

SECTION 7

WATER UTILITY POLICIES AND STANDARDS

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SECTION 7
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TABLE OF CONTENTS

	<u>Page</u>
Subsection 1 – General Policies	1
1-1 General Statement	1
1-2 Fees	8
1-3 Line Extension	10
1-4 Line Oversizing.....	17
1-5 Line Extension and Oversizing Agreement	18
1-6 Procedures Checklist for Public Water Mains	19
1-7 Procedures Checklist for Service Connections	19
1-8 Plan Review Checklist for Public Water Mains	19
1-9 Plan Review Checklist for Service Connections.....	19
1-10 Water Main Construction Inspection and Testing Checklist.....	19
1-11 Hydrant Meter Release Form.....	19
1-12 Service Interruption.....	20
1-13 Connections to Existing Mains.....	20
Subsection 2 – Design Criteria	1
2-1 Conformance with Water Distribution System Master Plan.....	1
2-2 Restrained Joints	1
2-3 Vertical and Horizontal Alignment	1
2-4 Protection of Water Supplies	3
2-5 Identification	4
2-6 Stream Crossings.....	4
Subsection 3 – Excavation and Trenching	1
3-1 Scope	1
3-2 General Requirements.....	1
3-3 Structures.....	1
3-4 Weather.....	1
3-5 Classification of Excavated Materials.....	2
3-6 Blasting.....	2
3-7 Unauthorized Excavation.....	2
3-8 Dewatering.....	2
3-9 Drainage Maintenance.....	3
3-10 Disposal of Excess Excavated Materials.....	3
3-11 Quality Assurance.....	4
3-12 Definitions.....	5

3-13	Materials.....	7
3-14	Excavation.....	9
3-15	Tunnel Excavation.....	12
3-16	Boring Smooth Steel Pipe.....	14
3-17	Pipe Embedment.....	15
3-18	Backfill and Compaction.....	16
3-19	Field Quality.....	18
3-20	Compaction Test Failure.....	20
3-21	Off-Road Construction.....	20
3-22	Maintenance of Traffic.....	20
3-23	Road Closings.....	21
3-24	Barricades and Lights.....	21
3-25	Fences.....	22
3-26	Protection of Public and Private Property.....	23
3-27	Dust Control.....	23
3-28	Temporary drainage Provisions.....	24
3-29	Erosion Control.....	24
3-30	Pollution Control.....	24
3-31	Final Cleanup.....	25

Subsection 4 – Pipe.....	1
4-1 General.....	1
4-2 Ductile Iron Pipe.....	1
4-3 Polyvinyl Chloride (PVC) Pressure Pipe.....	9
4-4 Miscellaneous Piping.....	16
4-5 Spacer, Casing or Sleeve Pipe.....	20

Subsection 5 – Waterline Equipment.....	1
5-1 Scope.....	1
5-2 Valves General.....	1
5-3 Gate Valves.....	3
5-4 Check Valves.....	3
5-5 Ball Valves.....	4
5-6 Butterfly Valves.....	4
5-7 Pressure Reducing Valves.....	4
5-8 Air Release and Vacuum Relief Valves.....	5
5-9 Corporation Stops.....	5
5-10 Curb Stops.....	5
5-11 Water Meters.....	5
5-12 Meter Yokes.....	5
5-13 Backflow Preventer.....	7
5-14 Fire Hydrants.....	7
5-15 Tapping Sleeves and Valves.....	7
5-16 Extension Stems.....	8
5-17 Pressure Gauges.....	8
5-18 Valve Boxes.....	9

5-19	Installation of Waterline Equipment.....	9
Subsection 6 – Vaults.....		
6-1	General.....	1
6-2	Materials.....	1
6-3	Vault Construction.....	3
6-4	Painting.....	3
6-5	Drawings and Data.....	4
Subsection 7 – Pressure and Leakage Tests and Disinfection of Waterlines.....		
7-1	General Requirements.....	1
7-2	Test Sections.....	1
7-3	Filling and Venting.....	1
7-4	Test Equipment and Facilities.....	1
7-5	Pressure and Leakage Test.....	2
7-6	Disinfection.....	3
Subsection 8 – Water Meters and Service Lines.....		
8-1	General Requirements.....	1
8-2	General.....	1
8-3	Location and Size.....	1
8-4	Installation of Service Line.....	2
8-5	Service Connections.....	3
8-6	Acceptance.....	3
Subsection 9 – Concrete and Grouting.....		
9-1	Scope.....	1
9-2	Materials.....	1
9-3	Preliminary Review.....	2
9-4	Limiting Requirements.....	2
9-5	Storage of Materials.....	3
9-6	Batching and Mixing.....	4
9-7	Placement.....	4
9-8	Reinforcement.....	4
9-9	Forms.....	5
9-10	Finishing.....	5
9-11	Curing.....	6
9-12	Repairing Defective Concrete.....	6
9-13	Nonshrinking Grout.....	7
Attachment A		
Waterline Extension and Oversizing Agreement		
Attachment B		
Procedures Checklist for Public Water Mains		
Attachment C		
Procedures Checklist for Service Connections		

Attachment D

Plan Review Checklist for Public Water Mains

Attachment E

Plan Review Checklist for Service Connections

Attachment F

Inspection and Testing Checklist

Inspection and Testing Checklist (Service Connections Only)

Attachment G

Weekly Inspection and Testing Reporting

Weekly Inspection and Testing Reporting (Service Connections Only)

Attachment H

Hydrant Meter Release Form

Appendix A – Water Utility Details

- 1 Typical Utilities Locations
- 2 Typical Trench Section Pipe Protection
- 3 Clamp Details & Dimensions for use with CI & DI Fittings Only
- 4 Blowoff/Flush Assembly 6-inch & 8-inch Permanent Mains
- 4a Temporary Blowoff Assemblies 6-inch & 8-inch Mains
- 4b Blowoff Assembly Dimension Data 12-inch & Larger Mains
- 4c Temporary & Permanent Blowoff Assemblies, 12-inch & Larger Mains
- 4d Protecting Tie-Rods
- 5 Tie Rod and Washer Details
- 6 Copper Tracer Wire on PVC Pipe
- 7 Plan, Profile & Locations for Fire Hydrants, Mains & Valves
- 8 Service Line, Stop Box & Inside Installation for ¾-inch & 1-inch Meters
- 9 Typical Inside Setting for ¾-inch & 1-inch Meter with AMR
- 10 Inside Setting for 1 ½-inch & 2-inch Meter with Check Valve & Bypass
- 11 Outside Setting for ¾-inch & 1-inch Meter
- 12 Outside Setting for 1 ½" & 2" Meters with Check Valve & Bypass in Manhole
- 13 Thrust Block Data
- 14 Flange-Lug Detail
- 15 Maximum Pipeline Deflection Data for DI and PVC Pipes
- 16 Mechanical Joint Restraint Detail
- 17 Joint Restraint Detail
- 18 Reverse Anchor Detail
- 18a Reverse Anchor Detail with Mechanical Joint Restraint
- 19 Pipe Encasement Detail
- 20 Crossing Storm and Sanitary Sewers
- 21 Pipe Bridging Detail
- 22 Typical Cutoff Wall or Ditch for Canal Crossing

23	Polyethylene Wrap
24	Reference Post Typical Detail
25	Length of Restrained Pipe
26	Valve Installation and Location
27	Valve Box Installation
28	Valve Box Top and Bottom Sections
29	Bore Casing Detail
30	Water Line Lowering Detail
30a	Lowering Detail with Mechanical Joint Restraint Fittings and Restraint Joint Pipe
31	6", 8" & 12" Pressure Regulator Station
32	6", 8" & 12" Pressure Regulator Station
32a	6" & 8" Size Pressure Regulator Station
32b	Pressure Regulator Station for 6", 8" & 12" Pipe
33	2-inch Air and Vacuum Valve Station
34	Standard Precast Concrete Vault for Valve Installation
35	Standard Cast-in-place Concrete Vault for Valve Installation
36	Standard Round Precast Vault for 1 ½-inch and 2-inch Meters
37	Compound Meters and Orion Radio RF System Details
38	Meter Details
39	Bonding Joint and Anode Installation

SUBSECTION 1

GENERAL POLICIES

TABLE OF CONTENTS

	<u>Page</u>
Subsection 1 – General Policies	1
1-1 General Statement	1
1-2 Fees	8
1-3 Line Extension	10
1-4 Line Oversizing.....	17
1-5 Line Extension and Oversizing Agreement	18
1-6 Procedures Checklist for Public Water Mains	19
1-7 Procedures Checklist for Service Connections	19
1-8 Plan Review Checklist for Public Water Mains	19
1-9 Plan Review Checklist for Service Connections.....	19
1-10 Water Main Construction Inspection and Testing Checklist.....	19
1-11 Hydrant Meter Release Form.....	19
1-12 Service Interruption.....	20
1-13 Connections to Existing Mains.....	20

SUBSECTION 1

GENERAL POLICIES

1 - 1 General Statement

- A. Purpose. This document has been developed to ensure that all waterlines, pumping stations, and other appurtenances provide adequate and reliable service and are accessible and maintainable. The standards and specifications presented herein shall be considered as minimums in that the developer, engineer, or contractor may incorporate more stringent standards if they so choose.

It shall be understood that the District has issued these standards via its statutory power to regulate certain activities within its jurisdiction and is not a party to any contracts which may exist between the persons responsible for installation of the facilities (developer, engineer, and contractor). The District may, at its discretion, inspect the contractor's work for the purpose of quality control and may periodically advise the developer as to its opinion whether the work meets these Design Standards. The District's costs for these inspections, including overtime pay if required, will be separately billed to the developer if they exceed the fee schedule established by the District. The developer, through its engineer and contractor, is responsible for adherence to the requirements established by the District. The District shall not shut down a job for poor workmanship or use of improper materials. If the water distribution facilities do not meet the requirements established herein, the District will use its regulatory powers to refuse ownership and maintenance responsibility for the facilities, deny the developer permission to purchase taps or connect them to the distribution system, or refuse to release the developer's bond. Further details regarding these procedures may be found in Subsections 1.2 through 1.12.

B. Responsibilities.

1. District Manager. The District Manager is designated by the District to exercise all authority on behalf of the Board of Directors in accordance with these Design Standards. The District Manager shall have the authority to assign a District Representative(s) to check any and all water-related work in areas subject to this document. This includes all materials, equipment, excavation, bedding, backfill, and structures. The District Manager shall have the sole authority to issue, in writing, any deviation from the provisions contained in these Design Standards or changes to any previously approved drawings.

2. District Representative. When and as required, the District Manager may assign a District Representative(s) to determine if the materials furnished and work performed is in compliance with these Design Standards. The District Representative may be an employee of the District who performs contract services for the District or a representative of the District's consulting engineering firm. Based on observations by the District Representative, the District Manager may advise the developer, in writing, on matters regarding defective materials and/or workmanship. The District Representative does not have authority to alter any provisions contained herein or make changes to previously approved drawings.

The contractor shall furnish all reasonable facilities and access to the District Representative for the purpose of observing the materials and workmanship used in construction. The contractor shall provide the District with at least 24 hours' notice in order that a District Representative can be made available if the District Manager determines that one is needed.

3. Developer. The developer is responsible for securing all approvals, payment of fees, adherence to these Design Standards, and all other aspects related to installation of water distribution facilities. The developer shall retain a professional engineer currently registered in Colorado and a contractor licensed in the State of Colorado to the extent necessary to meet the requirements specified herein. For all water distribution facilities that are deeded to the District for ownership and maintenance, the developer's warranty responsibility is as follows:

- (a) All workmanship and materials shall be warranted by the developer (via the contractor) for a period of two years (730 days) from the date that the Provisional Acceptance Letter is issued by the District. Any repair or reconstruction performed during the warranty period shall be warranted for a period of two years (730 days) from the date of acceptance of such repair or reconstruction by the District.

- (b) Nothing in the previous paragraph concerning the warranty period shall establish a period of limitation with respect to any other obligation which the developer has under these Design Standards. If the work is defective and did not meet the requirements of the Design Standards, the District can initiate proceedings for the developer to repair the work even if the warranty period has expired. In summary, there is no time period regarding defective work due to the District's obligation to comply with County and State environmental standards regarding bacteria. The establishment of time periods relates only to the specific obligations of developer to correct the work, and has no relationship to the time within which his

obligations under these Design Standards may be sought to be enforced.

- (c) Emergency repairs shall be carried out in the following manner: repair work shall commence immediately after the developer is notified by the District. If the developer or contractor does not respond in a timely manner, the District may do the work or contract with others to do the work and bill the responsible party for actual costs.
- 4. Engineer. The engineer who must be currently licensed in the State of Colorado is responsible for preparation of detailed drawings and specifications in accordance with these Design Standards.
 - 5. Contractor. Water distribution facilities shall only be installed by contractors licensed to do business in the State of Colorado. All construction work shall be in accordance with approved plans and specifications as defined herein, signed by the District Manager or his designated representative. No work may commence until the plans and specifications have been approved.
- C. Effective Date. These Design Standards shall be effective immediately upon adoption by the Board of Directors and shall supersede all previous editions that are in conflict herewith.
 - D. Revisions. These Design Standards may be revised, amended, or added to from time to time, and such revisions, amendments, and additions shall be binding and of full force and in effect when adopted in the manner set forth above in Subsection 1-1.C of this subsection. Current editions of standards such as ASTM, AWWA, and ANSI shall apply where referenced in these Design Standards.
 - E. District Control. These Design Standards shall apply to the installation of all water distribution facilities within or annexed to the District limits. No construction activities shall commence until the District Manager has approved the plans and specifications.

Notwithstanding any variance from these Design Standards that occurred or was authorized in the past or that may be authorized in the future, the District shall not be restricted or limited in the exercise of its lawful powers. No action, direct or indirect, of any person who is in violation of these Design Standards shall continue after discovery of such violation. The actual cost of the measures needed to correct defective work, regardless of when such deficiency is detected within the time limitations specified by statute, shall be the responsibility of the developer.

- F. Interpretation of the Design Standards. When necessary, interpretation of any section of this document shall be made in writing by the District Manager, and his interpretation shall be binding upon all persons affected by the decision.
- G. Water Outages during Construction. At all points of connection of new water mains to existing water mains, the Contractor will be responsible for excavating and verifying location of the existing lines, prior to installation of any new construction. If it is necessary to shut down any portions of the existing water system to make such connection, the Contractor will be responsible for notifying all District customers to be affected by water outage at least 48 hours prior to such outage. All existing water main valves shall be operated only by the District Representative. The duration of water outage to the existing District customers shall be minimized and, if directed by the District Representative, the Contractor shall provide temporary water supply to customers by means of tank trucks, temporary connections to facilities remaining in service, etc.
- H. Abbreviations.

AASHTO American Association of State Highway and Transportation Officials

ANSI American National Standards Institute, Inc.

APHA American Public Health Association

ASTM American Society for Testing Materials

AWPA American Wood Products Association

AWWA American Water Works Association

cfs Cubic Feet Per Second

D Internal Diameter

DIP Ductile Iron Pipe

ft Foot

gpd Gallons Per Day

in. Inch

lb Pound

MJ Mechanical Joint

NEMA National Electrical Manufacturers Association

PIF Plant Investment Fee

PVC Polyvinyl Chloride Plastic Pipe

- q Design Peak Hourly Flow
- SFE Single Family Equivalent
- v Flow Velocity at the Design Peak Hourly Condition

I. Definitions.

1. "ACTUAL COST" shall mean all costs incurred in the construction of public water mains, including, but not limited to, costs of construction, engineering, plant investment fees, plan review fees, inspection fees, as-built drawings, performance bonds, and administration.
2. "AGENT" shall mean any person contractually authorized to act on the behalf of another person.
3. "APPURTENANCE" shall mean all accessory items associated with the water distribution facilities proposed for or under construction.
4. "BUILDER" shall mean any person responsible for construction of buildings and/or installing service connections to the water distribution system.
5. "BUILDING" shall mean any enclosed structure, having a roof and outside walls, designed and constructed for temporary or permanent shelter for persons.
6. "BUILDING CODES" shall mean the current code as promulgated and revised by Pike's Peak Regional Building Department, concerning building, plumbing, fire, mechanical, electrical, zoning, dangerous building or energy codes or regulations, or mandate of any nature concerning the same. Said building codes are incorporated into these regulations, except for any penalty provisions contained therein. Should there be irreconcilable conflict between any of the provisions of these regulations and any of those building codes; the more stringent requirements of the conflicting provisions shall be applicable. Should a dispute arise between the District and any person concerning the applicability of such conflicting provisions, the dispute shall be resolved in the manner set forth in the particular building code, a provision, or the provisions, of which conflict with these regulations.
7. "CONNECTED TAP" means the building tap has been connected to the distribution system.

8. "CONTRACTOR" shall mean any person, firm, or corporation licensed by the State of Colorado to perform the work and furnish materials within the District.
9. "CUSTOMER" or "USER" shall mean any person (including successors and assigns) who has been issued a permit and to whose building the District's water services are being furnished.
10. "DAYS" shall mean the consecutive time span (including weekends and holidays) that is calculated, excluding the first and including the last day of the specified period. If the last day falls on a Saturday or Sunday or a legal holiday in Triview Metropolitan District, such day or days may be omitted from the period in question.
11. "DEFECTIVE" shall mean work that is faulty, is lacking something essential, and/or does not comply with the intent and requirements of the standards and specifications.
12. "DESIGN STANDARDS" shall mean this document.
13. "DEVELOPER" shall mean any person responsible for installation of public water distribution facilities in areas subject to these regulations.
14. "DISTRIBUTION SYSTEM" shall mean all water mains, equipment, pumping stations, fire hydrants, taps, meters, and appurtenances, whether publicly or privately owned.
15. "DISTRICT" shall mean the Triview Metropolitan District, Colorado.
16. "DISTRICT MANAGER" shall mean the Triview Metropolitan District's Manager.
17. "DISTRICT REPRESENTATIVE" shall mean any person designated by the District Manager to observe materials and workmanship used in construction.
18. "EASEMENT" shall mean a dedicated legal right for the specific use of land owned by others.
19. "ENGINEER" shall mean a person registered by the State of Colorado to prepare plans and specifications for construction of water distribution facilities.
20. "MAY" is permissive.

21. "MONTHLY" shall mean a calendar month or any part thereof.
22. The term "MORE STRINGENT", when used to resolve conflicts, shall mean those provisions which would best serve to protect and enhance the public health, safety, and general welfare and which provides the District with the greatest degree of powers, privileges, rights, or immunities.
23. "PARTY" shall mean any person contractually obligated to another person.
24. "PERSON" shall mean any individual, firm, company, association, governmental organization, society, corporation, or group.
25. "PRIVATE" shall mean water distribution facilities for which the District has not accepted ownership and/or maintenance responsibility.
26. "PUBLIC" shall mean water distribution facilities for which the District has accepted ownership and maintenance responsibility and are located over, under, across, and through dedicated streets, rights-of-way, or easements.
27. "RIGHT-OF-WAY" shall mean land occupied and used by persons who have been statutorily granted the authority to use private or public lands for a specific purpose.
28. "SEWER" or "SANITARY SEWER" shall mean a pipe or conduit that carries domestic and/or industrial wastes from buildings.
29. "SERVICE CONNECTION" shall mean the process of constructing a service line from the building to the distribution system.
30. "SERVICE LINE" shall mean a waterline which connects the building's plumbing system to a water main in the distribution system.
31. "SHALL" or "MUST" is mandatory.
32. "STANDBY TAP" means the service line has not been connected to the distribution system.
33. "STORM DRAIN" (sometimes termed storm sewer) shall mean a drain or sewer for conveying surface water, groundwater, or other waters.
34. "TOWN OF MONUMENT" shall mean the Town of Monument.

35. "UTILITY" shall mean the Triview Metropolitan District's water distribution system and treatment facilities. Where the context refers to an entity rather than the physical system, "Utility" shall mean "District".

36. "WATER MAIN" shall mean any pipe, piping, or system of piping used as a conduit for water. Unless otherwise designated by the District, a water main shall be any line 8 inches or more in diameter.

1 - 2 Fees

A. Plant Investment Fee. This fee is based on the capital cost of water mains, pumping, and treatment facilities that the District has provided for treatment and distribution of water to each customer. The Plant Investment Fee (PIF) reflects the District's cost to deliver water upon demand and is not a measure of total annual water consumption. The PIF is based on a tap size and a fee associated with each tap size. The current PIF rates may be obtained by contacting the District Manager. Except for separate water districts, the District's PIF shall be paid before any service connections can be made to the distribution system.

The tap size for determination of PIF's is estimated using equivalent fixture units from the Uniform Plumbing Code (UPC). These equivalent fixture units are based on the number and type of fixtures in the building according to the following schedule:

EQUIVALENT FIXTURE UNITS
(Includes Combined Hot and Cold Water Demand)

<u>Fixture</u>	<u>Number of Fixture Units</u>	
	<u>Private Use</u>	<u>Public Use</u>
Bar Sink	1	2
Bathtub (with or without shower over)	2	4
Bidet	2	4
Dental Unit or Cuspidor	-	1
Drinking Fountain (each head)	1	2
Hose Bibb or Sill Cock (standard type)	3	5
Mobile Home (each)	6	6
Laundry Tub or Clothes Washer (each pair of faucets)	2	4

Lavatory	1	2
Lavatory (dental)	1	1
Shower (each head)	2	4
Sink or Dishwasher	2	4
Sink (flushing rim, clinic)	-	10
Sink (washup, each set of faucets)	-	2
Sink (washup, circular spray)	-	4
Urinal (pedestal or similar type)	-	10
Urinal (stall)	-	5
Urinal (wall)	-	5
Urinal (flush tank)	-	3
Water Closet (flush tank)	3	5
*Water Closet (flushometer valve)	*	*

*See Subsection (j) of Section 1009 of the UPC for method of sizing flushometer valve installations.

Water supply outlets for items not listed above shall be computed at their maximum demand, but in no case less than:

3/8 inch (9.5 mm)	1	2
1/2 inch (12.7 mm)	2	4
5/8 inch (15.9 mm)	3	6
3/4 inch (19.1 mm)	4	8
1 inch (25.4 mm)	6	10

Once the number of equivalent fixture units has been computed, the tap size for determining the PIF shall be calculated as follows:

<u>Number of Equivalent Fixture Units</u>	<u>PIF Tap Size (in.)</u>
0-30	3/4
31-50	1
51-120	1-1/2
121-620	2
621-1,320	3

Over 1,321

Determined by District on
case-by-case basis

The minimum tap size shall be 3/4 inches and large, single-family residences, multi-family residences, commercial, and other customers shall use the above described fixture unit procedure for estimating tap size for determination of PIF's. Actual installed tap, service line, and meter size may be larger than the PIF tap size according to fire flow requirements and other factors. Justification for the larger tap size shall be included in the Engineering Feasibility Report as discussed in Subsection 1-3.C.2. Any increase from the PIF tap size must be approved by the District Representative or District Manager. In no case shall a smaller tap, service line, and meter size be allowed than the PIF tap size. Upon special request and the provision of appropriate supportive information, the District Manager, at his discretion, may appropriate tap requests based on alternative methods (i.e. AWWA MOP 23). The following table provides a value for "single family residential equivalents" (SFE) associated with non-residential water service tap size:

<u>Non-Residential Water Service Tap Size (Inches)</u>	<u>Number of Single Family Residential Equivalents (SFE)</u>
3/4	1.0
1	1.9
1-1/2	4.4
2	8.1
3	19
4	35
6	84
8	154
10	250
12	368

A separate service tap and meter shall be provided for irrigation.

1-3 Line Extension

- A. Policy. The purpose of this section is to ensure that water distribution facilities installed in the Triview Metropolitan District are adequately sized and installed in a manner such that the facilities are accessible and maintainable. It should be noted that private service lines will not be accepted for ownership and maintenance responsibilities by the District. At the discretion of the Board, extensions will not occur without a plat or PD Site Plan approved by the Town of Monument.

B. Applicable Provisions. This line extension policy applies to all land subdivisions, or any other development requiring a public waterline and/or other public water distribution facilities to be extended to serve the development. The provisions of this policy may be required for private service lines. Persons desiring to install service connections are referred to Subsections 1.7, 1.9, 1.10, and 8 for further information.

C. Procedure.

1. Preliminary Submittal. In accordance with Triview Metropolitan District's requirements, a preliminary submittal shall be made to the Development Services Department (Town of Monument). At the time this submittal is made, two copies of a separate submittal shall be made to the District Manager. The submittal to the District shall contain as a minimum the following information:

- (a) A location map and legal description of the property to be served.
- (b) A conceptual site plan and description of the proposed development. This shall include the location of all streets and existing and proposed Utility easements. Proposed waterline locations shall be schematically shown on the site plan.
- (c) Total number and size of taps that will produce a water demand.
- (d) A timetable for development.
- (e) The preliminary Utility plans.
- (f) Point(s) of connection to the existing Utility system.
- (g) A map showing the locations and elevations of all existing and proposed reuse, storm sewer and sanitary sewer lines in relation to the existing and proposed waterlines.

2. Engineering Feasibility Report. After favorable review and acceptance of the Preliminary Submittal by the District, the applicant may have to submit an Engineering Feasibility Report for approval. Two copies of this report if required shall be submitted to the District Manager. This report shall include the following:

- (a) A composite Utility plan drawn on 24-inch by 36-inch sheet(s) showing the following:

- (1) Subdivision lots and building footprints for planned developments.
 - (2) Proposed points of connection for building service lines.
 - (3) Location of all existing and proposed water and sewer facilities, including piping, valves, pumping stations, pressure regulating valves, manholes, storage tanks, potable wells, vaults, fire hydrants and auxiliary valves, and cross-connection prevention devices.
 - (4) Details of proposed fire hydrants, irrigation lines and meters, auxiliary valve installations, underground vault installations, water/sewer crossings, thrust blocking, stream crossings, backflow prevention device installations, pumping station piping, valving, building/vault construction, and controls.
 - (5) Locations and extent of public rights-of-way and easements.
 - (6) All existing and proposed off-site lines required to serve the development.
- (b) A topographic map (2-foot contour) of the proposed development with identifiable boundaries of all lots or development features.
 - (c) If the proposed development (1) exceeds currently approved zoning densities or (2) includes land not within the District limits or the District's currently proposed Ultimate Service Area, a hydraulic analysis shall be prepared showing the effect of the added water flow on existing and proposed water distribution facilities. This analysis shall include, but is not limited to, a water distribution system model indicating the effects of the new development on the District's system in terms of the maximum day demand, maximum hour demand, maximum day demand plus fire flow, and replenishment of storage facilities.
 - (d) Summary report including the following information:
 - (1) Number and size of taps that will demand water from the distribution system.
 - (2) Development timetable.
 - (3) Estimated peak hourly demands at full buildout.

- (4) Financial criteria:
 - (a) Total estimated plant investment fee payment.
 - (b) Estimated plan review and inspection fees.
 - (e) A Draft Line Extension and Oversizing Agreement with the District.
 - (f) Other information required by the District Manager to complete the review of the Engineering Feasibility Report.
 - (g) The Engineering Feasibility Report shall be completed and stamped by a professional engineer currently registered in the State of Colorado.
- 3. Report Update. Prior to final approval, the developer shall update the Engineering Feasibility Report to account for:
 - (a) Revisions to conform with final PD or subdivision approval by the District.
 - (b) Revisions required by the District Manager.
- 4. Line Extension Criteria. A necessary part of the Engineering Feasibility Report is the inclusion of a Draft Line Extension and Oversizing Agreement between the developer and the District. As a minimum, this agreement shall address the following items:
 - (a) Cost. All applicable water distribution facilities and related fees shall be paid by the developer.
 - (b) Standards. All water distribution facilities shall be designed and constructed in compliance with these Design Standards.
 - (c) Continuation of the Distribution System. Where appropriate, all public waterlines shall be installed to the furthest point in the property. This is so that the next property can be readily served via extension of the lines from the point where they enter the property. Deviation from this policy will be allowed only with the written permission of the District Manager.
 - (d) Size. The size of all public waterlines shall be consistent with the District's current Water Distribution System Master Plan and these Design Standards. The minimum size of public waterlines shall be 8

inches. Should a dispute arise regarding size, the decision of the District Manager shall be final and binding.

- (e) Access. The facilities to be accepted shall have adequate access.
 - (1) Access shall be available for vehicular traffic.
 - (2) Access shall not be seasonal.
 - (3) Landscaped areas or areas with considerable architectural treatment requiring removal for access will be considered for inclusion in the easement only on a case-by-case basis and only if the District is held harmless regarding restoration of the landscaped areas.
 - (4) The District shall be provided with written agreements relieving the District from liability for damage to buildings and appurtenant structures resulting from maintenance operations of public water mains routed in close proximity to buildings.

- (f) Easements. Rights-of-way and/or easements for the purpose of installing and maintaining utilities shall be provided for all facilities accepted by the District.
 - (1) For water mains, the minimum total width of permanent and exclusive easements and/or right-of-way shall be 30 feet measured perpendicular to the centerline of the water main. The additional amount of temporary construction easements shall be as determined by the contractor and developer.
 - (2) Minimum distance from each side of easement to centerline of pipe shall be 10 feet.
 - (3) Legal descriptions of all easements, both permanent and temporary, shall be provided to the District.
 - (4) Signed permanent easements shall be filed and recorded with El Paso County and incorporated into the deeds for the properties concerned.
 - (5) Copies of the recorded permanent easements shall be delivered to the District Manager.

- (g) Construction Period. Past experience in Triview Metropolitan District has shown that even with good design, construction, and

inspection, water distribution facilities installed below grade during the winter have frequently failed due to unstable subsurface conditions after the ground has thawed. For this reason, the allowable construction season shall be as follows:

- (1) As specified annually by Triview Metropolitan District.
 - (2) All year for exterior above grade facilities for which suitable cold weather installation techniques have been developed.
 - (3) All year for interior facilities both above and below grade.
 - (4) All testing and repair work, identified as a result of the required testing, shall be completed prior to the end of the allowable construction period.
 - (5) Construction on new projects or resumption of work on projects previously started may not commence after the date specified above in Subsection 1-3.C.4.g.1.
- (h) Special Provisions. Any special provisions deemed appropriate by the District Manager and not specifically identified herein.
- (i) Approval. Approval of the Engineering Feasibility Report if required does not constitute permission to construct any water distribution facilities. Before any construction can proceed, the District Manager shall approve the plans and specifications. Regarding the processing of the plans and specifications, the following procedures will be followed:
- (1) Prior to the start of construction, eight (8) sets of plans shall be submitted to the town and reviewed, and approved by the District Manager.. No approval will be granted until the plan review and inspection fees have been paid.
 - (2) At the discretion of the District Manager and prior to the start of construction, a preconstruction meeting shall be held with the District Manager and/or his designated representative.
 - (3) The preconstruction meeting shall be held at the site of the work. In addition to the District Manager and/or his designated representative, the following parties shall have representatives in attendance:
 - (a) Developer

- (b) Engineer
- (c) Contractor

- (j) Inspection and Engineer Certification Letter. Upon completion of construction, the developer shall deliver to the District Manager a certification letter from a professional engineer currently registered in the State of Colorado. This letter shall indicate that the water distribution facilities were constructed in accordance with the plans and specifications.
- (k) Provisional Acceptance Letter. Upon receipt of the above noted certification letter and if the District Representative concurs, the District Manager will issue a Provisional Acceptance Letter. The Final Line Extension and Oversizing Agreement will be executed two years (730 days) after the date of the Provisional Acceptance Letter provided all of the requirements contained under Subsection 1-3.C.4 contained herein are satisfied.

The Provisional Acceptance Letter will be required before the District will release the developer's bond.

Until the Provisional Acceptance Letter has been issued by the District Manager, procedures for installation of service connections cannot be initiated.

- (l) "As-Built" Records. Within 90 days from the date that the Provisional Acceptance Letter is issued, the developer shall deliver to the District Manager one set of blue-line prints and one set of mylar sepia reproductions of the project. As-built plans shall include measurements indicating the location of all valves and other appurtenances to enable the District to locate all underground facilities.
- (m) Warranty. The developer's warranty responsibilities shall be as outlined under Subsection 1-1.B.3.
- (n) End of Two Year Performance Tests. At the end of the two year warranty period, the District Representative shall check the following items to verify the integrity of the water distribution facilities prior to the final acceptance by the District.
 - (1) Settlement or signs of leakage of roadways, parking lots, sidewalks, or fill areas along the water main route.

- (2) Establishment of suitable sod or other vegetation over the area disturbed by construction activity along the water main route.
 - (3) Visual signs of pipe, PRV, vault, or pump leakage.
 - (4) Visual signs of improper vault drainage.
 - (5) The plumb and grade of all valving and proper drain in back of fire hydrant.
- (o) Final Line Extension and Oversizing Agreement. Once the requirements of the preceding paragraphs have been met, if applicable, the District will enter into the Final Line Extension and Oversizing Agreement with the developer. The District will assume operation and maintenance responsibilities for the water distribution facilities beginning the date the Final Line Extension and Oversizing Agreement is executed. Reimbursement for over-sizing of lines will be made when the Final Agreement is executed as outlined in the following section herein.

1-4 Line Oversizing

- A. Line Oversizing Policy. In certain cases, a public water main must be oversized to serve property that is not a part of the development under consideration. As noted in Subsection 1-3, the District Manager will make the final determination as to the required water main size.

The developer is responsible for all costs associated with 12-inch and smaller waterlines. At the District's discretion, if a 14-inch or larger public water main is required, the District may reimburse to the developer the amount in excess of what a 12-inch water main, valves, PRV's and other appurtenances would have cost. Reimbursement will only be for that portion of the waterline(s) that lies in or along the developer's property (e.g., no reimbursement to installing developer for intervening vacant land).

Normally, the District will reimburse developers for line oversizing expenses. However, such reimbursement is contingent upon the availability of funds and other factors that the District Manager must consider. Consequently, each reimbursement request will be evaluated on a case-by-case basis. A case-by-case review will also be made for public water pumping facilities that are oversized to serve areas outside the development in question.

- B. Reimbursement Procedure All material required for the installation of public water mains larger than 12-inches shall be supplied by the owner/developer. Thirty (30) days after the District Manager has issued the Final Line Extension

and Oversizing Agreement, the owner/developer in turn may then submit a written request for reimbursement of the cost difference between the 12-inch material and the size required larger than 12-inches. The District will reimburse the developer using the following procedure:

1. Each year the District will solicit bids from three independent pipe and valve suppliers. On a per foot and per valve basis, the difference in material cost between a 12-inch nominal inside diameter pipe and valve and the pipe and valve diameter(s) actually installed will be averaged for the various sizes used on the project.
2. Based on the actual length of pipe and number of valves installed (certified by a professional engineer registered in the State of Colorado), the developer will be reimbursed the difference in material cost plus an additional 10 percent. The additional 10 percent is intended to cover the additional excavation and bedding costs.
3. Calculation of reimbursement amounts for other public water distribution facilities will be performed by the District Manager on a case-by-case basis.

- C. Reimbursement for Line Extensions Through Intervening Vacant Land. The District will not reimburse to the installing developer any amount for lines that extend through intervening vacant property. Regardless of line size, if the vacant land is developed within five years (1,825 days) after the line has been accepted by the District, the developer of the vacant land shall reimburse to the developer who installed the line the total cost for that portion of the line that extended across the vacant property. It is the responsibility of the developer who installed the line to identify the person who developed the vacant property in question. After making payment to the installing developer, the developer of the vacant land may then request reimbursement for oversizing from the District.

1-5 Line Extension and Oversizing Agreement

- A. General. This agreement is the official document by which the District and developer agree on the conditions whereby the water distribution facilities will become a part of the distribution system. This document is initiated in draft form after the Engineering Feasibility Report has been approved by the District Manager. It is signed and issued in final form after all the requirements of Subsection 1-3.C are met. The standard Waterline Extension and Oversizing Agreement Form is presented at the end of this section as Attachment A. It may be modified by the District Manager on a case-by-case basis, depending upon the specific factors associated with each proposed line extension.

1-6 Procedures Checklist for Public Water Mains

- A. Purpose. The purpose of this checklist is to summarize the procedures required to install public water mains. It is to be used as a tool to ensure that all fees are paid and these Design Standards are adhered to before any construction work is initiated. The checklist is presented at the end of this section as Attachment B.

1-7 Procedures Checklist for Service Connections

- A. Purpose. The purpose of this checklist is to summarize the procedures required to install service connections. It is to be used as a tool to ensure that all fees are paid and these Design Standards are adhered to before the service connection is made. The checklist is presented at the end of this section as Attachment C.

1-8 Plan Review Checklist for Public Water Mains

- A. Purpose. The purpose of this checklist is to assist both the engineer in preparing and the District in reviewing plans and specifications that meet the requirements of these Design Standards. This checklist is presented at the end of this section as Attachment D.

1-9 Plan Review Checklist for Service Connections

- A. Purpose. The purpose of this checklist is to assist the engineer, contractor, and District in designing service connection details so that they meet the requirements of these Design Standards. This checklist is presented at the end of this section as Attachment E.

1-10 Water Main Construction Inspection and Testing Checklist

- A. Purpose. The purpose of this checklist is to provide a convenient means by which the District Representatives can determine if the work performed is in accordance with the approved plans and specifications or service connection details. This checklist is to be used for all water mains, both public and private, and is presented at the end of this section as Attachment F. A checklist which can be used to record the status of inspections and testing on a weekly basis is presented at the end of this section as Attachment G.

1-11 Hydrant Meter Release Form

- A. General. This form is for the District's record keeping of Contractors who make use of one of the District's hydrant meters for a period of time, and the amount of water used by that Contractor. The Hydrant Meter Release Form is present at the end of this section as Attachment H.

1-12 Service Interruption

- A. General. In the event that existing water service will be interrupted as a result of construction, the Developer/Contractor shall be responsible for the notification of all affected customers at least 48 hours in advance of the work. All notifications shall be approved by the District Manager and shall be subject to the conditions imposed by the manager. Service interruptions for schools, medical clinics and various commercial businesses shall be conducted at times specified by the District Engineer. If outages for more than 4 hours are necessary, they must be conducted at times to cause the least inconvenience to other customers. Under all circumstances, work shall be continuous until all customers are back in service. If, in the process of installing a connection, there exists a facility that cannot be without water, as designated by the District Engineer, such as a hospital, appropriate temporary means shall be taken to convey water. Any such measure shall be approved by the District Engineer.

1-13 Connections to Existing Mains

- A. General. Where connections are made between new and existing mains, each connection shall be made as indicated on the drawings. If field conditions make the detailed connection impossible, then an alternative method, approved by the District Representative shall be used.

It shall be understood that the location of existing stub-outs, as shown on the drawings, is based on the best available information but is not intended to be exact. The contractor shall be responsible for performing exploratory excavations prior to the start of installation from, or connection to, a stub-out.

The contractor shall notify the District Representative a minimum of 48 hours in advance of intentions to connect to an existing line or to terminate water supply to an existing line.

Apparatus shall be supplied by the contractor for dewatering of water lines, when necessary, and such water shall be removed from the excavation without damage to property. Special care shall be taken to prevent contamination when dewatering, cutting into, or making connections to existing pipes. No trench water, mud, or dirt shall be permitted to enter the lines.

SUBSECTION 2
DESIGN CRITERIA
TABLE OF CONTENTS

	<u>Page</u>
Subsection 2 – Design Criteria	1
2-1 Conformance with Water Distribution System Master Plan.....	1
2-2 Restrained Joints	1
2-3 Vertical and Horizontal Alignment	1
2-4 Protection of Water Supplies	3
2-5 Identification	4
2-6 Stream Crossings.....	4

SUBSECTION 2

DESIGN CRITERIA

2-1 Conformance with Water Distribution System Master Plan

Proposed water mains shown as a part of the District's current Water Distribution System Master Plan shall be sized in conformance with the master planning map. Lines which do not appear on the map shall be sized as determined by District Manager.

2-2 Restrained Joints

- A. General. The integrity of pipeline joints shall be protected from axial thrust at any change in direction greater than the allowable joint deflections. When undisturbed earth is available, concrete thrust blocks sized as noted in Detail 13 of Appendix A shall be constructed at the location of the pipe bend to provide a positive reaction surface for the thrust. Where thrust blocks cannot be constructed because the soils have been disturbed during excavation or where soils are unstable and incapable of providing adequate support or other utilities or structures create an interference, the pipeline sections shall be mechanically tied together to prevent movement of joints. The use of Megalug® restraining glands or approved equal is permitted in lieu of concrete thrust blocks. In certain situations, the District may require the use of both Megalugs® and thrust blocks.

2-3 Vertical and Horizontal Alignment

- A. Water Mains in Streets. In all proposed streets and where practical in existing streets, water mains shall be placed as follows (refer to Detail 1):
1. On streets running north and south, the water main shall be placed 8 to 10 feet east of the centerline of the street, depending on the street classification.
 2. On streets running east and west, the water main shall be placed 8 to 10 feet north of the centerline of the street, depending on the street classification.
 3. On streets shaped as a "U" or on streets having unusually sharp turns, the water main will conform to the above specifications as near as practical, but the final location shall be approved by the District Representative.

4. Adjustments in the waterline positioning may be necessary at pressure reducing valve stations to ensure adequate clearance between the station/appurtenances and the edge of gutter.
 5. Dead-end lines are discouraged and looped mains shall be provided whenever possible. Water mains may extend into a cul-de-sac and are not required to be looped, providing that it is no longer than 500 feet and no more than eighteen single-family dwelling units are served. The maximum length of dead ends shall be 300 feet where there are no services. All dead ends shall be closed with gray iron plugs and restrained by means of reverse anchors; see Details 18 and 18a.
- B. Water Mains in Easements Other Than Streets. In areas where water mains are placed in easements, all water mains shall be located within the easements shown on the contract drawings. All water main easements must be a minimum of 30 feet in width for exclusive easements or 50 feet for non-exclusive easements. No waterline shall be located less than 10 feet from the edge of an easement.
- C. Valves. If possible, valves should not be placed in drainage ditches. If this is not possible, the valve should extend 6 inches above bottom of ditch and be marked with a post (refer to the Standard Details). Refer to Detail 26 for locations of valves at intersections. No valves shall be placed in sidewalks without prior approval. Valves shall be located, where possible, at a point on the main or lateral which would be intersected by the extension of a property line, at the beginning of new extensions, and at a maximum spacing of 600 feet.
- D. Fire Hydrants. Fire hydrants shall be located, where possible, on the northeast corner of an intersection a minimum of 24 inches behind the curb or sidewalk, in accordance with Detail 7. Where this is not possible, fire hydrants shall be located as directed by the appropriate Fire Marshall or the District Representative. Hydrants shall be placed such that the hose cap nut is 18" above the surrounding ground or the bottom flange a minimum of 4" above top of curb. In all cases, the maximum spacing of fire hydrants shall be 500 feet in residential areas, 350 feet in commercial areas, and 350 feet in cul-de-sacs. All fire hydrant street valves shall be 6-inch and shall be located at the tee from the main line as shown on Detail 7.
- E. Water Service Lines. Water service lines shall be located a minimum of 10 feet from sewer service lines edge of pipe to edge of pipe and located where possible on the uphill side of the sewer service line. Water service lines shall be installed in a continuous straight line and shall enter the property a minimum distance of 5 feet from the nearest lot corner. Water service lines shall be separate from irrigation lines. In all cases, service line installation shall be in accordance with these specifications (refer to Subsection 8, Water Meters and Service Lines).

Alternatively, water service lines may be placed in a common trench with sewer service lines. The District Manager shall review and approve joint trench requests prior to their installation. If approved, water service lines may be installed in the same trench as sewer service lines provided the bottom of water service is located vertically a minimum of 18" above the top of sewer service and horizontally a minimum of 12" from the sewer service (edge of pipe to edge of pipe). The trench shall be excavated such that the width of the bench upon which the water service is placed is a minimum of 12" of undisturbed earth in accordance with the Typical Common Service Trench Section Detail in Section 8: Wastewater Collection of this manual (Refer to Detail SS-12). In addition, the water service lines shall be one continuous length of polyethylene pipe and have no joints between the curb stop and the building. Curb stops shall not be placed in driveways. If placement of the curb stop within the driveway is determined to be unavoidable, a request can be made to TMD for a waiver of this requirement. If the waiver is granted allowing the curb stop to be installed in the driveway, provide a 4 ft. by 4 ft. cut-out in the driveway slab, and isolate this cut-out from the driveway concrete with expansion joint material.

Service line installation shall be in accordance with these specifications and in accordance with Details 8, 9, 10, 11, 12 at the end of this section and Detail SS-12 of Section 8.

No water taps will be made prior to hydrostatic testing and acceptance of the water mains.

2-4 Protection of Water Supplies

A. Water Supply Inter-Connections. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenances thereto, which would permit the passage of any sewage or polluted water into the potable supply.

B. Relation to Sewer Mains.

1. Horizontal Separation. Waterlines shall be laid at least 10 feet from any existing or proposed sewer mains. The distance shall be measured edge-to-edge. Any deviation from this policy will require that the sewer line be encased in concrete or constructed equal to force mains (and pressure tested) wherever it is less than 10 feet from the waterline. See Details 1 and 20 for construction requirements.

Sewers shall be laid at least 100 feet away from any existing or proposed potable water supply well. This regulation has been promulgated by the State of Colorado and cannot be waived by the District Manager.

2. Vertical Separation. Sewer lines that cross water mains shall be laid to provide a minimum vertical distance of 18 inches between the bottom of the water main and the top of the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main must cross under a sewer or is less than 18 inches from it in any direction, concrete encasement shall be placed around the sewer line on either side of the waterline to support the sewer and eliminate leakage. For flexible sewer pipe materials (e.g., PVC), encasement shall extend to the next sewer joint beyond a 10-foot minimum distance either side of the water main. For rigid sewer pipe materials (e.g., concrete), the encasement shall extend for 10 feet beyond either side of the water main. See Details 1, 20, 30, and 30a for construction requirements. As indicated, for PVC sewer pipe, encasement shall stop just prior to the joint in order to provide flexibility at the joint to account for differential settlement that could shear the sewer pipe.

C. Sewer Manholes. No water pipe or main shall pass through or come into contact with any part of a sewer manhole.

2-5 Identification

A. Where water mains are constructed of a material and in a location where the water main could be confused with a sewer force main, the water main shall be appropriately identified. Marker posts shall be installed which conform to the reference marker post requirements included in Detail 24.

2-6 Stream Crossings

A. Design and Construction. Design and construction techniques must be in conformance with the U.S. Army Corps of Engineers nationwide permit for river and wetlands crossings. Additionally, compliance may be required with rules promulgated by the U.S. Fish & Wildlife Service. However, the Engineer shall contact the Corps regarding each river crossing to confirm if this approach is satisfactory. If the Corps determines that a 404 permit is required, one shall be obtained by the Engineer before the Contract Documents will be approved.

B. Cover Depth. The top of all water mains entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the pipe. The following minimum cover requirements shall be met:

1. Two feet of cover where the pipe is located in rock.
2. Three feet of cover in alluvial material.

3. In paved stream channels, the top of the waterline should be placed below the bottom of the channel pavement.
 4. In cases where a combination of these conditions are present, the more stringent requirements shall apply
 5. Additional cover may be required by the District Manager if the site-specific conditions warrant additional protection.
- C. Additional Provisions for Crossing Water Courses Greater Than 15 Feet. When crossing water courses which are greater than 15 feet in width (measured at the high water mark), the following shall be provided:
1. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valve closest to the supply source shall be in a vault.
 2. Permanent taps shall be made on each side of the valve within the vault to allow insertion of a small meter for testing to determine leakage and for sampling purposes.
 3. Where possible the mid-point of the pipe shall be centered on crossings of rivers or streams.
 4. Structural protection to prevent washout must be provided in unstable alluvial channels.
- D. Anchorage. The pipe shall be securely anchored to protect against displacement due to erosion and flotation.
- E. Location. Water mains located along streams shall be located sufficiently removed therefrom to provide for future possible stream widening and to prevent stream pollution by siltation during construction. The District Manager may require installation of sedimentation ponds during construction if it would be possible for sediment laden runoff to directly enter the stream.
- F. Obstruction of Flood Flows. All water distribution facilities shall be located and designed so that if they are located in the 100-year floodway or flood fringe, they do not interfere with the free discharge of flood flows. All facilities within the 100-year flood plain must be in conformance with El Paso County's flood plain regulations.
- G. Alignment. Water mains that cross streams shall be designed to cross the stream as nearly perpendicular to the stream flow as possible. Water distribution

systems shall be designed to minimize the number of stream crossings. Water mains crossing small streams shall be constructed so that the mid-point of the pipe is centered on the crossing.

