

POTABLE WATER SYSTEM SPECIFICATIONS

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SECTION 1
WATER TRANSMISSION AND DISTRIBUTION PIPE

1.00 GENERAL

1.01 Scope. This section shall include all materials, labor, equipment and miscellaneous items necessary to install potable water transmission and distribution pipelines, service lines, and appurtenances as specified herein for the Brush Creek Metro District.

1.02 All materials shall be NSF 61 rated for direct contact with potable water.

1.03 All design, materials, and testing shall comply with the Colorado Department of Public Health requirements for drinking water systems.

1.04 Protection of Work

A. All pipe, fittings, valves and equipment shall be carefully handled, stored and protected to prevent damage to materials, protective coatings and linings. At no time shall such materials be dropped or dumped into the trench.

B. Precautions shall be taken to prevent foreign matter from entering the pipe, fittings and valves prior to and during installation. No debris, tools, clothing or any other material shall be placed in the pipe during installation. Whenever pipe installation is suspended, either temporarily or overnight, the open end of the pipe shall be sealed with a watertight plug to prevent the entrance of trench water, debris or foreign matter into the pipeline system.

1. Under no circumstances shall trench water be allowed to enter the pipeline. When water is present in the trench, the plug shall remain in place until the trench is pumped dry. Whenever trench water becomes evident, measures shall be taken to prevent pipe flotation.

2. If, in the opinion of the Engineer, the Contractor is incapable of keeping the pipe free of foreign matter during installation, the Engineer shall require the Contractor to protect the pipe ends with water tight plugs until the start of the joining operation.

2.00 MATERIALS

2.01 General. This item covers the types of materials that will be required for the construction and installation of water lines. All materials used shall be new, of the best quality available, and conform to applicable standards as indicated herein. All pipe, fittings, and coatings in contact with partially treated and/or potable water shall be NSF 61 approved.

2.02 Ductile Iron Pipe and Fittings.

A. Ductile Iron Pipe

1. Reference Standard – ANSI/AWWA C150/A21.50 and ANSI/AWWA

C151/A21.51 (latest revisions).

2. Thickness Class - Minimum Class 52 unless design conditions warrant higher-class pipe.
3. Pipe joints shall be push-on joints (Tyton, Fastite, or approved equal) except where specifically shown or detailed otherwise.
4. Restrained joint pipe shall be Griffin Snap Lok American FLEX-RING or US Pipe TR-FLEX or approved equal.
5. External coating for buried pipe: Asphaltic coating, min. 1 mil

B. Fittings

1. Reference Standard: –Ductile Iron Compact Fittings. ANSI /AWWA C153/ A21.53- (latest revision).
2. Type – Fittings shall be mechanical joints with retainer gland type joint restraints except where specifically shown or detailed otherwise.
 - a. Material - Ductile iron.
4. Pressure Rating - 350 psi or higher, unless otherwise noted.
5. Coating:
 - a. Exterior: Asphalt coated in accordance with AWWA C111 (latest revision).
6. Lining:
 - a. Cement Mortar with Sealcoat, double thickness in accordance with AWWA C104 and C111.

C. Joints

1. Mechanical:
 - a. Reference Standard (latest revision) ANSI /AWWA C111/A21.11.
 - b. Bolts and nuts: High strength, low alloy steel, “Cor-Ten” or approved equal.
 - c. Mechanical Joints with Tie-rods. Tie-rod requirements:
 1. Conform to ASTM A242, Cor-ten entire length
 2. Steel pipe spacers: ASTM A53, standard weight galvanized
 3. Washers: Cor-ten or approved equal
 4. Bolts: Double bolt or locking bolt, Corten or approved equal
 5. Plastic plugs: As recommended by pipe manufacturer
3. Push-on:
 - a. Reference Standard - ANSI /AWWA C111/A21.11 (latest revision).
 - b. Only applicable for pipe-to-pipe joints, not permitted on fittings or valves.
 - c. Pressure rating: 350 psi

- d. Lubricant: NSF 61 certified vegetable soap solution suitable for potable water contact.
- e. All push-on joints shall be fully restrained, unless otherwise noted.

4. Flanged:

- a. Reference Standards (latest revisions)
 - 1. ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.
 - 2. For threaded flanges: ANSI /AWWA C115/ A21.15
 - 3. Bolt hole patterns to conform to ANSI B16.1, Class 125

D. Gaskets

- 1. Reference Standard - ANSI/AWWA C111/A21.11, (latest revision).
- 2. Type - Gaskets shall be neoprene or other synthetic rubber (SBR). Natural rubber is not acceptable. Rubber ring gaskets shall be suitable for the specified pipe sizes and pressure.
- 3. Lubricant
 - a. Reference Standard ANSI/AWWA A21.11/C111 (latest revision).
 - b. A non-toxic NSF 61 approved vegetable soap lubricant shall be supplied with the pipe.

F. Protective Lining

- 1. Reference Standard -ANSI/AWWA C100/A21 and ANSI /AWWA C104/ A 21.4, latest revision.
- 2. Type - Cement mortar with Sealcoat.
- 3. Thickness - Standard.
- 4. Application: Coat interior of all pipe and fittings, unless otherwise noted.

G. Solid Sleeves

- 1. Reference Standard ANSI/AWWA C153/A21.53, latest revision.
- 2. Style -Mechanical Joint Solid sleeve.

H. Bolts and Nuts

- 1. Reference Standard (latest revision): ANSI/AWWA C110/A21.10 or ANSI/AWWA C111/A21.11.
- 2. Type- High strength low alloy steel.
- 3. Manufacturer's Reference – Cor-Ten, US alloy or equal.

I. Joint Restraints

1. Push-On Pipe Bell
 - a) Manufacturer: EBAA Series 1700 or approved equal.
 - b) Manufacturer for existing push-on bells: EBAA Series 1100HD or approved equal.
2. Mechanical Joint DIP
 - a) Manufacturer: EBAA Mega-A-Lug series 1100 or equal
3. Nuts and bolts torqued to requirements of manufacturer.
4. Working pressure rated for 350 psi minimum.
5. Glands color coded: Black

J. Tracer Wire

1. Reference Standard - AWWA C800, latest revision.
2. Provide tracer wire for all PVC and HDPE pipe.
3. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water.
4. Tracer wire shall be UL listed.
5. Tape electrical tracer wire to the top of the pipe, on the outside of polywrap, at 5-foot intervals to prevent dislocation of the wire during backfilling.
6. Wire terminations underground shall be performed using a 3M direct bury splice kit with waterproof wire connectors.
7. Extend wire to ground surface and terminate in SnakePit Access Points or approved equal, when no valve boxes are near pipe and wire termination. All tracer wire shall terminate in SnakePit Access Points near structure.

K. Magnetic Tape

1. Detectable marking tape shall consist of a minimum of 5 mil (0.0005") overall thickness; five-ply composition; ultra-high molecular weight 100% virgin polyethylene; acid alkaline and corrosion resistant.
2. Elongation properties shall be in accordance with ASTM D882-80A and shall be less than 150% at break. The tape shall have a 20-gauge (0.0020") solid aluminum foil core, encapsulated within 2.55 mil (0.00255") polyethylene

backing.

3. Tape color and legend combination shall be in accordance with APWA or local requirements. The color shall be blue. The legend shall read "CAUTION - WATERLINE BELOW".
4. The tape tensile strength shall be in accordance with ASTM D882-80A and be not less than 7800 psi.
5. Tape width shall be minimum 3/4 of the diameter of the pipeline being protected.

Tape Width	2" – 12" or wider
Tape Bury Depth	36"

7. The tape shall be as manufactured by T. Christy Enterprises, or equal.

L. Polyethylene Encasement

1. Reference Standards: Polyethylene encasement shall conform to ANSI/AWWA C105/A.21.5, latest edition.
2. Provide envelope for all DIP, fittings, restrained mechanical joints and valves located in corrosive soils. The entire pipe shall be wrapped joint to joint.
3. Product Data:
 - a) Linear Low-density polyethylene film (min. 8 mil) or high-density, cross-laminated polyethylene film (minimum 4 mil).
 - b) Class C (black).
 - c) Tape for securing the film shall have a minimum thickness of 8 mils and a minimum width of 1 inch.
 - d) Film shall be free of streaks, pinholes, tears or blisters.

3.00 **INSTALLATION**

3.01 General. All transmission and distribution lines to be dedicated to the District shall be located a minimum of ten feet inside a public easement. The location of water lines within side lot line easements or rear lot easements is discouraged.

When site conditions allow, the water line should be located outside concrete/paved areas. At all times, water lines shall be located so that District maintenance personnel can easily maintain and operate those lines.

Easements or rights-of-way used during installation of water mains shall be a minimum width specified by the District. In dredge areas and other special conditions, a wider than typical easement may be required.

3.02 Pipeline Depth. The minimum depth of bury of water mains shall be as follows: (Depth of bury is defined as the depth to top of pipe).

- A. Mains shall be buried a minimum depth of 8 feet (below existing or proposed grade) in all locations. Maximum depth shall be no greater than 12 feet unless otherwise approved by District.
- B. When water mains are to be located underneath storm drains, culverts or any other submerged air space, the required depth of bury shall be 8 feet below invert of submerged air space. This is necessary to ensure that the water line is beyond the frost depth associated with the storm drain culvert, etc.
 - a. In some cases, the District may allow insulation in place of increased depth. In those instances, the ratio of 1-inch insulation per each 1 ft below minimum depth of cover shall be used, with a minimum of 2 inches of rigid insulation.
 - b. Minimum of 2 inch rigid insulation shall be installed on top and both sides of the pipe to create a top hat.
 - c. Manufacturer: Dow Styrofoam Blueboard or approved equal.

3.03 Cleaning and Inspection.

- A. Clean all pipe, fittings, valves and related materials thoroughly of all foreign material; inspect for cracks, flaws, or other defects prior to installation.
- B. Mark all defective, damaged or unsound materials with bright marking crayons or paint and remove from job site. Of particular concern should be the gasket groove in the pipe bell. All spurs, excess paint, and any other defects within the gasket groove shall be either removed or repaired, or the pipe shall be deemed unacceptable.
- C. The Contractor shall take all necessary precautions to prevent any construction debris from entering the water lines during construction of water lines and appurtenances. If debris shall enter the distribution system, the Contractor shall furnish all labor and materials necessary to clean the system. Under no circumstances will the Contractor flush the debris into an existing distribution system.

3.04 Installation. All pipe shall be installed as specified or in accordance with manufacturer's recommendations.

- A. Ductile Iron Pipe shall be installed and tested in accordance with AWWA C600. Ductile Iron Fittings shall be installed and tested in accordance with AWWA M41.
- B. Pipe shall be laid in straight sections with bell ends facing the direction of laying unless otherwise directed by the District. Where pipe is laid on grade of 10% or greater, the installation shall proceed uphill with the bell ends facing upgrade.

- C. The pipeline shall be installed so that a continuous positive or negative grade is maintained between high and low points to avoid air pockets. At no time will a high point in the line be acceptable unless an air release and vacuum valve is installed to relieve air pockets.
- D. The allowable pipe deflection per joint shall not exceed the maximum deflection tolerances specified by the manufacturer.
- E. Pipe shall be lowered into the trench with ropes, slings or machinery. Under no circumstances should the pipe be pushed off the bank and allowed to fall into the trench.
- F. Contractor shall provide and maintain adequate dewatering equipment including power supply, if necessary, to remove and dispose of surface and groundwater entering excavations, trenches, and any other part of the Work.
 - 1. Do not lay pipe when water is present in the trench. Maintain groundwater level a minimum of 12 inches below pipe to be installed.
 - 2. If discharging to surface waterways, Contractor must obtain a CDPHE dewatering permit. Contractor must comply with discharge requirements including any water treatment prior to discharge if necessary.
- G. Do not lay pipe under unsuitable weather (rain, snow, or sleet) or trench conditions (water present).
- H. The cutting of pipe for fittings or closure pieces shall be done in a neat and workmanlike manner to prevent damage to the pipe or lining.
 - 1. All cuts should leave a smooth end at right angles to the axis of the pipe. Flame cutting on pipe, by means of an oxyacetylene torch, will not be allowed. Once a pipe is cut, the cut end shall be beveled free of spurs, which may damage rubber gaskets.
 - 2. Pipe shall be cut to measurements taken at the site, not from drawings.

3.05 Connection to Existing Water Facilities.

- A. Owner, Developer, or designated applicant is responsible for application, permits, and fees to connecting to existing water facilities.
- B. All main line connections between existing and proposed piping shall be made during non-business hours or at a time predetermined through coordination with the District.
- C. All shut-offs shall be planned 48 hours in advance and all persons affected by the shut-off shall be given a minimum 24-hour notice. Special circumstances may exist

calling for evening or weekend shutoffs. Shutoffs will not be allowed on Fridays or weekends or holidays unless pre-approved.

