

PINEVIEW WATER SYSTEMS

DESIGN CRITERIA AND STANDARDS



October 2026



PINEVIEW WATER SYSTEMS DESIGN CRITERIA AND STANDARDS

October 2026

PINEVIEW WATER SYSTEMS COMPRISES THREE ENTITIES

Ogden River Water Users' Association
South Ogden Conservation District
Weber-Box Elder Conservation District

OWNER

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PART I

DESIGN CRITERIA

SECTION 00 00 10
CONCRETE LINED RESERVOIR DESIGN CRITERIA

1.1 SUMMARY

- A. Concrete-lined reservoirs shall be designed to provide reliable secondary water storage, operational flexibility, and safe maintenance access. Design shall consider constructability, long-term durability, geotechnical conditions, and long-term maintenance requirements. All reservoirs shall be designed and stamped by an engineer licensed in the State of Utah and submitted to Pineview Water Systems (PWS) for review and approval. Design shall be based on site-specific geotechnical recommendations.

1.2 GENERAL RESERVOIR REQUIREMENTS

- A. All reservoir designs shall be submitted to PWS for review prior to construction approval. Submittals shall include design calculations, layout, grading, structural details, and appurtenance design.
- B. Reservoirs shall be configured to allow for complete drainage, sediment removal, and safe maintenance operations.
- C. Reservoir geometry and layout shall minimize stagnation zones and promote proper hydraulic circulation.

1.3 GEOMETRY AND SLOPES:

- A. Interior side slopes shall be no steeper than 2H:1V.
- B. Reservoir geometry shall allow for maintenance equipment access and sediment removal.
- C. The reservoir floor shall be sloped at 0.5% minimum toward the outlet to facilitate complete drainage.
- D. The reservoir shall provide a minimum of 24 hours storage at peak day demand at full system buildout.

1.4 STRUCTURAL REQUIREMENTS

- A. The reservoir floor shall consist of a minimum 6-inch thick reinforced concrete slab.
- B. Reservoir walls shall consist of a minimum 6-inch thick reinforced concrete.
- C. Concrete design shall account for hydrostatic loading, subgrade conditions, and long-term durability.
- D. All construction and control joints shall include rubber waterstop to prevent leakage.

1.5 UNDER DRAIN SYSTEM

- A. An underdrain system shall be provided beneath the reservoir slab to relieve hydrostatic uplift pressures and intercept groundwater beneath the structure.
- B. The underdrain system shall be designed based on site-specific geotechnical recommendations and anticipated groundwater conditions. The system shall provide continuous drainage beneath the reservoir and shall be capable of operating under long-term saturated conditions.
- C. Underdrains shall consist of slotted PVC or HDPE pipe installed within a free-draining granular material. A geotextile filter fabric shall be provided to prevent migration of fines into the underdrain system. Underdrain pipe sizes, spacing, and configuration shall be determined by the design engineer and shall be coordinated with the structural design of the slab.
- D. The underdrain system shall discharge by gravity to an approved outlet, drain structure, or daylight location, subject to site constraints and PWS approval. Cleanouts or observation ports shall be provided as required to allow for inspection and maintenance of the underdrain system.
- E. The underdrain system shall be designed and constructed such that external groundwater is prevented from entering the reservoir and shall function independently from the reservoir low-level drain or sump system.

1.6 LEAK DETECTION SYSTEM

- A. A reservoir leak detection system shall be provided for all reservoirs.
- B. The leak detection system shall be designed to monitor leakage from the reservoir liner and floor system and shall be divided into a minimum of two and a maximum of four monitoring zones, based on reservoir size and configuration.

1.7 FREEBOARD

- A. A minimum freeboard of 12 inches shall be provided above the maximum operating water surface elevation.

1.8 ACCESS AND MAINTENANCE

- A. An access road shall be provided around the perimeter of the reservoir to allow maintenance vehicle access in all weather conditions. Access road material shall be 1 ½" roadbase that meets APWA requirements.
- B. Interior access shall include a maintenance ramp suitable for trucks, skid steers, or similar equipment.
- C. Ramps shall be designed for safe operation, with a recommended maximum slope of 15 percent unless otherwise approved by PWS.

1.9 SAFETY FEATURES

- A. Reservoirs shall include measures to prevent unauthorized access, as required by PWS. Fencing is required for all reservoir sites. Fencing material is site specific based on location of reservoir. Fencing to be chain link or wrought iron as required by PWS. Chain link fencing to meet APWA standards. Wrought Iron Fencing to meet ASTM F2408 and applicable ASTM material standards. Fences and gates shall be 6-ft from bottom of fabric edge to top of fabric edge.

1.10 APPURTENANCES

- A. All outlet works shall include:
 - 1. A traveling water screen incorporated in a reinforced concrete canal outlet structure to reservoir.
 - 2. A sliding trash rack incorporated in a reinforced concrete reservoir outlet structure in the concrete reservoir outlet to pump station.
- B. Valves, structures and other appurtenances shall be located and designed to allow safe and convenient maintenance access.

1.11 OPERATIONS AND MAINTENANCE

- A. Reservoir design shall allow for complete drainage and cleaning.

SECTION 00 00 20
PUMP STATION DESIGN CRITERIA

GENERAL

1.1 SUMMARY

- A. Pump stations shall be designed to collect secondary water in a wet well and pump the water into the PWS distribution system while providing operational flexibility, pump redundancy, and safe maintenance access. The design shall consider constructability, durability, geotechnical conditions, and long-term maintenance requirements. Pump stations shall be designed and stamped by an engineer licensed to practice in the state of Utah and submitted to PWS for review. A complete detailed design of the pump station is required for PWS review. PWS may request additional information if insufficient information is available for a complete review.

1.2 PWS FACILITIES DESIGN CRITERIA

- A. A minimum irrigation season beginning April 15 and ending October 15 shall be assumed during pump station design.
- B. Engineering calculations for irrigated acreage serviced by the proposed pump station shall be submitted to PWS as part of the design review. Pump stations shall be sized to adequately provide flows for the applicable Average Annual Demand, Peak Day Demand, and Peak Hour Demand.
- C. The design Average Annual Demand shall be based on the secondary water allotment described in the *Water Efficiency Standards for New Developments* document.
- D. The design Peak Day Demand shall be based on a flowrate of 7 gpm per irrigated acre unless justified by the design engineer using worst-case, site-specific data and approved by PWS Engineering.
- E. A Peaking Factor shall be applied to the Peak Day Demand to determine the design Peak Hour Demand. The Peaking Factor shall be dependent upon the applicable system unit as outlined in Table 1. For more information on which unit an area is in, refer to the unit map on the PWS website.

Table 1 – Peak Hour Factor by District and Unit											
Weber-Boxelder Conservancy District											South Ogden Conservancy District
Unit A	Unit B	Unit C	Unit D	Unit H	Unit I	Unit J	Unit K	Unit L	Unit P	Unit Q	-
2.24	2.23	2.24	2.32	2.25	2.11	2.69	1.70	2.69	2.61	2.32	2.36

1.3 GENERAL PUMP STATION REQUIREMENTS:

- A. All pump station designs shall be submitted to PWS for approval prior to construction approval. Submittals for design approval shall include design calculations, pump data, pump curves, maximum shutoff head, design flow capacity, design flow total dynamic head, net positive suction head requirements, static head, maximum pump speed, minimum motor size, pump discharge sizing, pump discharge flange pressure rating, projected energy consumption calculations, control sequence of operations, surge design, etc.
- B. Pump stations shall be readily accessible by maintenance vehicles during all weather conditions. Easements shall be granted to PWS and shall be sufficient to allow access by maintenance vehicles. Access roadways shall be a minimum 15-ft wide with a minimum 25-ft wide easement. The access roadway shall be centered in the easement whenever possible.
- C. Pump stations shall have adequate security to prevent unauthorized entry.
 - 1. Fencing is required for all pump station sites. Fencing material is site specific based on the location of the pump station. Fencing to be chain link as required by PWS. Chain link fencing to meet APWA 32 31 13 with three-strand barbed wire fixed above the top of the fence.
- D. The site shall be laid out with sufficient clearance around the building to allow for crane access to allow for removal of pumps, motors, and other mechanical equipment from enclosure roof hatches or skylights.
- E. Pump stations shall be designed within conformance of the most recent version of ANSI/HI 9.8 "American National Standard for Rotodynamic Pumps for Pump Intake Design."
- F. Access within the pump station shall conform to OSHA requirements and approved by PWS.
- G. Pump stations shall be designed to provide adequate ventilation for wet well.
- H. Pump stations shall be adequately lighted for night-time operation both on exterior of building and inside the building.
- I. Pump stations shall have suitable flow measurement devices.
- J. Pump stations shall be designed and equipped with a minimum of two pumps with capacity to add an additional pump in the future. Pump stations shall be designed and furnished with a minimum number of redundant pumps equal to at least 50 percent of the design operating pump quantity, rounded up, and shall not be less than one standby pump.
- K. Vertical turbine pumps controlled by VFDs shall be required. Other pump types are not acceptable.
- L. Variable Frequency Drive (VFD)
 - 1. VFDs shall be required for all pumps in all pump stations.
 - 2. Acceptable VFD Manufacturers follow:
 - a. Danfoss Inc.; Danfoss Electronic Drives Div.
 - b. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
 - c. No other equals

- M. Pump stations shall have Supervisory Control and Data Acquisition (SCADA) capability and compatible with PWS's SCADA system. RTU hardware, programming, and SCADA integration shall be coordinated directly with Variable Speed Solutions: +1 (801) 787-2180.
- N. SCADA may consist of the following based on specific site conditions:
1. monitoring equipment
 2. signal wiring
 3. RTU's
 4. radio transmitters
 5. modems
 6. battery backup
 7. antennas
 8. masts
 9. wiring
 10. repeaters
 11. wiring
 12. computers
 13. software
 14. Fiber optic communications
 15. other miscellaneous and appurtenant equipment used to remotely monitor and operate pumping facilities
 16. SCADA systems shall be designed using the following guidelines:
 - a. RTU's shall be as approved by PWS to monitor and transfer all required equipment and signals.
 - b. System and power supply shall be enclosed in a NEMA 4X enclosure.
 - c. Power supply shall include 120 V, single phase AC and 24 V DC power.
 - d. Battery backup via a suitably sized uninterruptible power supply capable of a minimum of 1-hour backup shall be supplied.
 - e. RTU's shall have power fail functions.
 - f. Internal radio and modems with proper antenna, cables, and connectors shall be supplied. Additional relay towers may be required if necessary to relay to the PWS Master Site.
 - g. SCADA system software shall be compatible with the PWS Master Site.

The SCADA system shall monitor and transmit signals including, but not be limited, to the following:

1. Pump on (for each pump)
2. Pump fail (for each pump)
3. Motor Overheat (for each motor)
4. Low water level
5. High water level
6. Power failure
7. Generator on
8. Generator fail
9. Flow Metering
10. Access/Entry Alarm
11. Building Temperature
12. Filtration system differential pressure

- O. Pump Motors
1. Refer to NEMA MG-1.
 2. All motors governed by NEMA MG-1 requirements shall meet NEMA Premium Efficiency standards.
 3. In no case shall the required horsepower at any point on the pump performance curve exceed the rated horsepower of the motor or engine, or encroach on the service factor.
 4. Acceptable Motor Manufacturers follow:
 - a. Emerson, US Motors
 - b. General Electric Company; GE Industrial Systems.
 - c. Reliance
 - d. Toshiba
 - e. Baldor
 - f. No other equals
 5. Motor voltage, amperage, and selection shall be provided for PWS review.
 6. Motor enclosure materials including bolts, studs, and other fastening devices shall be corrosion resistant.
- P. Pump Station Enclosure:
1. A suitable enclosure shall be constructed to contain the pump station pumps, motors, valves, and electrical controls.
 2. Enclosures shall be buildings with either a single-pitched or clerestory roof wherever feasible and shall include CMU block for the structural outer walls.
 3. Architectural treatment resembling the planned development in the area shall be incorporated, reviewed, and approved by the local government jurisdiction prior to PWS approval.
 4. Pump station enclosures must be sturdy and adequate for the purpose and shall be designed and stamped by a professional structural engineer licensed to practice in the state of Utah.
 5. Hatches/skylights shall be provided in the enclosure over the pumps with sufficient clearance and size to freely remove the pumps and motors.
 6. A roll-up door shall be provided to support the installation, removal, and maintenance of pump station equipment. The roll-up door opening shall be sized to provide a minimum clearance of 2 feet on each side based on the largest equipment to be removed and shall not be less than 10-ft wide by 10-ft tall unless otherwise approved by the PWS engineer. Door opening requirements shall be demonstrated in the design submittal for PWS review and approval.
 7. Design of the pump station layout shall maintain a minimum clearance of 6 feet between piping, mechanical equipment, and/or appurtenances and any adjacent wall. Clearances shall be included in the design submittal for PWS review and approval.
 8. The enclosure shall be designed and built according to the International Building Code, latest edition.
 9. An electrical room shall be provided separate from the pump room with doorway access between the two rooms. Electrical panels shall be mounted in the electrical room.
- Q. Cavitation
1. To avoid pump cavitation, the maximum pump speed shall be determined based on available pumps meeting flow and TDH requirements that ensure the sum of the net positive suction head available (NPSHa) and a satisfactory net positive suction head

margin (NPSH margin) does not exceed the net positive suction head required (NPSHr) or:

$$\text{NPSHr} \geq \text{NPSHa} + \text{NPSH margin}$$

2. NPSH Margin

a. NPSH margin is defined as:

$$\text{NPSH margin} = \text{NPSHa} - \text{NPSHr}$$

b. NPSH margin ratio is defined as the following:

$$\text{NPSH margin ratio} = \frac{\text{NPSHa}}{\text{NPSHr}}$$

- 1) Within the allowable operating region (AOR), NPSH margin shall be obtained using whichever is greater between a 1.2 NPSH margin or a 3.3 ft NPSH margin in accordance with ANSI 9.6.1.
- 2) Within the preferred operating region (POR), NPSH margin shall be obtained using whichever is greater between a 1.1 NPSH margin ratio or a 2-ft NPSH margin in accordance with ANSI 9.6.1.

R. Manufacturers:

1. Coordinate acceptable pump manufacturers with MCI/Flowtronex.

S. Pump Station Pipe Design

1. Pumps and piping shall be coated in accordance with the PWS Painting and Coatings Specification 09 90 00.
2. System Header Requirements
 - a. System header piping shall be sized to ensure typical operating velocities are between 3 and 5 ft/s.
 - b. The maximum allowable design velocity for the system header shall not exceed 7.5 ft/s under any condition.
 - c. Pipe pressure rating shall be 1.5 times the maximum working pressure of the system or minimum 200 psi; whichever is greater.
 - d. Air relief and vacuum valves shall be provided at pump stations and along system piping at localized high points. Locations shall be determined to prevent adverse hydraulic conditions associated with entrapped air, vacuum formation, and/or system piping transients.
 - e. Air Valves
 - 1) Vaults or manholes shall be provided where air valves are required to allow for inspection, maintenance, or replacement access.
 - 2) Air valve sizing shall be supported by generally accepted engineering calculations and/or manufacturer recommendations.
 - 3) Air valve sizing calculations shall be provided to PWS for review prior to construction approval.
 - f. Pump station piping shall include a permanent bypass and valving to allow PWS to bypass the filter units. This bypass shall pump directly to a location on the canal downstream of the pump station turnout. A dissipation structure shall also be required at the point of discharge to the canal.

- g. Mainline header shall include a flow meter fully compatible with PWS SCADA systems and minimum piping lengths upstream and downstream of the flow meter shall be provided in design and construction. Minimum pipeline lengths shall be provided for PWS's review and approval.
- h. Isolation valving shall be provided on the pump station header to isolate the pump station header from the main line as desired by PWS.
- i. Dismantling joints shall be provided on the pump station header to allow for maintenance of isolation valves and flow meter.
- j. Pump Lateral Discharge Piping
 - 1) Pump discharge velocities between pump and header shall be optimized for mechanical equipment requirements. Proposed mechanical equipment requirements shall be provided in the submittal for PWS review.
 - 2) Discharge piping shall include the following for each pump:
 - a) Globe style check valve
 - b) Air relief valves sized to protect pumps against surge
 - c) Dismantling joints to allow for maintenance of discharge piping
 - d) Sufficient spacing between equipment for operation and maintenance access
- 3. Isolation valves shall be designed and installed downstream of all other mechanical equipment in accordance with the PWS Specification 40 05 50 Valves and Fittings.

T. Filtration Requirements

- 1. Filters or strainers shall be designed and installed downstream of the pump discharge. Filters shall be capable of removing particles with a nominal diameter of 300 microns or smaller. Additional filtration may be required at the point of use.
- 2. Isolation valves shall be provided for each filtration unit allowing for isolation of filters from both the backwash system and main system.
- 3. Pump stations shall be designed and equipped with a minimum of two filtration units with capacity to an additional filtration unit in the future. Pump stations shall be designed and furnished with a minimum number of redundant filtration units equal to at least 50 percent of the design operating filtration unit quantity, rounded up, and shall not be less than one standby unit.
- 4. Filters or strainers shall be automatic, self-cleaning type.
- 5. Filtration units shall initiate an automatic cleaning cycle when the differential pressure across the filtration unit reaches the maximum manufacturer recommendation.
- 6. The system shall also allow manual initiation of cleaning cycles via SCADA.
- 7. Backwash water shall be discharged to a PWS canal downstream of the canal turnout whenever possible. Backwash water may also be discharged to a PWS reservoir when discharging to a PWS canal is not feasible.
- 8. Calculations and justification for filter selection shall be provided to PWS for review prior to pump station construction approval.
- 9. units. The manufacturer's minimum requirement shall be provided to PWS as part of the PWS review.
- 10. Minimum backpressure requirements shall be per filtration manufacturer's recommendations.

11. If a backwash booster pump is necessary, the backwash booster pump data shall be provided with pump curve, hydraulic calculations, NPSH information, energy consumption calculations, etc. for PWS review.
12. Pump station flows shall be adequate to meet peak system demands during a filtration backwash cycle.
13. The following is a list of acceptable filter manufacturers:
 - a. Amiad
 - b. No other equals

U. Wet Well Design

1. Pump station wet wells may be rectangular, circular, or trench-type.
2. A minimum of 1-ft of freeboard shall be provided in the design when the water level is at its maximum elevation.
3. Wet wells shall be self-cleaning types designed in accordance with the latest edition of ANSI/HI 9.8 "American National Standard for Rotodynamic Pumps for Intake Design".
4. Physical model studies of the wet well may be required by the PWS engineer in accordance with ANSI/HI 9.8 recommendations. If required, physical model study results shall be presented to PWS for review prior to construction approval.
5. Wet wells shall be sized to provide a minimum equalization storage volume equal to two hours of the peak hour demand, plus the maximum average daily flow during a filtration unit backwash cycle.
6. Wet well inlet shall be sized to allow for an inflow greater than or equal to the peak pump station design flowrate.
7. Pumps and wet wells shall be sized such that individual pumps do not start more than six times per hour.
8. Low flow "jockey" pumps shall be provided in the pump station. Jockey pumps shall be sized for low-flow and low-pressure system scenarios.
9. Pressure regulating valves, and/or hydropneumatics tanks may also be incorporated into the pump station design to ensure pumps do not exceed the maximum number of starts per hour.

V. Surge

1. Pump stations and associated system piping shall be designed to safely accommodate hydraulic transients, including pressure surge (water hammer) resulting from pump startup, pump shutdown, power failure, valve operation, and other rapid changes in flow conditions. Surge pressures shall not compromise the structural integrity, serviceability, or reliability of any component of the pumping system piping, including pumps, piping, valves, appurtenances, etc.
2. Surge analysis and designed protection measures shall be submitted to PWS for review as part of pump station design calculations.
3. The maximum transient pressure, including static pressure, shall not exceed:
 - a. The rated working pressure plus surge allowance of the pipe material; or
 - b. The pressure class of valves, fittings, and appurtenances; or
 - c. The maximum allowable operating pressure of the system components.
4. Transient pressures shall be limited to between 130% of normal operating pressure max, unless higher allowances are justified by the design engineer and approved by PWS.
5. The minimum transient pressure shall remain above vapor pressure to prevent column separation, cavitation, and possible pipe collapse. Sub-atmospheric pressures

- shall be avoided, particularly in system piping constructed of flexible or thin-wall pipe materials. Include pipe collapse calculations for minimum allowable pressure in surge calculations. In no case shall the minimum pressure drop to one-half of -12 psi.
6. Surge analysis shall be performed using an industry-accepted transient modeling software capable of elastic water column analysis. The model shall incorporate:
 - a. Accurate pipe material properties and wave speed
 - b. Pump inertia and characteristic curves
 - c. Valve type, location, and closure characteristics
 - d. Surge control devices and their dynamic behavior
 - e. Simplified or steady-state analyses are not acceptable where transient pressures may govern design.
 7. Where surge analysis indicates that transient pressures exceed acceptable limits, surge mitigation measures shall be provided. The selection of surge protection devices shall be based on hydraulic effectiveness, reliability, operational simplicity, and life-cycle cost.
 8. Surge protection may include, but is not limited to:
 - a. Hydropneumatic (surge) tanks or vessels
 - b. Surge anticipating or pressure regulating valves
 - c. Controlled closure or non-slam check valves
 - d. Air, vacuum, and/or combination air release valves
 - e. Variable frequency drives (VFDs) with controlled ramp-up and ramp-down
 9. Surge protection devices shall be properly sized based on the results of the surge analysis and located to maximize effectiveness. Surge analyses results shall be provided to PWS for review prior to construction approval.

W. Acceptance:

1. Acceptance of the pump stations by PWS shall be conditional upon the following:
2. Two copies of the operation and maintenance manuals and control and wiring diagrams shall be provided to PWS.
3. Four hours (minimum) of operation and maintenance training shall be provided for PWS personnel.
4. Successful completion of hydrostatic test in accordance with Hydrostatic Testing Requirements per PWS Standard Specification 33 13 00.
5. Start-up of all major equipment in the pump station shall be by each equipment manufacturer, followed by a report from the manufacturer that the installation complies with their requirements. PWS shall be notified 48 hours prior to start-up and testing so PWS personnel may attend.
6. All major equipment shall have a minimum two-year warranty. The two-year warranty period shall begin upon substantial completion of the pump station.
7. The pump station shall operate for 72 hours (minimum) without any failure.

SECTION 00 00 30
WATER EFFICIENCY STANDARDS FOR NEW DEVELOPMENTS

PART 1 - GENERAL

1.1 APPLICATION

- A. Applies to all new developments and changes of use on properties served by Weber-Box Elder Conservation District and South Ogden Conservation District (single-family, multifamily/HOA, commercial, industrial, institutional, and other irrigated common areas).

1.2 WATER EFFICIENCY ALLOTMENTS

- A. Each parcel's secondary water allotment will be a maximum of 0.38 acre-feet for a single-family residential lot of 0.25 acres or larger. Allocations for lots smaller than 0.25 acres will be reduced on a pro-rated basis according to lot size.
- B. Commercial, industrial, institutional, and multi-family parcels will be allotted 0.38 ac-ft per irrigable acre. Open space allotments will be evaluated separately.
- C. The Customer shall not use District water in any amount that exceeds the annual allotted volume.
- D. Landscape and irrigation shall be planned, installed, and operated consistently with efficient watering practices described in this document.

1.3 IRRIGATION DESIGN STANDARDS:

- A. Irrigation controllers should be WaterSense-labeled.
- B. Irrigation systems should be designed and operated to achieve the highest practical water efficiency for the plant materials served.
- C. Drip irrigation should be used for all non-turf areas; overhead irrigation should only be used for turf areas.
- D. Irrigation valves/zones should be configured so each zone irrigates areas with similar site/sun exposure, slope, soil conditions, and plant water needs.
- E. Drip zones and overhead sprinkler zones should be on separate valves.

1.4 LANDSCAPE DESIGN STANDARDS

- A. Commercial, Industrial, Institutional, and Multifamily (including HOA common areas)
 - 1. Turf grass shall not be placed in parking landscape areas (e.g., parking lot islands/medians and similar parking-adjacent landscape).
 - 2. Community-approved and District-accepted designated recreation areas (e.g. open space, parks, playfields) shall be evaluated on a case-by-case basis.
- B. All Development Type

1. Turf grass shall not be placed in areas with widths less than 8 feet, or in areas with slopes greater than 25%.

1.5 LANDSCAPE DESIGN RECOMENDATIONS

- A. Single-Family Residential
 1. Turf grass shall be limited to the greater of 37% of total lot area or 250 square feet but shall not exceed 4,000 square feet.
 2. Drip irrigation area shall be limited to 15% of total lot area but shall not exceed 1,650 square feet.
- B. Commercial, Industrial, Institutional, and Multifamily (including HOA common areas)
 1. Turf grass shall be limited to no more than 15% of the total irrigable area.

1.6 METERING, RESTRICTIONS, AND CONSERVATION OPERATIONS

- A. Secondary use shall be measured through appropriate metering consistent with District requirements.
- B. Property owners, HOAs, and/or designated operators are responsible for maintaining irrigation systems and landscapes in a manner that remains compliant with these standards.
- C. During water shortage conditions, deliveries may be restricted consistent with District priorities and operational constraints.
- D. Customers shall comply with applicable watering restrictions and any landscape-related requirements imposed by local jurisdictions.

1.7 ALLOTMENT ENFORCEMENT AND OVERUSE

- A. If total water use reaches 100% of the allotted volume, secondary water service will be shut off for the remainder of the irrigation season, and a service fee will be assessed.
- B. The service fee must be paid before the following irrigation season to resume secondary water service.
- C. To help stay within your allotment and support water conservation, customers are encouraged to follow the State of Utah's watering guidelines, available at <https://conserwater.utah.gov>.

PART II

TECHNICAL SPECIFICATIONS

DIVISION 09

FINISHES

**SECTION 09 90 00
PAINTING AND COATING**

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers surface preparation, furnishing, and application of protective coatings, complete.
- B. This specification recognizes NACE and SSPC standards as minimum industry standards and they are referenced for purpose of conformance, except where modified herein. The requirements of this specification section have been written to a higher design standard with the intent of achieving long-term coating performance.

1.2 ABBREVIATIONS

FBE	Fusion Bonded Epoxy
MDFT	Minimum Dry Film Thickness
MDFTPC	Minimum Dry Film Thickness Per Coat
mil	Thousandths of an Inch
OSHA	Occupational Safety and Health Act
PSDS	Paint System Data Sheet
SP	Surface Preparation
VOCs	Volatile Organic Compounds

1.3 SUBMITTALS

- A. Submit in accordance with APWA Section 01 33 00 - Submittal Procedure.
- B. Product Data:
 - 1. For each paint system used herein, furnish a Paint System Data Sheet (PSDS), Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers. A sample PSDS form is appended at the end of this section.
 - 2. The required information shall be submitted on a system-by-system basis.
 - 3. Provide copies of the paint system submittals to the coating applicator.
 - 4. Indiscriminate submittal of manufacturer's literature only is not acceptable.
- C. Quality Control Submittals:
 - 1. Signed letter from the coating manufacturer prefacing any coating product submittal. This letter shall indicate that the coating manufacturer's representative is aware of

- the Project, recommends the specific products included in the submittal for use on the Project, and that these systems meet or exceed requirements specified herein.
2. Applicator's Experience: List of projects of similar scope and size completed by the Applicator along with references.
 3. List of coating applicators, including supervisor, who have direct coating application responsibility with years of experience in application of indicated coating system.
 4. If the manufacturer of field-applied coating differs from that of shop applied primer, provide both manufacturers' written confirmation certifying that materials are compatible

1.4 QUALITY ASSURANCE

- A. Coating Applicator's Experience and Certification:
1. Coating Application Company and coating application supervisor (Certified Applicator) shall have a minimum of 5 years' experience applying the specified coating system.
 2. Coating application personnel, who have direct coating application responsibility, shall have a minimum of 2 years practical experience in application of the indicated coating system.
 3. Coating applicator shall be certified by the coating manufacturer as an approved applicator.

1.5 PAINT DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint to the project site in unopened containers that plainly show, at the time of use, the designated name, date of manufacture, color, and name of manufacturer.
- B. Store paints in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the paint manufacturer.
- C. Shipping:
1. Where precoated items are to be shipped to the jobsite, protect coating from damage. Batten coated items to prevent abrasion.
 2. Use nonmetallic or padded slings and straps in handling.
 3. Items will be rejected for excessive damage.

1.6 WARRANTY

- A. Warranty: The Contractor and coating manufacturer shall jointly and separately warrant to the Owner and guarantee the work under this section against defective workmanship and materials for a period of 2 years commencing on the date of final acceptance of the work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Store and handle all products per manufacturer's written directions.

- B. All metallic surfaces shall be prepared and coated in accordance with referenced standards, written instructions of the coating or lining manufacturer, and these specifications, whichever is more stringent, unless specified otherwise.
- C. Coatings shall be the product of a single manufacturer. Product substitutions during the project will not be permitted without District Engineer approval.

2.2 PAINT AND COATINGS MANUFACTURERS

A. Coatings Manufacturers (Able to supply most heavy-duty industrial coatings):

1. Carboline Coatings Company
2. ICI Devoe Coatings Company
3. International Coatings
4. Pittsburgh Paints (PPG)
5. Sherwin Williams
6. Tnemec Coatings

B. Fusion Bonded Coating Manufacturers:

1. 3M Company

C. Wax Tape Manufacturers

1. Denso North American
2. Trenton

2.3 PAINT MATERIALS

- A. Products shall meet federal, state, and local requirements limiting the emission of VOCs. Specific information may be secured through the local Division of Air Quality.
- B. Materials Including Primer and Finish Coats: Produced by same paint manufacturer of other components of the coating system, as previously stated.
- C. Thinners, Cleaners, Driers, and Other Additives: As recommended by paint manufacturer of the particular coating.
- D. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop.
- E. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the established chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop.

F.

Product	Definition
Epoxy	Polyamine or polyamide epoxy, two parts, suitable for immersion service, 75% volume solids minimum, capable of 4 to 8 MDFTPC, and suitable for the application temperatures and conditions .

Product	Definition
Epoxy Siloxane	Epoxy siloxane hybrid coating, high solids, semi-gloss or high gloss, tintable colors. Tinted colors shall be capable of storage for 30 days or longer prior to application. Coating shall be capable of spray, roller, or brush application on all metal substrates and specified prime and intermediate coats. Abrasion, corrosion, and UV resistant.
Inorganic Zinc Primer	Solvent or water based, 14 lbs. metallic zinc content per gallon minimum; unlimited recoat window, conform to manufacturer's recommended topcoats as specified herein.
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish, suitable for continuous dry service at 200 degrees F without discoloration or peeling. Suitable for exterior applications to steel and other metal substrates and continuous UV and environmental exposure.
Fusion Bonded Coating	100% solids, thermosetting, fusion bonded, dry powder epoxy or polyurethane resin, suitable for intended service.
Wax Tape	Non-firming anti-corrosion wrap consisting of a microcrystalline wax blend saturated into a non-woven bonded synthetic fabric, forming a wax tape wrapper for below ground service.

2.4 COLORS

- A. Provide as selected by the Owner.
- B. Formulated with colorants free of lead, lead compounds, or other materials which might be affected by the presence of hydrogen sulfide or other gasses.
- C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply matches.

2.5 QA/QC TESTING AND INSPECTION

- A. General
 - 1. Applicator shall inspect and test the coating system in accordance with referenced standards and these specifications, whichever is more stringent.
 - 2. If any conflict between this specification and referenced standards occurs, the more stringent requirement shall apply and any interpretation of this requirement or results shall be with the objective of achieving maximum coating performance.
 - 3. The frequency of the testing shall be determined by the applicator, but shall not be less than the requirements of this specification.
- B. Surface Profile Testing
 - 1. Surface profile of abrasive blasted surfaces to be tested with "Press-O-Film" tester tape or equivalent in accordance with NACE RP0287.
 - 2. Tester tape shall be suitable for the intended profile height.
 - 3. Profile shall be measured to a minimum tolerance of 0.1 mils, maximum.
 - 4. Electronic surface profilometer shall be used, where deemed necessary, to verify tester tape measurements.

5. Adhesion testing: Where directed by the District Engineer for assessing coating application problems.
- C. Holiday Testing
1. Holiday tests on epoxy or polyurethane coatings or linings will be conducted on the completed coating or lining after cure or 24-hours, whichever is less, using a high voltage spark test in accordance with NACE SP 0188 and these specifications.
 2. Coating thickness used for high voltage holiday testing setting shall be the average dry coating thickness.
- D. Dry Film Thickness Testing
1. Coatings shall be tested for dry film thickness using properly calibrated magnetic pull off, eddy current, or ultrasonic equipment.
 2. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.

PART 3 - EXECUTION

3.1 GENERAL

- A. Surface preparation and coating application shall be in conformance with these specifications and the coating manufacturer's written product data sheets and written recommendations of the manufacturer's technical representative. Where conflicts occur between the manufacturer's recommendations and these specifications, the more stringent of the two shall apply unless approved by the District Engineer.
- B. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating for any purpose until completion of curing cycle.

3.2 REGULATORY REQUIREMENTS

- A. Meet federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposures.
- B. Protect workers and comply with applicable federal, state, and local air pollution and environmental regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, coating application and dust prevention including, but not limited to the following acts, regulations, standards, and guidelines:
1. Clean Air Act
 2. National Ambient Air Quality Standard
 3. Resource Conservation and Recovery Act (RCRA)
- C. Comply with applicable federal, state, and local regulations for confined space entry.
- D. Provide and operate equipment that meets explosion proof requirements.

3.3 ENVIRONMENTAL CONDITIONS

- A. Do not perform abrasive blast cleaning whenever the relative humidity exceeds 85 percent, whenever surface temperature is less than 5 degrees F above the dew point of the ambient air.
- B. Surface preparation power tools and blast equipment shall contain dust collection equipment that will prevent discharge of dust particles into the atmosphere.
- C. Do not apply paint when:
 - 1. Surface temperatures exceeds the maximum or minimum temperature recommended by the paint manufacturer,
 - 2. In dust, smoke-laden atmosphere, damp or humid weather, or under conditions which could cause icing on the metal surface.
 - 3. When it is expected that surface temperatures will drop below 5 degrees above dew point within 8 hours after application of coating.

3.4 DEHUMIDIFICATION

- A. Where environmental conditions cannot be met or controlled, provide and operate desiccant dehumidification equipment to maintain environmental conditions for 24 hours a day during abrasive blasting and coating application and cure. Liquid, granular, or loose lithium chloride drying systems will not be acceptable.
- B. Provide dehumidification equipment sized to maintain dew point temperature 17 degrees or more below surface temperature of metal surfaces to be cleaned and coated. System shall provide ventilation within the environmentally controlled areas and shall meet the following requirements:
 - 1. Two air changes per hour, minimum
 - 2. Maintenance of personnel exposure limits (PEL) at 50 percent of OSHA PEL limits for all chemicals used in the performance of the work, and
 - 3. Maintenance of lower explosive limits (LEL) to less than 50 percent of the most volatile solvent used in the performance of the work.
- C. Dehumidification shall be operated in a manner that prevents all condensation or icing throughout surface preparation and coating application and cure.
- D. Reblasting of flash rusted metal surfaces or removal of damaged coatings, as a result of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the Contractor. Cleaned metal surfaces subject to flash rusting shall be cleaned to the same cleanliness as prior to the flash rust formation and shall be approved by the District Engineer.
- E. Monitor ambient temperature, humidity, dew point temperature, and pipe surface temperature both outdoors and within the environmentally controlled area at the start, midpoint, and end of each work shift, minimum, but not more than 5 hours between measurements.

3.5 VENTILATION AND ILLUMINATION

- A. Adequate illumination shall be provided while work is in progress. Whenever required by the inspector, provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the inspector.
- B. Ventilation shall be used to control potential dust and hazardous conditions within the work area. Ventilation flow rates shall be in accordance with OSHA regulations and as required to reduce air contamination to non-hazardous conditions.

3.6 PREPARATION AND TESTING OF SURFACES

- A. Surface Preparation Inspection and Testing:
 - 1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied.
 - 2. Perform such work only in the presence of Pineview Water System's District Engineer, unless District Engineer grants prior approval to perform such work in District Engineer's absence.
- B. Metal Surface Preparation:
 - 1. General:
 - a. Do not perform a surface preparation blast prior to submission of samples. Workmanship for metal surface preparation as specified shall meet current Steel Structures Painting Council (SSPC) Specifications as follows:
 - 1) Solvent Cleaning: SP 1
 - 2) Hand Tool Cleaning: SP 2
 - 3) Power Tool Cleaning: SP 3
 - 4) White Metal Blast Cleaning: SP 5
 - 5) Commercial Blast Cleaning: SP 6
 - 6) Brush-Off Blast Cleaning: SP 7
 - 7) Pickling: SP 8
 - 8) Near-White Blast Cleaning: SP 10
 - 9) Bare Metal Power Tool Cleaning: SP 11
 - b. All surface preparation shall be assumed to be on a SSPC Grade A steel surface condition, unless specifically noted otherwise.
 - c. Wherever the words "solvent cleaning", "hand tool cleaning", "wire brushing", or "blast cleaning", or similar words of equal intent are used in these Specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC Specifications listed above.
 - d. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply. Wet blasting methods shall be approved by the District Engineer.
 - e. Hand tool clean areas that cannot be cleaned by power tool cleaning.
 - 2. Welds and Adjacent Areas:
 - a. Prepared such that there is:
 - 1) No undercutting or reverse ridges on the weld bead.