SUBSECTION 3

EXCAVATION AND TRENCHING

TABLE OF CONTENTS

	<u>Page</u>
Subsection 3 – Excavation and Trenching	1
3-1 Scope	1
3-2 General Requirements.....	1
3-3 Structures.....	1
3-4 Weather.....	1
3-5 Classification of Excavated Materials.....	2
3-6 Blasting.....	2
3-7 Unauthorized Excavation.....	2
3-8 Dewatering.....	2
3-9 Drainage Maintenance.....	3
3-10 Disposal of Excess Excavated Materials.....	3
3-11 Quality Assurance.....	4
3-12 Definitions.....	5
3-13 Materials.....	7
3-14 Excavation.....	9
3-15 Tunnel Excavation.....	12
3-16 Boring Smooth Steel Pipe.....	14
3-17 Pipe Embedment.....	15
3-18 Backfill and Compaction.....	16
3-19 Field Quality.....	18
3-20 Compaction Test Failure.....	20
3-21 Off-Road Construction.....	20
3-22 Maintenance of Traffic.....	20
3-23 Road Closings.....	21

SUBSECTION 3

EXCAVATION AND TRENCHING

TABLE OF CONTENTS (CONT’)

3-24 Barricades and Lights.....22
3-25 Fences.....22
3-26 Protection of Public and Private Property.....23
3-27 Dust Control.....23
3-28 Temporary Drainage Provisions.....24
3-29 Erosion Control.....24
3-30 Pollution Control.....24
3-31 Final Cleanup.....25

SUBSECTION 3

EXCAVATION AND TRENCHING

3-1 Scope

- A. Purpose. This section covers excavation and trenching work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work.

3-2 General Requirements

- A. General. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings. All excavations and trenches shall abide by current OSHA safety rules.

3-3 Structures

- A. General. Except where exterior surfaces are specified to be dampproofed, monolithic concrete manholes and other concrete structures, or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.

3-4 Weather

- A. General. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the District Representative. No embedment, backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any embedment, backfill, fill, or embankment.

All construction operations, including excavation and trenching, are restricted to certain months of each year. A detailed listing of the restrictions is contained in Subsection 1-3.C.4.g of this document. A written request to deviate from this requirement shall be made to the District Manager. Any pipelines constructed

during this period, without the written consent of the District Manager, will not be considered for inclusion in the Triview Metropolitan District Water Distribution System.

3-5 Classification of Excavated Materials

- A. General. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

3-6 Blasting

- A. General. No blasting shall be permitted within the District without written permission from the District Manager. If blasting is allowed the Contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosive and protection of life and property. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

3-7 Unauthorized Excavation

- A. General. Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

3-8 Dewatering

- A. General. The Contractor is responsible for obtaining all local and state dewatering permits. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the ground

water level beneath such excavations 12 inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment. Under no circumstances shall pipe under construction be used for dewatering the trench.

3-9 Drainage Maintenance

- A. General. Trenches adjacent to drainage ditches or watercourses and that cross roadways, driveways, walks, or other trafficways shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary. In the event of heavy rains or precipitation, the Contractor will be required to temporarily open ditches or water courses to facilitate drainage.
- B. Protection of Trench Backfill in Drainage Courses. Where trenches are allowed to be constructed in ditches or other water courses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds one percent, ditch checks shall be installed. Ditch checks shall be subject to District approval. Unless otherwise directed by the District Representative, ditch checks shall be concrete. Ditch checks shall extend not less than 2 feet below the original ditch or water course bottom for the full bottom width and at least 18 inches into the side slopes and shall be at least 12 inches thick.

3-10 Disposal of Excess Excavated Materials

- A. General. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of the work. Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be installed in trench backfill, debris encountered in

excavation work, and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of 6 inches above the original ground surface elevation at and across the trench and sloping uniformly each way. Material thus wasted shall be carefully finished with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the Contractor.

3-11 Quality Assurance

- A. Reference Standards. This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM D698-00ae1	<i>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft)</i>
ASTM D1556-00	<i>Standard Test Methods for Density and Unit Weight of Soil in Place by the Sand-Cone Method</i>
ASTM D1557-02e1	<i>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft)</i>
ASTM D2487-00	<i>Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)</i>
ASTM D2922-05	<i>Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)</i>
ASTM D3017-05	<i>Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)</i>
ASTM D4253-00	<i>Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table</i>

ASTM D4254-00 *Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density*

CDOT *Colorado Department of Transportation, Division of Highways, "Standard Specifications for Road and Bridge Construction", latest edition (Sections 100 through 109 and measurement and payment provisions do not apply)*

- B. Tests. The Geotechnical Engineer will take samples and perform moisture content, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The Contractor shall remove surface material at locations designated by the Geotechnical Engineer or District's Representative and provide such assistance as necessary for sampling and testing. The Geotechnical Engineer or District's Representative may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications.

Tests will be made by the Geotechnical Engineer in accordance with the following:

<u>Test</u>	<u>Standard Procedure</u>
Moisture content	ASTM D3017
Density in-place	ASTM D1556 or ASTM D2922
Moisture-density relationships	ASTM D1557

3-12 Definitions

- A. "Backfill" shall mean the material used in refilling a trench or other excavation above the pipe or utility.
- B. "Compaction" shall mean the process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D1557 for general soil types. An example abbreviation in this specification is "90% ASTM D1557 maximum density".
- C. "Pipe Bedding" or "Pipe Embedment" means a dense, well-graded aggregate mixture of sand, gravel, or crushed stone (mixed individually, in combination with each other, or with on-site soil) placed on a subgrade and extended around pipe as shown on Detail 2.
- D. "Unyielding Material" shall mean a rock or solid with cobbles in the trench bottom requiring a covering of finer grain material or special bedding to avoid bridging the pipe or conduit.

- E. "Unstable Material" shall mean material in the trench bottom which lacks firmness to maintain alignment and prevent joints from separating in the pipe, conduit, or appurtenant structure during backfilling. This may be material otherwise identified as satisfactory which has been disturbed or saturated.
- F. "Lift" shall mean a layer or course of soil placed on top of unprepared subgrade or a previously prepared or placed soil in a fill or backfill. Maximum lift thickness shall be 8 inches, unless otherwise approved by the District Representative or Geotechnical Engineer.
- G. "Rock" means any material which cannot be excavated with a track mounted 235 Caterpillar or equivalent backhoe with a 12 in. bucket, and teeth, and requires the use of special buckets, rock teeth, jack-hammering, blasting and/or other special methods of excavation.
- H. "Unsatisfactory Material" shall mean soil or other material identified as having insufficient strength or stability to carry intended loads on trench backfills without excessive consolidation or loss of stability. Also backfill material which contains refuse, frozen material, large rocks, debris and other material which could damage the pipe or cause the backfill not to compact. As a minimum, materials classified as PT, OH, or OL by ASTM D2487 are unsatisfactory.
- I. "Crushed Rock" shall mean manufactured crushed stone with at least three (3) angular faces.
- J. "Cohesionless Soils" shall mean soils that do not exhibit the qualities of cohesive soils. Soils having an AASHTO soil classification of A-1, A-2, or A-3.
- K. "Cohesive Soils" shall mean a soil which the absorbed water and particle attraction work together to produce a body which holds together to produce a body which holds together and deforms plastically at varying water contents. Soils having AASHTO soil classification of A-4, A-5, A-6, or A-7.
- L. "Expansive Soils" shall mean soils which are clays of high plasticity and exhibit high swelling characteristics. Soils having a Group Index of 18 or greater.

3-13 Materials

- A. Bedding Material. Bedding material shall be an approved granular material or engineered fill, free from organic matter and of such size and gradation that the specified compaction can be readily attained. As a minimum, granular materials

shall have a sand equivalent value of not less than 20 with a coefficient of uniformity of three (3) or greater.

Embedment materials for all waterlines shall be squeegee, 3/4-inch washed rock, or *Unibell Handbook of PVC Pipe* Class I, II, or III material. Class IV and V material shall not be used.

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

<u>3/4-Inch Washed Rock (CDOT, Table 703-2, Size No. 67)</u>	
<u>Sieve Size</u>	<u>Total % Passing by Weight</u>
1-inch	100
3/4-inch	90 - 100
3/8-inch	20 - 55
No. 4	0 - 10
No. 8	0 - 5

- B. Backfill Material. Compacted backfill will be required for the full depth of the trench above the pipe embedment in all locations unless otherwise specified.

The top portion of backfill beneath established lawn areas shall be finished with at least 6 inches of topsoil corresponding to, or better than, that underlying adjoining lawn areas.

At the request of the Contractor and with the approval of the Geotechnical Engineer, compacted backfill may be (1) suitable job excavated material or (2) graded gravel as described below:

1. Job Excavated Material. Job excavated material may be used for compacted backfill when the job excavated material is finely divided and free from debris, organic material, cinders or other corrosive material, and stones larger than 3 inches in greatest dimension. Masses of moist, stiff clay shall not be used.
2. Graded Gravel. Gravel for compacted backfill shall conform to the following gradation:

U.S. Standard	Percent
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<u>Sieve Size</u>	<u>Passing by Weight</u>
1-inch	100
3/4-inch	85-100
3/8-inch	50-80
No. 4	35-60
No. 40	15-30
No. 200	5-10

The gravel mixture shall contain no clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

- C. Groundwater Barrier. Barrier material shall meet soil classification GC, SC, CL, or ML-CL. Material may be finely divided suitable job excavated material, free from stones, organic matter, and debris. Groundwater barriers specified under pipe embedment shall extend to the top of the graded gravel backfill.
- D. Stabilization Material. If the top 6 inches of existing (in-situ) soil in the trench bottom is deemed to be unsuitable by the District Representative, the unsuitable material shall be removed and replaced with stabilization material at a depth of at least 12 inches.

- 1. Stabilization material is crusher-run rock, conforming to CDOT, size #4.

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing by Weight</u>
2-inch	100
1-1/4-inch	90-100
3/4-inch	50-90
No. 4	30-50
No. 200	3-12

- 2. Geotextile: CDOT, Section 712.08, Class A Table 712-2

- E. Structural Backfill. Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically compacted backfill shall be deposited or compacted in water.

3-14 Excavation

- A. Topsoil. Contractor shall remove and stockpile sufficient topsoil from the surface to a minimum depth of 6 inches along all areas of the pipeline route disturbed by his operations which are not covered by paving, concrete, or gravel. Topsoil shall be free from trash and debris and surface vegetation more than

6 inches in height. After all other work has been completed in each area, topsoil shall be placed to a depth of at least 6 inches and graded to the satisfaction of the District Representative.

- B. Trench Excavation. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 300 feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction. All trenching must conform to OSHA Standards for the Construction Industry, Subpart P.

Except where tunneling is indicated on the drawings, is specified, or is permitted by the District Representative, all trench excavation shall be open cut from the surface.

1. Alignment, Grade, and Minimum Cover. The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe. The minimum depth of backfill cover over the top of the pipe shall be 66 inches in all locations.
2. Mechanical Excavation. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

3. Limiting Trench Widths. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. However, the limiting trench widths from the bottom of the trench to an elevation one foot above the top of installed pipe, and the minimum permissible sidewall clearances between the installed pipe and each trench wall shall be as follows:

<u>Nominal Pipe Size</u> (in.)	<u>Minimum Sidewall Clearance</u> (in.)	<u>Maximum Trench Width</u> (in.)
Less than or equal to 12	6	Pipe OD + 24
Between 12 and 24	8	Pipe OD + 24

Stipulated minimum sidewall clearances are not minimum average clearances, but are minimum clear distances which will be required.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one foot above the top of the pipe.

Where, for any reason, the width of the lower portion of the trench, as excavated at any point, exceeds the maximum permitted in the foregoing table, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and with the concurrence of the District Representative, shall be furnished and installed by and at the expense of the Contractor. Any requests for deviation of these widths shall be accompanied by a certification from the Developer's and/or pipe manufacturer engineer stating that the deviation will not be detrimental to the pipe.

4. Excavation in Rock. Over excavate a minimum of six inches below the bottom of the pipe. Backfill with compacted granular material.
5. Preparation of Trench Bottom. Grade trench bottom uniformly to provide clearance for each section of pipe. Remove loose materials, water, and foreign objects. Provide a firm subgrade suitable for application of bedding material.
6. Cutting Concrete and Asphalt Surface Construction. Cuts in concrete and asphalt pavement and concrete base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a

manner which will provide a clean groove at least 1-1/2 inches deep along each side of the trench and along the perimeter of cuts for structures.

Concrete and asphalt pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.

Pavement removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation as determined by the District Representative.

Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts as specified for pavement.

7. **Stabilization.** Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

Subgrades for concrete structures or trench bottoms, which are otherwise solid but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than 4 inches; if the required depth exceeds 4 inches, the material shall be furnished and installed as specified for granular fills. Not more than 1/2 inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

If in the opinion of the District Representative the subgrade is not solid enough to properly support the pipe or concrete structure, Contractor will stabilize the subgrade using granular material per Subsection 3-13.D.

All stabilization work shall be performed by and at the expense of the Contractor.

8. Sheeting and Shoring. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be sheeted, braced, and shored as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances.

Trench sheeting shall not be pulled before backfilling unless the pipe strength is sufficient, in the opinion of the District Representative, to carry trench loads based on trench width to the back of sheeting, nor shall sheeting be pulled after backfilling. When ordered by the District Representative, sheeting shall be left permanently in the trench.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

All trench sheeting and shoring shall conform to OSHA Standards for the Construction Industry, Subpart P.

3-15 Tunnel Excavation

- A. General. Pipelines shall be constructed in tunnels of the type designated on the drawings, in conformity to OSHA Standards for the Construction Industry, Subpart P, and with the requirements which follow. Tunnels shall be made of tunnel liner plate, corrugated steel pipe, or smooth steel pipe as specified below. Before starting work on any tunnel, detailed drawings, specifications, and other data covering the liner to be used shall be submitted to the District Representative for review.

The clear inside diameter of tunnel liners shall be within 4 inches of the nominal diameter indicated on the drawings.

- B. Tunnel Liner Plate. Steel tunnel liner plates shall be corrugated sections as manufactured by Armco or Commercial Shearing and Stamping Company. Liner plates shall have sectional properties conforming to Section 16.5 of AASHTO "Standard Specifications for Highway Bridges" or Section 4.12.5, Table 1, of AREA "Manual for Railway Engineering". The liner plates shall be designed so that erection and assembly can be accomplished entirely from inside the tunnel. Liner plates shall be capable of withstanding the ring thrust load and transmitting

this from plate to plate. Liner plates shall have a minimum thickness of 0.1046 inches.

All liner plates shall be hot-dip galvanized in conformity with ASTM A123 for 2.50 ounce coating after the plates are formed or shaped. Bolts and nuts shall be hot-dip galvanized in conformity with ASTM A153.

Care shall be taken during installation to maintain alignment, grade, and the circular shape of the tunnel. Longitudinal joints in adjacent rings shall be staggered and not in alignment more often than every second ring.

The entire operation of tunneling and setting of liners shall be acceptable to the District Representative and the agency having jurisdiction. Adequate means shall be provided to keep the work free from water.

Sufficient sections shall be provided with 1-1/2 inch or larger grouting holes, located near the centers, so that when the plates are installed there will be one line of holes on each side of the tunnel and one at the crown; the lower line of holes on each side shall be not more than 18 inches above the invert. The holes in each line shall be not more than 9 feet apart and shall be staggered.

All space between the lining and the earth shall be filled with grout forced in under pressure. The grout shall be mixed in the volumetric proportions of two parts Portland cement, one part fly ash, and not to exceed six parts of sand. Enough water shall be used to produce, when well mixed, a grout having the consistency of thick cream. As the pumping through any hole is stopped, it shall be plugged to prevent backflow of grout.

Grouting shall be performed in a sequence which will preclude deflections exceeding 5 percent of the tunnel diameter.

- C. Corrugated Steel Pipe. Corrugated steel pipe shall be manufactured in accordance with all applicable requirements of the specifications of the American Railway Engineering Association.

Pipe shall be fabricated from galvanized steel sheets not less than 12 USS gauge in thickness, measured before galvanizing.

Each conduit shall be installed by jacking into place. Earth displaced by the conduit shall be removed through the interior of the conduit by hand, by auger, or by other acceptable means. Sections of the corrugated steel pipe shall be coupled with bolted connections to form a continuous conduit capable of resisting all stresses, including jacking stresses. Each corrugated steel pipe conduit in its final position shall be straight and true in alignment and grade, as

required by the drawings. There shall be no space between the earth and the outside of the conduit.

3-16 Boring Smooth Steel Pipe

- A. Materials. Smooth wall casing pipe shall be of welded steel construction and shall be new material with a minimum yield point of 35,000 psi. The pipe shall have a wall thickness of at least 0.250-inch. The casing pipe shall be cleaned and coated both inside and outside with two coats of coal tar paint, Koppers "Bitumastic Super Service Black", Mobil "High-Build Bituminous Coating 35-J-10", or Tnemec "46-449 Heavy Duty Black".
- B. Installation. The conduit shall be installed by jacking into place. Earth displaced by the conduit shall be removed through the interior of the conduit by hand, by auger, or by other acceptable means. Sections of the casing pipe shall be welded together to form a continuous conduit capable of resisting all stresses, including jacking stresses. The casing pipe conduit in its final position shall be straight and true in alignment and grade, as required by the drawings. There shall be no space between the earth and the outside of the casing. Strapping material shall be at least ¾ inch wide.
- C. End Closure. At the option of the Contractor, both ends of each casing conduit shall be closed with 2 inch thick wood planks or with common brick and mortar. Planks shall be pressure treated with creosote, pentachlorophenol, or salt type preservative in accordance with AWWA C2. Cut surfaces shall be given two heavy coats of the same preservative. Nails and fasteners shall be galvanized or aluminum coated.
- D. Paved Invert. The bottom portion of each casing conduit constructed using either tunnel liner plates or corrugated steel pipe shall be provided with a paved concrete invert.
- E. Interruption of Traffic. No interruption of traffic will be permitted at any location where tunnels are required.

3-17 Pipe Embedment

- A. General. Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the requirements shown on Detail 2 and to the following requirements (for material requirement, refer to Subsection 3-13).
- B. Placement and Compaction. Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations. Compact granular bedding material by vibrating, slicing with a shovel, or bent tee-bar.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement. The first lift of material shall not exceed the depth of the pipe's springline. Additional lifts of embedment material shall not exceed 8 inches in uncompacted thickness unless otherwise approved by the District Representative or Geotechnical Engineer.

- C. Bell Holes. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.
- D. Groundwater Barrier. If conditions warrant, continuity of embedment material shall be interrupted by low permeability groundwater barriers to impede passage of water through the embedment. Barriers for waterlines shall be compacted soil the full depth of granular material, the full width of the trench and keyed into undisturbed trench wall a minimum 1 foot, and spaced not more than 500 feet apart. Place a groundwater barrier 20 feet down stream of the edge of all drainage ways, streams, and water courses. Groundwater barriers specified under pipe embedment shall extend to the top of the graded gravel backfill.
- E. Overdepth Excavation. Restore overexcavated subgrades to proper elevation with compacted stabilization material.

3-18 Backfill and Compaction

- A. Job Excavated Materials. Job excavated materials shall be placed in uniform layers not exceeding 8 inches in uncompacted thickness unless otherwise approved by the District Representative or the Geotechnical Engineer. Each layer of material shall have optimum moisture as described in these specifications. The material in each layer shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content and adequate compaction. Increased layer thickness may be permitted for noncohesive material if the Contractor demonstrates to the satisfaction of the District Representative that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.
- B. Gravel Backfill. Gravel Backfill shall be deposited in uniform layers not exceeding 12 inches in uncompacted thickness. The backfill shall be compacted by a suitable vibratory roller or platform vibrator.
- C. Topsoil. Replace Topsoil after construction and grading to the depth of stripping over all areas disturbed by construction activities and which will not receive other surface treatment.
- D. Resodding. All established lawn areas cut by the line of trench or damaged during the work shall be resodded, after completion of construction, to the complete satisfaction of the property owner and the District Representative. All sod used shall be the same type as removed or damaged, shall be best quality and, when placed, shall be live fresh growing grass with at least 1-1/2 inches of soil adhering to the roots.

All sod shall be procured from areas where soil is fertile and contains a high percentage of loamy topsoil and from areas that have been grazed or mowed sufficiently to form a dense turf.

Sod shall be transplanted within 24 hours from the time it is harvested unless stacked at its destination in a suitable manner. All sod in stacks shall be kept moist and protected from exposure to the sun and from freezing. In no event shall more than one week elapse between cutting and planting.

Before placing sod, all shaping and dressing of the areas shall have been completed to the satisfaction of the District Representative. After shaping and dressing, commercial fertilizer of a type acceptable to the District Representative shall be applied uniformly in the manner and amounts recommended by the manufacturer and harrowed lightly. Sodding shall follow immediately.

All sodding shall be done during the period from April 1 to November 15, unless written permission is given by the District Representative to extend the planting season.

- E. Reseeding. Where required by the drawings or as directed by the District Representative, and if reseeding requirements are not covered under another permit, lands disturbed by the Contractor's operations shall be reseeded. Seeding work shall be performed by personnel who are experienced and qualified in seeding native grasses.

Mulch shall be applied to all disturbed areas following seeding. Mulch shall be lightly disked or covered with a biodegradable net at the request of the District Representative.

- F. Seed. Seed shall be certified seed labeled in accordance with the U.S. Department of Agriculture Rules and Regulations and shall comply with the State Seed Laws of the State of Colorado. Seed mixture and application rate shall be acceptable to the District Representative.

The seed mixture shall conform to the following:

Arriba Western Wheatgrass	15%
Blue Grama	25%
Dwarf Perennial Rye	20%
Canada Bluegrass	10%
SR 3200 Blue Fescue	10%
Sheep Fescue	20%

Construction. Seeding shall be completed between April 1 through November 15, unless the period is extended by the District Manager and no seeding shall be done during periods of high winds, excessive moisture, snow cover, frozen ground, and when ground cannot be worked as determined by the District Representative. Seeding performed during the summer months shall be watered sufficiently so as to establish a substantial stand of grass.

Seed shall be applied at the rate of 50 pounds of live seed per acre. Seed shall be applied with a drill or cultipacker type seeder such that it is spread over the area and buried an average depth of 1/4-1/2-inch. Straw or native hay mulch shall be applied after seeding at a rate of 2 tons per acre and shall be crimped in mechanically. Hydroseeding may be required by the District in certain situations, and must meet the requirements of the District Representative.

G. Seeding Installations.

1. Hydraulic Seeding (where slurry combines all components – water mulch, seed, fertilizer, tacifier, etc.) may be required by the District in certain situations, and will be used generally on small areas, slopes steeper than 3 (horizontal): 1 (vertical), or areas where access limitations prohibit drilling. Use hydroseeding mix as formulated for use in El Paso County.
2. Seed shall not be hydraulically applied during windy weather, when the ground is frozen, muddy or unillable.
3. If seeding is done by means other than drilling, the seed application rate shall be done at twice the drilled application rate when slopes are between 4 (horizontal) : 1 (vertical); and 4 times the drilled application rate when slopes are steeper than 3 (horizontal) : 1 (vertical).
4. All seeded areas shall be evaluated after one growing season to determine whether a satisfactory stand of grass is evident and weeds have been controlled. A satisfactory stand of grass is where 90% of the seeded area has an evenly distributed grass surface. Reseed and mulch areas where there is not a satisfactory stand of grass immediately after evaluation. The contractor, at his discretion, may repair or reseed any areas at any time prior to an evaluation.

H. Erosion Control. Refer to Section 4: Storm Drainage and Erosion Control for matting and ground cover specifications.

3-19 Field Quality

A. General. All tests to ensure that embedment, fill, and backfill materials and their placement comply with specified requirements shall be made by an independent testing laboratory at the expense of the Contractor.

B. The following tests will be required at a minimum:

1. Two initial gradation tests for each type of embedment, fill, or backfill material and one additional gradation test for each additional 500 tons of each material.
2. Two moisture-density (Proctor) tests in accordance with ASTM D698, ASTM D1557 or two relative density tests in accordance with ASTM D4253 and D4254 unless otherwise permitted for each type of embedment,

fill, or backfill material proposed, except for granular embedment material.

3. Pipeline in-place density tests at average intervals of 400 feet along the trench for up to five feet backfill, two tests approximately every 400 feet for five to eight feet of backfill, and one additional test every 400 feet for every 3 feet of backfill greater than eight feet, or as directed by the District Representative. Test locations will be at the discretion of the Geotechnical Engineer with the approval of the District's Representative.
4. Precast and cast-in place structures shall have one in-place density test performed for up to five feet of backfill, two tests for five to eight feet of backfill and three tests for backfill greater than eight feet, or at the discretion of the District's Representative.
5. For Service Lines one test or set of tests for every fifth service.

C. Compaction. Compaction shall be to the following minimum densities per ASTM D1557 unless otherwise indicated:

1. Compaction of pipe bedding: 90% maximum density.
2. Compaction of groundwater barrier material: 95% maximum density.
3. Compaction of backfill:
 - a. Cohesive Soils: 90% maximum Modified Proctor dry density at +2% of optimum moisture content, or 95% maximum Standard Proctor dry density at +2% of optimum moisture content.
 - b. Cohesionless Soils: 92% maximum Modified Proctor dry density at +2% of optimum moisture content, or 97% maximum Standard Proctor dry density at +2% of optimum moisture content.
 - c. Expansive Soils: 88% maximum Modified Proctor dry density at +3% or greater above optimum moisture content, or 93% maximum Standard Proctor dry density at +1% or greater above optimum moisture content. For highly expansive soils (swelling potential > 2.00% under 200 psf surcharge pressure), paving will not be permitted without a subgrade treatment approved by the Engineer.
4. Do not compact topsoil.
5. Compaction around structures shall be 95% of maximum density.

- D. All compacted backfill shall be within 2% (+/-) of the optimum moisture content of the soil as determined by ASTM D1557.

3-20 Compaction Test Failure

- A. If the required state of compaction is not obtained, it shall be the responsibility of the Contractor to recompact the material to the required state of compaction. In cases where there is a failure to achieve the required state of compaction, the District may require that the backfill be removed and recompact or replaced.
- B. The pipeline and/or structures shall be required to be retested after recompaction if the testing had been performed prior to recompaction.
- C. Settlement. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within two years from acceptance by the District.

The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 14 days after notice from the District Representative.

3-21 Off-Road Construction

- A. General. Because of undesirable impacts, all off-road construction shall be done with extreme care to minimize erosion and damage to existing vegetation.

Restoration of vegetation shall be done after backfill and compaction are complete and surface is brought to final grade and shall conform to the planting prior to being disturbed.

3-22 Maintenance of Traffic

- A. General. Contractor shall conduct his work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever is it necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point. Contractor shall conform to the minimum signage and flagging requirements of the U.S. Department of Transportation's Manual For Uniform Traffic Control Devices. A traffic control plan shall be submitted whenever travel on a public thoroughfare is impacted by the construction.

Written approval by the District Engineer must be obtained before work can commence.

In making open cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

3-23 Road Closings

- A. General. The Contractor shall not close any street or portion of a street without receiving a traffic variance from the Triview Metropolitan District Engineer and the Town of Monument Engineer 48 hours prior to such closure. It is the Contractor's responsibility to notify the Town Police, Fire Department and School District 48 hours prior to closing any street, which has been authorized. The Contractor shall also notify the Police, Fire Department and School District immediately after opening of any street, alley, or fire lane.

- B. Detours. Where required by the authority having jurisdiction thereover that traffic be maintained over any construction work in public street, road, or highway, and traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at his own expense, construct and maintain a detour around the construction work. Traffic shall be maintained at all times on all State highways. Each detour shall include a bridge across the pipe trench and all necessary barricades, guard rails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

- C. Permits. All District and Town permits must be acquired before beginning construction within the right-of-way. This permit list includes, but is not limited to street cuts, jack & bore, and maintenance of traffic permit. Dewatering, local building, Corps of Engineers, and all other permits for work within the State, County or railroad right-of-way shall be obtained by the Developer prior to the start of construction. All Work performed within the limits of the right-of-way shall be in conformity with the requirements and be under the control of the authority having jurisdiction.

Contractor shall notify owners of private property and utilities when prosecution of the Work may affect them.

When it is necessary to temporarily deny access by owners or tenants to their property, or when any utility service connection must be interrupted, Contractor shall give notice 48 hours in advance to enable the affected persons to provide for their needs. Notices will conform to any applicable local ordinance and,

whether delivered orally or in writing, will include appropriate information concerning the interruption and instructions on how to limit their inconvenience.

Utilities and other concerned agencies shall be contacted at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

3-24 Barricades and Lights

- A. General. All streets, roads, highways, and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section. Barricading shall meet all appropriate ATSA Standards and be in conformance with the Traffic Control Plan approved by the District.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements, and where within railroad and highway right-of-way, as required by the authority having jurisdiction thereover. All barricades and lights shall conform to the U.S. Department of Transportation's Manual For Uniform Traffic Control Devices.

3-25 Fences

- A. General. All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until the owner of the fence is so advised, and the period the fence may be left relocated or dismantled has been established. Proper permit must be obtained before altering the District's fence. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition and to their original location. On completion of the Work, the Contractor must obtain approval of the District.

3-26 Protection of Public and Private Property

- A. General. Contractor shall protect shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by his construction operations. All pavement, surfacings, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards or parkings, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

No trees shall be removed outside the permanent easement, except where authorized by the District Manager. Whenever practicable, Contractor shall tunnel beneath trees in yards when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage by construction operations.

Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or men to or from the Work or any part or site thereof, whether by him or his Subcontractor. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

3-27 Dust Control

- A. General. Contractor shall take reasonable measures to prevent unnecessary dust and obtain an El Paso County Fugitive Dust Permit. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practicable to prevent blowing. All dust control chemicals must meet current EPA requirements.

3-28 Temporary Drainage Provisions

- A. General. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the site, and adjacent property. Developer/Contractor shall obtain NPDES permit for Stormwater Management Plan (SWMP) from the Colorado Department of Public Health and Environment as required.

Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

3-29 Erosion Control

- A. General. Contractor shall prevent erosion of soil on the site and adjacent property resulting from his construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection. Adhere to the requirements as outlined in the Stormwater Management Plan (SWMP).

Work shall be scheduled to expose areas subject to erosion for the shortest possible time and natural vegetation preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary, fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff. Refer to Section 4, Storm Drainage and Erosion Control, for measures to be used in the control/mitigation of erosion.

3-30 Pollution Control

- A. General. The Contractor shall comply with all applicable Federal, State and Town laws, orders and regulations concerning the abatement of water pollution. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediments, debris, and other objectionable substances resulting from construction activities. Objectionable substances include, but are not limited to refuse, garbage, cement, industrial waste, oil and other petroleum products, aggregate processing tailings and material salts. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No

sediment, debris, or other substance will be permitted to enter sanitary sewers, and reasonable measures will be taken to prevent such materials from entering any drain or watercourse. If any such materials enter storm sewers or watercourses, the Monument Police, the local fire district, and water department shall be notified immediately.

3-31 Final Cleanup

- A. General. After backfill and compaction has been completed, the right-of-way shall be dressed smooth and graded in a condition to the satisfaction of the District Representative. Final cleanup of Work shall include sweeping of streets to remove all dirt, sand, etc.

SUBSECTION 4

PIPE

TABLE OF CONTENTS

	<u>Page</u>
Subsection 4 – Pipe.....	1
4-1 General.....	1
4-2 Ductile Iron Pipe.....	1
4-3 Polyvinyl Chloride (PVC) Pressure Pipe.....	9
4-4 Miscellaneous Piping.....	16
4-5 Spacer, Casing or Sleeve Pipe.....	20

SUBSECTION 4

PIPE

4-1 General

All public water mains will be a minimum of 8 inches diameter. Sizing shall be as indicated in the Water Distribution System Master Plan or as determined by the District Manager.

Unless otherwise noted, all water mains shall be polyethylene wrapped ductile iron pipe or PVC pipe with ductile iron fittings as specified in this section.

4-2 Ductile Iron Pipe

A. Scope. This section covers ductile iron pipe smaller than 24 inches in diameter for water lines as approved by the District Representative. Ductile iron pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

B. Materials.

Pipe	Ductile iron, ANSI/AWWA C151/A21.51; thickness class as listed in the table in this section.
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Fittings	ANSI/AWWA C110/A21.10, except shorter laying lengths will be acceptable.
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12 Inch and Smaller	250 psi pressure rating.
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14 Inch and Larger	150 psi pressure rating, where approved by the District Representative.
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Push-on Joints	ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
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Restrained Push-on Joints	American "Lok-Fast" or "Lok-Ring"; Clow "Super-Lock"; U.S. Pipe "TR Flex"; or Griffin "Snap-Lok" or "Mechanical Restrained Joint" approved equal.
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Mega-lugs	Ebaa Iron, Inc. Mega lug Series 1100 or 1500 PV or approved equal.
Flanged Joints	ANSI/AWWA C115/A21.15.
Flanges	
Class 250	Ductile iron, flat faced with ANSI B16.1, Class 250, diameter and drilling, where required by District Representative.
All Others	Ductile iron, ANSI/AWWA C115/A21.15, flat faced.
Bolts	ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch beyond outer face of nut.
Nuts	ASTM A307, hexagonal, ANSI B18.2.2, heavy semifinished pattern. HS nuts shall be ASTM A 194, Grade 2H.
Gaskets	ASTM D1330, Grade I rubber, full face type, 1/8 inch thick.
Mechanical Joints	ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
Mechanical Joints with Tie Rods	See Details 5, 17 and 25 at the end of this section.
Tie Rods	May be black steel; in all cases they shall be equal to a minimum grade ASTM A307, except where high strength steel is required, in which case they shall have a minimum strength equal to ASTM-A325. See Details 5 & 25.
Steel Pipe	ASTM A120, standard weight.
Washers	ANSI B18.22.1, plain steel.
Threaded Connections	ANSI B2.1 NPT; provide boss or tapping saddle wherever wall thickness minus the

foundry tolerance at the tapped connection is less than that required for four-thread engagement as set forth in Table A.1, Appendix A of ANSI/AWWA C151/A21.51.

Mechanical Couplings
Couplings

Dresser "Style 38" or Rockwell "441 or 411 Flexible Coupling"; without pipe stop or approved equal.

Gaskets

Oil resistant synthetic rubber.

Flanged Coupling Adapters

Rockwell "Type 912" with anchor studs, 12 inch and smaller; "Type 913", 14 inch and larger or approved equal.

Tapping Saddles

Ductile iron with stainless steel straps (2 minimum) and rubber sealing gasket, 250 psi pressure rating. Similar in all respects to Mueller H 10400 Series or approved equal.

Shop Coating and Lining
Cement Mortar Lining

ANSI/AWWA C104/A21.4.

Shop Primer

Cook "391-N-167 Barrier Coat", Koppers "No. 10 Inhibitive Primer", Tnemec "77 Chem-Prime", or Valspar "13-R-28 Chromox Primer" or approved equal.

Asphaltic Coating

Manufacturer's standard.

Coal Tar Epoxy

Manufacturer's standard.

Rust Preventive
Compound

Houghton "Rust Veto 344" or Rust-Oleum "R-9".

Field Coating
Reaction Anchorage

Thixotropic coal tar, MIL-C-18480; Koppers "Bitumastic No. 50", or Tnemec "46-450 Heavy Tnemecol" or approved equal.

Pipe in Manholes

Gloss alkyd enamel, Fed Spec TT-E-489, Class A; Cook "Armorcote Glass Enamel", Koppers "Glamortex 501 Enamel", Mobil

"Series 12 Panorama Coatings", or Tnemec "Tneme-Gloss Enamel" or approved equal.

Polyethylene Tube

Seamless, ANSI/AWWA C105/A21.5.

Joint Tape

Self-sticking, PVC or polyethylene, 10 mils thick; Chase "Chasecote 750", Kendall "Polyken 900", or 3M "Scotchrap 50" or approved equal.

Tracer Wire or Thermoweld

Refer to Detail 6.

- C. Shop Coating and Lining. The interior of all pipe and fittings for water service shall be cement mortar lined.

The exterior surfaces of all pipe and fittings which will be exposed in interior locations shall be shop primed. Flange faces shall be coated with rust preventive compound. Exterior surfaces of all other pipe and fittings shall be asphaltic coated.

- D. Handling. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well padded contact surfaces.

Pipe and fittings in which the lining has been damaged shall be replaced. With the concurrence of the District Representative, small and readily accessible damaged areas may be repaired.

All pipe coating which has been damaged shall be repaired by the Contractor before the pipe is installed.

- E. Cutting Pipe. Cutting shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file or power grinder to remove all roughness, sharp edges, and slag. The cut ends of push-on joint pipe shall be suitably beveled.

Ends of ductile iron pipe shall be cut with a portable guillotine saw, abrasive wheel, saw, milling cutter, or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be permitted. Field cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be permitted.

- F. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter prior to installation and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wire brushed if necessary, wiped clean, and kept clean until jointing is completed.

Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other materials shall not be placed in or allowed to enter the pipe.

Whenever pipe laying is stopped, the open end of the pipe shall be sealed with a watertight plug which will prevent trench water from entering the pipe.

- G. Inspection. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.

- H. Alignment. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the values stipulated in Table 3 or Table 4 of AWWA C600, unless specially designed bells and spigots are provided.

Either shorter pipe sections or fittings shall be installed where alignment or grade requires them.

- I. Laying Pipe. Pipe shall be protected from lateral displacement by placing the specified pipe embedment material. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions.

Pipe shall be laid with the bell ends facing the direction of laying except when reverse laying is specifically authorized by the District Representative.

- J. Field Joints. Joints in buried locations shall be mechanical joint or push-on type for ductile iron pipe. All other joints shall be flanged unless otherwise indicated on the drawings.

- K. Mechanical Joints. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Bolts shall be uniformly tightened to the torque values listed in Table A.1 of Appendix A of ANSI/AWWA C111/A21.11. Overtightening of bolts to compensate for poor installation practice will not be permitted.

The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the

mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

- L. Push-On Joints or Slip Joints. The pipe manufacturer's instructions and recommendations for proper jointing operations shall be followed. All joint surfaces shall be lubricated with lubricant that has been supplied by the pipe manufacturer and meets the requirements of ANSI/AWWA C111 immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer's recommendations. Detail 15 indicates the maximum allowable deflections for this type of joint.

- M. Flanged Joints. Pipe shall extend completely through screwed-on flanges. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate, so that gasket compression is uniform.

- N. Flanged Coupling Adapters. Flanged coupling adapters shall be installed in strict accordance with the coupling manufacturer's recommendations. After the pipe is in place and bolted tight, the proper location of holes for the anchor studs shall be determined and the pipe field drilled. Anchor stud holes shall be drilled completely through the pipe wall. Hole diameter shall be not more than 1/8 inch larger than the diameter of the stud projection.

- O. Lugged Joints. Lugged joints shall be left open until all flanged joints in the pipe assembly are completed.

- P. Mechanical Couplings. Mechanical couplings shall be carefully installed in accordance with the manufacturer's recommendations. A space of at least 1/4 inch and not more than one inch shall be left between the pipe ends. Pipe and coupling surfaces which contact gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling,

damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of the District Representative.

- Q. Polyethylene Tube Protection. In all locations, ductile iron shall be provided with polyethylene tube protection installed in accordance with AWWA C105, Method A. The polyethylene tube shall have a minimum wall thickness of 8 mils.
- R. Reducers. Reducers adjacent to flowmeters and pumps shall be eccentric pattern. Eccentric reducers shall be installed with the straight side on top so that air traps are not formed. Unless otherwise indicated on the drawings, all other reducers shall be concentric pattern.
- S. Outlets. Where a 12 inch or smaller branch outlet is indicated and the diameter of the line pipe is at least twice the diameter of the branch, either a tee, factory welded-on boss, or a tapping saddle will be acceptable.
- T. Connections with Existing Piping. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers and as authorized by the District Representative. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing potable water piping. Trench water, mud, or other contaminating substances shall not be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, chlorine solution having a chlorine content of 200 milligrams per liter.

- U. Concrete Encasement. Concrete encasement shall be installed as indicated on the details. Concrete and reinforcing steel shall be as specified in the Subsection 9, Concrete and Grouting. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent flotation.
- V. Reaction Anchorage and Blocking. All exposed piping with mechanical couplings, push-on or mechanical joints, or similar joints subject to internal pressure shall be blocked and harnessed to preclude separation of joints. All push-on and mechanical joint tees, Y-branches, bends deflecting 11-1/4 degrees or more, and plugs which are installed in buried piping (subjected to internal hydrostatic heads in excess of 30 feet) shall be provided with suitable reaction blocking, anchors, joint harness, Mega-lugs, and other acceptable means for preventing movement of the pipe caused by internal pressure.

Generally, either harnessed pipe and/or concrete blocking may be used to restrain movement of buried piping. Harnessed pipe shall be installed either side of in-line valves and 90 degree bends. Harnessed joints shall be used only on ductile iron pipe. If soil material is unsuitable for concrete blocking, then harnessed ductile iron pipe shall be used in lieu of other piping materials. Harnessed ductile iron pipe shall be installed as shown on Detail 14 or 17.

Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on Detail 13 or as directed by the District Representative. If adequate support against undisturbed ground cannot be obtained, metal harness anchorages shall be installed to provide the necessary support. Metal harness anchorages shall consist of steel rods extending across the joint and securely anchored to pipe and fitting or other adequate anchorage facilities shall be installed to provide the necessary support. If the lack of suitable solid vertical excavation face is due to improper trench excavation, metal harness anchorages shall be furnished and installed by and at the expense of the Contractor. A sheet of 6 mil plastic shall be installed between concrete blocking material, ductile iron pipe, and fittings.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the drawings or as directed by the District Representative.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles, reaction anchorages, or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be protected from corrosion by two coats of thixotropic coal tar applied in the field to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structures shall be painted in accordance with the painting requirements of this section.

W. Dimensions. The thickness class for ductile iron pipe shall be as indicated in the following table:

Type of Pipe	Nominal Size (in.)	ANSI Thickness Class
DIP	3 & 4	54
DIP	6 & 8	53
DIP	10 & 12	52
DIP	14 thru 20	51

Notes:

1. The specified thickness class includes corrosion allowance and foundry tolerance.
2. Pipe smaller than 6 inch will only be allowed for service connections.

Pipe wall thickness for grooved and threaded pipe shall be increased if necessary to comply with the following minimum thicknesses:

<u>Pipe Size (in.)</u>	<u>Minimum Thickness Class</u>
	<u>Threaded Ends (*)</u>
3	53
4-16	53
20	53
24 and larger	53

Notes:

1. (*) Complies with ANSI/AWWA C115/A21.15 for minimum pipe wall thickness for threaded flanges.

X. Tie Rods. May be black steel; in all cases they shall be equal to a minimum grade ASTM A307, except where high strength steel is required, in which case they shall have a minimum strength equal to ASTM-A325. The size and minimum number of tie rods required shall be as referenced in Detail 5, 14, 17 & 25.

4-3 Polyvinyl Chloride (PVC) Pressure Pipe

A. Scope. This section covers 4 inch up through 12 inch buried polyvinyl chloride (PVC) pressure pipe. Pipe larger than 12 inches shall be ductile iron pipe. PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

Pressure and leakage tests, cleaning, disinfection, and cathodic protection are covered in other subsections. Pipe trenching, bedding, and backfill are covered in Subsection 3, Excavation and Trenching.

B. Governing Standards. Except as modified or supplemented herein, all PVC pressure pipe, couplings and fittings shall conform to the applicable requirements of the following standards:

AWWA Standards

Title

C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
C110	Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (75mm through 1,200 mm), for Water and Other Liquids
C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution

For PVC pressure pipe, the supplementary information required in the foreword of the governing standard is as follows:

Affidavit of Compliance (Sec. 1.4)	Required
Plant Inspection (Sec. 4)	Not Required
Special Markings (Sec. 2.2.5)	Not Required
Special Preparation for Shipment (Sec. 2.6)	Not Required
Certification (Sec. 2.1.5)	Required

C. Dimensions. All PVC pressure pipe shall have a 200 psi pressure class and a dimension ratio (DR) of 14.

D. Materials.

Pipe and Couplings	AWWA C900; cast iron and pipe OD; Pressure class and wall thickness as specified herein. Pressure Class 200, wall thickness of DR 14. NSF stamp or approved equal.
Fittings	Cast iron; ANSI/AWWA C110/A21.10, 250 psi pressure rating, except shorter laying lengths will be acceptable.
Joints PVC to PVC	AWWA C900, stab type, with elastomeric gaskets. Gaskets shall be synthetic rubber. Natural rubber will not be acceptable.
PVC to Cast Iron	ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable.
Tapping Saddles	Ductile iron with dual stainless steel straps similar to Mueller H 10400 Series and

synthetic rubber sealing gasket, 250 psi pressure rating or approved equal.

Tapping Sleeves

Ductile iron, 250 psi pressure rating.

Polyethylene Encasement

Tube or sheet, AWWA C105.

Joint Tape

Self-sticking, PVC or polyethylene, 10 mils thick; Chase "Chasekote 750", Kendall "Polyken 900", or 3M "Scotchrap 50" or approved equal.

Thixotropic Coal Tar Paint

MIL-C-18480, Koppers "Bitumastic No. 50", Mobil "35-J-10 High-Build Bituminous Coating", or Tnemec "46-450 Heavy Tnemecol" or approved equal.

Conductive Tracer Wire

No. 6 Copper. Refer to Detail 6.

Mega-Lugs

Ebaa Iron, Inc. Mega-Lug Series 2000 or 1500 PV or approved equal.

Manufacturing quality control shall be maintained by frequent regularly scheduled sampling and testing. Testing shall comply with the governing standard.

- E. Shop Coating and Lining. The exterior surfaces of ductile iron fittings shall be coated with a bituminous coating. The interior surfaces of ductile iron fittings shall be lined with cement mortar.
- F. Storage and Handling. Storage and handling shall be in accordance with Chapter 6 of AWWA Manual M23. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight. District representative may reject any pipe which is deemed unsuitable. Any pipe which remains uncovered for more than 1 week shall be removed from jobsite.
- G. Inspection. Pipe and fittings shall be carefully examined by the Contractor for cracks and other defects immediately before installation; spigot ends and bells shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.
- H. Laying Pipe. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in Subsection 3, Excavation and

Trenching. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions.

During cold weather, particular care shall be taken in handling and laying pipe to prevent impact damage.

Pipe shall be laid with bell ends facing the direction of laying, except when reverse laying is specifically permitted by the District Representative.

Foreign matter shall be prevented from entering the pipe during installation.

Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug. All water in the trench shall be removed prior to removing the plug.

Pipe shall be kept shaded and as cool as possible during installation and shall be covered with backfill immediately after inspection.

Tracer wire shall be attached to the top of all PVC pipe (mains, laterals and service lines), and surfaced at all valve, blow-off and hydrant locations.

1. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.
2. Alignment. Piping shall be laid to the lines and grades indicated on the drawings. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the maximum deflections specified by the manufacturer (or as indicated in Detail 15).

Unless otherwise specified or indicated on the drawings, and subject to the acceptance of the District Representative, either shorter pipe sections or fittings shall be installed as required to maintain the indicated alignment or grade.

- I. Cutting Pipe. Cutting shall comply with the pipe manufacturer's recommendations and Chapter 7 of AWWA Manual M23. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and beveled in accordance with the manufacturer's instructions.

- J. Jointing.

1. Stab-Type Joints. Jointing operations shall conform to the instructions and recommendations of the pipe manufacturer. All joint surfaces for gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be as supplied by pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. Each spigot shall be suitably beveled to facilitate assembly.
 2. Mechanical Joints. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Overtightening bolts to compensate for poor installation practice will not be permitted. Refer to Detail 16 for mechanical joint restraints.
- K. Polyethylene Encasement. All cast iron fittings, tapping sleeves, valves or other cast iron accessories shall be provided with polyethylene encasement installed in accordance with AWWA C105. See Detail 23.
- L. Connections with Existing Piping. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by the District. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.
- Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, chlorine solution having a chlorine content of 200 milligrams per liter.
- M. Service Connections. Tapping saddles or tapping sleeves shall be used for all service connections 2 inches and smaller. Direct tapping of PVC pipe will not be permitted. Fittings shall be used for service connections larger than 2 inches.
- N. Concrete Encasement. Concrete encasement shall be installed as indicated on the drawings. Concrete and reinforcing steel shall be as specified in the Subsection 9, Concrete and Grouting. All pipe to be encased shall be suitably supported and blocked in proper position and shall be anchored against flotation. See Detail 19.