- D. Take all precautions to prevent contamination when making connections to existing potable water lines. No trench water, mud, or other contaminating substances shall be permitted to enter the pipeline.
- E. Swab the interior of any new pipe, fittings, and valves installed in the existing pipeline with a NSF 60 approved (AWWA B300 Hypochlorite, latest version) 5 percent (50,000 ppm) chlorine solution prior to installation. After connection is completed, flush the main to remove all contaminated water.
 - 1. All new water line and appurtenances shall be disinfected in accordance with these specifications.

3.06 Protection of Water Supplies.

- A. All water lines shall be installed in accordance with CDPHE Design Criteria for Potable Water systems, latest revision.
- B. Water lines shall be located a minimum of 10 feet horizontally from existing or proposed sanitary or storm sewer lines and manholes. Water mains crossing sanitary or storm sewer lines shall be located with a minimum of 18 inches of vertical clearance with the water line located above the sewer line.
 - 1. If horizontal separation is impossible to obtain, pipe shall be installed in a separate trench, or an undisturbed earth shelf located on the “uphill” side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. The sewer materials must be water works grade 150 psi pressure rated pipe or similar.
 - a) Exceptions must comply with CDPHE Design Criteria.
- C. At crossings, one full length of water pipe must be located so both joints will be as far from the sewer crossing as possible. Crossing pipes shall be installed with a minimum vertical distance of 18 inches. When possible, the water main should be installed above the sewer line.
 - 1. When it is impossible to meet the crossing requirements, the sewer pipe must be installed with secondary containment described below.
 - A. Pipe may be encased no less than 10-ft each side of the crossing, and include joint on either side of crossing. Pipe casing must be watertight material with no joints. Casing pipe material options may be steel, ductile iron, fiberglass, PVC, or fiberglass reinforced polymer mortar.

- B. Alternatively, controlled low strength material (e.g., flowable fill) may be used, extending no less than 10ft each side of the crossing. Refer to standard CDOT specifications for controlled low strength material requirements.

3.07 THRUST RESTRAINT. Contractor shall install two forms of thrust restraint.

A. Megalug and Concrete Thrust Blocks

1. Megalugs (or other approved restraint devices) shall be installed on all mechanical joint pipe, tees, elbows, plugs, reducers, valves, fire hydrants and crosses. Restrained sections of pipe must be backfilled prior to hydrostatic pressure testing or returning sections of pipe into service.
2. Concrete thrust blocks shall be provided as shown in the Detail for all tees, elbows, plugs, reducers, valves, fire hydrants, and crosses if one or more sides of the cross are plugged.
3. The bearing area of the block shall be at least equal to that stated in the Detail. The bearing surface shall be against undisturbed earth. The block shall be placed normal to the thrust as show in the Detail.
4. Concrete for thrust blocks shall have a 28-day compressive strength of 3,000 psi. (NOTE: No other materials other than concrete may be used in thrust blocks and ready mix or bagged concrete is not allowed).
5. If the concrete has not had sufficient time to cure (e.g., restoring water service), the Contractor shall be required to use temporary bracing for added strength. Use of additional wood bracing will help prevent fitting and valves from leaking or "blowing off" when water pressure is restored to the main line.
6. Whenever a concrete thrust block is placed, wood or plastic sheets shall be used to prevent concrete from adhering to nuts and bolts. Any concrete splattering onto a nut or bolt will be removed before the line is backfilled.

B. Megalugs and Tie-Rods

1. Where sections are called to be restrained to achieve a required restrained length, a split megalug (EBAA 1100 SD) shall be installed past adjacent pipe joints and restrained to fitting with tie rods. Restrained sections of pipe must be backfilled prior to hydrostatic pressure testing or returning sections of pipe into service.
2. Megalugs and tie-rods shall be installed following manufacturer instructions.

4.00 SIZING OF MAINS

- 4.01 General. All main water lines shall be sized for peak hour flow plus fire flows required by the local Fire Protection at a 20-psi residual flow. Minimum size shall be 8 inches in diameter.

End of Section I

SECTION 2.0
WATER SERVICE LINES AND APPURTENANCES

1.00 GENERAL

1.01 Scope. This section shall include furnishing all materials, labor, equipment and miscellaneous items necessary to install all water service lines and appurtenances as specified herein for the District.

2.00 MATERIALS

2.01 Pure-Core HDPE Copper Tube Size (CTS) Service Pipe (Customer Side Only)

- A. Use of Pure-Core HDPE CTS is preferred by the District.
- B. Reference Standard -AWWA C901, latest revision.
- C. Material – SDR9 CTS, HDPE 3408 (reference standards AWWA C901, ASTM D2737 and ATSM D2239, latest revision)
 - a. Resin formulation: PE 3608
 - b. Hydrostatic Design Basis (HDB)
 - i. HDB: 1600 psi @ 73.4 °F
 - ii. HDB: 800 psi @ 140 °F
- D. Size – As shown on Drawings. Note pipe ID controls line sizes to match existing service size.
- E. Do not use any pipe lubricants for service line fittings.
- F. Minimum & Maximum bury depth: 8 ft minimum, 12 ft maximum.
- G. Tracer wire shall be installed along service line to the structure and terminated in a SnakePit Access Point.
- H. The service line shall be completely wrapped in polyethylene encasement from curb stop to main tap.

2.02 Copper Service Pipe (Customer Side Only)

- A. Reference Standard – AWWA C800.
- B. Material – Type K, ASTM B88.

- C. Flared type fittings only.
- D. Size: only ¾ inch.
- E. Minimum & Maximum bury depth: 8 ft minimum, 12 ft maximum.
- F. The service line shall be completely wrapped in polyethylene encasement from curb stop to main pipe tap.

2.03 Corporation Stops

- A. Reference Standard - AWWA C800, latest revision.
- B. Material – Brass or bronze body and ground key plug.
- C. Size - As shown on drawings.
- D. Inlet - Flared or threaded fitting.
- E. Outlet - Flared or threaded fitting.
- F. Manufacturer Reference -
 - a. Mueller, H-15013
 - b. Ford, FB1000G
 - c. A.Y. McDonald, 4701BQ or 4701BT
 - d. Or approved equal

2.04 Service Saddles

- A. Reference Standard - AWWA C800, latest revision.
- B. Materials - Bronze service clamp, 'O' ring gasket, double strap, stainless steel, CC thread.
- C. The District will require saddles to be installed on all service connections.
- D. Complete assembly, including double strap service clamp, bolts and nuts. Use service clamp and stop compatible with drilling machine.
- E. Manufacturers reference – Mueller BR2S or approved equal.

2.05 Curb Stop.

- A. Reference Standard - AWWA C800, latest revision.

- B. Materials - Cast bronze body, resilient 'O' ring seals, standard tee head operator, Teflon ball valve type.
- C. Inlet - Flared or threaded fitting
- D. Outlet - Flared or threaded fitting.
- E. Standard reference AWWA C800, latest revision.
- F. Manufacturer's reference –
 - a. Mueller B25204N
 - b. Ford B22-333W-NL
 - c. Or approved equal

2.06 Curb Box.

- A. Reference Standard - AWWA C800, latest revision.
- B. Materials – Arch pattern base, coal tar coated extensions. Complete with lid with lettering “WATER” and 1” tapped hole with a centered plug having a 5/8-inch hexagonal nut.
- C. Curb box must be traffic rated when located within traffic areas.
- D. 0.75 inch to 1 inch, Manufacturer's reference - Mueller H-10316 or equal.
- E. 1.25 inch to 1.5-inch, Manufacturer's reference - Mueller H-10336 or equal.

2.07 Couplings.

- A. Couplings are not allowed for services less than 50 feet long from the curb stop to the main and curb stop to house. In the case of a service line exceeding the available length of piping, an additional curb stop and box shall be installed. Flared fittings only. No compression or soldering fittings are allowed.

2.08 Meter box.

- A. Reference Standard - AWWA C800, latest revision.
- B. Materials - 18" diameter meter box with 30" PVC shell for 3/4" or 1" meter. Lid: cast-iron with closed cell insulating pad.
- C. Manufacturer's reference –
 - 7. Mueller Co.
 - 8. Ford
 - 9. Or approved equal
- D. Provide with shell extensions as required to satisfy bury depth requirements

2.09 Identification Marker Tape

- A. Reference Standard - AWWA C800, latest revision.
- B. Identification Marker Tape: Provide metallic core tape, blue with black letters “CAUTION – WATER LINE BELOW” continuously printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick.
- C. Manufacturer reference –
 - 7. Allen Systems, Inc.
 - 8. Emed Co., Inc.
 - 9. Seton Name Plate Corp.
 - 10. Or accepted substitution

2.10 Tracer Wire

- A. Reference Standard - AWWA C800, latest revision.
- B. Provide tracer wire for all PVC and HDPE pipe.
- C. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water.
- D. Tracer wire shall be UL listed.

3.00 INSTALLATION

3.01 Service Line Installation. All trenching, backfilling and compaction shall conform to these regulations. All service lines shall be disinfected and pressure tested as detailed in these regulations.

3.02 Service Line Depth. Depth of bury for all service lines shall be a minimum of 8 feet and a maximum of 12 feet.

3.03 Tapping Pressurized Mains. All 0.75 inch – 1.0-inch taps on pressurized mains shall be made by the District. Services 1.5” or greater shall be Ductile Iron Pipe and tapped by others. Services 1.5” or greater shall be disinfected as main lines.

3.04 Permits. A Right-of-Way Excavation and Obstruction permit for excavation in District streets, alleys and easements must be completed prior to tap. Forty-eight-hour notice is required by the District prior to making taps and locating lines.

3.05 Service Line Sizing. Service lines are to be sized by the District. A request for an exception for a larger service line can be made during the EQR determination process. The District

reserves the right to approve or deny any request for a larger line.

- 3.06 Final Inspection. The final inspection shall be scheduled with the District forty-eight hours in advance. The inspection will include inspection of the service connection, water meter, backflow device, rain sensor, curb valve and sewer cleanout. No service lines shall be backfilled or covered until approved by the inspector.

4.00 METERS

- 4.01 All meters shall be purchased directly from the District.

- 4.02 If an existing meter fails, the meter shall be replaced and installed inside. The existing meter pit shall be removed and backfilled in accordance with District standards. All equipment shall be removed and replaced with continuous pipe.

4.03 Installation.

- A. Install all meters inside homes at a location accessible by the homeowner and District. The District reserves the right to request meter inspection at any time. See Rules and Regulations for more information.
- B. Install the meter in the building where meter and pressure reducing valve will not freeze. The MXU shall be in a location that faces the roadway. The MXU shall be located on an outside wall at least 36-48" above grade where it is freely accessible and where falling or melting snow will not cover it (stucco construction can prevent the meters from being read by radio). MXU shall be easily accessible and located near the other utilities.
- C. Turbine meters should be installed with five pipe diameters of straight run pipe upstream or downstream of bends, valves, PRV's, check valves or any other fitting that causes turbulence.

- 4.04 Meter Inspection. The water meter must be inspected by the District at final inspection after it is installed and before the Certificate of Occupancy is issued.

- 4.05 Meter pits are not allowed unless specifically approved by the District.

5.00 PRESSURE REDUCING VALVE (PRV) (Required in-house)

5.01 Installation.

- A. Install upstream of the meter on 1 inch and 0.75-inch meters only. Install downstream of the meter for 1.25 inch and larger meters. Allow for easy access to strainer and cleanout plug.
- B. PRV shall be installed with new backflow prevention devices with house remote read.

PRV is not supplied by District.

- C. All appurtenances installed indoors shall comply with the International Plumbing Code and the latest adopted version in Rules and Regulations.

5.02 Pressure Testing. PRV shall be furnished, installed and maintained at not greater than seventy-five (75) PSI, by the customer.

5.03 Inspection. PRV will be inspected during final inspection.

6.00 BACKFLOW PREVENTION DEVICE

6.01 Backflow prevention device to be supplied by homeowner. The type of backflow prevention device shall depend upon the type of hazard which exists as follows:

1. Reduced Pressure Principle Device. In the case of a premises where there is an auxiliary water supply which is not subject to any other provisions of these specifications, the District water system shall be protected by an approved air gap separation or an approved reduced pressure principle backflow prevention device.
2. Double Check Valve Assembly. In the case of a premises where there is water or a substance that would be objectionable but not hazardous to health if introduced into the District water system, the District water system shall be protected by an approved double check valve assembly.
3. Air Gap Separation Device. In the case of a premises where there is any material dangerous to health which is handled in such a fashion as to create an actual or potential hazard to the District water system, the District water system shall be protected by an approved air gap separation or an approved reduced pressure principle backflow prevention device.
4. Maximum Protection. In the case of a premises where, because of security requirements or other prohibitions or restrictions, it is impossible or impractical to make a complete cross-connection inspection, the District water system shall be protected against backflow or back siphonage from the premises by the installation of an approved air gap separation or an approved reduced pressure principle backflow prevention device.
5. Irrigation Systems. The following guidelines relating to backflow prevention devices for irrigation systems shall apply:
 - a. A double check valve assembly may not be installed to serve multiple irrigation circuits in lieu of vacuum breakers on each individual irrigation circuit.