- 2) No weld spatter on or adjacent to the weld or any other area to be painted.
 - 3) No sharp peaks or ridges along the weld bead.
 - b. Grind embedded pieces of electrode or wire flush with the adjacent surface of the weld bead.
- 3. Preblast Cleaning Requirements:
 - a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
 - b. Cleaning methods: Steam, open flame, hot water, or cold water with appropriate (coating manufacturer approved) detergent additives followed with clean water rinsing.
 - c. Clean small isolated areas as above or solvent cleaned with suitable solvents and clean cloths.
 - d. Round or chamfered all sharp edges and grind smooth burrs, jagged edges, and surface defects.
- 4. Blast Cleaning Requirements:
 - a. General:
 - 1) Type of equipment and speed of travel: Designed to obtain specified degree of cleanliness.
 - 2) Select type and size of abrasive to produce a surface profile that meets the coating manufacturer's recommendations for the particular coating to be applied or not less than 20 percent of the specified coating thickness, whichever is more stringent.
 - 3) Meet applicable federal, state, and local air pollution control regulations for blast cleaning and disposition of spent aggregate and debris.
 - 4) Do not reuse abrasive, unless abrasive is a recyclable steel grit or shot abrasive.
 - b. Shop Blasting
 - 1) Notify District Engineer at least 7 days prior to start of shop blast cleaning to allow for inspection of the work during surface preparation and shop application of paints. Work shall be subject to the District Engineer's approval before shipment to the jobsite.
 - c. Field Blasting
 - 1) Perform sandblasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed.
 - 2) Field blasting in areas with electrical or mechanical equipment, within buildings or on coated surfaces with lead paint that exceed environmental regulations shall be performed with dustless abrasive systems such as "Sponge-Jet", dry ice abrasive blasting.
- 5. Post-Blast Cleaning and Other Cleaning Requirements:
 - a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wiped with a tack cloth.
 - b. Paint surfaces the same day they are sandblasted. Reblast surfaces that have started to rust before they are painted to original cleanliness prior to occurrence of flash rusting.

- C. Brush-off Blast Cleaning:
1. Equipment, procedure, and degree of cleaning shall meet SSPC-SP 7, Brush-off Blast Cleaning and shall achieve a profile on the coating equivalent to 80 grit sandpaper with no exposed metal. Profile shall be uniform over the surface with no glossy areas visible.
 2. Where metal substrate is exposed, apply full coating system as specified for new metal surfaces.
 3. Repair or replace surfaces damaged by blast cleaning, where damage is defined as visible metal substrate. If less than 5 percent of prepared surface has the metal substrate visible, the coating shall be repaired by application of a brush applied intermediate coat. If greater than 5 percent the coating shall be fully removed to meet the specified surface cleanliness and recoated with the specified coating system.
 4. Abrasive: Either conventional abrasive blasting with sand, grit, or nut shells or specialized abrasive blasting. Abrasives shall be 60 mesh grit, maximum.
 5. Select various surface preparation parameters such as size and hardness of the abrasive, nozzle size, air pressure, and nozzle distance from the surface such that the surface is cleaned without pitting, chipping, or other damage.
 6. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
 7. The District Engineer shall approve trial blast cleaned area and shall use area as a representative sample of surface preparation.

- D. Solvent Cleaning:
1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods which involve a solvent or cleaning action.
 2. Method meets SSPC-SP 1.

3.7 PROTECTION OF MATERIALS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
- B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.
- D. Mask openings in motors to prevent paint and other materials from entering the motors.

3.8 PAINT MIXING

- A. Multiple-component coatings:
1. Prepare using all the contents of the container for each component as packaged by the paint manufacturer.
 2. No partial batches will be permitted.
 3. Multiple-component coatings that have been mixed shall not be used beyond their pot life.

4. Provide small quantity kits for touchup painting and for painting other small areas.
 5. Mix only components specified and furnished by the paint manufacturer.
 6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.
 7. Fast set or plural component products shall be applied using an appropriate multipart pump that properly mixes both components at the recommended ratio using equipment recommended by the coating manufacturer. Hot mixing of fast set or plural component products will not be permitted.
- B. Keep paint materials sealed when not in use and provide nitrogen blanket on fast set, plural, or moisture cured coatings on opened product containers when stored or not in use more than 8 hours.
- C. Where more than one coat of a material is applied within a given system, alternate color to provide a visual reference that the required number of coats have been applied.

3.9 APPLICATION OF PAINT

A. General:

1. Schedule and attend a Pre-Application Conference with Pineview Water System's District Engineer prior to proceeding with coating application. Attendees should include any subcontractors intended to participate in the application of coatings on the Project.
2. Inspection: Schedule with District Engineer in advance for cleaned surfaces and all coats prior to the succeeding coat.
3. Apply coatings in accordance with the paint manufacturer's recommendations. Allow sufficient time between coats to assure thorough drying of previously applied paint.
4. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
5. Paint units to be bolted together and to structures prior to assembly or installation.
6. Shop Primed or Factory Finished Surfaces:
 - a. Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Follow with a spot primer using specified primer.
 - b. For two-package or converted coatings, consult the coatings manufacturer for specific procedures as relates to top coating of these products. Where scarification of the existing coating is required, prepare the surface in accordance with Brush-off Blasting Cleaning in this section.
 - c. Prior to application of finish coats, clean shop primed surfaces of dirt, oil, and grease, and apply a mist coat of specified primer, 1.0 mil dry film thickness.
7. Manufacturer Applied Paint Systems:
 - a. Repair abraded areas on factory-finished items in accordance with the equipment manufacturer's directions.
 - b. Carefully blend repaired areas into the original finish.
8. Apply finish coat in a manner that will present a uniform color and texture.

B. Application Safety:

1. Perform painting in accordance with recommendations of the following:
 - a. Paint manufacturer's instructions.
 - b. NACE publication, "A Manual for Painter Safety".
 - c. Federal, state, and local agencies having jurisdiction.

2. Be solely and completely responsible for condition of the project site, including safety of all persons (including employees) and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. Safety provisions will conform to U.S. Department of Labor, Occupational Safety and Health Act, any equivalent state law, and all other applicable federal, state, county, and local laws, ordinances, and codes.
 3. Comply with all safety-training requirements promulgated or required for this project.
- C. Film Thickness:
1. Applied coating system film thickness per coat shall be applied at the specified coating thickness or the manufacturer's recommended minimum thickness, whichever is greater. Where the manufacturer has not specified a minimum coating thickness on the product data sheets, the minimum recommended coating application thickness shall apply.
 2. Maximum film build per coat shall not exceed the coating manufacturer's recommendations.
- D. Stripe Coats:
1. Surfaces that are subject to immersion, condensing environments, or where specified shall be stripe coated on all angles, edges, corners, threads, welds, and similar type surfaces.
 2. Stripe coat shall be an extra coat of the intermediate or topcoat material and shall be applied between the prime and intermediate coats.
 3. The stripe coat shall be a separate coat of paint from coats specified under the coating system.
 4. Stripe coats shall be alternated in color like a full coat.
- E. Number of coats:
1. Apply specified number of coats, minimum, irrespective of the coating thickness.
 2. Additional coats may be required to obtain the minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
- F. Existing Coated Surfaces:
1. General:
 - a. Shop primed or coated surfaces shall be reviewed with the District Engineer to determine the extent of coating damage, repair methods, surface preparation requirements, and suitability of the finish coats to adhere to the shop applied coats.
 - b. All shop primed or finished coated surfaces shall be verified to be compatible with field applied finish coats.
 - c. If a cured epoxy, polyurethane, or plural-component material is to be top coated, contact the coating manufacturer concerned for additional surface preparation requirements. Existing coated surfaces shall be prepared as follows:
 - 1) Existing coated surfaces shall be brush-off blasted as specified herein to remove all gloss and provide a uniform profile on existing coating for adhesion of subsequent coats.

- 2) Power or hand sanding will not be allowed as a surface preparation procedure for existing coatings, unless reviewed and approved by the District Engineer.
 - 3) Where coating manufacturer surface preparation recommendations conflict with this section, the more stringent requirements shall apply.
 - 4) Profile shall be as specified by the manufacturer or equivalent of 80 grit sandpaper; whichever is more stringent. Profile shall be visible and uniform over existing coated surfaces.
 - d. All existing coated surfaces, where demolition of equipment was specified or required, shall be surface prepared, touch-up coating repairs completed, and a cosmetic overcoat applied using the specified coating system on all existing coated surfaces associated with the demolition work, unless otherwise specified.
 - e. Existing coatings on immersed equipment shall be removed to bare metal and recoated with the specified coating system where demolition work was specified.
 - f. Apply sealer/primer where recommended by coating manufacturer for coating compatibility.
 2. To be Recoated or Final Coated:
 - a. Detergent wash and freshwater rinse.
 - b. Perform touch-up repairs of existing coating.
 - c. Ductile iron pipe with asphaltic coating will require an application of a seal coat prior to the application of a cosmetic finish coat.
 3. Touch-up Repairs:
 - a. Clean loose, abraded, or damaged coatings to substrate by Power Tool (SP 3).
 - b. Feather surrounding intact coating.
 - c. Apply one spot coat of the specified primer to bare areas overlapping the prepared existing coating.
 - d. Apply one full finish coat of the specified primer or finish coat(s) overall.
 4. Application of a Cosmetic Coat:
 - a. The exact nature of shop-applied coatings is not known in all cases.
 - b. Check compatibility by application to a small area prior to starting the coating.
 - c. If lifting or other problems occur, request disposition from the District Engineer.
 - d. Cured epoxy, polyurethane, plural component materials or any other coating system that has exceeded its maximum recoat window shall be prepared as specified in this section and as specified by the manufacturer.
- G. Damaged Coatings, Pinholes, and Holidays:
1. Feather edges and repair in accordance with the recommendations of the paint manufacturer.
 2. Repair fusion bonded coatings as recommended by the original applicator. Applicator shall provide liquid repair kits for this purpose as recommended by the coating manufacturer.
 3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.
- H. Unsatisfactory Application:
1. If the item has an improper finish color, or insufficient film thickness, clean and topcoat surface with specified paint material to obtain the specified color and

- coverage. Obtain specific surface preparation information from the coating manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint and feather the edges. Follow with primer and finish coat in accordance with the specifications. Depending on the extent of repair and its appearance, a finish sanding and topcoat may be required.
 3. Evidence of runs, bridges, shiners, laps, or other imperfections shall be cause for rejection.
 4. Repair defects in coating system per written recommendations of coating manufacturer.
 5. Leave all staging up until the District Engineer has inspected the surface or coating.

3.10 COATING INSPECTION

A. General:

1. Film thickness measurements and electrical inspection of the coated surfaces:
 - a. Perform with properly calibrated instruments.
2. Recoat and repair as necessary for compliance with the Specifications.
3. All coats will be subject to inspection by the District Engineer and the coating manufacturer's representative.
4. Give particular attention to edges, angles, flanges, and other areas where insufficient film thicknesses are likely to be present and ensure proper mil thickness in these areas.

B. Coating Thickness Testing:

1. District Engineer shall conduct coating thickness testing as necessary and without limitation. Testing conformance to the requirements of SSPC-PA 2 is specifically excluded from this specification.
2. Measure coating thickness specified in mils with a magnetic type dry film thickness gauge as specified.
3. Check each coat for the correct mil thickness. Do not make measurement before a minimum of 8 hours after application of the coating.

C. Coating Continuity Testing:

1. Holiday detect coatings with high voltage units in accordance with NACE SP0188. High voltage detector shall have adjustable voltages in 100 volt increments and shall be operated in accordance with the manufacturer's instructions and the specified standard.
2. Use of an electrical holiday detector, low voltage, wet sponge type holiday detector will be permitted for coating systems less than 20 mils total dry film thickness and are not for immersion or condensing environments.
3. Holiday detect coatings on pipe for buried application with high voltage spark tester in accordance with NACE RP0274.

3.11 CLEANUP

- #### A.
- Place cloths and waste that might constitute a fire hazard in closed metal containers or destroyed at the end of each day.

- B. Upon completion of the work, remove staging, scaffolding, and containers from the site or destroyed in a legal manner.
- C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.
- D. Damages due to over spray on buildings, vehicles, trees, or other surfaces not specified to be painted would be the responsibility of the Contractor.

3.12 PROTECTIVE COATING SYSTEMS AND APPLICATION SCHEDULE

- A. Unless otherwise shown or specified in these Specifications paint or coat the work in accordance with the following application schedule.
- B. In the event of discrepancies or omissions in the following, request clarification from the District Engineer before starting the work in question.

System	Title
A	Submerged Metal – Lining
B	Exposed Metal - Highly Corrosive
C	Exposed Metal - Atmospheric
D	Hot Dip Galvanization
E	Fusion Bonded Coating
F	Wax Tape Coating

- C. System A Submerged Metal - Lining:
 - 1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Polyamide Epoxy	3 coats, 3 MDFTPC

- 2. Application:
 - a. Use on the following areas:
 - 1) Piping:
 - a) Lining of all steel vault and pump station piping
- 3. Special Requirements:
 - a. Fusion bonded epoxy linings will be permitted as alternative lining for small diameter pipes, valves, and couplings. FBE coating to be applied as specified for FBE coatings this section and in accordance with the manufacturer's recommendations.

- D. System B Exposed Metal - Highly Corrosive:
 - 1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Organic Zinc Rich Primer	1 coat, 2.5 MDFT
	Polyamide Epoxy	1 coat, 5 MDFT
	Hybrid Epoxy Siloxane	2 coats, 6 to 8 DFT
	OR Polyurethane Enamel	2 coats, 4 to 6 DFT

2. Application:
 - a. Ensure that manufacturer's recommended relative humidity is maintained during product application.
 - b. Exposed piping and metal surfaces, new and existing, located inside of structures, manholes, vaults, and the following specific areas unless otherwise specified.
 - c. Use on the following areas:
 - 1) Exterior of metallic piping, valves, couplings, etc. within buried valve vaults, structures, and enclosed above ground structures such as pump stations
3. Special Requirements:
 - a. The surface preparation and primer shall be shop applied to all surfaces prior to installation. Intermediate and final coats shall be field applied.
 - b. All existing exposed metal surfaces with an existing coating system, including new shop primed or coated equipment, shall be prepared as specified under "Coating Application, Existing Coated Surfaces" and final topcoat applied per this system.
 - c. Aliphatic polyurethane will not be allowed as a substitute for polysiloxane due to restrictive overcoat requirements.
 - d. Dry film coating thickness of polysiloxane, including touch up repairs, shall not exceed the manufacturer's recommended maximum film thickness.
 - e. Surface preparation and primer shall be shop applied to all surfaces prior to installation.
 - f. DFT thicknesses greater than manufacturer's recommendations shall be subject to rejection and removal.
 - g. All shop primed or finish coated surfaces shall be prepared as an existing coated surface as specified herein and shall be top coated with intermediate and/or finish coats as required to provide color uniformity throughout the vault or structure.
 - h. Color uniformity requirements shall apply to all components installed within the vault and visibly part of completed installation regardless of shop applied coating system.

- E. System C Exposed Metal - Atmospheric:
1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Inorganic Zinc Rich Primer	1 coat, 2.5 MDFT
	Polyurethane Enamel	2 coats, 6 MDFT

2. Application:
 - a. Exposed metal surfaces, new and existing, located outside of structures and exposed to weather and the following specific surfaces unless otherwise specified.
 - b. Use on the following items or surfaces:
 - 1) Above ground piping which is normally full of water during operation and is continuously exposed to atmosphere and weather
3. Special Requirements:
 - a. The surface preparation and primer shall be shop applied to all surfaces prior to installation. Final coats shall be field applied.
 - b. All shop primed or finish coated surfaces shall be prepared as an existing coated surface as specified herein and shall be top coated with intermediate and/or finish coats as required to provide color uniformity.
 - c. Color uniformity requirements shall apply to all components visibly part of the completed installation regardless of shop applied coating system.
 - d. Polyurethane coating to overlap buried pipe coating a minimum of 4 inches below top of concrete or grade.
 - e. Dry film coating thickness of polyurethane, including touch up repairs, shall not exceed the manufacturer's recommended maximum film thickness.

F. System D Hot Dip Galvanization:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1) Followed by Hand Tool (SP 2), or Power Tool (SP 3), or Brush-off Blast (SP 7)	Hot-dip galvanized zinc coating applied after fabrication per ASTM A123	Per ASTM A123

2. Application:
 - a. Above grade metallic piping and surfaces that are normally dry during operation and are not intended to convey water.
 - b. Vent piping
 - c. Handrails and posts
 - d. Bollards
 - e. Miscellaneous sleeves, supports, or other metalwork

G. System E Fusion Bonded Coating:

1. Surface Preparation and Coating System

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10) or Acid Pickling (SP 8)	Fusion Bonded 100% solids Epoxy or Polyurethane	1 or 2 coats, 10 MDFT

2. Application:
 - a. Use on the following surfaces:
 - 1) Valves, couplings, metallic restraint devices, etc.
 - 2) Pump and surge tank internal surfaces

- H. System F Wax Tape Coating:
1. Surface Preparation and Coating System

Surface Prep.	Material	Cover
Solvent Clean (SP 1) Followed by Hand Tool (SP 2), or Power Tool (SP 3), or Brush-off Blast (SP 7)	Wax Tape Primer	Apply per manufacturer's written procedures
	Wax Tape Filler Material	Required at complex shapes if wax tape application results in tenting or voids beneath the tape
	Wax Tape	Apply per manufacturer's written procedures
	Outerwrap	Apply per manufacturer's written procedures

2. Application:
- Use on all buried couplings, thrust restraint rods and brackets, valves, and on flanged joints, mechanical joints, fittings, or other miscellaneous buried metallic hardware.
 - All components of the wax tape coating system to be provided by the same manufacturer.

3.13 ATTACHMENTS

- A. List of Attachments:
1. Paint/Coating System Data Sheet

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PAINT SYSTEM DATA SHEET

Attached products' Technical Data Sheet (if applicable) to this sheet for each paint system submittal.

Paint System Number (from spec.):		
Paint System Title (from spec.):		
Coatings Manufacturer:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	Product Name/Number Proprietary)	Min. Coats, Coverage

Additional Information Required (check applicable items):

- ☐ Manufacturer's minimum and maximum recommended coating thickness per coat and for total coating system.
- ☐ Immersion coating cure requirements from minimum coating application temperature to 100 degrees in 15-degree temperature increments.

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DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13 11 40
CORROSION CONTROL AND CATHODIC PROTECTION

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. This section covers the work necessary to furnish and install corrosion control and cathodic protection on buried metallic piping, which includes electrical isolation, joint bonds for electrical continuity, and installation of galvanic anode groundbeds, complete.
- B. Third-party Corrosion Expert to perform Contractor required quality control testing as defined in this section.

1.2 QUALITY CONTROL

- A. All Contractor specified testing shall be performed by a third-party Corrosion Expert who holds a current NACE/AMPP accreditation as a Cathodic Protection Specialist (CP-4) or Cathodic Protection Technologist (CP-3), and/or a registered professional engineer with verifiable expertise in corrosion control and cathodic protection.
- B. Perform quality control testing shall include the following tests, which shall be performed as defined in this section.
 - 1. Joint Bond Resistance test
 - 2. Insulating Joint Testing (before burial and filling the pipeline)
 - 3. Other testing as specified in contract documents

1.3 DEFINITIONS

- A. Ferrous Metal Pipe: Pipe made of steel or iron, or pipe containing steel or iron as a principal structural material, except reinforced concrete pipe.
- B. Foreign-Owned: Buried pipe or cable not specifically owned or operated by the Owner.
- C. Electrically Continuous Pipeline: A pipeline which has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable joint bond resistance for each bonded pipe joint as specified in this section.
- D. Electrical Isolation: The condition of being electrically isolated from other metallic structures (including, but not limited to, piping, reinforcement, casings) and the environment as defined in NACE Recommended Practice SP-0169.
- E. Lead, Lead Wire, Joint Bonds, Pipe Connecting Wires, Cables: Insulated copper conductor; the same as wire.

1.4 SUBMITTALS

- A. Submit in accordance with APWA Section 01 33 00 – Submittal Procedure.

- B. Product Data:
 - 1. Manufacturer's technical data and installation instructions.
- C. Quality Assurance Submittals:
 - 1. Manufacturers' Certificates of Compliance.
 - 2. Field Test Reports.
 - 3. Qualifications of NACE Accredited Testing Personnel.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Like items of materials provided hereunder shall be the product of one manufacturer to achieve standardization for appearance, maintenance, and replacement.
- B. The use of a manufacturer's name and model or catalog number is for establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered.

2.2 SUPPLIERS

- 1. Corrpro, Inc.
- 2. Farwest Corrosion Control
- 3. MESA Products

2.3 PREPACKAGED GALVANIC ANODES

- A. High-Potential Magnesium Alloy:
 - 1. Composition:

a. Aluminum:	0.01 percent maximum.
b. Manganese:	0.5 to 1.3 percent
c. Silicon:	0.05 percent maximum
d. Copper:	0.02 percent maximum
e. Nickel:	0.001 percent maximum
f. Iron:	0.03 percent maximum
g. Total Others:	0.05 percent each or 0.3 percent maximum
h. Magnesium:	Remainder
 - 2. Bare Weight per the Drawings.
- B. Zinc Alloy:
 - 1. Composition per ASTM B418, Type I.

a. Iron:	0.005 percent maximum
b. Lead:	0.005 percent maximum
c. Copper:	0.005 percent maximum
d. Aluminum:	0.1 to 0.5 percent
e. Cadmium:	0.025 to 0.07 percent
f. Zinc:	Remainder
 - 2. Bare Weight per the Drawings.
- C. Anode Wire:

1. Wire: Furnish each anode with black No. 12 AWG solid copper wire with cross-linked polyethylene (XLPE), Type USE-2 insulation, 10 feet long.
2. Wire-to-Anode Connection: Manufacturer's standard. The anode connection shall be stronger than the wire.

D. Backfill:

1. Composition:
 - a. High Potential Magnesium Anodes:
 - 1) Ground Hydrated Gypsum: 75 percent.
 - 2) Powdered Wyoming Bentonite: 20 percent.
 - 3) Anhydrous Sodium Sulfate: 5 percent.
 - b. Zinc Alloy Anodes:
 - 1) Ground Hydrated Gypsum: 50 percent.
 - 2) Powdered Wyoming Bentonite: 50 percent.
2. Grain Size: 100 percent passing through a 20-mesh screen and 50 percent retained by a 100-mesh screen.
3. Mixture: Thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration.
4. The quantity of backfill shall be sufficient to cover surfaces of the anode to a depth of 1 inch.

2.4 JOINT BONDS

A. General:

1. All joint bonds provided by pipe manufacturer or Contractor shall meet the following minimum requirements:
 - a. All connections shall be welded or soldered.
 - b. Mechanical or compression type connections will not be permitted.
 - c. Bonds and welds shall exhibit sufficient strength and flexibility to allow thermal movement of the pipe after pipe backfill without cracking or breakage.
 - d. Bond connections to pipe shall be with a District Engineer approved welding method.
2. All installed bonds shall be insulated or coated copper with all exposed copper field coated.

B. Ductile or Cast-Iron Pipe, External Bonds:

1. Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with formed copper sleeve on each end of the wire.
2. Quantity of joint bonds per pipe joint by pipe diameter shall be as defined below:

Bond Type	Two Bonds	Three Bonds
#2 AWG Wire	16" or less	42" or less

3. Connection of wire joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for bond type used.
4. Bonds shall be as manufactured by Erico Products, Continental Industries, or approved equal. Third party manufactured bonds shall be approved by the District

Engineer for conformance with the requirements of this specification and proper thermite welding.

C. Flange joints:

1. Flanged joint bonds shall be one of the following types at the Contractor's option:
 - a. Steel flanges only: Steel rod, 5/8-inch diameter, length as required, arc welded to flange. Steel rod bonds will not be allowed where welding to the flange is not approved by the District Engineer.
 - b. Single-conductor, No. 2 AWG stranded copper wire with 600-volt HMWPE insulation, 18 inches long, with a formed copper sleeve on each end of the wire.
2. Quantity of joint bonds per pipe joint shall be as defined below per pipe diameter:

Bond Type	Two Bonds	Three Bonds
Steel Rod	36" or less	72" or less
#2 AWG Wire	NA	30" or less

3. Connection of wire joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for bond type used.
4. Coat steel rod bonds with fast curing epoxy after welding to joint as specified in this Section, except when pipe is specified to be coated in accordance with Specification Section 09 90 00 Painting and Coating.

D. Sleeve Coupling, Flanged Coupling Adapter, and Other Non-standard Joints:

1. Ductile Iron Pipe:
 - a. Bond: No. 2 AWG wires, 24 inches long, HMWPE insulation, with two 12-inch long XLPE USE-2 insulated No. 12 AWG wire pigtails.
 - b. Manufacturer: Erico Products Inc. (Cadweld), Cleveland, OH, Hoff Company, Denver, Colorado, or equal.
2. Steel Pipe:
 - a. Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with five punched holes for thermite welding to the coupling follower rings, middle, ring, and pipe. Strap bond shall be fabricated for the length of the coupling with sufficient additional length for 1 inch of joint movement. Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
 - b. Strap bond shall be as manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured copper strap bonds shall be approved by the District Engineer for conformance with the requirements of this specification and proper thermite welding.
3. Bond Quantity per Joint: Provide the quantity of bonds per pipe diameter as defined on the following page:

Bond Type	Three Bonds	Four Bonds
-----------	-------------	------------

Copper Strap	54" or less	Over 54"
No. 2 Wire Bond	54" or less	Over 54"

4. Connection of wire or copper strap joint bonds to pipe shall be with the thermite weld method using molds and cartridges as recommended by the welder manufacturer for the bond type used.

E. Insulated Sleeve Coupling Joints:

1. Ductile Iron Pipe:
 - a. No. 8 AWG wire, 18-inch long, with one 12-inch long XLPE USE-2 insulated No. 12 AWG wire pigtail.
 - b. Manufacturer: Erico Products Inc. (Cadweld), Cleveland, OH, Hoff Company, Denver, Colorado, or equal.
2. Steel Pipe:
 - a. Solid copper strap, 1-1/4-inch wide by 1/16-inch thick, equivalent to 1/0 AWG wire, with four punched holes for thermite welding to the coupling and pipe. Strap bond shall be fabricated for the length of the coupling with sufficient additional length for 1 inch of joint movement. Strap holes shall be sized for the thermite weld mold and shall provide for physical centering of the mold over the hole.
 - b. Strap bond shall be as manufactured by Erico Products, Continental Industries, Hoff Company, or approved equal. Third party manufactured bonds shall be approved by the District Engineer for conformance with the requirements of this specification and proper thermite welding.
3. Bond Quality per Joint: Provide the quantity of bonds per pipe diameter as defined below:

Bond Type	One Bonds	Two Bonds	Three Bonds
Copper Strap	Up to 36"	36" to 60"	Over 60"
No. 2 Wire Bond	Up to 36"	36" to 60"	Over 60"

2.5 CATHODIC PROTECTION TEST STATIONS

B. Flush Style, Vehicular Traffic (Type 2):

1. Test Box: Concrete body cast with a cast iron ring, minimum weight of 55 pounds and minimum dimensions of 9-inch inside diameter and 12 inches long.
2. Furnish extensions as required to penetrate concrete surfaces by 4 inches minimum.
3. Furnish with a 14-pound cast iron lid with the words "CP Test" cast into the lid.
4. Manufacturer and Products: Brooks; Models 3RT or Christy Oldcastle Model G05, or equal

C. Flush Style Terminal Boards:

1. Dimensions: 5-inch by 8-inch by 1/4 inch thick
2. Material: Phenolic, micarta, or fiberglass.
3. Terminals: Stainless steel bolts, double nuts, double flat washers, lock and shunt. Quantity and placement as shown on the Drawings.
4. Labels: Engrave terminal board with label of each terminal as shown Drawings and with the Owner's name and contact number.

- D. Post Style, Steel Conduit:
1. Test Box:
 - a. Cast aluminum with thread hub suitable for mounting to a 2-inch x 3-inch reducer. Reducing bushings will not be permitted.
 - b. Manufacturer and Product:
 - c. (1) Type T, C, and I Stations: Gerome Manufacturing, Testox 700 series (rectangle) with 2-inch threaded hub.
 - d. (2) Type F and A Stations: Gerome Manufacturing, Testox 2000 series (rectangle) with 2 or 3-inch threaded hub.
 2. Street Reducer:
 - a. Hot dipped galvanized 2-inch x 3-inch reducer and close nipple. Not required with 3-inch threaded hub.
 3. Terminal Block:
 - a. Plastic or glass-reinforced laminated, 1/4-inch thick with seven terminals for Type T, C, and I test stations.
 - b. Plastic or glass-reinforced laminated, 1/4-inch thick with eleven terminals for Type F, and A test stations.
 - c. Terminal heads shall have special heads to keep them from turning or shall be easily accessible from both sides of the terminal block without requiring its removal.
 - d. Terminal studs, washers, and nuts shall be stainless steel.
 4. Mounting Structure:
 - a. Rigid hot dipped galvanized steel conduit 3-inches diameter, threaded at one end (minimum), 5-feet long or as required for installation requirements.
 - b. PVC long radius sweep elbow, 1-inch diameter, for wire protection as shown on Drawings.

2.6 WIRES

- A. Pipe and Test Lead Wires:
1. Pipe Test Wires: No. 10 AWG wire, single-conductor, stranded copper with 600-volt, TW, THWN, or HMWPE insulation. Color coded insulation as specified.
 2. Insulation Color: Color shall indicate the function of each test wire and shall be as follows:

a. Pipe:	White
b. Reference electrodes:	Yellow
c. Casings:	Orange
d. Foreign Pipe:	Blue (Water) or Red (Gas or Oil)
e. Insulating Joints:	White and Green as shown on drawings
f. Corrosion Coupons:	Green
g. Galvanic Anode:	Black
- B. Reference Electrode Wires: No. 14 or 12 AWG wire single-conductor, stranded copper with 600-volt, TW, THWN, USE2, or HMWPE insulation. Color code insulation as specified. Wire length of 25 feet or as required for splice free installation.
- C. Anode Header Wires: No. 8 AWG wire, single-conductor, stranded copper with 600-volt, TW, THWN, or HMWPE insulation. Color coded insulation as specified.

2.7 WIRE SPLICE INSULATING KIT:

- A. Tap Splice: Tap splice insulating kit for the connection of the anode wire to the anode header wire shall be 3M Company Scotchcast 90-B1; Hexcel Kit No. 7K53; Raychem Corp. Thermofit No. ASE-4, or equal.
- B. In-Line Splice: In-line splice insulating kit for the connection of the anode wire to the anode header wire shall be 3M Company Scotchcast 82-A2; Hexcel Kit No. 7K32; Raychem Corp. Thermofit No. ASE-4, or equal.

2.8 THERMITE WELD MATERIALS:

- A. General:
 - 1. Thermite weld materials consist of wire sleeves, welders, and weld cartridges. All parts should be compatible with the specific wire size, pipe material, and size of pipe at each location as indicated by the manufacturer's published product data.
 - 2. Welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers is not acceptable.
- B. Welding Materials Manufacturers:
 - 1. Erico Products Inc. (Cadweld), Cleveland, OH.
 - 2. Continental Industries, Inc. (Thermo-Weld), Tulsa, OK.

2.9 COATING REPAIR MATERIAL FOR PIPE AND FITTINGS

- A. General:
 - 1. Complete coating repairs in accordance with recommendations of the pipe or fitting manufacturer.
- B. Coating Requirements:
 - 1. Steel Pipes:
 - a. Polyurethane or Epoxy Coatings: Fast cure epoxy, 20 mils dry film thickness, minimum
 - b. Tape Wrap Coating: Thermite Weld Cap, Canusa CRP Patch, or Raychem PERP patch, or equal
 - 2. Ductile iron Pipe:
 - a. Fast cure epoxy
 - b. Thermite weld cap
- C. Coating Materials:
 - 1. Thermite Weld Caps:
 - a. Royston Laboratories Handi-Cap IP, prefabricated primerless thermite weld cap and coating system.
 - b. Provide primer unless specifically stated in product data sheet that no primer is required.
 - 2. Fast Cure Epoxy Coating:
 - a. 100 percent solids, fast curing epoxy suitable for submerged or buried conditions.
 - b. Acceptable products or equal:
 - 1) Denso Protal 7125 (low temperature) or Protal 7300
 - 2) 3M ScotchKote 323

2.10 INSULATING JOINTS

- A. General: Insulating joints shall be dielectric unions, flanges, or couplings. The complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline. All materials shall be resistant for the intended exposure, operating temperatures, and products in the pipeline.
- B. Insulating Flanges:
 - 1. Flange:
 - a. As specified in applicable pipe sections or in conformance with AWWA C207, whichever is more stringent.
 - b. Bolt holes may be oversized not more 1/4 inch over nominal bolt diameter where required for insulating flange assembly.
 - 2. Gaskets:
 - a. Full-face, fiberglass (G10) with O-ring seal gasket. Buried insulating flanges shall be full face gaskets only.
 - b. Complete assembly shall have an ANSI rating equal to the flanged joint.
 - c. Gasket materials shall be resistant to intended chemical exposure, operating temperatures, and pressures in the pipeline.
 - 3. Insulating Sleeves: Full-length Mylar or fiberglass reinforced epoxy (NEMA G-10 grade).
 - 4. Insulating Washers: Fiberglass reinforced epoxy (NEMA G-10 grade).
 - 5. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.
 - 6. Manufacturers:
 - a. GPT Industries, Houston, Texas
 - b. Advanced Products and Systems, Scott, LA
 - c. Central Plastics Co., Shawnee, OK.
- C. Insulating Unions: O-ring sealed with molded and bonded insulating bushing to union body, as manufactured by Central Plastics Company, Shawnee, OK; or equal.

2.11 OTHER MISCELLANEOUS MATERIALS

- A. Test Station Wire Terminations: One-piece, tin-plated crimp-on ring tongue connector as manufactured by Burndy Co. or Thomas and Betts.
- B. Electrical Tape:
 - 1. Linerless rubber high-voltage splicing tape and vinyl electrical tape suitable for moist and wet environments.
 - 2. Use Scotch 130 C and Scotch 88 as manufactured by 3M Products.

PART 3 - EXECUTION

3.1 GENERAL:

- A. The installation of the facilities herein specified and described shall conform to the latest applicable NEC rules.
- B. The workmanship shall be of the highest grade and shall be in strict accordance with material manufacturer's instructions. Equipment or materials damaged in shipment or during installation shall be replaced.

3.2 STORAGE AND HANDLING:

- A. Store all prepackaged anodes off the ground and keep them dry until after installation. Protect against weather, condensation, and mechanical damage.
- B. Immediately remove from the project site all mechanically damaged anodes.
- C. Galvanic anodes shall not be lifted or held by the lead wire.
- D. Anode backfill material that has become wet prior to installation shall not be acceptable.

3.3 PIPE JOINT BONDING, NEW PIPE

- A. To form an electrically continuous pipeline and associated appurtenances, all metallic pipe joints shall be electrically bonded; including buried, vault, and manhole pipe, fittings, and restrained joints; except threaded, welded, or insulated joints.
- B. All buried pipe shall be electrically continuous from test station to test station and from test station to fire hydrant or blowoff. Contractor shall locate and repair any joint that is found to be discontinuous during Engineer performed electrical continuity testing.
- C. Install the quantity of joint bonds at each joint required to be bonded as specified this section or shown on the Drawings. Should the specifications and drawings conflict, the larger quantity shall apply.
- D. Test each bonded joint for electrical resistance as specified under CONTRACTOR QUALITY CONTROL TESTING, this section.

3.4 TEST STATION INSTALLATION:

- A. General:
 - 1. Test station location, type, and style shall be as shown on the Drawings.
 - 2. Contractor may relocate test station up to ± 25 feet for site conditions without District Engineer approval. Relocation greater than ± 25 feet must be approved by the District Engineer.
 - 3. Contractor shall maintain records showing actual pipeline stationing of test station wire connections to the pipe.
 - 4. Records of actual pipeline stationing shall be provided to District Engineer prior to electrical continuity testing by District Engineer.
 - 5. Test stations shall be generally located as follows:
 - a. Install Type T test stations or other type test stations as required or at 1/4 mile intervals, but not greater than 1,500 feet.
 - b. Install a Type F test station where pipe crosses a foreign-owned metallic pipeline under cathodic protection.
 - c. Install a Type C test station at both end of cased crossings, unless shown otherwise on the Drawings.
 - d. Install a Type I test station at all buried insulated joints.
 - 6. Locate post-mounted test stations directly over the pipe and, where possible, at protected locations such as structures, fences, manholes, power poles, or edges of cultivated land.

7. Locate flush mounted test stations directly over the pipeline, except in areas of heavy traffic conditions. When heavy traffic conditions exist, offset the test stations to the side of the street.
 8. All offset test stations shall protect the test wires with PVC coated rigid steel conduit from pipeline centerline to within 6-inches of test station as shown on the Drawings. Do not connect rigid steel conduit to test station.
 9. Drawings. Do not connect rigid steel conduit to test station.
- B. Style:
1. Test station style shall be as shown on the Drawings and as follows:
 2. Post mount style test stations shall be steel conduit style as shown on the Drawings.
 3. Flush mount style test stations shall be as shown on the Drawings and used where directed by the District Engineer.
- C. Installation:
1. Post mounted test station:
 - a. Height shall be between 36 to 42 inches above finish grade.
 - b. Buried steel posts shall be concrete encased as shown on the Drawings.
 2. Flush Mounted Test Stations
 - a. Place in concrete pad or sidewalk with cast iron cover as shown on Drawings.
 - b. Place concrete box on top of 3-inch base of compacted sand.
 - c. In unimproved areas provide blue "Carsonite" utility marker with yellow reflector on each side 1 foot from test box or as directed by the District Engineer.
- D. Test Wires:
1. Wires shall be attached to the pipe as specified under WIRE CONNECTIONS, this section.
 2. Wire connections shall be an individual connection with not less than 6-inches separation from other connections. Common connections will not be allowed. Where a steel tab is welded to pipe for test wire connections, a separate tab shall be provided for each wire connection.
 3. Wires to foreign-owned pipelines shall be connected to the pipe by the Contractor unless the foreign pipeline owner has indicated otherwise in writing. The Contractor shall coordinate this work with the owner of the foreign pipeline.
 4. Where foreign owners refuse test wire installation to their pipe, the Bidder shall obtain a written refusal from the field representative and install a Type T test station.
 5. Wires shall be buried a minimum of 24 inches below finished grade, except in undeveloped or cultivated areas where test wires shall be a minimum of 30-inches below finished grade.
 6. Wires shall be direct buried except where test station offset is required. Offset wires shall be installed in PVC coated rigid steel conduit from the centerline of the pipeline to 6-inches from test station. Rigid conduit shall not be connected to the test station.
 7. Provide 12-inch diameter loop in wires at the pipeline connection, at each end of rigid conduit when required, and below post mounted test stations to prevent wires from being stressed or broken.
 8. Maintain sufficient slack in flush mount test wires to permit extension of terminal block 18-inches above test station. Connect all wires to a terminal board as specified.
 9. Make wire connections to test station terminals with crimp-on ring tongue terminals, except where solid wire is specified.

