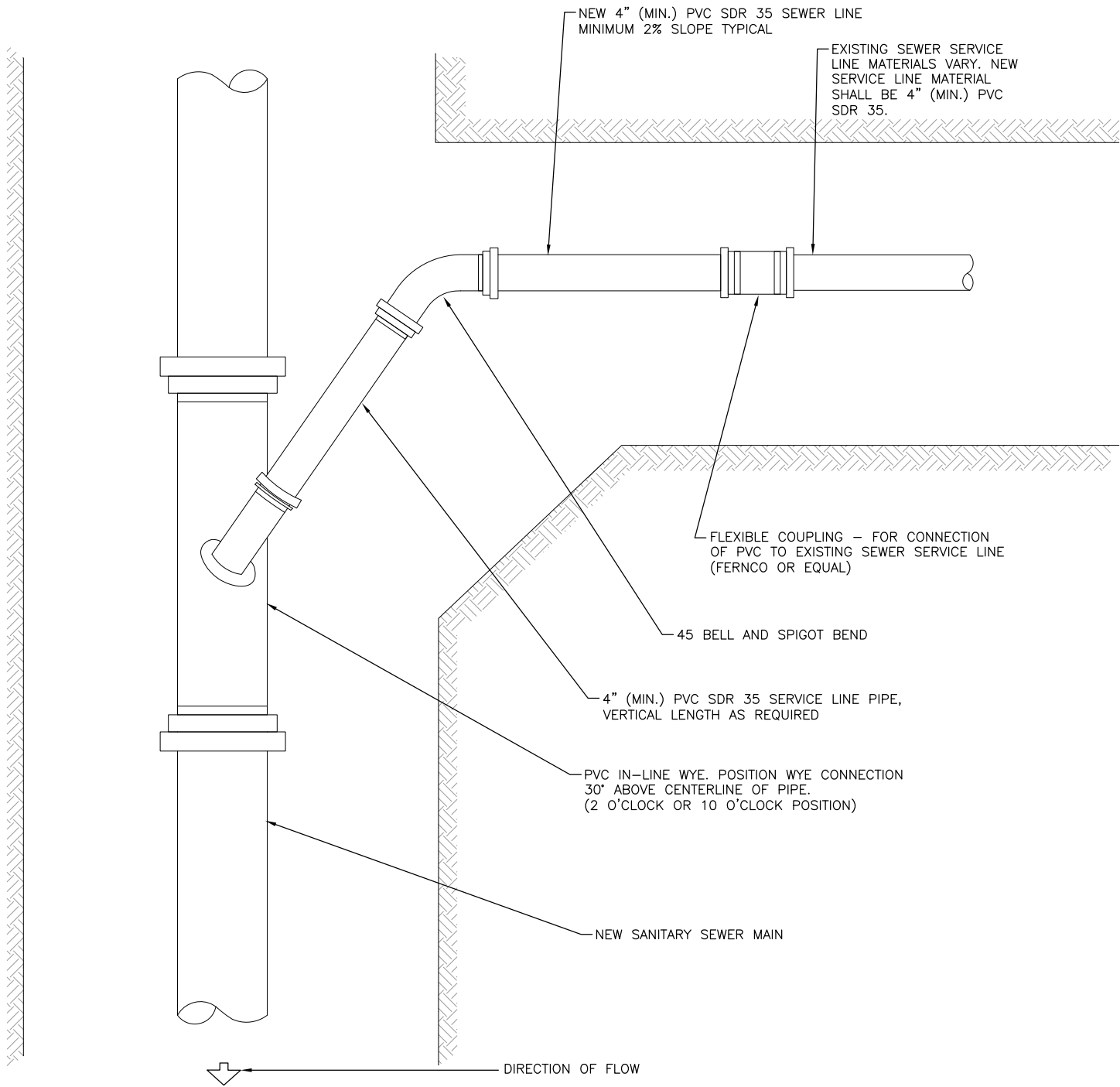




SANITARY SEWER MAIN CLEANOUT

STRASBURG SANITATION AND WATER DISTRICT

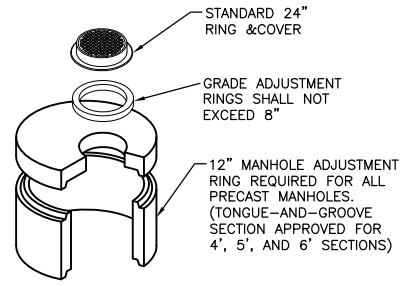
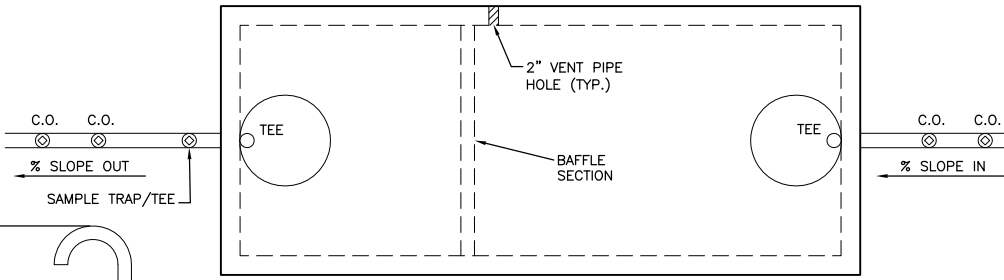