- b. A reduced pressure principle backflow preventer or air gap separation shall be required before any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system. A reduced pressure principle backflow preventer may be installed to serve multiple irrigation circuits in lieu of vacuum breaks on each individual irrigation circuit.

7.00 ABANDONMENT OF SERVICES

7.01 Water Services. Shall be abandoned at the main. Abandonment will consist of closing the corporation valve and removing the service line from the valve. The District shall inspect all abandoned service lines.

7.02 Water Wells. All wells located on private property are the responsibility of the property Owner. The District does not manage, operate, maintain, or use any water from existing private wells.

End of Section II

**SECTION 3
FIRE PROTECTION FACILITIES**

1.00 GENERAL

1.01 Scope. This section shall include furnishing all materials, labor, equipment and miscellaneous items necessary to install fire hydrants as specified herein for the District.

2.00 MATERIALS

2.01 Fire Hydrants.

- A. Type - Dry barrel, traffic model with breakaway flange bolts and coupling.
- B. Reference Standard - AWWA C502, latest revision
- C. Outlet Size - One 4.5-inch NST, two 2.5-inch NST
- D. Hydrant Size – 6 feet or greater, from bury line to top of pipe
- E. Inlet Size - 6 inch
- F. Operation – 1.5-inch pentagonal national standard operating nut, open counter-clockwise, and grease lubricated.
- G. Depth of Bury – 6 feet minimum
- H. Additional Requirements - Furnish hydrant complete with pipe and tee, 6 inch restrained mechanical joint gate valve and thrust blocks. Hydrant shall be restrained to the hydrant tee by 0.75-inch threaded rods protected from corrosion by the use of an approved bituminous coating. Furnish hydrant with bronze seat and lubrication reservoir. Either all thread or mega lugs can be used.
- J. Manufacturer -Kennedy Guardian K81D
- K. Gate valve – see these specifications for valve requirements
- K. Color - Hydrant to be painted red above the final grade.
- L. Pressure Rating - 250 psi

3.00 INSTALLATION

3.01 Hydrant Spacing.

- A. The development density and type of development shall determine the spacing of fire hydrants that each hydrant is to serve. The spacing shall meet the latest adopted version of the International Fire Code. See Rules and Regulations for latest version.

3.02 Location.

- A. Fire hydrants shall be located whenever possible at an intersection and in a public right-of-way or a utility easement. In all cases, hydrants shall be located out of the direct flow of pedestrian and vehicular traffic.
- B. Hydrant locations and spacings shall be approved by the local Rural Fire Protection District.

3.03 Installation.

- A. The bury line shall be located at finished grade. If the previously mentioned conditions are not met after the hydrant is installed and the street is at final grade, the hydrant must be brought to proper grade by installing extensions or other modifications as required.
- B. Bag all hydrants that are not in service with orange plastic bags.
- C. If the hydrants have been accepted by the District and the hydrant needs to be raised due to property owner landscaping or any other development changes, the cost of the hydrant raising will be the responsibility of the homeowner.

3.04 Hydrant Appurtenances.

- A. All fire hydrants shall be connected to the main line by means of a mechanical joint swivel tee with 6-inch Class 52 ductile iron pipe branch piping to hydrant.
 - a. MJ tee and foster adapter is an acceptable substitution for swivel tee.
- B. Each fire hydrant shall have a 6-inch valve on the branch pipe conforming to standards as outlined in these specifications. The 6-inch gate valve shall not be located in the sidewalk, curb line, or gutter of the proposed street. The 6-inch gate valve shall be connected directly to the tee, or shall be located in close proximity and rodded to the main tee, where applicable.

3.05 Hydrant Restraint.

- A. The hydrant shall be restrained to the main line with 0.75-inch all-thread cor-ten rod extending from the main line tee to the 6-inch valve (only applicable when valve is not attached directly to tee) and then from the 6-inch valve to the hydrant. The 0.75-inch rods shall be tied to each joint with the use of eyebolts. All rods shall be Cor-Ten material or approved equal. In addition, the hydrant and main line tee shall be provided with either meg-a-lugs or concrete thrust blocks as a second means of thrust restraint in accordance with these specifications.

3.06 Dry Barrel Type Drainage.

- A. All hydrants shall be provided with a minimum of 0.33 cubic yard of 3/4 inch screened, crushed and washed rock and shall be placed under the weep hole outlet to assure proper drainage. The crushed rock shall be encased in separator fabric to prevent the mitigation of fines. Prior to the screened rock being placed under the weep hole outlet, the area around the weep holes on the hydrant will be covered with plastic sheeting allowing enough room under the sheeting for the hydrant to drain and also preventing concrete from entering the weep holes and covering any hardware.

3.07 Inspection. Prior to backfilling around the hydrant, a visual test shall be conducted to ensure plumb alignment and the proper operation of the weep holes. The hydrant shall be partially opened and then closed. Water trapped in the hydrant barrel section should begin to drain. If water is not draining, the weep holes should be cleared of any obstructions restricting the flow of water.

End of Section III

SECTION 4 VALVES

1.00 GENERAL

1.01 Scope. This section shall include furnishing all materials, labor, equipment, and miscellaneous items necessary to install gate valves, butterfly valves, air release and vacuum valves, and valve boxes as specified herein for the District. All valves in contact with potable water must be NSF 61 certified.

2.00 GATE VALVES

2.01 Materials.

A. Resilient seat.

1. Size - As shown on plans up to 12 inch (14 inch and larger shall be butterfly valves).
2. Reference Standard - AWWA C509, latest revision.
3. Style - Iron body, resilient seat.
4. Pressure Rating - 250 psi.
5. Wrench Nut - Two-inch square, open by turning to the left (counterclockwise).
6. Stem - Non-rising.
7. Epoxy coated.
8. Manufacturer – Kennedy KS-FW or Mueller A-2361 RWGV

2.02 Location.

- A. Whenever possible, water main valves shall be located at street intersections.
- B. Valves must be placed on all runs of a tee or cross. For instance, each cross shall have four valves located at the intersection while tees shall have three valves located at the intersection.
- C. Valves shall be installed directly on tees or crosses.
- D. Valves shall be located at the end of all dead-end intersections for future connections.
- E. A minimum of 2 ft of pipe shall be installed downstream of dead-end valves with a

fully restrained MJ cap and thrust block.

2.03 Valve Spacing.

- A. Valves on cross-connecting or looped mains shall be spaced such that no single break shall require more than 500 feet of line to be out of service at one time. All distribution mains connecting to transmission mains must be valved at the tie-in.
- B. Valves shall be required every 1,000 feet on transmission mains where service is limited.

2.04 Installation.

- A. All gate valves shall be installed with the 2-inch operating nut plumb and true with the vertical and centered within the valve box. Debris caps shall be installed in all valve boxes within traffic areas.
- B. District personnel will inspect the valve and valve box after installation to ensure that a valve key can easily be set on the operating nut. The operating nut shall be within 5 feet of finished grade or an extension must be provided attached to the nut. The top of the extension must be within 1-ft of grade.

3.00 BUTTERFLY VALVES

3.01 Materials.

- A. Reference Standard - AWWA C504, latest revision.
- B. Type - Rubber-seated, tight closing type.
- C. Ends - Both ends shall be mechanical joint for direct bury with meg-a-lug. Valves in vaults shall be flanged.
- D. Valve Body - Shall be heavy duty ASTM A536 Ductile Iron designed to meet or exceed AWWA C504.
- E. Operator - Valve operator shall be of the traveling nut type, sealed, gasketed and lubricated for underground service. Operating nut shall be two-inch square and shall open by turning to the left (counterclockwise).
- F. Rated Working Pressure - Class 150B, 150 psi. Above 150 psi working pressure, use Class 250B or equal.
- G. Manufacturer's Reference - Kennedy Style 4500.

4.00 AIR RELEASE AND VACUUM VALVES

4.01 General. This specification covers all air release, vacuum valves or combination air release valves. The size and type of valve used shall be dependent upon the conditions under which it will operate.

4.02 Materials.

- A. Size - To be designed by Engineer for proper application.
- B. Body - Cast iron.
- C. Float - Stainless steel.
- D. Seat - Buna-N.
- E. Pressure Rating - 200 psi.
- F. Manufacturer: APCO Series 140 Air and Vacuum Release Valve

4.03 Locations.

- A. Air release, vacuum valves or combination air release valves shall be installed on transmission and long distribution lines to permit efficient filling or draining of long pipelines. In addition, they should provide protection against vacuum and shall continuously vent pockets of air accumulated in the pipeline.
- B. The type of valve shall depend upon the intended use of operation.

4.04 Installation.

- A. Air release, vacuum valves or combination release valves shall always be installed at the extreme high point, on ascending stretches of distribution piping, at locations where separated water column could occur, or at peaks or sharp gradients of the distribution or transmission line.
- B. These valves shall be installed in a precast manhole vault with the fittings.
- C. Valves shall be installed in accordance with manufacturer's requirements.
- D. Tapping saddle is required for valve assembly connection to water main. Saddle shall have bronze service clamp, 'O' ring gasket, double strap, stainless steel, and CC thread.

5.00 VALVE BOXES

5.01 Materials.

- A. Material - Cast iron.
- B. Type - Three-piece, adjustable, screw type.
- C. Size – 5.25-inch diameter.
- D. Cover - Deep socket type with the word "Water" cast in the top.
- E. Base – Tyler/Union Type 6860 Series Type with No. 160 20.5-inch-wide oval base.
- F. Valve Markers - For valves that fall outside of road pavement and shoulders, install a 6 foot long, water "carsonite" marker or water metal "T" stake on all new valves. Marker shall have valve decal at top.
- G. Debris caps are required on all valve boxes.

5.02 Installation.

- A. Valve boxes shall be installed plumb and true, and centered over the 2-inch operating nut.
- B. Bricks shall be placed under the flange of the valve box bottom so that at no time loadings on the valve box will be transmitted to the valve.
- C. Valve box lid to be placed 0.50 inch - 0.75 inch below grade when located in asphalt or concrete. A debris cap shall be installed as close as possible to the cast iron cap without interfering with the operation of the cap.

End of Section 4

SECTION 5
TRENCHING, BACKFILLING AND COMPACTION

1.00 GENERAL

1.01 Scope. This section shall include all labor, materials, equipment, and miscellaneous items necessary to perform all excavation, backfilling and compaction of underground waterlines and sewer lines, and associated appurtenances as specified herein for the District.

It shall be the Contractor's responsibility to secure all required excavation permits and pay all costs thereof. If trenching requires existing pavement to be demolished, Contractor shall patch and repave in accordance with District road standards.

1.02 Protection of Work.

- A. All excavation shall be protected by accepted safety materials such as barricades, lights, signs, etc., as required by governing federal, state and local safety codes and regulations.
 - 1. Under no circumstances will more than 20 feet of trench be left open at night. Any trench left open at night will be protected by a temporary snow fence barricade and reflective tape.

- B. Sheeting, Shoring and Bracing - Where trench walls are not excavated at a stable slope, the Contractor shall provide and maintain sheeting sufficient to prevent caving, sliding or failure and property or bodily damage. Any damage due to inadequate support shall be repaired at the sole expense of the Contractor.
 - 1. Under normal construction conditions, sheeting shall be removed as work progresses. Sheeting shall remain installed if directed by the District or if pipe does not have sufficient strength to support backfill based on trench width as defined by the sheeting. Sheeting shall not be removed after the start of backfilling.
 - 2. Use of a movable trench shield or coffin box will not be allowed where pipe strength is insufficient to support backfill as defined by the trench width after the trench shield is removed.
 - 3. The Contractor shall be held solely responsible for any violations of applicable safety standards. Particular attention is called to minimum requirements of OSHA and State of Colorado Occupational Safety and Health laws.

- B. Site Drainage - Excavation to be protected from surface water at all times. At no time shall excavated area be allowed to fill with storm water runoff. Contractor shall provide

proper, temporary drainage structures at their cost to detour runoff from excavated areas.

2.00 MATERIALS

2.01 Embedment Materials. Pipeline embedment materials shall comply with the appropriate material as listed below and as illustrated on the Construction Drawings.

- A. Class 6 Aggregate Base Course - Use for all distribution and transmission mains. In addition, use for all water service lines. Densely compacted 3/4-inch Class 6 aggregate, 4 inches below bottom of pipe with densely compacted 3/4-inch Class 6 aggregate to 12 inches above top of pipe.
- B. 3/4-inch screened rock shall only be used if approved by District.

2.02 Backfill Material.

- A. Characteristics - made of materials free from debris, organic matter or frozen material. Uniformly graded sufficient to allow proper compaction.
- B. For open vegetation and field areas, no material greater than 12 inches in trench backfill, and for road/pavement areas no material greater than 6 inches in diameter in trench backfill.