3.5 THERMITE WELD WIRE CONNECTIONS:

- A. Use thermite weld method for electrical connection of copper wire to steel, ductile iron, and cast iron surfaces. Observe proper safety precautions, welding procedures, thermite weld material selection, and surface preparation as recommended by the material manufacturer. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way.
- B. Before the connection is made, the surface shall be cleaned to bare metal by making a 2-inch by 2-inch window in the coating and then filing or grinding the surface with a vitrified wheel to produce a bright metal finish. Wire sleeves shall be installed on the ends of the wire before welding to the metal surface.
- C. After the weld connection is cooled, remove slag, visually inspect, and physically test wire connection by hitting with a hammer. Remove and replace any defective connections.
- D. Coat each completed wire connection as specified, this section. If lining is damaged by welding, repaired in accordance with the lining applicator's recommendations.

3.6 WIRE INSULATION REPAIR

- A. Underground splicing of wire will not be permitted, except where specifically shown on the drawings and approved by the District Engineer.
- B. Where splicing is approved by the District Engineer, splices shall be mechanically secure and soldered with rosin cored 50/50 solder. Compression connectors will not be permitted.
- C. Splices or insulation damage to test station wires shall be spirally wrapped with two coats of high-voltage self-vulcanizing rubber splice tape and two layers of vinyl electrical tape.

3.7 INSULATED JOINTS

- A. Install insulated joints to electrically isolate the pipeline from other pipes or structures where shown on the Drawings.
- B. Install insulated joints as shown on the Drawings.
- C. Align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials.
- D. Test each insulated joint for electrical insulation as specified this section. Defective insulating joints shall be repaired by the Contractor at his sole expense. All damaged or defective insulation parts shall be replaced.

3.8 QUALITY CONTROL TESTING

- A. General:
 - 1. Correct all construction defects identified during testing.
 - 2. Provide 7 days advance notice of completion for District Engineer acceptance testing.
 - 3. Contractor required testing as defined in QUALITY CONTROL TESTING shall be

performed by a Corrosion Expert, with qualifications as specified this section, whom is an employee or subcontractor to the Contractor.

B. Joint Bond Resistance Test:

1. General

- a. Test completed joint bonds for electrical continuity using a digital low resistance ohmmeter.
- b. Joint bond quality control test shall be performed on all bonded joints after the bonds are installed but before backfilling of the pipe.
- c. Furnish all equipment and materials as required for test.

2. Digital Low Resistance Ohmmeter Test Method:

a. Required Equipment and Materials:

- 1) (1) One AVO Model DLR010, digital low resistance ohmmeter or equivalent instrument.
- 2) (2) Two duplex, helical spring point leads with current and potential points, AVO Model No. 242011-7, or equivalent wire lead set.

b. Test Procedure:

- 1) Measure the resistance of joint bonds with the low resistance ohmmeter in accordance with the manufacturer's written instructions.
- 2) Use the helical handspikes to contact the pipe on each side of the joint, without touching the thermite weld or the bond. The contact area shall be cleaned to bright metal by filing or grinding and without any surface rusting or oxidation.
- 3) Record the measured joint bond resistance on the test form described herein.
- 4) Repair any damaged pipe coating in accordance with WIRE CONNECTIONS, this section.

3. Joint Bond Acceptance:

- a. Joint bond resistance shall be less than or equal to the maximum allowable bond resistance values shown below.

Joint Type	Max. Allowable Resistance (micro-ohms)		
	Two Bonds/Joint	Three Bonds/Joint	Four Bonds/Joint
No. 2 AWG wire (Steel)	162	108	81
No. 2 AWG wire (DIP)	185	123	93
Copper Strap (12-inch)	64	43	32
Copper Strap (9-inch)	48	32	24
Coupling, 24" No. 2 AWG	212	142	106
Coupling, 24" Copper Strap	128	85	64
MLC Steel Pipe Clips	N/A	55	42

- b. Remove and replace all joint bonds on a joint that exceeds the maximum allowable resistance. Replacement joint bonds shall be retested for compliance with the specified bond resistance.
 - c. Any defective joint bond discovered during SYSTEM TESTS AND INSPECTION shall be located, excavated, repaired, and backfilled.
 4. Test Records: Records shall be made of each bonded pipeline during the test and submitted to Pineview Water Systems. These records shall include:
 - a. Description and location of the pipeline tested.
 - b. Starting location and direction of test.
 - c. Date of test.
 - d. Joint type.
 - e. Measured joint bond resistance
 5. Report: Submit a QC report upon completion of joint bond resistance testing which includes the information listed above.
- C. Insulated Joint Isolation Test:
1. Provide a Corrosion Expert to test each insulating joint after assembly with a insulator tester or equivalent instrument in accordance with the manufacturer's written instructions.
 2. The Corrosion Expert shall conduct additional insulating joint testing as required to ensure that insulating flanges are not electrically shorted by other equipment or incidental contact with concrete reinforcement.
 3. Conduct test before burial and coating of buried insulating flanges.
 4. Replace damaged or defective insulation parts identified during testing.
 5. Electrical Isolation is defined as a condition of being electrically isolated from other metallic structures as defined in NACE Recommended Practice RP0169-83.
 6. Submit a report prepared by the Corrosion Expert certifying insulating joint testing isolation, test method(s), test data, and any corrective action required.

3.9 SYSTEM TESTS AND INSPECTION

A. General

1. Acceptance testing may be performed by the District Engineer and may include:
 - a. Preliminary electrical continuity testing of the full pipeline.
 - b. Electrical discontinuity locating.
2. Correct all construction defects identified during testing.

END OF SECTION

DIVISION 33

UTILITIES

SECTION 33 05 01
HIGH DENSITY POLYETHYLENE PIPE (AWWA C906, MODIFIED)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install high density polyethylene (HDPE) pipe and appurtenant work, complete in place, in accordance with Contract Drawings and these Specifications.
- B. High-density polyethylene pipe and fittings shall be new without any defects when delivered to the job site.

1.2 RELATED SECTIONS

- A. APWA Section 31 - Earthwork
- B. Section 33 13 00 - Water Pipeline Testing and Disinfection

1.3 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers (ASME) standards, most recent editions:
 - ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings
 - ASME/ANSI B16.5 Pipe Flanges and Flanged Fittings
- B. ASTM International (ASTM) standards, most recent editions:
 - ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
 - ASTM A194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
 - ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
 - ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
 - ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique

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| ASTM D2683 | Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing |
| ASTM D2837 | Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products |
| ASTM D3035 | Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter |
| ASTM D3261 | Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing |
| ASTM D3350 | Standard Specification for Polyethylene Plastics Pipe and Fittings Materials |
| ASTM F714 | Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter |
| ASTM F1055 | Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing |
| ASTM F1417 | Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air |
| ASTM F2164 | Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure |
- C. American Water Works Association (AWWA) standards, most recent editions:
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| AWWA C901 | Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Service |
| AWWA C906 | Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks |
- D. Plastic Pipe Institute (PPI) standards, most recent editions.
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| PPI TR 33 | Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe |
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- 1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordination: Where tie-ins are required at existing utilities, coordinate timing of those operations with Owner through District Engineer.

1.5 SUBMITTALS

- A. Submit in accordance with APWA Section 01 33 00 – Submittal Procedures.
- B. Product Data:
 - 1. Manufacturer's installation instructions. Indicate any special procedures required to install the products specified.
 - 2. Submit proposed butt fusion procedures, including training and qualification requirements and joint repair procedures to District Engineer for approval prior to fabricating pipe.
 - 3. Fusion parameters, including the recommended limits, for all criteria to be recorded by the data logger.
 - 4. Manufacturer's data on metallic locating tape.
- C. Shop Drawings
 - 1. Submit shop drawings of pipe and fittings in accordance with the requirements of the referenced standards and the following supplemental requirements, as applicable and as specified herein.
 - a. Provide a marking plan with details showing standard pipe section, dimensions, pipe joints, fittings and special fittings, pressure rating, thickness, size, coating, and lining data.
 - b. Pipeline layout drawings showing the location of each pipe section, each special length, closure sections, location and angle of bends, outlets, location of valves, and other special fittings.
- D. Certificates
 - 1. Furnish an affidavit of compliance for all HDPE pipe and other products or materials furnished under this Section, as specified in the referenced standards, and the following supplemental requirements:
 - a. Physical and chemical properties.
 - b. Fusion Reports for each joint.
 - c. Hydrostatic Test Reports.
- E. Source Quality Control Submittals
 - 1. Submit certified resin test reports covering the physical, stress, regression, thermal, and impact tests of resin material to be used for the pipe. Submit this information for approval prior to manufacturing any pipe.
 - 2. Submit reports of manufacturer's quality control tests outlined in ANSI/AWWA C901 and C906.
- F. Field Quality Control Submittals
 - 1. Submit a fusion report for each joint, including the following information:
 - a. Nominal pipe size and actual dimensions.
 - b. Machine size.
 - c. Operator identification.
 - d. Job identification number.
 - e. Weld number.
 - f. Fusion, heating, and drag resistance settings.
 - g. Heater plate temperature.
 - h. Time stamp.

- i. Heating and curing time of weld.
 - j. Curing temperature readings and time stamps of readings.
 - k. Ambient air temperature and humidity.
 - l. Error messages and warnings for out-of-range temperature or pressure settings.
 - 2. Submit hydrostatic pressure testing plan for pipe including the following:
 - a. Schedule for testing.
 - b. Method for water conveyance, control, and disposal after testing is complete.
 - G. Qualification Statements
 - 1. Submit welder and welding operator performance qualification test records for approval prior to commencing field operations.
- 1.6 QUALITY ASSURANCE
- A. Qualifications
 - 1. Manufacturers
 - a. Finished pipe and fittings shall be the products of a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of HDPE pipe to be furnished.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon District Engineer's approval.
 - b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
 - c. Manufacture HDPE pipe in accordance with ANSI/AWWA C901 and C906.
 - 1) Perform quality control tests and maintain results as outlined within standard and as specified herein to assure compliance.
 - 2. Fusion Welders and Welding Operators
 - a. Use only fusion welders and welding operators that are qualified and certified for the Work specified in this Section. Welder qualification generally requires that during the past 12 months, welders and welding operators have successfully completed certified fusion joints using the pipe and welding machine proposed for this Project.
 - b. Personnel that will be operating the fusion welder shall be certified by either 1 and 3, or 2 and 3 of the following criteria:
 - 1) Previous demonstrated experience during the past 12 months, in the use of the procedure on similar projects using the same welding machines and type of pipe proposed.
 - 2) Appropriate training and apprenticeship.
 - 3) All operators shall make a specimen joint from the pipe to be used on the project. This joint shall then be subjected to the test requirements specified herein.
 - 3. Testing Agencies: The testing laboratory performing tests under this Section shall meet or exceed the requirements of ASTM E329.
 - B. Certifications: Submit an affidavit from the pipe manufacturer that the pipe, specials, fittings, and other products furnished under this Section comply with applicable provisions of ANSI/AWWA C901 or ANSI/AWWA C906 and these Specifications.

- C. Documentation: Perform the factory tests specified herein under Section 2.3 - SOURCE QUALITY CONTROL and record results as part of the manufacturer's permanent records. Provide copies of these records to District Engineer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with APWA Section 01 25 10 - Products, Materials, Equipment and Substitutions.

- B. Storage And Handling Requirements

1. Handle and store HDPE pipe materials in accordance with the guidelines in ANSI/AWWA C901 and ANSI/AWWA C906 and as required by the pipe manufacturer.
2. Deliver pipe and materials in such a manner as to minimize handling operations and provide proper weather protection and storage, while meeting schedule requirements.
3. Crate or box loose parts appropriately identified for shipping and ship with the associated pipe sections.
4. Furnish and use load-rated nylon slings for securing, lifting, and unloading pipe sections; or use protective wraps to minimize damage from the alternate rigging equipment.
5. Load all materials for shipping so that they will not bear on each other. Brace to prevent damage to materials during shipping.
6. Avoid compression damage or deformation to ends of the pipe.
7. Upon delivery to the site, remove any temporary attachments to special components installed by the supplier for transportation purposes.
8. Store material on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe or on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports. Limit stack height of polyethylene pipe to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions.
9. Provide internal timber bracing to maintain pipe shape and integrity throughout plant storage, transportation, and site storage operations through installation and backfill placement. Do not remove internal bracing until a minimum of 2 feet of compacted trench zone material has been placed above the top of the pipe.
10. Keep piping products free of dirt, grease, vermin, petroleum-based products, and other foreign matter.
11. Protect pipeline materials stored at the Site from damage, including weather and vandalism.
12. Be responsible for pipe materials until final acceptance of the Project by Owner.

1.8 WARRANTY

- A. Provide warranty from pipe manufacturer against manufacturing defects in material and workmanship for a period of 10 years after the final acceptance of the Project by Owner. Warranty to provide for replacement of any defective pipe/fitting, including labor, within the warranty period, at no expense to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Pipe:
 - a. AGRU America
 - b. Chevron Phillips Chemical Company: DriscoPlex.
 - c. ISCO Industries.
 - d. WL Plastics: Camcore.
 - e. District Engineer-approved equal.

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

- A. Materials
1. Materials used for manufacturing polyethylene pipe and fittings shall be made from a PE 4710 high density polyethylene resin compound meeting cell classification 445574C per ASTM D3350; and meeting ASTM D1238 Type III, Class D, Category 5, Grade E10.
 2. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type and from the same raw material supplier shall be used. Clean rework material of the same type, grade, and cell classification generated from the manufacturer's own pipe and fitting production may be used by the same manufacturer as long as the pipe, tubing, and fittings produced meet all the requirements specified herein.
- B. Compatibility
1. Be responsible for compatibility between differing pipe materials, fittings, and appurtenances.
- C. Pipe
1. Provide pipe in the diameter and Diameter Ratio (DR) as shown on the Contract Drawings or as specified.
 2. All pipe must be new and recently manufactured. Refurbished pipe will not be accepted.
 3. Unless otherwise noted, manufacture HDPE pipe with outside diameter dimension conforming to iron pipe size (IPS).
 4. Provide pipe with lay length of 40 feet or 50 feet, except for special fittings or closure pieces and as necessary to comply with the Contract Drawings. Shorter lengths greater than 20 feet long will be permitted when authorized by District Engineer.
 5. Identification: The following shall be continuously indent-printed on the pipe or spaced at intervals not exceeding 5 feet.
 - a. Name and/or trademark of the pipe manufacturer.
 - b. Nominal pipe size.
 - c. Dimension ratio (DR).
 - d. The letters "PE" followed by the polyethylene material designation or cell classification.
 - e. ASTM product standard with pressure classification or pressure rating.

- f. Manufacturer's Production code by which the date and place of manufacture can be determined.
 - g. Color
 - 1) White or Blue for pipe used in potable or culinary water systems, or directly attached to potable or culinary water systems.
 - 2) Green for pipe used in sanitary sewer systems.
 - 3) Lavender or Purple for pipe used in irrigation, reuse, utility water, or any other non-potable system except sanitary sewers.
 - 6. Finish:
 - a. Pipe shall be homogenous throughout and uniform in color, opacity, density, and other properties, as prescribed in the resin manufacturer's specifications.
 - b. Finish pipe smooth throughout all inside surfaces and true to all specified tolerances in circumference and diameter such that the difference between maximum and minimum diameters at any cross-section along the length of the pipe does not exceed 1percent of the nominal diameter.
 - c. Inside and outside surfaces shall be matte to glossy in appearance and free from sticky or tacky material.
 - d. Pipe walls shall be free from cuts, cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye, and which may affect wall integrity.
 - 7. Pipe Design
 - a. Fabricate HDPE pipe in accordance with ANSI/AWWA C901 for sizes ½-inch through 3-inch and ANSI/AWWA C906 for sizes 4-inches and above, in addition to the requirements of this Section.
 - b. Dimensions and workmanship shall conform to ASTM F714 and the following:
 - 1) HDPE fittings and transitions: Conform to ASTM D3261.
 - 2) Pipe Density: Between 0.966 g/cm³ and 0.964 g/cm³.
 - 3) Hydrostatic Design Basis (HDB): 1,600 psi at 73.0 degF in accordance with ASTM D2837.
 - c. Extruded pipe shall have impact strength greater than 42 in-lb/in in accordance with ASTM D256, Method A, with material thickness representative of the cross-section in which the material is to be used.
- D. Fittings
- 1. The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Contract Drawings and specified herein.
 - 2. Fabricate HDPE fittings in conformance with ANSI/AWWA C906 unless noted otherwise.
 - 3. All molded and fabricated fittings shall be fully pressure rated to match the pipe DR pressure rating for which they are made. All fittings shall be molded and shop-fabricated by the manufacturer. No field-fabricated fittings will be allowed unless specifically approved by District Engineer.
 - 4. Fittings furnished under this specification shall be manufactured using compounds complying with the requirements of HDPE pipe listed above, in addition to appropriate requirements of AWWA C906.
 - a. Socket fittings: Comply with ASTM D2683.
 - b. Butt Fusion fittings: Comply with ASTM D3261.
 - c. Electrofusion fittings: Comply with ASTM F1055.

- d. Mechanical fittings: (e.g., back-up rings, etc.) shall be of stainless steel, including stainless steel hardware, as indicated on the Contract Drawings and will be approved only after submission of appropriate test data and service histories indicating their acceptability for intended service.
 - e. In all cases, the specification and requirements for the fittings supplied must comply with the appropriate sections of AWWA C906 and must be approved by District Engineer. No size-on-size wet taps will be permitted.
 - 5. For pipelines that require pigging, all bends shall have a minimum bending radius of no less than 1.5 times the outside diameter of the pipe. Interior fusion beads shall be removed for fabricated fittings and all other interior joints. No removal of the outside bead is required.
- E. Tracer Wire: Provide No. 12 AWG copper wire, PVC jacketed for underground service.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests

- 1. General:
 - a. Complete testing in accordance with applicable ASTM and ANSI/AWWA standards at no additional expense to Owner.
 - b. District Engineer to have the right to witness all testing conducted by Contractor and manufacturer, provided that Contractor's schedule is not delayed for convenience of District Engineer.
 - c. Perform tests on pipe with wall thickness equal to that specified.
- 2. Perform the following tests for resin identification:
 - a. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
 - b. ASTM D1505 - Standard Test Method for Density of Plastics by the Density - Gradient Technique.
- 3. Provide certification that stress regression testing in accordance with ASTM D2837 has been performed on the specific polyethylene resin being utilized in the manufacture of this product. Provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.
- 4. Check each length of pipe produced for the items listed below. Record the results of measurements on production sheets, which becomes part of the manufacturer's permanent records.
 - a. Check pipe in process visually, inside and out, for cosmetic defects (grooves, pits, hollows, etc.)
 - b. Measure outside diameter of pipe using a suitable periphery tape to ensure conformance with ASTM D3035.
 - c. Measure pipe wall thickness at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM D3035.
 - d. Measure pipe length.
 - e. Examine pipe marking and check for accuracy.
 - f. Check pipe ends to ensure they are cut square and clean.
 - g. Perform "reverse bend test" on the inside surface, to ensure pipe is free of oxidation (brittleness).
- 5. Submit copies of all manufacturer documentation to District Engineer for review and approval upon completion of manufacturing.

- B. Preconstruction Testing
 - 1. Owner may, at its own cost, subject additional pipe materials to testing by an independent laboratory for compliance with this Specification.
 - a. Submit to the additional selected samples for testing at no additional cost to Owner.
 - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.
- C. Inspections
 - 1. All pipe materials are subject to inspection at the place of manufacture and in the field, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.
 - 2. Notify District Engineer in writing of the manufacturing start date, not less than 14 calendar days prior to the start of any phase of the pipe manufacture.
- D. During manufacture of the pipe, allow District Engineer access to all areas where manufacturing is in process and permit inspections necessary to confirm compliance with the Contract Documents.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

- A. Install HDPE pipe only when the ambient air temperature conforms to manufacturer's specifications. Be responsible for verifying the temperature by maintaining a log listing dates, times, length of pipe installed, and ambient temperature during installation.

3.2 INSTALLATION

- A. General
 - 1. Store and handle pipe, fittings, etc., carefully and protect against damage, impact shocks, and free fall. Use pipe handling equipment acceptable to District Engineer.
 - 2. Replace or repair all pipe damaged prior to Substantial Completion to satisfaction of District Engineer.
 - 3. Perform open-trench excavation and backfill conforming to the requirements of APWA Section 31 – Earthwork.
 - a. Excavate sufficiently in advance of pipe laying operations to enable the alignment and profile to be revised to clear existing utilities and to align with existing connection points. Ensure that pipe zone material is compacted and in full contact with the haunches of the pipe and that the pipe is fully supported.
 - b. HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.
 - c. Do not permit construction vehicles or ride-on mechanical compaction equipment to travel over the pipe until a minimum of 2 feet of trench backfill has been placed above the top of the pipe.
 - 4. Clean Pipe
 - a. Before placement of pipe in the trench, thoroughly clean each pipe or fitting to remove any foreign substance which may have collected thereon and keep

clean thereafter. For this purpose, close the openings of pipes and fittings in the trench during any interruption to the Work.

- b. Wipe ends of mechanical joint pipe and fittings and of rubber gasket joint pipe and fittings clean of dirt, grease, and foreign matter.
- c. Do not permit groundwater to enter the pipe.

B. Joining Pipe

1. Join HDPE pipe sections and fittings with butt, heat fusion joints as outlined in ASTM D3261, PPI TR-33, and in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by the pipe manufacturer or experienced, trained technician shall perform all heat fusion joints in the presence of District Engineer. Minimum requirements for butt-fusion welded joints are as follows:
 - a. Make pipe ends clean and square prior to fitting and alignment.
 - b. Take care to assure a clean work area, free from airborne dust, moisture, or other foreign matter which may contaminate the finished weld.
 - c. Maintain internal surfaces of the pipe clean following completion of a weld and prior to starting the next joint.
 - d. Make butt-fusion joints watertight under maximum internal pressure.
2. Install the HDPE pipeline completely, including bends, valves, and other associated fittings and appurtenances as shown on the Contract Drawings or specified herein. Make necessary connections to the lines and grades shown on the Contract Drawings and in accordance with these Specifications.
3. Furnish welding equipment and construction materials required for lugs, railings, templates, spiders and other supports, and internal bracing as may be required to hold the components firmly within the specified tolerances during welding, concrete placement, and backfill placement. Furnish and install necessary positioning devices, ties, pedestals, and supports required for installation. Include details of such equipment in the proposed installation procedure to be submitted to the District Engineer prior to the start of operations.
4. Assemble lengths of pipe into suitable installation lengths by the butt-fusion process. All pipe so joined shall be made from the same class and type of raw material made by the same raw material manufacturer. Be responsible for correct fitting of all pipeline members and components.
5. For pipelines that require bead removal, the Contractor is to ensure bead cuttings are removed from the pipe prior to pipe installation. No removal of the outside bead is required.
6. Flange adapters
 - a. Use polyethylene flange adapters at pipe material transitions and other locations as indicated on the Contract Drawings.
 - b. Connect adapters together or to other flanges by using a 316 stainless steel "back-up" ring conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe.
 - c. Ensure that back up rings are in place prior to joining flange adapter to piping or other components.
 - d. Connect flange adapter assemblies with corrosion resistant bolts and nuts of Type 316 stainless steel per ASTM A193 and ASTM A194.
 - 1) Tighten bolts alternately and evenly to the manufacturer's specified torques.

- 2) Retighten to specified torques 48 hours after initial tightening, or a period of time recommended by the manufacturer, whichever is greater.
 - 3) After installation, apply wax tape coating system to bolts and nuts.
 7. Sleeve couplings
 - a. Sleeve couplings shall not be allowed.
- C. Laying Pipe
 1. Grade trench bottoms so that each section of pipe can be placed to the specified depth or elevation with uniform support. When the bottom of the trench has been excavated below the specified depth or elevation, bring it to the specified depth or elevation by backfilling with approved pipe zone material. When District Engineer determines that material at the bottom of the trench is unsuitable, remove the unstable material and backfill with approved subgrade material or bedding material to the specified depth of excavation.
 2. Do not free-drop pipe or accessories into the trench.
 3. During pipe installation, keep the trench bottom free of frost, frozen earth, and standing water. Always maintain the trench in stable condition to prevent caving.
 4. Take precautions to prevent flotation of the pipe in the trench.
 5. When laying pipe is not in progress, close the open ends of the pipe using fabricated plugs, or by other means approved by District Engineer.
 6. The pipeline may be buried as it is installed, provided all inspection, testing and backfill requirements are met.
- D. Unforeseen Obstructions
 1. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, District Engineer may change the alignment and/or the grades. Make all such changes as directed. However, in no case shall the deflection exceed the maximum designed deflection recommended by the pipe manufacturer.
- E. Cold Weather Protection
 1. Do not install pipe on a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. Do not install pipe unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- F. Tracer Wire
 1. Provide HDPE pipelines with tracer wire secured to the pipe with surface connections provided at all valve boxes and hydrants, and as required to maintain a maximum distance between surface connections of 500 feet maximum.
 2. Lay tracer wire along the top of the pipe and secure in place with ties or hitches, spaced not more than 10 feet apart.
 3. The copper wire will be used in the future as a means of locating the pipe with an electronic pipe locator.
- G. Metallic Locating Tape
 1. For buried pipelines, provide a metallic locating tape laid along the centerline of the pipe trench above top of pipe as shown in the design drawings. Furnish manufacturer's literature, completely describing the tape proposed to be furnished. Do not install tape prior to receipt of written approval of District Engineer.

3.3 CONNECTION TO EXISTING FACILITIES

- A. Prior to making connections to any existing structure or pipe, ensure that the new pipe has had time to acclimate to the buried conditions. Make the appropriate adjustments required by the thermal expansion and contraction properties of HDPE materials before connecting to any dissimilar material or structure.
- B. Make transitions from HDPE to ductile iron or PVC per approval of District Engineer and per the HDPE manufacturer's recommendations and specifications. Use a molded flange connector adapter with a back-up ring assembly for pipe type transitions. Use Ductile iron back-up rings mated with cast iron flanges per ANSI B16.1. Use Type 316 stainless steel back-up rings mated with Type 316 stainless steel flanges per ANSI B16.5 for all buried applications.
 - 1. For transitions from HDPE to ductile iron fittings and valves, obtain approval of District Engineer before installation.
 - 2. No solid sleeve couplings will be allowed between such material transitions.
 - 3. The pipe manufacturer must certify compliance with the above requirements.

3.4 PIPE APPURTENANCES

- A. Make connections of HDPE pipe to auxiliary equipment such as valves, pumps, and tanks through flanged connections consisting of the following:
 - 1. Thermally butt-fuse an HDPE flange adapter to the stub end of the pipe.
 - 2. Mate a Type 316 stainless steel back up ring with the HDPE flange adapter.
 - 3. Install a full-face Garlock Multi-Swell 3760 gasket.
 - 4. Complete the connection using Type 316 stainless steel bolts and nuts conforming to ASTM A193 and A194.

3.5 REPAIR AND RESTORATION

- A. If a defective pipe is discovered after it has been installed, remove and replace with a sound pipe in a satisfactory manner at no additional cost to the Owner.
 - 1. Regardless of cause, the maximum allowable depth of cuts, scratches, or gouges on the exterior of the pipe is 5 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges, or scratches. Remove sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness and rejoin the ends of the pipeline. Repair of damaged pipe during or after installation shall conform to the manufacturer's repair procedures or another repair method approved by District Engineer.
- B. Restore all areas disturbed by installation of the pipeline in accordance with these Specifications and the Contract Drawings.

3.6 FIELD QUALITY CONTROL

- A. Field Tests and Inspections
 - 1. On days when butt fusions are to be made, make the first fusion of the day as a trial fusion in the presence of District Engineer. The following apply:
 - a. Inspect the heating plates for cuts and scrapes.

- b. Measure the plate temperature at various locations to ensure proper heating/melting per manufacturer's recommendations and as approved by District Engineer.
- c. Cut out the fusion or test section after cooling completely for inspection.
- d. Test section dimensions: 12 inches or 30 times (minimum) the wall thickness in length and 1 inch or 1.5 times the wall thickness in width (minimum).
- e. Visually inspect the joint for continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e. – joint must have visible molded material between walls of (pipe).
- f. Joint spacing between the walls of the two ends: Minimum of 1/16 inch to maximum 3/16 inch.

3.7 CLEANING

- A. Do not allow dirt, grease, mud, groundwater, tools, equipment, and all other foreign matter to enter the pipe at any point during construction.
- B. Flush pipes with water velocities no less than 4.0 feet per second for pipes up to 12 inches in diameter and 3.0 feet per second for all other pipes. For large diameter pipes, alternate methods, including pigging, or cleaning the pipe may be proposed, subject to the approval of District Engineer. The proposed method must provide a clean pipe equivalent to flushing as finally determined by District Engineer.
- C. Do not permit debris, rubbish, dirt, rocks, or other foreign material to enter downstream sections of the pipeline or system.
- D. Furnish, install, and permanently remove all cross-connections, piping, valving, ports, etc. required to complete the cleaning process. Obtain approval of District Engineer prior to adding any components to the pipeline.

3.8 TESTING

- A. Hydrostatic pressure testing
 - 1. Conduct hydrostatic pressure testing per the requirements of ASTM F2164 and these specifications.
 - 2. All HDPE mains will be field-tested. Provide labor, equipment, material, gages, pumps, plugs, meters, and incidentals required for testing. Upon completion of the pipe laying and backfilling operations (including placement of any required temporary roadway surfacing), pressure test each main.
 - 3. Submit a plan for hydrostatic testing to District Engineer for review at least 10 days before starting the test and notify District Engineer a minimum of 48 hours prior to test.
 - 4. Maximum test pressure: As indicated in the Contract Drawings, not to exceed 150 percent of the maximum working pressure of the pipe or the design pressure of any component on the pipe, whichever is less.
 - 5. Test temperature: Not to exceed 73 degF (pipe and water) or the temperature related to the pressure rating of the pipe as reported by the manufacturer.
 - 6. Test equipment, preparations and procedures: Follow the requirements of ASTM F2164 and the manufacturer's recommendations.

7. In preparing for the test, fill the pipeline slowly with water. Maintain flow velocity less than 2 feet per second or less than the capacity of any air release devices used to expel trapped air, whichever is less.
8. Expel air completely from the line during filling and again before applying test pressure. Expel air by means of taps at points of highest elevation. Permanently cap any taps installed solely for the purpose of releasing trapped air at the conclusion of the test.
9. Once all air is expelled and all testing equipment and pipeline components are adequately braced, gradually increase the pressure in the pipeline to the required maximum test pressure. Hold test pressure for 4 hours, adding make-up water as required to maintain the noted maximum test pressure.
10. After the 4-hour equalization period, reduce pressure in the pipeline by 10 psi to the test pressure and monitor the pressure for 1 hour. Do not increase the pressure or add make-up water during this time.
11. During and after the 1-hour test period, observe all components, joints, fittings, and appurtenances of the pipeline for visible signs of leakage. Any visible signs of leakage indicate a failed test. Repair such leaks and retest the before pipeline for acceptance. If any visible signs of leakage in any butt-fusion joints in the pipe are noted, immediately stop the test and carefully release the test pressure. Repair the noted leaks and restart the test procedure from beginning.
12. A successful hydrostatic pressure test will be indicated by no visible signs of leakage and a steady pipeline pressure within 5 psi of the test pressure throughout the 1-hour test period without increasing the pressure or the addition of make-up water.
13. Upon completion of the test, bleed the pressure off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by District Engineer at the point where the pressure is being monitored and shall show on the recorded pressure read-out submitted to District Engineer.
14. Repair and/or replace any failed pipeline sections, components, fittings, valves or other appurtenances to the satisfaction of District Engineer and at no additional expense to Owner.

B. Mandrel testing

1. After successful completion of hydrostatic test, mandrel test all buried HDPE piping.
2. Mandrel configuration: Rigid circular cross-section with a diameter of not less than 95% of the average inside diameter of the pipeline with a length of circular section equal to the nominal diameter of the pipeline.
3. Mandrel pulling method: By hand, rope, or as directed by District Engineer.

END OF SECTION

SECTION 33 05 07
POLYVINYL CHLORIDE PIPE (AWWA C-900, MODIFIED)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install polyvinyl chloride pressure pipe (PVC) and appurtenant work, complete in place, in accordance with Contract Drawings and these Specifications.
- B. PVC pipe and fittings shall be new without any defects when delivered to the job site.

1.2 RELATED SECTIONS

- A. APWA Section 31 – Earthwork
- B. Section 33 13 00 – Water Pipeline Testing

1.3 DEFINITIONS

- A. Gland or Follower Gland: Non-restrained, mechanical joint fitting.
- B. Retainer Gland: Mechanically restrained mechanical joint fitting.

1.4 REFERENCE STANDARDS

- A. ASTM International (ASTM) standards, most recent editions:

ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D1922	Standard Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method
ASTM D2584	Test Method for Ignition Loss of Cured Reinforced Resins
ASTM D3139	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D4976	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

- B. American Water Works Association (AWWA) standards, most recent editions:

- | | |
|-----------------------|--|
| ANSI/AWWA C104/A21.4 | Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water |
| ANSI/AWWA C105/A21.5 | Polyethylene Encasement for Ductile Iron Pipe |
| ANSI/AWWA C110/A21.10 | Ductile-Iron and Gray-Iron Fittings 3-in Through 48-in for Water and Other Liquids |
| ANSI/AWWA C153/A21.53 | Ductile-Iron Compact Fittings |
| ANSI/AWWA C605 | Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings |
| ANSI/AWWA C800 | Underground Service Line Valves and Fittings |
| ANSI/AWWA C900 | Polyvinyl Chloride (PVC) Pressure Pipe 4-in Through 12-in for Water Distribution |
- C. Plastic Pipe Institute (PPI) standards, most recent editions.
- | | |
|-----|---|
| TR2 | PVC Range Composition Listing of Qualified Ingredients |
| TR3 | Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), Minimum Required Strength (MRS) Ratings, and Categorized Required Strength (CRS) for Thermoplastic Piping Materials or Pipe |
- 1.5 SUBMITTALS
- A. Submit in accordance with APWA Section 01 33 00 – Submittal Procedure.
- B. Product Data:
1. Manufacturer’s technical data and installation instructions.
 2. Manufacturer’s data on coatings and linings.
 3. Manufacturer’s data on metallic locating tape.
- C. Shop Drawings
1. Submit shop drawings of pipe and fittings in accordance with the requirements of the referenced standards and the following supplemental requirements, as applicable and as specified herein.
 - a. Provide a marking plan with details showing standard pipe section, dimensions, pipe joints, fittings and special fittings, pressure rating, thickness, size, coating, and lining data.
 - b. Pipeline layout drawings showing the location of each pipe section, each special length, closure sections, location and angle of bends, outlets, location of valves, and other special fittings.
- D. Certificates

1. Furnish an affidavit of compliance for all PVC pipe and other products or materials furnished under this Section, as specified in the referenced standards, and the following supplemental requirements:
 - a. Physical and chemical properties.
 - b. Hydrostatic Test Reports
- E. Quality Control Tests
 1. Submit certified inspection reports from the independent agency for witnessed tests within 10 days of the inspection. As a minimum, include the following:
 - a. Hydrostatic proof test.
 - b. Sustained pressure test.
 - c. Bursting strength test
 2. Test results must show restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure.

1.6 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturers
 - a. Finished pipe and fittings shall be the products of a single manufacturer.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon District Engineer's approval.
 - b. Pipe manufacturing operations (pipe, lining, and coatings) shall be performed under the control of the manufacturer.
 - c. Manufacture PVC pipe in accordance with ANSI/AWWA C900
 - 1) Perform quality control tests and maintain results as outlined within standard and as specified herein to assure compliance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with APWA Section 01 25 00 - Products, Options and Substitutions.
- B. Storage And Handling Requirements
 1. Handle and store PVC pipe materials in accordance with the guidelines in ANSI/AWWA C605.
 2. Handle the pipe with devices acceptable to District Engineer, designed and constructed to prevent damage to the pipe coating/exterior.
 3. If possible, store pipe at the Site in unit packages provided by the manufacturer.
 4. Avoid compression damage or deformation to bell ends of the pipe.
 5. Support pipe uniformly to prevent sagging or bending and accidental rolling.
 6. Protect from exposure to direct sunlight by covering it with an opaque material while permitting adequate air circulation above and around the pipe.
 7. Store gaskets in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Restrained Joint Connectors:
 - a. EBAA Iron Sales, Inc.: Megalug.
 - b. Star Pipe Products: Stargrip.
 - c. Tyler Union Waterworks: TUFGRIP.
 - d. Romac Industries: Romagrip
 - e. District Engineer-approved equal.

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

- A. Pipe
1. Provide pipe in the diameter and pressure class specified or shown, complete with rubber gaskets, and all specials and fittings required in the Contract Documents.
 2. All pipe must be new and recently manufactured. Refurbished pipe will not be accepted.
 3. Manufacture PVC pipe with outside diameter dimension conforming to cast iron pipe (CIOD).
 4. Provide pipe with lay length of 20 feet, except for special fittings or closure pieces and as necessary to comply with the Contract Drawings. Shorter lengths greater than 10 feet long will be permitted when authorized by District Engineer.
 - a. Provide closures and correction pieces as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing shown on the Contract Drawings.
 - b. Field cut lengths of pipe used as closures may not be shorter than 2 feet long and must be approved by District Engineer.
 5. Pipe Design
 - a. Design and manufacture PVC pressure pipe in accordance with the requirements of ANSI/AWWA C900.
 - b. Color
 - 1) Purple for pipe used in irrigation, reuse, utility water, or any other non-potable system.
 - c. Additives and Fillers
 - 1) Unless otherwise allowed in alternate qualification procedures of PPI-TR3, compounds which have a Hydrostatic Design Basis (HDB) of 4000 psi at 73.4 deg F and for water shall not contain additives and fillers that exceed the recommended values in Table 1, Part A of PPI-TR2 (e.g., allowable content range for calcium carbonate is 0.0-5.0 parts per hundred of resin).
 - 2) If requested by District Engineer, determine the additive and filler content using the pyrolysis method as specified in ASTM D2584.
 6. Joint Design
 - a. Joints for buried PVC pipe shall be either an integral bell manufactured on the pipe or a separate coupling both employing a rubber ring joint.