- O. Reaction Anchorage and Blocking. All bell and spigot or all-bell tees, Y-branches, bends deflecting 11-1/4 degrees or more, valves, and plugs which are installed in piping subjected to internal hydrostatic heads in excess of 30 feet shall be provided with suitable reaction blocking, anchors, joint harness, or other acceptable means for preventing movement of the pipe caused by internal pressure.

Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on Detail 13 or as directed by the District Representative. If adequate support against undisturbed ground cannot be obtained, PVC pipe shall be replaced with DIP as required and metal harness anchorages consisting of joint clamps or tie rod and clamp systems acceptable to the District Representative shall be installed to provide the necessary thrust resistance. If the lack of suitable solid vertical excavation face is due to improper trench excavation, DIP and acceptable metal harness anchorages shall be furnished and installed by the Contractor at no additional cost to the District.

Reaction blocking, anchorages, Mega lugs, or other supports for fittings installed in fills or other unstable ground shall be provided as required by the drawings or as directed by the District Representative.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material and not encased in concrete shall be protected from corrosion by two coats of coal tar paint applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied.

- P. Hydrostatic and Leakage Tests. After installation, PVC piping shall be tested for defective workmanship and materials, and for watertightness, by being subjected to a hydrostatic test as specified in Subsection 7, Pressure and Leakage Tests and Disinfection of Waterlines. Each leak which is discovered within the correction period stipulated in Subsection 1, General Policies shall be repaired by and at the expense of the Contractor.
- Q. Cleaning and Disinfection. After installation, PVC piping shall be cleaned and disinfected as specified in Subsection 7, Pressure and Leakage Tests and Disinfection of Waterlines
- R. Cathodic Protection. All installations of water mains/service lines will have cathodic protection where such measures are determined to be necessary. In cases where the contractor plans to install Ductile Iron Pipe, the appropriate soils evaluations shall be made to determine if any extraordinary corrosion protection measures are required.

1. 17lb magnesium anodes shall be installed at all reverse anchors and/or plugs.
2. Bonding Joints. All 12-inch and larger DIP pipelines and other pipelines that require protection will be bonded at every joint and/or coupling (except insulating couplings). Bonding shall be accomplished by thermo-welding straps or wire across each joint or coupling. The contractor shall furnish all material required for bonding.
3. Installation of 9 lb or 17 lb magnesium anodes may be required for additional corrosion protection to the DIP/steel water pipeline and fittings (larger size anodes, greater than 17 lb maybe required by the District), see chart below for approximate spacing of 17lb anodes on water pipelines. Additional anodes are required at all metal fittings and appurtenances (valves, hydrants, bends, crosses, tees, etc.). All anodes shall be furnished and installed by the contractor in conformance with these standards. Refer to Detail 39.
4. For use with DIP pipe in conjunction with poly-wrap sleeves in 1000 ohm-cm soil estimating a 5% holiday area, anode design shall conform to the following:

Pipe Size Inches	Actual OD Inches	Anode Spacing Feet
4	4.8	763
6	6.9	531
8	9.05	405
10	11.1	330
12	13.2	277
14	14	239
16	16	210
18	18	188
20	20	169
24	24	142
30	30	114
36	36	95.7
42	42	82.4
48	48	72.1
54	54	64.2

The distance from the point of the beginning to the first anode shall not exceed one-half the recommended spacing.

5. When soil testing indicates that corrosion protection is required, PVC pipe shall meet the following requirements:

- (a) All metal fittings and appurtenances (valves, hydrants, bends, crosses, tees, etc.) shall be installed with one (1) nine pound (9lb.) magnesium anode bonded to the metal. A minimum of one (1) anode for each individual fitting or appurtenance shall be required.
- (b) All fittings and appurtenances shall be encased in polyethylene wrap and tightly taped against the pipe at a minimum distance of one (1) foot on each side of the fitting or appurtenance, with the exception that encasement on hydrant barrels will be terminated near ground line.
- (c) All tie rods will be protected from corrosion by encasing them in polyethylene wrap and securing with tape, except where the rods are in contact with concrete, in which case it must be coated.

All mechanical joint fittings tied back with rods shall be wrapped in polyethylene to protect that portion of the tire rod, which extends through the flange.

- (d) Tracer wire shall be used in trenches along side of PVC & HDPE water lines. A #6 copper clad steel (boring) or #6 solid copper (direct bury applications) insulated tracer wire shall be used to locate the pipe, being taped to the top of the pipe on all main and service lines. A 1 lb anode shall be attached to the end of the tracer wire for all new dead end mains and studs. For long runs of plastic pipe, a 1 lb anode will be attached to the tracer wire every one thousand (1,000) feet.

S. High Deflection Couplings. High deflection couplings shall be used if the pipe's deflection is more than 70% of the manufacturer's allowable deflection.

T. Drawings and Data. Drawings and data shall be submitted to the Contractor and made available for review by the District Representative. Drawings and data shall include, but not be limited to, the following:

- Details of Joints
- Gasket Material
- Pipe Length
- Affidavit of Compliance (AWWA C900, Sec. 6.3)
- Certification (AWWA C900, Sec. 4.2.3)

4-4 Miscellaneous Piping

- A. Scope. This section covers the piping for the air release and vacuum relief valve and pressure reducing valve vaults, blowoff piping, and water meter piping. See other sections for ductile iron pipe and PVC pipe.

Miscellaneous piping shall be furnished and installed complete with all fittings, jointing materials, hangers and supports, anchors, and other necessary appurtenances.

- B. Materials. All piping and fitting materials shall contain less than 8 percent lead content.

Steel Pipe

Standard Weight Pipe

ASTM A120, standard weight (Schedule 40) or Fed Spec WW-P 406, Weight A or approved equal.

Nipples

CS5, extra strong (Schedule 80); "close" nipples will be permitted only by special authorization in each case or approved equal.

Fittings

Drainage

Fed Spec WW-P-491.

Malleable Iron

ANSI B16.3 or Fed Spec WW-P 521, Type II for galvanized pipe or approved equal.

Unions

Malleable Iron

Fed Spec WW-U-531, Class 2; Type B for galvanized pipe or approved equal.

Mechanical Couplings

Dresser "Style 38" or Rockwell/ Smith-Blair "Type 411 Flexible Couplings" or approved equal.

Iron-Pipe-Size Brass Pipe

Standard Weight Pipe

ASTM B43, red brass, regular weight, or Fed Spec WW-P-351, Class 1, regular weight or approved equal.

Fittings

ANSI B16.15, 125 lb.

Unions	Fed Spec WW-U-516, Composition B or approved equal.
Copper Tubing	
Water Tubing	ASTM B88 or Fed Spec WW-T-799, Type K or approved equal.
Fittings	
Flared	ANSI B16.26.
Solder	ANSI B16.18 or B16.22.
Threaded	PSI "Delrin Insulating Couplings" Or Vallet "V-Line Insulating Couplings" or approved equal.
Couplings	2-inch and smaller, for connection to water meter, Ford "Loc-pak" or approved equal.
Solder	Solid wire, ASTM B32, Alloy Grade Sb5 (95-5), less than 0.2 percent lead content.
Soldering Flux	Paste type, Fed Spec O-F-506, Type I, Form A, less than 0.2 percent lead content.
Brazing Filler Metal	AWS A5.8, BCuP-5; Engelhard "Silvaloy 15", Goldsmith "GB-15", or Handy & Harman "Sil-Fos", less than 0.2 percent lead content or approved equal.
Brazing Flux	Paste type, Fed Spec O-F-499, Type B, less than 0.2 percent lead content.
PVC Vent Pipe	ASTM D1785, Schedule 40, bearing NSF seal.
Thread Tape	Teflon; John Crane "Thread-Tape", Garlock "Plasti-Thread", or Hoke "EZ Seal" or approved equal.

Sealant

Thiokol Sealant Nonsag Polysulfide rubber, two component, 20-35 Shore A Hardness ANSI A116.1 and Fed Spec TT-S-227, bearing Thiokol Chemical "Tested and Approved Sealant" seal.

Urethane Sealant Mameco International "Vulkem 45 or 230", PRC "N. 210 or 220" or approved equal.

Protective Coatings

Coal Tar Coating MIL-C-18480; Koppers "50 Bitumastic", Porter "Tarmastic 101", or Tnemec "476 Super Tnemecol" or approved equal.

C. Service and Type Requirements. Except as otherwise specified or authorized, pipe and tubing shall conform to the general requirements which follow. Kinds of pipe for service conditions not listed shall be as specified in other sections, as indicated on the details or, in the absence of any definite requirement, as determined by the District Representative. All piping materials shall contain less than 8 percent lead content.

1. Standard Weight Galvanized Steel Pipe.

(a) With Threaded Drainage Fittings. All 6-inch and smaller drainage, waste, and vent piping, except where PVC is noted on the details.

(b) With Threaded Malleable Iron Fittings. All 2-1/2-inch and smaller piping in the pressure reducing valve manhole and blowoff piping.

2. Iron-Pipe-Size Brass Pipe. All 2-inch piping in air release/vacuum relief valve vault and where shown for blowoffs.

3. Copper Tubing.

(a) Soft Annealed with Flared Fittings. Where shown for blowoffs, and for 2-inch and smaller water service connections, where in contact with earth.

(b) Hard Drawn with Solder Fittings. 2-inch and 1-1/2-inch piping adjacent to water meters, where exposed inside meter pits or basements.

4. Polyethylene Tubing. Minimum ¾-inch – Maximum 2-inch diameter Drisco Plex 5100 Ultra-Line Polyethylene 3408 Product with SIDR-7 (200psi) or approved equal. Ball curb valves shall be Mueller E25211 or Ford B66-333. Ball Corporation valves shall be Mueller E25009 or Ford FB1001. 4'-0" diameter meter pits is required for commercial installations with this tubing.
5. PVC Vent Pipe. All 6-inch and smaller buried vault vents.
6. DR14 PVC. Minimum 2-inch for water service connections.

D. Pipe Joints. Pipe joints shall be carefully and neatly made in accordance with the requirements which follow.

1. Threaded. Pipe threads shall conform to ANSI B2.1, NPT, and shall be full and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed, after threading and before assembly, to remove all burrs.

At the option of the Contractor, threaded joints may be made up with thread tape or a suitable joint compound.

2. Flared. Ends of annealed copper tubing shall be cut square and all burrs shall be removed. Flared ends shall be uniform without scratches or grooves.

E. Pipe Installation. Pipe shall be installed as specified, as indicated on the details or, in the absence of detail piping arrangement, in a manner acceptable to the District Representative. A union shall be provided within 2 feet of each threaded end valve. Piping shall not obstruct openings or passageways.

F. Protective Coating. Joints in steel or galvanized steel piping in underground locations shall be field painted with one coat of coal tar coating.

G. Cleaning. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when erected. All lines shall be thoroughly blown out before placing in service.

4-5 Spacer, Casing or Sleeve Pipe

A. General. Whenever it is necessary to provide a casing or sleeve for the water main, the water main shall not be inserted into the casing or sleeve pipe without providing insulating skids for each joint of the water main. Insulating skids shall be of a type such as the "PSI Model C12 G-2" or an equivalent approved by the

District. Casing pipes shall be protected on the outside with corrosion resistant materials having a bituminous base or install appropriate cathodic protection. Casing or sleeve pipe size (depending on mechanical fitting or connecting device, typical example of casing sizes can vary from approximately one and one-half (1.5) to three (3) times the size of the carrier pipe. This can also vary based on bell size, MJ restraint size, spacer runners being used, HDPE pipe being used, length of sleeve being shorter than section of carrier pipe), length, type and side wall thickness will be determined by the District Representative. All casing pipe shall be new. It is recommended that eight (8") inch wide steel spacers be used for pipe sizes up to twenty four (24") inches, and twelve (12") inch wide steel spacers be used on pipe diameters greater than twenty four (24") inches in size.

When determined necessary by the District, steel casing pipe shall be used for protecting above ground pipe spans. The casing pipe shall be designed to support the carrier pipe, which will be installed with insulating skids and pipe insulation. The casing pipe shall be designed by an engineer to withstand movement and protect the carrier pipe.

1. Casing Spacers on the Carrier Pipe. Casing spacers on the carrier pipe shall be spaced a maximum of four (4) feet apart along the length of the carrier pipe with one casing spacer with two (2) feet on each side of a pipe joint and the rest evenly spaced.
 - (a) Casing spacers shall be all non-metallic, molded in segments for field assembly without any special tools. Spacer segments shall be secured around carrier pipe by insertion of a Slide-Lock. The casing spacer polymer shall contain ultraviolet inhibitors and shall have a minimum compressive strength of 3,000 psi, an 800 Volts/mil dielectric strength and impact strength of 1.5 ft-lbs/inch. Each casing spacer shall have full length integrally molded skids extending beyond the bell or mechanical joint of the carrier pipe.
 - (b) Casing spacers shall be at least as wide as listed below in the table:

The following are approved for installation within the District:

Carrier Pipe Diameter Inches	Ranger II™ Model	Length Inches
0.83 to 3.07"	Micro	2.13"
2.48 to 5.51"	Mini	3.15"
4.99 to 16.65"	Midi	5.12"
16.77 to 37.60"	Maxi	8.66"

*Check with Manufacturers for compliance with the District specifications.

2. Casing pipe to be sized based on actual materials being used for the carrier pipe. Typical examples of casing pipe sizes depend on materials and if mechanical joint restraints (MJ RSNT) are used.

Pipe Size	Casing Size (if MJ RSNT used)
6"	16"
8"	20"
12"	24"
16"	30"
18"	36"
20"	36"
24"	42"
30"	42"
36"	48"

SUBSECTION 5
WATERLINE EQUIPMENT
TABLE OF CONTENTS

	<u>Page</u>
Subsection 5 – Waterline Equipment.....	1
5-1 Scope.....	1
5-2 Valves General.....	1
5-3 Gate Valves.....	3
5-4 Check Valves.....	3
5-5 Ball Valves.....	4
5-6 Butterfly Valves.....	4
5-7 Pressure Reducing Valves.....	4
5-8 Air Release and Vacuum Relief Valves.....	5
5-9 Corporation Stops.....	5
5-10 Curb Stops.....	5
5-11 Water Meters.....	5
5-12 Meter Yokes.....	5
5-13 Backflow Preventer.....	7
5-14 Fire Hydrants.....	7
5-15 Tapping Sleeves and Valves.....	7
5-16 Extension Stems.....	8
5-17 Pressure Gauges.....	8
5-18 Valve Boxes.....	9
5-19 Installation of Waterline Equipment.....	9

SUBSECTION 5

WATERLINE EQUIPMENT

5-1 Scope

This subsection covers all waterline equipment, including that equipment used specifically for setting water meters. Installation of this equipment is covered at the end of this subsection and in Subsection 8, Water Meters and Service Lines.

5-2 Valves - General

- A. Manual Operators. All valves, except those which are equipped with power actuated operators or are designed for automatic operation, shall be provided with manual operators. Unless otherwise specified or shown, each manual operator shall be equipped with an operating handwheel.
- B. Wrench Nuts. Wrench nuts shall be provided on all buried valves and where shown on the details. Unless otherwise directed by the District, all wrench nuts shall comply with Section 4.4.13 of AWWA C500. Not less than two operating keys shall be furnished for operation of the wrench nut operated valves.
- C. Lever Operators. Unless otherwise specified, ball valves shall be lever operated. For each project, two suitable operating levers shall be furnished for each type and size of lever operated valve.
- D. Rotation. The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word "OPEN" and an arrow indicating the direction to open.
- E. Length Tolerance. The actual length of valves shall be within 1/16 inch (plus or minus) of the specified or theoretical length.
- F. Ends. Unless otherwise specified, all 3 inch or larger buried valves shall have push-on or mechanical joint ends; all other 2-1/2 inch or larger valves shall have flanged ends; and all 2 inch or smaller valves shall have threaded, solder, or welding ends as required by the piping system in which the valve is to be installed. Unless otherwise indicated, flange diameter and drilling shall conform to ANSI B16.1, Class 125 or ANSI B16.5, Class 150. Push-on and mechanical joints shall conform to ANSI/AWWA C111/A21.11. Wafer style valves shall be designed for installation between ANSI Class 125 flanges.

- G. Unions. A union or flanged connection shall be provided within 2 feet of each threaded end valve unless the valve can be easily removed from the piping.
- H. Line Valves. Line valves are required every six hundred feet (600') in the potable water distribution system. Where blocks exceed six hundred feet in length, one or more line valves may be required between intersections.
- I. Shop Painting. All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop painted for corrosion protection. The valve manufacturer's standard paint will be acceptable provided it is functionally equivalent to the specified paint and is compatible with the specified field painting.

1. Materials.

Asphalt Varnish	Fed Spec TT-V-51.
Alkyd Enamel	Fed Spec TT-E-489, Class A; Cook "Armorcote Gloss Enamel", Koppers "Glamortex 501 Enamel", Mobil "Series 12 Panorama Coatings", or Tnemec "Tneme-Gloss Enamel" or approved equal.
Coal Tar	Koppers "Bitumastic Super Service Black", Tnemec "46-449 Heavy Duty Black", or Valspar "35-J-10 Hi-Build Bituminous Coating" or approved equal.
Epoxy	Cook "920-W-965 Epicon-MW HB Epoxy", Koppers "200 HB Epoxy", Tnemec "Hi-Build Epoxoline Series 66", or Valspar "89 Series Val-Chem Hi-Build Epoxy" or approved equal.
Rust-Inhibitive Primer	Cook "391-N-167 Barrier Coat", Koppers "No. 10 Inhibitive Primer", Tnemec "77 Chem-Prime", or Valspar "13-R-28 Chromox Primer" or approved equal.
Rust-Preventive Compound	Houghton "Rust Veto 344" or Rust-Oleum "R-9" or approved equal.

2. Surfaces to be Painted.

Unfinished Surfaces

Interior	Asphalt varnish (two coats) or epoxy.
Exterior to be Buried	Asphalt varnish or coal tar.
Exterior in Manholes or Vaults	Alkyd enamel.
Other Exterior	Rust-inhibitive primer.
Polished or Machined Surfaces	Rust-preventive compound.
Operators and Accessories	Rust-inhibitive primer.

5-3 Gate Valves

All in-line valves for water distribution service which are 12-inch and smaller shall be resilient seat gate valves. All 3 inch and larger gate valves shall conform to AWWA C509 as modified herein. Gate valves shall have a minimum working water pressure of 200 psig. Gate valves which are buried or submerged shall be nonrising stem type with O-ring stem seals. Buried gate valves shall be provided with valve boxes and shall be installed as shown in Details 26, 27 and 28.

Two inch and smaller gate valves shall be Class 125, solid wedge type. Each valve shall be of bronze construction with screwed bonnet, rising stem, and teflon impregnated asbestos packing. Threaded end gate valves shall be Milwaukee "1148", Stockham "B-107", or Walworth "Figure 55" or approved equal. Soldered end gate valves shall be Milwaukee "149", Stockham "B-109", or Walworth "Figure 55SJ" or approved equal.

5-4 Check Valves

Unless otherwise specified, all 2-1/2 inch and larger check valves shall be Class 125 horizontal swing type with iron body and flanged ends. All seats, seat rings, pins, bushings, and other parts subject to wear shall be bronze. Flanges shall be flat faced with ANSI B16.1, Class 125 diameter and drilling. Swing check valves shall be Milwaukee "F-2974", Stockham "Figure G-931", or Walworth "Figure 8928F" or approved equal.

Check valves 2 inch and smaller shall be Class 125 or higher, all bronze, Y-pattern, regrinding, horizontal swing type. Threaded end valves shall be Stockham "B321" or Walworth "Figure 3406" or approved equal. Soldered end

valves shall be Nibco "S-413-B" or Walworth "Figure 3046SJ" or approved equal.

5-5 Ball Valves

Unless otherwise specified, all 2-1/2 inch and smaller shutoff valves shall be ball valves.

Two inch and smaller ball valves shall be of bronze or brass construction with two-piece end entry body, bronze or brass ball, teflon or Viton stem seal, reinforced teflon seats and thrust washer, a removable operating lever, and threaded ends. Valves shall be rated not less than 500 psi nonshock cold WOG and shall be driptight in both directions. Valves shall be Conbraco Industries "Apollo 70-100 Series" or Stockham "S-216" or approved equal.

5-6 Butterfly Valves

All in-line valves for water distribution service which are larger than 12-inch shall be butterfly valves. Unless otherwise specified, butterfly valves shall be of the rubber-seat, tight-closing type. All butterfly valves and operators shall conform to AWWA C504. The minimum working water pressure shall be 150 psig. Metal mating seat surfaces shall be 18-8 stainless steel or monel. Each valve shall be provided with an operator with a torque rating as described in AWWA C504, Section 4.5.8 & A.8, Class 150B. Valve discs shall seat at 90 degrees with the pipe axis.

Flanged end valves shall be of the short body type. Where mechanical joint ends are specified, either mechanical joint or push-on ends conforming to ANSI/AWWA C111/A21.11 will be acceptable. For buried or submerged service, shaft seals shall be O-ring type.

A valve position indicator shall be provided on each exposed operator and on each operating nut on an extension stem. Indicators for extension stems shall be Mills Engineering "Indico Model 128" or Pratt "Diviner".

5-7 Pressure Reducing Valves

Each pressure reducing valve shall be designed to provide tight shutoff under conditions of no flow and shall not "hunt" under ordinary flow conditions. Valves shall be piston type with flanged end connection and shall be installed in concrete vaults. Valves shall have gate valves and pressure gauges on both upstream and downstream sides and shall have bypasses with smaller pressure reducing valves to handle minimum flows as determined by the District Representative.

Pressure reducing valves shall be selected and sized as recommended by the valve manufacturer and shall be installed in a concrete vault as shown in Details 31, 32 and 32a.

Valves for maximum flow greater than 150 gpm shall be pilot actuated, globe pattern with a position indicator rod and shall be Cla-Val "90". Other water pressure reducing valves shall be Fisher "75" or Kieley and Mueller "461" or approved equal.

5-8 Air Release and Vacuum Relief Valves

Combination air release and vacuum relief valve assemblies shall be installed at each high point on all 8-inch and larger water mains and all other locations directed by the District Representative. Each valve assembly shall be installed in a concrete vault complete with appurtenant piping as shown in Detail 33.

Combination air release and vacuum relief valves shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. Valves shall have a 2-inch inlet connection, and shall be GA Industries "Figure GH-7K", Multiplex "Crispin Universal Air Valves", Valmatic "200 Series", or Valve and Primer "Apco Standard Combination Air Release Valves" or approved equal.

The valves shall be designed for a water working pressure of 150 psi and shall have stainless steel floats. All working parts shall be constructed of brass, stainless steel, or other corrosion-resistant materials.

These valves must not be installed in vaults subject to flooding. Provisions must be made to prevent flooding of vaults.

5-9 Corporation Stops

Corporation stops shall be AWWA taper thread to copper thread and shall be Mueller "No. H-15000" or Ford "No. F-600" or approved equal.

5-10 Curb Stops

Curb stops shall be bronze construction, tee head type, Ford Meter Box "Ford Ball Valve", Hays "Nuseal Curb Stop", or Mueller "Mark II Oriseal" or approved equal.

5-11 Water Meters

Water meters installed in the district shall be the Badger Meter, Inc. "Recordall."

(A) ¾-inch diameter: Model 25

(B) Other Sizes: As required by District

(C) Bronze Body

Meters shall comply with the following:

- | | |
|---------------------------------|--|
| Residential Units | - Recordall® Cold Water Bronze Disc Meter Model 25, 5/8x3/4" |
| Residential or Commercial Units | - Recordall® Compound Series Meter, 2", 3", 4" and 6"
- Recordall® Cold Water Bronze Disc Meter Model 70, 1" |
| Commercial Units | - Recordall® Cold Water Bronze Disc Meter Model 120, 1-1/2"
- Recordall® Cold Water Bronze Disc Meter Model 170, 2" |
| Irrigation Systems | - Cold Water Recordall® Turbo 160 Meter with Integral Strainer, 1"
- Cold Water Recordall® Turbo 200 Meter with Integral Strainer, 2"
- Cold Water Recordall® Turbo 450 Meter with Integral Strainer, 3"
- Cold Water Recordall® Turbo 1000 Meter with Integral Strainer, 4"
- Cold Water Recordall® Turbo 2000 with Integral Strainer, 6" |
| Fire Hydrants | - Recordall® Turbo 450 Fire Hydrant Meter |
| Meter Reading Systems | - Orion®, RF Module |

5-12 Meter Yokes

Meter yokes for inside setting of one inch and smaller meters shall contain no valves and shall be Ford "Copperhorn" or equal as required to set the meter in a horizontal position as specified in Subsection 8, Water Meters and Service Lines. Meter yokes for outside setting of one inch and smaller meters shall be Ford "Series V-80" or equal, with integral valve on inlet side.

5-13 Backflow Preventer

The backflow preventer shall consist of a dual check valve assembly with reduced pressure zone between the check valves. Backflow preventers in 2 inch and smaller sizes shall be Cla-Val "Model RP-2", Febco "Model 825Y", Hersey "Beeco Model FRP-II", or Watts "No. 909" with bronze body and threaded end connections. Backflow preventers in 2-1/2 inch and larger sizes shall be Febco "Model 825", Hersey "Beeco Model 6CM", or Watts "No. 909" with cast iron body and flat faced, flanged end connections. Flange diameter and drilling shall conform to ANSI B16.1, Class 125. The backflow preventer shall not be installed in any area with the possibility of flooding or freezing, and provisions must be made to handle discharge of water. Backflow preventers shall be installed in an area large enough for easy accessibility for testing. The backflow preventer shall have valving on each side to isolate the device for testing and repairs.

To prevent excessive pressures in the plumbing due to water expansion from the water heater, provisions must be made to either provide a water heater with an emergency pressure relief valve and drain or provide an expansion tank. One of these methods must be used and is the responsibility of the owner.

5-14 Fire Hydrants

Fire hydrants shall conform to AWWA C502 and shall be Waterous Pacer, Mueller or approved equal hydrants. Fire hydrants shall conform to the following:

Type of shutoff	Compression.
Size of hydrant	6 inches.
Inlet connection	6 inch, mechanical joint.
Harnessing lugs	Two required.
Minimum Depth of Bury	6 feet.
Outlet nozzles	Two 2-1/2 inch hose and one 4-1/2 inch pumper, National Standard Threads (NST).
Outlet nozzle threads	ANSI/NFPA 1963, NST.
Direction to open	Counterclockwise.
Stem seals	O-ring.
Outlet nozzle cap chains	Required.
Drain outlet	Required.

5-15 Tapping Sleeves and Valves

Tapping sleeves and valves shall be furnished and installed where required. Each tapping sleeve and valve shall be designed for a minimum water working pressure of 150 psi and shall be tested at 200 psi.

With the exception of the valve ends and other modifications necessary for tapping service, tapping valves shall conform to AWWA C500 and shall be Mueller "No. H-667" or approved equal. Each tapping valve shall be provided with a flanged inlet end designed, faced, and drilled for attachment to the outlet flange of the tapping sleeve; with an outlet end provided with a tapping flange for attachment of a standard drilling machine; and also with a mechanical joint type bell end for connection of the branch main.

Tapping sleeves shall be of the flanged outlet type designed for attachment to the flanged inlet end of the tapping valve and shall be provided with mechanical joint ends at each end of the run. Tapping sleeves shall be Mueller "No. H-615".

5-16 Extension Stems

Extension stems shall be of solid steel and shall be not smaller in diameter than the stem of the valve operator shaft. Extension stems shall be connected to the valve operator with Hooke's type universal joints. All stem connections shall be pinned.

Extension stems shall be provided for buried gate valves when the valve operator is greater than 5 feet below finished grade. Each extension stem for a buried valve shall extend to within 3 to 5 feet of the ground surface, shall be provided with spacers which will center the stem in the valve box, and shall be equipped with a wrench nut.

5-17 Pressure Gauges

Pressure gauges for water service shall be as specified herein. Gauges shall be liquid filled and shall be Ashcroft "1279" or approved equal, 4-1/2 inch dials, and bronze elements.

The pressure gauge shall be capable of withstanding pressures of at least 300 psi without damaging the gauge or affecting the calibration of the gauge.

The pressure gauges shall be graduated for a pressure range of 0 to 200 psi in 5 psi increments.

Each gauge shall be furnished with a minimum 1/2 inch NPT stem mounting and shall be installed complete with gauge cock, snubber, and adapter fitting. A tapping saddle shall be used for mounting the gauge on to the pipe.

5-18 Valve Boxes

All buried valves shall be provided with valve boxes. Valve boxes shall be of cast iron, three-piece slip type, suitable for the depth of cover required by the drawings. Valve boxes shall be of 6 inches in diameter, shall have a minimum thickness at any point of 3/16 inch, and shall be provided with suitable cast iron bases and covers. Covers shall have cast thereon an appropriate name designating the service for which the valve is used. Valve boxes shall be of the following pattern:

- A. For Butterfly Valves. Slip type, 6-inch diameter cast iron with oval base, Tyler "Series 6860" with No. 160 oval base, Clay and Bailey "No. P-108" with No. 160 large oval base or approved equal.
- B. For Gate Valves. Slip type, Casting Inc. VB Slip Type C.I. 6855 Series, Tyler/Union "7000 Series", Tyler/Union "Series 6855" or approved equal with flange removed prior to installation, or approved equal. Contractor shall lower flange of Tyler/Union "6855 Series" prior to installation.
- C. For Curb Stops. Buffalo type, 5-foot extension; Tyler "Series 6500, Size 94E" or approved equal for one inch and smaller valves; Tyler "Series 6870, Size 145R" or approved equal for valves larger than one inch.

All parts of valve boxes, bases, and covers shall be coated by dipping in bituminous varnish.

5-19 Installation of Waterline Equipment

Installation of waterline equipment shall be governed by the following requirements.

- A. Valves. Valves shall be located as specified in Subsection 2-3.B. Valve marker posts shall be installed to locate valves on lines located within easements or other rights-of-way when not at street intersections. Fire hydrant valves shall not be marked unless specifically directed by the District Representative. Marker posts shall be installed as shown on Detail 24. Fire hydrants highly susceptible to traffic damage will be surrounded by 6 inch steel castings to prevent damage.
- B. Gate Valves. Gate valves and valve boxes shall be installed as shown on Detail 26, 27 and 28.

Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped in each side of the box.

- C. Fire Hydrants. Hydrants shall be set so that at least the minimum pipe cover is provided for the branch supply line and the nozzles are at least 18 inches above finished grade. Branch supply lines shall be 6-inch PVC or ductile iron pipe with 6 inch gate valve. Each hydrant shall be blocked against the end of the trench with a concrete kickblock and suitably harnessed. Hydrant drainage shall be provided by installing a minimum of 1/3 cubic yard of gravel (refer to Subsection 3 for granular fill material specification) or ¾" crushed rock. Hydrants shall be installed as shown in Detail 7.

All hydrants shall stand plumb. Hydrants shall have hose nozzles parallel with, and the pumper nozzle perpendicular to, the curb line. Hydrants shall be located as specified in Subsection 2-3.D, a minimum of 24 inches from the curb or sidewalk and 5 feet from intersecting property lines. Hydrants shall be placed such that the hose cap nut is 18" above the surrounding ground or the bottom flange a minimum of 4" above top of curb, see Detail 7.

Immediately before installation of a hydrant, the following operations shall be performed:

- (1) The hydrant shall be thoroughly inspected.
- (2) The hydrant interior shall be thoroughly cleaned.
- (3) The hydrant shall be opened and closed as many times as may be necessary to determine if all parts are in proper working order, with valves seating properly and the drain valve operating freely.
- (4) The packing gland checked to determine if the packing is in place and the gland nut properly tightened.

- D. Combination Air Relief-Vacuum Breaker Valves. Combination air relief-vacuum breaker valves shall be installed at each high point on all 8-inch and larger waterlines and at all other locations as directed by the District Representative. They shall be located in concrete vaults in accordance with Detail 33. Provisions shall be made to prevent flooding of vaults.
- E. Pressure Reducing and Regulating Valves. Pressure reducing and regulating valves shall be installed in concrete vaults as shown on Details 31, 32 and 32a. Provisions shall be made to prevent flooding of vaults. Vaults shall be set level and the adjustments to match slope of the

street shall be made with concrete risers. Adjustments may be necessary to the waterline positioning in the vicinity of pressure reducing valve stations, to ensure adequate clearance between the station/appurtenances and the edge of gutter.

- F. Blowoff Assemblies. Blowoff assemblies shall be installed at each low point in all water mains of 8-inch diameter and larger and on all major transmission lines larger than 8-inch. Such blowoff assemblies shall be fire hydrants, as shown on Detail 7, where water mains permanently dead end. All water mains having temporary dead ends where stagnant water may collect shall be provided with a blowoff assembly in accordance with Detail 4.

- G. Drawings and Data. Complete specifications, data, and catalog cuts or drawings covering the items furnished under this section shall be submitted to the Contractor and shall be available for review by the District Representative.

SUBSECTION 6

VAULTS

TABLE OF CONTENTS

	<u>Page</u>
Subsection 6 – Vaults.....	1
6-1 General.....	1
6-2 Materials.....	1
6-3 Vault Construction.....	3
6-4 Painting.....	3
6-5 Drawings and Data.....	4

SUBSECTION 6

VAULTS

6-1 General

This subsection covers standard vaults for water line equipment. Vaults shall be constructed complete with covers, steps, fittings, and other appurtenances, in accordance with Details 31, 32, 32a, 33, 34, 35 and 36, and the Water Meter Details 37 and 38.

6-2 Materials

Concrete	Materials, handling, forms, finishing, curing, and other work as specified in Subsection 9, Concrete and Grouting.
Concrete Block	ASTM C90, Grade N, Type I, minimum compressive strength 2,000 psi based on the net area.
Precast Sections	Circular and/or rectangular precast concrete; ASTM C478.
Openings	Circular or horseshoe-shaped boxout for each connecting pipe, with surfaces grooved or roughened to improve mortar bond.
Portland Cement	ASTM C150, Type II
Hydrated Lime	ASTM C207, Type S.
Sand	Concrete sand (fine aggregate) sieved through 8 mesh screen.
Shrinkage-Correcting	Master Builders "Embeco", Sika Aggregate "Kemox", or Sonneborn "Ferrolith G-DS".
Mortar	One part Portland Cement, 1/2 part Hydrated Lime, three parts Sand.

Nonshrinking Mortar	Premixed or job mixed; job mixed shall be one part Shrinkage-Correcting Aggregate, one part Portland Cement, one part Sand.
Mastic	Fed Spec SS-S-210; K. T. Snyder "Ram-Nek", "Con-Seal" or Hamilton-Kent "Kent-Seal No. 2".
Coal Tar Paint	Koppers "Bitumastic Super-Service Black", Porter "Tarmastic 103", or Tnemec "450 Heavy Tnemecol".
Water Stops	For PVC pipe - ribbed elastomeric gasket as manufactured by Hamilton-Kent.
Castings	ASTM A48, with asphalt varnish coating applied at the foundry.
Manhole and Vault Rings and Covers	24-inch diameter, Clay and Bailey "No. 2008BV" or Neenah "R-1736"; 24-inch by 36-inch diameter, Neenah "R-1740-1 Series" or J-Mark "1423".
Meter Pit Covers	Cast iron top lid, aluminum frost cover, for 20-inch inside diameter meter pit, J-Mark "J-2288" or Castings, Inc. "M-70-AL", "M-70-CL", and Armorcast Products Co. "Polymer Concrete Pit Lid".
Meter Pit Domes	Aluminum per ASTM A132, or cast iron per ASTM A48.
Manhole and Vault Steps	Alcoa Aluminum Company "No. 12653B".
Safety Ladders LadderUP Safety Post	Bilco LadderUP, Safety Post – "Model-1 High Strength Steel/Black Enamel" (regular conditions), Model-2 "High Strength Steel/Hot Dip Galvanized" (corrosive conditions), Model-3 "Stainless Steel", or Model-4 "Mil Finish Aluminum". See manufacturer specification for correct installation.

- A. Delivery. Precast concrete sections shall not be delivered to the job until representative concrete control cylinders have attained a strength of at least 80 percent of the specified minimum.
- B. Handling. Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces. Use of lifting holes will not be permitted.
- C. Inspection. Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units rejected.
- D. Installation. Vaults shall be set level and the adjustments to match slope of the street shall be made with concrete risers.
- E. Meter Pit Domes and Covers. Meter pit domes and covers shall be of double lid frost proof construction and shall fit a 20 inch ID concrete meter pit ring. The meter pit dome may be constructed of aluminum in accordance with ASTM A132, or cast iron in accordance with ASTM A48. The cap type top lid shall be cast iron or polymer concrete. Remote transponder shall be installed as close to the bottom of the meter pit lid as possible. The polymer concrete lid shall have integral supports to hold the remote transponder below the surface of the lid, in accordance with manufacturer's installation instructions. All top lids shall be furnished with a worm-gear locking bolt with a large 5-sided brass nut. The inner frost lid shall be molded of high-density polyethylene at least 1/8 inch thick. The frost lid shall be dish-shaped with a recess 2-1/2 to 3 inches deep with three to five 1/4 inch diameter drainage holes located around the edge of the recessed area. There shall be a 1/4 inch wide notch the full width of the top lip, and a lifting tab projecting 2 inches inward with a 9/16 inch or larger hole. See Detail 11.
- F. Safety Ladders -- LadderUP Safety Post. The Bilco LadderUP Safety post is furnished completely assembled ready to mount on the tread of the ladder with brackets on the climbing side. See manufacturer specification for correct installation.

6-3 Vault Construction

Vaults shall be constructed as shown on Details 31, 32, 33, 34, 35 and 36. Where pipes pass through circular precast section, the vault shall be sealed with Link-seals.

6-4 Painting

If castings arrive on the job without a foundry coating, one coat of coal tar paint shall be applied. Before painting, all castings shall be thoroughly cleaned and

properly supported. All loose rust shall be removed by wire brushing. Castings shall not be handled until the paint is dry and hard.

6-5 Drawings and Data

Drawings and data covering precast concrete sections shall be submitted to the Contractor and shall be available for review by the District Representative.

SUBSECTION 7

**PRESSURE AND LEAKAGE TESTS AND DISINFECTION OF
WATERLINES**

TABLE OF CONTENTS

	<u>Page</u>
Subsection 7 – Pressure and Leakage Tests and Disinfection of Waterlines.....	1
7-1 General Requirements.....	1
7-2 Test Sections.....	1
7-3 Filling and Venting.....	1
7-4 Test Equipment and Facilities.....	1
7-5 Pressure and Leakage Test.....	2
7-6 Disinfection.....	3

SUBSECTION 7

PRESSURE AND LEAKAGE TESTS AND DISINFECTION OF WATERLINES

7-1 General Requirements

All waterlines shall be subjected to pressure and leakage tests as specified herein and as directed by the District Representative.

The required pressure and leakage tests shall be made after all pipe laying and backfilling work has been completed. All concrete reaction blocks and bracing or restraining facilities shall be in place at least 48 hours before the initial filling of the line.

7-2 Test Sections

The pressure and leakage tests may be applied to the entire line and end plugs. The Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from defective material or workmanship.

7-3 Filling and Venting

The section of line to be tested shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

7-4 Test Equipment and Facilities

The Contractor shall perform the necessary work to fill the pipeline with test water, as specified. The Contractor shall furnish all pumping equipment, water meter, pressure gauge, and other equipment, materials, and facilities required for the tests.

Test pressures shall be applied by means of a force pump of such design and capacity that the required pressure can be applied and maintained without interruption for the duration of each test.

The water meter and pressure gauge shall be accurately calibrated and shall be subject to the approval of the District Representative.

7-5 Pressure and Leakage Test

The low point in the pipeline for each test section shall be subjected to a test pressure of 200 psi.

After the section of the line to be tested has been filled with water, the specified test pressure shall be applied and maintained for a period of not less than two hours and for whatever longer period as may be necessary for the District Representative to complete the inspection of the line under test or for the Contractor to locate any and all defective joints and pipeline materials. If repairs are needed, such repair shall be made, the line refilled, and the test pressure applied as before; this operation shall be repeated until the line and all parts thereof withstand the test pressure in a satisfactory manner.

The line shall further be subjected to a leakage test under a hydrostatic pressure of 200 psi. The pressure shall be maintained constant (within a maximum variation, plus or minus, of 5 percent) during the entire time that line leakage measurements are being made so that the allowable leakage rate may be determined accurately from the leakage rate formula.

Leakage testing shall not be started until a constant test pressure has been established. Compression of air trapped in unvented pipes or fittings will give false leakage readings under changing pressure conditions. After the test pressure has been established and stabilized, the line leakage shall be measured by means of a water meter installed on the line side of the force pump.

Line leakage is defined as the total amount of water introduced into the line as measured by the meter during the leakage test. The pipeline, or tested section thereof, will not be accepted if and while it has a leakage rate in excess of that rate determined by the following formula:

$$L = 0.00025NDP$$

In which:

L = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

N = Number of gasketed joints (two for each asbestos-cement coupling and mechanically coupled joint) in the line under test.

D = Nominal internal diameter (in inches) of the pipe in the line.

P = The square root of the actual pressure, in psig, on the lowest joint in the tested portion of the line.

If the line or section under test contains pipe joints of more than one type, the allowable leakage from all joints of each type shall be calculated separately and then added to obtain the total allowable leakage from the entire section of line.

Where the leakage test shows a leakage rate in excess of the permissible maximum, the Contractor shall make all necessary surveys in connection with the location and repair of leaking joints to the extent required to reduce the total leakage to an acceptable amount.

All joints in piping shall be watertight and free from visible leaks during the prescribed tests. Each and every leak which may be discovered at any time prior to the expiration of two years from and after the date of acceptance of the work by the District shall be located and repaired by and at the expense of the Contractor, regardless of any amount that the total line leakage rate during the specified leakage test may be below the specified maximum rate.

7-6 Disinfection

All waterlines shall be thoroughly disinfected after installation in accordance with the requirements of AWWA C651, as modified herein, and the local health authority having jurisdiction. The chlorinating agent shall be approved by the District Representative.

The chlorination of the pipeline shall be done prior to hydrostatic testing. The pipe shall be free of debris and cleaned to the satisfaction of the District Representative prior to disinfection.

After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24-hour period, the water in the pipeline shall be tested by the District Representative or the local health authority or their designated representative to ensure a residual chlorine content of not less than 25 mg/l. If the chlorine residual is less than the 25 mg/l specified, the line shall be rechlorinated by the continuous – feed or slug method of chlorination, and retested. Then the pipeline shall 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. If there is any question that the chlorinated water will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to thoroughly neutralize the chlorine residual remaining in the water. All measures will be taken to prevent flushing of mains into the ditch line. If water is flushed into the ditch line, all material will be dug out, backfilled, and compacted with dry material.

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 bacteriological sampling will be done by the District Representative or local health authority or their designated representative.

SUBSECTION 8
WATER METERS AND SERVICE LINES
TABLE OF CONTENTS

	<u>Page</u>
Subsection 8 – Water Meters and Service Lines.....	1
8-1 General Requirements.....	1
8-2 General.....	1
8-3 Location and Size.....	1
8-4 Installation of Service Line.....	2
8-5 Service Connections.....	3
8-6 Acceptance.....	3

SUBSECTION 8

WATER METERS AND SERVICE LINES

8-1 Scope

This subsection covers installation of water meters and water service lines within the District. Material specifications for pipe are covered in Subsection 4; material specifications for valves are covered in Subsection 5; and material specifications for vaults are covered in Subsection 6. Appendix A contains details taken from the Engineering Standards of the Board of Water Commissioners, Denver, Colorado and the City of Colorado Springs Water Resources Department, which cover the installation of water meters and service lines. All references to "District" or "Water Department" shall mean the Triview Metropolitan District and its District Representative. The details included in Appendix A shall govern the installation of water meters and service lines, except as modified herein.

8-2 General

All water meters used in the District shall be purchased from the District and installed by the Contractor except for the 3/4-inch meters in Triview which are installed by Triview. The District Representative shall install remote read units and inspect all water meter installations and all remote read units (if required), upon 48 hours advance notice. A Badger Model 25 Meter with an Orion remote read unit will be provided. If the meter is shown to be accurate within plus or minus 3 percent, it is considered to be within an acceptable accuracy range.

If a residential customer has reason to believe that the meter and/or remote read unit are not functioning properly, the District will remove, test, and replace the equipment as required. If the residential meter is found to be within an acceptable accuracy range (within plus or minus 3 percent), the equipment is considered to be accurate, and the cost of any subsequent retests within one year of the first test will be charged to the customer if the retest shows the equipment to be accurate within plus or minus 3 percent.

8-3 Location and Size

Water meters shall be the same size as the service line from the main to the meter. Minimum meter size is 3/4-inch. All meters one inch and smaller for residential applications shall be installed inside the house, in a basement, in accordance with the standard details included in this manual. Inside meter settings will not be allowed in crawl spaces or similar inaccessible locations. The

District Representative shall make the final decision regarding location of the meter after consultation with the Contractor and customer.

Meters inside structures shall be set in a horizontal position such that there is adequate room for installation, inspection and maintenance of the meter, and such that the meter is easily accessible. The top of the meter shall be not more than 54 inches above the floor and the front of the meter not more than 18 inches from the wall through which the service line enters the building.

Meters one inch or larger may be set outside in meter pits or vaults, in accordance with the standard details included in this manual, and shall be located as directed by the District Representative.

Backflow prevention devices must be installed in an easily accessible area for testing and maintenance. Provisions must be made for discharges of water from these devices.

8-4 Installation of Service Line

The service line shall be installed as shown on Details 8, 9, 10, 11, 12 and 36 included in Appendix A and in accordance with AWWA C-800. Customers shall make a request for water service to the District 48 hours in advance of tapping the water main. Main shall be tapped with an approved tapping saddle and the service line connected to the tapping saddle with an approved corporation stop and polyethylene pipe fittings. Service lines shall be laid with a minimum of 5 feet of cover. Water service lines may be placed in a common trench with sewer service (refer to Subsection 2-3.E.). Couplings between curb stop and building will not be permitted unless they are transition couplings between polyethylene pipe and copper tubing. Refer to Detail 8 for curb stop location. Curb stops shall not be placed in driveways. If placement of the curb stop within the driveway is determined to be unavailable, a request can be made to TMD for a waiver of this requirement. If the waiver is granted, allowing the curb stop to be installed in the driveway, provide a 4 ft by 4ft cut-out in the driveway slab, and isolate this cut-out from the driveway concrete with expansion joint material. The tap and service line shall be left uncovered until inspected by the District Representative. The service line shall be furnished and installed complete with curb stop, meter yoke, valves, meter pit or vault, and all other appurtenances required for the type of installation required. All meters one inch or larger shall be installed with a valved meter bypass, couplings adjacent to the water meter, and either check valves or backflow preventers in the service and bypass lines (see Detail 12). Tapping saddles or tapping sleeves shall be used on all service connections 2" and smaller. Use fittings and pipe as specified in subsection 5. Any polyethylene pipe passing under a foundation shall be protected with a schedule 40 sleeve.

8-5 Service Connections

All service connections shall meet the criteria outlined above and in the State Cross Connection Control Manual to ensure the safety of District's water supply.

8-6 Acceptance

All meter pit or vault installations and service line installations shall be inspected by the District Representative after completion of the work but prior to backfilling. Inside meter settings shall be inspected at the time of meter installation. Any installation not complying with these standards shall be made to conform prior to acceptance by the District. No water meter will be set until the installation is deemed acceptable. All premises will be inspected to ensure necessary backflow prevention devices are installed at all cross connections.

SUBSECTION 9
CONCRETE AND GROUTING
TABLE OF CONTENTS

	<u>Page</u>
Subsection 9 – Concrete and Grouting.....	1
9-1 Scope.....	1
9-2 Materials.....	1
9-3 Preliminary Review.....	2
9-4 Limiting Requirements.....	2
9-5 Storage of Materials.....	3
9-6 Batching and Mixing.....	4
9-7 Placement.....	4
9-8 Reinforcement.....	4
9-9 Forms.....	5
9-10 Finishing.....	5
9-11 Curing.....	6
9-12 Repairing Defective Concrete.....	6
9-13 Nonshrinking Grout.....	7

SUBSECTION 9

CONCRETE AND GROUTING

9-1 Scope

This chapter covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work. All concrete furnished hereunder shall be air-entraining. This chapter also covers grouting as indicated on the Details. Unless otherwise specified, all grouting shall be done with nonshrink grout.