3.00 METHODS AND PROCEDURES

3.01 Site Preparation.

- A. Clearing - Remove all vegetation, stumps, roots, organic matter, debris and other miscellaneous structures and materials from work site. Contractor shall dispose of materials off site unless otherwise directed by District.
- B. Topsoil Removal - Strip existing topsoil from all areas to be disturbed by construction. Topsoil to be stockpiled separately from excavated materials.
- C. Pavement Removal - Asphalt and bituminous pavements to be cut to the full depth of pavement. The vertical face of the cut shall be a straight line parallel to the limit of excavation. Cuts shall be made with a flat-bladed air hammer, concrete saw, or as approved by the District. The method used should provide a straight, true cut. All asphalt located within trench limits to be hauled off site.
 - 1. Concrete pavements, including curbs, gutters and sidewalks, to be saw cut to the full depth of pavement at the nearest construction joint. The vertical face of the cut shall be a straight line parallel to the limit of excavation.
 - 2. All pavement removal shall be disposed of offsite. Broken pavement shall not

to be used in backfill material. See Specification Section 02101 for more details.

3.02 Trench Excavation.

- A. Limits of Excavation - Trenches to be excavated along lines and grades as approved by the District. Trench widths for pipe loading shall be measured 12 inches above top of pipe.
1. Minimum trench width shall be the outside diameter of the pipe or conduit plus 12 inches. See details.
 2. Maximum trench width to be the outside diameter of the pipe or conduit plus:
 - (1) 24 inches for outside pipe diameter of 24 inches or less.
 - (2) 30 inches for outside pipe diameter of greater than 24 inches.
 3. If maximum trench width is exceeded, Contractor will provide, at their expense, higher strength pipe or special bedding including concrete at the direction of the Engineer.
 4. Trench excavation shall not be completed more than 100 feet in advance of pipe installation. Backfill shall be completed within 20 feet of pipe installation by the end of any working day.
- B. Groundwater Control - Contractor to maintain facilities on site to remove all groundwater from trench. Water shall be kept at least 12 inches below the trench bottom, to a point such that a firm base for pipe or conduit installation exists. Facilities shall be maintained until all concrete is cured and backfilling is in place at least 24 inches above anticipated water levels before water removal is discontinued. All water removal shall be subject to approval by the District and appropriate permits if applicable.
- C. Stockpile Excavated Material - Excavated material to be stockpiled so as to not endanger the work or public safety. Maintain existing vehicular and pedestrian traffic with minimum disruption. Maintain emergency access and access to existing fire hydrants and water valves. Maintain natural drainage courses and street gutters.
1. Backfill material to be segregated from stockpiled topsoil and unusable backfill materials.
- D. Excavation for Appurtenances.
1. Excavation to be done in accordance with these specifications and as shown on the Drawings. Adequate working clearances to be maintained around appurtenances. Provisions for base and bottom preparations shall apply to all

appurtenances. Precautions to be taken to maintain trench widths in the vicinity of adjacent pipelines and conduits.

3.03 Bottom Preparation.

- A. Undisturbed Foundation. Where soils are suitable and have adequate strength, bottom to be graded and hand-shaped such that the pipe barrel rests uniformly on embedment material. All rocks or stones, which may result in a point bearing on the pipe shall be removed.
 - 1. Undisturbed grades shall be within 0.1 feet \pm tolerance. Soils for final pipe grade placed within these limits shall be fine granular (100% passing No. 4 sieve) or may be native materials, hand compacted to 95% maximum density.
- B. Bell Holes - Material to be removed to allow installation of all fittings and joint projections without affecting placement of pipe.
- C. Over-Excavation - Whenever trench is over-excavated to eliminate point bearing rocks or stones or when undisturbed grade tolerances of 0.1 foot is exceeded, the Contractor is to re-establish grade using aggregate bedding materials. Compaction shall be 95% maximum density Standard Proctor. All work to re-establish grade shall be at Contractor's expense.
- D. Unstable Materials - Materials that are not capable of supporting super-imposed loadings are defined as unstable materials. Should unstable materials be encountered during excavation, immediately notify the District. If unstable material is encountered, the trench bottom shall be over-excavated (minimum 6 inches) and backfilled with clean 2 inch to 6-inch rock with filter fabric installed around it to prevent migration of fines. The rock backfill provides increased water movement and helps stabilize the trench bottom.
 - 1. Inclusion of a bid item for Unstable Soil Excavation indicates such excavation is anticipated. The Contractor is to notify the Engineer and District prior to any unstable soil excavation; no payment shall be made for excavation prior to authorization of District and/or Engineer.
- E. Rock Excavation - Rock shall be removed to a 6" depth below in bottom pipe grading. Additionally, all rock loosened during jacking, blasting, etc., shall be removed from the trench. Contractor to notify District or Engineer prior to any rock excavation, no payment shall be made for rock excavation prior to notification.

3.04 Backfilling.

- A. Tamping Equipment - Except immediately next to the pipe, mechanical or air operated tamping equipment is to be used. Hand equipment, such as T-bar, is to be used next to pipe if necessary. Care is to be taken when compacting under, alongside

and immediately above pipe to prevent crushing, fracturing, or shifting of the pipe. The Contractor is to note densities required for materials being backfilled and shall use appropriate approved equipment to obtain those densities.

1. Wheel rolling is not considered to be an adequate compaction technique to meet these Specifications and will not be allowed. Where 85% compaction is required, wheel rolling may be considered. Before acceptance, the Contractor shall backfill a portion of the trench and pay for density testing to verify adequacy of the proposed backfill technique.
 2. A hydro hammer may be allowed to obtain the specified density up to 4 ft in depth. The Contractor will be required to re-excavate those areas that have been tamped so that density tests can be taken to ensure that the specified intensity is being obtained full depth.
- B. Moisture Control - Generally, maintain moisture of the backfill material within 2% of optimal moisture content as determined by ASTM D 698. Maintain close tolerances as needed to obtain densities required.
- C. Compaction - Maximum density (100%) based upon ASTM D698 or AASHTO T99.
- 1) Bedding Material. Includes material used for over-excavation of any kind: 95% Standard Proctor.
 - 2) Select Material: 95% Standard Proctor.
 - 3) Backfill beneath existing or proposed pavements, roadways, sidewalks, curbs, utility lines and other improvements or within 5 feet horizontally of such improvements 95% Standard Proctor.
 - 4) Backfill within public or designated right-of-way: 90% Standard Proctor or as shown on the Drawings for those areas outside of No. 3 above.
 - 5) Backfill within undeveloped, green or designated area: 85% Standard Proctor.
- D. Placing Backfill - The maximum loose lifts of backfill material to be as follows (use smaller lifts where necessary to obtain required densities):
- 1) Bedding and select material: 6 inches;
 - 2) Backfill Material: 12 inches where 95% compaction required; 24 inches where less than 95% compaction required.
- E. Backfilling Appurtenances. Backfilling to be done generally at the same time as adjacent pipeline. Backfilling procedure to conform to these Specifications. Use special techniques or materials as shown on Drawings.
- F. Disposal of Excess Excavation. Contractor to dispose of excess excavation off site.

Disposal in any case shall be the sole responsibility of the Contractor.

- G. Maintenance of Backfill - Contractor to maintain all backfill in a satisfactory condition during the extent of the contract and warranty period. The Contractor will be responsible for repairing any deterioration or settlement of the road surface. The District will issue notification of the required repairs. All costs for repair and all liability, as a result of surface deterioration or settlement, shall be the responsibility of the Contractor.
- H. Clay Barrier Water Stops. Because of the presence of ground water, a clay barrier may be required to be installed full depth in trench in place of all bedding material and backfill. This barrier shall be full depth and two feet thick and installed every 100 linear feet of trench. Clay barrier installation shall be considered incidental to the pipe installation and not paid for separately.

3.05 Surface Restoration

- A. All existing surface improvements and site conditions disturbed or damaged during construction to be restored to a condition equal to pre-construction condition. All restoration costs are considered incidental to excavation and backfill.
 - 1. Improvements. Replace, repair or reconstruct all improvements as required. Work will not be accepted until Engineer and all affected property owners accepts restoration. Improvements include, by example, other utilities, culverts, structures, curb and gutter, mailboxes, signs, sprinkler systems, etc.
 - 2. Final Grading. The Contractor is to re-establish existing final grade or finish final grades as modified and shown on the Drawings. The Contractor is to backfill to property subgrade elevation with backfill material to allow placement of surface improvements or materials.
 - 3. Roadways. All roadways to be restored to original condition with material types removed. Materials and methods to conform to 02612 Hot Bituminous Pavement. Requirements include:
 - a) Minimum base course material on gravel roadways or minimum depth gravel on hard surface roadways to be 8", unless otherwise shown on Drawings.
 - b) Minimum bituminous surfacing to be 4" unless shown otherwise on Drawings.
 - c) Minimum concrete pavement surfacing to be 6", unless shown otherwise on Drawings.

4.00 **QUALITY CONTROL - FIELD**

4.01 Compaction.

- A. It should be fully understood that it will be the sole responsibility of the Contractor to achieve the specified densities for all embedment and backfill materials placed. Contractor will be responsible for ensuring that correct methods are being used for the placement and compaction of said materials. Correct backfill methods include, but are not limited to:
1. Use of proper equipment for existing soil condition encountered.
 2. Moisture content of existing soils; determination if water should be added or if soil should be air-dried to reduce moisture content.
 3. Thickness of backfill lift.

Contractor may, at their own expense, have an approved geotechnical engineer monitor the methods of backfill and compaction used to ensure that the desired densities are being obtained.

4.02 Inspection and Testing. Inspection and testing to be performed at the direction of the District. Contractor to cooperate fully with all persons engaged in testing. Contractor shall excavate as required to allow testing. Contractor shall backfill all test excavations in accordance with these regulations.

4.03 Density Testing and Control.

- A. Reference Standards - Density/moisture relationships to be developed for all soil types encountered according to ASTM D698 or AASHTO T99.
- B. Field Testing - Testing for density during compaction operations to be done in accordance with ASTM D2922 using nuclear density methods.
- C. Frequency of Testing - Minimum of one (1) test for each 100 feet of trench per lift or as directed by the District. Contractor to excavate to depths required by Engineer for testing and backfill test holes to density specified. Testing to be paid for by the Contractor.

End of Section V

SECTION 6
PRESSURE TESTING AND FLOW TESTING

1.00 GENERAL

1.01 Scope. This section shall include furnishing all materials, labor, equipment and miscellaneous items necessary to perform pressure and leakage tests for all distribution, transmission, and service lines as specified herein for the District.

1.02 Hydrostatic Tests.

- A. Pressure and leakage tests shall be conducted on all newly laid pipe and service lines. Contractor to furnish all the necessary equipment and materials to conduct the test. Contractor shall test through fire hydrants if possible and will be responsible for installing and abandoning the appropriate taps as approved by the District engineer if a hydrant is not available used.
- B. The test shall be conducted between valved sections of the pipeline, or as approved by the District. Water service lines will be tested up to the closed curb stop. A visual inspection of the water service connection, at the water main and at the curb stop, will be performed to check the leakage; thus, Contractor shall not backfill the corporation, service line couplings and curb stop connections until inspection by District representative has been completed and accepted.
- C. Conduct the tests after the trench has been backfilled or partially backfilled with the joints left exposed for inspection, or when completely backfilled, as permitted by the District. Where any section of pipe is provided with concrete reaction blocking, do not make the pressure tests until at least 5 days have elapsed after the concrete thrust blocking is installed. If High-Early cement is used for the concrete thrust blocking, the time may be cut to 2 days.
- D. Conduct pressure test in the following manner unless otherwise approved by the District: After the trench has been backfilled as specified, fill the pipe with water, expelling all air during the filling. The test pressure shall be 1.5 times normal static system working pressure of the pipe at the point of lowest elevation (test minimum 150 psi).

2.00 Methods

2.01 Duration

- A. The duration of each pressure test shall be two hours, unless otherwise directed by the District.
- B. Procedure

1. Disconnect all fixture devices and other accessories which may be damaged by the specified test pressure.
 2. Plug or cap ends as required.
 3. Bleed system to eliminate all air from system.
 4. No pressure testing shall be permitted until all concrete thrust blocks have adequate curing time to reach design strength, 7 day minimum.
 5. Notify Owner and Engineer 48 hours prior to testing.
 6. Test for 2 hours with no more than 5 psi pressure loss.
7. Leakage shall be defined as the quantity of water necessary to hold the specified test pressure ± 5 psi for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as

$$L = \frac{SD\sqrt{P}}{148,000}$$

determined by the following formula:

In the above formula:

- L = Allowable leakage (in gallons per hour)
- S = Length of Pipe Tested (in feet)
- D = Nominal diameter of pipe (in inches)
- P = Average test pressure during the leakage test (in pounds per square inch gauge).