- 1) The bell and coupling shall be the same thickness as the pipe barrel, or greater thickness.
- 2) The sealing ring groove in the coupling shall be of the same design as the groove in ductile iron fittings and valves available from local distributors.
- 3) When the spigot end of pipe is to be inserted into a mechanical joint fitting, remove the beveled end of the pipe prior to insertion.
- 4) Solvent-weld joints are not permitted.
- b. Seal joints with an elastomeric gasket meeting the requirements of ASTM F477 and ASTM D3139.
 - 1) Gaskets and lubricants shall be made from materials that are compatible with the plastic material and with each other when used together. They shall not support the growth of bacteria and shall not adversely affect the potable qualities of the water that is to be transported.
 - 2) Furnish one elastomeric gasket with each length of bell-end pipe.
- c. Restrained Joint
 - 1) Permanent (primary) restraint for all buried PVC pipe fittings must be accomplished using concrete thrust blocks. Temporary (secondary) fitting restraint for testing of pipelines can be accomplished using mechanical thrust restraint. Temporary fitting restraint shall be in addition to permanent restraint.
 - 2) Mechanical Wedge Action Type Joint
 - a) Use only where prior to purchase and installation, the type and application of this joint has been approved by District Engineer.
 - b) Restraint devices for nominal pipe sizes 3 inch through 36 inch, consisting of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.
 - c) The devices shall have a working pressure rating that includes a minimum safety factor of 2:1 for all sizes.
 - d) Not allowed for pipe diameters greater than 36 inches.
- d. Joint Deflection
 - 1) Deflection at the joint shall not exceed 1.5 degrees or the maximum deflection recommended by the manufacturer.
 - 2) No deflection of the joint will be allowed for joints which are over-belled or not belled to the stop mark.

B. Fittings

1. Ductile Iron

- a. Provide ductile iron fittings meeting the requirements of ANSI/AWWA C110/A21.10 and/or ANSI/AWWA C153/A21.53.
- b. Wrap fittings in polyethylene encasement per ANSI/AWWA C105/A21.5.
 - 1) Virgin polyethylene raw material conforming to ASTM D4976.
 - 2) Elongation: 800 percent minimum, in machine and transverse directions per ASTM D882.
 - 3) Tensile Strength: 3,600 psi minimum.
 - 4) Dielectric Strength: 800 V per mil thickness, minimum.

- 5) Propagation Tear Resistance: 2,550-gram force minimum in machine and transverse directions per ASTM D1922.
 - 6) Film Thickness: Minimum 0.008 in (8 mil) thickness.
 - 7) Number of Film Layers: Two.
 - c. Coat all hardware with non-oxide grease.
 - d. Provide ductile-iron fittings with minimum rated working pressure of 250 psi.
 - e. Cement-mortar line all ductile-iron fittings conforming to the requirements of ANSI/AWWA C104/A21.4.
 - 2. Fabricated PVC
 - a. Use only where specifically required.
 - b. Fittings (4-inch through 48-inch) shall conform to the applicable requirements of ANSI/AWWA C900 subject to additional requirements specified herein.
 - c. Fabricated PVC fittings 14-inch and larger shall include fiberglass reinforcement permanently bonded to the outside surfaces of the fitting.
 - 3. Clearly label all fittings to identify size and pressure class.
 - 4. Restrain all fittings and valves against thrust forces by installing concrete thrust blocks furnished and installed as indicated on the Contract Drawings.
- C. Tracer Wire: Provide purple No. 12 AWG copper wire, PVC jacketed for underground service.
- D. Service Saddles
- 1. Provide nylon coated ductile iron saddles with stainless steel straps or full circle body clamp double bolted to each side of the saddle on pipe sizes 4 inch through 12 inch.
 - 2. Saddle body shall be manufactured from ductile iron in accordance with ASTM A536.
 - 3. The single strap shall have double bolts on each end of the strap to connect it to the saddle. The ears of the strap shall turn inward and rest against the inside of the strap. The gasket shall be Buna N. The saddle shall be threaded with 1-inch or 2-inch iron pipe threads

2.3 SOURCE QUALITY CONTROL

A. Factory Tests

- 1. General:
 - a. Complete testing in accordance with applicable ANSI/AWWA standards at no additional expense to Owner.
 - b. District Engineer to have the right to witness all testing conducted by Contractor and manufacturer, provided that Contractor's schedule is not delayed for convenience of District Engineer.
 - c. Perform tests on pipe with wall thickness equal to that specified.

B. Preconstruction Testing

- 1. Owner may, at its own cost, subject additional pipe materials, including lining and coating, to testing by an independent laboratory for compliance with this Specification.
 - a. Submit the additional selected samples for testing at no additional cost to Owner.
 - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.

- C. Inspections
 - 1. All pipe materials are subject to inspection at the place of manufacture and in the field, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.
 - 2. Notify District Engineer in writing of the manufacturing starting date, not less than 14 calendar days prior to the start of any phase of the pipe manufacture.
 - 3. During manufacture of the pipe, allow District Engineer access to all areas where manufacturing is in process and permit inspections necessary to confirm compliance with the Contract Documents.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform operations of laying, jointing, testing for defects and for leakage in the presence of District Engineer, and obtain approval. Material found to have defects will be rejected and must be promptly removed from the Site.
- B. Install materials to conform to the requirements of ANSI/AWWA C605, instructions furnished by the pipe manufacturer, and to the supplementary requirements herein.

3.2 EXAMINATION

- A. Verify that excavation will allow a minimum pipe cover as shown on the Contract Drawings and described elsewhere in these Specifications. If existing pipelines are less than minimum cover, connect to existing pipeline and angle pipe as necessary to achieve cover requirements.
- B. Verify that excavations are to the required alignment, grades, and are dry.
- C. Examine pipe and fittings for defects or damage prior to installation. PVC pipe that has been gouged will not be allowed. PVC pipe with minor scratches may be used at the sole discretion of District Engineer.
- D. Do not install any pipe contaminated with petroleum products (inside or outside).
- E. Do not install any pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage. Decision of District Engineer is final as to the acceptability of the pipe to be installed.
- F. Verify all pipe, fittings, aggregates, and all other materials delivered to the Site meet the requirements of these Specifications.
- G. Field verify existing pipe locations and structures where connections are to be made.
- H. Field verify equipment locations and make modifications in piping to properly connect to equipment as necessary, prior to pipe fabrication.

3.3 PREPARATION

- A. Trench Grade

1. Grade bottom of trench by hand to specified line and grade with proper allowance for pipe thickness and pipe base. Grade to form a continuous and uniform bearing and support for pipe between bell holes.
 2. Before laying each section of pipe, check grade and correct irregularities found. Grade may be disturbed for removal of lifting tackle.
- B. Bell (joint) Holes:
1. At each joint, dig bell holes of ample dimensions in bottom of trench, and at sides where necessary, to permit joint to be made properly and to permit easy visual inspection of entire joint.

3.4 INSTALLATION

A. General

1. Store and handle pipe, fittings, etc., carefully and protect against damage, impact shocks, and free fall. Use pipe handling equipment acceptable to District Engineer.
2. Replace or repair all pipe damaged prior to Substantial Completion to satisfaction of District Engineer.
3. Perform trench excavation and backfill conforming to the requirements of APWA Section 31 – Earthwork. Excavate sufficiently in advance of pipe laying operations to enable the alignment and profile to be revised to clear existing utilities and to align with existing connection points. Ensure that pipe zone material is compacted and in full contact with the haunches of the pipe and that the pipe is fully supported.
4. Clean Pipe
 - a. Before placement of pipe in the trench, thoroughly clean each pipe or fitting to remove any foreign substance which may have collected thereon and keep clean thereafter. For this purpose, close the openings of pipes and fittings in the trench during any interruption to the Work.
 - b. Wipe ends of mechanical joint pipe and fittings and of rubber gasket joint pipe and fittings clean of dirt, grease, and foreign matter.

B. Laying Pipe

1. Lay pipe directly on the pipe zone material. No blocking will be permitted.
2. Direction of Laying: Lay pipe with bell end facing in direction of laying. For lines on an appreciable grade, face bells upgrade at discretion of District Engineer.
3. Use short lengths of pipe in and out of each rigid joint or rigid structure. Replace pipe that does not allow sufficient space for proper installation of jointing material with pipe of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
4. Cut pipe by means of saws, power driven abrasive wheels, or pipe cutters, which will produce a square cut. No wedge-type roller cutters will be permitted. After cutting, bevel the end of the pipe using a beveling tool, portable type sander, or abrasive disc.
5. Install PVC pipe such that the indelible identification strip markings on each pipe section are continuously aligned for the total length of the pipeline being installed. Orient the strip marking upward to the 12 o'clock position (top) of the trench opening.
6. Assemble the pipe joint using the NSF certified lubricant supplied by the manufacturer. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint.

7. Prevent floating of pipe prior to completion of backfill operation.
 8. When using movable trench shield, prevent pipe joints from pulling apart when moving shield ahead.
 9. Do not allow foreign material to enter pipe while it is being placed in trench.
 10. Close and block open end of last laid section of pipe to prevent entry of foreign material or creep of gasketed joints when laying operations are not in progress, at close of day's work, or whenever workers are absent from Site.
- C. Unforeseen Obstructions
1. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, District Engineer may change the alignment and/or the grades. Make all such changes by the deflection of joints, or by using additional fittings. However, in no case shall the deflection in the joint exceed the maximum designed deflection recommended by the pipe manufacturer. No joint shall be misfit any amount that will be detrimental to the strength and water tightness of the finished joint.
- D. Steep Grades
1. Except for short runs which may be permitted by District Engineer, lay pipes uphill on grades exceeding 10 percent. Block pipe which is laid on a downhill grade to hold in place until sufficient support is furnished by the following pipe to prevent movement. Install all bends properly as shown on the Contract Drawings.
- E. Cold Weather Protection
1. Do not install pipe on a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. Do not install pipe unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- F. Tapping Saddles
1. Install tapping saddles a minimum of 5 feet from the edge of the saddle to any pipe joint or other saddle. Do not make multiple taps of 6 inches or larger in the same length of pipe without the approval of District Engineer.
- G. Tracer Wire
1. Provide Polyvinyl chloride pipelines with tracer wire secured to the pipe with surface connections provided at all valve boxes drains, air vacs, service laterals, and as required to maintain a maximum distance between surface connections of 500 feet maximum.
 2. Lay tracer wire along the top of the pipe and secure in place with ties or hitches, spaced not more than 10 feet apart.
 3. The copper wire will be used in the future as a means of locating the pipe with an electronic pipe locator.
- H. Metallic Locating Tape
1. For buried pipelines, provide a metallic locating tape laid along the centerline of the pipe trench at a depth of 18 inches below finished grade OR above top of pipe. Furnish manufacturer's literature, completely describing the tape proposed to be furnished. Do not install tape prior to receipt of written approval of District Engineer.

3.5 PIPE APPURTENANCES

A. Valve Installation:

1. Handle all valves in a manner to prevent any injury or damage to any part of the valve.
2. Clean and prepare all joints prior to installation.
3. Adjust stem packing and operate each valve prior to installation to assure proper operation.
4. Install all valves in the location shown on the Contract Drawings, with valve stems plumb.

3.6 CORROSION PROTECTION

A. Polyethylene Encasement

1. Encase ductile-iron fittings, and valves in accordance with ANSI/AWWA C105/A21.5, Method A.
2. Cut polyethylene tube approximately 2 feet longer than fitting length.
3. Slip tube around fitting, centering to provide 1-foot overlap on each adjacent pipe section.
4. Wrap and tape encasement snug around fittings and valves.

3.7 FIELD TESTS

- #### A.
- Conduct testing of the pipeline in accordance with Section 33 13 00 – Water Pipeline Testing as applicable.

3.8 CLEANING

- #### A.
- As pipe laying progresses, keep the pipe interior free of all debris. Completely clean the interior of the pipe of all sand, dirt, mortar splatter, and any other debris following completion of pipe laying, pointing of joints, and any necessary interior repairs prior to testing the completed pipeline.

3.9 PROTECTION

- #### A.
- Protect the openings of all pipe and specials with suitable bulkheads to prevent unauthorized access by persons, animals, water, or any undesirable substance. At all times, provide means to prevent the pipe from floating.

END OF SECTION

SECTION 33 13 00 WATER PIPELINE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Perform flushing and testing of all pressure pipelines and appurtenant piping, complete.
- B. This applies to all pipelines requiring hydrostatic tests (water medium) regardless of the pipeline service medium.

1.2 SUBMITTALS

- A. A testing schedule, including proposed plans for water conveyance, control, disposal, and disinfection shall be submitted in writing for approval a minimum of 7 days before testing is to start.

PART 2 - PRODUCTS

2.1 MATERIALS REQUIREMENTS

- A. All test equipment, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor subject to the District Engineer's review. No materials shall be used which would be injurious to the construction or its future function.
- B. Used pressure gauges shall be recertified prior to testing.

PART 3 - EXECUTION

3.1 GENERAL

- A. Water for testing water pipelines shall be furnished by the Contractor. Make all necessary provisions for conveying the water from the source to the points of use, and disposal of the water.
- B. All pressure pipelines shall be tested. Testing operations shall be performed in the presence of the District Engineer or Inspector.
- C. Pipeline pressure tests will include the following tests:
 - 1. Hydrostatic pressure test of the complete pipeline, in segments as required to match pipe pressure class.
- D. Notification: Notify the District Engineer at each of the following stages:
 - 1. Three working days prior to the start of filling the pipeline with water.
 - 2. Three working days prior to the start of flushing.

3.2 HYDROSTATIC TESTING OF PIPELINES

- A. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. Test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. Be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. Provide sufficient temporary air tapping in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. In sections tested where no air valves exist, provide temporary air valves for the automatic venting of air and vacuum protection. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open prior to and during filling.
- B. The pipeline shall be filled at a rate not to exceed 2-feet per second as calculated by using the cross-sectional area based on the inside diameter of the pipe and which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the escape of air from any air pocket. No personnel shall be within or enter any vault or confined space subject to flooding during the initial filling and for a 24 hour period. After the 24 hour period bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the District Engineer shall be taken.
- C. The hydrostatic test shall consist of holding a test pressure of 200 psi on the pipeline for a period of 2 hours measured at the lowest point of the pipeline section being tested, or as noted on the drawings. All visible leaks shall be repaired.
- D. The maximum allowable leakage for distribution and transmission gasketed joint pipelines shall be 10 U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 40-foot or greater lengths between joints and with rubber-gasketed joints and 20 U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 20-foot or less lengths between joints and with rubber-gasketed joints. Pipe with welded joints shall have no leakage.
- E. In the case of pipelines that fail to pass the prescribed leakage test, determine the cause of the leakage, take corrective measures necessary to repair the leaks, and again test the pipelines at no additional cost to the Owner.
- F. The pipeline shall be drained after successful completion of the hydrostatic test.

END OF SECTION

DIVISION 40

PROCESS INTEGRATION

**SECTION 40 05 50
VALVES & FITTINGS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide miscellaneous valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Submittal Procedure.
- B. Shop Drawings: Shop Drawings shall contain the following information:
1. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number.
 2. Complete information on valve actuator, including size, manufacturer, model number, limit switches, and mounting.
 3. Cavitation limits for control valves.
 4. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, handwheels, position indicators, limit switches, integral control systems and control systems.
 5. Calculations showing dynamic seating and unseating torque versus output torque of the actuator.
 6. Complete wiring diagrams and control system schematics.
- C. Technical Manual: The Technical Manual shall contain the required information for each valve.
- D. Spare Parts List: A Spare Parts List shall contain the required information for each valve assembly, where indicated.
- E. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. General: Valves and gates shall be new and of current manufacture. Buried valves shall be provided with valve boxes, covers and valve extensions.
- B. Protective Coating: The exterior surfaces of all valves and the wet interior surfaces of ferrous valves of sizes 4-inches and larger shall be coated in accordance with Section 09 90 00 – Painting and Coating. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications. Flange faces of valves shall not be epoxy coated.

- C. Valve Testing: As a minimum, unless otherwise indicated or recommended by the reference Standards, valves 3-inches in diameter and smaller shall be tested in accordance with manufacturer's standard and 4-inches in diameter and larger shall be factory tested as follows:
1. Hydrostatic Testing: Valve bodies shall be subjected to internal hydrostatic pressure equivalent to twice the water rated pressure of the valve. Metallic valves rating pressures shall be at 100 degrees F and plastic valves shall be 73 degrees, or at higher temperature according to type of material. During the hydrostatic test, there shall be no leakage through the valve body, end joints, or shaft seals, nor shall any part of the valve be permanently deformed. The duration shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes.
 2. Seat Testing: Valves shall be tested for leaks in the closed position with the pressure differential across the seat equal to the water rated pressure of the valve. The duration of test shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes. Leakage past the closed valve shall not exceed 1 fluid ounce per hour per inch diameter for metal seated valves and drop-tight for resilient seated valves.
 3. Performance Testing: Valves shall be shop operated from fully closed to fully open position and reverse under no-flow conditions in order to demonstrate the valve assembly operates properly.
- D. Certification: Prior to shipment, submit for valves over 12-inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.
- E. Valve Marking: Valve bodies shall be permanently marked in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MANUAL ACTUATORS

- A. Buried Valves
1. Unless otherwise indicated, furnish buried valves with extension stems to grade, with square nuts or floor stands, position indicators, and cast-iron or steel pipe extensions with valve boxes, covers, and operating keys.
 2. Where indicated, install buried valves in cast-iron, concrete, or similar valve boxes with covers of ample size to allow operation of the valve actuators. Permanently label covers of valve boxes as required by the Owner, local Utility Company or Engineer. Furnish with wrench nuts that comply with AWWA C500.
- B. Floor stands
1. Valve floor stands shall be cast iron or fabricated steel pedestals. The centerline of the actuator shall be approximately 42 to 48 inches above the base of the pedestal.
- C. Tee Wrenches
1. Furnish buried valves with floor with 2 operating keys or 1 key per 10 valves, whichever is greater. Size tee wrenches so that the tee handle will be 2 to 4 feet above ground and fit the operating nuts.

2.3 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Combination Air Valves
 - a. APCO (Valve and Primer Corporation)
 - b. Val-Matic (Valve and Manufacturing Corporation)
 - c. No Equal.
 2. Corporation Stops
 - a. Ford Meter Box Company, Inc.
 - b. James Jones Company (Watts, ACV)
 - c. Jones (A Mueller Brand)
 - d. Pineview Water Systems Engineer approved equal.
 3. Resilient Seated Gate Valves (2-inches)
 - a. Mueller Company
 - b. No Equal.
 4. Resilient Seated Gate Valves (3-inches and larger)
 - a. American Flow
 - b. Kennedy
 - c. Mueller Company
 - d. Or District Engineer Approved Equal.
 5. Gate Valves (Smaller than 2-inch)
 - a. Smith Cooper Series 9101L
 - b. No Equal.
 6. Double Offset Butterfly Valves (4-inches and Larger) Class 150B and 250B
 - a. VAG Armaturen, EKN Double Offset
 - b. AV-Tek Dex Double Offset
 - c. No Equal.
 7. Hydrant Blowoff
 - a. Vertical Mainguard No 78, Kupferle Water Solutions
 - b. No Equal.
 8. Flow Meters (1-inch to 6-inch)
 - a. Metron-Farnier
 - b. Neptune as determined by District Engineer in areas with poor cell service.
 - c. No Equal.
 9. Pressure Reducing Valves
 - a. Cla-Val
 - b. Or District Engineer Approved Equal.

2.4 MATERIALS

- A. General: Materials shall be suitable for the intended application. Materials shall be high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Unless otherwise indicated, valve and actuator bodies shall conform to the following requirements:
1. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 2. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

3. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service.
4. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications.
5. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel.
6. PVC: Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454.
7. CPVC: Chlorinated Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447.

2.5 AIR-VACUUM AND AIR-RELEASE VALVES

- A. All air valves shall be combination air release and vacuum valves.
- B. All air valves shall be outfitted with low durometer seating to provide drop tight seating at pressure as low as 2.9-psi.
- C. All air valves shall be capable of vertically fitting within the allowable pipe cover depth.
- D. Air and Vacuum Valves: Air and vacuum valves shall be capable of venting large quantities of air while pipelines are being filled and allowing air to re-enter while pipelines are being drained. They shall be of the size indicated, with flanged or screwed ends to match piping. Bodies shall be of either fusion bonded high-strength cast iron or 304 stainless steel. The floats and moving parts shall be constructed of Type 316 or Type 304 stainless steel, HDPE, or Buna-N and be capable of sealing to the pressures specified. Seat, washers, O-rings, and gaskets shall be of a material insuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 175 psi water-working pressure, unless otherwise indicated. The manufacturer shall have ISO-9001, and third-party vacuum testing to certify sizing and performance. CFD, FEA or other types of theoretical modeling are not acceptable. Valve shall have a 2-year in-service warranty for all internal components, include top and bottom flushing ports.
- E. Air-Release Valves: Air-release valves shall vent accumulating air while system is in service under pressure and be of the size indicated. Valves shall meet the same general requirements as indicated for air and vacuum valves except that the vacuum feature will not be required. Valves shall be designed for a minimum water-working pressure of 175 psi, unless otherwise indicated.
- F. Combination Air Valves: Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting large quantities of air while a system is being filled or drained, respectively. Valves shall have the same general requirements as indicated for air and vacuum valves.

2.6 CORPORATION STOPS

- A. Unless otherwise indicated, corporation stops shall be made of solid brass for key operation, with screwed ends with corporation thread or iron pipe thread, as required. Note that corporation stops on special chemical diffuser ports shall be 316 stainless steel – unless indicated otherwise.

2.7 RESILIENT-SEATED GATE VALVES

- A. Construction: Resilient-seated gate valves shall conform to AWWA C509 - Resilient-Seated Gate Valves for Water Systems AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service. The valves shall be suitable for a minimum design working water pressure of 150 psig with flanged, bell and spigot, or mechanical joint ends. The valve body, bonnet, and disc shall be of cast iron or ductile iron and the disc or body shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 1 of AWWA C509 AWWA C515. The stem, stem nuts, glands, and bushings shall be bronze, with the stem seal per AWWA C509 AWWA C515.
- B. Pressure Ratings:
 - 1. AWWA C509 valves that are 3, 4, 6, 8, and 12 inches in size shall be rated for 200 psig minimum design working water pressure, and 16-, 20-, 24-, and 30-inch valves shall be rated for 150 psig minimum design working water pressure.
 - 2. AWWA C515 valves 3- through 36-inch with outside screw-and-yoke (OS&Y) rising stem and 3- through 16-inch for non-rising-stem (NRS), shall be rated for 200 psig minimum design working water pressure.
- C. Protective Coating: Valves shall be factory coated in accordance with Section 09 90 00 - Painting and Coating. Submit a test report from a coating inspector that the coating is holiday-free. Be aware that it may retain the services of a third party coating applicator to achieve the holiday-free requirement.

2.8 GATE VALVES (SMALLER THAN 3-INCHES)

- A. Construction: Gate valves smaller than 3-inches, for general purpose use, shall be non-rising stem, heavy-duty type for industrial service, with screwed or soldered ends to match the piping. The bodies shall have union bonnets of bronze conforming to ASTM B 62 - Composition Bronze or Ounce Metal Castings. The stems shall be of bronze conforming to ASTM B 62, or ASTM B 371 - Copper-Zinc-Silicon Alloy Rod. The solid wedges shall be of bronze conforming to ASTM B 62. The valves shall have malleable iron handwheels unless otherwise indicated, and stem seals shall be of Teflon-impregnated or other acceptable non-asbestos packing. Valves shall have a pressure rating of minimum 125 psi steam and 200 psi coldwater, unless otherwise indicated.

2.9 DOUBLE OFFSET BUTTERFLY VALVES 4-INCH AND LARGER – CLASS 150B AND 250B

- A. General: The butterfly valve shall be designed expressly for waterworks applications and shall be of the double offset design whereby the elastomeric seal is not compressed with the valve in the open position. Zero, single and API based triple offset butterfly valve designs are not acceptable. Butterfly valves for water working pressures up to 150 psi shall conform to ANSI/AWWA C504 Class 150B. Butterfly valves for water working pressures greater than

150 psi shall conform to the design requirements of ANSI/AWWA C-504, Class 250B. Valves shall be of the size and class indicated in the valve schedule or in the plans. All valves, unless noted otherwise, shall be sized for bi-directional water service, full rated pressure and a line velocity of 16 feet per second and suitable for higher linebreak velocities of 50 fps. Lifting lugs will be provided for all valves 24" and larger.

- B. Flanges: Class 150B flanged valves shall have ANSI B16.1 Class 125-pound flanges. Class 250B flanged valves shall comply with ANSI B16.1 Class 250 up through 48-inch unless otherwise noted or if mating to ductile iron pipe. Above 48-inch, flange outside diameter, number of bolts, diameter of bolt circle, and diameter of bolts shall comply with ANSI/AWWA C 207 Class E.
- C. Body: Valve bodies shall be ductile iron, ASTM A536 65-45-12 or A536 60-40-18. Cast gray iron is not allowed due to near zero elongation and as it vulnerable to shear stress. The valve body shall include integrally cast support feet top and bottom. It shall be mechanically equipped with a fastened stainless steel stamped or engraved tag indicating manufacturer and reference build data. Valves 54-inch and larger shall include two tags diametrically opposed. The valve build data shall be made available upon request by the customer and shall be retained by the manufacturer for no less than 20 years unless noted longer. The entire valve body and flanges shall be epoxy corrosion coat protected except for the valve shaft bores.
- D. Disc: The disc shall be ductile iron ASTM A536 65-45-12 or ASTM A536 60-40-18. The entire disc and all its wetted surfaces shall be coated without exception. The disc's elastomeric seal retainer shall be 304 or 316 stainless steel. Neither bronze nor carbon steel is acceptable. Both the disc and elastomeric seal retainer shall have recesses designed to retain a dual shouldered seal under extreme localized velocities, at full differential opening and/or linebreak closing. The disc shall be mechanically fastened to the valve shaft by using Polygon "no fail" connection or equivalent stainless steel key connection or the disc shall be mechanically fastened to the valve shaft using tangential stainless steel shaft pins of type 316 or higher alloy. Disc pins shall extend completely through the valve and shall be mechanically fastened. The disc shall be completely coated except for the disc shaft bores.
- E. Shaft: Valve shafts shall be dual stub shafts of stainless steel ASTM A240 or A276, Type 316, 304, 431 or 420. The valve shaft material and thickness shall be suitable for the applications pressure and velocity without the use of its safety factors. Shafts may not be turned down to fit drive splines without accompanying torsional strength reduction calculations and its effect on the safety factor.
- F. Elastomeric Seal and Seal Ring: Valve seals shall be EPDM, secured to a completely coated valve disc by a 316 stainless steel, continuous non-segmented seal ring and secured by 316 stainless steel fasteners. The seal shall not scallop, cold flow or tear at localized velocities less than 300 fps. The elastomeric seal shall not be penetrated by fasteners. The valve shall be bi-directionally leak free. The elastomeric seal shall be double shouldered and extend no greater than 0.25 inches past the disc edge to seat the valve. The seal shall be designed to flex in either flow direction. The elastomeric seal shall be field replaceable and adjustable in line. It shall not require special skills or tools to replace the seat. Seat methods which do not comply or use either irreplaceable vulcanized seals or which use hardened epoxy or grout in a dovetailed groove are not acceptable.

- G. **Metallic Seat:** The metallic valve seat shall be located in the valve body. It shall be a highly wear resistant stainless steel alloy. There shall be no gap between the valve body and metallic body seat and consequently no potential for corrosion or lifting of the seat. The seat shall be applied through a high alloy weld overlay process or other manufacturing technique. Metallic seats shall not be mechanically retained by fasteners.
- H. **Shaft Seals:** Shaft seals shall not need periodic manual adjustment. They shall be multi-O-ring seals protecting both the OD and ID of the shaft bearings. They shall prevent pressurized system water from entering the uncoated valve disc hub and valve body shaft bore. The valve shaft shall remain non-wetted and unpressurized. The non-wetted shaft shall allow the actuator to be removed without dewatering the pipeline. It shall prevent debris and system pressurized water from entering into the uncoated valve body shaft bore. It shall prevent waters or contaminated media, external to the valve, from entering through the valve shaft under vacuum/ negative pressure conditions in the pipeline, or hydrostatic pressure conditions external to the valve. Neither manual pulldown packing glands nor braided packing are allowed. The outer shaft seals shall be a replaceable cartridge type, bolted to the valve body. Packing shall not be held in place with an adapter plate or by the valve actuator.
- I. **Shaft Bearings:** Valve shaft bearings shall be corrosion resistant, self-lubricating sleeve type made of bronze, stainless steel or stainless steel backed PTFE. Bearing choice and consequent bearing friction shall be correctly added to valve input torque requirements.
- J. **Strength:** The proportion and dimensions of all parts of the valve and actuator shall be designed to withstand, without failure, the stresses occurring under the testing and operating conditions. The maximum allowable stress in any material shall not exceed 1/5 of the ultimate tensile strength or 1/3 of the minimum yield strength. Class 150B valves shall be rated to 150 psi and Class 250B valves shall be rated to 250 psi applied to one side of the disc with zero pressure applied to the other side of the disc while in the closed position, without damage or permanent deformation to any part of the valve, seat, disc or shaft. The valve shall be capable of withstanding such pressures in both directions.
- K. **Safety Disc Pinning:** Where noted herein, where noted on the plans or in the bid documents, an integrated safety locking device shall be incorporated. The valve shall have an externally lockable disc in the closed position. Calculations shall be provided to verify that the disc cannot rotate even with the full stall output torque of the actuator. The disc shall remain in the zero leak sealed closed position even if the entire actuator is removed for safety or maintenance. With the actuator and or the adapter plate removed, the valve will not leak through the stem. The locking device shall be handwheel operated; stainless steel wetted construction, pad lockable and suitable for lockout/tag out safety procedures.
- L. **Manual Actuators:** All actuators shall be self-locking and shall hold the valve disc in the closed, open and any intermediate position without creeping or fluttering. All actuators shall incorporate a mechanical stop-limiting device to prevent over travel of the disc. Unless direct buried or otherwise indicated, all manually actuated butterfly valves shall be equipped with a handwheel and external position indicator. The number of turns for direct buried valves shall be a minimum of 1.4 times the nominal valve size with no fewer than 25 turns. The valve manufacturer shall be responsible for mounting and testing the actuator. Screw-type (traveling nut) actuators are not permitted due to their inconsistent output torques through the 90 degree stroke. All manual direct buried service actuators shall be designed for a 300

foot-pound input torque against the closed and open travel stops. The owner reserves the right to field verify.

- M. Worm-Gear Actuators: All valves including submerged and buried valves, shall be equipped with top tier AWWA worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing. Buried service valves shall be 90% or greater, grease packed. Submerged service valves in potable water applications shall be 100% grease filled with FDA approved food grade grease. Documentation for the selected grease for submerged service valves shall accompany submittals. The owner reserves the right to field verify grease levels. Non-complying gears shall be remedied by the factory, verified by the customer and signed off by both parties. Gears are recommended to be Auma and are required to be of an equal or better quality. No name or unbranded actuators will not be accepted.
- N. Hardware: All fasteners and hardware in non-wetted areas shall be type 316 Stainless Steel.
- O. Coatings and Linings: The manufacturer is required to have and follow a system of valve preparation and coating which assures a quality, holiday free application and which maximizes the available multi-decade protection the coating offers. Submit holiday test prior to shipment.
- P. The manufacturer must provide their written system of valve preparation and coating. This document shall include the methodologies used (quality compliance, QC) as well as post application review (quality assurance, QA).
 - 1. Valves 48-inch and smaller: All external and internal surfaces except for the seating surface shall be 400 degree F plus, heat bonded fusion coated. Coating damaged in shipping or installation shall be noted and properly repaired to the satisfaction of the utility or its authorized agent.

2.10 HYDRANT BLOWOFF

- A. Unless otherwise indicated, blow-off hydrants shall be non-freezing, self-draining type with a 2" FIP inlet, horizontal configuration, a non-turning operating rod, and shall open to the left. All working parts shall be of bronze-to bronze design with an aluminum plunger and serviceable from above grade with no digging. The outlet shall be bronze and be 2 ½ NST or smaller. Hydrants shall be lockable to prevent unauthorized use as manufactured by Kupferle Foundry Co.

2.11 FLOW METERS

- A. Unless otherwise indicated, flow meters shall be as follows:
 - 1. 1" diameter: Metron Farnier Model 50DLC
 - 2. 1.5" diameter: Metron Farnier Model 88DL
 - 3. 2" diameter: Metron Farnier Model S130
 - 4. 4" diameter: Metron Farnier Model S500
 - 5. 6" diameter: Enduro
 - 6. 1" – 6" diameter: Neptune Mach-10 w/ Multi-Carrier Cellular Unit, as determined by the District Engineer
 - 7. 1" – 6" diameter: Neptune Mach-10 w/ Multi-Carrier Cellular Unit and Pressure Sensor, as determined by the District Engineer

2.12 FLANGED VALVES, SIZES 1-1/2 INCHES THROUGH 42-INCHES

- A. Valve Body: The valve body shall be of cast iron to ASTM A 48 - Gray Iron Castings, or ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings, with 125 lb flanged ends to ANSI/ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800. The valve cover shall be flanged and be the same material as the body.
- B. Valve Trim: The valve stems with position indication, springs, body seat rings, and bolts, nuts, and washers shall be of Type 303, or 316 stainless steel. The valve stems shall have top and bottom guides. Rubber parts shall be Buna-N. The diaphragms shall be of Nylon-reinforced Buna-N, supported firmly between body and valve cover. The valve pistons and piston liners shall be bronze to ASTM B 62 - Composition Bronze or Ounce Metal Castings.
- C. Valve Controls: The valve shall be provided with a complete, externally mounted control system, including speed control needle valves, strainers, check valve, isolation valves, and necessary copper or stainless steel connecting tubing and fittings. The controls shall be capable of achieving the flow and speed adjustment indicated.
- D. Factory Tests and Warranty: Valves shall be factory tested with a hydrostatic test and a functional test and a test certificate shall be submitted to the Engineer prior to delivery of the valve. The valve shall be warranted for a period of 3 years from the date of shipment to be free of defects in materials and workmanship.
- E. Spare Parts: The following spare parts shall be furnished:
 - 1. One set of all resilient seals and discs.
 - 2. One diaphragm (for diaphragm valves, only).

2.13 SERVICE CONNECTIONS

- A. Service Saddles: Service connection saddles to PVC pipe shall be saddles specifically designed for plastic pipe (equal to Romac 202-NS) with nylon coated head and stainless steel straps. Reducing bushing shall be brass.
- B. Service Pipe: Pipe for water service shall be 200 psi CTS pipe size high molecular weight polyethylene tubing.
- C. Main Sprinkler Pipe: Pipe connecting master valve to property's irrigation system shall be 125 psi (minimum) IPS HDPE.
- D. Service Adapters: Adapters to poly pipe shall be of a brass compression style, with stainless steel insert stiffener.
- E. Service Valves: Service connection valves shall be Smith and Cooper 9101L brass gate valves, 300 psi rating.
- F. Service Fittings: All tees, caps, plugs, bends, adapters etc shall be brass.
- G. Service Valve Boxes: Service valve boxes shall be Carson #708-9-4 or equivalent, unless otherwise determined by the District Engineer.
- H. Service Pit Setters: Service Pit Setters shall be:

1. McDonald 7180-414KNPP 44x18x437 w/DFW18AYP-AF5BF Small IRR-Lid (for 1" service)
2. DFW 1600-12-EAF5MBA IRR Box w2/DFW 1600E-AF5MBA IRR-Lid (for 1.5"-2" service)

PART 3 - EXECUTION

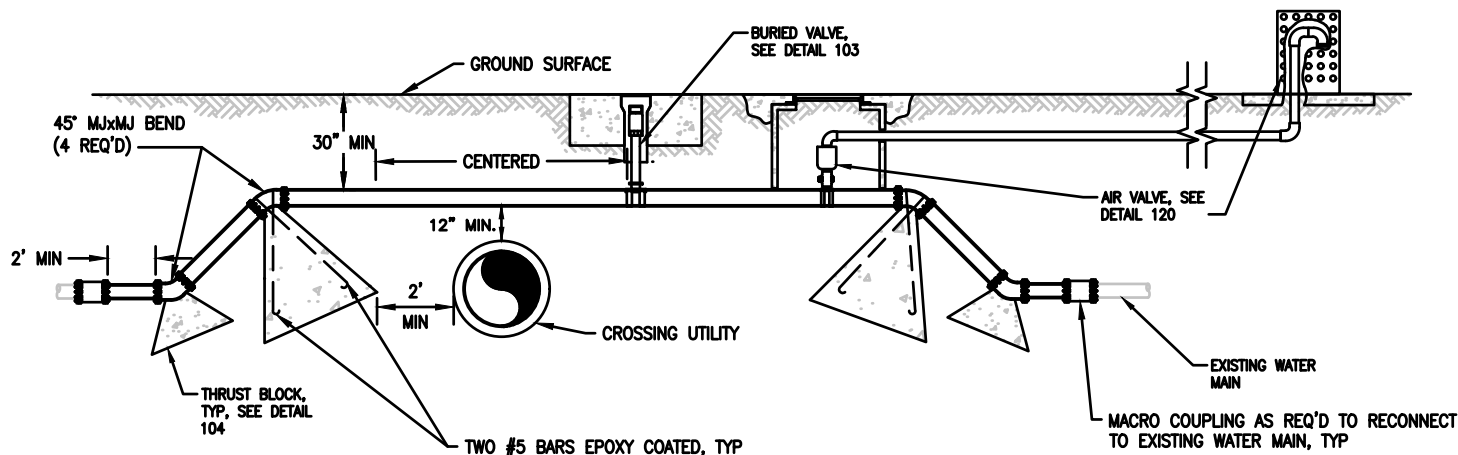
3.1 INSTALLATION

- A. Valves shall be installed in accordance with the manufacturer's printed recommendations. Gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stress on the pipe.
- B. Access: Valves shall be installed with easy access for actuation, removal, and maintenance and to avoid interference between valve actuators and structural members, handrails, or other equipment.