WASTEWATER COLLECTION SYSTEM STANDARD DRAWINGS



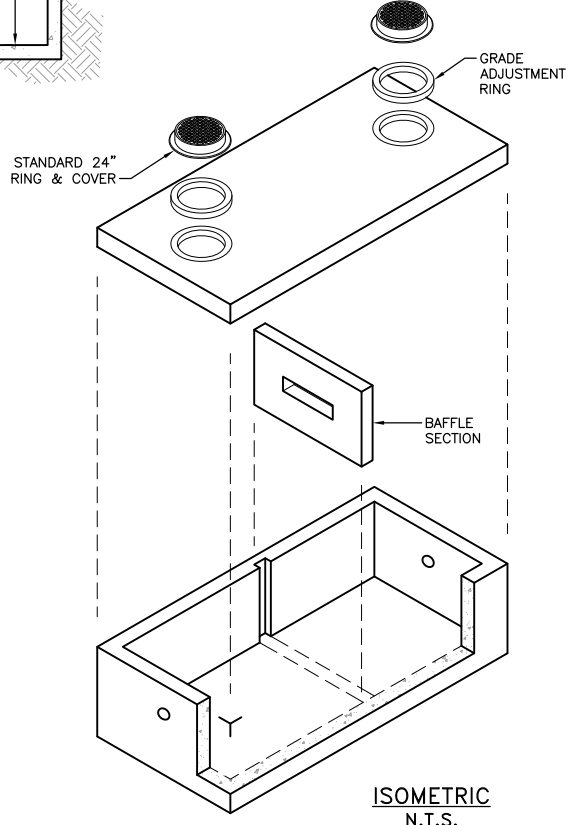
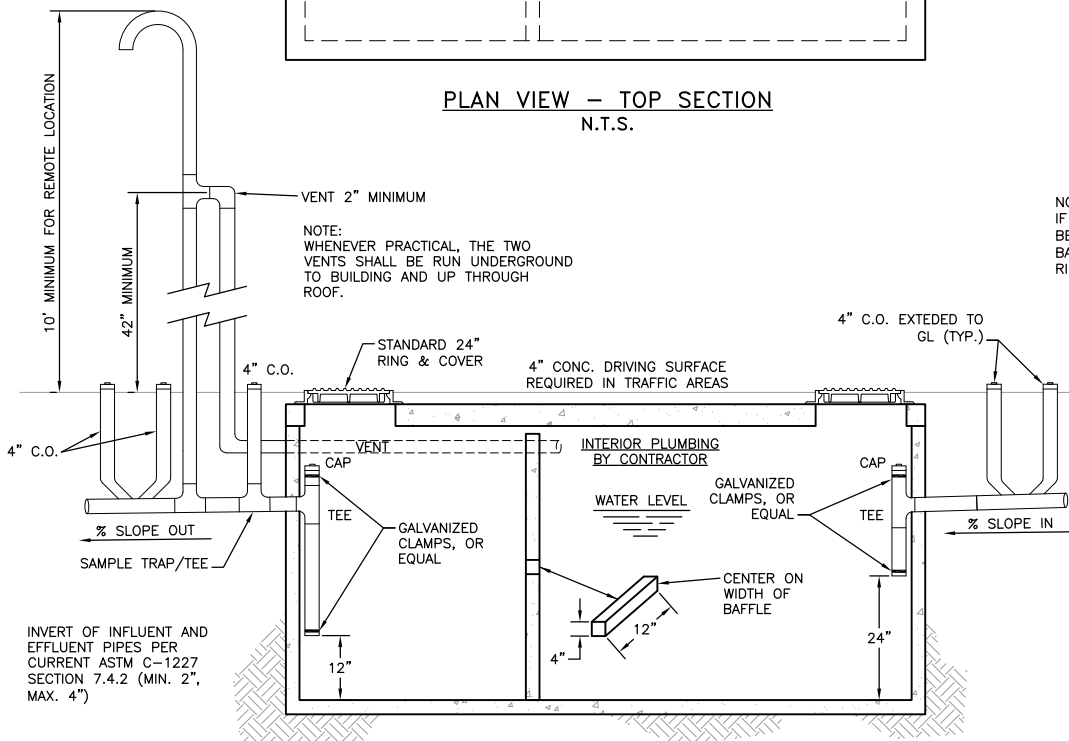
SANITARY SEWER SERVICE CONNECTION