9-2 Materials

Cement	ASTM C150, Type II
Fine Aggregate	Clean natural sand, ASTM C33.
Coarse Aggregate	Crushed rock, washed gravel, or other inert granular material conforming to ASTM C33.
Nonshrinking Grout	Master Builders "Masterflow LL-713 Grout", Sauereisen Cements "F-100 Level Fill Grout", U.S. Grout "Five Star Grout", or USM "Upcon".
Water	Clean and free from deleterious substances.
Air-Entraining Agent	ASTM C260.
Reinforcing Steel Bars	ASTM A615 (and Supplement S1), deformed, Grade 60.
Welded Wire Fabric	ASTM A185 or A497.
Bar Supports	CRSI Class C, plastic protected, or Class E, stainless steel protected.
Forms Plywood	PS1, waterproof, resin-bonded, exterior type, Douglas fir.

Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
Form Oil	Light colored paraffin oil or other acceptable nonstaining material.
Polyethylene Film	PS17; 6 mil.
Membrane Curing Compound	Fed Spec TT-C-800, Type I, Class 1; min 18 percent solids; nonyellowing; unit moisture loss 0.039 gm/cm ² max; Gifford-Hill "Sealco 800", ProSoCo "Kure and Seal", Protex "Acrychlor", or Sonneborn "Kure-N-Seal".

9-3 Preliminary Review

The source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the Contractor for review and shall be available for review by the District Representative before any concrete is placed.

9-4 Limiting Requirements

Unless otherwise specified, concrete shall be controlled within the following limiting requirements.

- A. Minimum Cement Factors. The quantity of portland cement, expressed in pounds per cubic yard, shall not be less than that shown in the following table:

<u>Concrete Slump (in.)</u>	Coarse Aggregate Size		
	From No. 4 Sieve to		
	<u>1/2"</u>	<u>3/4"</u>	<u>1"</u>
2	639	602	573
3	658	620	592
4	677	639	611
5	696	658	630
6	714	677	649

- B. Aggregates. The maximum total combined aggregate weight and the maximum fine aggregate weight in pounds per hundred pounds of cement shall be as follows:

<u>Concrete Slump (in.)</u>	<u>Maximum Total Aggregate Coarse Aggregate Size</u>			<u>Maximum Fine Aggregate</u>
	<u>1/2"</u>	<u>3/4"</u>	<u>1"</u>	
2	457	500	537	229
3	436	479	511	218
4	415	457	489	207
5	394	436	468	202
6	372	415	447	191

Note: The weights stipulated above are maximum and not authorized weights. Actual weights used shall be those necessary to produce concrete of the proper consistency.

- C. Total Water Content. Total water content of concrete shall not exceed 6.5 gallons of water per hundred pounds of cement in the mix.
- D. Slump. Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by the Engineer, slump shall not exceed 4 inches.
- E. Total Air Content. The total volumetric air content of concrete after placement shall be 6 percent plus or minus one percent.
- F. Strength. The minimum acceptable compressive strengths as determined by ASTM C39 for Cast In-place Concrete and ASTM C478 for Pre-cast Concrete shall be:

<u>Age (days)</u>	<u>Minimum Strength (psi)</u>	
	<u>Pre-cast Concrete</u>	<u>Cast In-Place</u>
7	2,800	2,100
28	4,000	3,000

9-5 Storage of Materials

Cement shall be stored in suitable moistureproof enclosures. Cement which has become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of on-site aggregate piles in contact with the ground shall not be used.

Reinforcing steel shall be carefully handled and shall be stored on supports which will keep the steel from contact with the ground.

9-6 Batching and Mixing

Concrete shall be furnished by an acceptable ready-mixed concrete supplier and shall conform to ASTM C94.

- A. Consistency. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall float uniformly throughout the mass and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.
- B. Delivery Tickets. A delivery ticket shall be prepared for each load of ready-mixed concrete. A copy of each ticket shall be handed to the Contractor by the truck operator at the time of delivery. Delivery tickets shall be available for review by the District Representative. Tickets shall show the quantity delivered, the amount of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

9-7 Placement

Concrete shall be conveyed to the point of final deposit by methods which will prevent the separation or loss of ingredients. During and immediately after placement, concrete shall be thoroughly compacted, worked around all reinforcements and embedments, and worked into the corners of the forms. Concrete shall be compacted by immersion-type vibrators, vibrating screeds, or other suitable mechanical compaction equipment.

9-8 Reinforcement

Reinforcements shall be accurately formed and positioned and shall be maintained in proper position while the concrete is being placed and compacted. Unless otherwise indicated on the drawings, the details of fabrication shall conform to ACI 315 and 318. In case of conflict, ACI 318 shall govern. Cover over reinforcement shall adhere to the following: for concrete placed against earth – 3 inches; for concrete placed in forms but exposed to weather, water or earth – 2 inches.

9-9 Forms

Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment.

Forms for pavement, curbs, or gutters shall be made of steel or wood and shall be supported on thoroughly compacted earth. The top face of pavement forms shall not vary from a true plane more than 1/4 inch in 10 feet.

Forms shall be thoroughly cleaned and oiled before concrete is placed.

Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be lapped at least 4 inches.

- A. Form Ties. Form ties shall be of the removable end, permanently embedded body type and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders.
- B. Edges and Corners. Chamfer strips shall be placed in forms to bevel all salient edges and corners except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Unless otherwise noted, bevels shall be 3/4 inch wide.
- C. Form Removal. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

9-10 Finishing

Recesses from form ties shall be filled flush with mortar. Fins and other surface projections shall be removed from all formed surfaces, except exterior surfaces that will be in contact with earth backfill.

Slabs, pavement, curbs, and other unformed surfaces shall be screeded and given an initial float finish followed by additional floating or belting. Unformed surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and

replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface.

Initial floating shall be followed by belting or a second floating at the time of initial set. The belting or second floating shall produce a finish of uniform texture and color. The completed finish for unformed surfaces shall be the finish produced by the belting or second floating.

9-11 Curing

Concrete shall be protected from loss of moisture by water saturation or membrane curing for at least seven days after placement.

Water saturation of concrete surfaces shall begin as quickly as possible after initial set of the concrete. Unformed surfaces shall be covered with polyethylene film, tarpaulins, or sand to retain the water. Water shall be applied as often as necessary to keep the concrete saturated for the entire curing period.

Chlorinated rubber type membrane curing compound may be used in lieu of water curing on concrete which will not be covered later with mortar or additional concrete. Membrane curing compound shall be spray applied at a coverage of not more than 300 square feet per gallon. Unformed surfaces shall be covered with curing compound within 30 minutes after final finishing. If forms are removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surfaces before they dry out. Curing compound shall be suitably protected against abrasion during the curing period.

Concrete shall be protected against freezing for at least seven days after placement.

9-12 Repairing Defective Concrete

Defects in concrete surfaces shall be repaired to the satisfaction of the District Representative. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges square cut to avoid feathering.

Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

9-13 Nonshrinking Grout

Nonshrinking grout shall be furnished factory premixed so only water is added at jobsite. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

- A. Preparation. The concrete foundation to receive nonshrinking grout shall be saturated with water for 24 hours prior to grouting.
- B. Placement. Grout shall be placed in strict accordance with the directions of the manufacturer so all spaces and cavities below the top of baseplates and bedplates are completely filled without voids. Forms shall be provided where structural components of baseplates and bedplates will not confine the grout.
- C. Edge Finishing. The grout shall be finished smooth in all locations where the edge of the grout will be exposed to view after it has reached its initial set.
- D. Curing. Nonshrinking grout shall be protected against rapid loss of moisture by covering with wet rags or polyethylene sheets. After edge finish is completed, the grout shall be wet cured for at least seven days.

ATTACHMENT A

TRIVIEW METROPOLITAN DISTRICT, COLORADO
WATERLINE EXTENSION AND OVERSIZING AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 20____, by and between the TRIVIEW METROPOLITAN DISTRICT BOARD OF TRUSTEES ("District") operating and existing under and by virtue of the laws of the State of Colorado, and _____ ("Developer").

WITNESSETH:

WHEREAS, Developer is the owner of the following described property:

(See Exhibit A, attached hereto and incorporated herein by this reference.)

and it is proposed that said property be served by water distribution facilities constructed pursuant to this Agreement; and

WHEREAS, Developer wishes to construct water distribution facilities to serve said property and connect to the distribution system; and

WHEREAS, the District is not required to enlarge or extend its facilities beyond those currently existing and all such enlargements or extensions are undertaken at the discretion of the District in the interest of the public health, safety, and welfare.

THEREFORE, it is mutually understood and agreed as follows:

1. Water Distribution Facilities. The following water distribution facilities will be designed and constructed in accordance with the most current edition of the District's Water Utility Policies and Standards ("Design Standards"):

Developer: _____

Project: _____

Engineer: _____

2. Warranty. The Developer shall deliver to the District a written warranty in accordance with the requirements of the Design Standards.
3. Transfer of Facilities. After the District has executed this Agreement, ownership and maintenance responsibility for the facilities will transfer from

the Developer to the District. Before such transfer will occur, the Developer shall deliver to the District a good and sufficient bill of sale for the water distribution facilities. The conveyance must state that the facilities so conveyed are free and clear of any claims or liens whatever. The Developer shall also deliver any required easements and said easements must be properly recorded with the El Paso County Recorder prior to submission to the District Manager.

4. Operation and Maintenance of Facilities. After the water distribution facilities have been transferred and subject to the provisions of the warranty, the District shall have full responsibility for operation and maintenance of the facilities and the actual costs incurred in connection therewith. The District agrees to allow connection to the facilities in accordance with the Rules and Regulations of Triview Metropolitan District.
5. Indemnification. The Developer hereby agrees to hold harmless the District, its successors and assigns, against any and all liability, loss, or damage the District may suffer as a result of claims or judgments against it under the mechanics' lien laws of the State of Colorado, or on account of defective materials and workmanship used to install the facilities. Said indemnification shall include, but not be limited to, court costs, damages, repair costs, and reasonable attorney's fees.
6. Enforcement of Contract. The Developer and District acknowledge and agree that this Agreement may be enforced in law or in equity by a decree of specific performance, damages, or such other legal and equitable relief as may be available to either party.
7. Survival of Obligations. The provisions of this Agreement shall be deemed to survive the transfer of the water distribution facilities and shall be binding upon the successors, transferees, and assigns of the parties.
8. Assignments. The Developer shall not assign its rights or delegate its duties under this Agreement without prior written consent by the District.
9. Reimbursement for Oversizing. Where appropriate, the District will reimburse the Developer for costs incurred to install lines greater than 12 inches in diameter. Such reimbursement will only be for that portion of the water line(s) that lies in or along the Developer's property. This means that the District will not reimburse the applicant for oversizing costs to extend the water line(s) across intervening vacant land. Section 1.4-C of the Design Standards details reimbursement and refunding provisions for public water lines extended across intervening vacant land. As specified in Section 1.4-B of the Design Standards, the following method will be used to calculate the amount the District will reimburse to the Developer:

()
(Length) x (Difference in Pipe Cost) x (1.10) = (Amount)

_____ feet of 14-inch x \$ _____/foot x 1.10 = \$ _____

_____ feet of 16-inch x \$ _____/foot x 1.10 = \$ _____

_____ feet of 18-inch x \$ _____/foot x 1.10 = \$ _____

(Number of Valves) x (Difference in Valve Cost) x (1.10) = (Amount)

_____ 14-inch _____ valves x \$ _____/valve x 1.10 = \$ _____

_____ 16-inch _____ valves x \$ _____/valve x 1.10 = \$ _____

_____ 18-inch _____ valves x \$ _____/valve x 1.10 = \$ _____

TOTAL REIMBURSEMENT = \$ _____

()
IN WITNESS WHEREOF, the parties hereby have caused their names and seals to be affixed the day and year first above written.

DEVELOPER:

Name: _____

By: _____

Title: _____

BOARD OF TRUSTEES
TRIVIEW METROPOLITAN DISTRICT,
COLORADO

Name: _____

By: _____

Title: _____

Signed before me this _____ day of _____, 20____.

Notary Public

My commission expires: _____

ATTACHMENT B

PROCEDURES CHECKLIST FOR PUBLIC WATER MAINS

1) Preliminary Submittal

Submittal Number	Date	Approval Status [Approved (A) / Not Approved (N/A)]					
		Water Department	District Engineer	Town Dev. Services	Fire Department	Date	Initials
1							
2							
3							
4							
5							

2) Engineering Feasibility Report

Submittal Number	Date	Approval Status [Approved (A) / Not Approved (N/A)]					
		Water Department	District Engineer	Town Dev. Services	Fire Department	Date	Initials
1							
2							
3							
4							
5							

Note: This document is to be submitted at the same time the detailed submittal is made to the District Manager. In addition, the Draft Line Extension and Oversizing Agreement must be initialed by the District Manager and Developer before the Engineering Feasibility Report will be formally approved.

3) Draft Line Extension and Oversizing Agreement

Submittal Number	Date	Approval Status [Approved (A) / Not Approved (N/A)]					
		Water Department	District Engineer	Town Dev. Services	Fire Department	Date	Initials
1							
2							
3							
4							
5							

4) Contract Documents

Submittal Number	Date	Approval Status [Approved (A) / Not Approved (N/A)]					
		Water Department	District Engineer	Town Dev. Services	Fire Department	Date	Initials
1							
2							
3							
4							
5							

5) Plan Review and Inspection Fees

District

o Date Paid: _____

o Amount: \$ _____

o Name of District Employee Certifying That Payment Was Made:

Town

o Date Paid: _____

o Amount: \$ _____

o Name of Town Employee Certifying That Payment Was Made:

6) Preconstruction Meeting

- o Required _____ Not Required _____
Requirement for Meeting Established by _____
- o Attendees:
Developer _____ Engineer _____ Contractor _____ District _____
Excavator _____ Others _____
- o Date Held: _____

7) Inspection by Utility

- o Inspected by: _____
- o Not Approved: Date: _____
- o Corrected: Date: _____
- o Approved: Date: _____

8) Engineer Certification Letter

- o Date of Certification: _____
- o Name of Registered Professional Engineer: _____
- o Colorado Registration Number: _____

9) Provisional Acceptance Letter

- o Issued by: _____
- o Date: _____

10) Release of Developer's Bond

District

Bond Required and Held by District? Yes _____ No _____

Date District Indicated That Bond Could be Released:

_____ By: _____

Town

Bond Required and Held by Town? Yes _____ No _____

Date Town Indicated That Bond Could be Released:

_____ By: _____

11) As-Built Records

District

Date Submitted to District Manager (one set of mylar sepias, Compact Disk and bluelines): _____

Received by: _____

Town

Date Submitted to Town Development Services (one set of mylar sepias and bluelines): _____

Received by: _____

12) End of Two Year Performance Tests

Date: _____

Inspected by: _____

Route Checked for Settlement and Leakage? Yes _____ No _____

Route Checked for Proper Revegetation? Yes _____ No _____

Vaults Checked for Improper Drainage or Leakage? Yes _____ No _____

Deficiencies Corrected? Yes _____ No _____

Date: _____

13) Final Line Extension and Oversizing Agreement

Submittal Number	Date	Approval Status				Date	Initials
		District		Town			
		Approved	Not Approved	Approved	Not Approved		
1							
2							
3							
4							
5							

14) Oversizing Reimbursement.

- o Are Lines Larger than 12 Inches in Diameter Proposed?

Yes _____ No _____

- o Amount of Reimbursement: \$ _____

- o Date Paid: _____

15) Line Extension Through Intervening Vacant Land.

- o Are Public Water Mains Being Extended Through Intervening Vacant Land?

Yes _____ No _____

- o If Yes, Specify Length and Diameter of All Mains that Extend Through or Along Vacant Property:

Length: _____ feet Diameter: _____ inches

Length: _____ feet Diameter: _____ inches

Length: _____ feet Diameter: _____ inches

ATTACHMENT C

PROCEDURES CHECKLIST FOR SERVICE CONNECTIONS

1. Public Water Main Status

- o Name of Development: _____
- o Address: _____

- o Month/Year Installed: _____
- o Provisional Acceptance Letter Issued? Yes _____ No _____

2. Service Connection Details

Approval Status
Approved(A)/Not Approved (N/A)

Submittal Number	Date	Approved	Not Approved	Date	Initials
1					
2					
3					
4					

3. Plan Review and Inspection Fees

- o Date Paid: _____
- o Amount: \$ _____
- o Name of District Employee Certifying That Payment Was Made:

4. Plant Investment Fees (PIF's)

- o Number of Buildings:

Commercial: _____ Residential: _____

- o Number of Equivalent Fixture Units Per Building:

Commercial: _____ Residential: _____

- o PIF Tap Size:

Commercial: _____ Residential: _____

- o Current PIF Charge: \$ _____ per _____ PIF Tap Size

- o Total PIF for the Building(s) Associated with This Service

Connection Application: \$ _____ (If building units are not identical, attach calculations for each type of structure.)

- o Date Paid: _____ Received by: _____

5. Inspection by Utility

- o Inspected by: _____

- o Not Approved: Date: _____

- o Corrected: Date: _____

- o Approved: Date: _____

6. As-Built Records

- o Final Drawing of Actual Installation: Date: _____

- o Received by: _____

7. Approval to Issue Certificates of Occupancy (CO's)

- o Service Connection Details Approved? Yes _____ No _____
- o Backflow Prevention Device Approved? Yes _____ No _____
- o PIF's Paid? Yes _____ No _____
- o Date Utility Informed District That CO's Could be Issued: _____

By: _____

ATTACHMENT D

PLAN REVIEW CHECKLIST FOR PUBLIC WATER MAINS

Project Name: _____

Developer: _____ Engineer: _____

Review By: _____ Date: _____

<u>Item</u>	<u>Specification Subsection</u>	<u>Acceptable</u>	<u>Unacceptable</u>	<u>Comments</u>
○ Conformance with Master Plan	2-1	()	()	
○ Vertical and Horizontal Alignment	2-3	()	()	
○ Protection of Water Supplies	2-4	()	()	
○ Identification	2-5	()	()	
○ Stream Crossings	2-6	()	()	
○ Cover	3-14.1	()	()	
○ Pipe Materials	4-1	()	()	
○ Restrained Joints	2-2	()	()	
○ Reaction Blocking	2-2, Detail 13	()	()	
○ Polyethylene Wrap	4-2.Q, Detail 23	()	()	
○ Valves and Hydrants	5, Detail 7	()	()	
○ Test Pressure	7-5	()	()	
○ Leak Test	7-6	()	()	

Additional Comments:

ATTACHMENT E

PLAN REVIEW CHECKLIST FOR SERVICE CONNECTIONS

Project Name: _____

Service Connection
Location (Address): _____

Review By: _____ Date: _____

<u>Item</u>	<u>Specification Subsection</u>	<u>Acceptable</u>	<u>Unacceptable</u>	<u>Comments</u>
Pipe Material	4-4.C.3	()	()	
Main Tap Detail	8-4; Details 8-12, 36	()	()	
Embedment Material	3-13	()	()	
Alignment of Service Line	2-3.E, 8-4; Details 8-12, 36	()	()	

Additional Comments:

ATTACHMENT F

INSPECTION AND TESTING CHECKLIST

Project Name: _____

Developer: _____ Engineer: _____

Contractor: _____

Date Construction Began: _____

Date Construction Complete: _____

<u>Work Classification</u>	<u>Specification Subsection</u>	<u>Acceptable</u>	<u>Unacceptable</u>	<u>Comments</u>
<u>Excavation and Trenching (Refer to Subsection 3 of Design Standards and Specifications for Water Main Construction)</u>				
Excavation	3-2, 3-14	()	()	
Topsoil	3-14.A	()	()	
Dewatering	3-8	()	()	
Subgrade Stabilization	3-13.D 3-14.B.7	()	()	
Pipe Embedment	3-13, 3-17	()	()	
Gradation		()	()	
Bedding Class		()	()	
Compaction	3-18, 3-19, 3-20	()	()	
Moisture Content		()	()	
Compactive Effort		()	()	
Groundwater Barriers	3-13.C, 3-17.D	()	()	
Soil Characteristics		()	()	
Frequency		()	()	
Tunnel Excavation	3-15	()	()	

Material Gauge or Thickness		()	()
Material Composition of Coating		()	()
Alignment and Grade		()	()
Grouting		()	()
Paved Invert		()	()
Stabilized Sand		()	()
End Closures		()	()
Resodding	3-18.D	()	()
Sod Condition		()	()
Soil Preparation		()	()
Reseeding	3-18.E to 3-18.G	()	()
Mixture		()	()
Seeding Procedure		()	()
Traffic Control	3-22	()	()
Barricades and Lights	3-24	()	()

Pipe Installation

(Refer to Subsections 4 and 5 of Design Standards and Specifications for Water Line Construction)

Materials	4-1	()	()
Ductile Iron Pipe	4-2	()	()
PVC Pipe	4-3	()	()
Handling	4-2.D, 4-3.F	()	()

Loading and Unloading		()	()
Storage		()	()
Overall Pipe Condition		()	()
Alignment	4-2.H, 4-3.H.2	()	()
Method of Maintaining		()	()
Proper Alignment		()	()
Laying Pipe	4-2.I, 4-3.H	()	()
Trench Conditions		()	()
Trench Widths		()	()
Bell Holes		()	()
Bedding Procedures		()	()
Grade Check		()	()
Polyethylene Wrap	4-2.K, 4-3.K	()	()
Jointing	4-2.J, 4-3.J	()	()
Concrete Encasement	4-2.N; 4-3.N	()	()
Reinforcing Steel		()	()
Concrete Cover		()	()
Reaction Anchoring and Blocking	4-2.V, 4-3.O	()	()

Testing and Disinfection

(Refer to Subsection 7 of Design Standards and Specifications for Waterline Construction)

Pressure and 7-5,

Leakage Testing 7-6 () ()

Disinfection 7-7 () ()

Concrete and Grouting

(Refer to Subsection 9 of Design Standards and Specifications for Waterline Construction)

Materials 9-2 () ()

 Cement Type () ()

 Reinforcing
 Steel Grade () ()

 Forms () ()

Reinforcement 9-8 () ()

 Alignment () ()

 Position
 (concrete
 cover) () ()

Finishing 9-10 () ()

Curing 9-11 () ()

Additional Comments:

ATTACHMENT F

**INSPECTION AND TESTING CHECKLIST
(Service Connections Only)**

Applicant Name: _____

Service Connection
Location (Address): _____

Contractor: _____ Inspector: _____

Date Construction Began: _____ Date Construction Complete: _____

<u>Item</u>	<u>Specification Subsection</u>	<u>Acceptable</u>	<u>Unacceptable</u>	<u>Comments</u>
Plan Review and Inspection Fees Paid	1-2.C	()	()	
Plant Investment Fees Paid	1-2.A	()	()	
Pipe Material	4-4.C	()	()	
Tapping Saddles/ Fittings	4-3.D	()	()	
Excavation and Bedding	3-14, 3-13	()	()	
Tapping of Main	8-4, Appendix A	() ()	() ()	
Service Line Alignment	2-3.E, 8-4, Appendix A	()	()	
Backfill/ Compaction	3-18, 3-19, 3-20	()	()	

Additional Comments:

()

ATTACHMENT G

WEEKLY INSPECTION AND TESTING REPORT

Project Name: _____

Developer: _____

Engineer: _____

Contractor: _____

This report covers week from _____ to _____

Inspector: _____

Work covered this report:

Date Construction Began: _____

Date Construction Complete: _____

Acceptable: _____ Unacceptable: _____

Date Testing Began: _____

Signed: _____

(Inspector Triview Metropolitan District)

Date Testing Complete: _____

<u>Work Classification</u>	<u>Specification Subsection</u>	<u>Acceptable</u>	<u>Unacceptable</u>	<u>Comments</u>
----------------------------	---------------------------------	-------------------	---------------------	-----------------

Excavation and Trenching

(Refer to Subsection 3 of Design Standards and Specifications for Water Main Construction)

Excavation	3-2, 3-14	()	()	
------------	-----------	-----	-----	--

Topsoil	3-14.A	()	()	
---------	--------	-----	-----	--

Dewatering	3-8	()	()	
------------	-----	-----	-----	--

Subgrade Stabilization	3-13.D, 3-14.B.7	()	()	
------------------------	---------------------	-----	-----	--

Pipe Embedment	3-13, 3-17	()	()	
----------------	------------	-----	-----	--

Gradation		()	()	
-----------	--	-----	-----	--

Bedding Class		()	()	
---------------	--	-----	-----	--

Compaction	3-18, 3-19, 3-20	()	()
Moisture Content		()	()
Compactive Effort		()	()
Groundwater Barriers	3-13.C 3-17.D	()	()
Soil Characteristics		()	()
Frequency		()	()
Tunnel Excavation	3-15	()	()
Material Gauge or Thickness		()	()
Material Composition of Coating		()	()
Alignment and Grade		()	()
Grouting		()	()
Paved Invert		()	()
Stabilized Sand		()	()
End Closures		()	()
Resodding	3-18.D	()	()
Sod Condition		()	()
Soil Preparation		()	()
Reseeding	3-18.E to 3-18.G	()	()
Mixture		()	()
Seeding Procedure		()	()
Traffic Control	3-22	()	()
Barricades and			

Lights 3-24 () ()

Pipe Installation

(Refer to Subsection 4 and 5 of Design Standards and Specifications for Waterline Construction)

Materials 4-1 () ()

Ductile Iron Pipe 4-2 () ()

PVC Pipe 4-3 () ()

Handling 4-2.D, 4-3.F () ()

Loading and Unloading () ()

Storage () ()

Overall Pipe Condition () ()

Alignment 4-2.H, 4-3.H.2 () ()

Method of Maintaining () ()

Proper Alignment () ()

Laying Pipe 4-2.I, 4-3.H () ()

Trench Conditions () ()

Trench Widths () ()

Bell Holes () ()

Bedding Procedures () ()

Grade Check () ()

Polyethylene Wrap 4-2.K, 4-3.K () ()

Jointing 4-2.J, 4-3.J () ()

Concrete 4-2.N () ()

Encasement	4-3.N	()	()
Reinforcing Steel		()	()
Concrete Cover		()	()
Reaction Anchoring and Blocking	4-2.V, 4-3.O	()	()

Testing and Disinfection

(Refer to Subsection 7 of Design Standards and Specifications for Waterline Construction)

Pressure and Leakage Testing	7-5, 7-6	()	()
Disinfection	7-7	()	()

Concrete and Grouting

(Refer to Subsection 9 of Design Standards and Specifications for Waterline Construction)

Materials	9-2	()	()
Cement Type		()	()
Reinforcing Steel Grade		()	()
Forms		()	()
Reinforcement	9-8	()	()
Alignment		()	()
Position (concrete cover)		()	()
Finishing	9-10	()	()
Curing	9-11	()	()

Additional Comments: _____

()

ATTACHMENT G

**WEEKLY INSPECTION AND TESTING REPORT
(Service Connections Only)**

Applicant Name: _____

Service Connection
Location (Address): _____

Contractor: _____

Inspector: _____

Date Construction Began: _____

Date Construction Complete: _____

<u>Item</u>	<u>Specification Subsection</u>	<u>Acceptable</u>	<u>Unacceptable</u>	<u>Comments</u>
Plan Review and Inspection Fees Paid	1-2.C	()	()	
Plant Investment Fees Paid	1-2.A	()	()	
Pipe Material	4-4.C	()	()	
Tapping Saddles/ Fittings	4-3.D	()	()	
Excavation and Bedding	3-14, 3-13	()	()	
Tapping of Main	8-4, Appendix A	()	()	
Service Line Alignment	2-3.E, 8-4, Appendix A	()	()	
Backfill/ Compaction	3-18, 3-19, 3-20	()	()	

()

()
Additional Comments: _____

Distribution: Developer _____ Engineer _____ Contractor _____
Project File _____ District Manager _____ Inspector _____

Distribution made by: _____



TRIVIEW METROPOLITAN DISTRICT

174 N. Washington Street Suite C
P.O. Box 849
Monument, CO 80132-0849
(719) 488-6868 Fax: (719) 488-6565

ATTACHMENT H

HYDRANT METER RELEASE FORM:

COMPANY NAME: _____
BILLING ADDRESS: _____
STREET ADDRESS (IF DIFFERENT): _____
CITY/STATE/ZIP: _____
TELEPHONE NO: _____ FAX NO: _____
PROJECT NAME: _____
NAME OF PERSON OBTAINING METER: _____

DEPOSIT: \$3,000
DEPOSIT CHECK: YES: CHECK NUMBER: _____ OTHER: _____

METER NUMBER: _____
DATE CHECKED OUT: _____ DATE CHECKED IN: _____
METER READING (OUT): _____ METER READING (IN): _____
ESTIMATE OF WATER USAGE: _____ ESTIMATE OF TIME INVOLVED: _____
WATER USAGE RATE: \$7.25 PER 1,000 GALLONS
WATER USAGE : _____ @ \$7.25 = \$ _____ FOR WATER
TOTAL CHARGES DUE: \$ _____ DATE BILLED: _____ DATE RECEIVED: _____

CUSTOMER
SIGNATURE : _____ DATE: _____

APPROVED FOR
TMD BY: _____ DATE: _____



TRIVIEW METROPOLITAN DISTRICT

174 N. Washington Street Suite C
P.O. Box 849
Monument, CO 80132-0849
(719) 488-6868 Fax: (719) 488-6565

ATTACHMENT H

HYDRANT METER RELEASE FORM:

COMPANY NAME: _____

BILLING ADDRESS: _____

STREET ADDRESS (IF DIFFERENT): _____

CITY/STATE/ZIP: _____

TELEPHONE NO: _____

FAX NO: _____

NAME OF PERSON OBTAINING METER: _____

DEPOSIT: \$3,000

DEPOSIT CHECK: YES: CHECK NUMBER: _____

OTHER: _____

METER NUMBER: _____

DATE CHECKED OUT: _____

DATE CHECKED IN: _____

METER READING (OUT): _____

METER READING (IN): _____

ESTIMATE OF WATER USAGE: _____

ESTIMATE OF TIME INVOLVED: _____

WATER USAGE RATE: \$3.50 PER 1,000 GALLONS

WATER USAGE : _____

@ \$3.50

= \$ _____

FOR WATER

TOTAL CHARGES DUE: \$ _____

DATE BILLED: _____

DATE RECEIVED: _____

CUSTOMER

SIGNATURE : _____

DATE: _____

APPROVED FOR

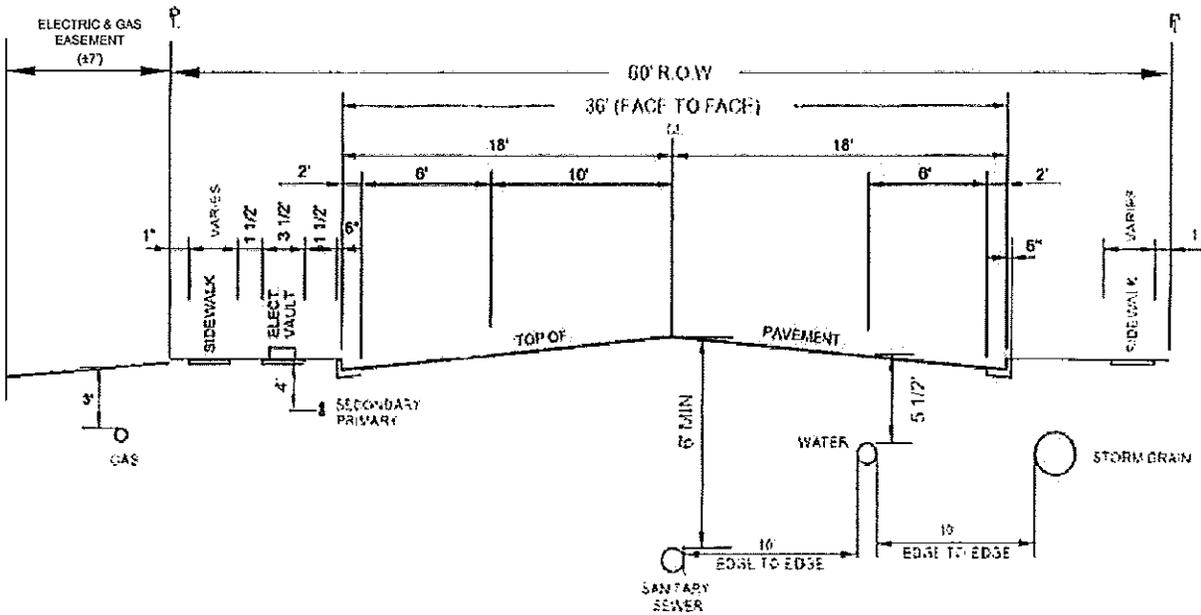
TMD BY: _____

DATE: _____

Appendix A
Water Utility Details

Table of Contents

1	Typical Utilities Locations
2	Typical Trench Section Pipe Protection
3	Clamp Details & Dimensions for use with CI & DI Fittings Only
4	Blowoff/Flush Assembly 6-inch & 8-inch Permanent Mains
4a	Temporary Blowoff Assemblies 6-inch & 8-inch Mains
4b	Blowoff Assembly Dimension Data 12-inch & Larger Mains
4c	Temporary & Permanent Blowoff Assemblies, 12-inch & Larger Mains
4d	Protecting Tie-Rods
5	Tie Rod and Washer Details
6	Copper Tracer Wire on PVC Pipe
7	Plan, Profile & Locations for Fire Hydrants, Mains & Valves
8	Service Line, Stop Box & Inside Installation for ¾-inch & 1-inch Meters
9	Typical Inside Setting for ¾-inch & 1-inch Meter with AMR
10	Inside Setting for 1 ½-inch & 2-inch Meter with Check Valve & Bypass
11	Outside Setting for ¾-inch & 1-inch Meter
12	Outside Setting for 1 ½" & 2" Meters with Check Valve & Bypass in Manhole
13	Thrust Block Data
14	Flange-Lug Detail
15	Maximum Pipeline Deflection Data for DI and PVC Pipes
16	Mechanical Joint Restraint Detail
17	Joint Restraint Detail
18	Reverse Anchor Detail
18a	Reverse Anchor Detail with Mechanical Joint Restraint
19	Pipe Encasement Detail
20	Crossing Storm and Sanitary Sewers
21	Pipe Bridging Detail
22	Typical Cutoff Wall or Ditch for Canal Crossing
23	Polyethylene Wrap
24	Reference Post Typical Detail
25	Length of Restrained Pipe
26	Valve Installation and Location
27	Valve Box Installation
28	Valve Box Top and Bottom Sections
29	Bore Casing Detail
30	Water Line Lowering Detail
30a	Lowering Detail with Mechanical Joint Restraint Fittings and Restraint Joint Pipe
31	6", 8" & 12" Pressure Regulator Station
32	6", 8" & 12" Pressure Regulator Station
32a	6" & 8" Size Pressure Regulator Station
32b	Pressure Regulator Station for 6", 8" & 12" Pipe
33	2-inch Air and Vacuum Valve Station
34	Standard Precast Concrete Vault for Valve Installation
35	Standard Cast-in-place Concrete Vault for Valve Installation
36	Standard Round Precast Vault for 1 ½-inch and 2-inch Meters
37	Compound Meters and Orion Radio RF System Details
38	Meter Details
39	Bonding Joint and Anode Installation



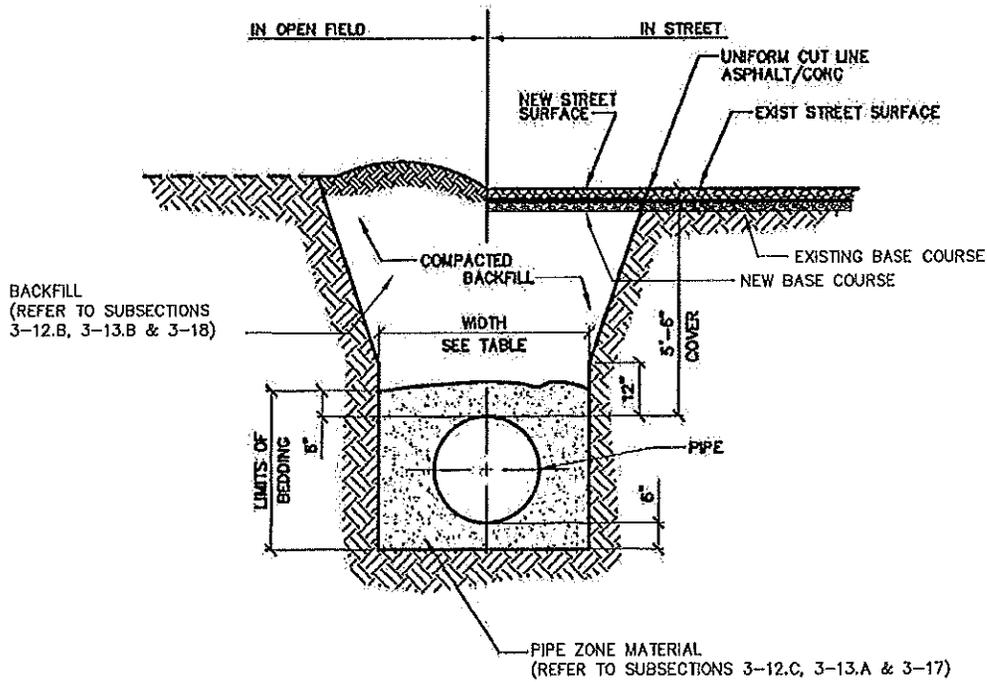
TYPICAL CROSS SECTION
UTILITIES LOCATION
 60' R.O.W. COLLECTOR STREETS

NOTES:

1. STORM DRAINS AND SANITARY SEWERS SHALL MAINTAIN A 10' HORIZONTAL SEPARATION FROM WATER LINES (EDGE TO EDGE). REFER TO SUBSECTION 2-3.A.
2. ELECTRIC CONDUITS SHALL BE ON THE OPPOSITE SIDE OF THE STREET FROM WATER LINE.
3. ALTERNATIVE LOCATION FOR ELECTRIC SHALL BE WITHIN +/- 7 FT EASEMENT.



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TYPICAL TRENCH SECTION

NOTES:

1. PAVING SURFACE SHALL COMPLY WITH PAVEMENT SECTION 6.
2. TRENCH WALLS TO BE SUPPORTED AS REQUIRED BY OSHA-SUBPART P.
3. MINIMUM COVER TO BE BELOW OFFICAL STREET GRADE (SEE DETAIL 1).

PIPE #	MIN WIDTH	MAX WIDTH
4"	1'-4"	2'-4"
6"	1'-6"	2'-6"
8"	1'-8"	2'-8"
12"	2'-0"	3'-0"
18"	2'-4"	3'-4"
20"	2'-8"	3'-8"
24"	4'-0"	6'-0"



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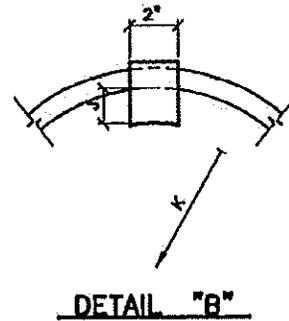
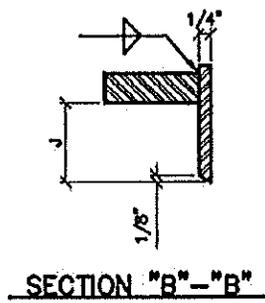
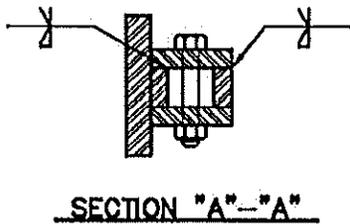
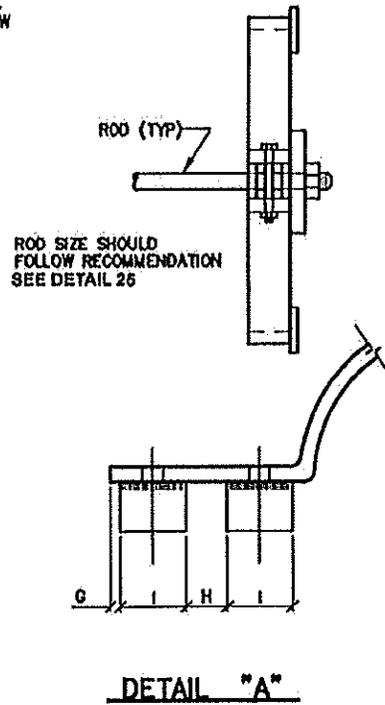
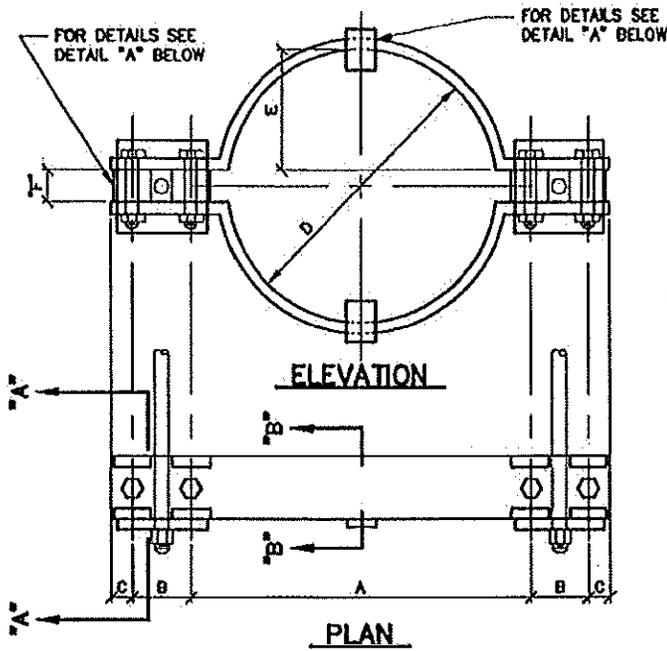
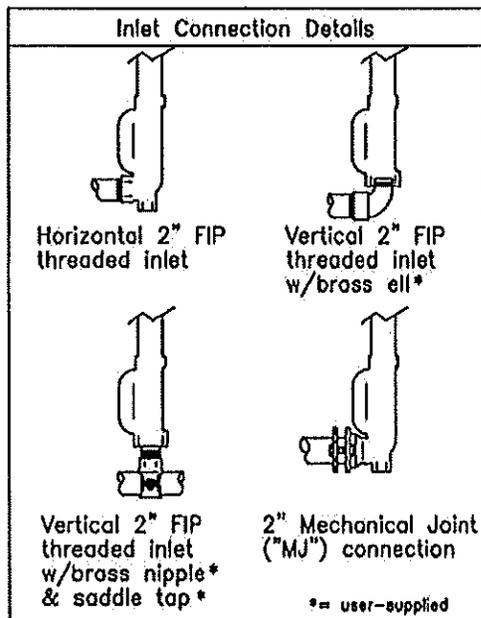


TABLE OF DIMENSIONS FOR CLAMPS																										
CL. NO.	BAR SIZE	A		B		G		D		E		F		G		H		I		J		K		BOLT SIZE		CL. NO.
		BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	
4	1 1/2 x 1/2	9	7 3/8	3	4	1 1/2	1 1/2	6 1/4	4 3/4	2 5/8	1 7/8			3/8	3/8	1 1/4	1 1/4	2 1/4	2 1/2	5/8	2 1/2	3x 1 1/2	2 1/2x 3/8	4		
6	2 x 1/2	11 1/4	9 5/8	3	4	1 1/2	1 1/2	8 1/2	6 7/8	3 5/4	2 15/16							2 1/4	2 1/2	1/2	5 3/4	3 1/2x 1/2	3 1/2x 1/2	6		
8	2 1/2 x 1/2	13 5/8	11 7/8	3 1/2	4	1 1/2	1 1/2	10 3/4	9 1/8	4 7/8	4 1/8							2 1/4	2 1/2	5/8	4 3/4	4 1/2x 1/2	4x 1/2	8		
12	2 1/2 x 5/8	18 1/4	16 3/8	3 1/2	4	1 1/2	1 1/2	15 1/8	13 1/4	7 1/8	6 1/8							2 1/4	2 1/2	13/16	6 3/4	4 1/2x 5/8	4 1/2x 5/8	12		
18	3x 3/4	23 1/8	20 5/8	4	4 1/2	1 1/2	1 1/2	19 3/4	17 3/8	9 1/4	8 1/8	1 1/4	1 1/4	1/4	1/4	1 1/2	1 1/2	2 1/4	2 3/4	15/16	8 15/16	5 1/2x 5/8	5 1/2x 5/8	18		
20	3x 3/4	27 1/2	25	4	4 1/2	1 1/2	1 1/2	24 1/8	21 5/8	11 5/16	10 1/16	1 1/2	1 1/2	3/8	3/8	1 3/4	1 3/4	2 1/4	2 1/2	1	11 1/16	5 1/2x 5/8	5 1/2x 5/8	20		
24		RODS AND CLAMPS NOT ALLOWED.																				24				

- NOTES:
1. ALL DIMENSIONS IN INCHES.
 2. NOT FOR USE WITH 18-INCH & 20-INCH DI COMPACT FITTINGS.

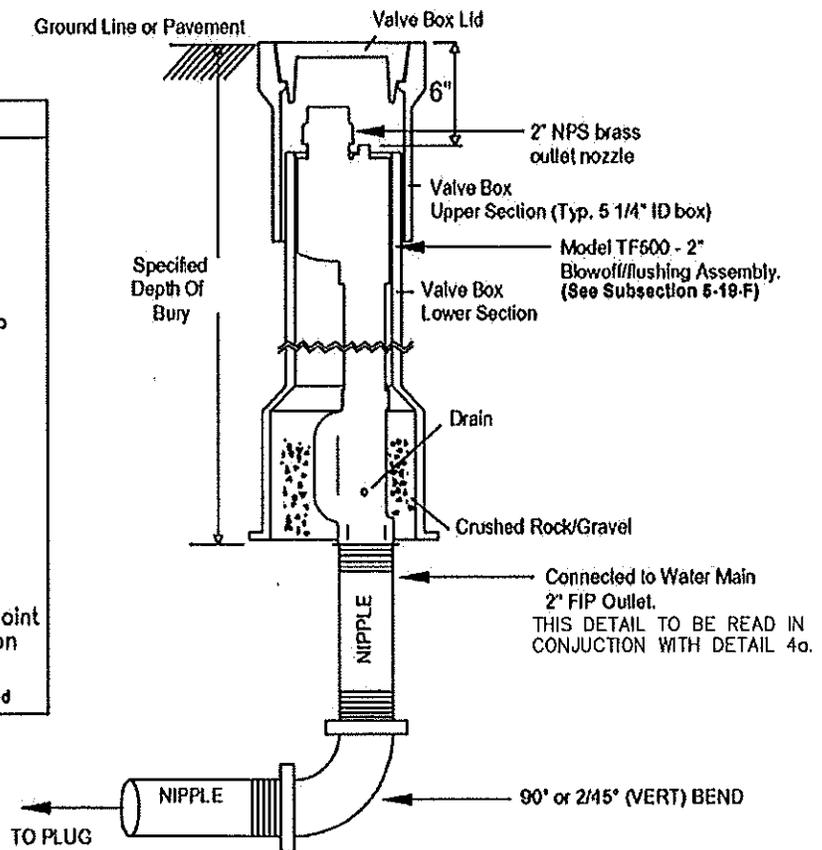


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WITH THE APPROVAL OF THE DISTRICT

NOTE:
FOR VALVE BOX INSTALLATION
(SEE DETAILS 27 AND 28).