8. Hydrostatic (Hydrotest) Test Conditions: At lowest point in the line or section under test, pressurize to 1.5 times working pressure. The pipeline shall be filled at a rate that does not create surges and does not exceed the rate at which air can be released. Minimum test pressure shall be 150 psi for all pipes.
9. While the test pressure is maintained, an examination shall be made of the pipeline and any leaks located and repaired. Pipe or fittings found to be faulty shall be removed and replaced. Leakage is not allowed through the bonnet of the line valve. A valve leaking through the bonnet may be repaired in place or removed and replaced. Cutting and replacement of pavement as well as excavation and backfilling may be necessary when locating and repairing leaks discovered during pressure testing.
10. After visible leaks are stopped, repeat procedure beginning at 3.03.B of this section.

D. Pipe Flushing

1. After new main has been leak tested, the line shall be flushed to achieve a

minimum of 3 ft/s in accordance with AWWA C651-14 until three or more pipe volumes are discharged.

2. If minimum velocity of 3 ft/s cannot be achieved then flushing the 2-3 pipe volumes of the line is acceptable,

End of Section VI

**SECTION 7
DISINFECTION OF POTABLE WATER LINES**

1.00 GENERAL

1.01 Disinfection.

- A. The following procedure shall apply to all main extensions within the District service area. Pipe extensions shall be chlorinated in accordance with AWWA C600 and C651 *Standard for Disinfecting Water Mains.*

THE CHLORINATION OF THE FINISHED PIPELINE SHALL BE DONE PRIOR TO THE INSTALLATION OF ANY SERVICE TAPS.

- B. Before filling the pipe with water, the pipe shall be clean and *free of* debris to the satisfaction of the District.
- C. The Contractor shall perform disinfecting by chlorination of the pipe prior to acceptance. The chlorinating agent and method of application shall be in accordance with AWWA C651, latest revision. The Contractor shall provide material for disinfecting of water mains. The Contractor shall also provide a testing, flushing, and disinfection plan to the District for approval at least one week prior to the scheduled testing.
- D. Contractor shall provide all temporary blow-offs, pumps, chlorination equipment, chlorine and all necessary apparatus required.
- E. Preliminary Flushing. Flush pipeline prior to disinfection, except when the tablet method is used, to remove all remaining foreign material. The flushing operation shall develop a minimum velocity of 3.0 ft/s.
- F. Chlorine Application. In general, chlorine shall be applied using the tablet/granule method.
1. Tablet Method. The tablet method consists of placing chlorite tablets in the water main during installation. Tablets (5-grams each) shall be placed upstream of each section of pipe to be disinfected, including branch lines. At least one tablet shall be placed in each hydrant branch and other appurtenances.
 - a) The number of 5-g tablets required for each pipe section shall be $0.0012d^2L$ rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is length of the pipe section, in feet. **Table 1** shows the number of tablets required for commonly used sizes of pipe. Tablets shall be attached to the surface of the pipe with NSF/ANSI 61 approved adhesive at the top of the main. It is assumed there is 3.25-g available chlorine per tablet.
 - b) This method should not be used on solvent-welded plastic or screwed-joint steel

pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

Table 1. Number of 5-g tablets required for a dose of 25 mg/L.

Pipe Diameter (in)	Length of Pipe Section, ft				
	13	18	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

2. Granule Method. Calcium hypochlorite granules shall be adhered, with a CDPHE approved adhesive, to the inside top of every stick of pipe. The quantity of granules shall be as shown in Table 2. This method may be used only if the pipes and appurtenances have been kept cleaned and dry during construction. This method is **not to be used** on solvent welded plastic or on screwed joint steel pipe because of the danger of fire or explosion from the reaction of the joint compound with the calcium hypochlorite.
3. If solvent welded plastic or screwed joint steel pipe is to be used, Contractor may submit an alternative chlorination method for approval by the District.

Table 2. Quantity of 65% CALCIUM HYPOCHLORITE GRANULES

To be placed at the beginning of main and at each 500-foot interval.

Pipe Diameter	Ounces
4"	1.7
6"	3.8
8"	6.7
12"	10.5
14" and larger	15.1

4. The pipe shall be filled with water no faster than 1 ft/s. After the pipe is filled with water and chlorine, and unless approved otherwise by the District, the chlorinated water shall be held in contact with the pipe for 24 hours.
 - a) If under cold water conditions (temp. less than 41 F) contact time should be 48 hours.
5. At the end of the 24-hour period, the water in the pipeline shall be tested by the District to ensure residual chlorine content of not less than 25 mg/l. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water and/or debris. Care shall be taken in flushing the pipeline to prevent

- property damage and danger to the public.
6. Discharge of highly chlorinated water shall not be released to any stream or watercourse.
 7. Samples of water will be collected for bacteriological examination and residual chlorine content testing before the pipeline is put into service. The District will not perform testing of residual chlorine and bacteriological sampling and testing. All bacteriological testing shall conform to AWWA Standards required by one test immediately and another test 24 hours later.
- G. No main that has been disinfected and flushed shall stand stagnant for more than 15 days without being re-flushed and a new disinfecting test performed, passed and approved by the District.
- H. Final Flushing. After the applicable retention period, heavy chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use.
1. A flushing velocity of 2.5 feet per second shall be maintained during final flushing.
 2. The environment to which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the residual chlorine.
 - i. Water shall be dechlorinated to less than 0.1 ppm free chlorine prior to discharge in accordance with State, County, and local regulations.
 - ii. Contractor or Developer shall not discharge chlorinated water to any water body, or the District's sewer system until the chlorine is neutralized and eliminated.
- I. Disinfection Field Quality Control
1. After final flush, and before main or equipment is placed in service, collect water samples from representative points along the main and field test for chlorine residual.
 2. Chlorine residual shall be within 50 percent of the chlorine residual prevailing in the source.
 3. If initial disinfection fails to provide satisfactory samples, repeat disinfection

until satisfactory samples have been obtained.

J. Bacteriologic Tests. Standard conditions. After final flushing and before the new water main is connected to the distribution system, the Contractor shall collect two consecutive sets of acceptable samples, taken over 24 hours apart, from the new main. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. A minimum of two sampling points is required for any segment over 500 feet in length.

1. When pipelines of considerable length (>1200 ft) are being installed and tested, the District may allow the Contractor to only test for bacteria at both pipe ends. The Contractor is also required to test a volume of water equal to every 1,200 LF of pipe. This method may be approved by the District on a case-by-case basis. Contractor is required to submit a plan to the District seven days prior to the start of testing.

i. For example, 4800 LF of 12" pipe requires a test at either end of the pipe, plus one additional test when a volume of water equal to 1,200, 2,400, and 3,600 LF is discharged.

2. All samples shall be tested for bacteriological (chemical and physical) quality in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show absence of coliform organisms.

3. Contractor to collect samples in sterile bottles from sampling points furnished and installed by the Contractor in the main.

4. If any portion of the piping, equipment, or tanks fails Bac-T testing, the Contractor is responsible for repeating disinfection procedures until passing Bac-T test is obtained.

H. Final Connections to Existing Mains. When connections to existing mains are made without a new valve at the connection point, new water main and appurtenances shall be installed, flushed, disinfected and satisfactory bacteriological sample results received prior to permanent connections being made to the active, existing system.

1. Final connections or those portions of the new system installed that have not been disinfected as part of a previous disinfection procedure, shall be disinfected in accordance with Section 4.6 of AWWA C651.

1.02. Final Acceptance

E. Comply with District standards and specifications for placing water line in service.

F. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.

1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete

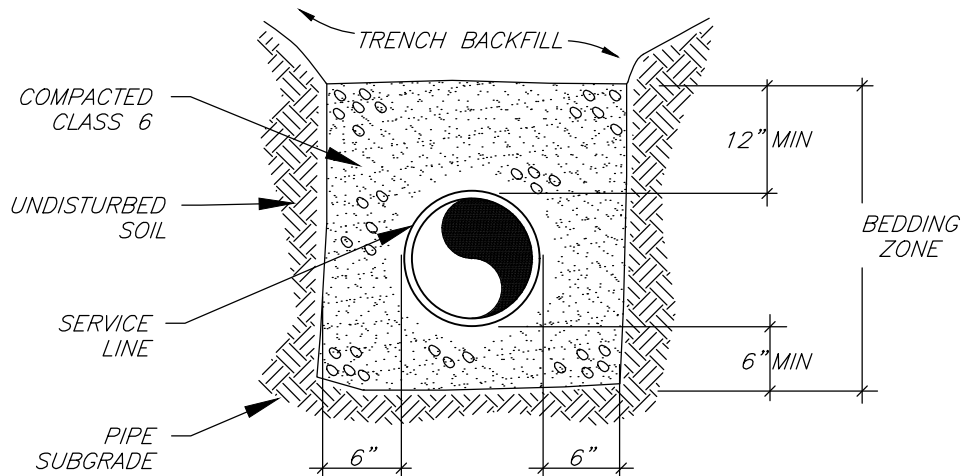
- G. Drain all test water from the new pipe system prior to placing in service.
- H. Provide water tap locations (x, y, z) on the Drawings.
- I. Provide operation and maintenance manuals for appurtenances installed (valves, hydrants, etc.)
- J. Provide final reports to Engineer for:
 - 1. Bac-T results
 - 2. Residual chlorine tests
 - 3. Hydrostatic tests for each section or pipe

End of Section VII

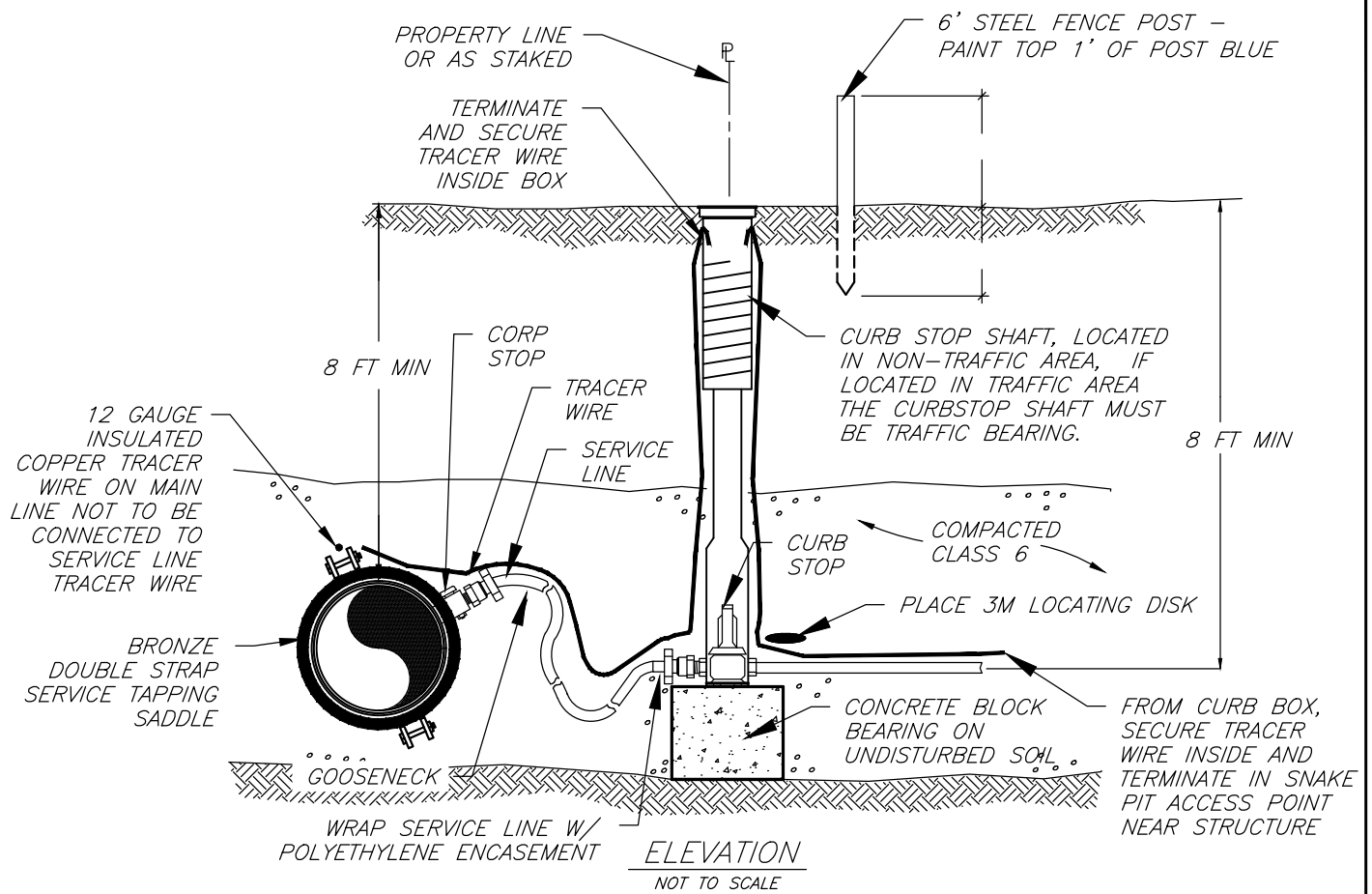
DRINKING WATER REFERENCE DOCUMENTS

1. Regulation No. 11 – Colorado Primary Drinking Water Regulations
2. Policy 5: State of Colorado Design Criteria for Potable Water Systems
3. Policy 7: Backflow Prevention and Cross-Connection Control