STRASBURG SANITATION  
AND WATER DISTRICT

WASTEWATER COLLECTION SYSTEM  
STANDARD DRAWINGS



NOTE:  
IF TOP OF GREASE INTERCEPTOR IS MORE THAN 8" BELOW FINISHED GRADE, 4" DIAMETER MANHOLE BARREL SECTION(S) WILL BE REQUIRED TO BRING RING AND COVER TO GRADE.



TYPICAL GREASE INTERCEPTORS

SIZE (GAL.)	USE	LENGTH	WIDTH	HEIGHT
800	NON-TRAFFIC	96"	48"	73"
1000	NON-TRAFFIC	102"	58"	73"
1000	TRAFFIC	96"	72"	87.5"
1500	NON-TRAFFIC	126"	68"	73"
1500	TRAFFIC	162"	84"	65"
2250	NON-TRAFFIC	144"	78"	79"
2500	TRAFFIC	162"	84"	103"
3500	TRAFFIC	162"	84"	103"
5000	TRAFFIC	162"	84"	147"

APPROX. SIZE OF GREASE INTERCEPTORS  
CHECK WITH MANUFACTURER FOR CORRECT DIMENSIONS AND INVERTS

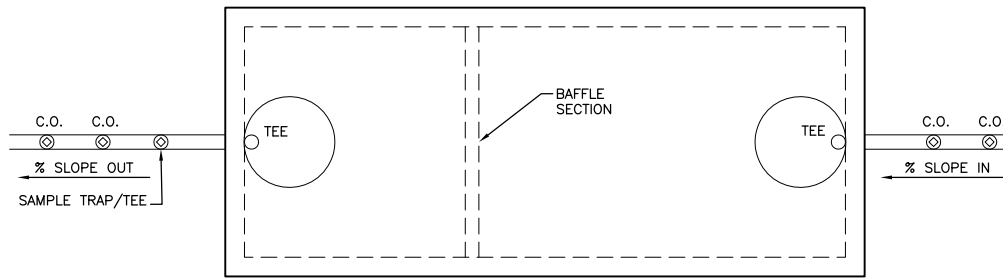
NOTES:

1. TO BE READ IN CONJUNCTION WITH DISTRICT WASTEWATER SPECIFICATIONS AND INTERNATIONAL PLUMBING CODE.
2. SPECIFIC SIZE APPLICATION OF THE GREASE INTERCEPTOR TO BE DETERMINED BY DISTRICT.