TF500 Installation Notes

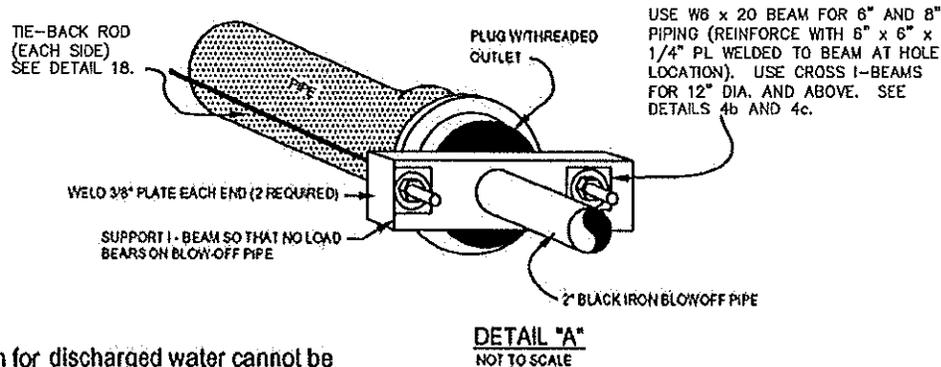
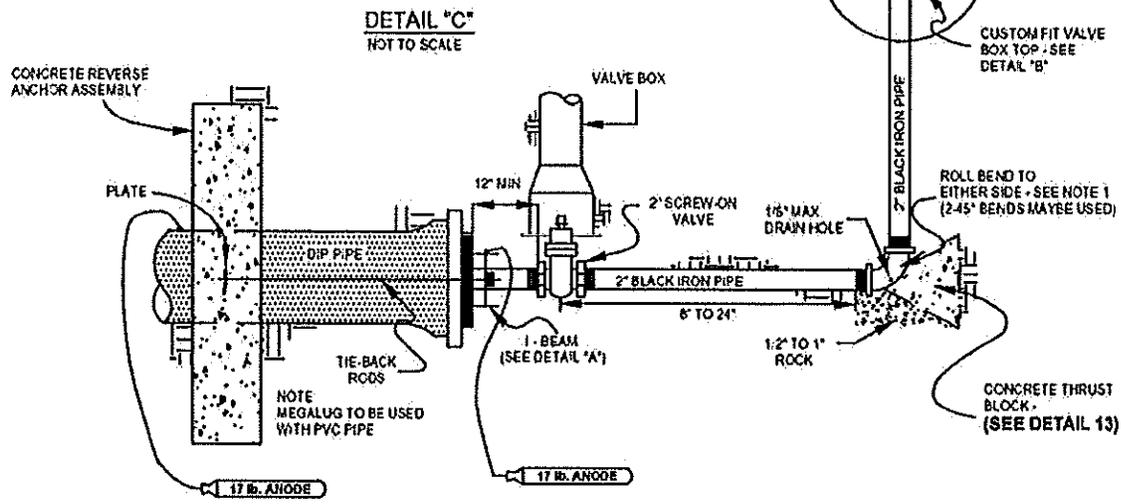
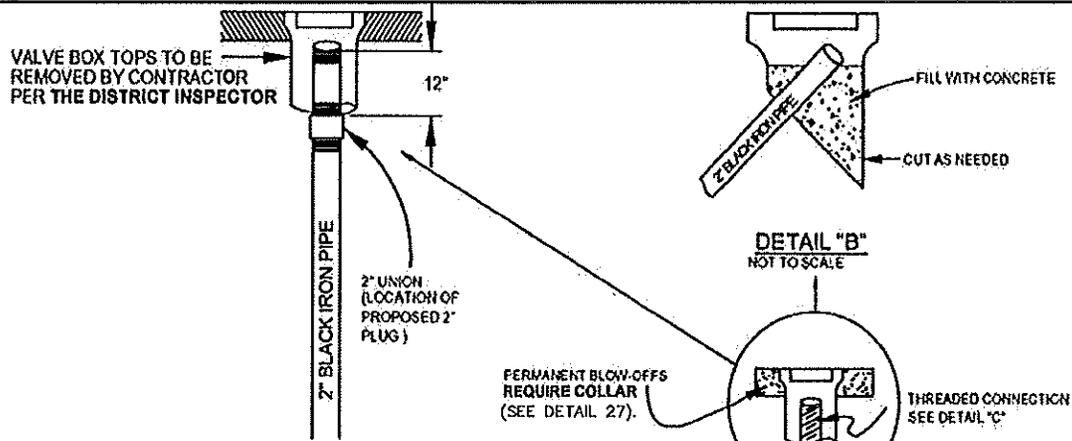
- Insure that the hydrant is free to move vertically within the valve box. In order to prevent the transmission of traffic loads to the blowoff/flushing assembly, it should not be jammed or wedged against the valve box ID.
 - The normal position of the top of the operating nut is about 6" below the top of the valve box. Maintenance procedures are best performed when the bolts attaching the top cap are within an easy reach.
- Surround the drain port with a sufficient amount of crushed rock/gravel to provide an adequate drain field.

TF500 Specification's

Blowoff/Flushing Assembly shall be _____' bury, with (2" Vertical FIP / 2" Horizontal FIP / 2" MJ / 3" MJ) inlet and 2" NPT nozzle outlet. Blowoff/Flushing Assembly shall fit in a 5-1/4" ID valve box. The assembly shall be non-freezing and self-draining. Blowoff/Flushing Assembly shall be operated by turning a top-mounted 9/16" square operating nut counterclockwise to open, clockwise to close. The Blowoff/Flushing Assembly must seal the drain outlet in all positions from 1/4-open to fully-open. All internal working parts, the inlet, and the outlet shall be lead-free brass. All working parts shall be serviceable from above with no digging required. Disassembly must be accomplished with no turning forces applied to the assembly barrel. All wear parts (o-rings and valve seat) shall be of commonly-available dimensions and materials, and none may be of vendor-unique design. Blowoff/Flushing Assembly shall be the Model TF500 as manufactured by The Kupferle Foundry Company, St. Louis, MO 63102 or other approved by The District.



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NOTES:

1. If appropriate location for discharged water cannot be reached by rolling the bend, additional bends may be required by The District Inspector.
2. Coat tie rods, beam and black iron pipe with coal tar protection. (SEE SUBSECTION 4-2 AND DETAIL 4d)
3. Entire blow-off assembly must be adequately supported, concrete stepping stones may be required.
4. Pipe dope approved for use in potable water systems must be used on all threaded fittings.
5. Fire hydrants to be used as a blowoff assembly where water mains permanently dead end (See Detail 7 and Subsections 5-14 and 5-19-C).
6. See Details 27 and 28 for Valve Box Installation.



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**TEMPORARY BLOWOFF ASSEMBLIES
 6-INCH & 8-INCH MAINS**

BLOW - OFF ASSEMBLY SIZING

MAIN PIPE DIA (IN.)	STATIC PEASURE RANGE (P.S.I.)	DIMENSIONS FROM DETAIL 4c.				
		"A" (IN)	"B" (IN)	"C" (W-SHAPE)	"D" ROD SIZE (IN)	"E" BLOW-OFF PIPE SIZE(IN)
12	<100	36	10	W10 x 15	5/8	4
	101-150	36	10 1/4	W10 x 19	3/4	4
	151-200	36	10 1/8	W10 x 22	7/8	4
	201-250	36	10 1/8	W10 x 22	1	4
16	<100	40	12 1/4	W12 x 26	7/8	4
	101-150	40	12 1/4	W12 x 26	1	4
	151-200	40	12 1/4	W12 x 26	1 1/8	4
	201-250	40	12 1/2	W12 x 35	1 1/4	4
20	<100	44	12 1/4	W12 x 26	1	4
	101-150	44	12 1/2	W12 x 35	1 1/4	4
	151-200	44	12	W12 x 40	1 3/8	4
	201-250	44	12	W12 x 45	1 1/2	4
24	<100	48	12 1/2	W12 x 36	1 1/4	6
	101-150	48	12	W12 x 40	1 1/2	6
	151-200	48	12	W12 x 53	1 1/4*	6
	201-250	48	12	W12 x 63	1 1/8*	6
30	<100	54	12 1/4	W12 x 50	1 1/8*	6
	101-150	54	12 1/4	W12 x 58	1 3/8*	6
	151-200	54	12 1/8	W12 x 65	1 1/2*	6
	201-250	54	12 1/4	W12 x 72	1 5/8*	6
36	<100	60	12 1/4	W12 x 58	1 1/4*	8
	101-150	60	12 1/4	W12 x 72	1 1/2*	8
	151-200	60	12 3/4	W12 x 96	1 3/4*	8

NOTES:

1. ALL W-SHAPES FABRICATED FROM A36 STEEL.
2. ALL RODS SHALL BE MINIMUM GRADE A307 EXCEPT WHERE NOTED AS *. THESE SHALL BE MINIMUM STRENGTH EQUAL TO ASTM A325 RODS. (SEE SUBSECTION 4-2.X)
3. A 50% SURGE FACTOR HAS BEEN INCLUDED IN DESIGN.
4. FOR SIZES AND PRESSURES GREATER THAN THOSE SHOWN, SPECIAL DESIGN IS REQUIRED, APPROVED BY THE DISTRICT.



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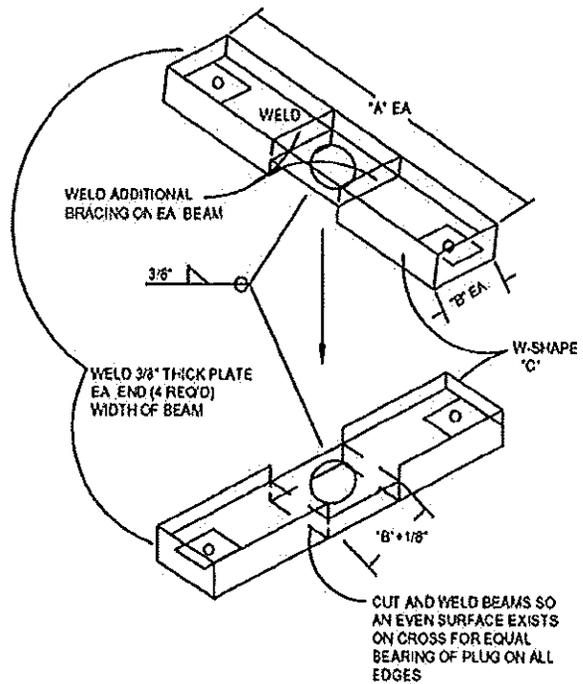
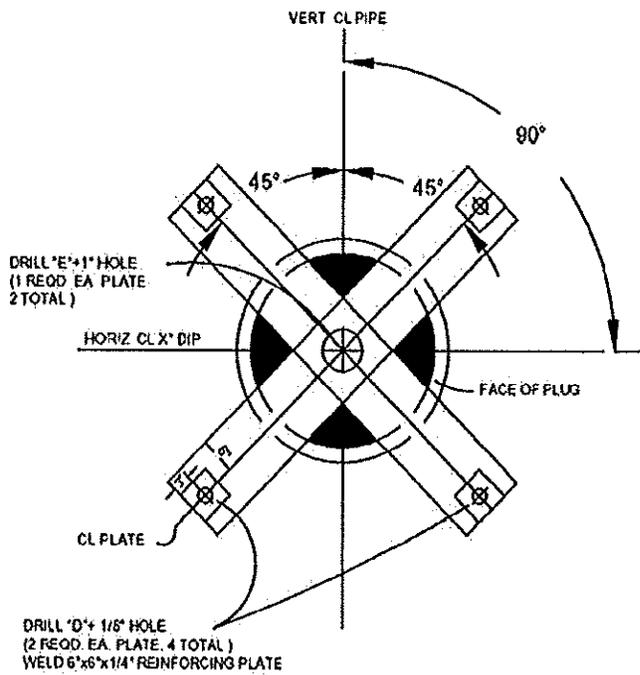
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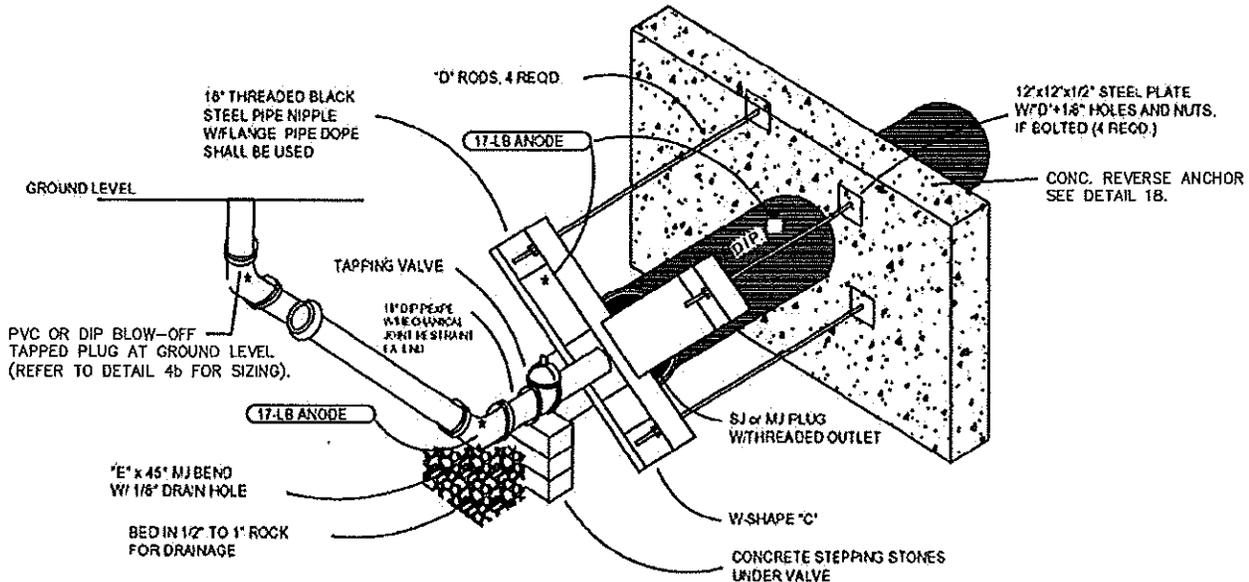
2005 MODIFIED DRAWING FROM COLORADO SPRINGS UTILITIES [DETAIL A 2-1]

**BLOWOFF ASSEMBLY DIMENSION
DATA 12-INCH & LARGER MAINS**

DETAIL 4b



REFER TO DETAIL 4b FOR ALL DIMENSIONS AND SIZES FOR BLOW-OFF ASSEMBLY



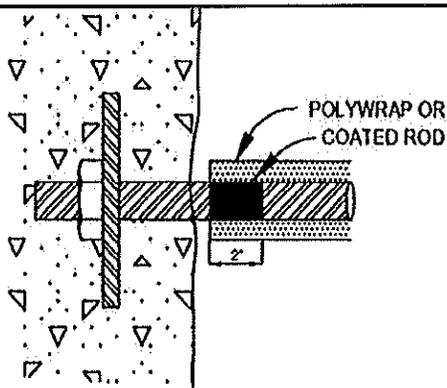
"E" = SIZE OF BLOW-OFF ASSEMBLY
(WHEN "E" = 2-INCH, USE DETAILS 4 AND 4a)

NOTES:

1. PIPE DOPE SHALL BE PLACED ON ALL THREADED CONNECTIONS.
2. SUPPORT BEAMS SO NO LOAD BEARS ON BLOW-OFF PIPING.
3. WRAP ENTIRE ASSEMBLY (EXCEPT BEAMS) WITH 8-ML POLYETHYLENE (SEE DETAIL 23) AND INSTALL 17 lb. ANODES WHERE SHOWN.
4. COAT RODS AND BEAMS WITH COAL TAR PROTECTION (SEE DETAIL 4d).

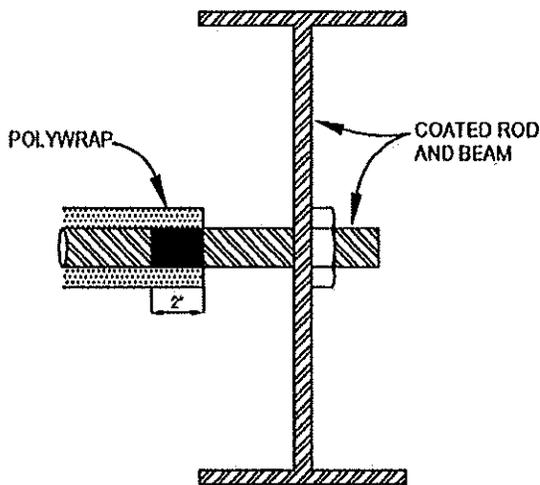


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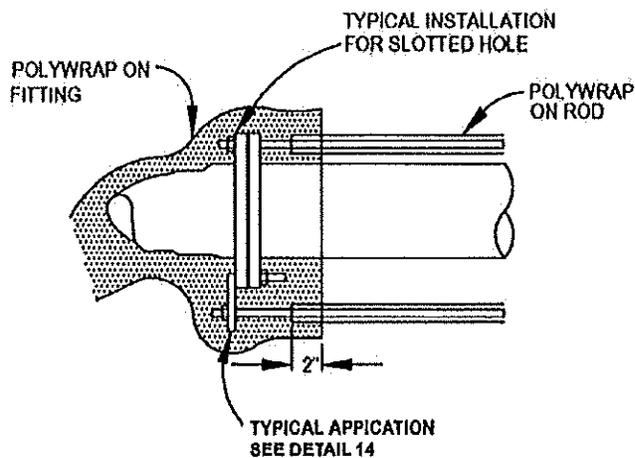
METAL IN CONCRETE

1. Coat metal parts where in contact with concrete, extending coating several inches beyond the concrete.
2. Polywrap the rod, overlapping the polywrap and coating a minimum of 2".
3. Secure polywrap to the rod using 2" wide, 10-mil polyethylene pressure-sensitive tape.



ROD THROUGH I-BEAM

1. Coat entire i-beam.
2. Coat nut and rod, extending coating several inches beyond the beam.
3. Polywrap the rod, overlapping the coating a minimum of 2".
4. Secure polywrap with tape.



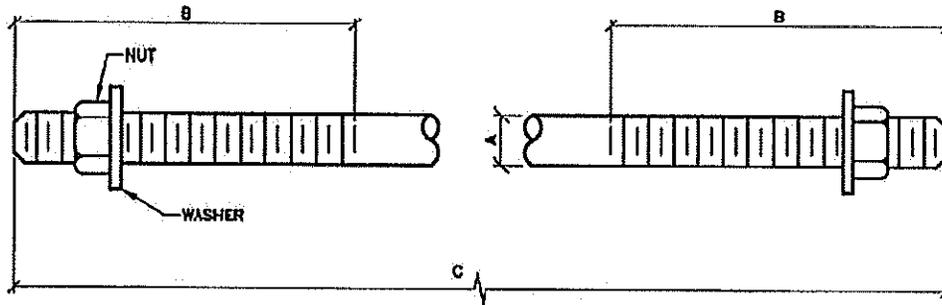
RODS IN M.J. FITTING

1. Polywrap the rod and secure with tape
2. Polywrap the fitting, overlapping the polywrap on the rod a minimum of 2" and secure with tape.

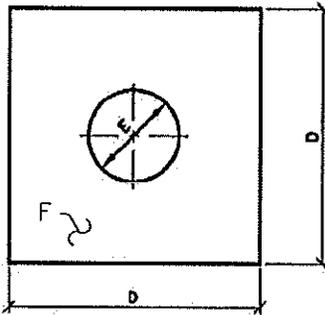


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TIE ROD DETAILS



WASHER DETAIL

TIE RODS			
A	B	C	
ROD ϕ	THREAD LENGTH	ROD LENGTH	GRADE
3/4", 1'	6"	1' TO 11' & 20'	MS
3/4", 1 1/2"	ALL THREAD	1' TO 11' & 20'	HS

WASHERS		
D	E	F
WIDTH	HOLE ϕ	THICKNESS
5"	1/8" LARGER THAN ROD ϕ	1/2"
6"	1/8" LARGER THAN ROD ϕ	5/8"

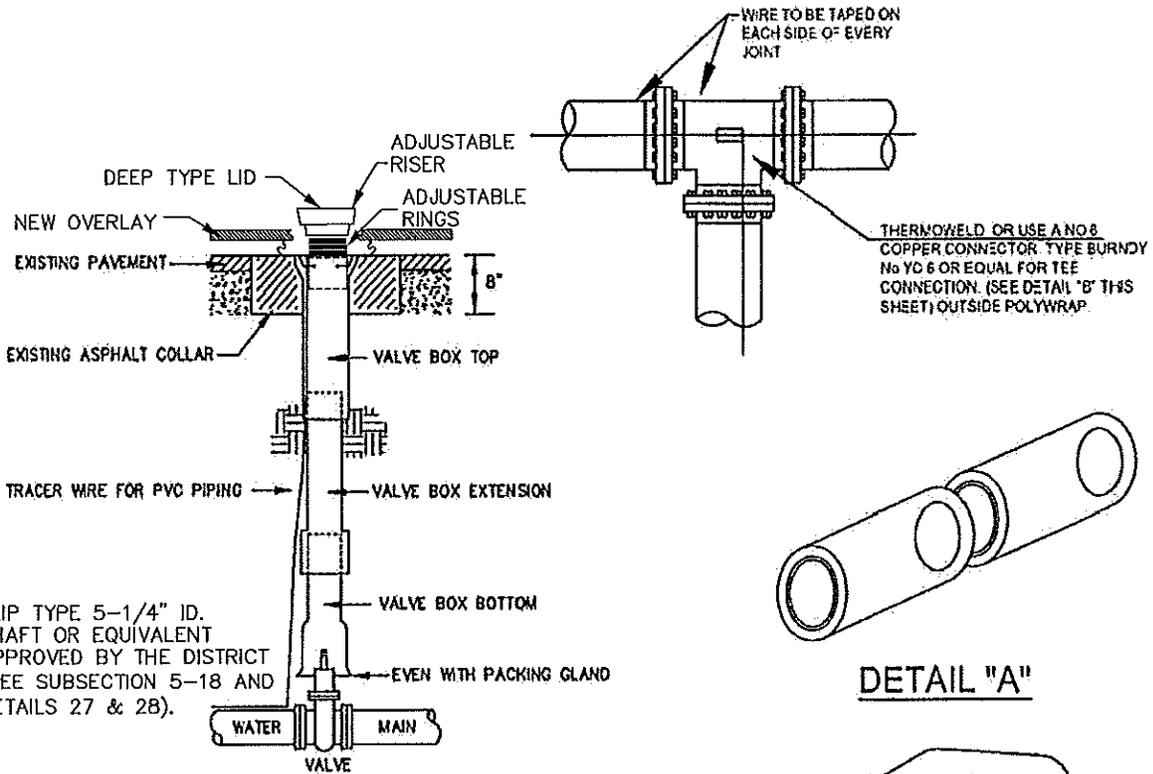
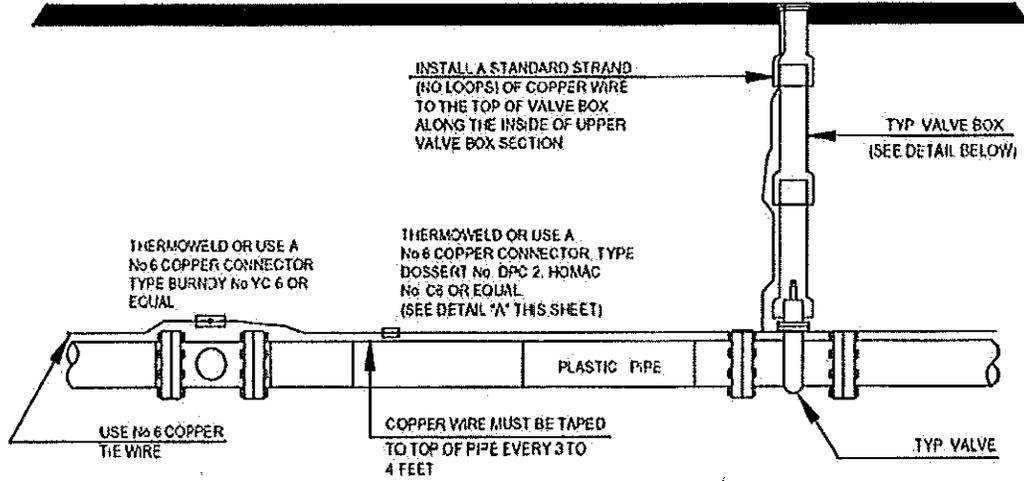
NOTES:

1. SEE DETAILS 16, 17 & 25 TIED JOINTS, ROD DIMENSIONS.
2. SEE DETAIL 3 CLAMP DETAILS & DIMENSIONS AND DETAIL 14 FLANGE-LUG FOR PROPER PLACEMENT OF WASHERS.
3. MS = MILD STEEL, HS = HIGH STRENGTH.



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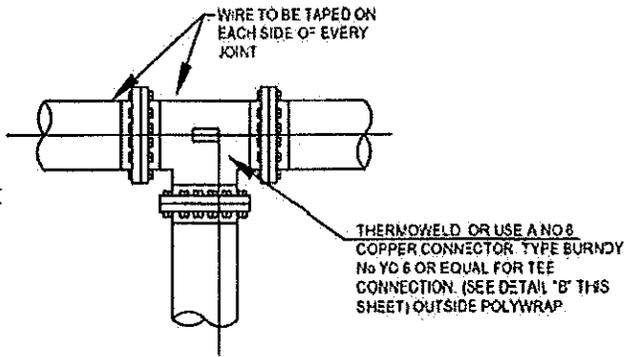
FINISHED GRADE



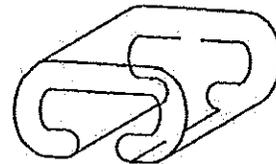
SLIP TYPE 5-1/4" ID. SHAFT OR EQUIVALENT APPROVED BY THE DISTRICT (SEE SUBSECTION 5-18 AND DETAILS 27 & 28).

TYPICAL VALVE BOX

- NOTE
1. Contractor is responsible for continuity of all tracer wire.
 2. Tracer wire is required on all water mains, laterals and service lines, and surfaced at all valve, blowoff and hydrant locations.



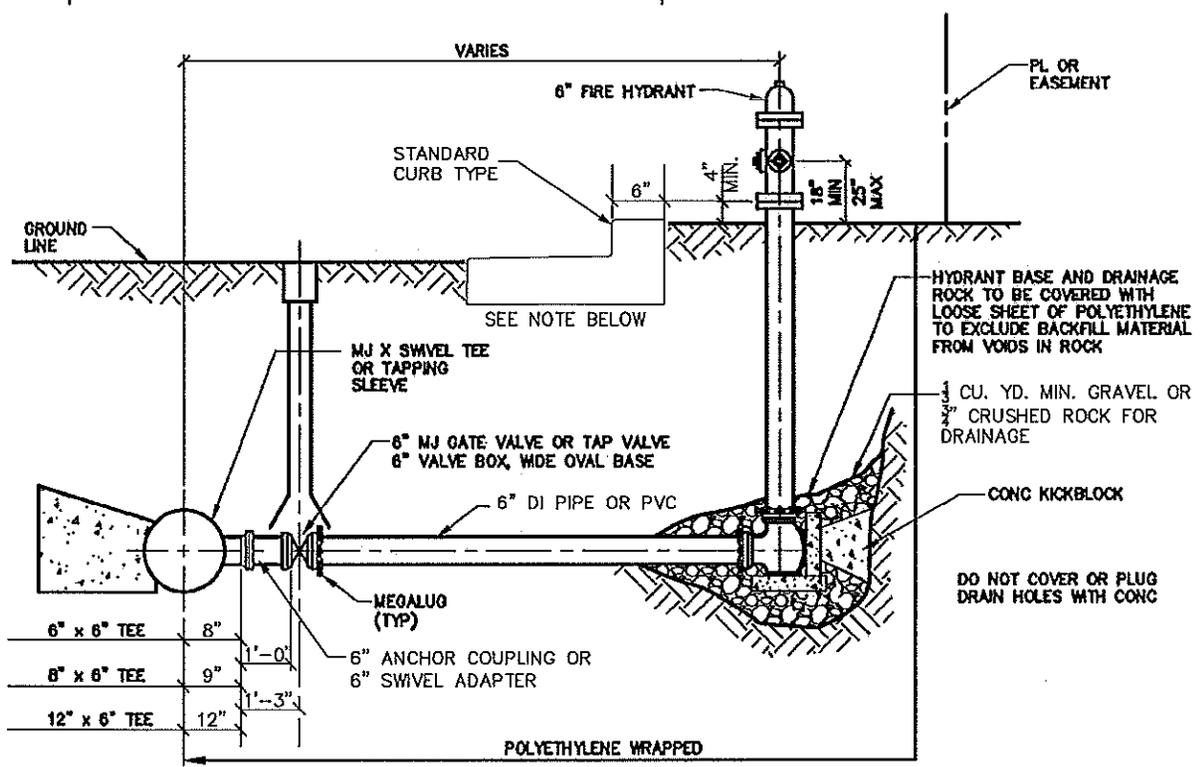
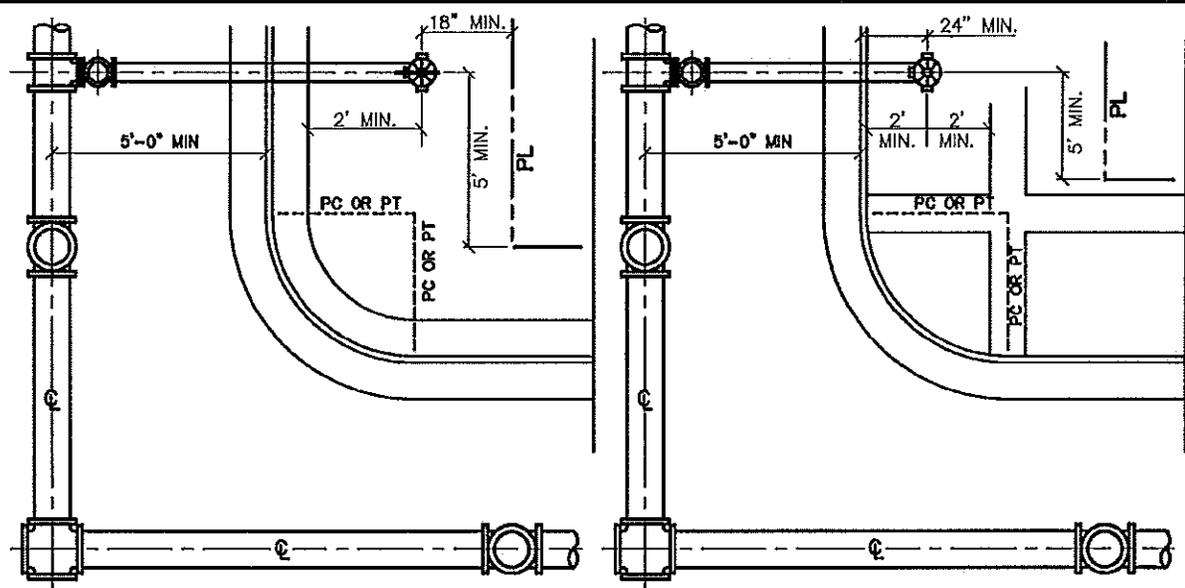
DETAIL "A"



DETAIL "B"

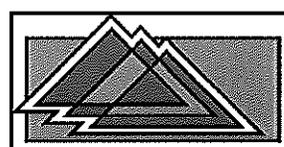
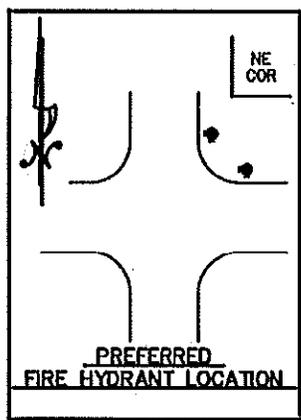


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NOTE:

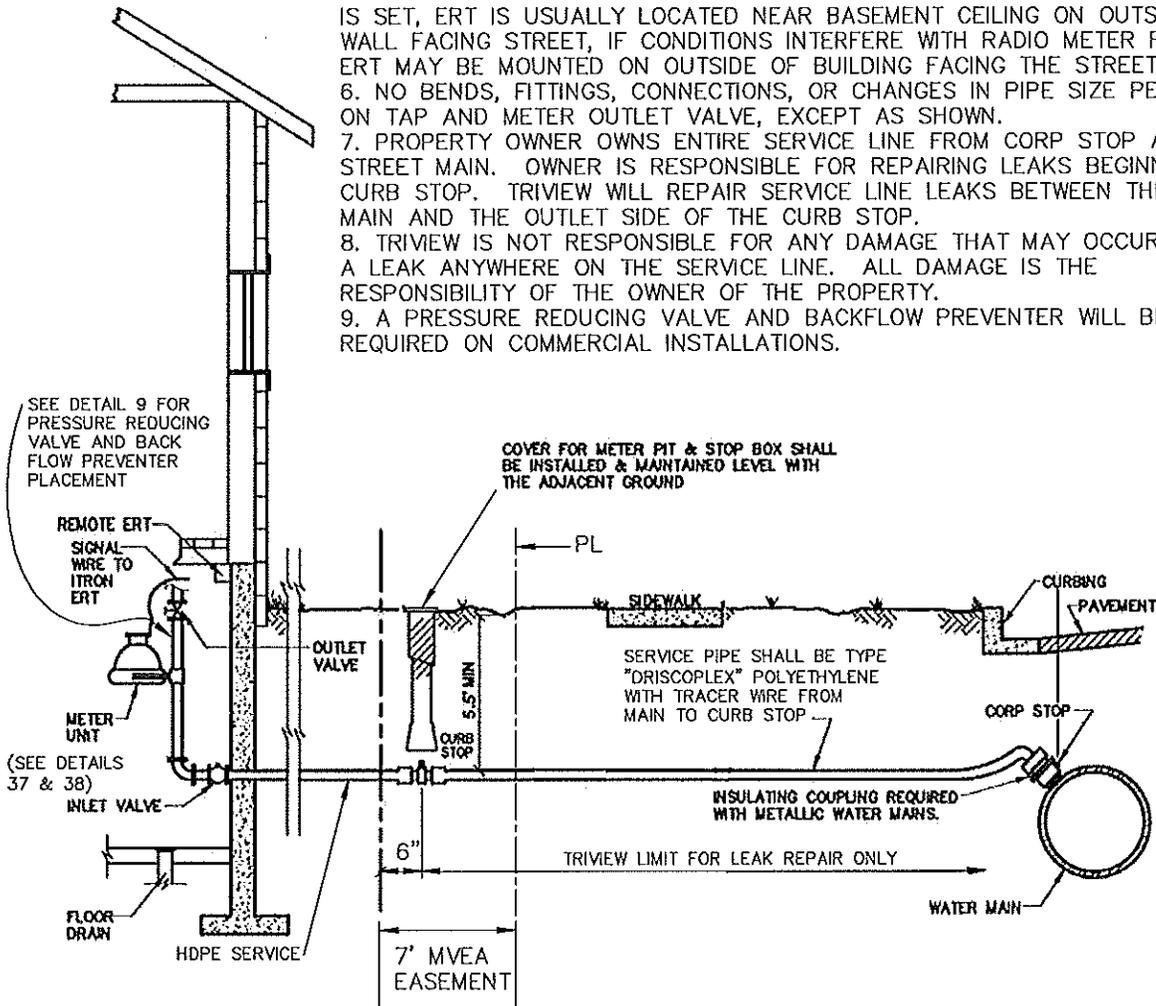
1. ALTERNATE TO THE ABOVE: FASTEN M.J. VALVE DIRECTLY TO A M.J. ANCHOR TEE (ALSO CALLED SWIVEL TEE).
2. FOR ACCEPTABLE FIRE HYDRANTS, SEE SUBSECTION 5-14.
3. FOR ACCEPTABLE VALVE BOXES, SEE SUBSECTION 5-18.
4. FOR ACCEPTABLE VALVES, SEE SUBSECTION 5-3.
5. NO HORIZONTAL OR VERTICAL BENDS ARE ALLOWED IN FIRE HYDRANT BRANCH OR SPRINKLER LINES, FOR EXCEPTIONS REFER TO SUBSECTION 5-19 FOR INSTALLATION INFORMATION.
6. NO VALVES ALLOWED IN SIDEWALK.



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NOTES:

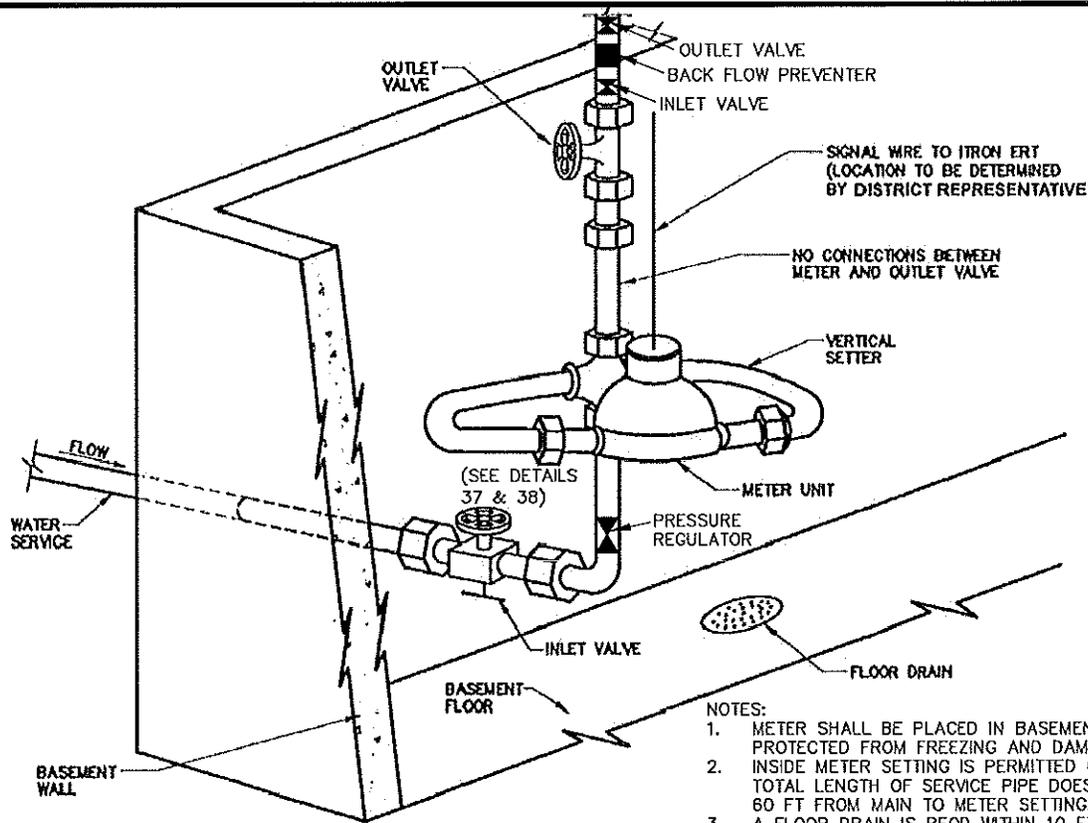
1. VALVE SHALL NOT BE PLACED IN A SIDEWALK OR DRIVEWAY.
2. PLACE STOP BOX 6-INCHES INSIDE OF MOUNTAIN VIEW ELECTRIC ASSOCIATION (MVEA) EASEMENT LINE.
3. INDOOR METER SETTING IS PERMITTED ONLY IF THE TOTAL LENGTH OF THE SERVICE PIPE DOES NOT EXCEED 60 FEET FROM MAIN TO METER SETTING.
4. INDOOR METER SHALL BE PLACED IN BASEMENT WITH FLOOR DRAIN NEARBY.
5. ITRON REMOTE ERT WILL BE MOUNTED BY THE DISTRICT WHEN THE METER IS SET, ERT IS USUALLY LOCATED NEAR BASEMENT CEILING ON OUTSIDE WALL FACING STREET, IF CONDITIONS INTERFERE WITH RADIO METER READING, ERT MAY BE MOUNTED ON OUTSIDE OF BUILDING FACING THE STREET.
6. NO BENDS, FITTINGS, CONNECTIONS, OR CHANGES IN PIPE SIZE PERMITTED ON TAP AND METER OUTLET VALVE, EXCEPT AS SHOWN.
7. PROPERTY OWNER OWNS ENTIRE SERVICE LINE FROM CORP STOP AT STREET MAIN. OWNER IS RESPONSIBLE FOR REPAIRING LEAKS BEGINNING AT CURB STOP. TRIVIEW WILL REPAIR SERVICE LINE LEAKS BETWEEN THE WATER MAIN AND THE OUTLET SIDE OF THE CURB STOP.
8. TRIVIEW IS NOT RESPONSIBLE FOR ANY DAMAGE THAT MAY OCCUR DUE TO A LEAK ANYWHERE ON THE SERVICE LINE. ALL DAMAGE IS THE RESPONSIBILITY OF THE OWNER OF THE PROPERTY.
9. A PRESSURE REDUCING VALVE AND BACKFLOW PREVENTER WILL BE REQUIRED ON COMMERCIAL INSTALLATIONS.



ANY VARIATION FROM THIS STANDARD REQUIRES APPROVAL PRIOR TO INSTALLATION FROM THE DISTRICT REPRESENTATIVE.



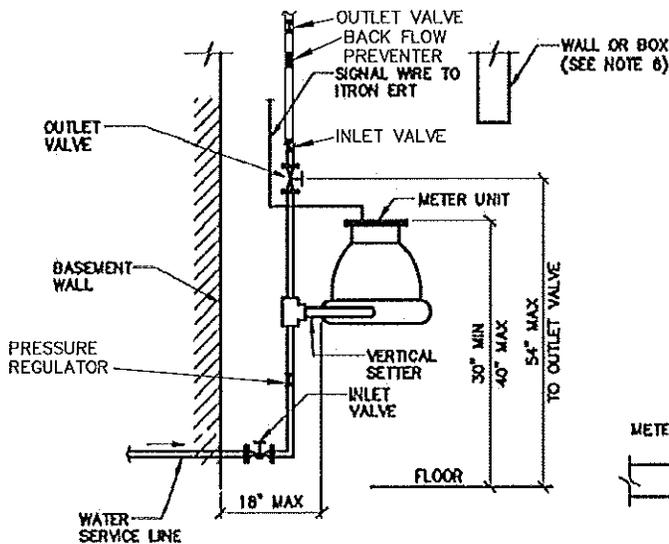
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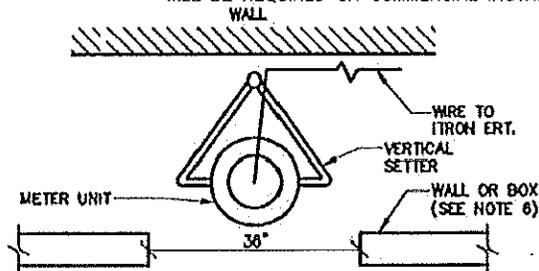
ISOMETRIC VIEW

NOTES:

1. METER SHALL BE PLACED IN BASEMENT, PROTECTED FROM FREEZING AND DAMAGE.
2. INSIDE METER SETTING IS PERMITTED ONLY IF TOTAL LENGTH OF SERVICE PIPE DOES NOT EXCEED 60 FT FROM MAIN TO METER SETTING.
3. A FLOOR DRAIN IS REQD WITHIN 10 FT OF THE METER FOR ALL NEW METER INSTALLATIONS (RECOMMENDED FOR EXISTING INSTALLATIONS).
4. NO CONNECTIONS ARE PERMITTED BEFORE THE METER OUTLET VALVE EXCEPT AS SHOWN ON THIS DRAWING.
5. METERS REQUIRED ELECTRONIC DIGITAL ENCODER REGISTER OR MECHANICALLY ENCODED REGISTER WITH ITRON REMOTE ERT AND 10 FT OF SIGNAL CABLE. ERT IS NORMALLY LOCATED NEAR BASEMENT CEILING AT WALL. FACING STREET, BUT MAY BE MOUNTED ON OUTSIDE OF BUILDING.
6. IF METER IS BOXED IN OR PLACED BEHIND A WALL, PROVIDE ACCESS OPENING 36" WIDE FROM ABOVE OUTLET VALVE TO FLOOR.
7. A DUAL CHECK BACKFLOW PREVENTER AND PRESSURE REGULATOR WILL BE REQUIRED ON RESIDENTIAL INSTALLATIONS.
8. A DOUBLE CHECK OR REDUCED PRESSURE BACKFLOW PREVENTER AND PRESSURE REGULATOR WILL BE REQUIRED ON COMMERCIAL INSTALLATIONS.



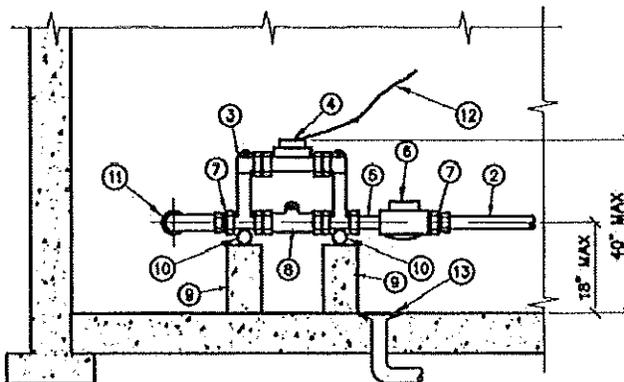
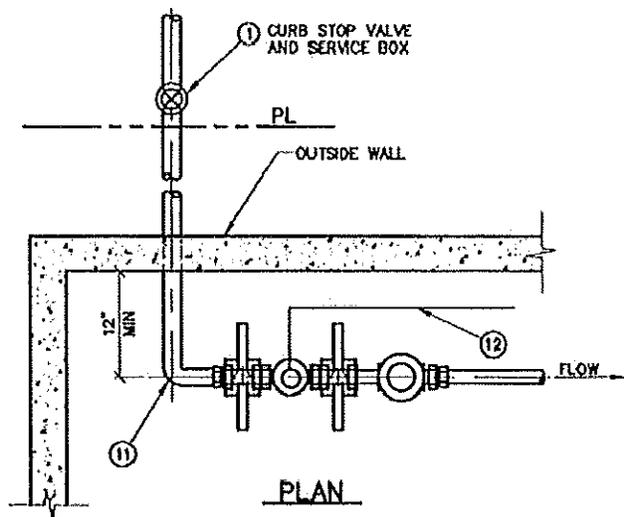
ELEVATION



PLAN



TRIVIEW METROPOLITAN DISTRICT
 174 N. Washington Street Suite C
 P.O. Box 849
 Monument, CO 80132-0849
 (719) 488-6868 Fax: (719) 488-6565



ELEVATION

NOTES:

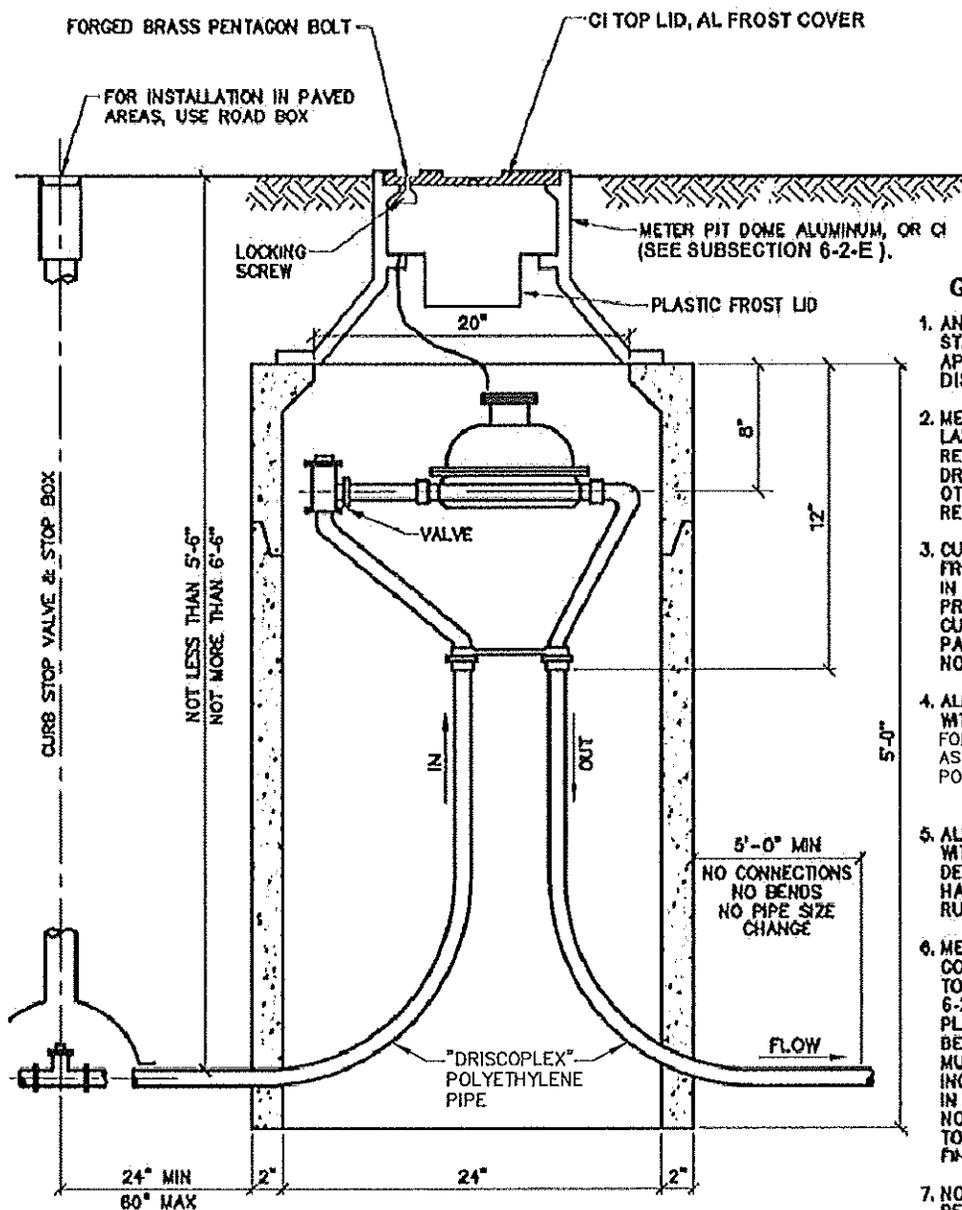
1. PIPE JOINT SHALL BE THREADED OR SOLDERED WITH 95-5 TIN/ANTIMONY SOLDER.
2. INSTALLATION MUST ALLOW FOR FULL ACCESS TO METER AND VALVES, AND PROVIDE PROTECTION FROM FREEZING.
3. SEE DETAILS 34, 35 AND 36 FOR VAULT INFORMATION.
4. A FLOOR DRAIN SHALL BE PLACED NEAR THE METER INSTALLATION.
5. METER SUPPORT MAY BE EITHER CONC. OR UNISTRUT ATTACHED TO WALL.
6. ALL METERS MUST BE FURNISHED WITH AN ELECTRONIC DIGITAL ENCODER REGISTER OR MECHANICALLY ENCODED REGISTER, AND WITH AN ITRON REMOTE ERT.
7. ERT WILL BE INSTALLED AT A LOCATION DETERMINED BY THE DISTRICT AT THE TIME OF METER INSPECTION. IN MOST CASES, ERT WILL BE INSTALLED ON THE OUTSIDE OF THE BUILDING FACING A PUBLIC STREET. IF ERT IS MORE THAN 20 FEET FROM METER LOCATION, OWNER MUST PROVIDE CONDUIT AND SIGNAL WIRE FROM METER TO ERT LOCATION.
8. INSIDE METER SETTINGS ARE PERMITTED ONLY WHEN THE TOTAL LENGTH OF SERVICE PIPE FROM MAIN TO METER SETTING DOES NOT EXCEED 60 FEET.
9. BYPASS NOT PERMITTED ON IRRIGATION SERVICES.
10. A BACKFLOW PREVENTER, PRESSURE REGULATOR AND METER WILL BE REQUIRED ON THE BYPASS LINE. SEE DETAIL 9 FOR PLACEMENT.