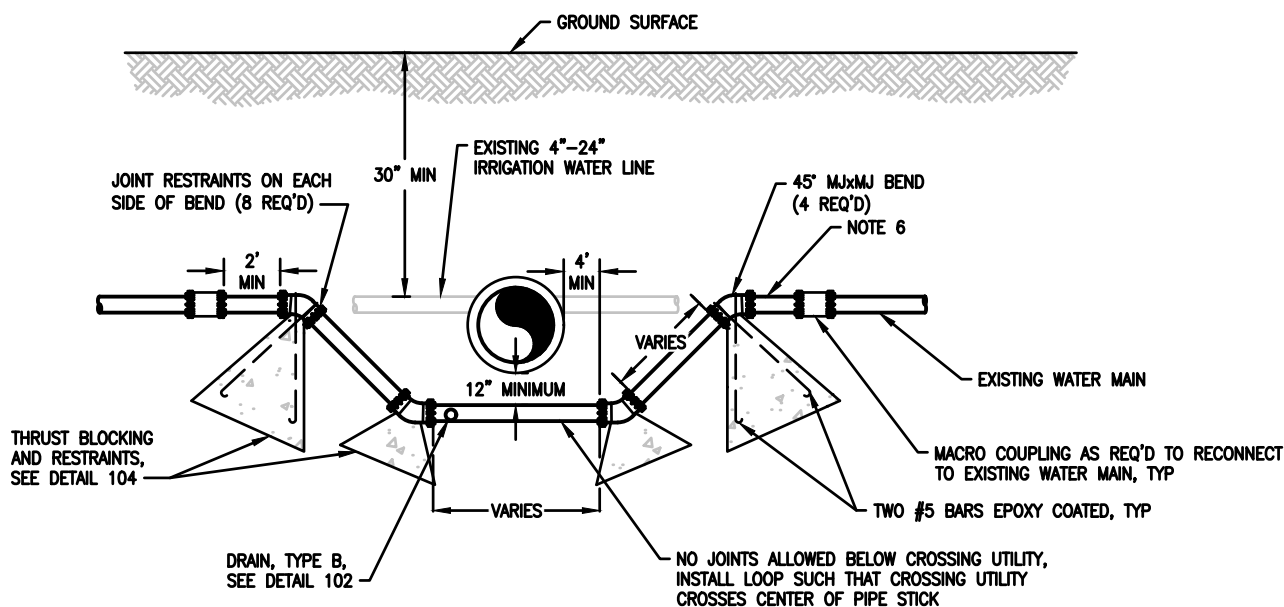
END OF SECTION

PART III

STANDARD DRAWINGS



SECONDARY WATER MAIN LOOP (OVER)



SECONDARY WATER MAIN LOOP (UNDER)

NOTES

1. ALL NEW PIPE SHALL BE PURPLE PVC DR18.
2. MACRO COUPLINGS MUST HAVE A LOW RANGE GASKET WHEN TYING ONTO STEEL LINES.
3. INSPECTION OF INSTALLATION BY DISTRICT REPRESENTATIVE REQUIRED BEFORE BACK FILLING TRENCH.
4. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217. ENCASE ALL METAL PIPE, FITTINGS, VALVES, ETC. WITH V-BIO POLYETHYLENE ENCASUREMENT PER AWWA C105. SECURE ENCASUREMENT WITH PVC PIPE WRAP TAPE. METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES.
5. ALL PIPE, FITTINGS, COUPLINGS, THRUST RESTRAINTS AND BLOCKING ARE TO BE IN ACCORDANCE WITH AWWA SPECIFICATIONS AND APWA REQUIREMENTS UNLESS OTHERWISE SPECIFIED.
6. CONNECTIONS TO STEEL OR TRANSITE PIPE WILL REQUIRE TRANSITION COUPLINGS OR SLEEVES WITH TRANSITION GASKETS AS REQUIRED.
7. MATERIALS SUBSTITUTIONS TO BE SUBMITTED TO ENGINEER FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION AND IN ACCORDANCE WITH SPECIFICATIONS.
8. ALL BENDS AND FITTINGS SHALL REMAIN EXPOSED UNTIL ENGINEER OR OWNER HAS COMPLETED ALL REQUIRED MEASUREMENTS OF THE INSTALLED LOOP. LOOPS BURIED PRIOR TO MEASUREMENT WILL BE REQUIRED TO BE COMPLETELY EXCAVATED AND RE-BACKFILLED AT THE CONTRACTOR'S EXPENSE.
9. DRAWING IS INTENDED FOR REFERENCE ONLY, CONTRACTOR TO PROVIDE ALL FIELD MODIFICATIONS REQUIRED TO COMPLETE THE INSTALLATION AS REQUIRED BY DISTRICT REPRESENTATIVE.

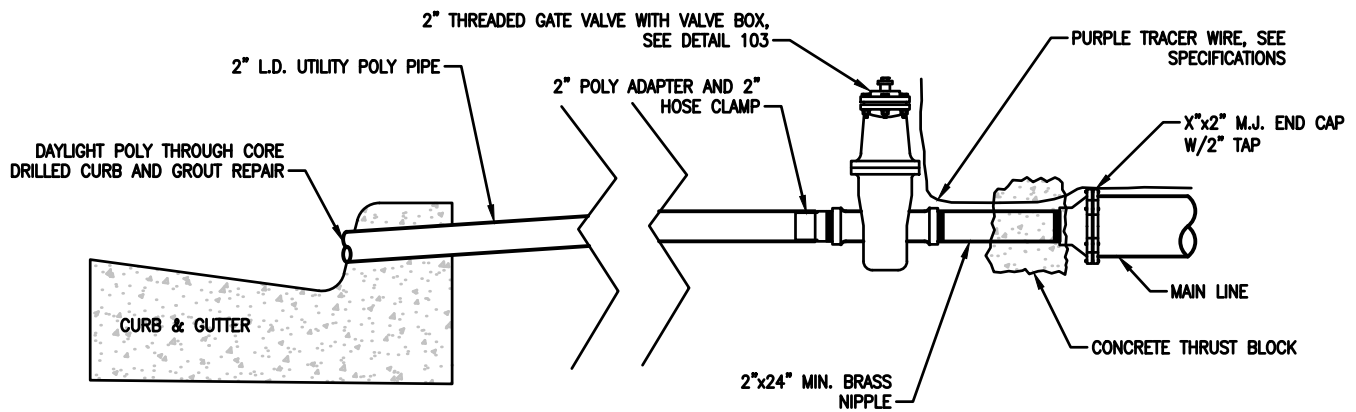
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

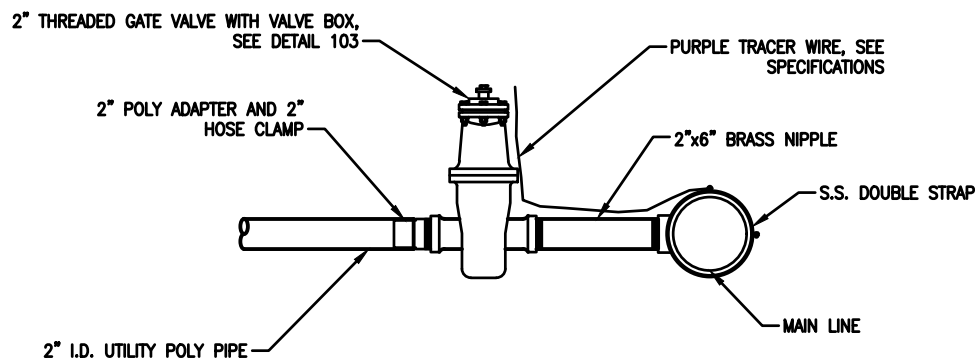
WATER MAIN LOOP

DETAIL 101

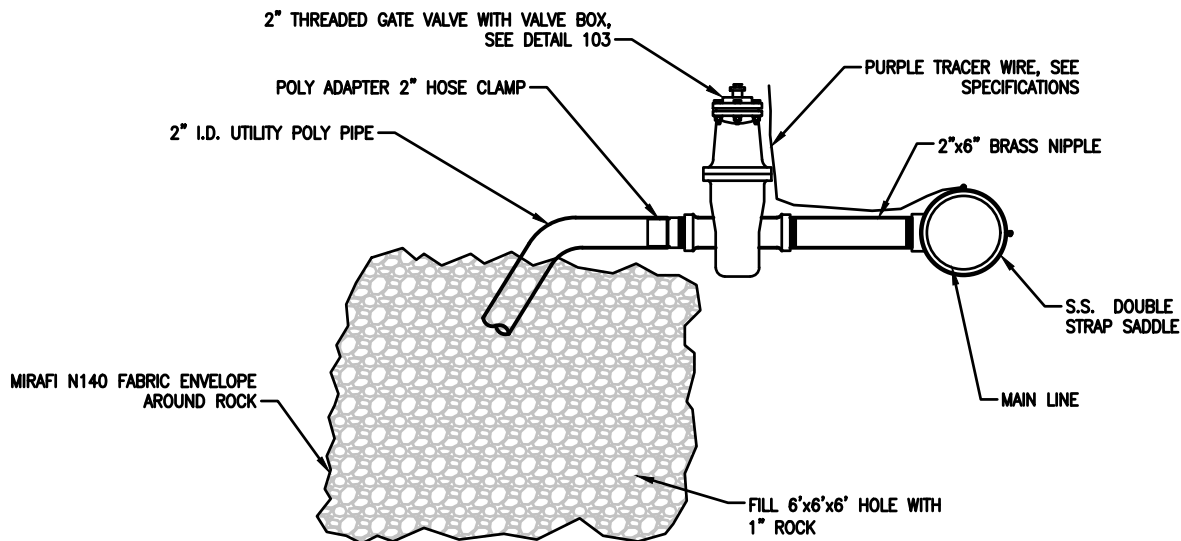
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DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



TYPE A – TYPICAL M.J. REDUCER AND BLOW-OFF DRAIN



TYPE B – TYPICAL DRAIN

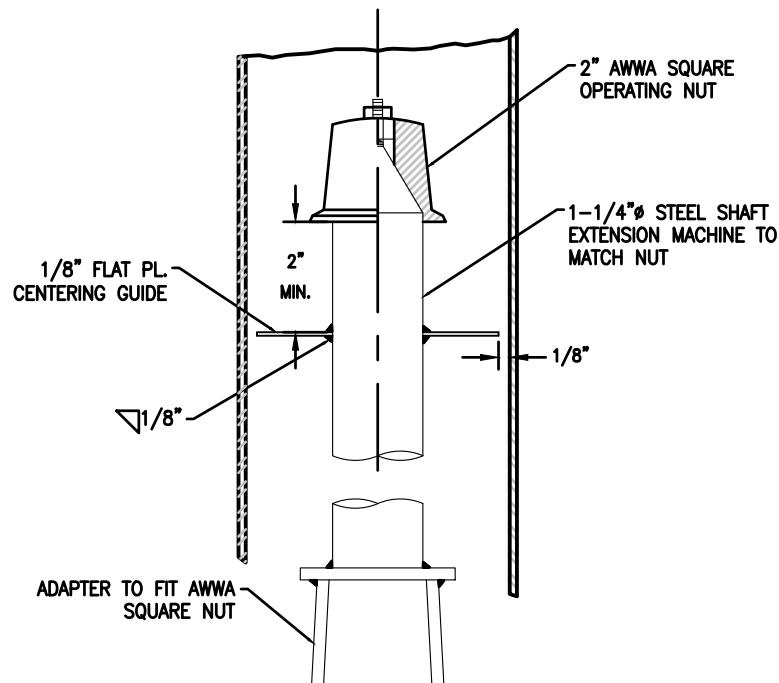
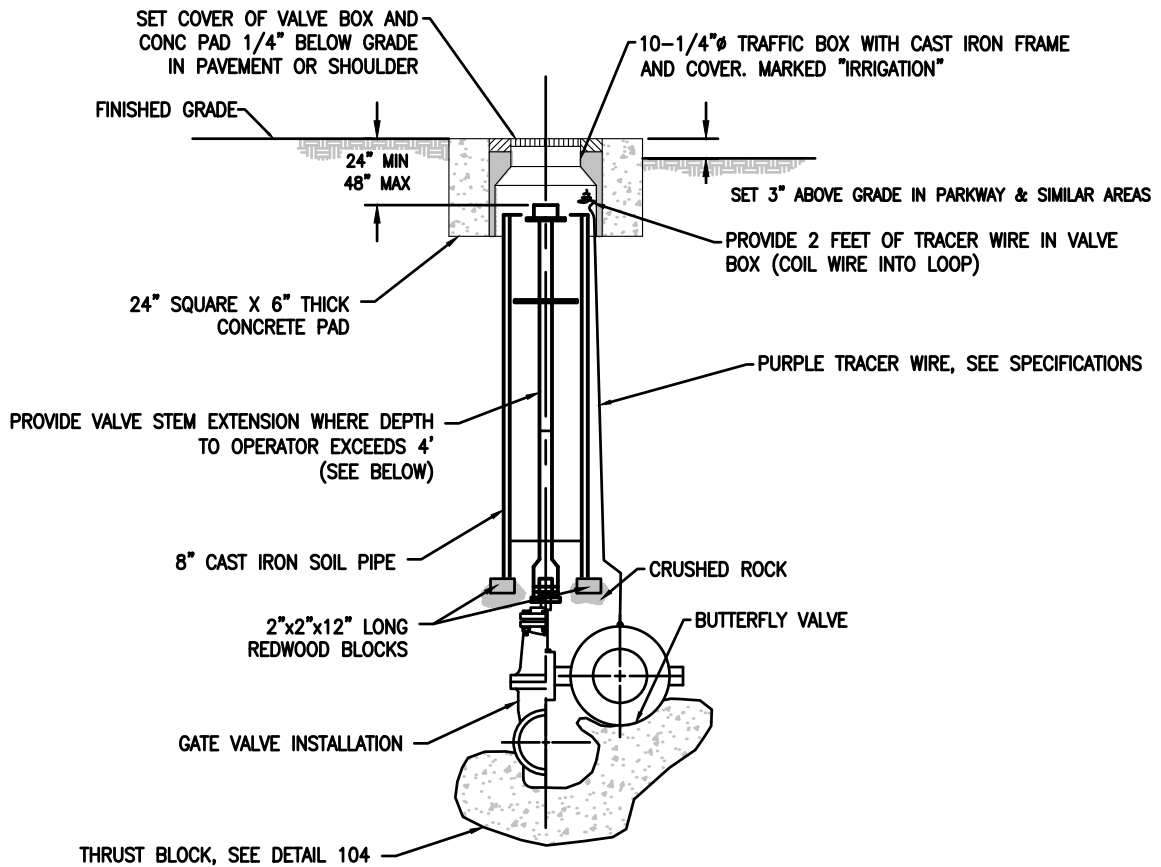


TYPE C – TYPICAL SUMP DRAIN

NOTES:

1. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217. ENCASE ALL METAL PIPE, FITTINGS, VALVES, ETC WITH V-BIO POLYETHYLENE ENCASEMENT PER AWWA C105. SECURE ENCASEMENT WITH PVC PIPE WRAP TAPE. METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES.

#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	DRAIN VALVE	DETAIL 102	
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								DATE: OCT 2026
								DRAWN BY: S. SANDERS
								DESIGN BY:
								SCALE:



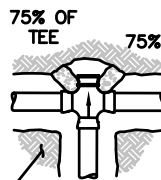
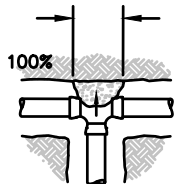
VALVE STEM EXTENSION

NOTES:

1. INSPECTION OF INSTALLATION BY DISTRICT REPRESENTATIVE REQUIRED PRIOR TO BACKFILLING..
2. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217. ENCASE ALL METAL PIPE, FITTINGS, VALVES, ETC. WITH V-BIO POLYETHYLENE ENCASUREMENT PER AWWA C105. SECURE ENCASUREMENT WITH PVC PIPE WRAP TAPE. METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES.
3. ALL BOLTS AND OTHER HARDWARE SHALL BE BLUE BOLTS.
4. VALVES 2" - 12" SHALL BE GATE VALVE, VALVES 14" AND GREATER SHALL BE DOUBLE OFFSET BUTTERFLY VALVES, SEE SPECIFICATIONS

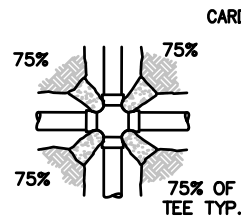
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						DRAWN BY: S. SANDERS
						DESIGN BY:
						SCALE:

BEARING AREA, TYP



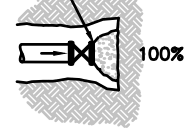
UNDISTURBED
EARTH TYP.

PLANS

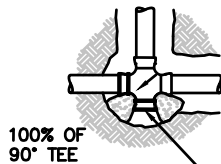


CARDBOARD SEPARATOR

VALVE IF SHOWN
ON PLAN

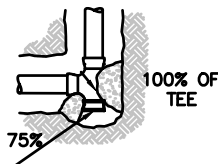


DEAD-END

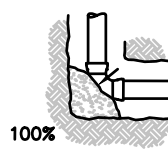


100% OF
90° TEE

PLUG OR CAP



100% OF
TEE

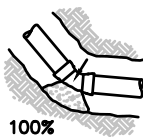


100%

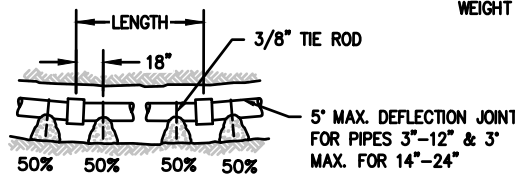


100% OF TEE

VALVE

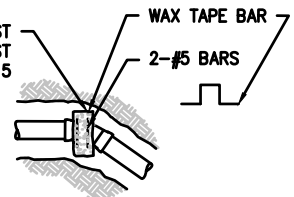


100%



CURVE THRUST BLOCKING

WEIGHT OF CONCRETE TO RESIST
100% OF TOTAL THRUST
SEE TABLE NOTE 5



VERTICAL BEND

DETAIL NOTES:

- FIGURE (100%) AT THRUST BLOCK INDICATES PERCENT OF TOTAL THRUST TO BE APPLIED FOR BEARING AREA.
- ARROW (→) INDICATES THRUST DIRECTION.
- CONCRETE FOR THRUST BLOCKS TO BE 2000 P.S.I. MIN
- ALL MJ AND FLANGED FITTINGS TO BE WRAPPED PER NOTE 4 BELOW PRIOR TO POURING THRUST BLOCK.

SIDE THRUST PER 1 PSI

PIPE SIZE	DEAD END OR TEE	90° ELBOW	45° ELBOW	22½° ELBOW	11½° ELBOW
4	27	39	21	11	6
6	56	80	44	23	11
8	96	137	74	38	20
10	146	206	111	57	29
12	206	291	158	80	41
14	276	390	212	108	54
16	357	504	273	140	71
18	449	633	344	176	89
20	549	777	420	215	108
24	785	1109	600	306	153

* THRUST VALUES INCLUDE A SAFETY FACTOR OF 1.5

SIDE THRUST PER 100 PSI PRESSURE PER DEGREE OF
DEFLECTION - USE FOR CURVE THRUST BLOCKING DETAIL ABOVE

PIPE SIZE	SIDE THRUST-lb.	PIPE SIZE	SIDE THRUST-lb.
4	35	14	566
6	108	16	729
8	183	18	998
10	296	20	1185
12	417	24	1725

* THRUST VALUES INCLUDE A SAFETY FACTOR OF 1.5
MULTIPLY THRUST BY DEGREE OF DEFLECTION TO OBTAIN
TOTAL THRUST MULTIPLY THRUST BY DEGREE OF
DEFLECTION TO OBTAIN TOTAL THRUST

TABLE NOTES:

- IN USING THE ABOVE TABLES, USE THE MAXIMUM INTERNAL PRESSURE ANTICIPATED (I.E. HYDROSTATIC TEST PRESSURE, POSSIBLE SURGE PRESSURE DUE TO PUMP SHUT-OFF, ETC.)
- SEE SOILS REPORT FOR BEARING STRENGTH OF SOIL IN THE ABSENCE OF A SOILS REPORT, AND AVERAGE SOIL (SPADABLE MEDIUM CLAY) CAN BE ASSUMED TO HAVE A BEARING STRENGTH OF 2000 P.S.F. IF HIGH CLAY, USE 1500 P.S.F.
- THRUST BLOCKS ARE NOT REQUIRED ON PVC PIPE WITH SOLVENT WELDED JOINTS.
- ALL MJ FITTINGS TO HAVE PIPE RESTRAINT COLLARS WITH BLUE BOLTS AND WRAPPED TRENTON WAX TAPE PRIMER AND TRENTON WAX TAPE PER AWWA C217. ENCASE ALL METAL PIPE, FITTINGS, VALVES, ETC. WITH V-BIO ENHANCED POLYETHYLENE PER AWWA C105, SECURE ENCASUREMENT WITH PVC PIPE WRAP TAPE, METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES.
- THRUST BLOCKS TO BE INSTALLED IN ACCORDANCE WITH DETAIL SHOWN ABOVE.
- CONCRETE MUST BE ALLOWED TO CURE IN THRUST RESTRAINTS FOR 5 DAYS PRIOR TO PRESSURIZING WATER LINES OR HAVE ADDITIONAL APPROVED THRUST RESTRAINTS INSTALLED PRIOR TO PRESSURIZING THE WATERLINE.

EXAMPLE:

8" 90° ELBOW, PRESSURE=200LB./SQ.IN.
FROM TABLE: THRUST=137 X 200=27400 LB.
ASSUME BEARING STRENGTH OF SOIL=2000 P.S.F.
IF CLAY, USE 1500 P.S.F.

$$\frac{27400}{2000} = 13.7 \text{ SQ.FT.} = \text{AREA OF BEARING REQUIRED FOR THRUST BLOCK}$$

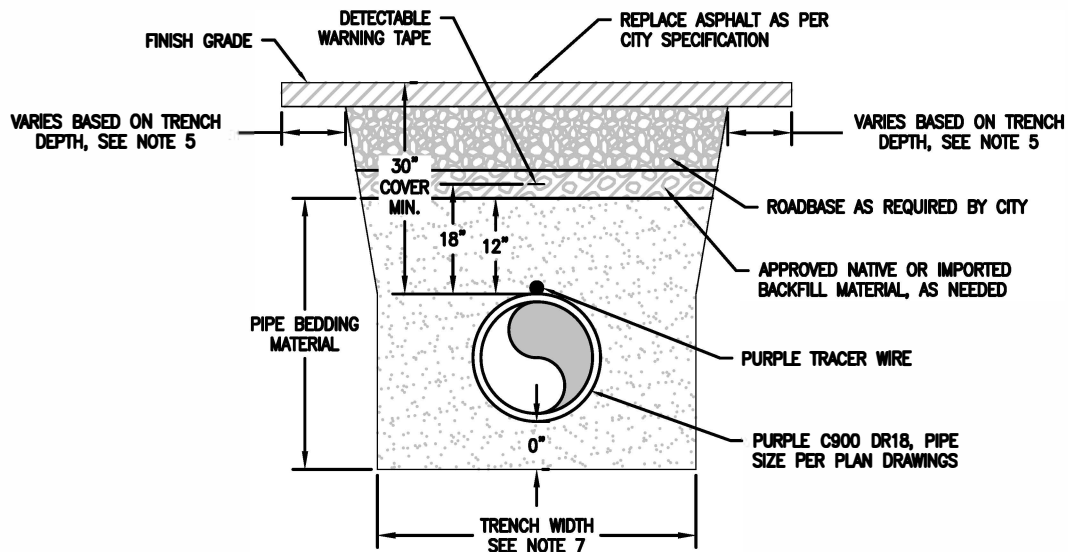
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

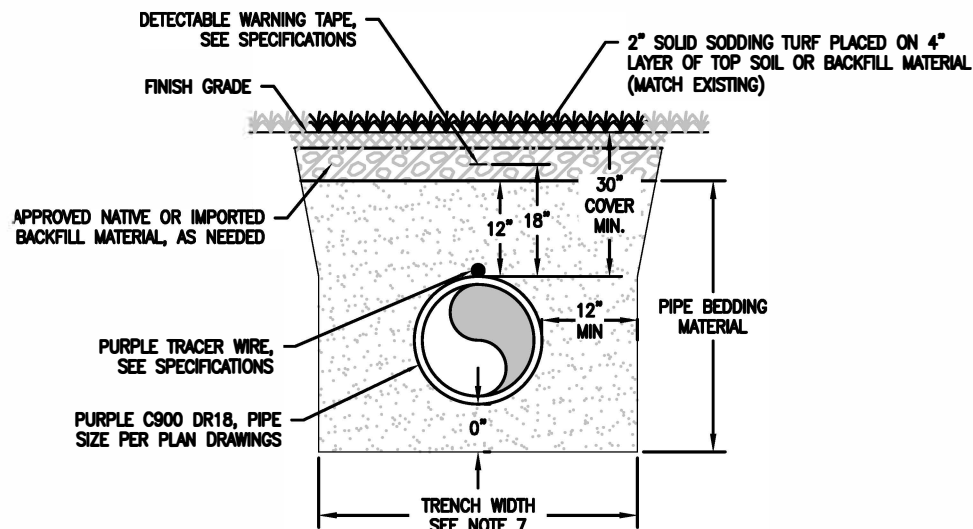
CONCRETE THRUST BLOCKS

DETAIL 104

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



ROAD INSTALLATION



FIELD INSTALLATION

NOTES:

A. VERTICAL TRENCH WALL

- A.1. 3.5 FT. MAX. UNSUPPORTED HEIGHT
- A.2. FOR DEPTH OVER 3.5 FT., SHORING OR SHEATHING REQUIRED

B. SLOPING TRENCH WALL

- B.1. NOT TO BE USED WITHOUT APPROVAL OF ENGINEER
- B.2. REQUIRES "IMPROVED" PIPE ZONE BACKFILL OR INCREASE IN PIPE CLASS.

C. COMBINATION VERTICAL/SLOPING TRENCH

- C.1. TRENCH IN PIPE ZONE SHALL HAVE VERTICAL WALLS WHERE STABLE SOIL EXISTS

1. TRENCH EXCAVATIONS TO BE IN ACCORDANCE WITH OSHA SAFETY AND HEALTH STANDARDS FOR CONSTRUCTION. (29 CFR 1926)
2. CONTRACTOR TO PROVIDE SHORING OR TRENCH BOX IN ROADWAY AREAS TO MINIMIZE TRENCH WIDTH.
3. CONTRACTOR TO PROVIDE ALL DE-WATERING MEASURES AS REQUIRED
4. TRENCH SECTIONS SHOWN DO NOT DESIGNATE PAY LIMITS.
5. AFTER TRENCH IS FILLED AND COMPACTED, FOR EXCAVATION LESS THAN 4' DEPTH, A 2' WIDE SECTION OF ASPHALT WILL BE SAWCUT ON BOTH SIDES OF TRENCH. NEW ASPHALT WILL THEN BE LAYED AS ONE CONTINUOUS LAYER INTO SWATH IN ROADWAY AREAS. FOR EXCAVATIONS GREATER THAN 4' DEPTH, USE 3' WIDE SECTIONS.
6. SEE SPECIFICATIONS FOR TYPICAL TRENCH EXCAVATION AND BACKFILL REQUIREMENTS. COMPACT TO 95% AASHTO T-180.
7. TRENCH WIDTH TO BE 18" FOR 4" MAINS, 12" FOR SERVICE LINES. ANY MAINS LARGER THAN 4" USE 12" WIDTH ON BOTH SIDES OF PIPE.
8. AVOID HIGH POINTS ALONG MAINLINE PIPE INSTALLATIONS. WHERE HIGH POINTS ARE UNAVOIDABLE, COORDINATE WITH DISTRICT REPRESENTATIVE TO DETERMINE IF AN AIR VALVE INSTALLATION IS NECESSARY.
9. AVOID LOW POINTS ALONG MAINLINE PIPE INSTALLATIONS. WHERE LOW POINTS ARE UNAVOIDABLE, COORDINATE WITH DISTRICT REPRESENTATIVE TO DETERMINE IF A DRAIN INSTALLATION IS NECESSARY.

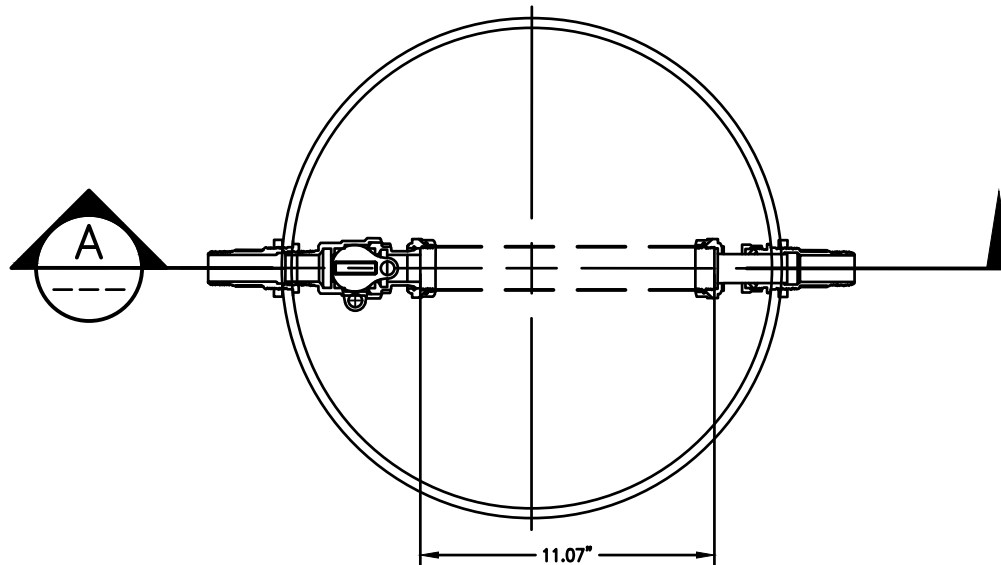
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PINEVIEW WATER SYSTEMS STANDARDS

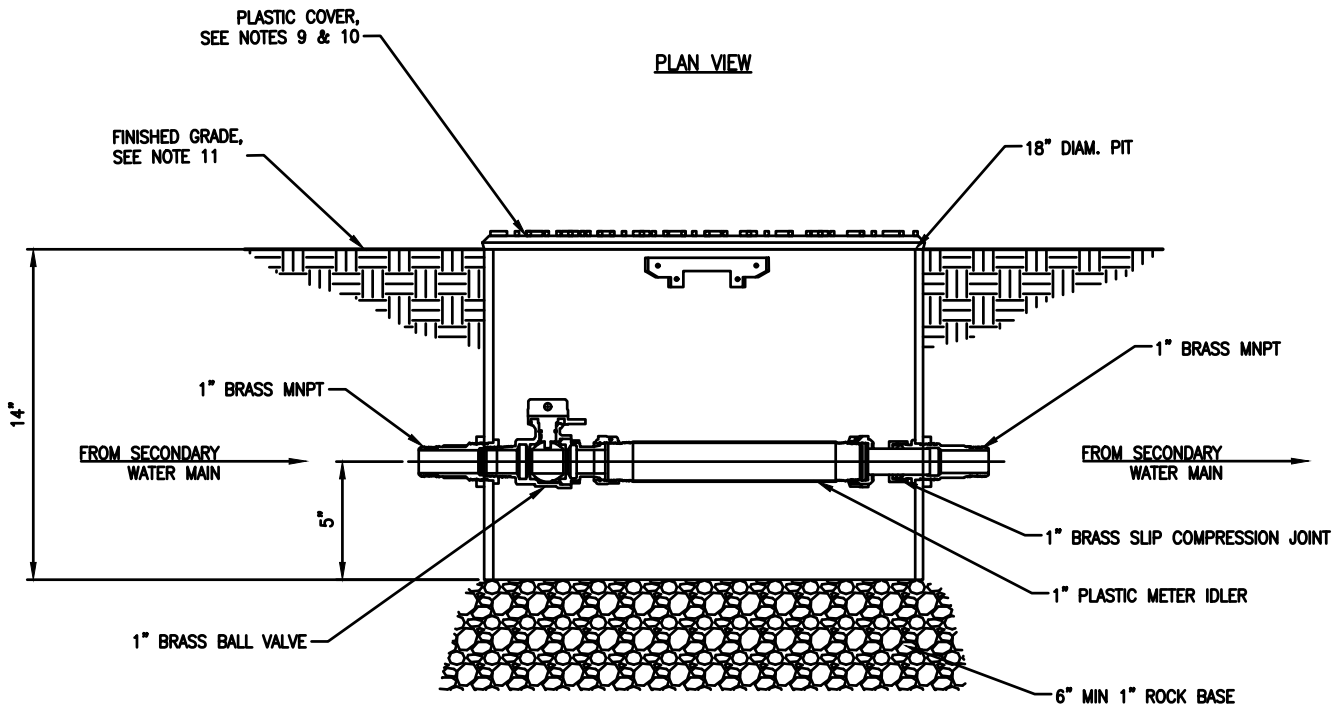
TRENCH SECTION

DETAIL 105

CAD DWG: PWS DETAIL S.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



PLAN VIEW



SECTION A

NOTES:

1. INSTALLATION OF 1" METRON-FARNIER METER TO BE COORDINATED WITH PINEVIEW WATER SYSTEMS.
2. PIT SETTER SHALL BE A.Y. McDONALD NL PIT SETTER - 7180-414KNPP 44X18X437 OR PINEVIEW WATER SYSTEMS APPROVED EQUAL.
3. BRASS COMPONENTS SHALL CONFORM TO ASTM B62 AND ASTM B584, UNS C83600-85-5-5-5.
4. COPPER TUBING SHALL BE MADE IN COMPLIANCE WITH ASTM B75 OR B88, UNS C12200.
5. ALL SOLDER JOINTS SHALL BE LEAD FREE.
6. PIT SHALL BE HEAVY WALL PVC SHELL.
7. LARGE WRENCH FLATS SHALL BE PROVIDED ON PIPE FOR PROPER INSTALLATION.
8. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAP PER AWWA C217 EXCEPT FOR PIPING INSIDE METER VAULT
9. PLASTIC COVER SHALL BE DFW PLASTICS DFW18AYP-AF5BT FOR RETROFIT SERVICES OR DFW18AYP-AF5BF FOR NEW SERVICES.
10. LID SHALL BE PURPLE AND CLEARLY LABELED "IRRIGATION".
11. SOIL SHALL BE COMPACTED LEVEL WITH TOP OF VAULT EXTENDING OUT RADIALLY THREE FEET MINIMUM AND SLOPED AWAY FROM LID FOR DRAINAGE.

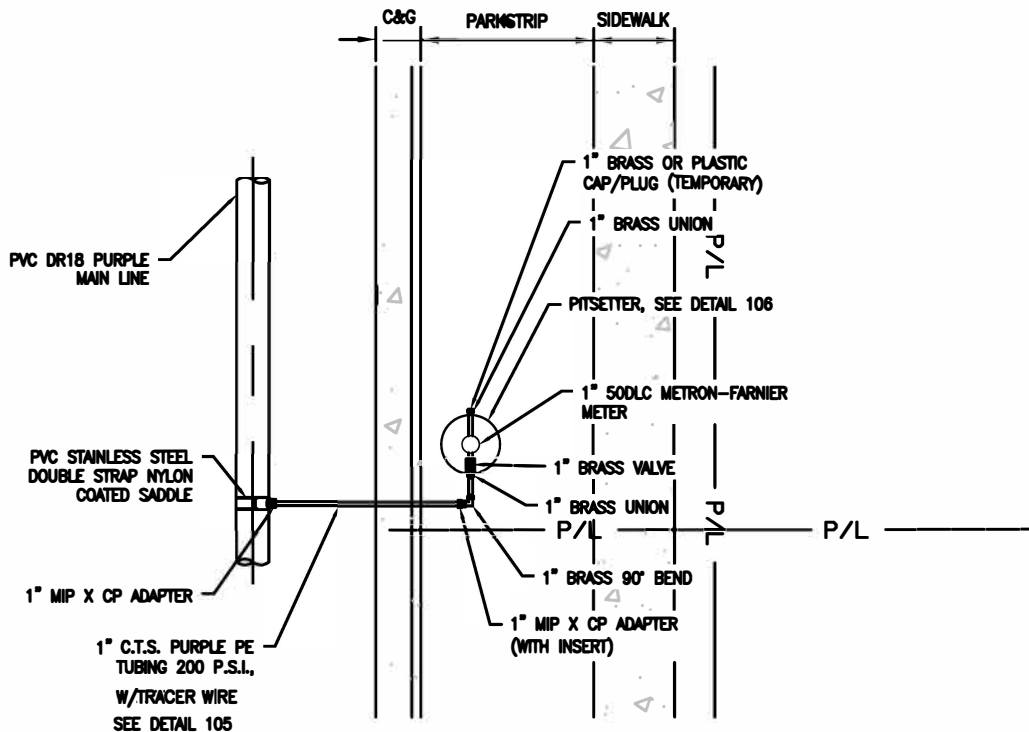
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PINEVIEW WATER SYSTEMS STANDARDS

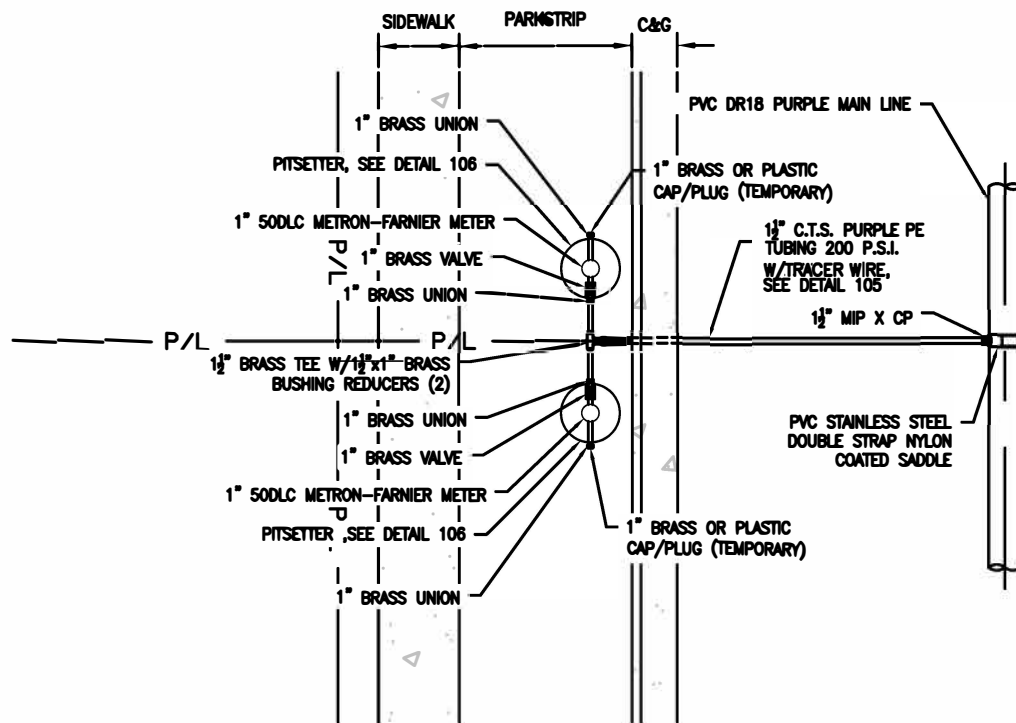
1 IN. SERVICE LATERAL METER VAULT

DETAIL 106

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



SINGLE SERVICE



DOUBLE SERVICE

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NOTES:

1. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.
2. PITSETTER AND SERVICE LINES SHALL BE INSPECTED BY DISTRICT REPRESENTATIVE PRIOR TO BACKFILLING.
3. COIL UP A MINIMUM OF 2' OF TRACER WIRE IN PITSETTER.