DISTRICT STANDARD DETAILS	
1. Water Service Stub	9. Tie-Rod Assembly
2. Water Pipe Bedding	
3. Concrete Thrust Blocks	
4. Easement Width	
5. Fire Hydrant Assembly	
6. Gate Valve	
7. Pipe Insulation	
8. Water Meter Pit	



SERVICE STUB-OUT BEDDING
NOT TO SCALE



ELEVATION
NOT TO SCALE

GENERAL NOTES

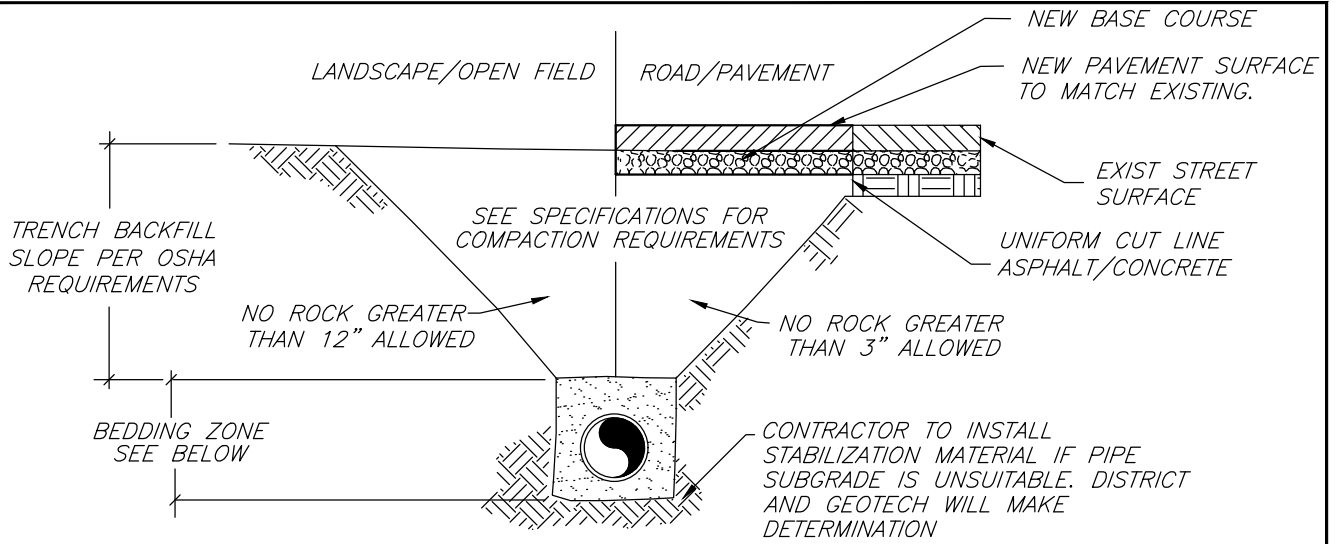
1. CURB STOP TO BE LOCATED AT THE PROPERTY LINE OR AT THE EDGE OF EASEMENT—WHICHEVER IS CLOSER TO THE MAIN.
2. SERVICE LINE SHALL BE BURIED TO MIN. 8 FT AND MAX. 12 FT. FOR ANY SERVICES BURIED LESS THAN MINIMUM DEPTH SPECIFIED, 1-INCH INSULATION IS REQUIRED.
3. ADDITIONAL CURB STOPS ARE REQUIRED IF SERVICE LINE IS OVER 50 FT LONG, NO FITTINGS ALLOWED.



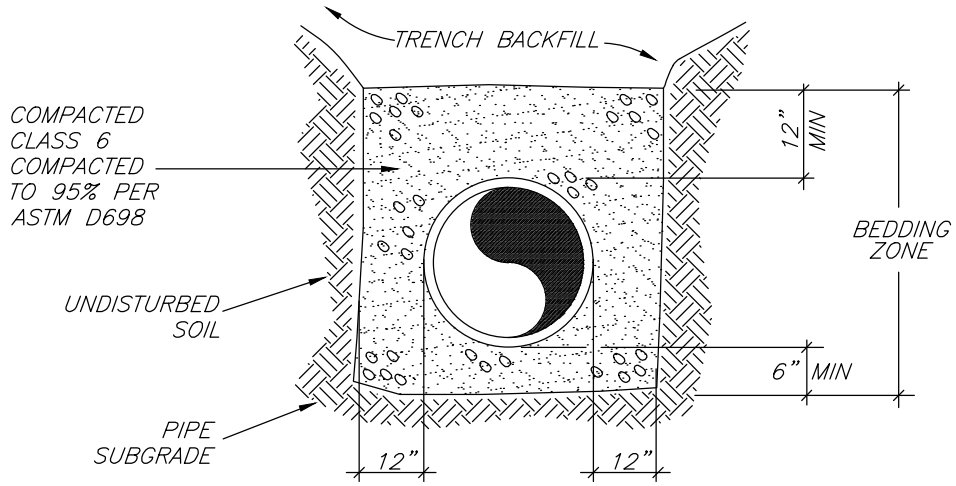
WATER SERVICE CONNECTION
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 1

DATE: JUNE 2023



TRENCH ZONE
NOT TO SCALE



PIPE BEDDING ZONE
NOT TO SCALE

NOTES:

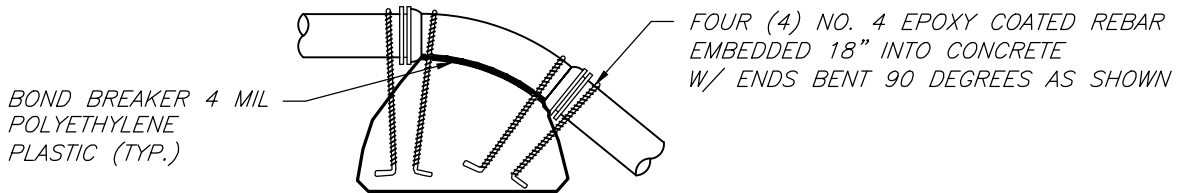
1. PAVEMENT REPLACEMENT SHALL MEET EXISTING THICKNESS AND KIND WITH THE FOLLOWING MINIMUMS:
ASPHALT SURFACING = 4" MIN.
AGGREGATE BASE COURSE = 8" MIN.
2. GRAVEL ROAD REPLACEMENT SHALL MEET EXISTING THICKNESS AND KIND WITH THE FOLLOWING MINIMUMS:
AGGREGATE BASE COURSE = 12" MIN.
3. DIRT / TOPSOIL PLACEMENT SHALL MEET EXISTING THICKNESS AND KIND WITH THE FOLLOWING MINIMUMS:
4" TOPSOIL.
4. INSTALL TRACER WIRE AND MAGNETIC TAPE PER MANUFACTURER'S REQUIREMENTS.
5. FOR AREAS WITH EXISTING PAVEMENT, FOLLOW LOCAL STREET CUT STANDARDS.
6. EXCAVATION SHALL BE LEFT OPEN FOR INSPECTION BY DISTRICT REPRESENTATIVE.



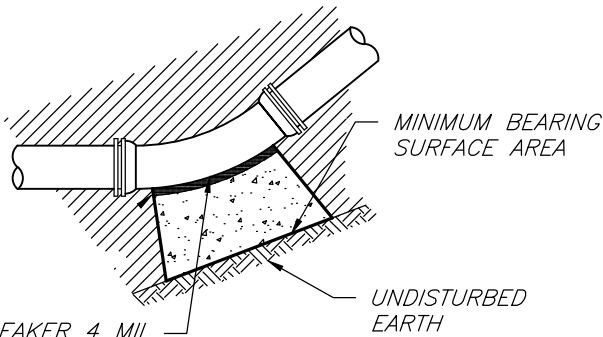
WATER PIPE BEDDING
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 2

DATE: JUNE 2023

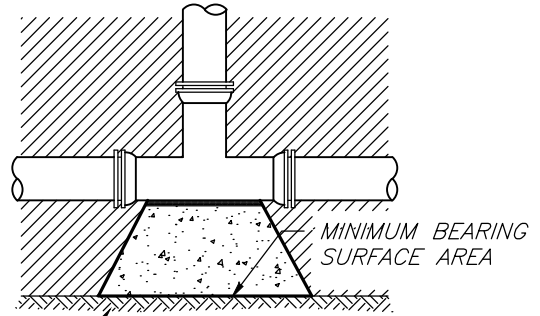


VERTICAL THRUST BLOCK - SECTION

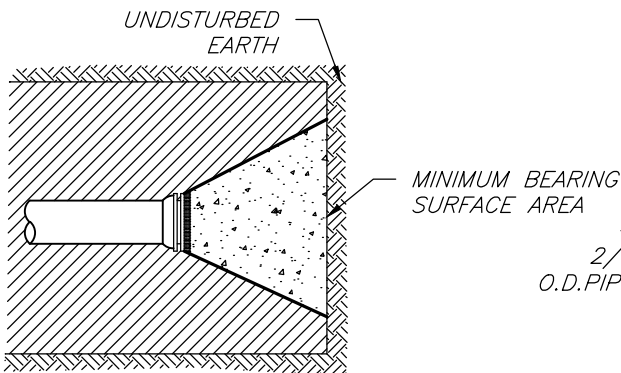


BOND BREAKER 4 MIL POLYETHYLENE PLASTIC (TYP.)

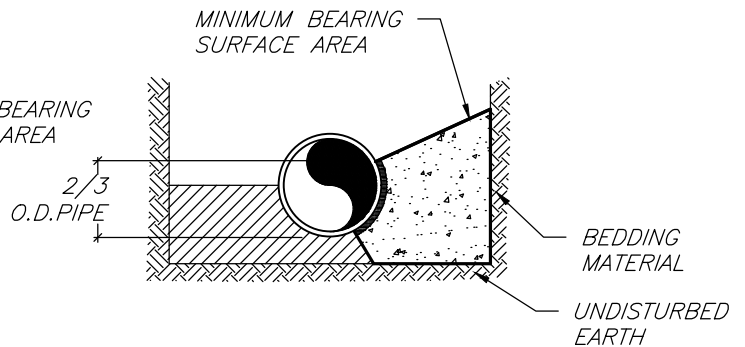
BENDS - PLAN



TEE - PLAN



DEAD END - PLAN



TYPICAL CROSS SECTION

BEARING AREAS (SQ. FT)					
SIZE (IN)	BENDS				TEES, DEAD ENDS, AND CROSS w DEAD END BRANCHES
	90°	45°	22 1/2°	11 1/2°	
3	1.5	0.81	0.4	0.21	1.1
4	2.7	1.4	0.73	0.37	1.9
6	6.0	3.2	1.7	0.83	4.2
8	10.7	5.8	2.9	1.5	7.5
10	16.7	9.0	4.6	2.3	11.8
12	24.0	12.9	6.6	3.3	16.9
14	32.7	17.7	9.0	4.5	23.0
15	37.5	20.3	10.3	5.2	26.5
16	42.6	23.1	11.8	5.9	30.1
18	53.9	36.0	14.9	7.5	38.1
20	66.6	39.8	18.4	9.2	47.1

MIN. BEARING AREAS CALCULATED IN ACCORDANCE WITH "THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE", 7TH EDITION.
MIN. BEARING AREAS FOR PIPES LARGER THAN 20" SHALL BE CALCULATED BY LOCAL MUNICIPALITY'S ENGINEER.