LEGEND:

- | | |
|--|--|
| <ul style="list-style-type: none"> ① CURB STOP ② "DRISCOPEX" POLYETHYLENE PIPE ③ 12" COPPERSETTER / METER YOKE ④ METER UNIT ⑤ 3" NIPPLE BETWEEN COPPERSETTER AND CHECK VALVE ⑥ CHECK VALVE ⑦ IRON PIPE TO FLARE COUPLING FROM INLET SIDE OF COPPERSETTER AND OUTLET SIDE OF CHECK VALVE | <ul style="list-style-type: none"> ⑧ BY-PASS WILL BE 1" FOR 1 1/2" COPPERSETTERS AND 1 1/2" OR 1 1/4" FOR 2" COPPERSETTERS ⑨ CONC BLOCK SUPPORTS 4"x 4"x 12" ⑩ 1"x 18" PIPE ⑪ 90° ELL ⑫ SIGNAL WIRE TO ITRON ERT ⑬ FLOOR DRAIN |
|--|--|



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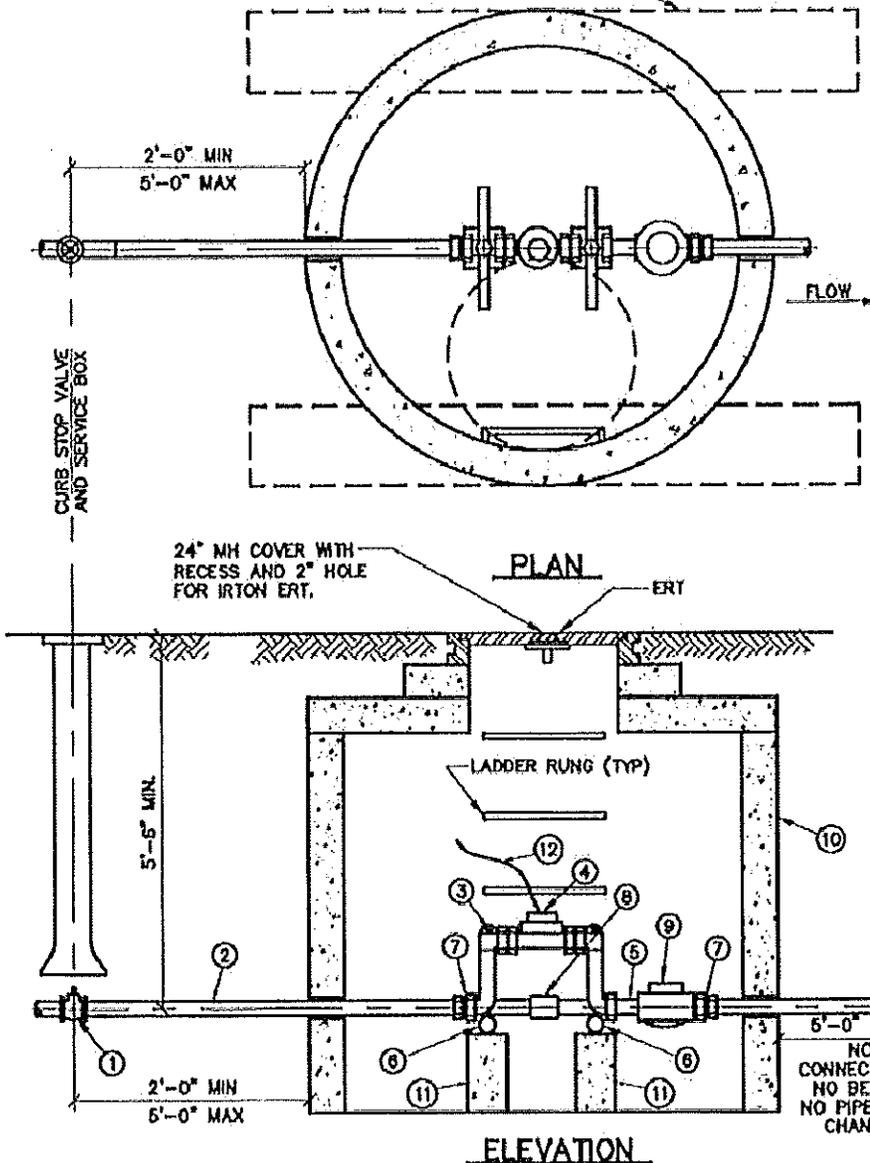
GENERAL NOTES:

1. ANY VARIATION OR DEVIATION FROM THIS STANDARD REQUIRES PREVIOUS APPROVAL PRIOR TO INSTALLATION FROM DISTRICT REPRESENTATIVE
2. METER PIT MUST BE INSTALLED IN LANDSCAPED AREA. PRIOR APPROVAL REQD FOR INSTALLATIONS IN ROADWAYS, DRIVEWAYS OR SIDEWALKS. ROAD LIDS OR OTHER SPECIAL MODIFICATIONS MAY BE REQD.
3. CURB STOP SHALL BE 24 INCHES FROM INLET SIDE OF METER PIT, LOCATED IN LANDSCAPED AREA IF POSSIBLE. WITH PRIOR APPROVAL OF METER INSPECTOR, CURB STOP MAY BE PLACED BENEATH PAVED AREA UNDER ROADWAY BOX, BUT NOT IN A PARKING AREA.
4. ALL METER PITS SHALL BE FURNISHED WITH CI METER PIT LID AND WITH PROVISIONS FOR REMOTE TRANSPONDER TO BE INSTALLED AS CLOSE TO THE BOTTOM OF THE LID AS POSSIBLE.
5. ALL METER PITS SHALL BE FURNISHED WITH PLASTIC FROST LID WITH 3 INCH DEEP PAN, FIVE DRAIN HOLES, LIFTING HANDLE, AND SLOT FOR ERT WIRE RUNNING FULL DEPTH OF LID.
6. METER PIT SHALL BE CONSTRUCTED OF A COMBINATION OF CONG RINGS WITH A TOTAL HEIGHT OF 60 INCHES (SUBSECTION 6-2). ADJUSTMENT RINGS OF APPROVED PLASTIC OR CONG SHALL BE INSERTED BETWEEN TOP RING AND DOME. RINGS MUST BE 2 INCH, 3 INCH, 4 INCH, OR 6 INCH HEIGHT. NO CONG FLOOR ALLOWED IN METER PITS. PLASTIC METER PITS ARE NOT PERMITTED. PIT SHALL BE INSTALLED TO MAINTAIN PIT LID 1/2 INCH BELOW FINISHED GRADE.
7. NO BENDS PERMITTED IN SERVICE LINE BETWEEN TAP AND 5 FT BEYOND OUTLET SIDE OF METER PIT. NO CHANGES IN PIPE # OR CONNECTIONS OF ANY TYPE ARE PERMITTED IN THE SERVICE LINE UNTIL 5 FT OR MORE FROM THE OUTLET SIDE OF THE METER PIT.
8. METER SHALL BE FURNISHED WITH ELECTRONIC DIGITAL REGISTER OR ELECTRONIC ENCODED REGISTER AND AN ITRON PIT ERT. IN SPECIAL CASES, A REMOTE ERT MAY BE REQD, MOUNTED ON A NEARBY BUILDING OR POST.



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CONC MH BASE BEAMS REQD FOR METER IN STREET OR PARKING AREA: TWO 1'-0" X 8'-0" CONC. BASE BEAMS



NOTES:

1. METER VAULT SHALL BE INSTALLED IN LANDSCAPED AREA UNLESS APPROVED BY METER INSPECTOR.
2. CURB STOP SHALL BE 24" TO 60" FROM THE INLET SIDE OF THE METER VAULT, IN LANDSCAPED AREA.
3. FOR VAULT INSTALLATIONS IN ROADWAYS AND DRIVEWAYS, WHEN APPROVED, MH BASE BEAMS ARE REQD. METER VAULT MAY NOT BE INSTALLED IN PARKING AREA.
4. NO CONC FLOOR ALLOWED IN METER VAULT.
5. NO CONNECTIONS OF ANY TYPE, PIPE BENDS, OR CHANGES IN PIPE SIZE ARE PERMITTED BETWEEN THE TAP AND 5 FT BEYOND THE OUTLET SIDE OF THE METER VAULT, EXCEPT AS SHOWN ON THIS DETAIL.
6. METER SHALL BE FURNISHED WITH ELECTRONIC DIGITAL REGISTER OR ELECTRONIC ENCODED REGISTER AND AN ITRON PIT ERT. 24" MH LID SHALL HAVE 7" Ø RECESS AND 2" Ø HOLE TO ACCOMMODATE PIT ERT. IN SPECIAL CIRCUMSTANCES, REMOVE ERT MAY BE REQD (SEE DETAIL 8). TO BE INSTALLED ON NEARBY BUILDING OR POST.
7. JOINTS INSIDE METER VAULT SHALL BE THD OR SHALL BE SOLDERED WITH 95-5 TIN/ANTIMONY SOLDER IN ACCORDANCE WITH ASTM B 32.
8. DISTANCE BETWEEN RUNGS, CLEATS AND STEPS SHALL NOT EXCEED 12" AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
9. VAULT WALL PENETRATIONS SHALL BE GROUTED WITH CONC.
10. COPPERSETTER OR METER YOKE SHALL BE NO MORE THAN 12" HIGH. IRRIGATION SERVICE INSTALLATIONS SHALL NOT HAVE METER BYPASS. ALL OTHER SERVICES SHALL USE COPPERSETTER OR YOKE WITH BYPASS AND LOCKING BYPASS VALVE.
11. ADJUSTABLE STEEL PIPE VALVE SUPPORT MAY BE USED IN PLACE OF CONC. SUPPORT BLOCKS.

DETAILS:

- | | |
|---|---|
| <ul style="list-style-type: none"> ① CURB STOP ② "DRISCOPLEX" POLYETHYLENE PIPE ③ 12" COPPERSETTER / METER YOKE WITH BYPASS ④ METER UNIT (SEE DETAILS 37 & 38) ⑤ 3" NIPPLE BETWEEN COPPERSETTER AND CHECK VALVE ⑥ 1" x 23" PIPE ⑦ IRON PIPE TO FLARE COUPLING FROM INLET SIDE OF COPPERSETTER AND OUTLET SIDE OF CHECK VALVE | <ul style="list-style-type: none"> ⑧ BY-PASS WILL BE 1" FOR 1-1/2" COPPERSETTERS AND 1-1/2" OR 1-1/4" FOR 2" COPPERSETTERS- NO BYPASS FOR IRRIGATION METERS ⑨ CHECK VALVE (CHECK VALVES ARE NOT REQUIRED WHERE A BACKFLOW PREVENTION DEVICE IS INSTALLED) ⑩ 48" CONC MH WITH FLAT LID ⑪ CONC BLOCK SUPPORTS 4" x 4" x 24" ⑫ SIGNAL WIRE TO ITRON ERT |
|---|---|



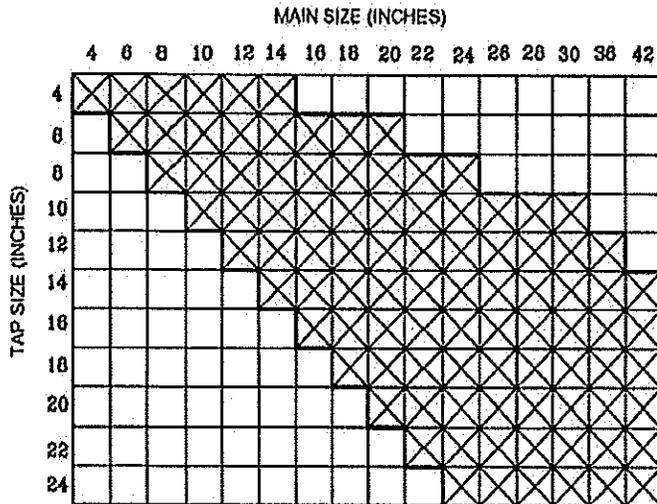
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CONCRETE THRUST BLOCKS

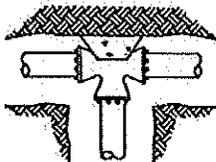
WATER MAIN AND TAP SIZE COMBINATIONS WHICH REQUIRE A CONCRETE THRUST REACTION BLOCK BEHIND THE MAIN AT THE TAPPING SLEEVE OR SADDLE.

ALL WATER MAINS

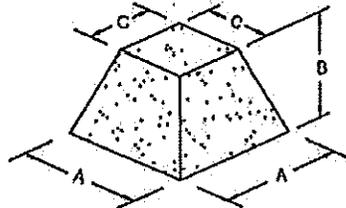
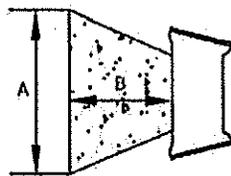
☒ INDICATES CONCRETE THRUST BLOCK REQUIRED



ANY THRUST REACTION BLOCK REQUIREMENTS FOR WATER MAIN AND TAP SIZE COMBINATIONS OTHER THAN THOSE SHOWN ABOVE WILL REQUIRE SPECIAL DESIGN APPROVAL BY TRIVIEW METROPOLITAN DISTRICT.



TEE OR TAP



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. (in yds.)	A	B If C=1'-6"	B If C=2'-0"	B If C=3'-0"
1/4	2'-6"	1'-7"	N/A	N/A
1/2	3'-2"	2'-5"	2'-0"	N/A
3/4	4'-0"	2'-6"	2'-2"	N/A
1	4'-4"	3'-0"	2'-7"	2'-0"
1-1/4	4'-10"	3'-1"	2'-8"	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'-6"		4'-1"	3'-7"
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'-9"	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'-6"
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 WILL HAVE VOLUMES SHOWN ON PLAN AND PROFILE DRAWINGS.

SEE VOLUMES ABOVE FOR A, B, & C DIM.

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



TRIVIEW METROPOLITAN DISTRICT

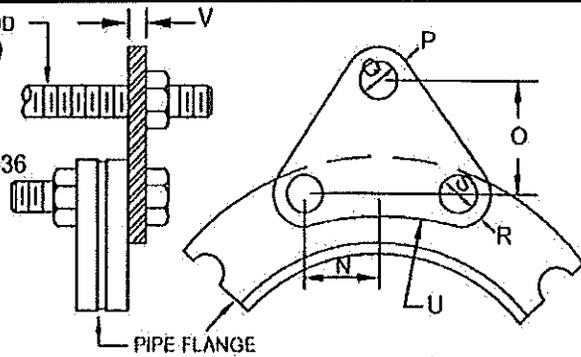
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THRUST BLOCKS DATA

NOTES:

1. M.S. means mild steel rod, A.S.T.M. standard designation A-36 nuts shall be A.S.T.M. standard designation A-307 grade A or B hexagon series.
2. H.S. means high strength steel rod, A.S.T.M. standard designation A-193 grade B-7 nuts shall be A.S.T.M. standard designation A-194 grade 2-H.

RESTRAINING ROD
(LENGTH VARIES)
10' MAXIMUM
PIPE FLANGE



PIPE DIA.	PRESS. CLASS	N	O	H.S. ROD			M.S. ROD			R	S	U	V	NO. REQD.
				P	Q	ROD DIA.	P	Q	ROD DIA.					
6"	150 LB.	1 13/16"	2 1/4"	1"	7/8"	3/4"	1"	7/8"	3/4"	7/8"	7/8"	3 3/4"	3/4"	2 EA.
	300 LB.	1 3/8"	2 3/4"	1"	1"	7/8"	1"	1"	7/8"	7/8"	7/8"	4 7/16"	1"	
8"	150 LB.	2 1/4"	2 3/4"	1"	7/8"	3/4"	1"	7/8"	3/4"	1"	7/8"	4 7/8"	3/4"	2 EA.
	300 LB.	1 11/16"	2 7/8"	1"	1"	7/8"	1"	1"	7/8"	1"	1"	5 1/2"	1"	
12"	150 LB.	2 3/16"	2 3/4"	1 1/4"	1 1/8"	1"	1 1/4"	1 1/8"	1"	1 1/8"	1"	7 1/4"	7/8"	2 EA.
	300 LB.	1 3/4"	3 3/4"	1 5/8"	1 1/4"	1 1/2"	1 3/8"	1 3/8"	1 1/4"	1 1/4"	1 1/8"	7 5/8"	1 1/4"	
16"	150 LB.	2 1/16"	2 3/4"	1 1/2"	1 3/8"	1 1/4"	1 1/2"	1 3/8"	1 1/4"	1 1/4"	1 1/8"	9 3/8"	1 1/8"	3 EA.
	300 LB.	1 3/4"	4 1/4"	1 1/2"	1 1/2"	1 3/8"	1 1/2"	1 1/2"	1 3/8"	1 1/2"	1 1/8"	9 7/8"	1 1/2"	
20"	300 LB.	2"	3 1/16"	1 3/8"	1 9/16"	1 1/2"	1 3/8"	1 9/16"	1 1/2"	1 3/8"	1 5/16"	10 1/2"	2 1/2"	4 EA.
24"	300 LB.	2 5/16"	3 1/8"	1 1/2"	1 9/16"	1 1/2"	1 1/2"	1 9/16"	1 1/2"	1 1/2"	1 7/16"	12 1/2"	2 1/4"	6 EA.
30"	300 LB.	2"	3 1/4"	1 5/8"	1 9/16"	1 1/2"	N/A	N/A	N/A	1 5/8"	1 7/16"	15 5/8"	2 5/8"	8 EA.
36"	300 LB.	2 1/16"	3 1/2"	1 7/8"	1 9/16"	1 1/2"	N/A	N/A	N/A	1 7/8"	1 11/16"	16 5/8"	3"	10 EA.



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MAXIMUM DEFLECTION

PER SLIP JOINT OF D.I.P.

PIPE DATA			MFRS. DEFL.	DESIGN DEFLECTION (80% MAX.)				APPROX. RADIUS FOR DEFLECTING CURVES WITHOUT BENDS	
PIPE SIZE	O.D. (IN)	O.D. (FT)		(HORIZ. DEFL.)	(VERT. DEFL.)	MAX. DEFL. DIST.		20'L	18'L
						20'L	18'L		
4"	4.80"	0.400'	5'00"00"	4'00"00"	6.99%	16"	15'	206'	256'
6"	6.90"	0.575'							
8"	9.05"	0.754'							
10"	11.10"	0.925'							
12"	13.20"	1.100'							
14"	15.30"	1.275'	4'00"00"	3'12"00"	5.59%	13"	12"	358'	322'
16"	17.40"	1.450'							
18"	19.50"	1.625'	3'00"00"	2'24"00"	4.19%	10"	9"	477'	430'
20"	21.60"	1.800'							
24"	25.80"	2.150'							
30"	32.00"	2.668'							
36"	38.30"	3.192'							
42"	44.50"	3.708'	2'00"00"	1'36"00"	2.79%	6"	6"	716'	645'

DATA FOR DIP PIPES

PER SLIP JOINT OF P.V.C. PIPE W/HIGH DEFL. COUPLINGS

PIPE DATA			MFRS. TOTAL JOINT DEFL. W/ COUPL.	DESIGN DEFLECTION (80% MAX.)			MIN. RADIUS FOR DEFLECTING CURVES WITH HIGH DEFL. COUPLINGS	
PIPE SIZE	O.D. (IN)	PIPE WALL THICKNESS		(HORIZ. DEFL.)	(VERT. DEFL.)	MAX. DEFL. DIST.	20'L	
							20'L	
4"	4.80"	0.343"	5'00"00"	4'00"00"	6.99%	24"	286'	
6"	6.90"	0.493"	5'00"00"	4'00"00"	6.99%	16"	286'	
8"	9.05"	0.646"	5'00"00"	4'00"00"	6.99%	12"	286'	
12"	13.20"	0.943"	5'00"00"	4'00"00"	6.99%	8"	286'	
16"	17.40"	0.967"	NO DEFLECTION COUPLING FOR 16" PIPE					

CLASS 200 (DR-14)
CLASS 235 (DR-18)

DATA FOR PVC PIPES

SLIP JOINT P.V.C. PIPE - NO DEFLECTION

NOTE:

T. HIGH DEFLECTION COUPLINGS REQUIRED IF PIPE DEFLECTION IS GREATER THAN 70% OF THE MANUFACTURER'S ALLOWABLE DEFLECTION.



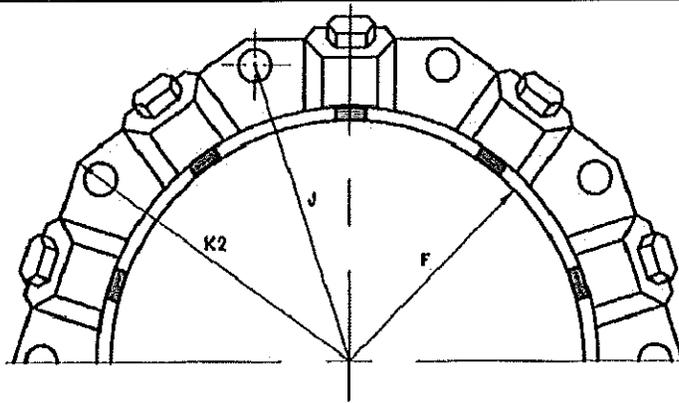
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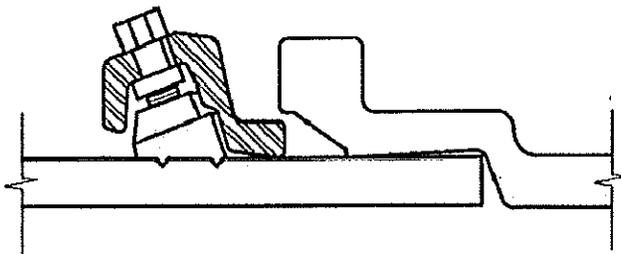
2003 DRAWING FROM COLORADO SPRINGS UTILITIES
[DETAIL A 3-1]

**MAXIMUM PIPELINE DEFLECTION
DATA FOR DI AND PVC PIPES**

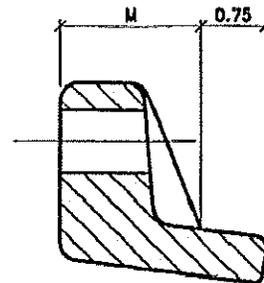
DETAIL 15



MECHANICAL JOINT RESTRAINT



WEDGE DETAIL



BOLT HOLE DETAIL

DIMENSIONS

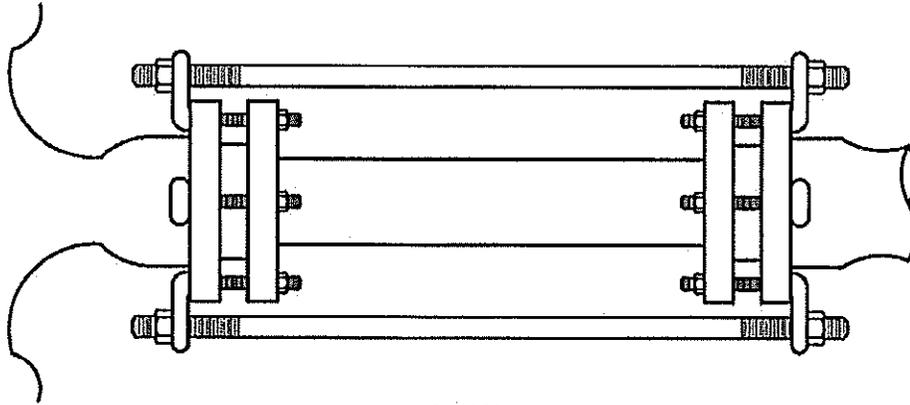
	NOMINAL PIPE SIZE	NO OF BOLTS	NO OF WEDGES	K2 INCHES	J INCHES	F INCHES	M INCHES	
PVC	4"	2	2					PVC
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
DI	4"	4	2					DI
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
	16"	12	12	22.50	21.00	17.54	1.56	
	20"	14	14	27.00	25.50	21.74	1.69	

NOTES:

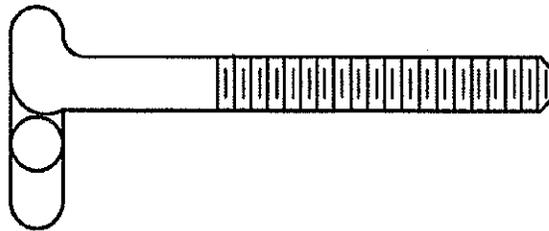
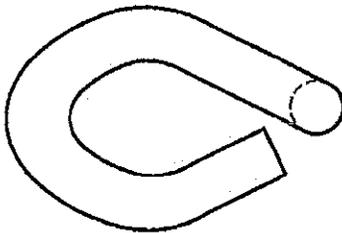
1. REFER TO SUBSECTIONS 4-2.K AND 4-3.J.2.
2. DIMENSIONS FOR 16-INCH AND 20-INCH PVC PIPE NOT SHOWN.
3. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BY DISTRICT BEFORE INSTALLATION.



TRIVIEW METROPOLITAN DISTRICT
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PLAN



DETAIL

DIMENSIONS

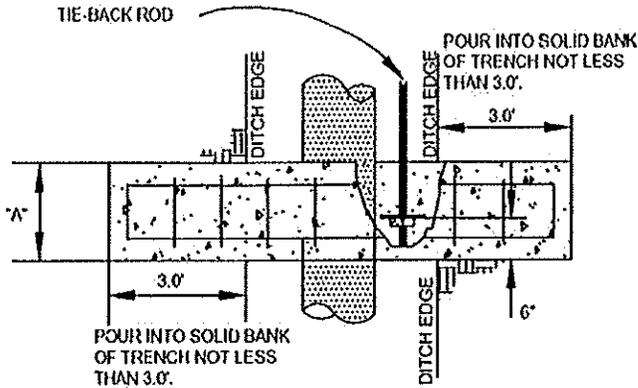
ALLOWABLE PIPE Ø INCHES	BOLT SIZE INCHES	NO OF BOLTS REQD
4	3/4	2
6	3/4	2
8	3/4	2
10	3/4	4
12	3/4	6

NOTES:

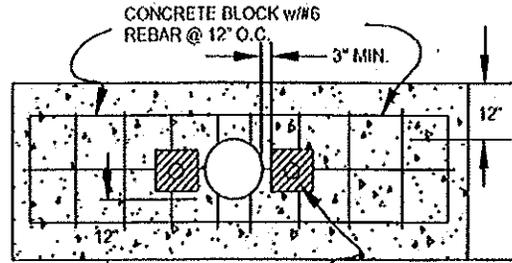
1. THE BOLT SHALL BE MANUFACTURED OF "COR-TEN" OR APPROVED EQUAL (SEE SUBSECTION 4-2-B).
2. THE BOLT MAY BE HEAT TREATED.



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PLAN
DEAD-END OR
REVERSE ANCHOR

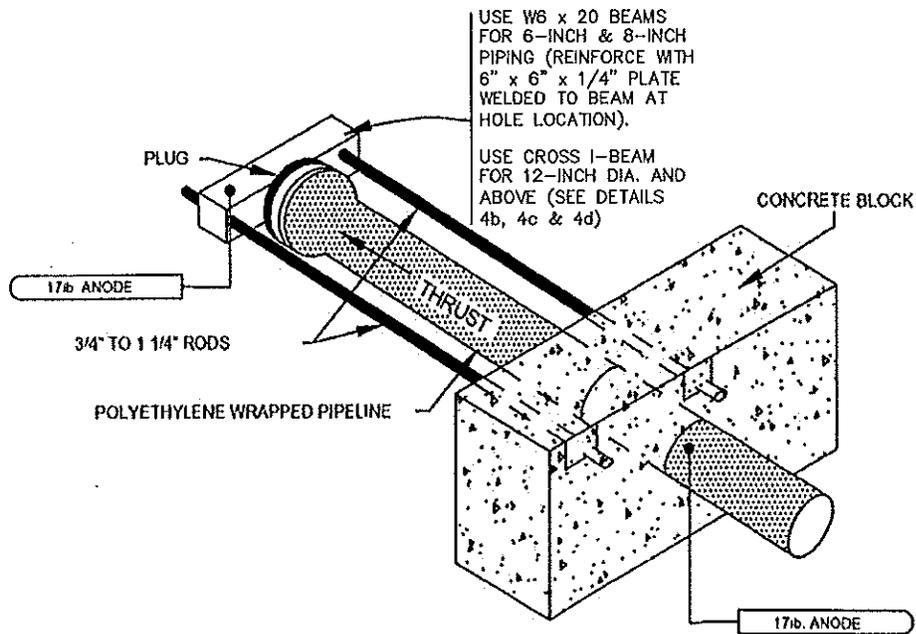


STEEL PLATE SPECS:
OVER 12-INCH:
AS SPECIFIED (SEE DETAILS 4b & 4c)
12-INCH & UNDER:
8" x 8" x 3/8"

ELEVATION
DEAD-END OR
REVERSE ANCHOR

'A' MEASUREMENTS:

12 & UNDER = 2'-0"
OVER 12" = 3'-0"



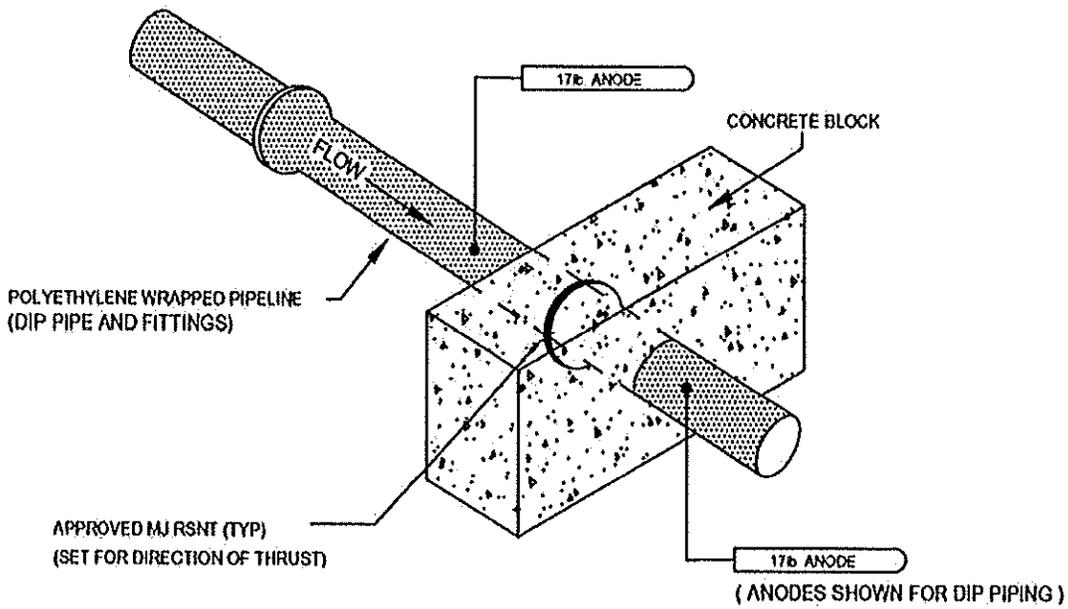
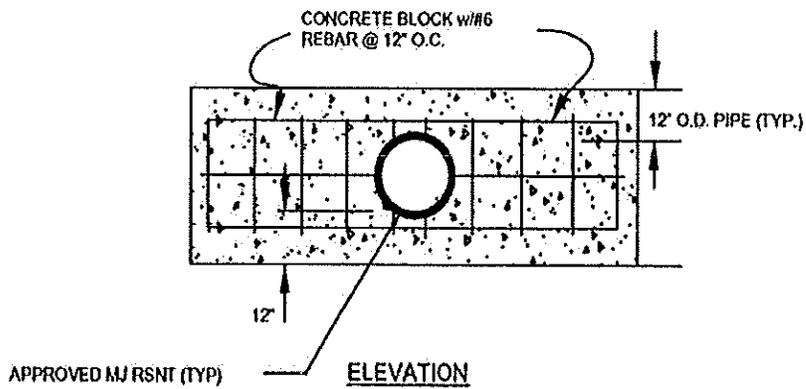
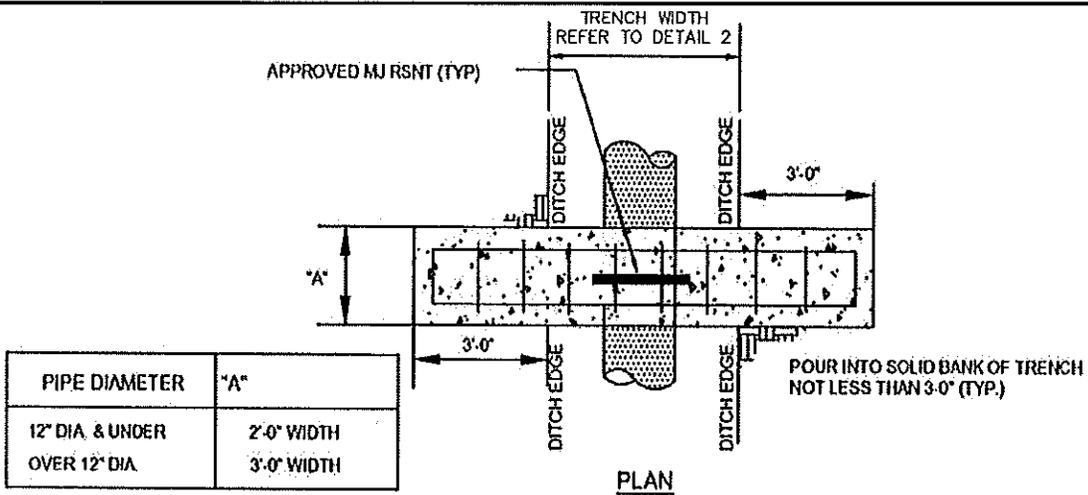
TYPICAL DEAD-END
OR REVERSE ANCHOR

NOTES:

1. MAXIMUM ROD LENGTH = 12- FEET
MINIMUM ROD LENGTH = 4- FEET
2. COAT RODS & BEAM WITH COAL TAR PROTECTION (SEE SUBSECTIONS 4-2, 4-3 & 4-4 AND DETAIL 4d).



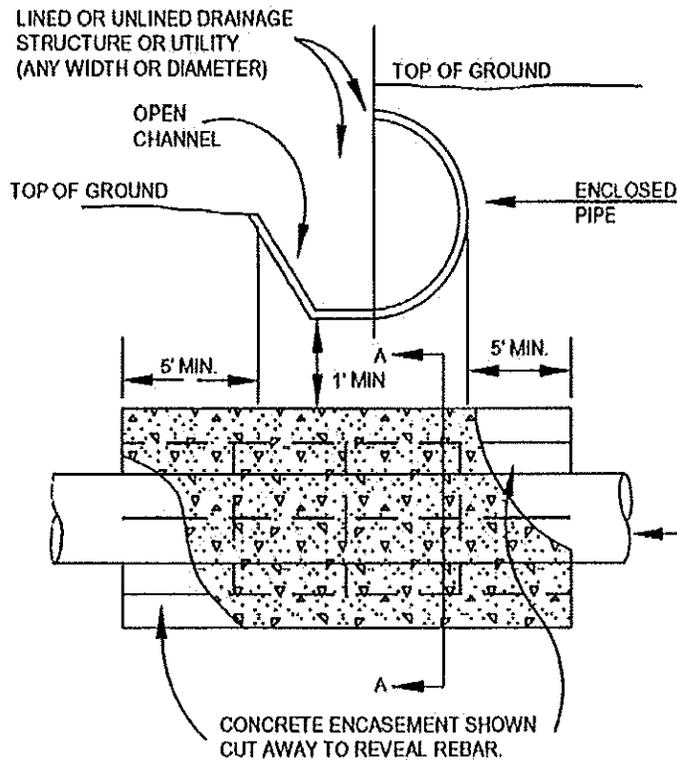
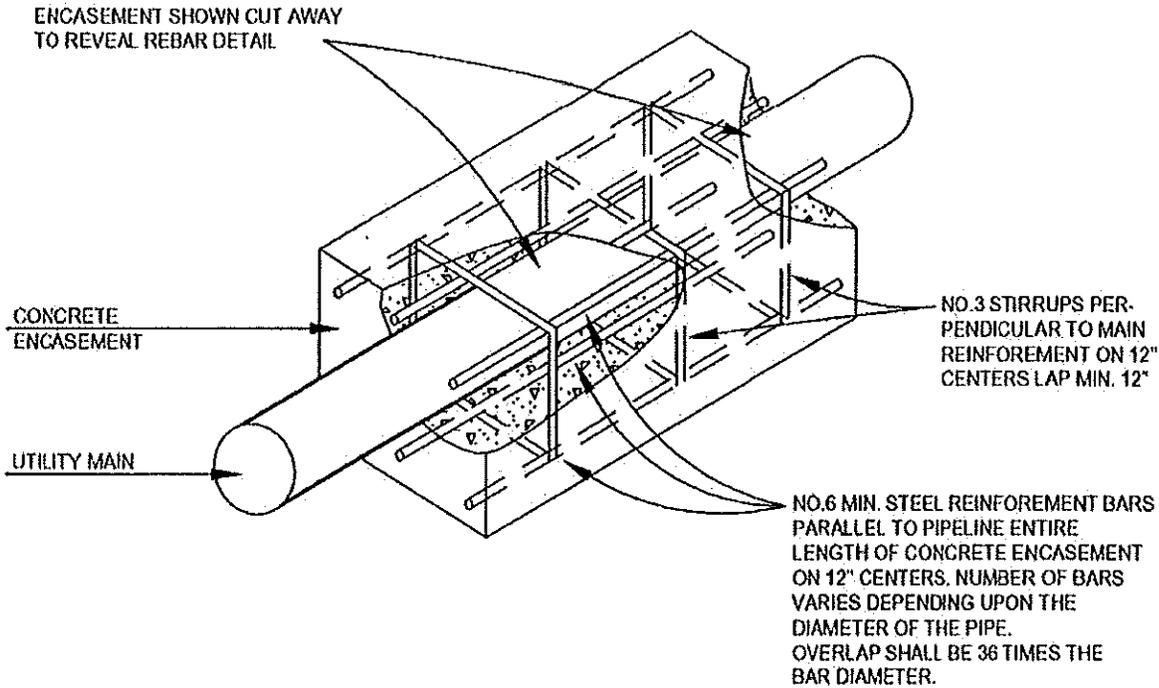
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TYPICAL REVERSE ANCHOR DETAIL

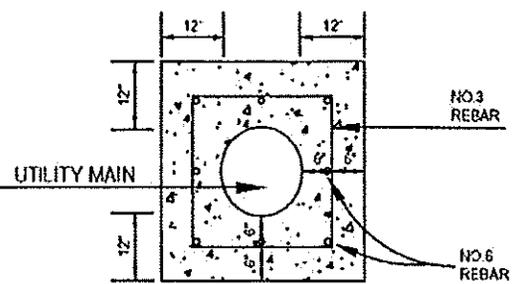


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ELEVATION

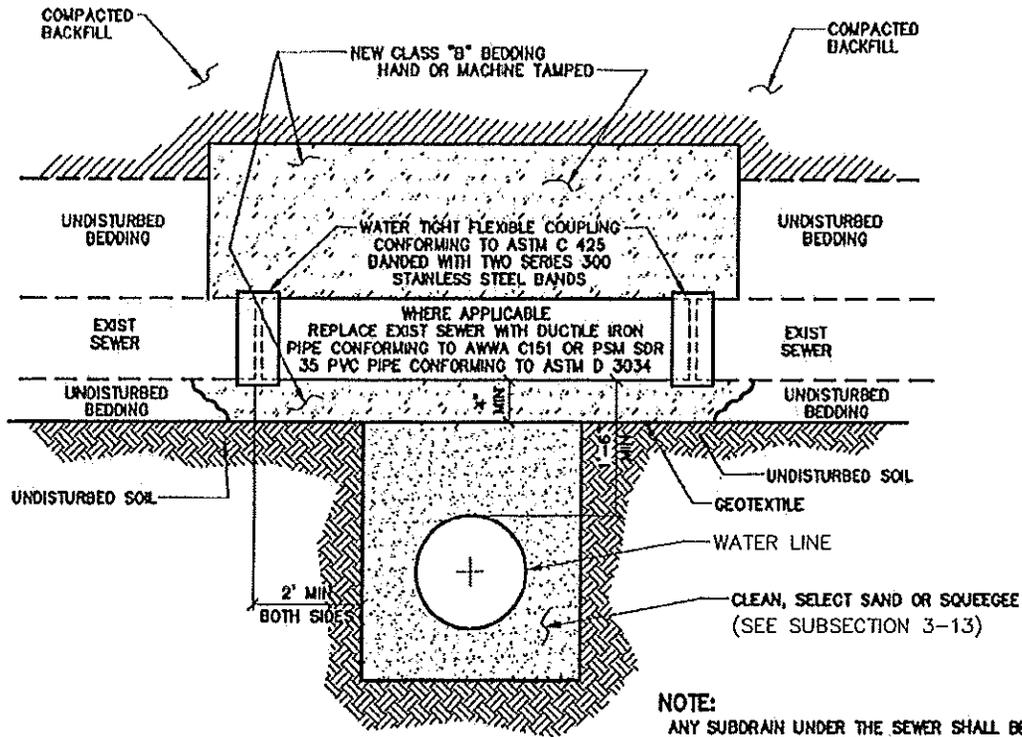
- NOTE:
1. ALTERNATIVES ALLOWED WITH DISTRICT APPROVAL
 2. SEE SUBSECTIONS 4--2.U AND 4--3.N.



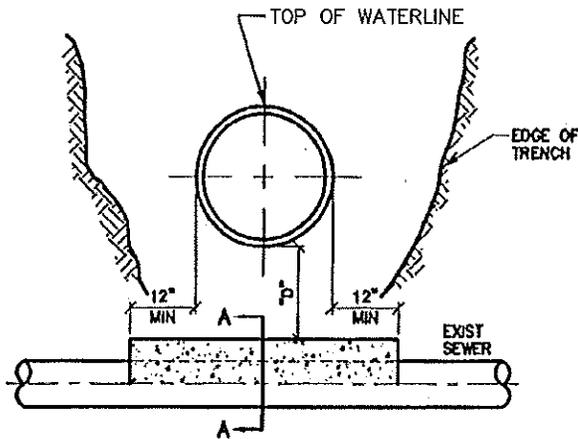
PROPER CORROSION PROTECTION REQUIRED SEE SUBSECTION 4-5

SECTION A-A

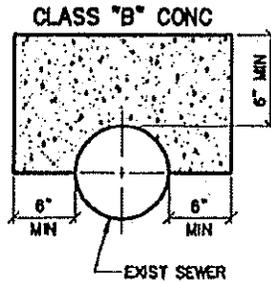




NOTE:
 ANY SUBDRAIN UNDER THE SEWER SHALL BE REPLACED SUCH THAT NO FLOW SHALL ENTER THE WATER LINE TRENCH.