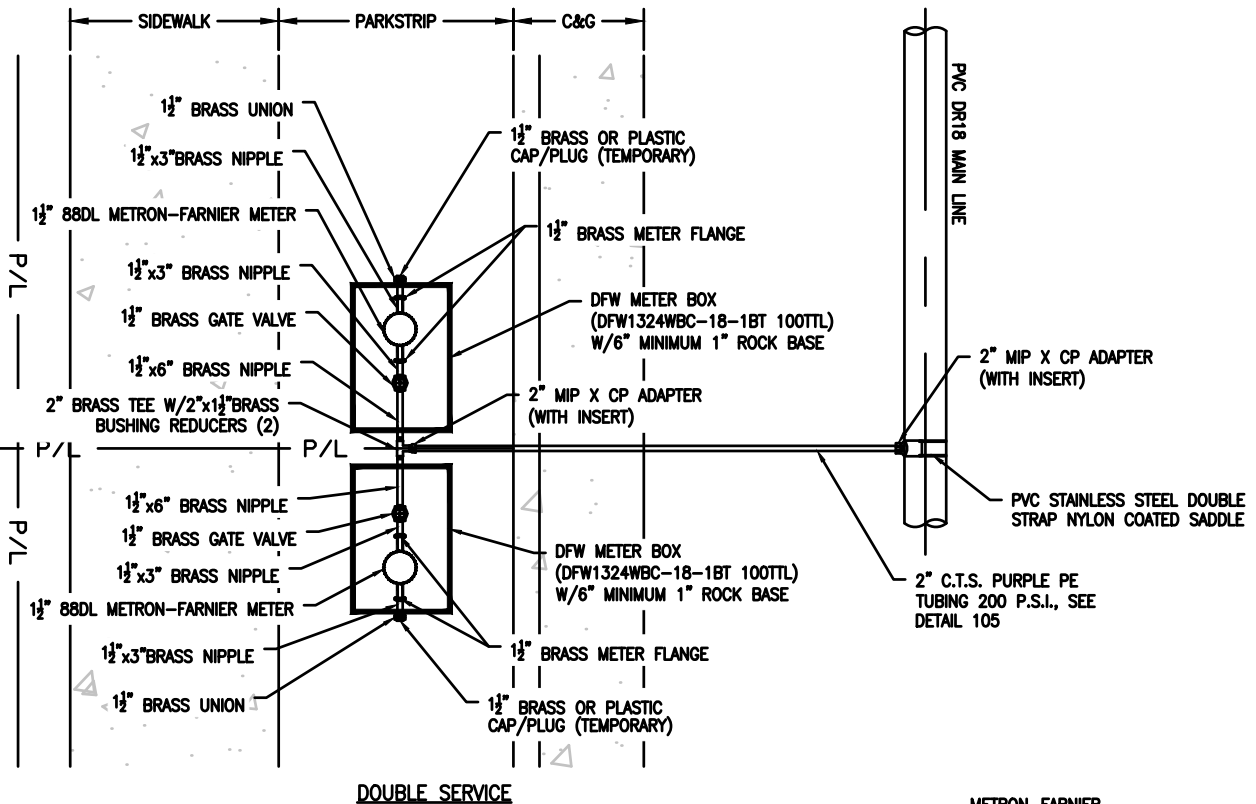
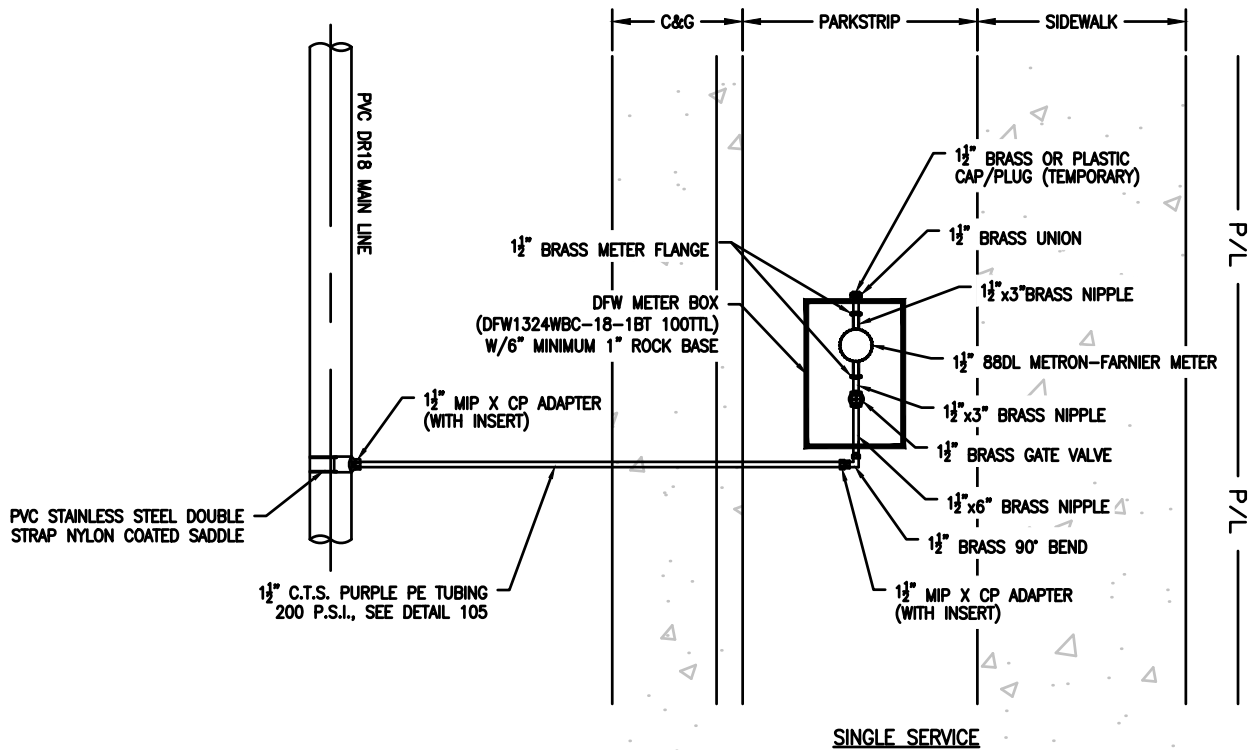
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PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL 1 IN. METER & PIT SETTER (NEW)

DETAIL 107

CAD DWG:	PWS DETAIL S.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	



NOTES:

1. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.
2. METER BOX AND SERVICE LINE SHALL BE INSPECTED BY DISTRICT REPRESENTATIVE PRIOR TO BACKFILLING.
3. COIL UP A MINIMUM OF 2' OF TRACER WIRE IN METERBOX.

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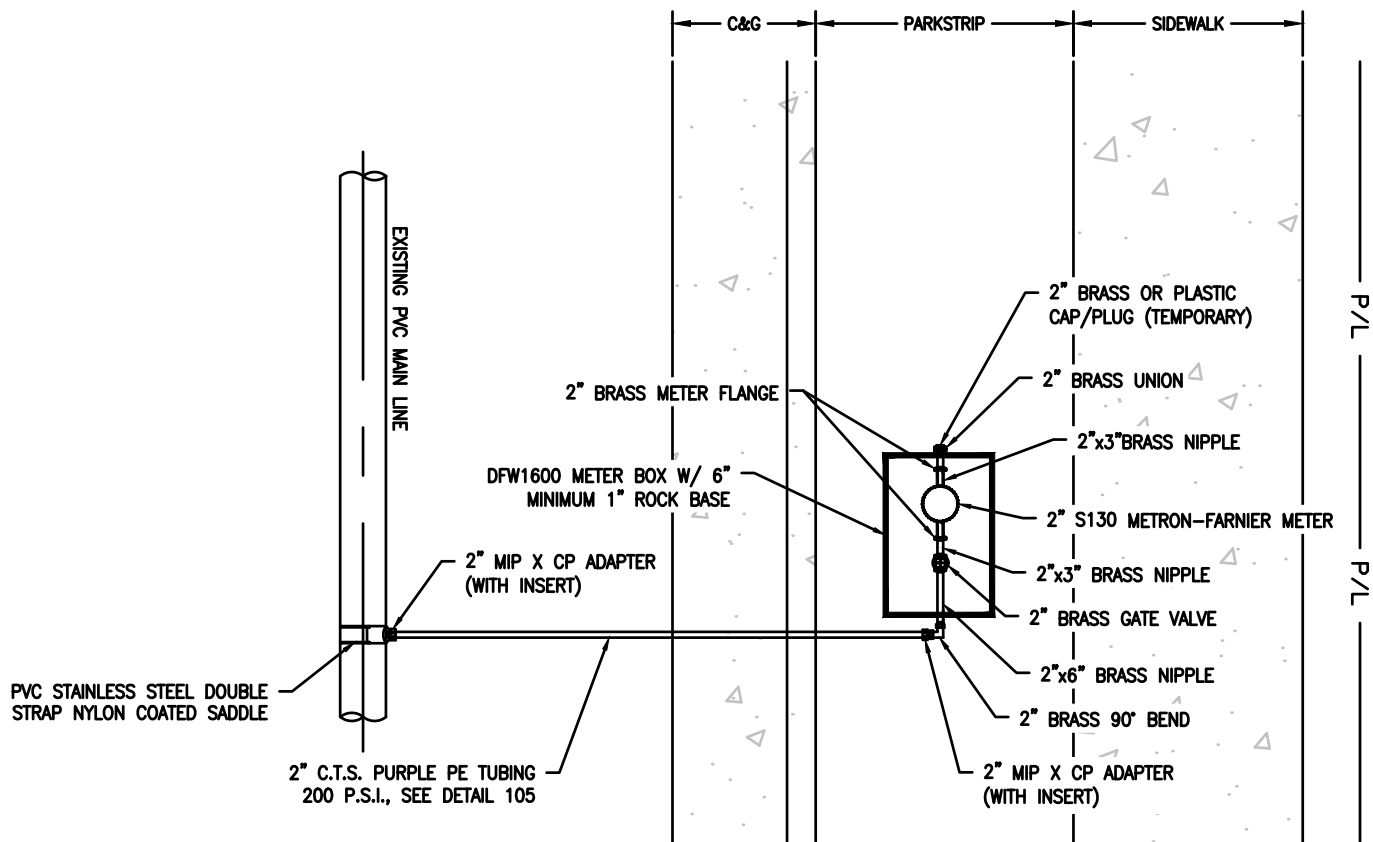
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PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL 1.5 IN. METER & PIT SETTER (NEW)

DETAIL 108

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	

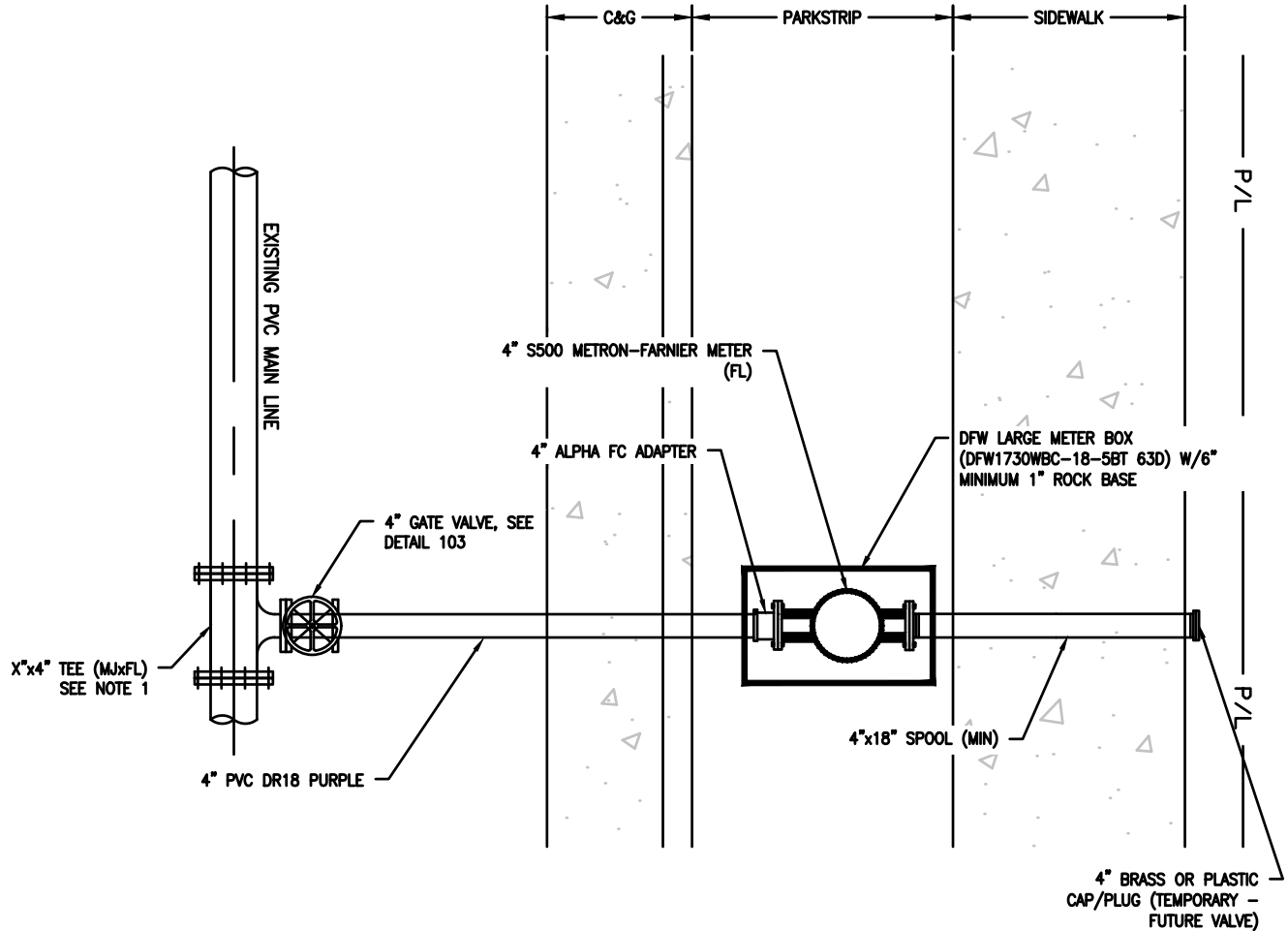


NOTES:

1. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.
2. METER BOX AND SERVICE LINE SHALL BE INSPECTED BY DISTRICT REPRESENTATIVE PRIOR TO BACKFILLING.
3. COIL UP A MINIMUM OF 2' OF TRACER WIRE IN METERBOX.

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#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	TYPICAL 2 IN. METER & PIT SETTER (NEW)	DETAIL 109
#	#	#	#	#			
#	#	#	#	#			
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NO.	DESCRIPTION			BY	APR.	DATE	CAD DWG: PWS DETAILS.DWG DATE: OCT 2026 DRAWN BY: S. SANDERS DESIGN BY: SCALE:

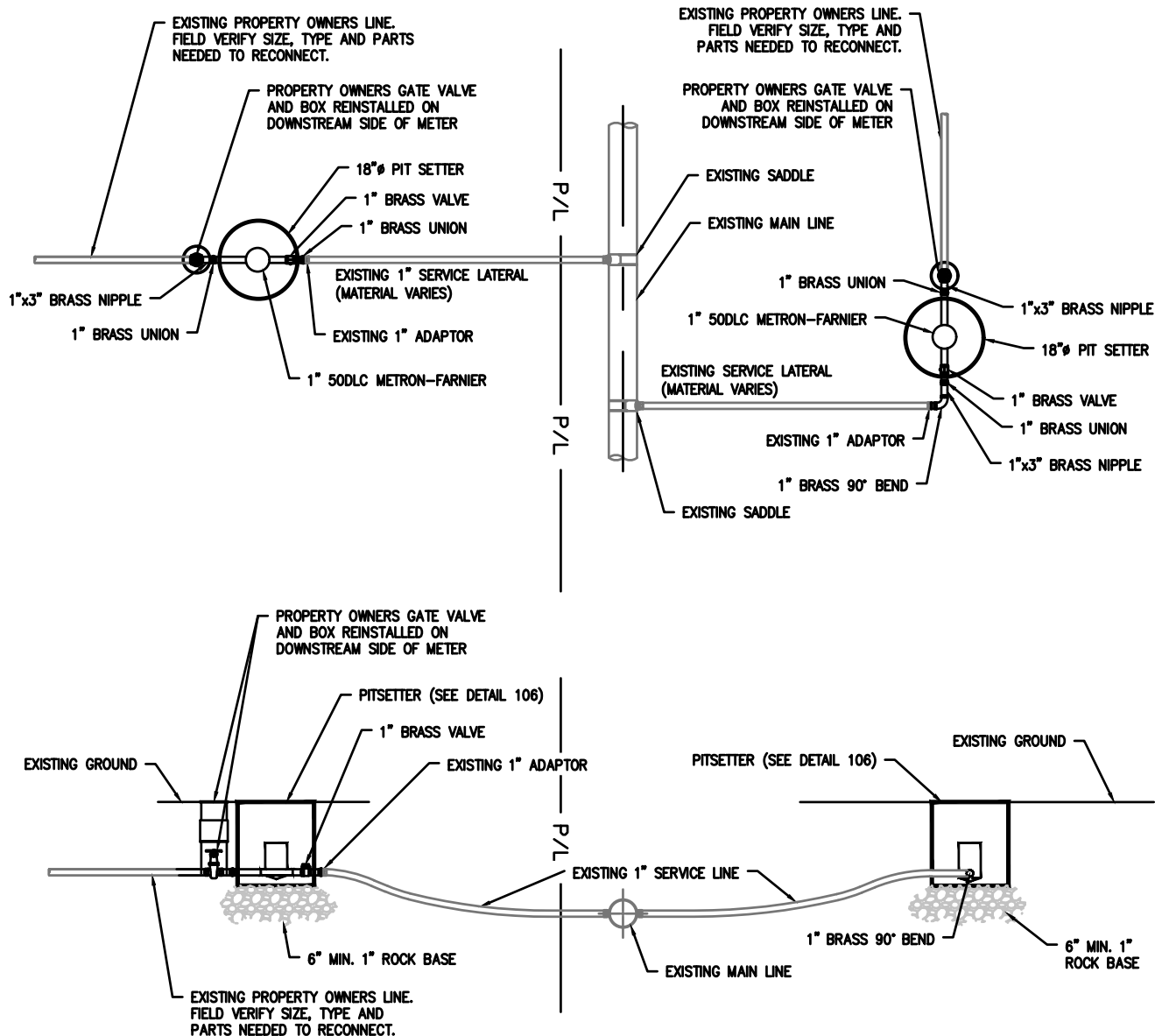


NOTES:

1. FOR 8" AND ABOVE, USE TAPPING SLEEVE. FOR 4"-6", USE TEE.
2. METAL FITTINGS, VALVES, HARDWARE, AND NUTS & BOLTS SHALL BE COATED WITH TRENTON WAX TAPE PRIMER, WRAPPED WITH TRENTON WAX TAPE PER AWWA C105, AND COVERED WITH 8-MIL V-BIO ENHANCED POLYETHYLENE ENCASEMENT SECURED WITH PVC PIPE WRAP TAPE, INSTALL PER MANUFACTURER'S RECOMMENDATIONS. METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES, SEE DETAIL 154.
3. METER BOX AND SERVICE LINE SHALL BE INSPECTED BY DISTRICT REPRESENTATIVE PRIOR TO BACKFILLING.
4. COIL UP A MINIMUM OF 2' OF TRACER WIRE IN METER BOX.

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#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	TYPICAL 4 IN. METER & PIT SETTER (NEW)	DETAIL 110
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NO.	DESCRIPTION			BY	APR.	DATE	CAD DWG: PWS DETAILS.DWG DATE: OCT 2026 DRAWN BY: S. SANDERS DESIGN BY: SCALE:



NOTES:

- EXISTING PROPERTY OWNERS GATE VALVE SHALL BE REMOVED FROM EXISTING ADAPTOR. PIT SETTER WILL THEN BE INSTALLED AT MALE ADAPTOR. PROPERTY OWNERS GATE VALVE AND VALVE BOX WILL BE REINSTALLED AFTER THE PIT SETTER.
- CONTRACTOR SHALL FIELD VERIFY PROPERTY OWNERS TYPE AND SIZE OF MAIN LINE. THEN USING APPROVED PARTS, RECONNECT TO PROPERTY OWNERS GATE VALVE.
- TYPICAL PARTS TO RECONNECT TO PROPERTY OWNERS MAIN LINE.
 - 10' OF 1" I.P.S. MAIN LINE POLY PIPE.
 - 1- 1" THREADED BY BARBED POLY ADAPTOR.
 - 1- 1" POLY SPLICE OR 1" PVC BY POLY ADAPTOR.
 - 6- 1" STAINLESS STEEL CLAMPS.
 - 1- 1" GALV. THREADED COUPLING.
- ITEMS SUPPLIED BY PINEVIEW WATER SYSTEMS
 - 4.1. FORD PIT SETTER WITH BRASS BALL VALVE (UPSTREAM SIDE)
 - 4.2. PIT SETTER LID
 - 4.3. 1 METRON-FARNIER METER WITH ANTENNA & 5' WIRE
 - 4.4. 1 BRASS UNION (2 FOR EACH PIT SETTER)
- IF PIT IS LOWER THAN MAIN/SERVICE LINE, INSTALL KING AUTO DRAIN.
- COAT ALL METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.

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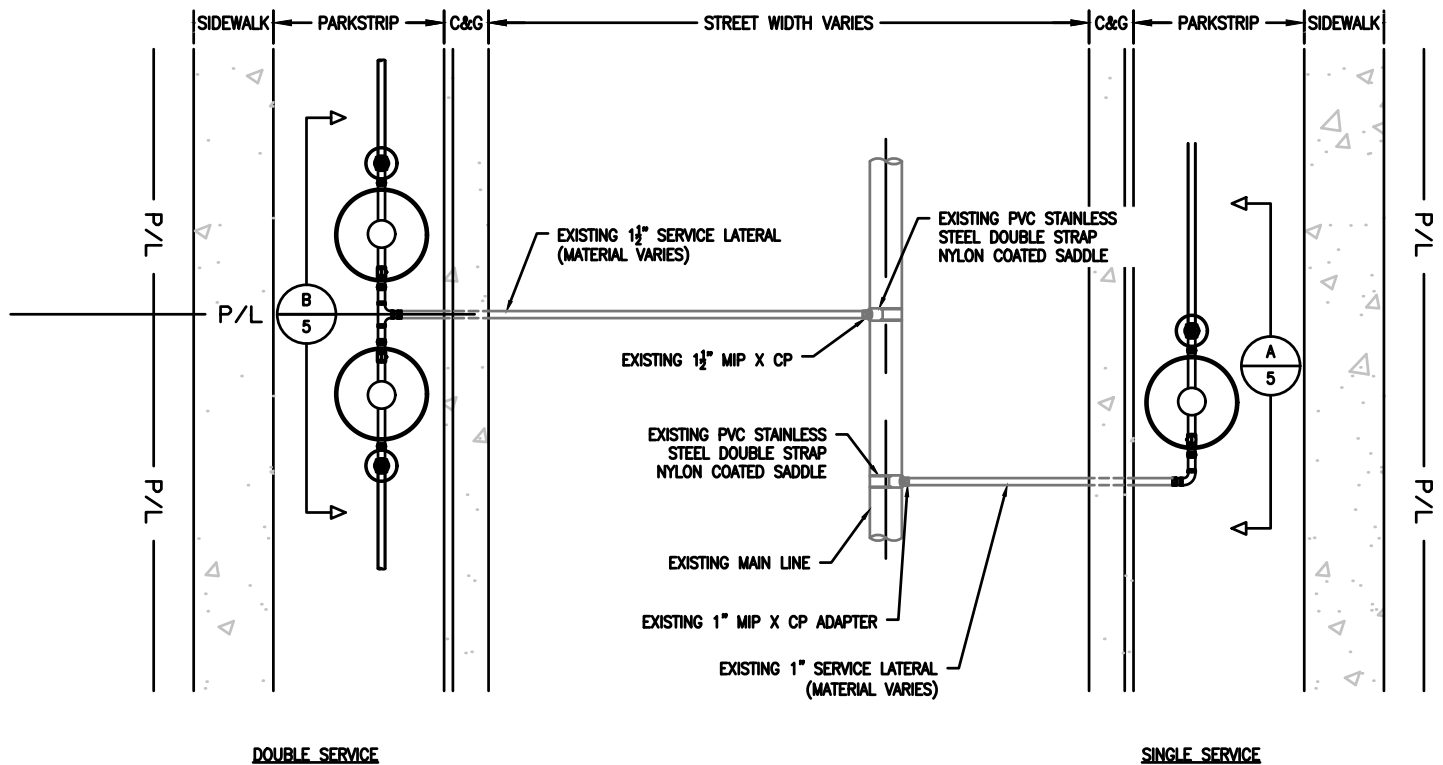
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PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL REAR LOT METER & PIT SETTER (RETROFIT)

DETAIL 111

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:

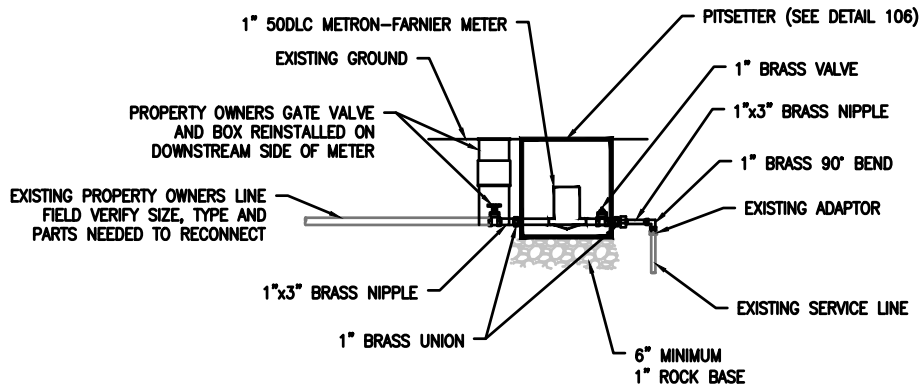


NOTES:

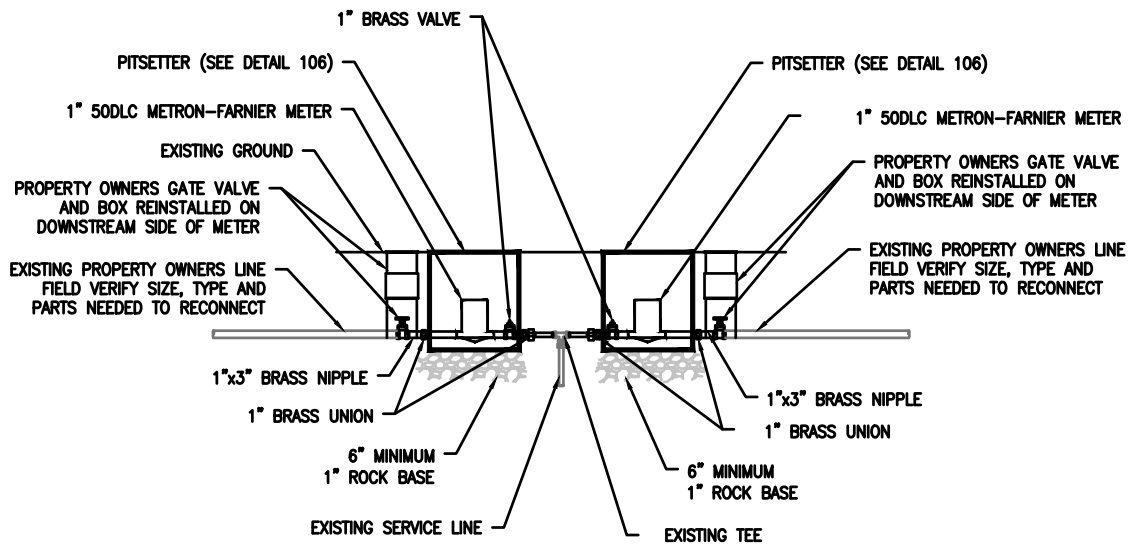
- EXISTING PROPERTY OWNERS GATE VALVE SHALL BE REMOVED FROM EXISTING ADAPTOR. PIT SETTER WILL THEN BE INSTALLED AT MALE ADAPTOR. PROPERTY OWNERS GATE VALVE AND VALVE BOX WILL BE REINSTALLED AFTER THE PIT SETTER.
- CONTRACTOR SHALL FIELD VERIFY PROPERTY OWNERS TYPE AND SIZE OF MAIN LINE. THEN USING APPROVED PARTS, RECONNECT TO PROPERTY OWNERS GATE VALVE.
- TYPICAL PARTS TO RECONNECT TO PROPERTY OWNERS MAIN LINE.
 - 10' OF 1" I.P.S. MAIN LINE POLY PIPE.
 - 1- 1" THREADED BY BARBED POLY ADAPTOR.
 - 1- 1" POLY SPLICE OR 1" PVC BY POLY ADAPTOR.
 - 6- 1" STAINLESS STEEL CLAMPS.
 - 1- 1" GALV. THREADED COUPLING.
- ITEMS SUPPLIED BY PINEVIEW WATER SYSTEMS
 - 4.1. FORD PIT SETTER WITH BRASS BALL VALVE (UPSTREAM SIDE)
 - 4.2. PIT SETTER LID
 - 4.3. 1 METRON-FARNIER METER WITH ANTENNA & 5' WIRE
 - 4.4. 1 BRASS UNION (2 FOR EACH PIT SETTER)
- COAT ALL METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.

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NO.	DESCRIPTION	BY	APR.	DATE	TYPICAL FRONT LOT METER & PIT SETTER (RETROFIT)	CAD DWG: PWS DETAILS.DWG DATE: OCT 2026 DRAWN BY: S. SANDERS DESIGN BY: SCALE:



A – TYPICAL 1" SINGLE METER AND PIT SETTER RETROFIT



B – TYPICAL 1" DOUBLE METER AND PIT SETTER RETROFIT

NOTES:

1. EXISTING PROPERTY OWNER'S GATE VALVE SHALL BE REMOVED FROM EXISTING ADAPTOR. PIT SETTER WILL THEN BE INSTALLED AT MALE ADAPTOR. PROPERTY OWNER'S GATE VALVE AND VALVE BOX WILL BE REINSTALLED AFTER THE PIT SETTER.
2. CONTRACTOR SHALL FIELD VERIFY PROPERTY OWNERS TYPE AND SIZE OF MAIN LINE. THEN USING APPROVED PARTS, RECONNECT TO PROPERTY OWNERS GATE VALVE.
3. TYPICAL PARTS TO RECONNECT TO PROPERTY OWNERS MAIN LINE.
 - 1- 1" THREADED BY BARBED POLY ADAPTOR.
 - 1- 1" POLY SPLICE OR 1" PVC BY POLY ADAPTOR.
 - 6- 1" STAINLESS STEEL CLAMPS.
 - 1- 1" GALV. THREADED COUPLING.
4. ITEMS SUPPLIED BY PINEVIEW WATER SYSTEMS
 - 4.1. PIT SETTER WITH BRASS BALL VALVE (UPSTREAM SIDE)
 - 4.2. PIT SETTER LID
 - 4.3. 1" METRON-FARNIER METER WITH ANTENNA & 5' WIRE
 - 4.4. 1" BRASS UNION (2 FOR EACH PIT SETTER)
5. COAT ALL METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.

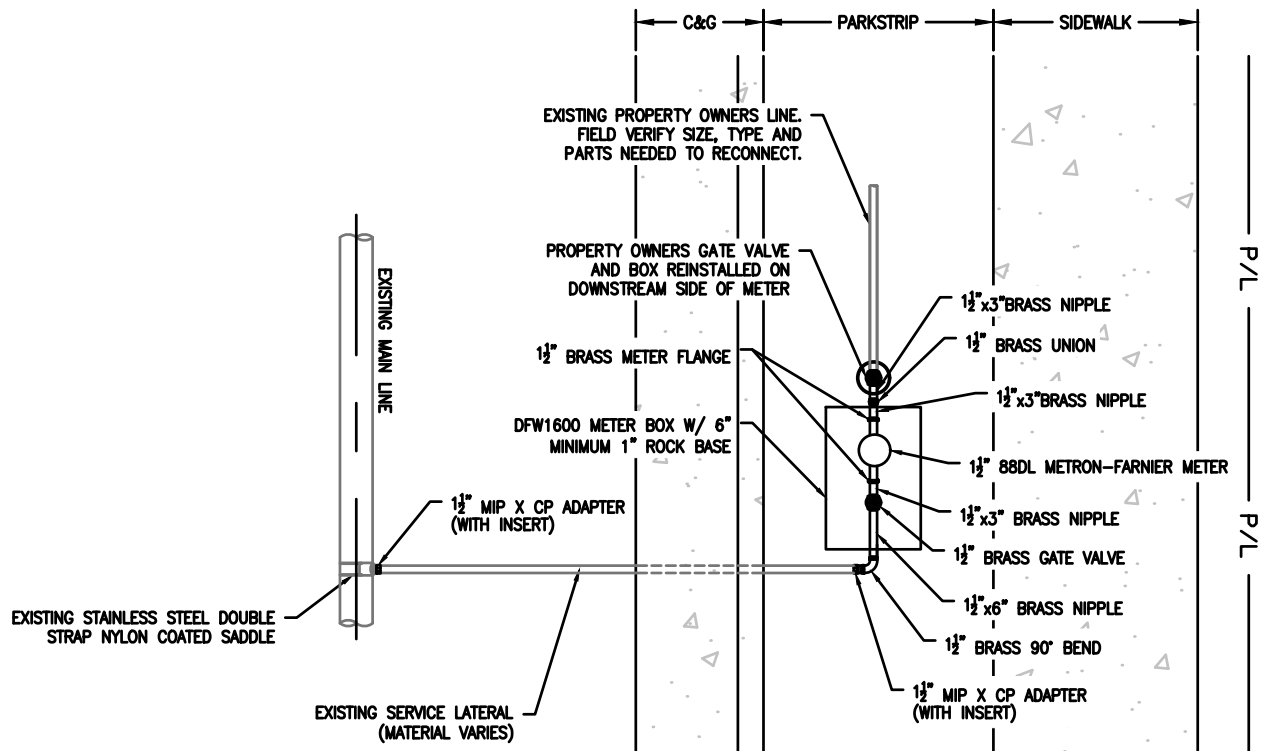
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PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL 1 IN METER & PIT SETTER (RETROFIT)

DETAIL 113

CAD DWG: PWS DETAILS.DWG
 DATE: OCT 2026
 DRAWN BY: S. SANDERS
 DESIGN BY:
 SCALE:



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NOTES:

- EXISTING PROPERTY OWNERS GATE VALVE SHALL BE REMOVED FROM EXISTING ADAPTOR. PIT SETTER WILL THEN BE INSTALLED AT MALE ADAPTOR. PROPERTY OWNERS GATE VALVE AND VALVE BOX WILL BE REINSTALLED AFTER THE PIT SETTER.
- CONTRACTOR SHALL FIELD VERIFY PROPERTY OWNERS TYPE AND SIZE OF MAIN LINE. THEN USING APPROVED PARTS, RECONNECT TO PROPERTY OWNERS GATE VALVE.
- TYPICAL PARTS TO RECONNECT TO PROPERTY OWNERS MAIN LINE.
 - 1- 1.5" THREADED BY BARBED POLY ADAPTOR.
 - 1- 1.5" POLY SPLICE OR 1" PVC BY POLY ADAPTOR.
 - 6- 1.5" STAINLESS STEEL CLAMPS.
 - 1- 1.5" GALV. THREADED COUPLING.
- ITEMS SUPPLIED BY PINEVIEW WATER SYSTEMS
 - 4.1. PIT SETTER WITH BRASS BALL VALVE (UPSTREAM SIDE)
 - 4.2. PIT SETTER LID
 - 4.3. 1.5" METRON-FARNIER METER WITH ANTENNA & 5' WIRE
 - 4.4. 1.5" BRASS UNION (2 FOR EACH PIT SETTER)
- COAT ALL METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.