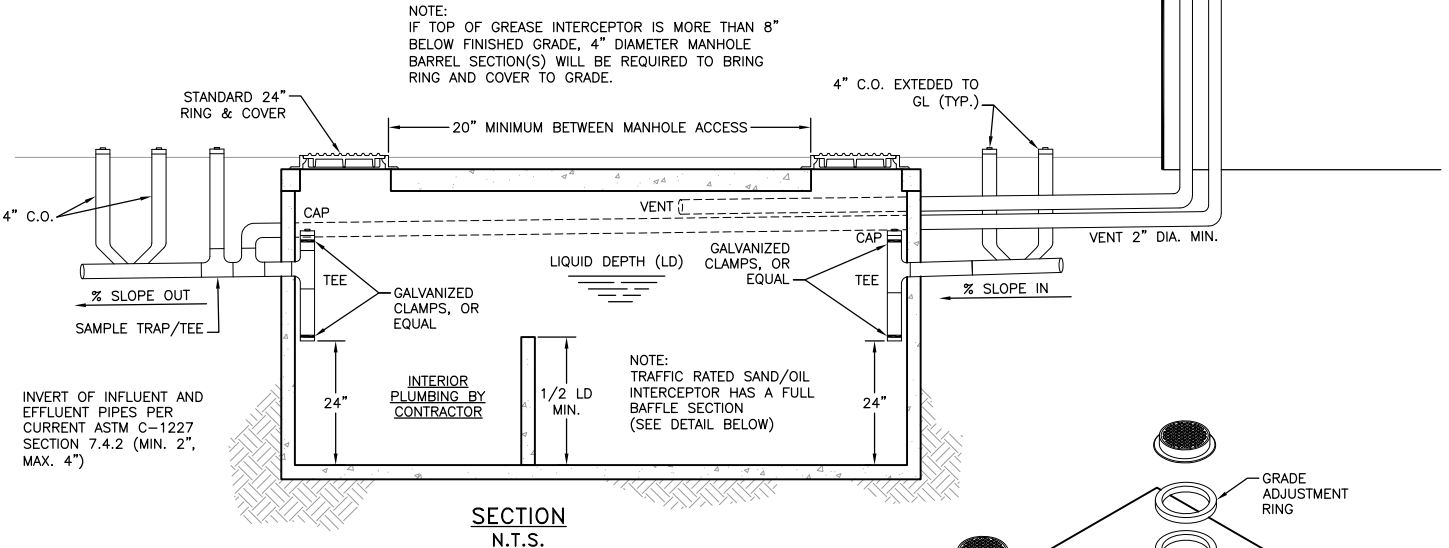
GREASE INTERCEPTOR

STRASBURG SANITATION AND WATER DISTRICT

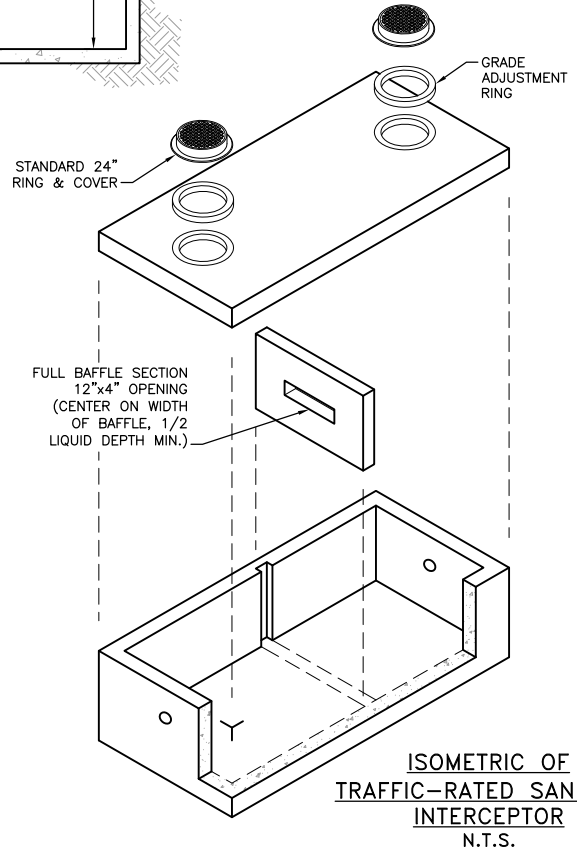
WASTEWATER COLLECTION SYSTEM STANDARD DRAWINGS



PLAN VIEW - TOP SECTION  
N.T.S.



SECTION  
N.T.S.



ISOMETRIC OF  
TRAFFIC-RATED SAND/OIL  
INTERCEPTOR  
N.T.S.

TYPICAL SAND/OIL INTERCEPTORS

SIZE (GAL.)	USE	LENGTH	WIDTH	HEIGHT
500	TRAFFIC	72" OD x 74" (ID=60")		
1000	NON-TRAFFIC	102"	58"	77"
1000	TRAFFIC	96"	72"	86"
1500	NON-TRAFFIC	126"	68"	77"
1500	TRAFFIC	162"	84"	64"
2250	NON-TRAFFIC	144"	78"	82"
2500	TRAFFIC	162"	84"	102"

APPROX. SIZE OF SAND/OIL INTERCEPTORS  
CHECK WITH MANUFACTURER FOR CORRECT DIMENSIONS AND INVERTS

NOTES:

1. TO BE READ IN CONJUNCTION WITH DISTRICT WASTEWATER SPECIFICATIONS AND INTERNATIONAL PLUMBING CODE.
2. SPECIFIC SIZE APPLICATION OF THE GREASE INTERCEPTOR TO BE DETERMINED BY DISTRICT.
3. INTERIOR PIPING TO BE STRAPPED AT BOTTOM WITH GALVANIZED CLAMPS, UNISTRUT, OR EQUAL.
4. VENTS SHALL BE CONSTRUCTED ON THE OUTSIDE OF THE TANK.

SAND/OIL SEPARATOR

STRASBURG SANITATION  
AND WATER DISTRICT

WASTEWATER COLLECTION SYSTEM  
STANDARD DRAWINGS