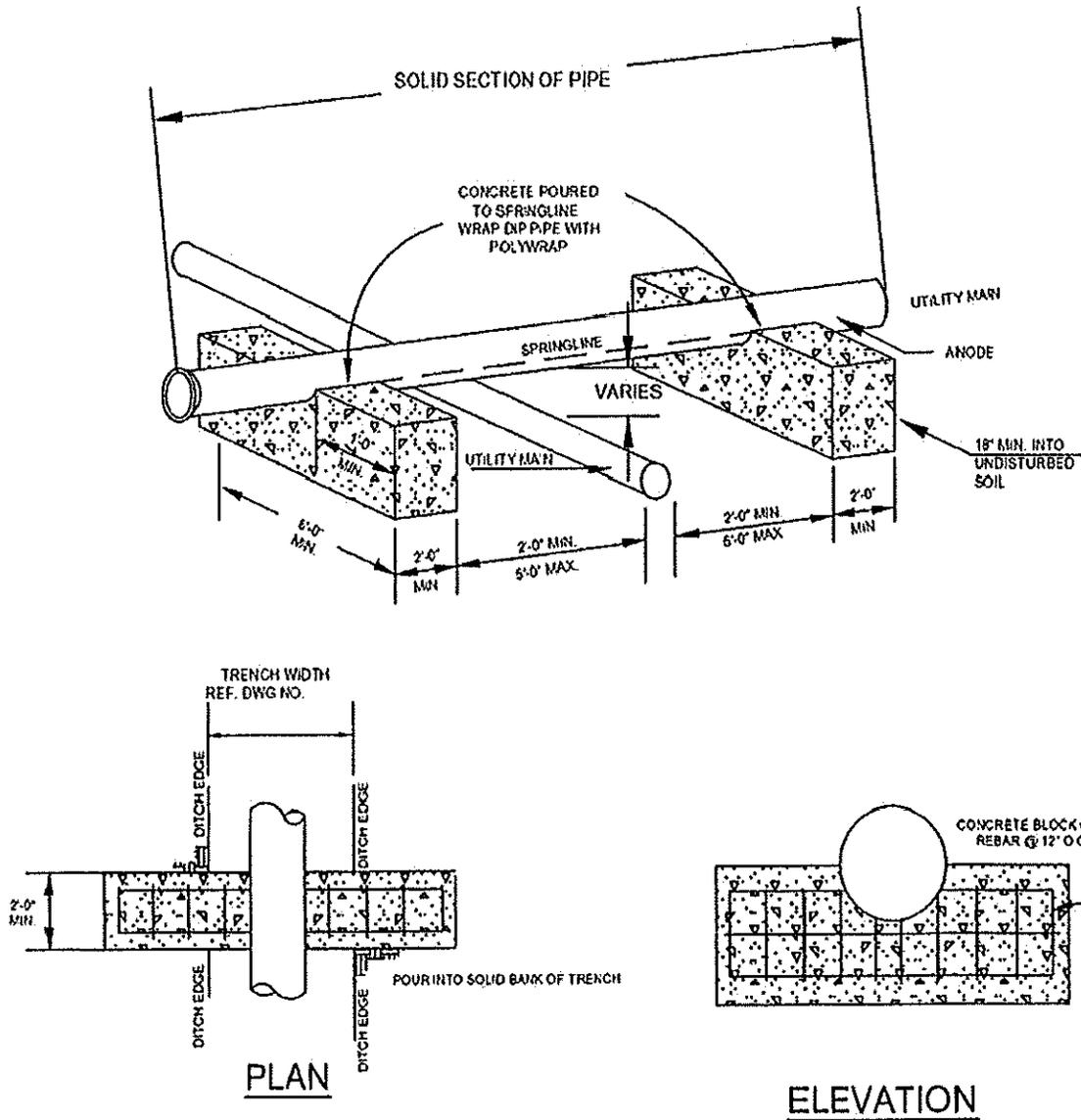
**SEWER CROSSING UNDER
 WITH "D" LESS THAN 2'**



SECTION A-A

NOTE:
 1. ALTERNATIVES ALLOWED WITH DISTRICT APPROVAL.
 2. SEE SUBSECTIONS 4-2.U AND 4-3.N





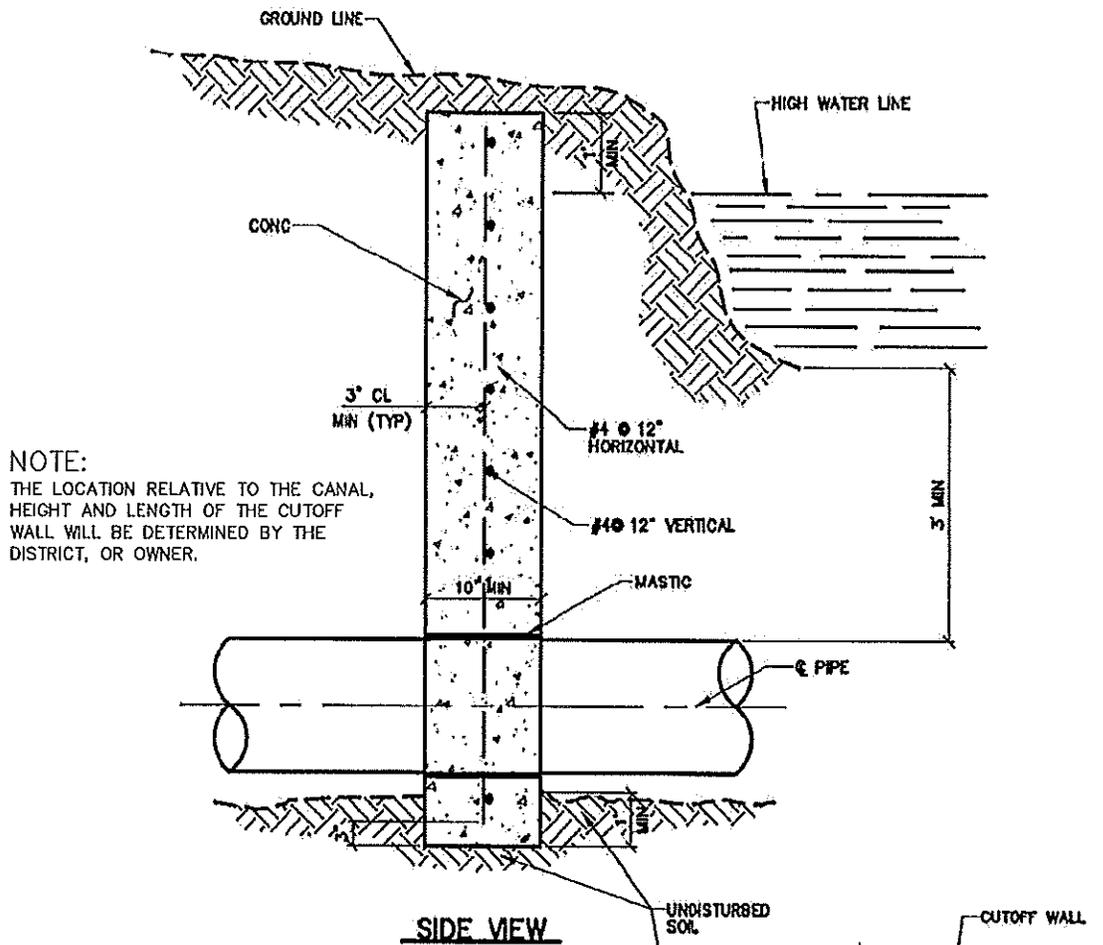
NOTE:

1. Blocks will be reinforced with No. 6 rebar, set on 12" centers.
2. No joints of new utility main allowed between concrete bridging blocks.
3. RCP utility pipe line with prior approval.
4. Helical pier anchors may be used depending on site conditions and locations.



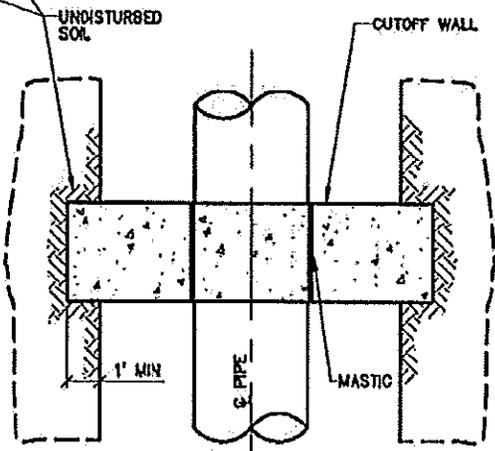
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PIPE BRIDGING DETAIL



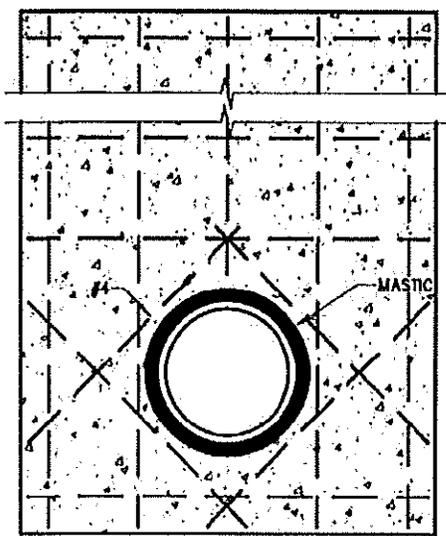
NOTE:
THE LOCATION RELATIVE TO THE CANAL,
HEIGHT AND LENGTH OF THE CUTOFF
WALL WILL BE DETERMINED BY THE
DISTRICT, OR OWNER.

SIDE VIEW



TOP VIEW

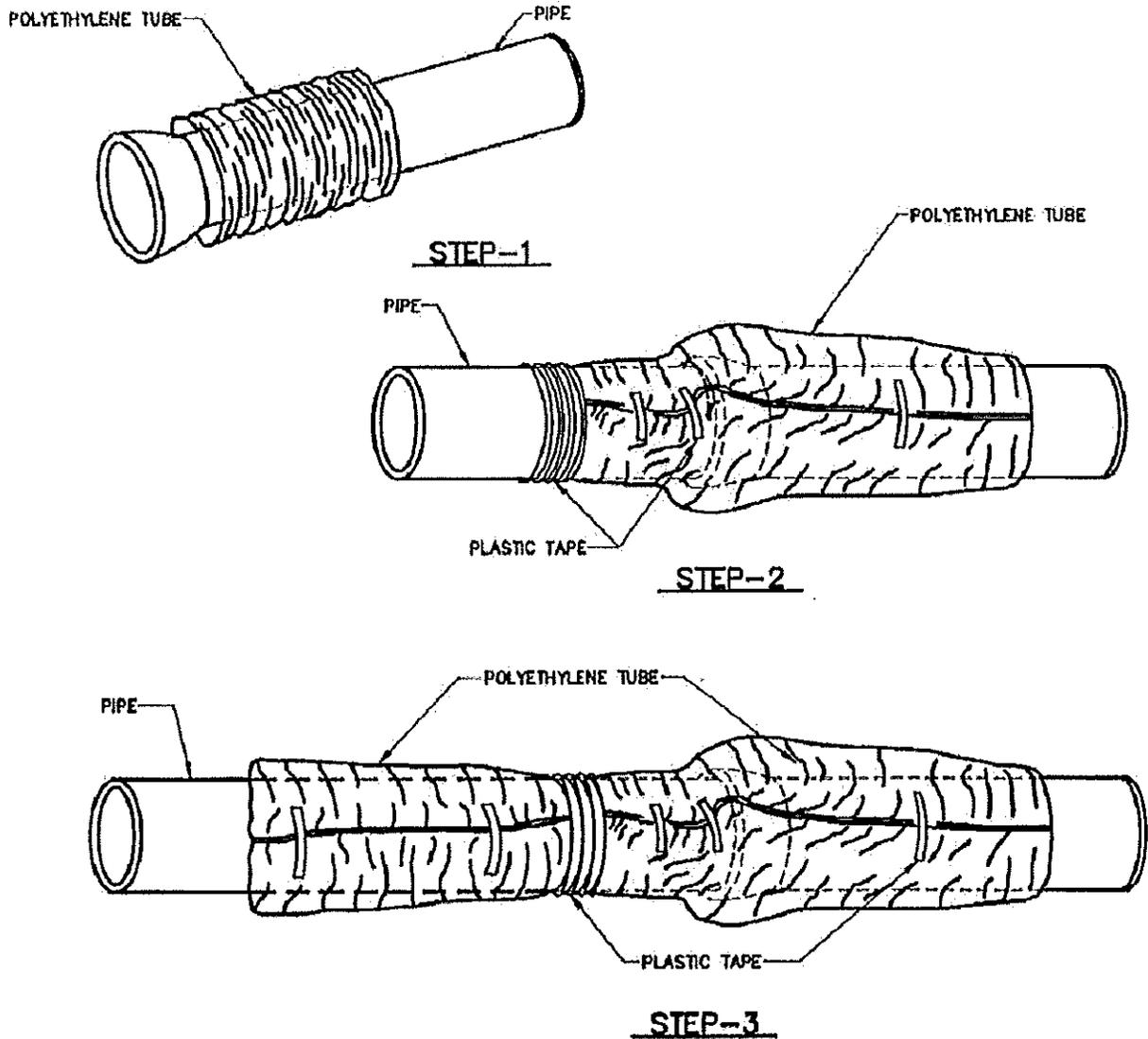
NOTE:
REINFORCEMENT NOT SHOWN.



FRONT VIEW



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FIELD INSTALLATION—POLYETHYLENE WRAP

- STEP-1** PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.
- STEP-2** PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO-INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.
- STEP-3** ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FT INTERVALS.

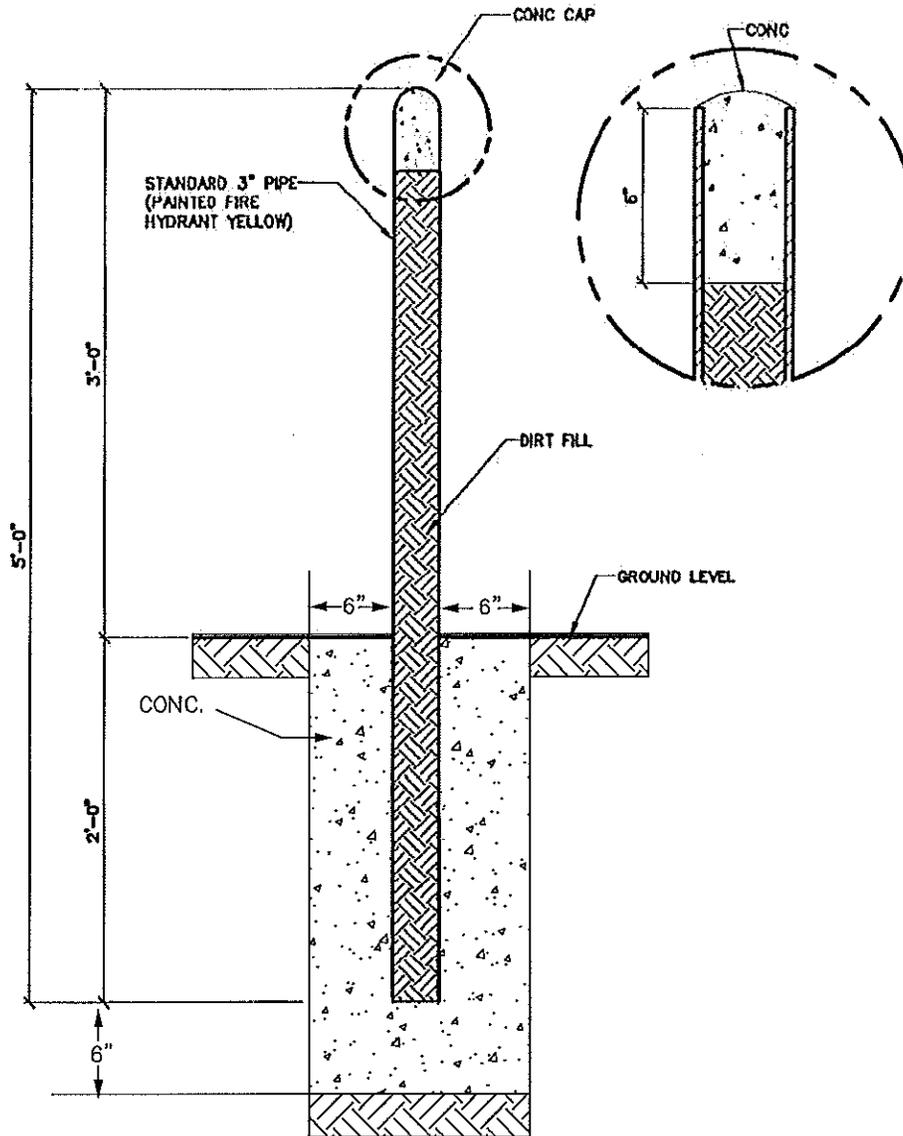
(SEE SUBSECTION 4-2.Q, 4-3.K & 4-5)



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POLYETHYLENE WRAP



IDENTIFICATION MARKS ON POSTS SHALL BE 3"Ø CIRCLES BROKEN IN VERTICAL CENTER () POINTING TO APPURTENANCE, WITH 1" STENCILS INSIDE CIRCLE INDICATING TYPE OF APPURTENANCE (MH, 12" GATE VALVE, ETC) AND THE DISTANCE IN FEET AND INCHES FROM POST.



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2005 MODIFIED DRAWING FROM DENVER WATER
[SHEET 33]

REFERENCE POST
TYPICAL DETAIL

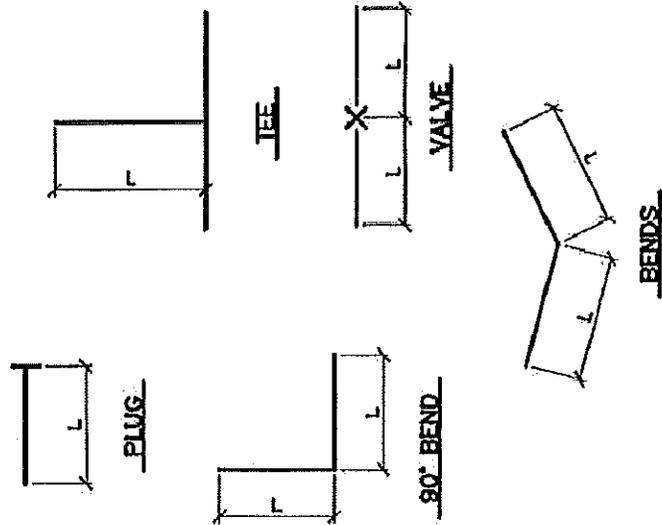
DETAIL 24

ROD DIAMETER, GRADE & LENGTH OF RESTRAINED PIPE

PIPE SIZE	4"			6"			8"			12"			16"			20"			24"				
	D	L	G	D	L	G	D	L	G	D	L	G	D	L	G	D	L	G	D	L	G		
FITTING																							
90° BEND, TEE, PLUG	3/4"	30'	MS	3/4"	45'	MS	3/4"	60'	MS	3/4"	86'	HS	1"	108'	HS	1 1/4"	132'	HS					
VALVE	-	-	-	-	-	-	-	-	-	-	-	-	1"	108'	HS	1 1/4"	132'	HS					
45° BEND	3/4"	9'	MS	3/4"	13'	MS	3/4"	18'	MS	3/4"	25'	MS	1"	32'	MS	3/4"	39'	HS					
22 1/2° BEND	3/4"	1'	MS	3/4"	4'	MS	3/4"	5'	MS	3/4"	7'	MS	3/4"	8'	MS	3/4"	10'	MS					
11 1/4° BEND	-	-	-	-	-	-	3/4"	1'	MS	3/4"	2'	MS	3/4"	2'	MS	3/4"	3'	MS					

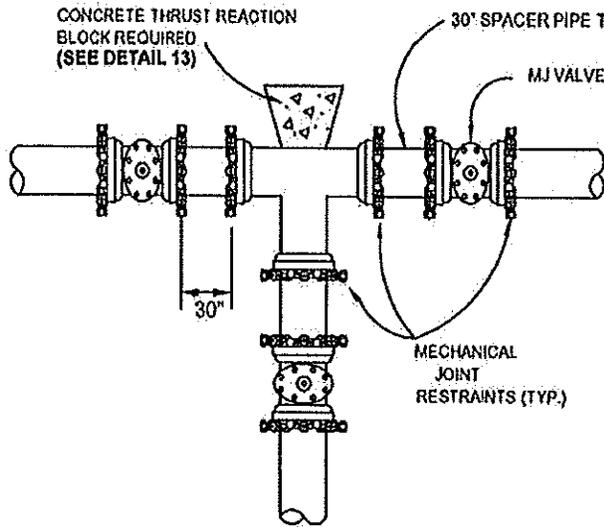
NOTES:

1. LENGTH OF RESTRAINED PIPE MEASURED EACH WAY FROM VALVES AND BENDS.
2. CLAMPS, RODS & MEGALUGS NOT ALLOWED FOR 24-INCH AND LARGER PIPES.
3. D = DIAMETER, L = LENGTH, G = GRADE.
4. MINIMUM 5.5' GROUND COVER REQUIRED.
5. BASED ON 150 PSI INTERNAL PRESSURE, FOR L AND PRESSURES LISTED ON DETAIL 4b FOR D AND G.
6. MS = MILD STEEL ROD ASTM A36.
7. HS = HIGH STRENGTH ROD ASTM A193 GRADE B7.
8. NUTS SHALL BE ASTM A307 GRADE A OR B HEXAGON HEAVY SERIES.
HS NUTS SHALL BE ASTM A 194, GRADE 2H.
9. SEE DETAIL 3 CLAMP & DIMENSIONS FOR USE WITH CI & DI FITTINGS AND SEE DETAIL 5 TIE ROD & WASHER.
10. LENGTH REFERS TO THE AMOUNT OF PIPE WHICH MUST BE RESTRAINED TOGETHER AND IS NOT NECESSARILY THE LENGTH OF THE RODS.
11. LENGTH OF RESTRAINED PIPE CHART IS ALSO FOR THE LENGTH OF JOINT RESTRAINT FOR MEGALUGS.
12. CROSSES MUST BE RESTRAINED IN ALL APPLICABLE DIRECTIONS.
13. 12-INCH AND SMALLER IN LINE VALVES AND TEES SHALL HAVE A MECHANICAL JOINT RESTRAINT DEVICE ON EACH SIDE OF THE FITTING OR VALVE. MECHANICAL JOINT RESTRAINT DEVICE SHALL BE PER SUBSECTIONS 4-2.B, 4-3.J.2 AND DETAIL 16.
14. A SECOND VALVE WILL BE REQUIRED TO BE CLOSED WHEN EXCAVATING NEXT TO AN EXISTING VALVE.
15. ON PLUGS, TEES AND BENDS KICKBLOCKS SHALL BE USED IN ADDITION TO RESTRAINT.
16. WHEN REDUCERS ARE USED ON VALVE INSTALLATIONS, THE LENGTH OF RESTRAINT SHALL BE BASED ON THE SIZE OF THE PIPE NOT THE SIZE OF THE VALVE.

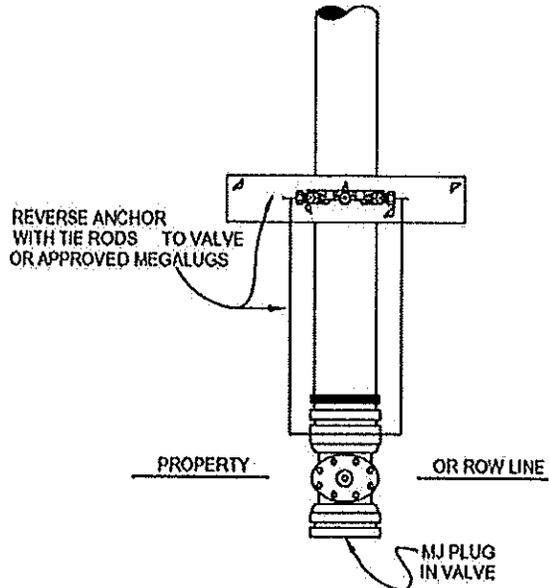


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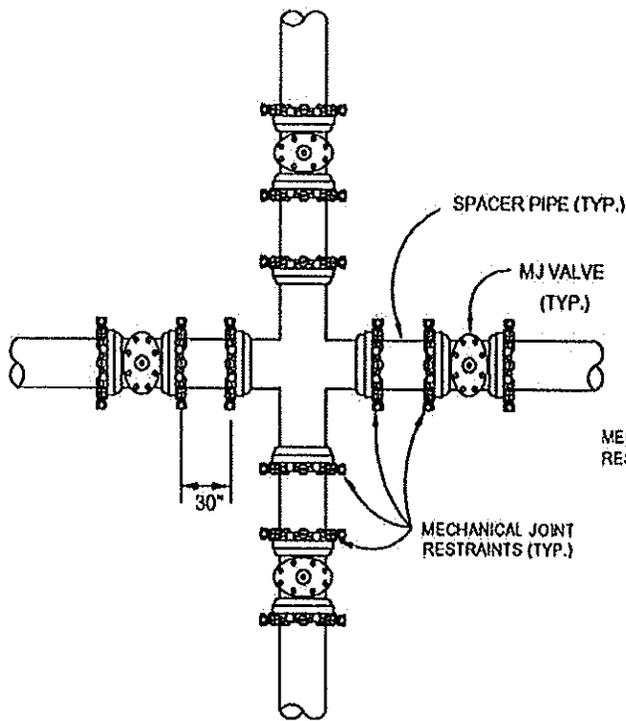
LENGTH OF RESTRAINED PIPE



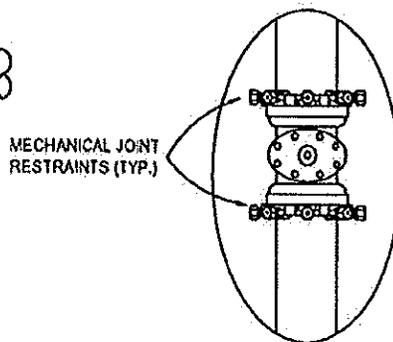
CROSS OR TEE WITH SPACER PIPE



AT END OF LINES USE REVERSE ANCHOR WITH TIE BACK RODS



CROSS OR TEE WITH ANCHOR PIPES



MECHANICAL JOINT RESTRAINT DETAIL

1. MECHANICAL JOINT RESTRAINTS SHALL BE APPROVED ACCORDING TO SPECIFICATION IN SUBSECTIONS 4-2 AND 4-3 FOR DIP AND PVC PIPE.
2. LENGTH OF PIPE REQUIRING JOINT RESTRAINT SHALL BE DETERMINED FROM CHART ON DETAIL 25.

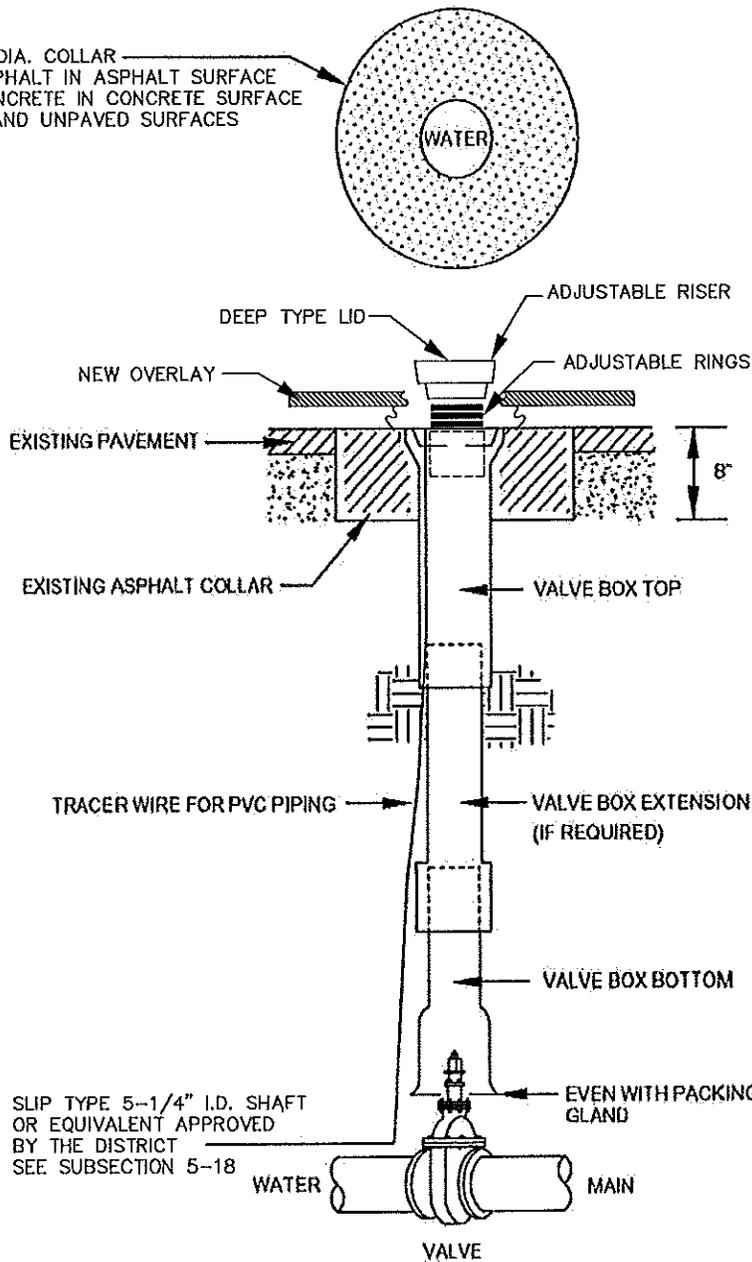
NOTES:

1. ON ANY VALVE INSTALLATION THE INSPECTOR MAY REQUIRE VALVE TO BE ANCHORED BY RODS OR REVERSE ANCHOR WITH THE APPROVAL OF THE DISTRICT.
2. ANCHOR PIPE MAY BE SUBSTITUTED FOR SPACER PIPE AND RODS.
3. THE CONCRETE REVERSE ANCHORS USED SHALL BE SIZED AS INDICATED ON DETAILS 18 & 18a.
4. SEE DETAIL 16 AND SUBSECTIONS 4-2.K & 4-3.J.2 FOR APPLICATION OF MECHANICAL JOINT RESTRAINTS.
5. SEE DETAILS 27 & 28 FOR VALVE BOX INSTALLATION.

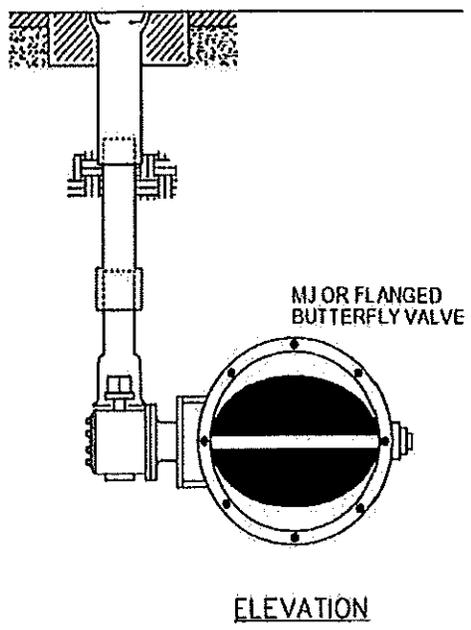
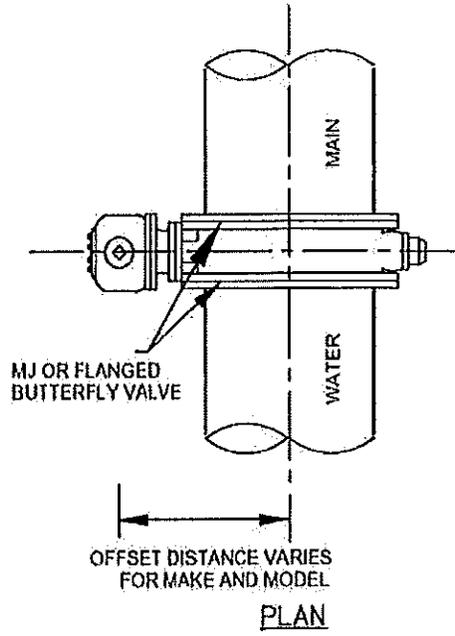


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2' DIA. COLLAR
 ASPHALT IN ASPHALT SURFACE
 CONCRETE IN CONCRETE SURFACE
 AND UNPAVED SURFACES



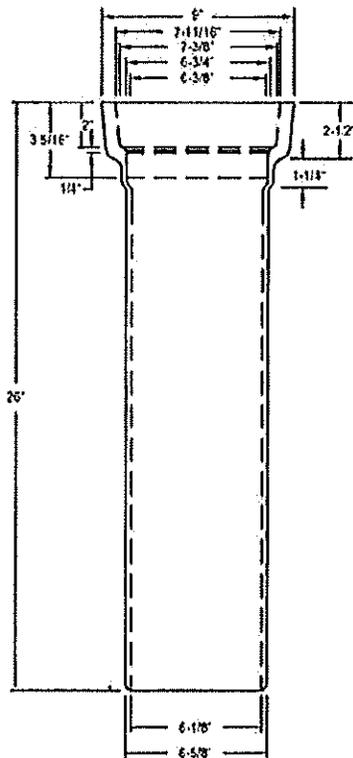
SLIP TYPE 5-1/4" I.D. SHAFT
 OR EQUIVALENT APPROVED
 BY THE DISTRICT
 SEE SUBSECTION 5-18



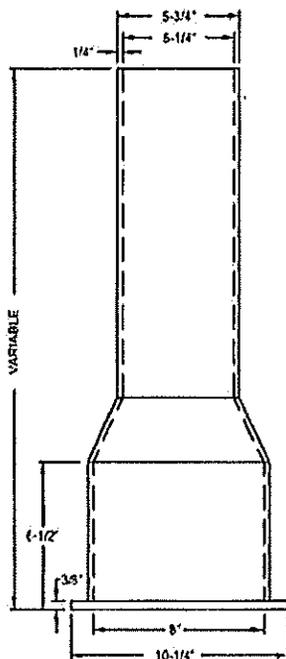
NOTE: MAIN AND FIRE HYDRANT VALVES AND VALVE BOXES SHALL BE LOCATED IN THE PAVEMENT SURFACE OF THE STREET, AND SHALL NOT BE IN THE CURB PAN, CURB OR SIDEWALK.

NOTE: MAKE AND MODEL MAY VARY FROM SCHEMATIC SHOWN IN DETAIL. CONTROL VALVE MAY BE LOCATED ON THE TOP OR SIDE.



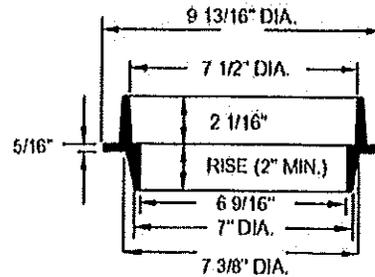


TOP.

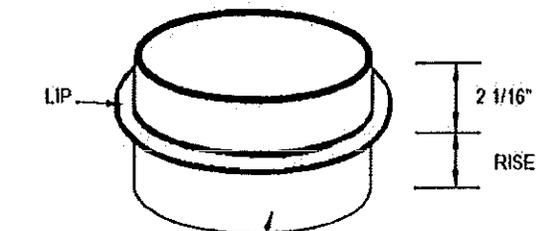


BOTTOM.

EXAMPLE OF RISER INSERT



VALVE BOX RISER FOR STANDARD DROP LID



VALVE BOX RISER INSERT

NOTE:
RISE TO MATCH EXISTING
PAVEMENT DEPTH TO ALLOW
VALVE LID TO BE FLUSH WITH
DRIVING SURFACE.

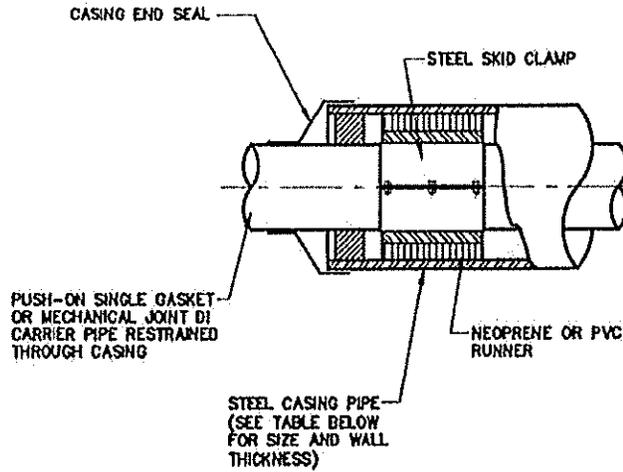
GENERAL NOTES:

1. Valve box is to be cleaned of all debris and obstructions prior to installation of the riser.
2. Riser shall be installed as close to the final pavement elevation without interfering with cover operation.

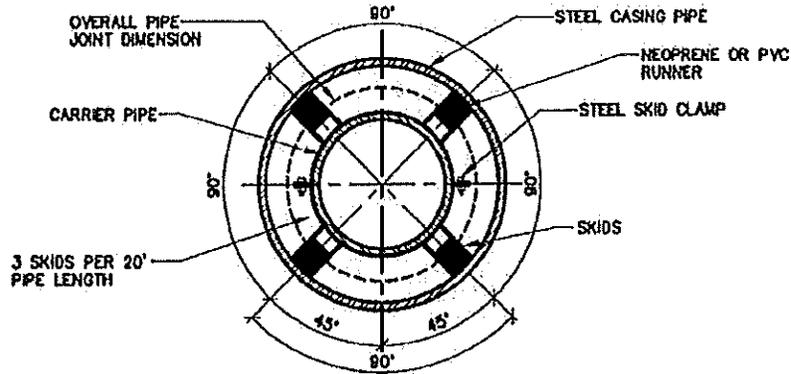


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VALVE BOX TOP AND BOTTOM SECTIONS



SLED DETAIL



PIPE CASING DETAIL

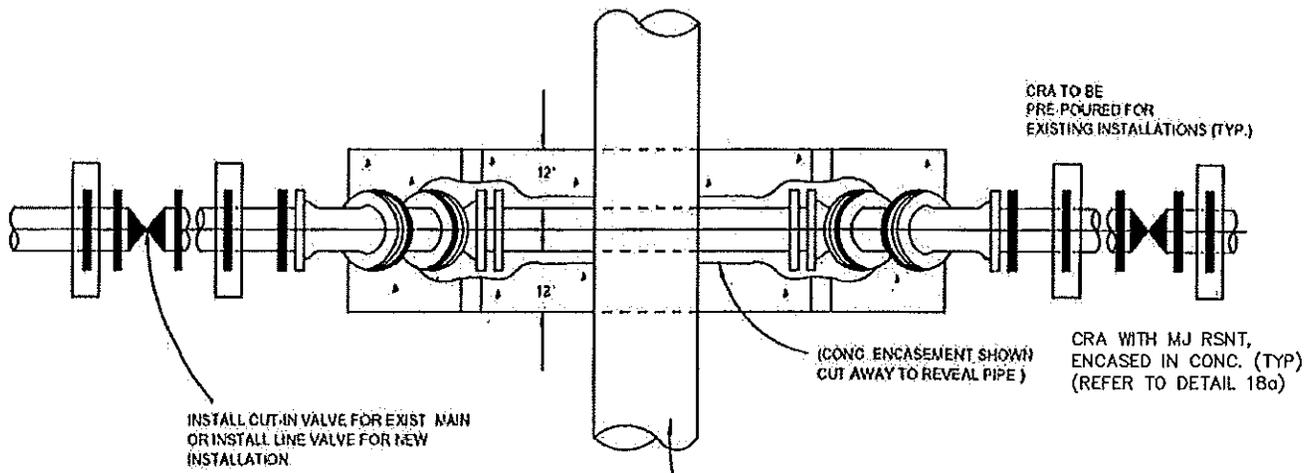
CARRIER PIPE NOMINAL #	CASING PIPE	
	MIN OD	MIN WALL THICKNESS
4"	12"	0.188"
6"	16"	0.25"
8"	18"	0.262"
12"	22"	0.344"
16"	26"	0.406"
20"	32"	0.489"



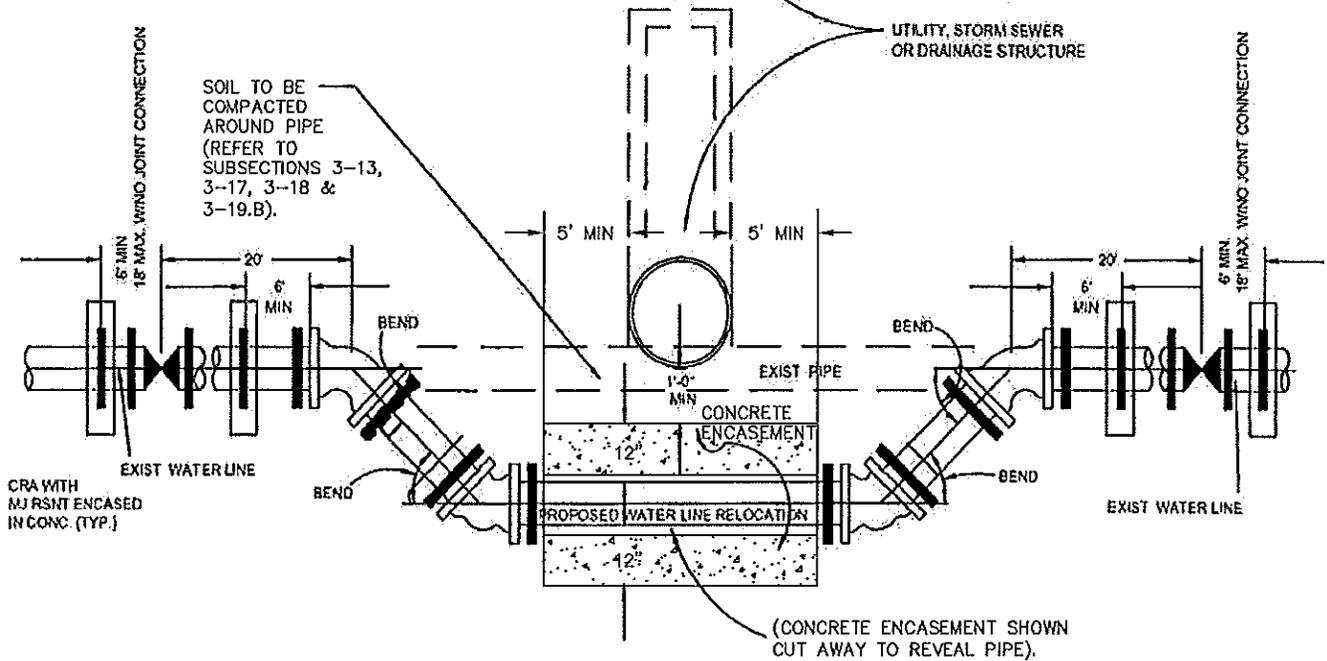
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BORE CASING DETAIL

PLAN:



PROPOSED/EXISTING GROUND LEVEL



ELEVATION:

NOTES:

1. NO PVC PIPE IN SANITARY CROSSINGS.
2. LOWERINGS TO BE INSPECTED UNDER SUPERVISION OF INSPECTOR.
3. ALL FITTINGS SHALL HAVE MJ RSNTS. SEE DETAILS 16, 25 & SUBSECTION 4-2.
4. SEE DETAIL 19 FOR CONCRETE ENCASEMENT
5. SEE DETAIL 30a FOR ALTERNATIVE.

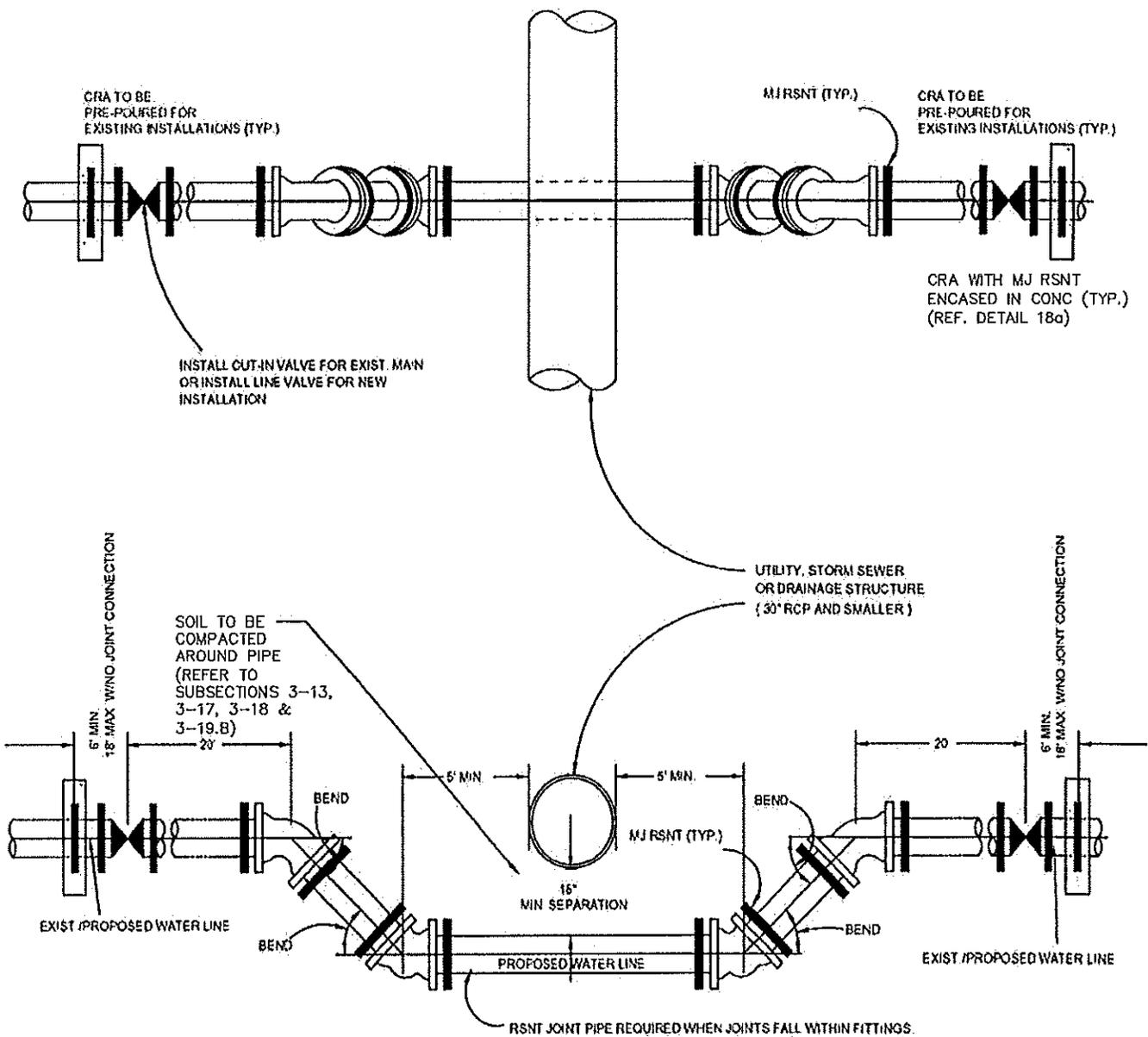


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2005 MODIFIED DRAWING FROM COLORADO
 SPRINGS UTILITIES [DETAIL A 8-5]

WATER LINE LOWERING DETAIL

PLAN:



ELEVATION:

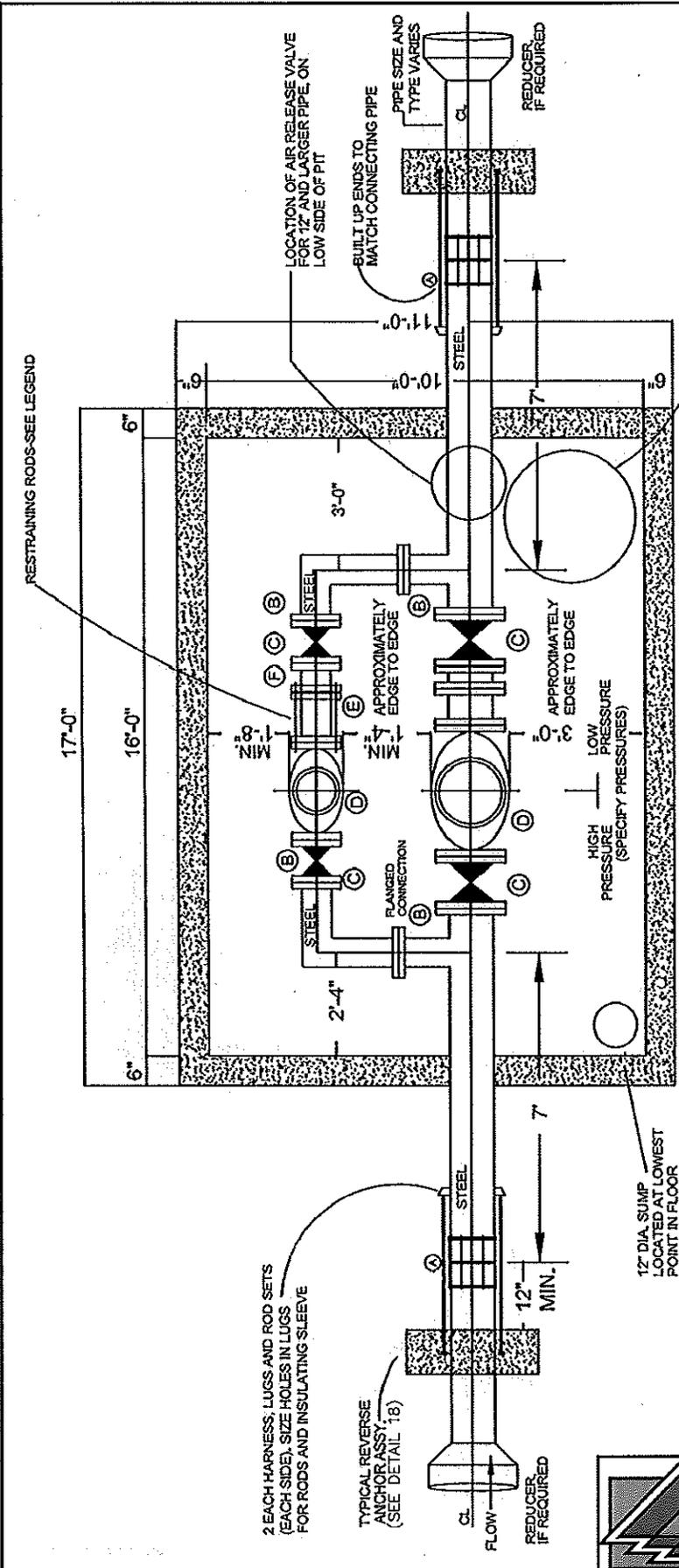
30" RCP AND SMALLER-UTILITY STRUCTURE

NOTES:

1. NO PVC PIPE IN SANITARY CROSSINGS.
2. LOWERINGS TO BE INSPECTED UNDER SUPERVISION OF INSPECTOR.
3. ALL FITTINGS SHALL HAVE MJ RSNT. SEE DETAILS 16, 25 & SUBSECTION 4-2.
4. EXAMPLES CAN VARY DUE TO SITE CONDITIONS AND INSPECTOR'S DIRECTIONS.
5. SEE DETAIL 30 FOR ALTERNATIVE.