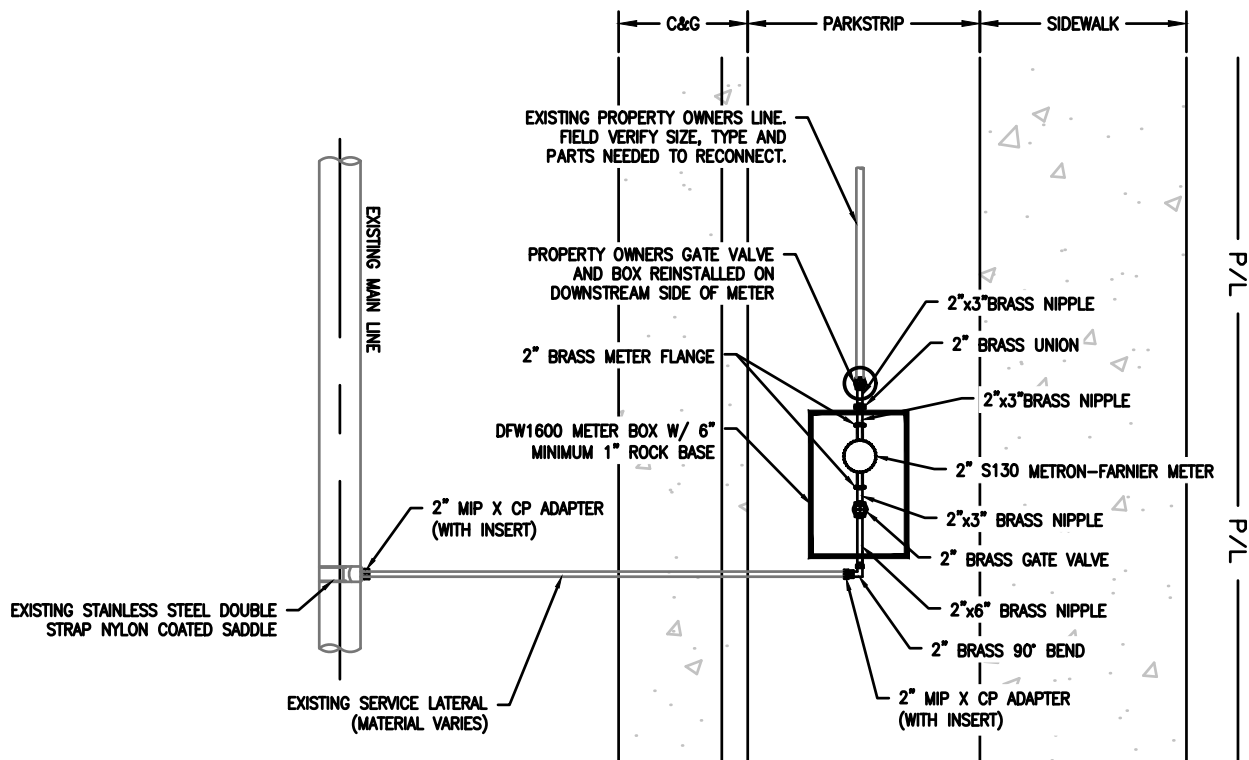
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL 1.5 IN METER & PIT SETTER (RETROFIT)

DETAIL 114

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



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 MIKEW@METRONFARNIER.COM

NOTES:

1. EXISTING PROPERTY OWNERS GATE VALVE SHALL BE REMOVED FROM EXISTING ADAPTOR. PIT SETTER WILL THEN BE INSTALLED AT MALE ADAPTOR. PROPERTY OWNERS GATE VALVE AND VALVE BOX WILL BE REINSTALLED AFTER THE PIT SETTER.
2. CONTRACTOR SHALL FIELD VERIFY PROPERTY OWNERS TYPE AND SIZE OF MAIN LINE. THEN USING APPROVED PARTS, RECONNECT TO PROPERTY OWNERS GATE VALVE.
3. TYPICAL PARTS TO RECONNECT TO PROPERTY OWNERS MAIN LINE.
 - 1- 2" THREADED BY BARBED POLY ADAPTOR.
 - 1- 2" POLY SPLICE OR 1" PVC BY POLY ADAPTOR.
 - 6- 2" STAINLESS STEEL CLAMPS.
 - 1- 2" GALV. THREADED COUPLING.
4. ITEMS SUPPLIED BY WEBER-BOX ELDER CONSERVATION DISTRICT (PINEVIEW WATER SYSTEMS)
 - 4.1. PIT SETTER WITH BRASS BALL VALVE (UPSTREAM SIDE)
 - 4.2. PIT SETTER LID
 - 4.3. 2" METRON-FARNIER METER WITH ANTENNA & 5' WIRE
 - 4.4. 2" BRASS UNION (2 FOR EACH PIT SETTER)
5. COAT ALL METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 EXCEPT WITHIN 1' OF BOX.

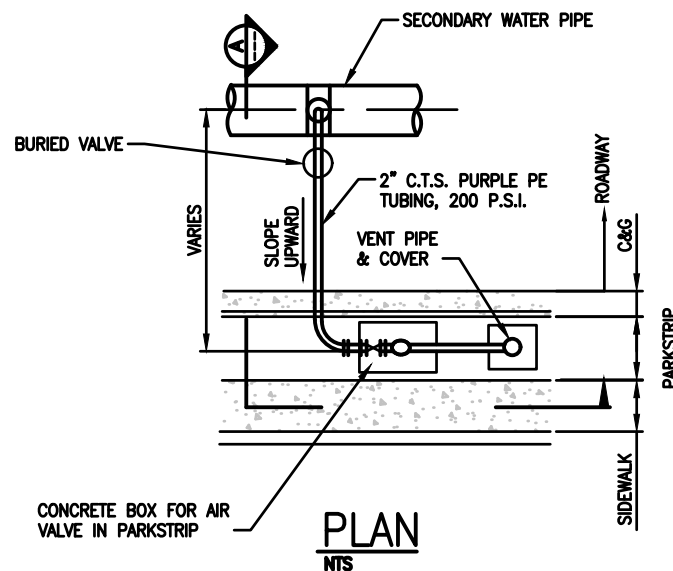
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PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL 2 IN METER & PIT SETTER (RETROFIT)

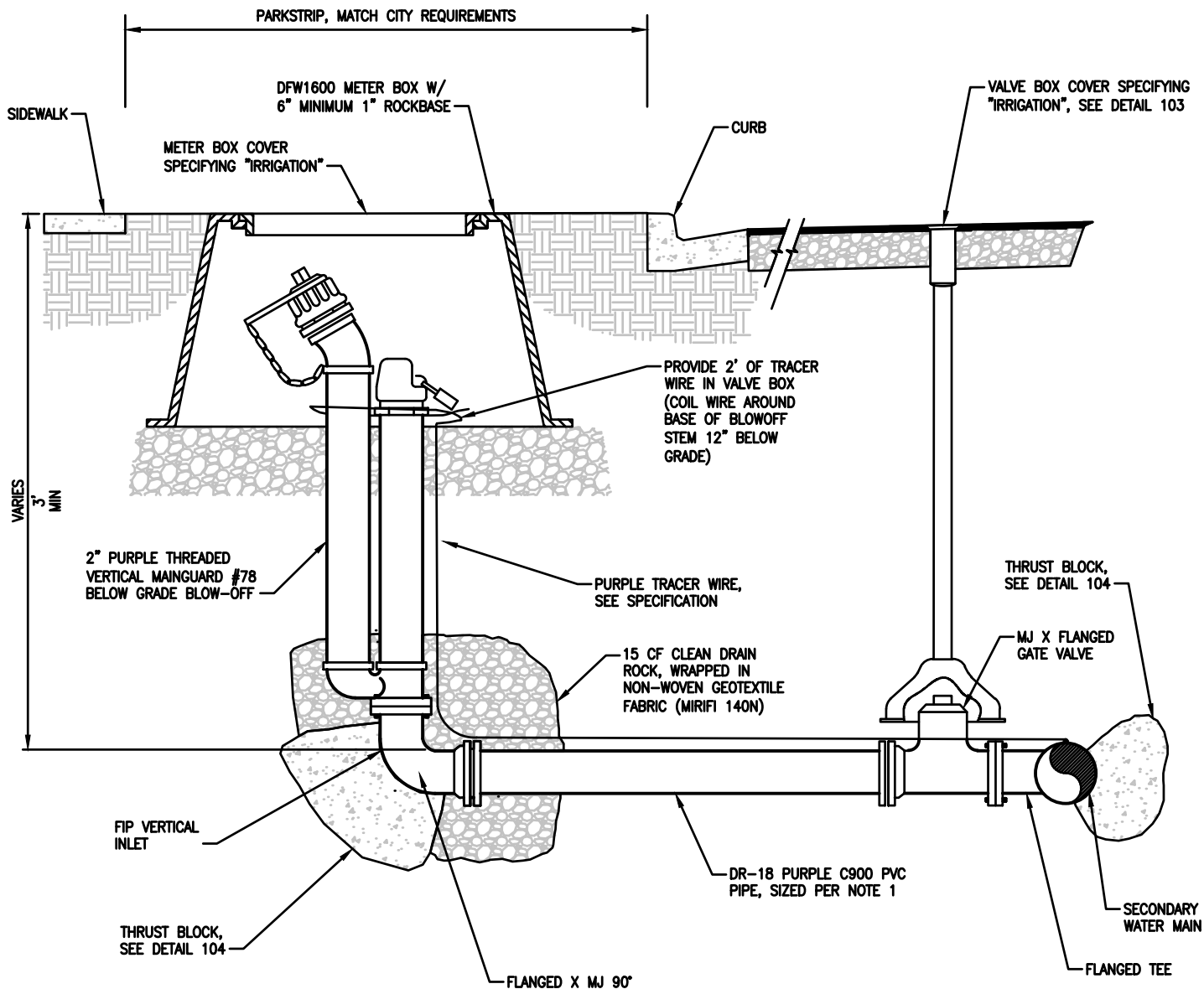
DETAIL 115

CAD DWG: PWS DETAILS.DWG
 DATE: OCT 2026
 DRAWN BY: S. SANDERS
 DESIGN BY:
 SCALE:



1. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217.
2. AIR VALVE TO BE VALMATIC OR APCO SINGLE BODY COMBO VALVE, NO EQUALS.
3. INSTALL PURPLE TRACER WIRE ON ALL AIR VALVE & VENT PIPING.
4. ALL PIPE, VALVES, & FITTINGS TO HAVE 200 PSI PRESSURE RATING.

#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	DETAIL 120
#	#	#	#	#		CAD DWG: PWS DETAILS.DWG
#	#	#	#	#		DATE: OCT 2028
#	#	#	#	#		DRAWN BY: S. SANDERS
NO.	DESCRIPTION	BY	APR.	DATE	AIR VALVE WITH OFFSET TO PARKSTRIP	DESIGN BY: SCALE:



NOTES:

1. BLOW-OFF SIZE TO BE:
 - A. 2" SIZE FOR 8" OR SMALLER SECONDARY WATER MAIN LINES.
 - B. 6" SIZE FOR 10" OR LARGER SECONDARY WATER MAIN LINES.
 - C. OTHER SIZES AS DIRECTED BY PINEVIEW WATER SYSTEM.
2. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217.
3. ALL DIP FITTINGS TO RECEIVE CATHODIC PROTECTION PER DETAIL 150.
4. ALL PIPES, VALVES, AND FITTINGS TO HAVE 200 PSI PRESSURE RATING.

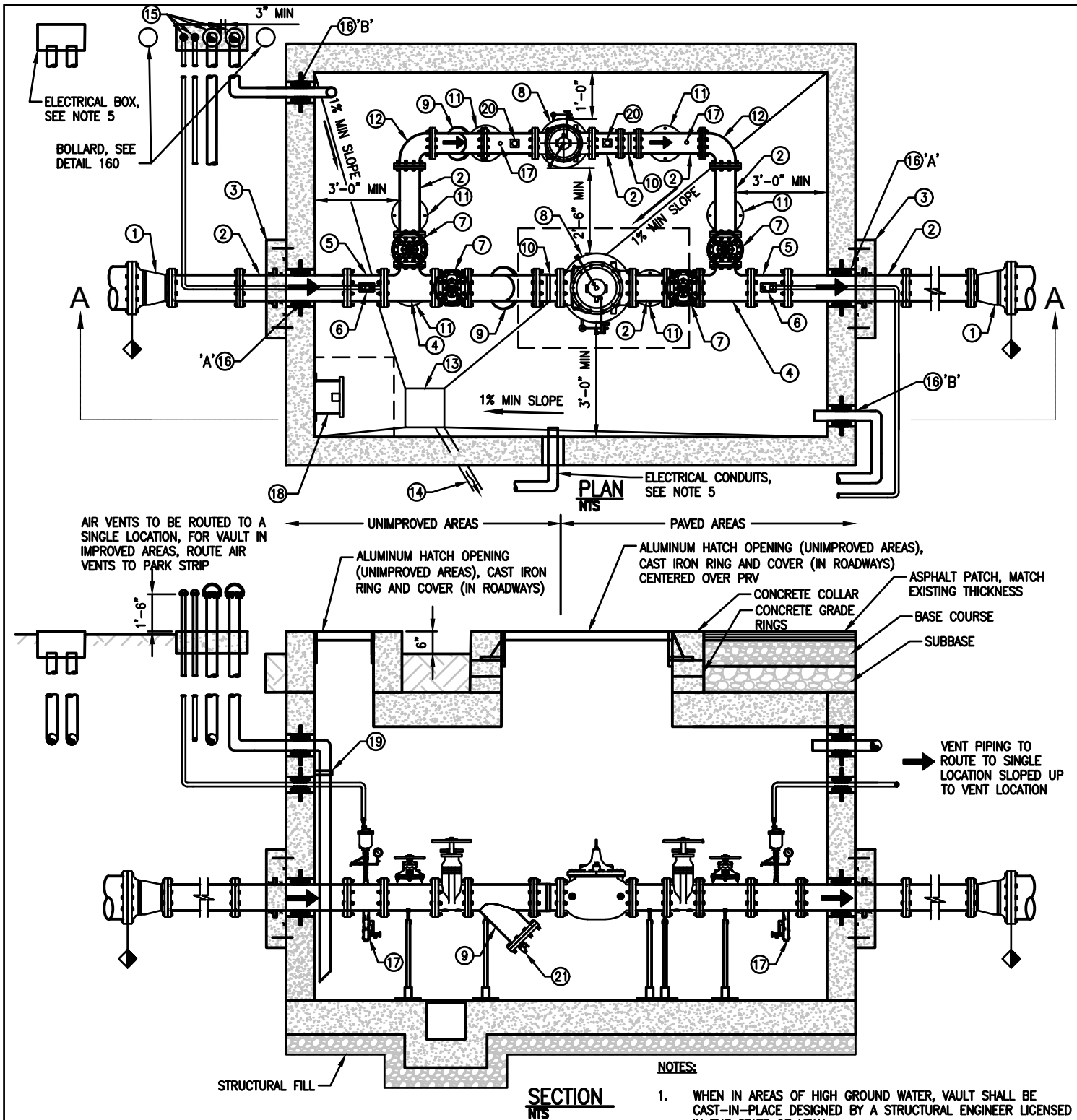
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

TYPICAL BLOWOFF

DETAIL 121

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	



MATERIALS LIST

①	FL x FL DIP REDUCER	⑧	CLA-VAL PRESSURE REDUCING VALVE	⑮	AIR VENT MUSHROOM CAP WITH INSECT SCREEN
②	FL x FL DIP SPOOL, SEEP RING REQUIRED FOR CAST-IN-PLACE VAULT	⑨	FL DI WYE STRAINER	⑯	SLEEVED PIPE OPENING, SEE DETAIL 135, SEE NOTE 3
③	THRUST ANCHOR W/ DI WALL ANCHOR, SEE NOTE 2 & 3	⑩	RESTRAINED DISMANTLING JOINT	⑰	DRAIN ASSEMBLY
④	FL x FL DIP TEE	⑪	PIPE SUPPORT	⑱	LADDER, SEE DETAIL 161
⑤	FL x FL DIP SPOOL WITH TAPPING SADDLE	⑫	FL x FL DI 90° BEND	⑲	PIPE SUPPORT
⑥	COMBINATION AIR RELEASE VALVE, PRESSURE GAUGE, & SAMPLING TAP	⑬	1'x1'x1' SUMP W/ GALV METAL GRATING	⑳	PRESSURE GAUGE & SAMPLING TAP
⑦	FL x FL RESILIENT WEDGE GATE VALVE	⑭	FOR VAULT LOCATION WHERE SUMP CAN BE DRAINED BY GRAVITY, 4" HDPE DRAIN SLOPED @ 2% TO DAYLIGHT	㉑	BLIND FLANGE W/ THREADED 2" BRASS GATE VALVE

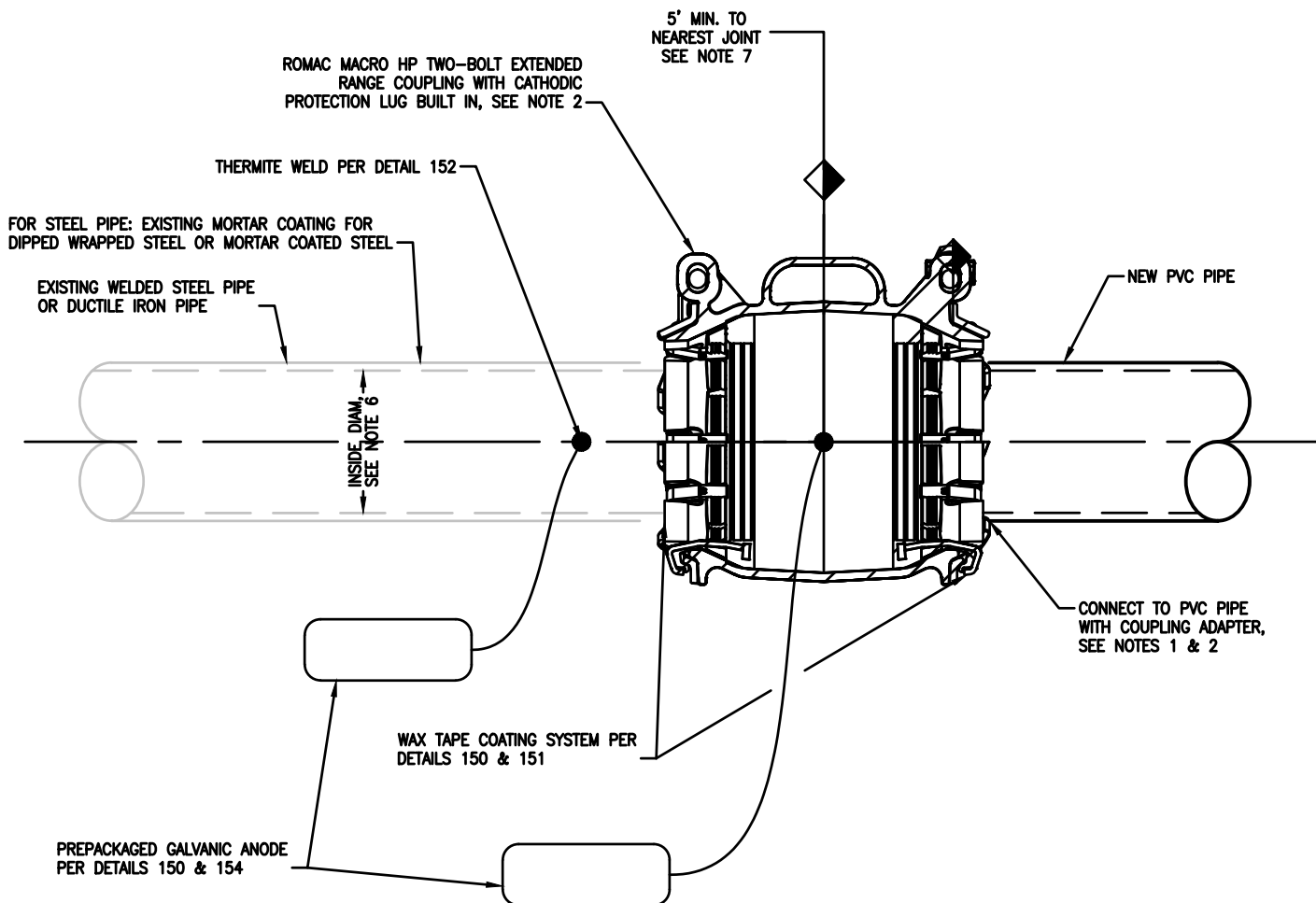
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

PRESSURE REDUCING VALVE VAULT

DETAIL 122

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



NOTES:

1. ALL COMPONENTS TO BE RATED MINIMUM OF 200 PSI.
2. COUPLING ADAPTER TO BE EPOXY LINED AND COATED ROMAC MACRO HP TWO-BOLT EXTENDED RANGE COUPLING WITH CATHODIC PROTECTION LUG BUILT IN, OR DISTRICT-APPROVED EQUAL.
3. WSP COATINGS NOT SHOWN FOR CLARITY.
4. THIS DETAIL DEPICTS AN UNRESTRAINED CONNECTION. WHERE A RESTRAINED CONNECTION IS REQUIRED, RESTRAINT SHALL BE PROVIDED USING THE DISTRICT'S APPROVED METHOD.
5. REPAIR ANY DAMAGED WSP MORTAR LINING AND COATING TO NEW CONDITION IF EXISTING PIPE IS DAMAGED DURING INSTALLATION.
6. VERIFY EXISTING PIPELINE MATERIAL, CONFIGURATION, SIZE, AND DEPTH BEFORE ORDERING PARTS. POT HOLE AS REQUIRED TO OBTAIN CONNECTION DATA.
7. CONNECTION TO EXISTING PIPE SHALL BE MADE TO EXISTING STICK OF PIPE THAT IS A MINIMUM OF 5 LINEAR FEET IN LENGTH. IF EXISTING PIPE STICK IS SHORTER THAN 5 LINEAR FEET, THAT STICK SHALL BE REMOVED, AND ADDITIONAL FULL LENGTH NEW PIPE SHALL BE ADDED.

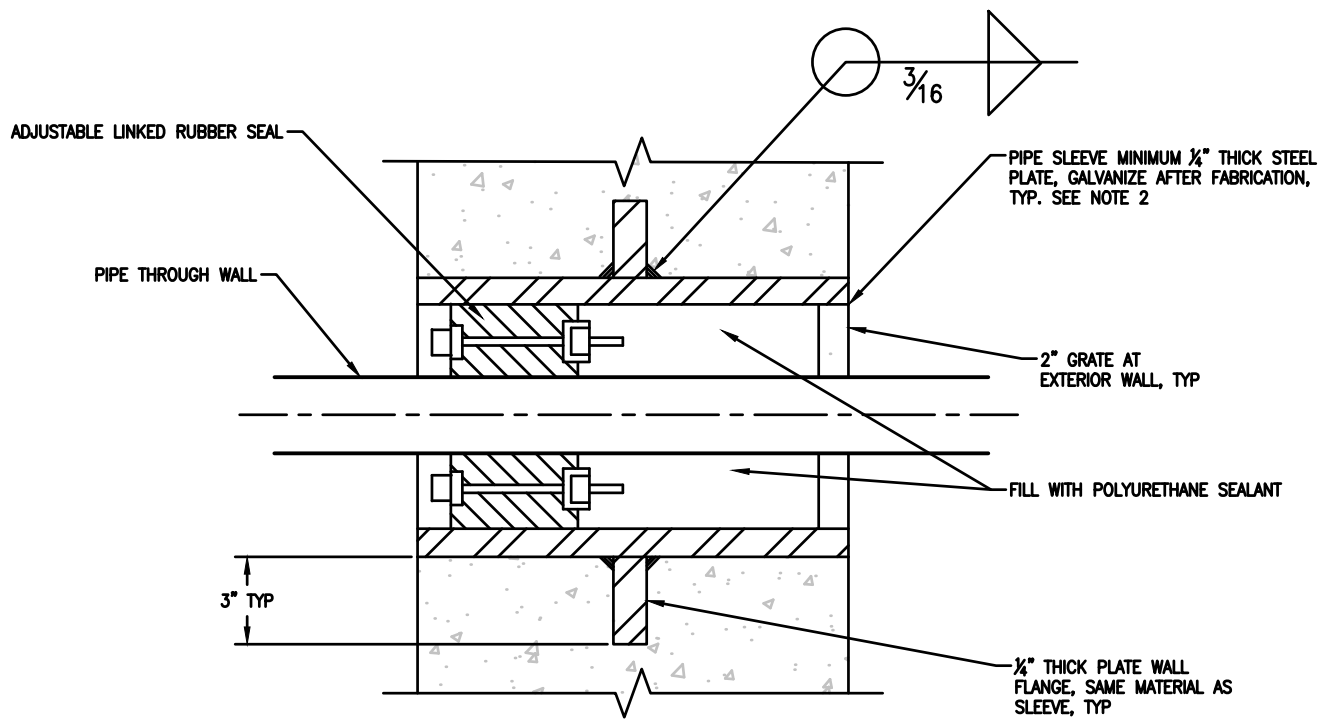
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PINEVIEW WATER SYSTEMS STANDARDS

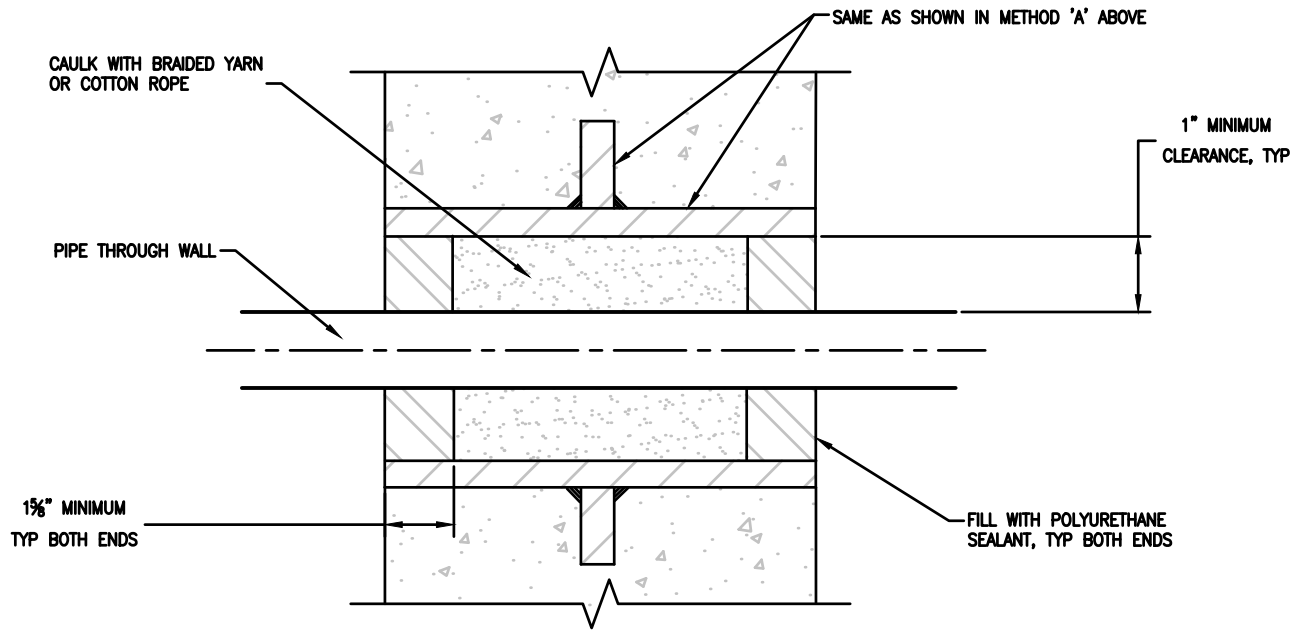
WSP/DIP TO PVC CONNECTION

DETAIL 130

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	



METHOD 'A'



METHOD 'B'

NOTES:

1. FOR WATER BEARING WALLS, USE METHOD 'A' WITH ADJUSTABLE LINKED RUBBER SEAL AT BOTH ENDS.
2. SLEEVES ARE NOT REQUIRED IN CORE DRILLED WALLS, PENETRATIONS THROUGH EXISTING WALLS, OR FLOORS

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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

SLEEVED PIPE OPENING

DETAIL 131

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	

PINEVIEW WATER SYSTEMS – CORROSION PROTECTION REQUIREMENTS:

PINEVIEW WATER SYSTEMS HAS EXPERIENCED ACCELERATED EXTERNAL CORROSION OF WATER INFRASTRUCTURE MATERIALS IN VARYING DEGREES THROUGHOUT THEIR SYSTEMS RESULTING IN SIGNIFICANTLY REDUCED LIFESPANS, INCREASED O&M EFFORTS, AND HIGH REPAIR AND REPLACEMENT COSTS. TO MAXIMIZE THE LIFESPAN OF WATER SYSTEM IMPROVEMENTS, REDUCE O&M CHALLENGES, AND SAVE WATER USERS FROM THE FINANCIAL BURDEN ASSOCIATED WITH SUCH, PINEVIEW WATER SYSTEMS HAS IDENTIFIED KEY DESIGN AND CONSTRUCTION REQUIREMENTS.

1. FOR PROJECTS ON THE WEST SIDE OF HIGHWAY 89, CORROSION PROTECTION SHALL BE ADDRESSED IN THE FOLLOWING MANNER:

A. IN ADDITION TO THE REQUIRED VBIO POLYETHYLENE WRAP AND GALVANIC ANODES PER DETAIL 151 AND THE ANODE TABLE BELOW, APPLY A WAX TAPE COATING SYSTEM TO ALL BURIED METAL, INCLUDING DUCTILE IRON, VALVE BONNET BOLTS, SADDLES, CORP STOPS, STAINLESS STEEL REPAIR CLAMPS AND ALL OTHER BURIED BOLTS, NUTS, CONNECTORS, RESTRAINER GLAND BOLTS, AND COUPLING HARDWARE, PER AWWA C217. COATING SYSTEM TO INCLUDE A 4-MIL MINIMUM WAX TAPE PRIMER, FILLER MATERIAL, 45-MIL MINIMUM WAX TAPE AND PROTECTIVE OUTER WRAP, PER MANUFACTURER'S REQUIREMENTS. WHEN WAX TAPING A STAINLESS STEEL CLAMP THE ENTIRE CLAMP SHOULD BE WRAPPED NOT JUST BOLTS.

B. WAX TAPE COATING MATERIALS (SEE INSTALLATION PROCEDURES BELOW):

- i. TRENTON PRIMER, #1 WAX-TAPE, AND GUARD-WRAP
- ii. DENSO NORTH AMERICA DENSO PRIMER, DENSYL TAPE AND/OR MASTIC, DENSO FIBER-WRAP

2. FOR PROJECTS EXCEEDING 50 SERVICE CONNECTIONS, CORROSION PROTECTION SHALL BE ADDRESSED IN THE FOLLOWING MANNER:

A. THE DEVELOPER AND ITS' DESIGN ENGINEER, GEOTECHNICAL ENGINEER, AND CORROSION CONSULTANT SHALL PROVIDE A SITE SPECIFIC "CORROSION STUDY REPORT". THE REPORT SHALL INCORPORATE PROJECT SPECIFIC FINDINGS INTO CORROSION PROTECTION RECOMMENDATIONS FOR THE PROPOSED WATER SYSTEM IMPROVEMENTS. THE REPORT SHALL INCLUDE AT A MINIMUM THE FOLLOWING ITEMS:

- i. DETAILED INFORMATION ON EXISTING CONDITIONS, SOIL TYPES, CLASSIFICATION, ETC.
- ii. IDENTIFICATION OF STRAY CURRENT SOURCES AND ANY EXISTING CORROSION PROTECTION SYSTEMS IN THE IMMEDIATE AREA
- iii. IDENTIFICATION OF ANY POTENTIAL FOR HOT SPOTS OR VARYING SOIL CONDITIONS THAT MAY WARRANT CHANGES TO THE CORROSION PROTECTION PLAN DURING CONSTRUCTION
- iv. FIELD SAMPLING AND TESTING RESULTS WITHIN THE PROPOSED PIPE ZONE BASED ON REPRESENTATIVE SAMPLING OF THE DEVELOPMENT AREA CONDITIONS
- v. SOIL RESISTIVITY TESTING RESULTS IDENTIFYING CORROSIVE SOIL CONDITIONS AND LOCATIONS (WENNER 4-PIN SOIL RESISTIVITY TESTS OR SOIL BOX RESISTIVITY TESTS) AT REPRESENTATIVE PIPE INSTALL DEPTHS
- vi. LABORATORY ANALYSIS OF SOIL SAMPLES FOR PH, CHLORIDES, SULFATES, TOTAL SALTS, AND CONDUCTIVITY
- vii. DETERMINATION OF THE NEED FOR CORROSION PROTECTION BASED ON SOIL CORROSIVITY CLASSIFICATION/SOIL RESISTIVITY AND RECOMMENDATION OF SUITABLE PIPE, CONSTRUCTION MATERIALS, PIPE PROTECTION METHOD, PIPE EXTERIOR COATINGS, ETC., BASED ON SITE CORROSIVITY
- viii. SPECIFY IF THE INVESTIGATION INCLUDES ONLY THE INITIAL PHASE OR ALL FUTURE PHASES

B. FOLLOWING PINEVIEW WATER SYSTEMS RECIEPT AND REVIEW OF THE CORROSION STUDY REPORT, THE DEVELOPER WILL BE NOTIFIED OF PINEVIEW'S DETERMINATION AS TO REQUIRED PROTECTION OR THE DESIGN TEAM WILL BE REQUESTED TO MEET AND REVIEW THE FINDINGS AND ESTABLISH THE FINAL WATER SYSTEM DESIGN CRITERIA.

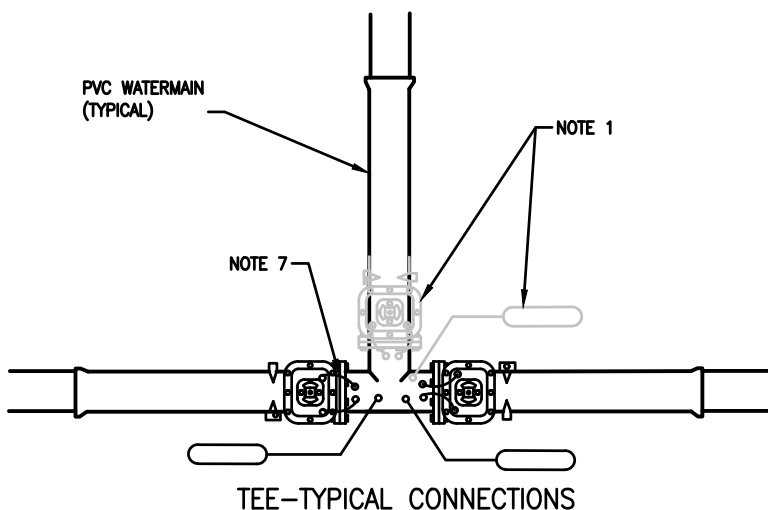
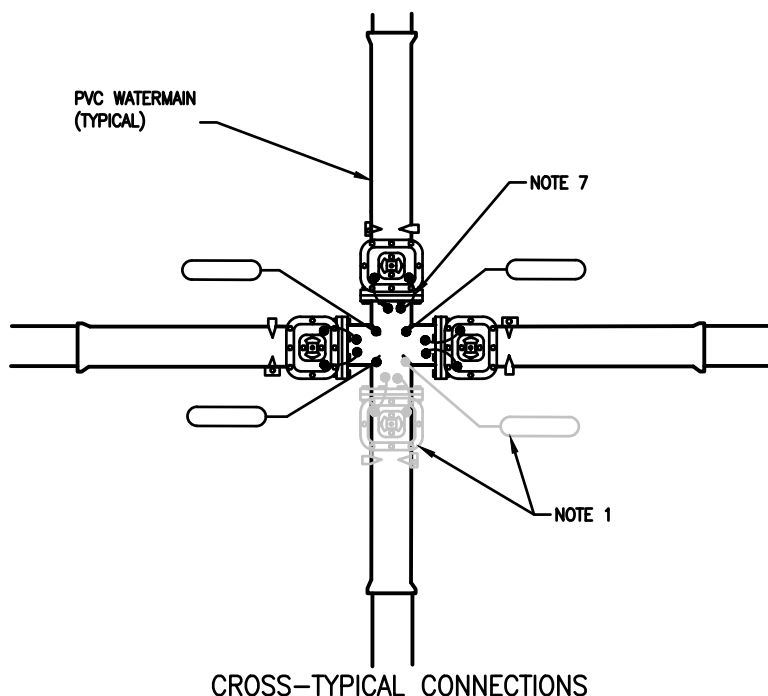
C. REFER TO PERTINENT PINEVIEW WATER SYSTEMS WATER STANDARDS PLANS OR PROVIDE CONSTRUCTION DRAWING DETAILS ASSOCIATED WITH CORROSION STUDY RECOMMENDATIONS AND THE PINEVIEW WATER SYSTEMS FINAL APPROVED WATER SYSTEM.

WAX TAPE INSTALLATION PROCEDURE

FOLLOW MANUFACTURER'S RECOMMENDATIONS. WIRE BRUSH AND SCRAPE THE SURFACE CLEAN OF DIRT, LOOSE COATING AND LOOSE RUST. APPLY A THIN FILM OF WAX TAPE PRIMER. IF THE SURFACE IS WET, COLD OR RUSTY, RUB AND PRESS ON PRIMER TO DISPLACE MOISTURE AND ENSURE ADHESION. THEN WRAP WAX-TAPE WRAP USING A 1' OVERLAP. ON STRAIGHT PIPE APPLY SLIGHT TENSION TO ENSURE CONTACT WITH SURFACE. ON IRREGULAR SURFACES ALLOW SLACK SO THE WRAP CAN BE MOLDED INTO CONFORMITY. IN EITHER CASE, PRESS AND FORM THE WRAP SO THERE ARE NO AIR POCKETS OR VOIDS UNDER THE WRAP. ALSO, PRESS AND SMOOTH OUT THE LAP SEAMS TO ENSURE THEY ARE SEALED AND APPLY OUTERWRAP. THE WRAP DOES NOT REQUIRE CURING OR DRYING TIME SO IT CAN BE BACKFILLED IMMEDIATELY.