NOTES:

- AREAS GIVEN IN TABLE ARE BASED UPON INTERNAL STATIC PRESSURE OF 100 PSI AND SOIL BEARING CAPACITY OF 1,000 LBS PER SQ. FT.
- BEARING AREAS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING TABULATED VALUES BY A CORRECTION FACTOR "F":

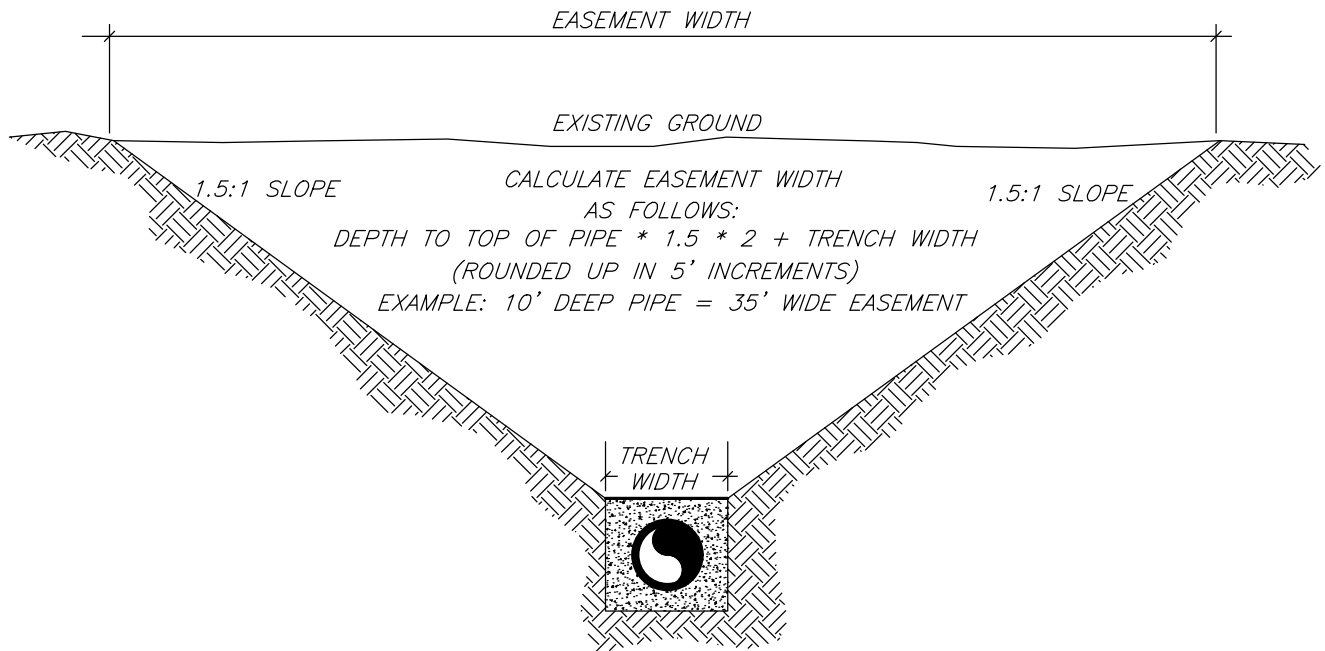
$$F = \frac{\text{ACTUAL SPECIFIED TEST PRESSURE IN HUNDREDS OF lbs.}}{\text{ACTUAL SOIL BEARING CAPACITY IN THOUSANDS OF lbs.}} * S.F.$$
- MIN. SAFETY FACTOR OF 1.1 SHALL BE APPLIED AT DISCRETION OF TOWN AND ENGINEER, UNLESS TOWN OR ENGINEER DETERMINES A HIGHER S.F.
- SOIL BEARING CAPACITIES SHALL BE DETERMINED BY THE ENGINEER.
- CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI.



CONCRETE THRUST BLOCKS
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 3

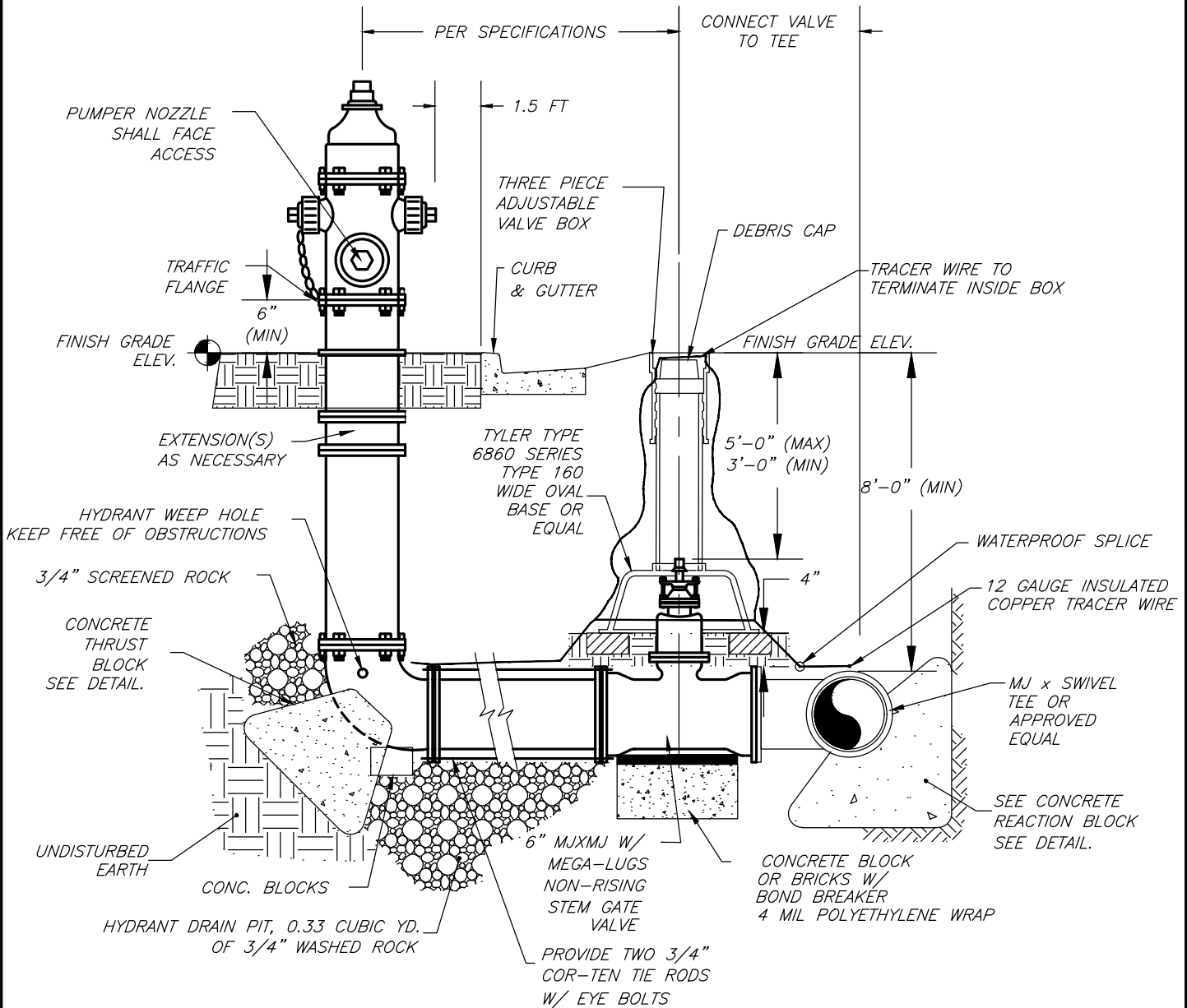
DATE: JUNE 2023



NOTES:

1. TRENCH SLOPE SHOULD BE VERIFIED WITH GEOTECHNICAL DATA BEFORE FINALIZING EASEMENT.

NOTE:
DETAIL NOT TO SCALE.



NOTES:

1. ALL JOINTS FROM MAIN TO HYDRANT SHALL BE RESTRAINED MECHANICAL JOINTS.
2. HYDRANT, VALVE, AND FITTINGS TO BE 250 P.S.I. RATED.
3. POLYETHYLENE WRAP SHALL COVER D.I.P. ASSEMBLY FROM HYDRANT BASE TO WATER MAIN.
4. ALL HYDRANT LEAD PIPING TO BE 6" CLASS 250 D.I.P UNLESS OTHERWISE NOTED.
5. INSTALL VALVE STEM EXTENSION AS NEEDED TO ENSURE THE DISTANCE FROM VALVE BOX LID TO TOP OF NUT SHALL NOT EXCEED 5'-0".
6. HYDRANT WEEP HOLE SHALL BE FREE OF OBSTRUCTIONS WITH 3/4" WASHED ROCK SURROUNDING WEEP HOLE DISCHARGE LOCATION. ROCK SHALL BE CONTINUOUS AROUND EXPOSED PORTION OF CRB.
7. LOOSELY WRAP TRACER WIRE AROUND VALVE BOX BARREL. DRILL 1/8" HOLE TO ALLOW TRACER WIRE TO ENTER BARREL 4" BELOW VALVE BOX COVER WITH 12" OF WIRE DRAPED IN BARREL.

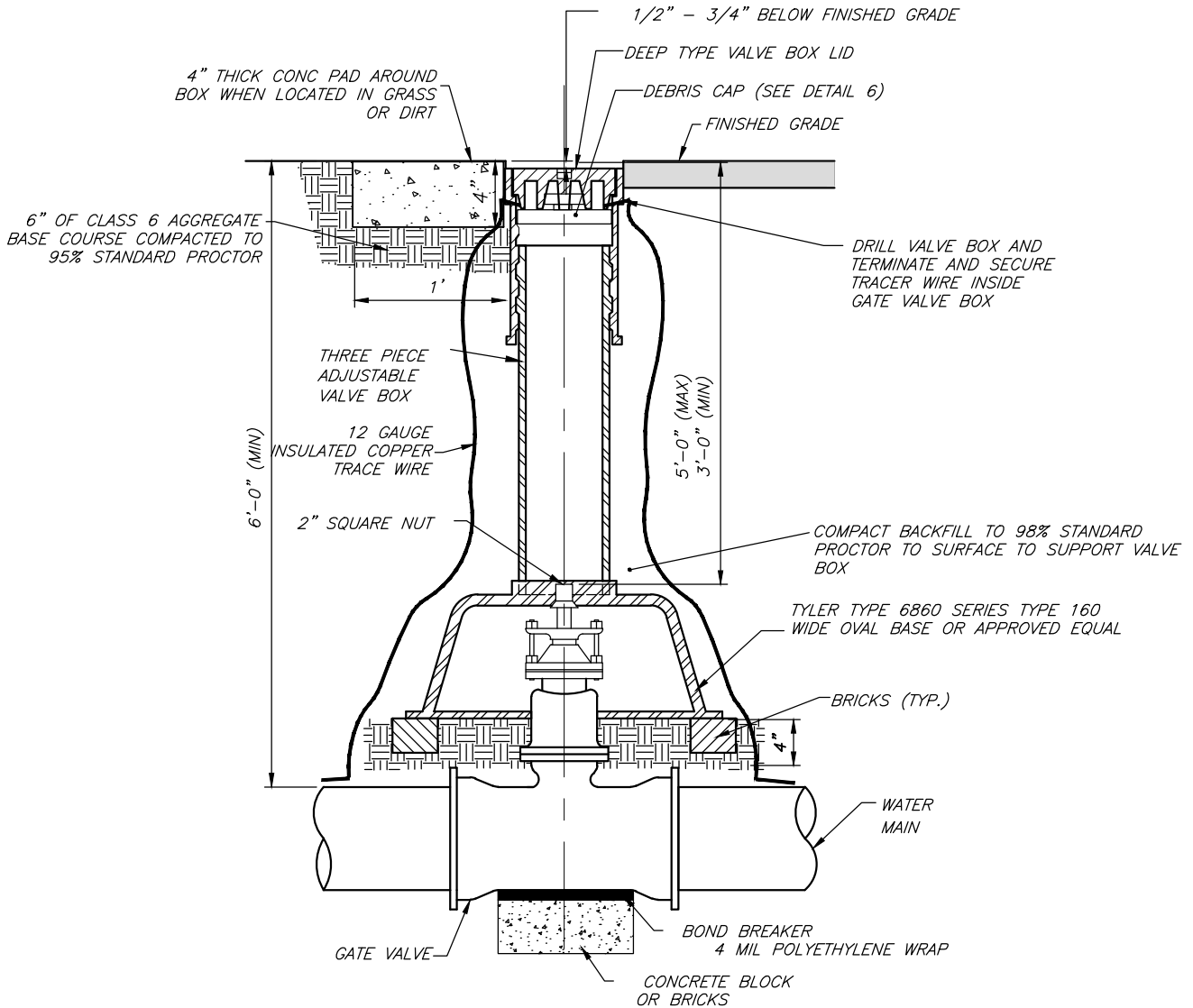


FIRE HYDRANT ASSEMBLY
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 5

DATE: JUNE 2023

NOTE: DETAIL NOT TO SCALE



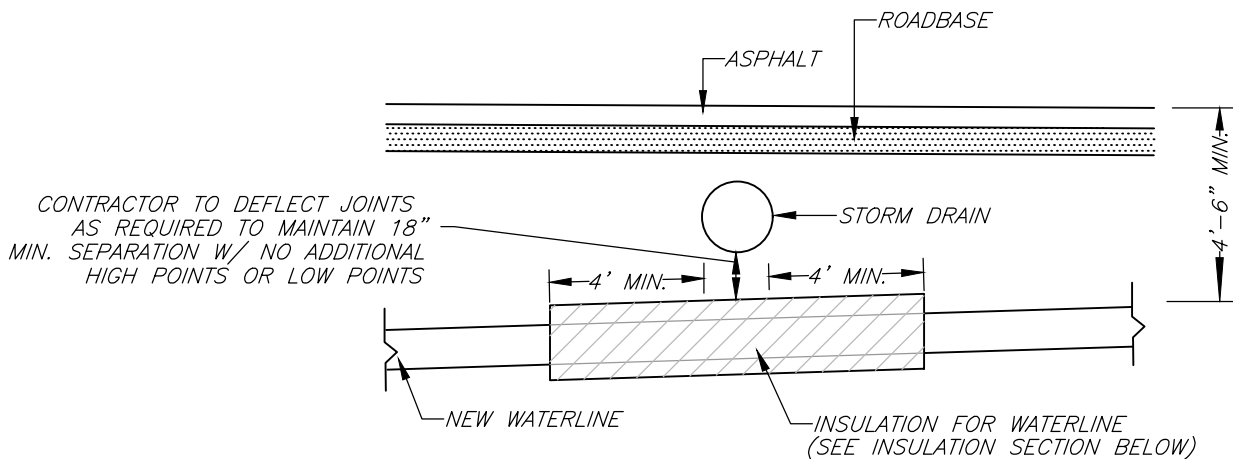
NOTES:

1. DESIGN LOCATIONS OF VALVES ARE OUTSIDE OF CONCRETE AND CURB/GUTTER AND VALLEY PANS.
2. INSTALLED VALVES WHICH CONFLICT WITH CONCRETE AREAS SHALL BE RELOCATED AT THE CONTRACTOR'S EXPENSE.
3. THIS DETAIL DOES NOT APPLY TO HYDRANT ASSEMBLY VALVES.
4. INSTALL VALVE STEM EXTENSION AS NEEDED TO ENSURE THE DISTANCE FROM VALVE BOX LID TO TOP OF NOT SHALL NOT EXCEED 5'-0".
5. THE TRACER WIRE SHALL BE WRAPPED AROUND THE VALVE BOX, TERMINATED AND SECURED INSIDE VALVE BOX, ON BOTH SIDES OF BOX.