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HEAVY DUTY SINGLE 38" NOMINAL MANHOLE RING AND COVER. (SEE SUBSECTION 6-2)

PLAN
(NOT TO SCALE)

PLAN LEGEND

- A. 6", 8", 12" STYLE 39 DRESSER COUPLING OR APPROVED EQUAL
- B. 125 LB. FLANGES (REF: NOTE 1 BELOW)
- C. 4", 6", 8" OR 12" - 250 LB. GATE VALVE
- D. 4", 6", 8" OR 12" - FLANGED 150 LB. CLA-VAL REGULATOR
- E. 4", 6", OR 8" - STEEL FITTING, 150 LB FLANGED ONE END, SPIGOT ONE END
- F. 4", 6", OR 8" - 250 LB. DRESSER STYLE 128 FLANGED ADAPTER OR EQUAL-TIE BACK TO REGULATOR WITH TWO 3/4" RODS. SEE PLAN VIEW.

NOTES

- 1. 125 LB DRILLING (DUCTILE IRON) = 150 LB DRILLING (FORGED STEEL)
- 2. CONCRETE VAULTS SHALL MEET ALL CRITERIA AS OUTLINED ON DETAILS 34 & 35.
- 3. ALL REGULATOR INSTALLATIONS LARGER THAN 8-INCH SHALL BE SPECIALLY DESIGNED AND APPROVED BY THE DISTRICT.
- 4. ALL MATERIAL INSIDE VAULT SUPPLIED BY CONTRACTOR (SEE SUBSECTION 6-2).
- 5. SEE SUBSECTION 5-17 FOR GAUGE SPECIFICATIONS.
- 6. SEE DETAIL 32a FOR FLANGED ADAPTER.
- 7. TO BE READ IN CONJUNCTION WITH DETAIL 32.

APPROX. SIZE OF REGULATOR, 150 ANSI		
SIZE	LENGTH	WIDTH
4"	15.00	11.50
6"	20.00	15.75
8"	25.38	20.00
12"	34.00	28.00

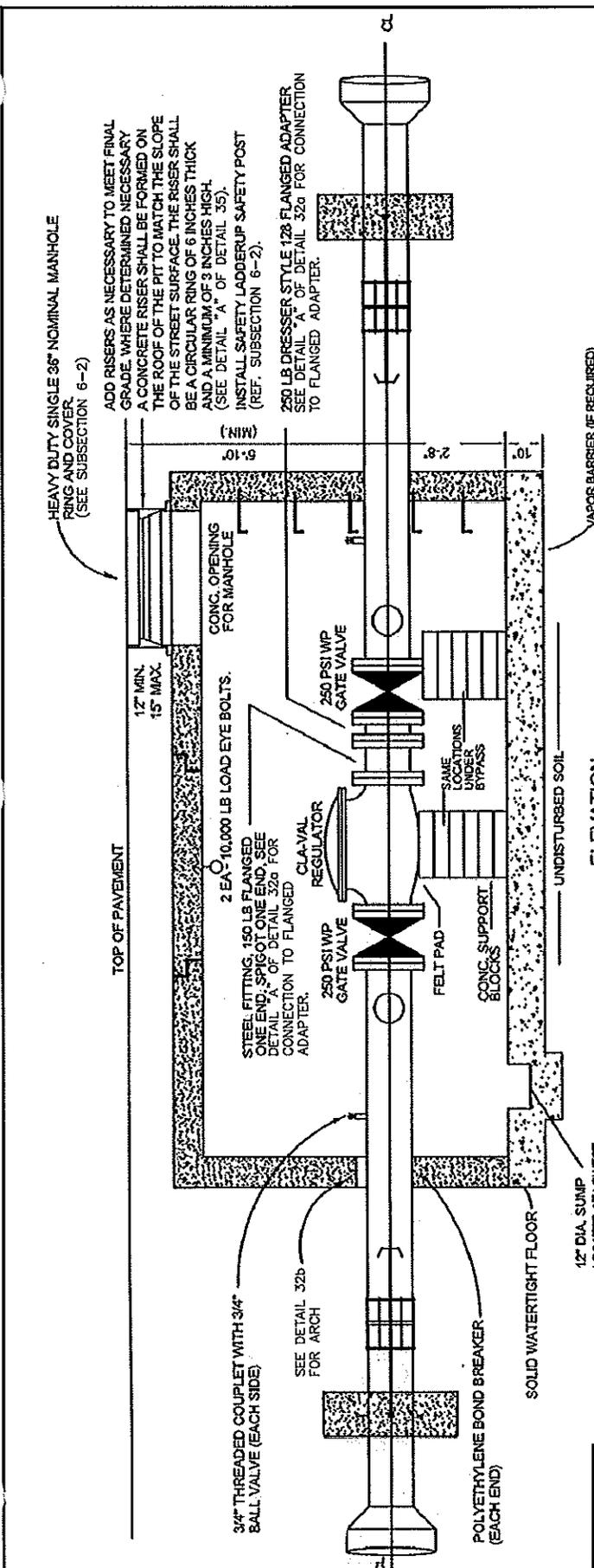
REFERENCE MANUFACTURERS SPECIFICATIONS FOR CORRECT SIZING

2007 MODIFIED DRAWING FROM COLORADO SPRINGS UTILITIES [DETAIL A 1-3]



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**6", 8" & 12" PRESSURE
REGULATOR STATION**



APPROX. SIZE OF REGULATOR, 150 ANSI		
SIZE	LENGTH	WIDTH
4"	15.00	11.50
6"	20.00	15.75
8"	25.38	20.00
12"	34.00	28.00

REFERENCE MANUFACTURERS SPECIFICATIONS FOR CORRECT SIZING

- NOTES:
1. CONCRETE VAULTS SHALL MEET ALL CRITERIA AS OUTLINED ON DETAILS 34 & 35.
 2. ALL REGULATOR INSTALLATIONS LARGER THAN 8-INCH SHALL BE SPECIALLY DESIGNED AND APPROVED BY THE DISTRICT.
 3. ALL MATERIAL INSIDE VAULT SUPPLIED BY CONTRACTOR (SEE SUBSECTION 6-2).
 4. ADJUSTABLE STEEL PIPE VALVE SUPPORT MAY BE USED IN PLACE OF CONC. SUPPORT BLOCKS.
 5. SEE SUBSECTION 5-17 FOR GAUGE SPECIFICATIONS.
 6. SEE DETAIL 32a FOR FLANGED ADAPTER.
 7. 125 LB DRILLING (DUCTILE IRON) = 150 LB DRILLING (FORGED STEEL)
 8. TO BE READ IN CONJUNCTION WITH DETAIL 31.

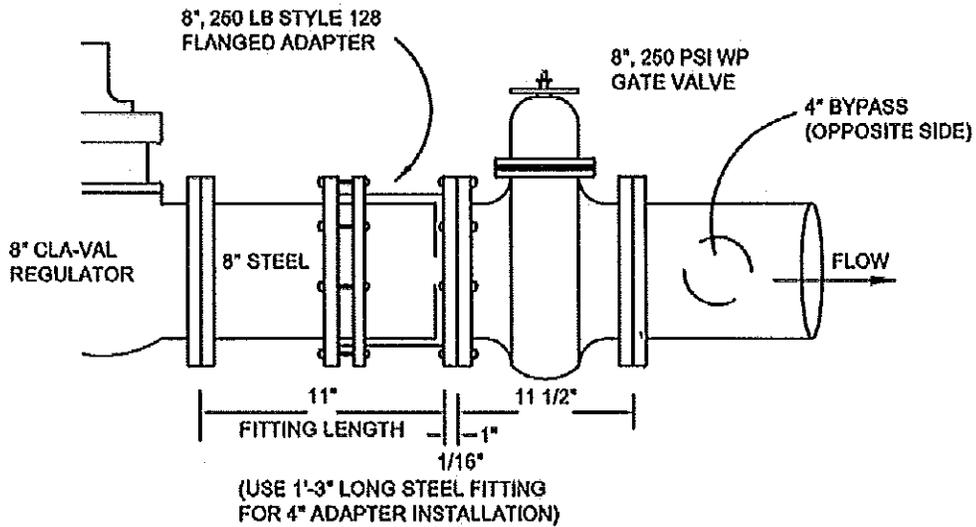
2007 MODIFIED DRAWING FROM COLORADO SPRINGS UTILITIES [DETAIL A 1-4]



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6", 8" & 12 PRESSURE REGULATOR STATION

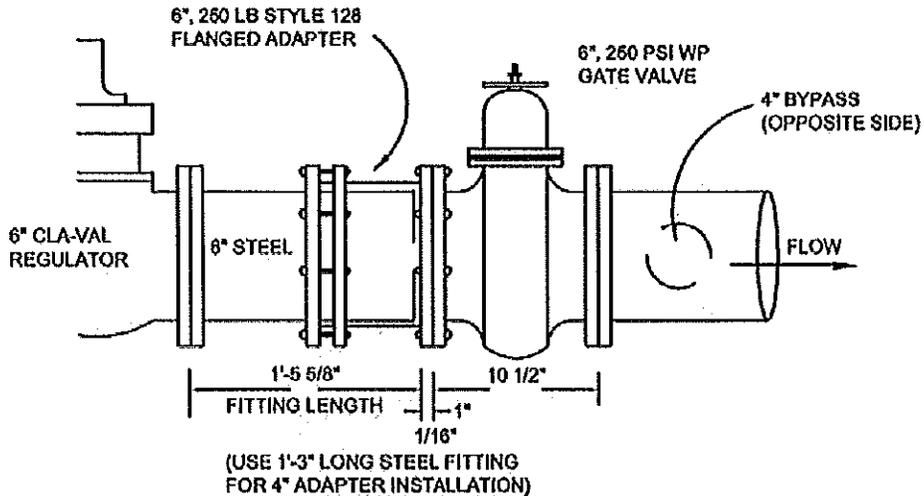
8-INCH SIZE PRESSURE REGULATOR STATION



DETAIL "A"

FLANGED ADAPTER
(NOT TO SCALE)

6 - INCH SIZE PRESSURE REGULATOR STATION



DETAIL "B"

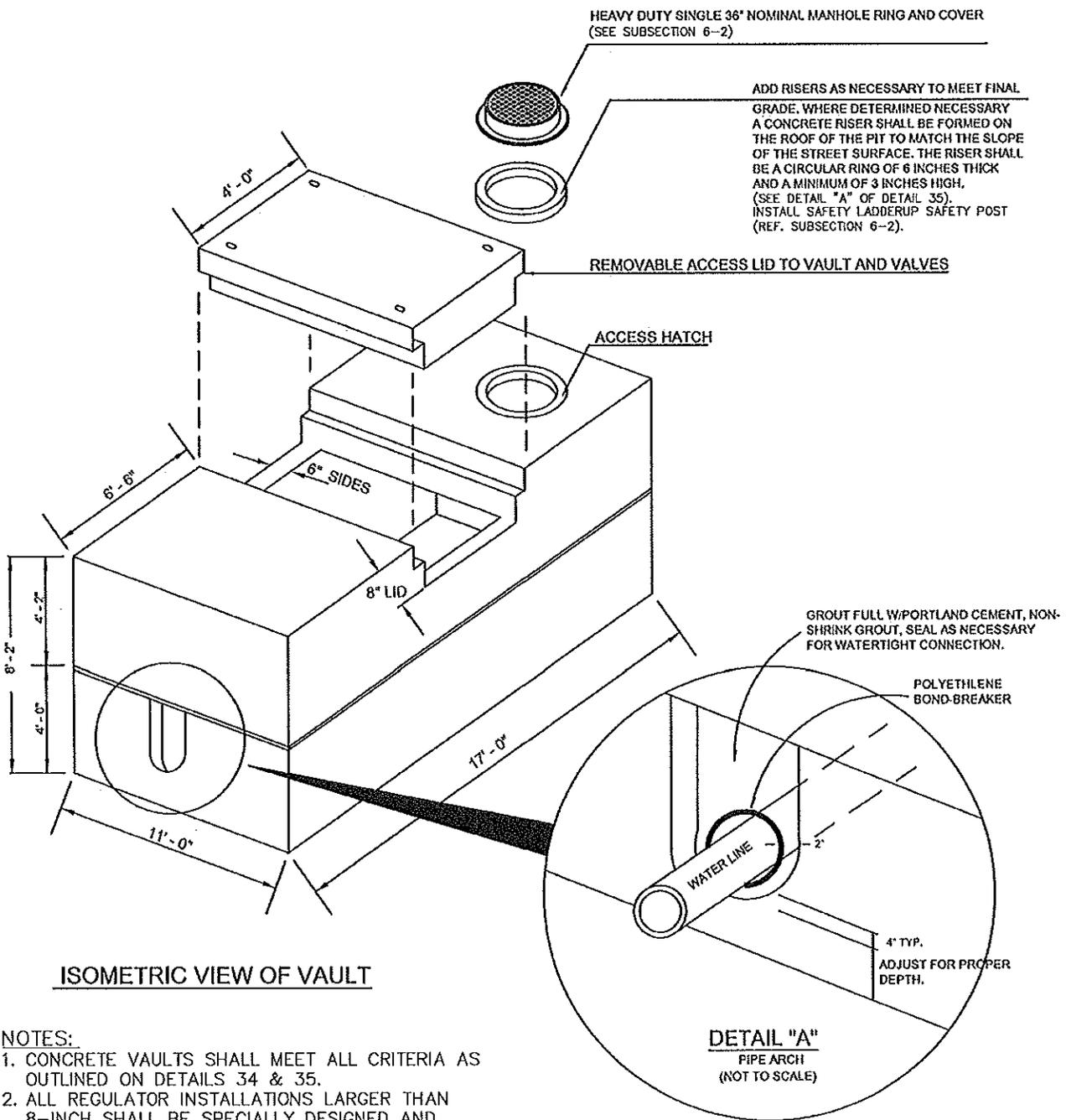
FLANGED ADAPTER
(NOT TO SCALE)

NOTES:

1. CONCRETE VAULTS SHALL MEET ALL CRITERIA AS OUTLINED IN DETAILS 34 & 35 AND SUBSECTION 6.
2. ALL REGULATOR INSTALLATIONS LARGER THAN 8-INCH SHALL BE SPECIALLY DESIGNED AND APPROVED BY THE DISTRICT.
3. ALL MATERIAL INSIDE VAULT SUPPLIED BY CONTRACTOR (SEE SUBSECTION 6-2).
4. 125 LB DRILLING (DUCTILE IRON) = 150 LB DRILLING (FORGED STEEL).



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ISOMETRIC VIEW OF VAULT

NOTES:

1. CONCRETE VAULTS SHALL MEET ALL CRITERIA AS OUTLINED ON DETAILS 34 & 35.
2. ALL REGULATOR INSTALLATIONS LARGER THAN 8-INCH SHALL BE SPECIALLY DESIGNED AND APPROVED BY THE DISTRICT.
3. ALL MATERIAL INSIDE VAULT SUPPLIED BY CONTRACTOR (SEE SUBSECTION 6-2).
4. SEE SUBSECTION 5-17 FOR GAUGE SPECIFICATIONS.
5. 125 LB DRILLING (DUCTILE IRON) = 150 LB DRILLING (FORGED STEEL)
6. TO BE READ IN CONJUNCTION WITH DETAILS 31 & 32.
7. PRE-CONSTRUCTED PRESSURE REGULATOR STATION MAY BE USED WITH TOWN APPROVAL.

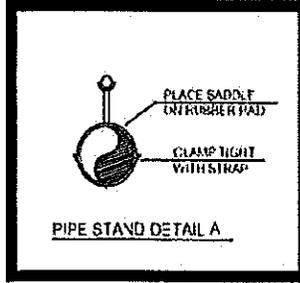
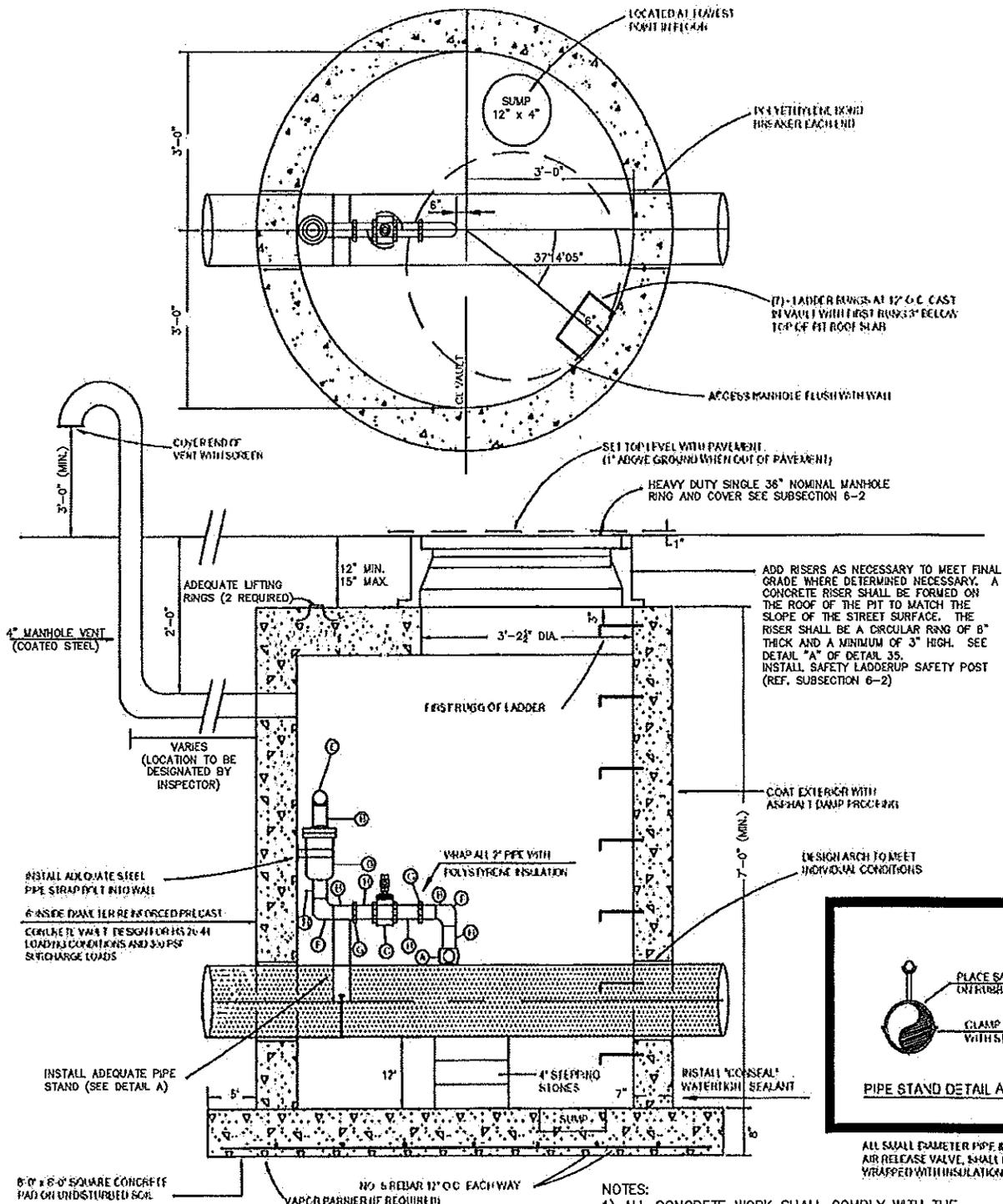


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**PRESSURE REGULATOR STATION
 FOR 6", 8" & 12" PIPE**

**2007 MODIFIED DRAWING FROM COLORADO
 SPRINGS UTILITIES [DETAIL A 1-4]**

DETAIL 32b



ALL SMALL DIAMETER PIPE & AIR RELEASE VALVE, SHALL BE WRAPPED WITH INSULATION & TAPPED

- LEGEND:
- (A) 2" CORPORATION TAPERED THREADS INLET WITH 2" FEMALE IRON PIPE OUTLET (MUELLER OR FORD)
 - (B) 2" x CLOSE THREADED BRASS NIPPLE
 - (C) 2" THREADED GATE VALVE WITH STANDARD OPENING NUT.
 - (D) 2" THREADED INLET CRISPIN AIR AND VACUUM VALVE (SEE SUBSECTION 5-8)
 - (E) 2" x 90° PLASTIC ELBOW
 - (F) 2" x 90° BRASS THREADED ELBOW
 - (G) 2" BRASS UNION
 - (H) 2" x 4" THREADED BRASS NIPPLE

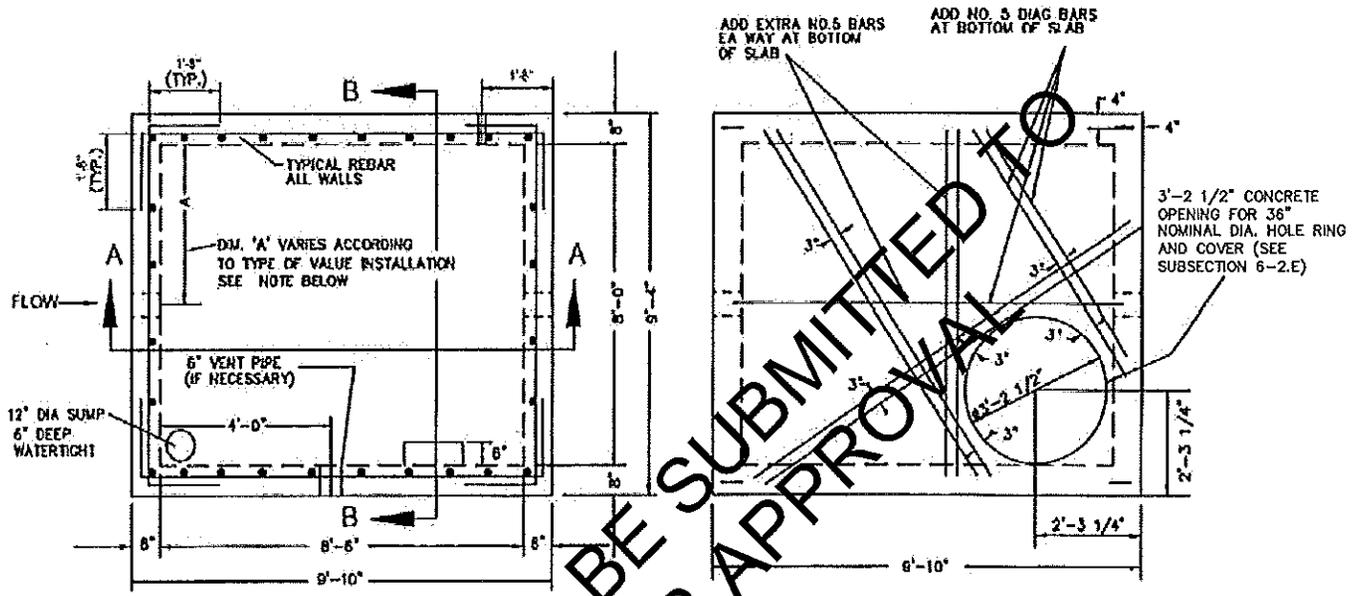
- NOTES:
- 1) ALL CONCRETE WORK SHALL COMPLY WITH THE LATEST ACI-318 SPECIFICATIONS.
 - 2) AIR VALVE ASSEMBLY LARGER THAN 2" SIZE OR MAINS THAN 16" SHALL BE SPECIALLY DESIGNED AND MEET THE DISTRICT'S REQUIREMENTS.
 - 3) ALL SUPPORT MATERIALS SHALL BE GIVEN 2 COATS OF RUST INHIBITIVE PAINT.
 - 4) ALL LADDER RUNGS MUST LINE UP BOTH HORIZONTALLY AND VERTICALLY.



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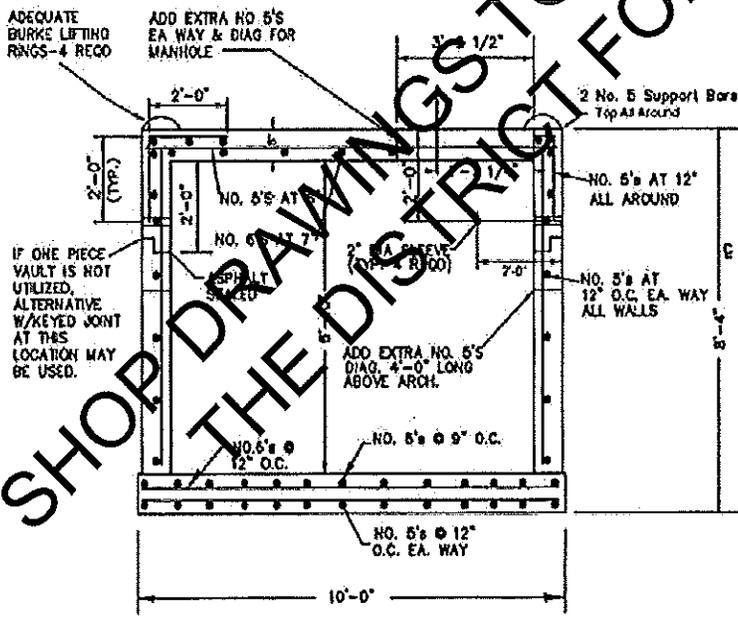
2005 MODIFIED DRAWING FROM COLORADO SPRINGS UTILITIES [DETAIL A 1-7]

2-INCH AIR AND VACUUM VALVE STATION

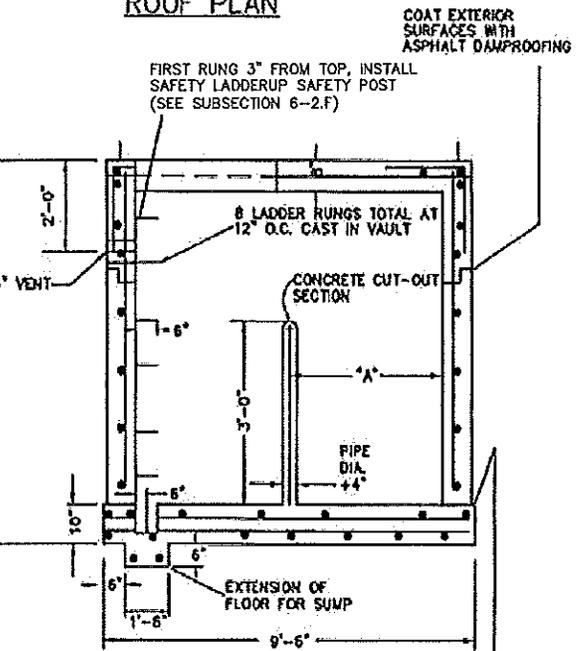


PLAN

ROOF PLAN



SECTION A-A



SECTION B-B

NOTE:

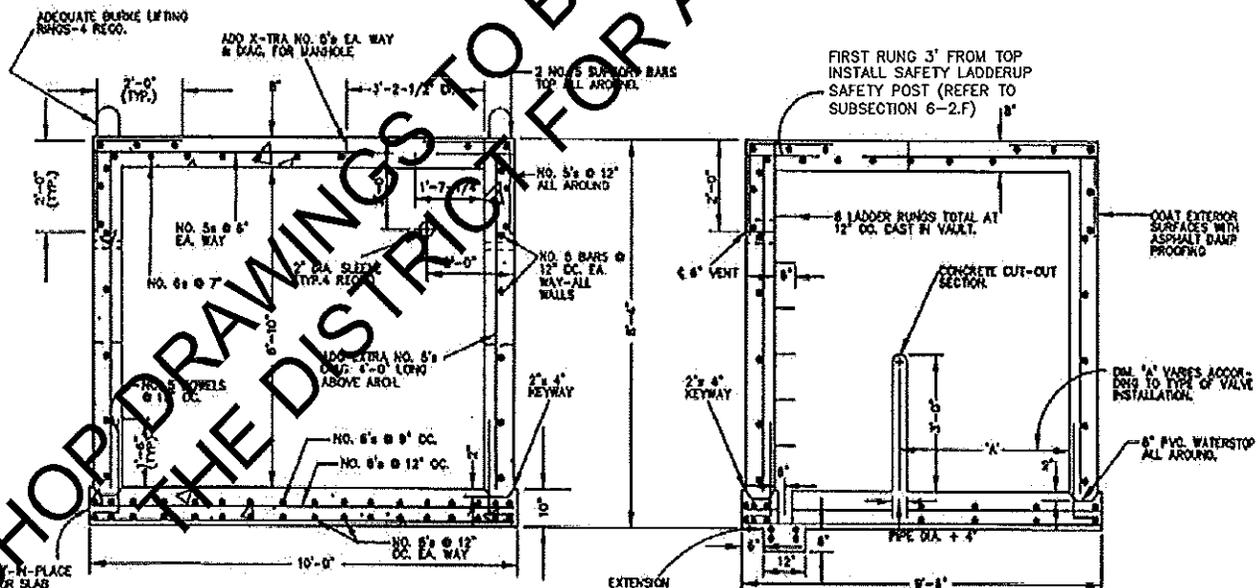
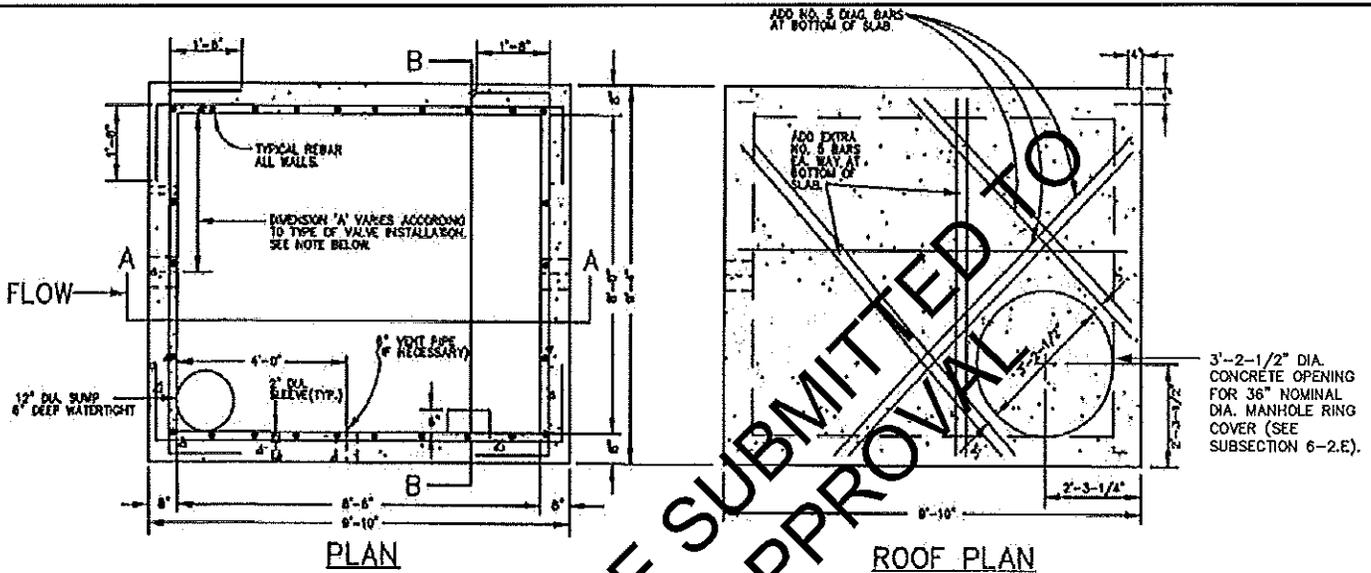
1. DIMENSION "A" = 4'-0" FOR PRESSURE REGULATOR STATION.
(REFER TO DETAILS 31 & 32)
2. ALL CONCRETE WORK SHALL COMPLY WITH SUBSECTION 9 AND THE LATEST ACI-318 CODE.
3. MINIMUM CONCRETE CLEARANCES FOR REBAR:
 - 3" WHERE POURED AGAINST THE GROUND
 - 2" WHERE FORMED AND THEN EXPOSED TO GROUND OR WEATHER FOR NO. 6 AND LARGER, 1-1/2" FOR NO. 5 AND SMALLER.
 - 1" WHERE EXPOSED TO INTERIOR SURFACES.
 - ALL VAULTS SHALL BE CONSTRUCTED TO MEET HS 20-44 TRAFFIC LOADING CONDITIONS AND 300 PSF SURCHARGE LOAD.

INSTALL CONSEAL (OR APPROVED URETHANE CHEMICAL GROUT WHEN REQUIRED BY OWNER) BETWEEN FLOOR & WALL AS WATERTIGHT SEALER.



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STANDARD PRECAST CONCRETE VAULT FOR VALVE INSTALLATION

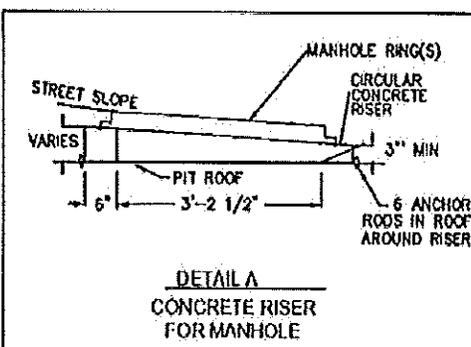


NOTE:

SECTION A-A

SECTION B-B

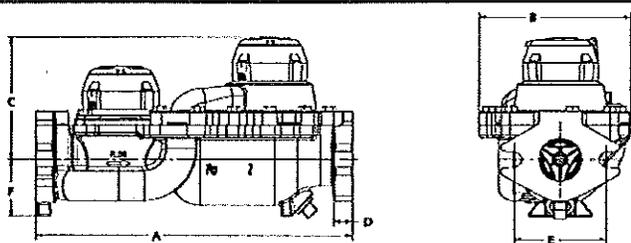
1. DIMENSION "A" = 4'-0" FOR PRESSURE REGULATOR STATION (REFER TO DETAILS 31 & 32).
2. ALL CONCRETE WORK SHALL COMPLY WITH SUBSECTION 9 AND THE LATEST ACI-318 CODE.
3. MINIMUM CONCRETE CLEARANCES FOR REBAR:
 - 3" WHERE POURED AGAINST THE GROUND
 - 2" WHERE FORMED AND THEN EXPOSED TO GROUND OR WEATHER FOR NO. 6 AND LARGER, 1-1/2" FOR NO. 5 AND SMALLER.
 - 1" WHERE EXPOSED TO INTERIOR SURFACES.
 - ALL VAULTS SHALL BE CONSTRUCTED TO MEET HS 20-44 TRAFFIC LOADING CONDITIONS AND 300 PSF SURCHARGE LOAD.
4. THE DISTRICT MAY REQUIRE A PRECAST VAULT WHEN WEATHER OR FIELD CONDITIONS WARRANT (SEE DETAIL 34).



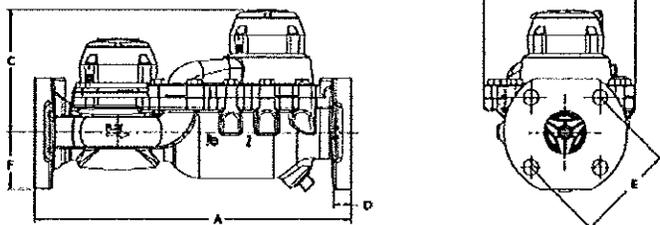
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STANDARD CAST-IN-PLACE CONCRETE VAULT FOR VALVE INSTALLATION

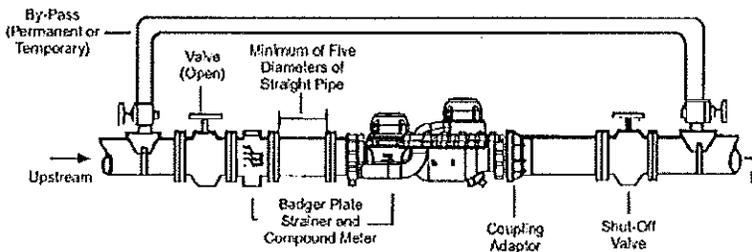
DETAIL 35



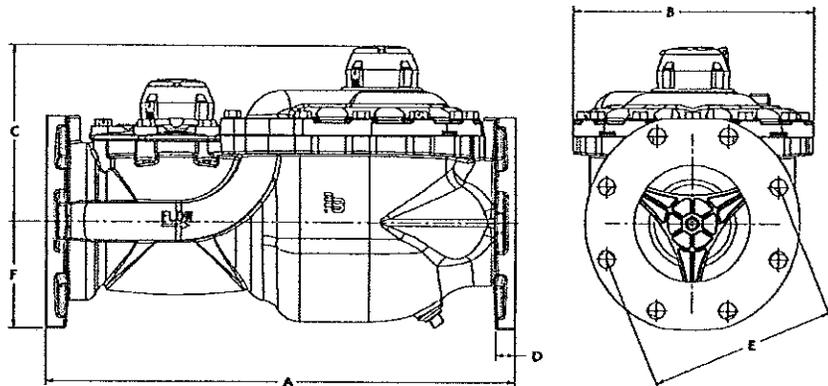
2" COMPOUND SERIES METER



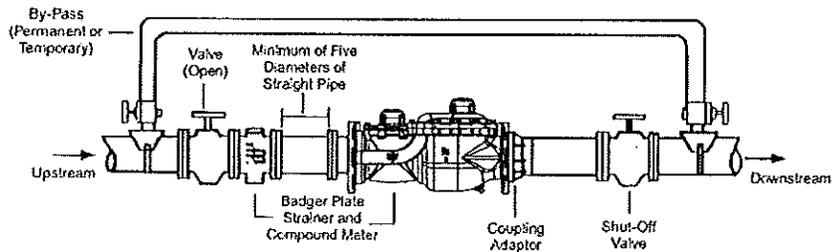
2" & 4" COMPOUND SERIES METER



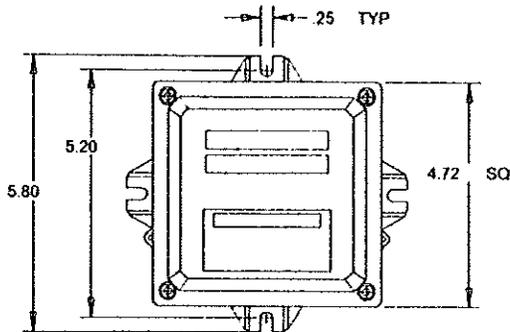
2" & 4" COMPOUND SERIES METER



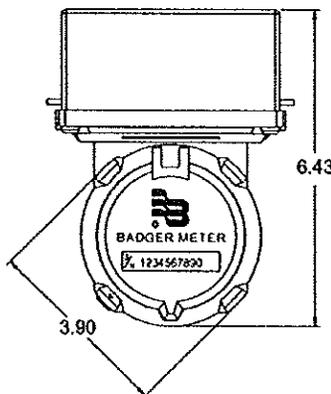
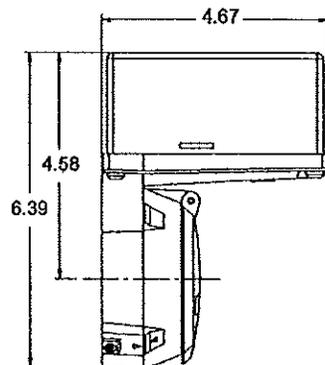
4" & 6" COMPOUND SERIES METER



4" & 6" COMPOUND SERIES METER



RTR-REMOTE ORION DIMENSIONAL DRAWING



RTR-INTEGRAL ORION DIMENSIONAL DRAWING

NOTE:
SEE MANUFACTURE'S SPECIFICATIONS FOR
INSTALLATION INSTRUCTIONS



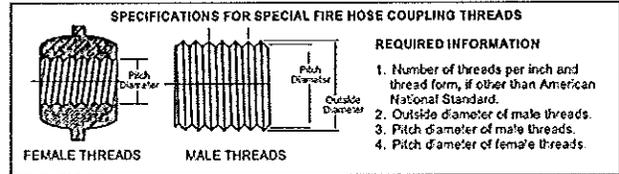
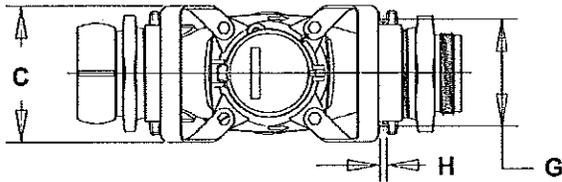
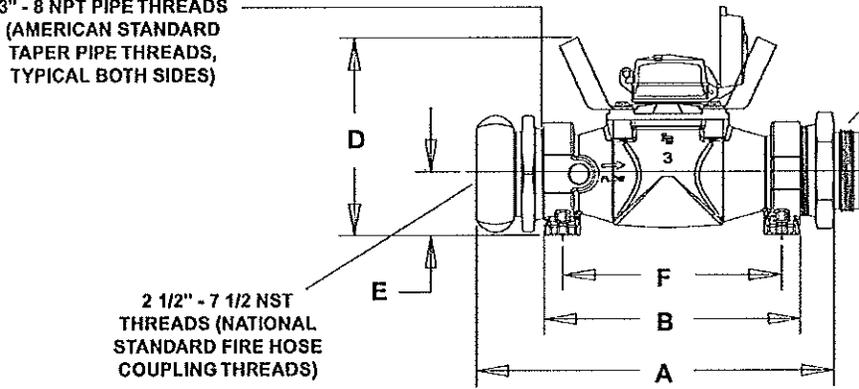
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COMPOUND METERS AND ORION
RADIO RF SYSTEM DETAILS

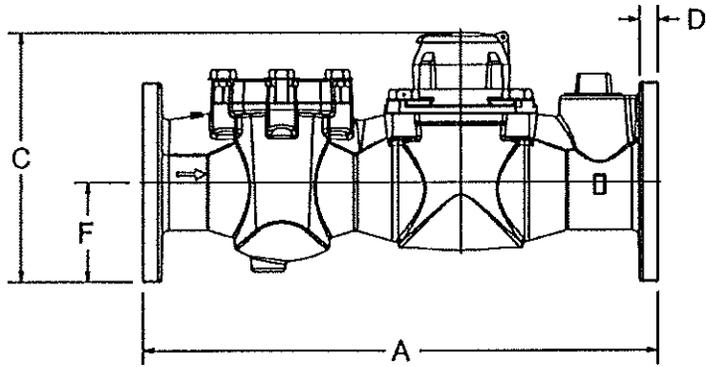
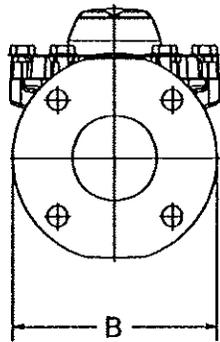
3" - 8 NPT PIPE THREADS
(AMERICAN STANDARD
TAPER PIPE THREADS,
TYPICAL BOTH SIDES)

2 1/2" - 7 1/2 NST
THREADS (NATIONAL
STANDARD FIRE HOSE
COUPLING THREADS)

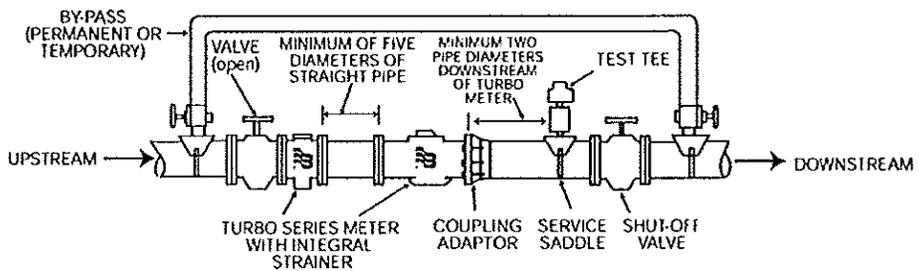
2 1/2" - 7 1/2 NST
THREADS (NATIONAL
STANDARD FIRE
HOSE COUPLING
THREADS)



FIRE HYDRANT METER

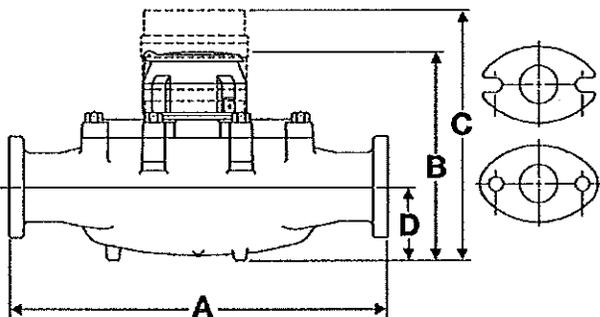


TURBO METER WITH INTEGRAL STRAINER



TURBO METER WITH INTEGRAL STRAINER

NOTE:
SEE MANUFACTURE'S SPECIFICATIONS FOR
INSTALLATION INSTRUCTIONS

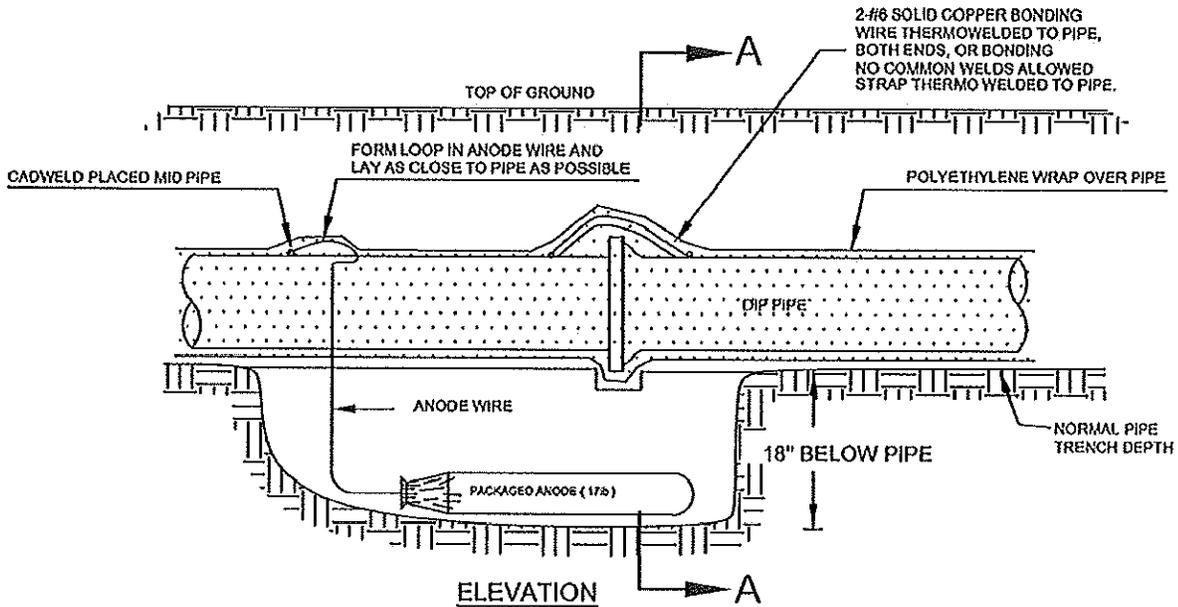


TOP LOAD BRONZE DISC METER



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METER DETAILS



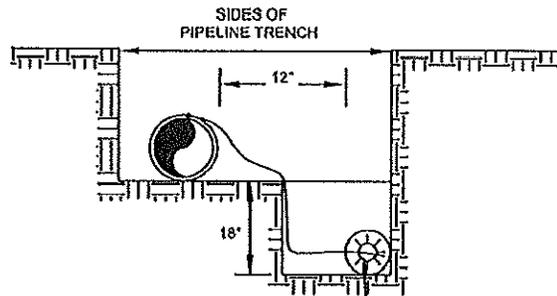
Anode Design

FOR USE WITH DIP IN CONJUNCTION WITH POLY-WRAP SLEEVES IN 1000 OHM-CM SOIL ESTIMATING A 5% HOLIDAY AREA.

Pipe Size Inches	Actual OD Inches	Anode Spacing Feet
4	4.8	763
6	6.9	531
8	9.05	405
12	13.20	277
16	16	210
20	20	169
24	24	142
30	30	114
36	36	95.7
42	42	82.4
48	48	72.1
54	54	64.2

THE DISTANCE FROM THE POINT OF THE BEGINNING TO THE FIRST ANODE SHALL NOT EXCEED ONE HALF THE RECOMMENDED SPACING. WITH DISTRICT APPROVAL.

NOTE: TRENCHING OPERATIONS SHALL BE IN CONFORMANCE WITH THESE STANDARDS AND OSHA REGULATIONS.



SECTION A-A

PLACE PACKAGED ANODE AS FAR AWAY AS POSSIBLE FROM PIPELINE IN SAME DITCH, 18" LOWER.

NOTES:

1. CADWELD CONNECTION TO BE PRIMED AND COATED CAREFULLY. PACKED 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 INSTALLATIONS, THE ANODES SHALL BE PLACED AND ATTACHED TO THE METAL FITTINGS IN THE SAME MANNER AS SHOWN IN THIS DRAWING. REFER TO SUBSECTION 4-3.R.
3. PACKAGED ANODE TO BE WETTED AND COVERED WITH SOIL PRIOR TO BACKFILLING.



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