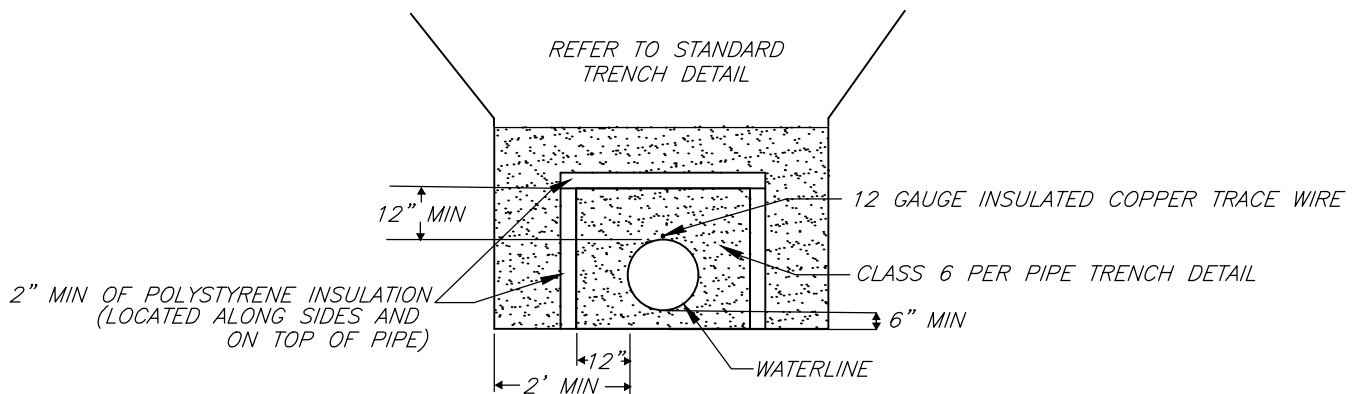
GATE VALVE
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 6
DATE: JUNE 2023



WATERLINE/CULVERT CROSSING

NOT TO SCALE

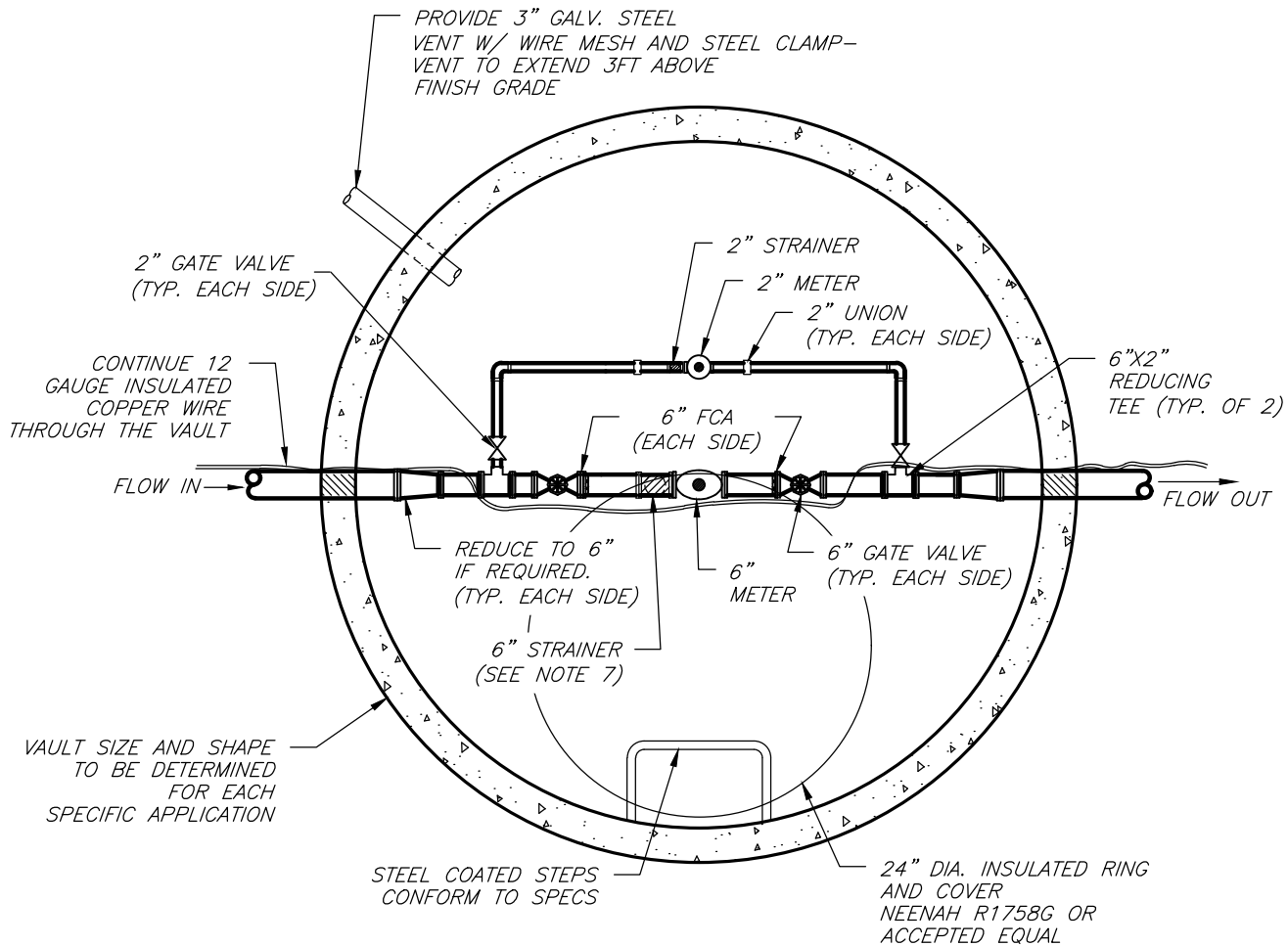


INSULATION SECTION

NOT TO SCALE

NOTES:

1. IF WATER MAINS ARE LOCATED UNDERNEATH STORM DRAINS, CULVERTS, OR ANY OTHER SUBMERGED AIR SPACE, THE REQUIRED DEPTH OF BURY SHALL BE 8 FT. IF DEPTH OF BURY CANNOT BE MET THEN INSULATION SHALL BE INSTALLED AT A RATIO OF 1-INCH PER 1 FT BELOW 6FT. MINIMUM DEPTH OF BURY IS 4'-6".
2. MINIMUM OF 2" INSULATION SHALL BE USED. TOTAL INSULATION THICKNESS TO BE DETERMINED BY ENGINEER.
3. IF 18" VERTICAL SEPARATION CANNOT BE MET, WATER LINE ENCASEMENT AND/OR JOINT OFFSET MAY BE REQUIRED (SEE DETAIL 12). ADDITIONALLY, INSULATION MUST EXTEND MIN. OF 10FT TO EACH SIDE OF THE PIPE.
4. INSULATION TO BE INSTALLED 4" BELOW TOP OF TRENCH. PIPE TRENCH TO FOLLOW WATER PIPE BEDDING DETAIL.



PLAN
NOT TO SCALE

NOTES

NEW WATER METER PITS SHALL BE APPROVED BY DISTRICT ON CASE-BY-CASE BASIS.

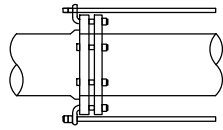
1. VAULT SHALL BE PRECAST CONCRETE AND CAPABLE OF WITHSTANDING HS 20-44 TRAFFIC LOADING CONDITIONS
2. WHERE PIPES PENETRATE WALLS, USE LINK SEAL W/ NON-SHRINK GROUT.
3. COAT ALL EXTERIOR VAULT SURFACES WITH BITUMINOUS DAMPROOFING.
4. ALL 2" PIPE SHALL BE BRASS W/ ALL OTHER PIPE AND FITTINGS BEING FLANGED OR PLAIN END DUCTILE IRON.
5. SUPPORT PIPE ON EITHER SIDE OF METER AND ON UPSTREAM AND DOWNSTREAM SIDE OF GATE VALVES ON BOTH 2" AND 6" PIPE. PIPE SUPPORTS SHALL BE SS FLANGE TYPE ADJUSTABLE SUPPORTS OR APPROVED EQUAL.
6. CONTRACTOR SHALL SUBMIT VAULT PIPING SCHEMATIC W/ VAULT DIMENSIONS TO DISTRICT PRIOR TO ORDERING MATERIALS OR EQUIPMENT.
7. STRAINER SHALL BE METER MANUFACTURER RECOMMENDED MAKE/MODEL OR APPROVED EQUAL, PROVIDED THE METER DOES NOT HAVE AN ADEQUATE STRAINER SYSTEM INTEGRATED INTO THE METER.
8. WATER MAIN SIZE TO BE VERIFIED AND REDUCE TO 6" AS NEEDED.



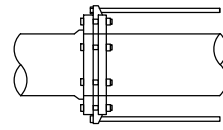
WATER METER PIT
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 8

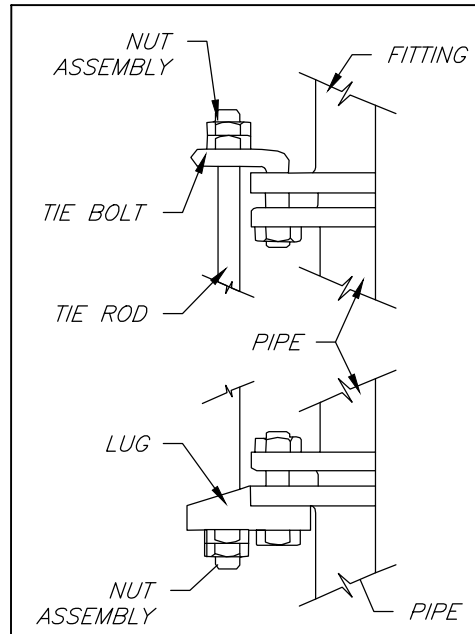
DATE: JUNE 2023



TIE BOLT ASSEMBLY



DUCTILE IRON LUGS



ATTACHMENT DETAIL

NOTES:

1. TIE-RODS SHALL BE COR-TEN ALL THREAD ROD OF ASTM A242 STEEL OR APPROVED EQUAL.
2. TIE-RODS SHALL HAVE NATIONAL COARSE THREAD WITH EITHER TWO NUTS OR ONE SELF-LOCKING NUT AT EACH END. NUTS SHALL BE COR-TEN STEEL OR APPROVED EQUAL.
3. NUMBER OF TIE-RODS PER JOINT SHALL BE IN ACCORDANCE WITH SPECIFICATION/PLANS.
4. TIE-ROD ASSEMBLY SHALL BE COATED WITH 2 COATS OF COAL TAR EPOXY (16-MIL MINIMUM DRY THICKNESS). ASSEMBLY SHALL ALSO BE WRAPPED IN POLYETHYLENE WRAP.
5. TIE-RODS SHALL BE INSTALLED SYMMETRICALLY ABOUT EACH JOINT.
6. TIE-ROD LENGTHS SHALL BE DETERMINED BY TOWN AND ENGINEER ON A CASE BY CASE BASIS. CONTRACTOR TO CONFORM TO TIE-ROD LENGTH NOTED ON PLANS.
7. TIE-ROD COUPLINGS SHALL BE OF COR-TEN STEEL TYPE OR APPROVED EQUAL.



TIE-ROD ASSEMBLY
BRUSH CREEK METROPOLITAN DISTRICT
STANDARD DETAIL

DETAIL 9

DATE: JUNE 2023