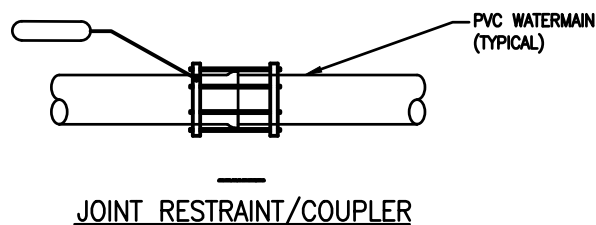
ANODE TABLE			
ANODE MATERIAL	WEIGHT	LEAD WIRE	NOTES
ZINC	15-LB BARE WEIGHT MIN.	NO. 12 AWG STRANDED COPPPER	SUPPLY PREPACKAGED IN A CLOTH BAG AT 2.5 TIMES THE BARE WEIGHT IN 50% GYPSUM AND 50% BENTONITE
MAGNESIUM	18-LB BARE WEIGHT MIN.	NO. 12 AWG STRANDED COPPPER	SUPPLY PREPACKAGED IN A CLOTH BAG AT 2.5 TIMES THE BARE WEIGHT IN 75% GYPSUM, 20% BENTONITE, AND 5% SODIUM SULFATE

#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS PIPE CORROSION PROTECTION REQUIREMENTS	DETAIL 150 CAD DWG: PWS DETAILS.DWG DATE: OCT 2026 DRAWN BY: S. SANDERS DESIGN BY: SCALE:
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#	#	#	#	#		
NO.	DESCRIPTION		BY	APR.	DATE	



LEGEND

- THERMITE WELD, SEE NOTE 6
-  GALVANIC ANODE, SEE NOTES 3 THROUGH 5 AND DETAIL 150
-  JOINT BOND, HMWPE JACKETED #2 AWG STRANDED COPPER WIRE, SEE NOTE 7



PIPE FITTINGS DESCRIPTIONS	ANODE QUANTITIES		
	PIPELINE DIAMETER		
	4"-10"	12"-18"	20"-24"
SINGLE FITTING, VALVE, OR JOINT RESTRAINT/COUPLER	1	1	2
ADDITIONAL FITTINGS, PER	1	1	1
CROSS-TYPICAL CONNECTION	3	4	5
TEE-TYPICAL CONNECTION	3	3	4

*SEE ANODE TABLE ON DETAIL 150 FOR ANODE REQUIREMENTS, SEE NOTES FOR DETAILS.

NOTES:

- EVERY METAL VALVE, COUPLING, OR FITTING ON A CONNECTION SHALL HAVE AT LEAST ONE ANODE.
- COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217. ENCASE ALL METAL PIPE, FITTINGS, VALVES, ETC. WITH V-BIO OR VB3 ENHANCED POLYETHYLENE ENCASEMENT PER AWWA C105. SECURE ENCASEMENT WITH PVC PIPE WRAP TAPE. METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES.
- INSTALL ANODES WITH MINIMUM OF 3 FEET HORIZONTAL SEPARATION FROM METALLIC FITTING OR PIPE AND AT LEAST 5 FEET BELOW GRADE. ANODES SHALL BE PREPACKAGED AND INSTALLED IN A HORIZONTAL POSITION PER ANODE INSTALLATION DETAIL 154 AND WETTED PRIOR TO BACKFILLING. BURY ANODES IN NATIVE SOIL.
- LOCATE MULTIPLE ANODES AT EQUAL SPACING ALONG PIPE FITTING ASSEMBLY AND ON ALTERNATING SIDES OF PIPE WHEN MORE THAN FOUR ANODES ARE REQUIRED.
- HEAVIER ANODES MAY BE SUBSTITUTED AND PROVIDED IN LIEU OF THE SPECIFIED ANODES AT THE CONTRACTOR'S OPTION, BUT THE TOTAL QUANTITY OF ANODES REQUIRED WILL NOT CHANGE.
- COAT ALL EXPOSED METAL INCLUDING EXPOSED COPPER WIRE WITH 3M SCOTCHKOTE LIQUID EPOXY COATING 323 OR DENSO PROTAL 7300, PER MANUFACTURER'S REQUIREMENTS. FOR THERMITE WELDS USE ROYSTON HANDY CAP IP THERMITE WELD CAPS, PER MANUFACTURER'S REQUIREMENTS. SEE DETAIL 152 FOR THERMITE WELD DETAILS.
- BOND ALL ADJACENT FITTINGS TOGETHER WITH JOINT BONDS AS SHOWN. SEE DETAIL 153 FOR JOINT BOND DETAILS.

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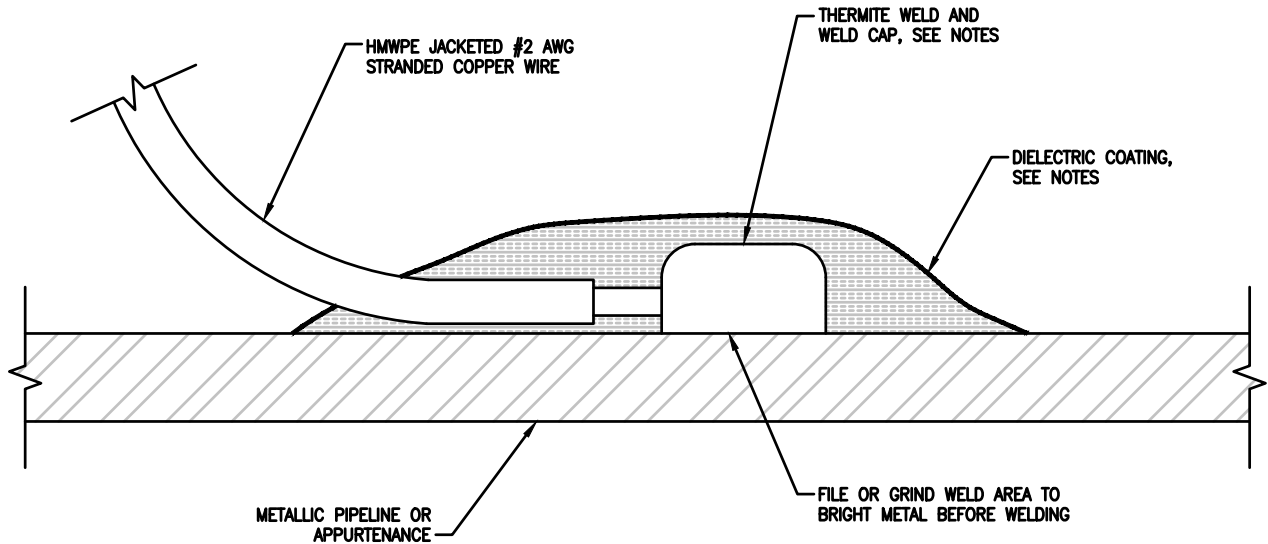
PINEVIEW WATER SYSTEMS STANDARDS

METALLIC PIPE APPURTENANCES AND FITTING CATHODIC PROTECTION

DETAIL 151

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	

THERMITE WELD CONNECTION



NOTES:

1. MAINTAIN SEPARATION BETWEEN MULTIPLE TEST WIRE CONNECTIONS OF ONE PIPE DIA OR 24", WHICHEVER IS LESS.
2. COPPER SLEEVES SHALL BE USED FOR #2 AWG JOINT BOND WIRE CONNECTIONS.
3. WELDER AND CARTRIDGE SIZE VARIES ACCORDING TO PIPE SIZE AND PIPE MATERIAL, CONSULT WELDER MANUFACTURER FOR RECOMMENDED WELDER AND CARTRIDGE.
4. COAT ALL EXPOSED METAL WITH 3M SCOTCHKOTE LIQUID EPOXY COATING 323 OR DENSO PROTAL 7300, PER MANUFACTURER'S REQUIREMENTS. FOR THERMITE WELDS USE ROYSTON HANDY CAP IP THERMITE WELD CAPS, COATING SYSTEM AS OTHERWISE SPECIFIED, OR APPROVED EQUAL. HANDY CAPS SHALL NOT BE APPLIED ON TOP OF LIQUID EPOXY.

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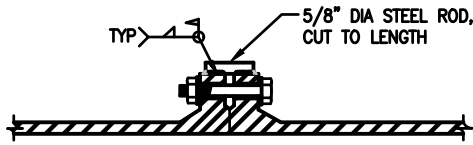
PINEVIEW WATER SYSTEMS STANDARDS

STEEL AND DUCTILE IRON PIPE WIRE CONNECTION

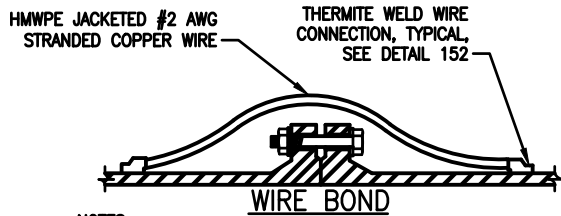
DETAIL 152

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	

FLANGED JOINT BONDS



STEEL ROD BOND



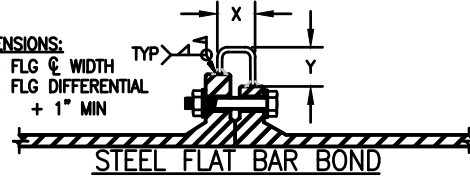
WIRE BOND

JOINT BOND QUANTITIES			
SCENARIO	SIZE	NUMBER OF BONDS	BOND TYPE
FLANGED JOINTS	≤24"	3	#2 AWG STRANDED HMWPE JACKETED COPPER WIRE
	≤24"	2	STEEL ROD
MECHANICAL JOINTS	≤24"	2	#2 AWG STRANDED HMWPE JACKETED COPPER WIRE

*IF >24" PIPE DIAMETER, SITE SPECIFIC CORROSION STUDY REQUIRED BY CORROSION ENGINEER, SEE DETAIL 150, NOTE 2.

DIMENSIONS:

X = FLG Ø WIDTH
Y = FLG DIFFERENTIAL
+ 1" MIN

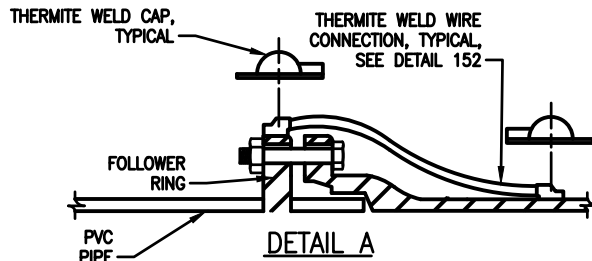


STEEL FLAT BAR BOND

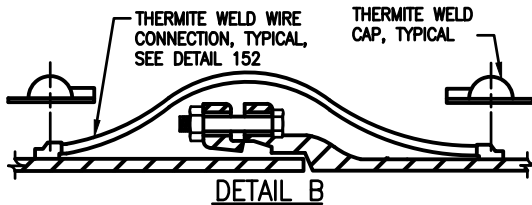
NOTES:

1. CONTRACTOR MAY INSTALL EITHER STEEL ROD, STEEL FLAT BAR, OR BOND WIRE AS SHOWN.
2. INSTALL TWO BONDS AT EACH JOINT, MINIMUM, SEE JOINT BOND QUANTITY SCHEDULE FOR QUANTITY REQUIRED FOR PIPE DIAMETER.
3. COAT STEEL ROD OR FLAT BAR AND WELDS WITH FAST CURE EPOXY (BURIED) OR WITH COATING SYSTEM TO MATCH PIPE (VAULT).
4. FOR WIRE BONDS, SEE THERMITE WELD WIRE CONNECTION DETAIL BELOW FOR COATING REQUIREMENTS.
5. PROVIDE SST FLAT BAR IN LIEU OF STEEL WHERE COATING CANNOT BE PROPERLY APPLIED TO INTERIOR SURFACES.
6. ARC WELDING OR BRAZING IS NOT PERMITTED.

MECHANICAL JOINT BONDS



DETAIL A

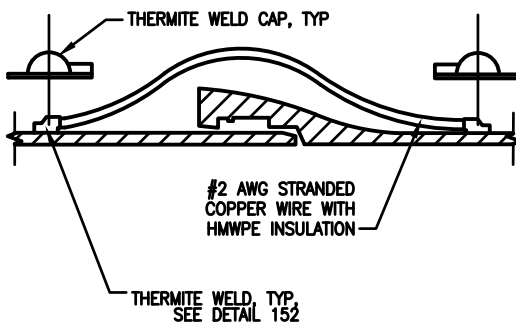


DETAIL B

NOTES:

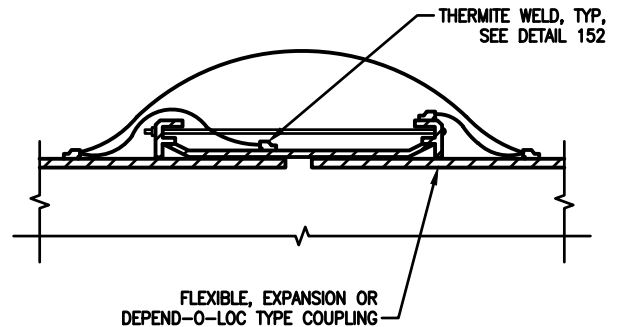
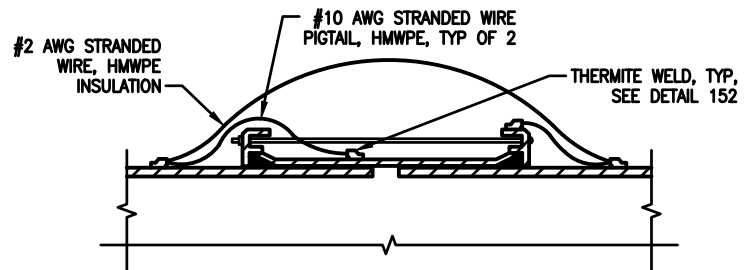
1. INSTALL NUMBER OF BOND WIRES SPECIFIED PER JOINT BOND QUANTITY SCHEDULE, ABOVE.

DUCTILE IRON JOINT BOND



THERMITE WELD, TYP.
SEE DETAIL 152

COUPLING JOINT BONDS



NOTES:

1. COUPLING JOINT SHOWN, SIMILAR FOR RESTRAINED JOINTS, DEPEND-O-LOC, FLANGED ADAPTERS, AND OTHER TYPE DISMANTLING JOINTS.
2. INSTALL TWO BONDS AT EACH JOINT, MINIMUM, SEE SPECS FOR QUANTITY REQUIRED FOR PIPE DIAMETER.
3. SEE THERMITE WELD DETAIL 152 FOR COATING REQUIREMENTS.

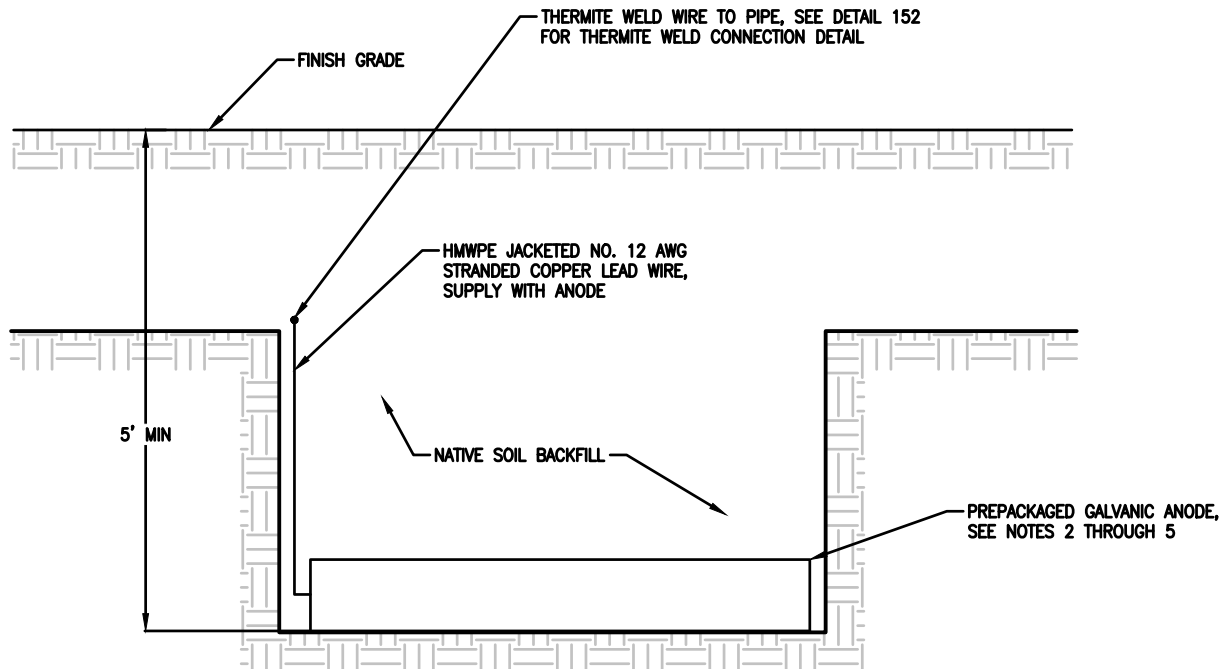
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PINEVIEW WATER SYSTEMS STANDARDS

JOINT BONDS

DETAIL 153

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:

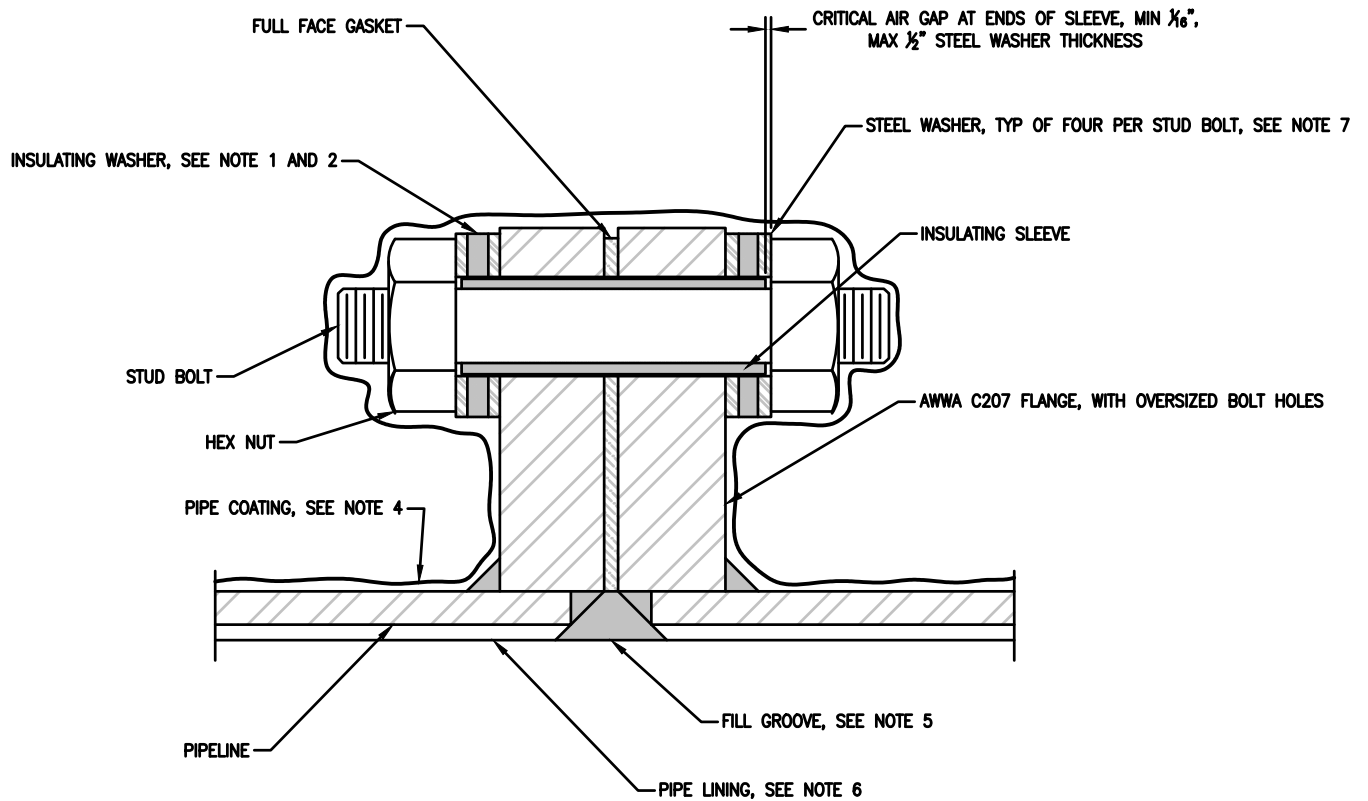


GALVANIC ANODE INSTALLATION

Notes

1. COAT ALL BURIED METAL FITTINGS, VALVES, AND HARDWARE WITH TRENTON WAX TAPE PRIMER AND WRAP WITH TRENTON WAX TAPE PER AWWA C217 PER MANUFACTURER'S RECOMMENDATIONS. ENCASE ALL METAL PIPE, FITTINGS, VALVES, ETC. WITH V-BIO OR VB3 ENHANCED POLYETHYLENE ENCASEMENT PER AWWA C105. SECURE ENCASEMENT WITH PVC PIPE WRAP TAPE. METAL PIPE AND APPURTENANCES TO BE PROTECTED BY GALVANIC ANODES.
2. SEE DETAIL 151 FOR GALVANIC ANODE MATERIAL, SIZE, AND PREPACKAGED MATERIAL REQUIREMENTS.
3. INSTALL ANODES WITH MINIMUM OF 3 FEET HORIZONTAL SEPARATION FROM METALLIC FITTING OR PIPE AND AT LEAST 5 FEET BELOW GRADE. ANODES SHALL BE INSTALLED IN A HORIZONTAL POSITION PER ANODE INSTALLATION DETAIL BELOW AND WETTED PRIOR TO BACKFILLING. BURY ANODES IN NATIVE SOIL.
4. LOCATE MULTIPLE ANODES AT EQUAL SPACING ALONG PIPE FITTING ASSEMBLY AND ON ALTERNATING SIDES OF PIPE WHEN MORE THAN FOUR ANODES ARE REQUIRED.
5. LARGER/HEAVIER GALVANIC ANODES MAY BE SUBSTITUTED AND PROVIDED IN LIEU OF SPECIFIED LIGHTER/SMALLER ANODES AT THE CONTRACTOR'S OPTION, BUT THE TOTAL QUANTITY OF ANODES REQUIRED WILL NOT CHANGE.
6. COAT ALL EXPOSED METAL INCLUDING EXPOSED COPPER WIRE WITH 3M SCOTCHKOTE LIQUID EPOXY COATING 323 OR DENSO PROTAL 7300, PER MANUFACTURER'S REQUIREMENTS. FOR THERMITE WELDS USE ROYSTON HANDY CAP IP THERMITE WELD CAPS, PER MANUFACTURER'S REQUIREMENTS. SEE DETAIL 152 FOR THERMITE WELD DETAILS.
7. BOND ALL ADJACENT FITTINGS TOGETHER WITH JOINT BONDS AS SHOWN. SEE DETAIL 153 FOR JOINT BOND DETAILS.

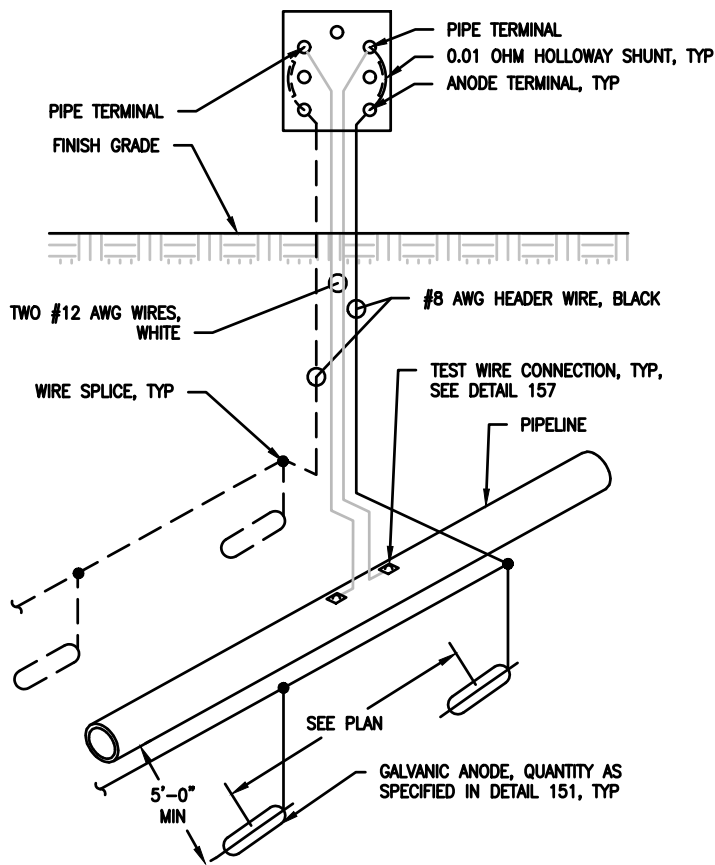
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NO.	DESCRIPTION	BY	APR.	DATE	GALVANIC ANODE INSTALLATION	CAD DWG: PWS DETAILS.DWG
						DATE: OCT 2026
						DRAWN BY: S. SANDERS
						DESIGN BY:
						SCALE:



NOTES:

1. DOUBLE INSULATING WASHER SET FOR VAULT OR EXPOSED FLANGES.
2. SINGLE INSULATING WASHER SET FOR BURIED OR SUBMERGED FLANGES, PLACE INSULATORS ON UNPROTECTED SIDE OF FLANGE.
3. TEST COMPLETED JOINT FOR ELECTRICAL ISOLATION AS SPECIFIED AND REPAIR AS REQUIRED, PRIOR TO BURYING.
4. COAT BURIED OR IMMersed INSULATING FLANGES FOR 12-INCHES MINIMUM ON EACH SIDE OF FLANGE WITH PIPELINE DIELECTRIC JOINT COATING OR HEAT SHRINK SLEEVE, INCLUSIVE OF OVERCOATING CEMENT MORTAR.
5. FOR PIPE LARGER THAN 24-INCH DIAMETER, FILL INTERIOR GAP BETWEEN FLANGES WITH DIELECTRIC FILLER OR SEALANT COMPATIBLE WITH SPECIFIED PIPE LINING.
6. EXTEND SPECIFIED PIPE LINING TO FACE OF FLANGE AND COAT INTERIOR OF MORTAR LINED PIPE FOR TWO PIPE DIAMETERS WITH NSF APPROVED EPOXY AT 20 MILS DFT.
7. FOR PIPE LESS THAN 36-INCH DIAMETER, DELETE INNER STEEL WASHERS.
8. SEE SPECIFICATIONS FOR INSULATING FLANGE REQUIREMENTS.

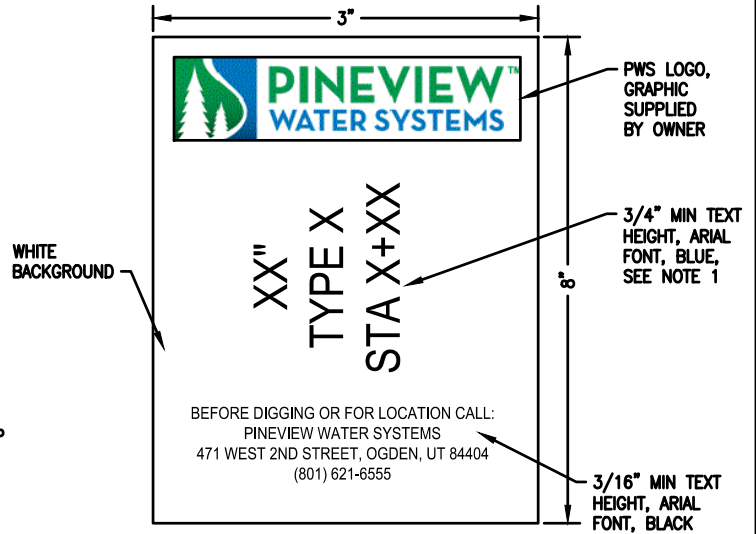
#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	DETAIL 155
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NO.	DESCRIPTION	BY	APR.	DATE	INSULATING FLANGE	CAD DWG: PWS DETAILS.DWG
						DATE: OCT 2026
						DRAWN BY: S. SANDERS
						DESIGN BY:
						SCALE:



TYPE A WIRING DIAGRAM
SCALE: NTS

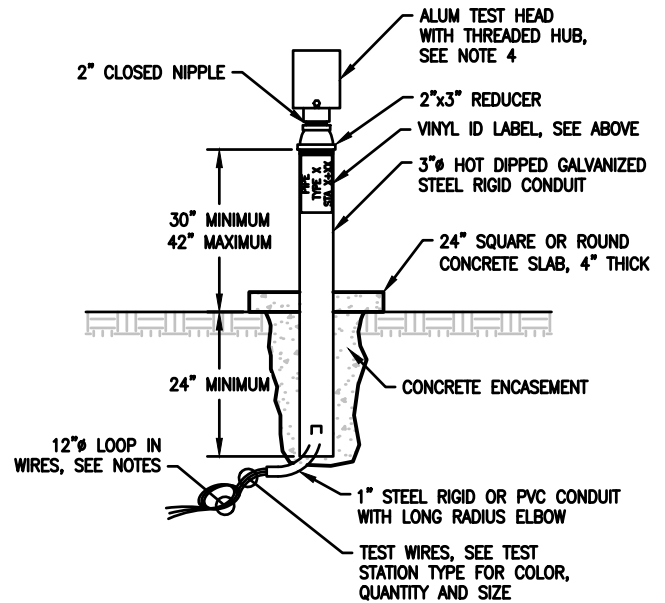
NOTES:

1. TEST STATIONS TO BE POST STYLE STEEL CONDUIT.
2. WHERE TEST STATION OFFSET IS REQUIRED, SEE DETAIL 158.
3. ALL TEST STATIONS TO BE TYPE A, UNLESS NOTED OTHERWISE.



NOTES:

1. LABELS SHALL DISPLAY PIPE DIAMETER, TEST STATION TYPE, AND PIPELINE STATION OF TEST STATION CONNECTION.



POST STYLE, STEEL CONDUIT
SCALE: NTS

NOTES:

1. TERMINAL QUANTITY AND WIRE CONNECTIONS VARY, SEE TEST STATION TYPE DETAIL.
2. LOOP WIRE AT BASE OF POST TO MINIMIZE WIRE STRESS
3. COAT THREADS WITH INORGANIC ZINC PRIMER OR COLD GALVANIZING REPAIR COATING.
4. TESTOX SERIES 700 TEST STATION WITH THREADED HUBS. IF ADDITIONAL TERMINALS ARE NEEDED, TESTOX SERIES 2000 TEST STATION WITH THREADED HUBS.
5. SLIP FIT HUBS WILL NOT BE PERMITTED.

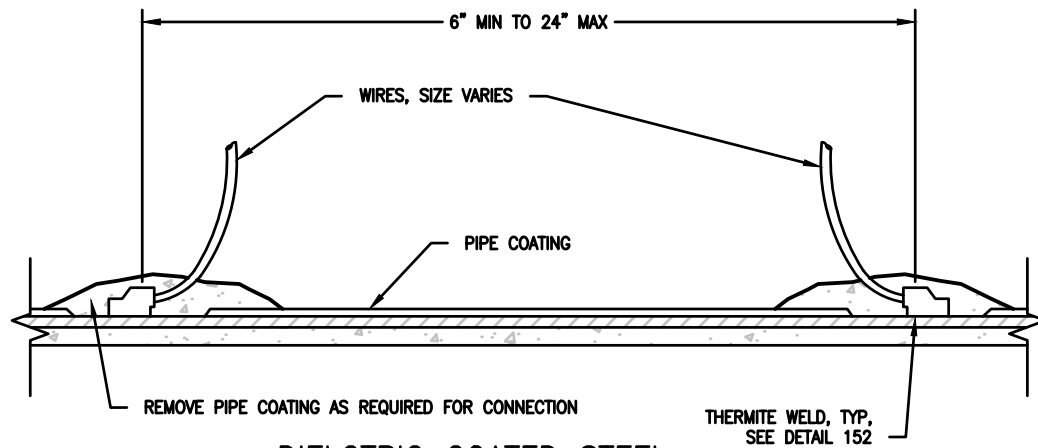
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PINEVIEW WATER SYSTEMS STANDARDS

TYPE A TEST STATION

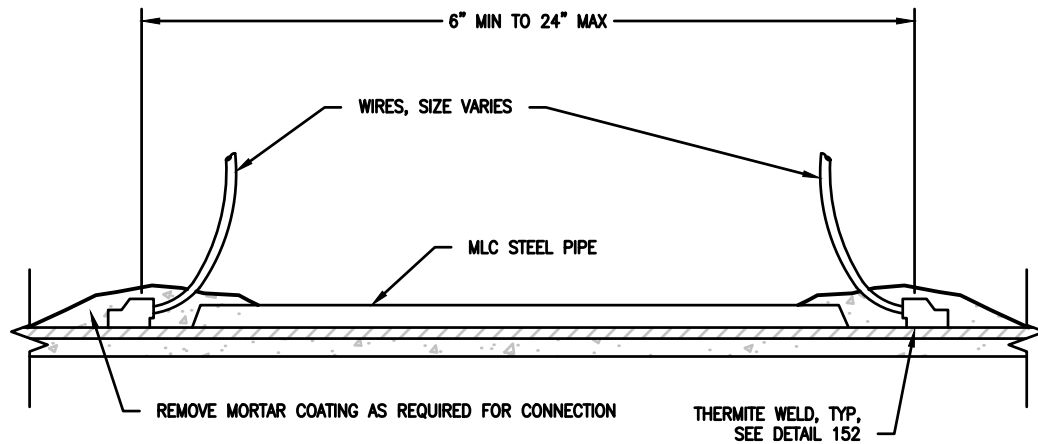
DETAIL 156

CAD DWG:	PWS DETAILS.DWG
DATE:	OCT 2026
DRAWN BY:	S. SANDERS
DESIGN BY:	
SCALE:	



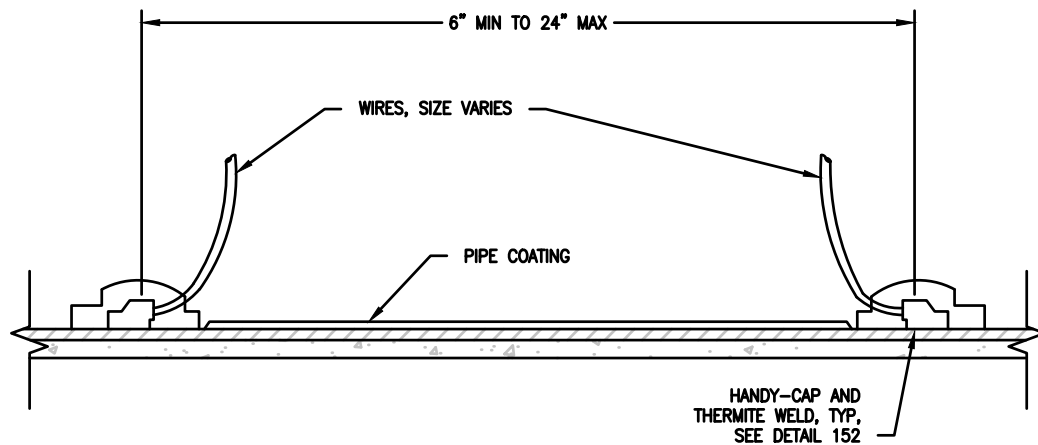
DIELECTRIC COATED STEEL

SCALE: NTS



CCP OR MLC STEEL

SCALE: NTS



DUCTILE IRON

SCALE: NTS

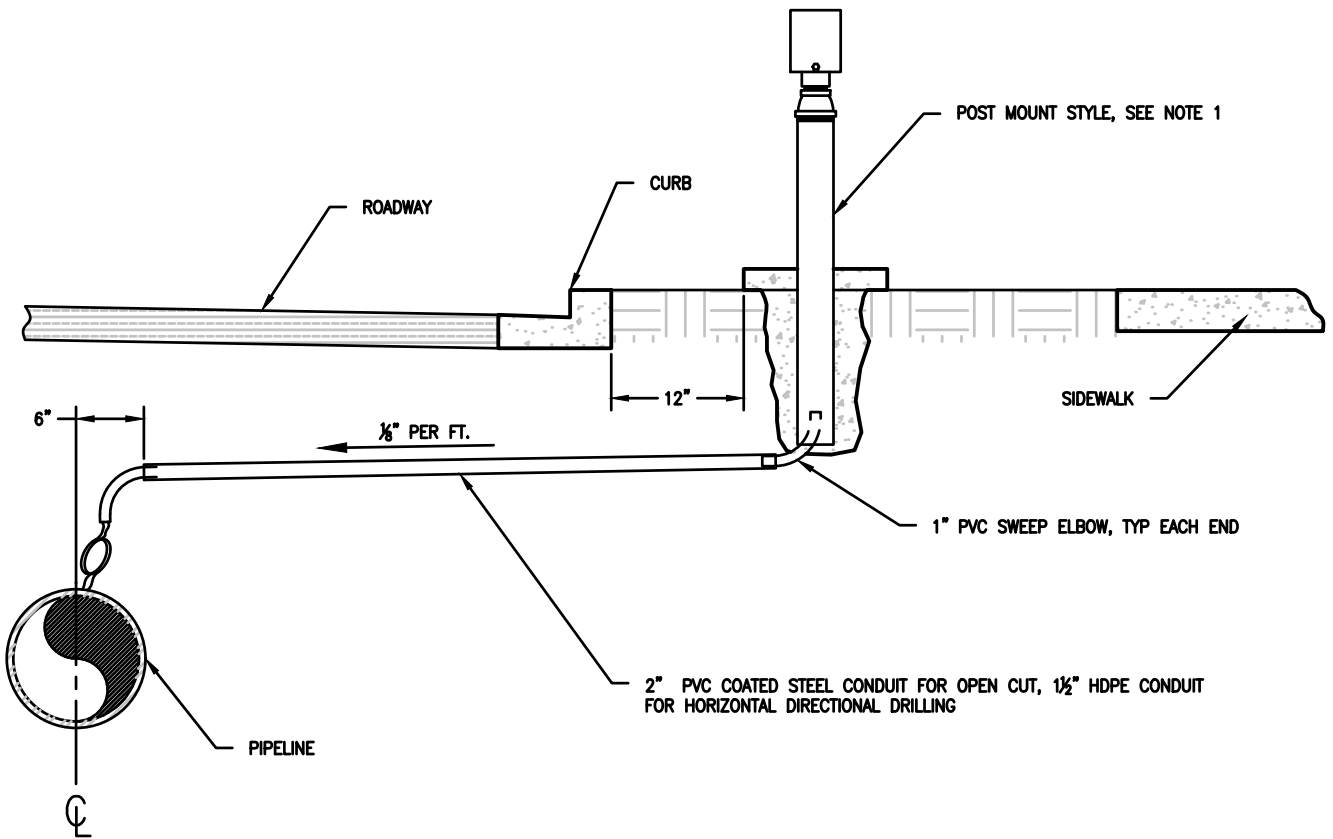
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

TEST WIRE CONNECTION

DETAIL 157

CAD DWG: PWS_DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



NOTES:

1. SEE DETAIL 156 FOR POST MOUNT TEST STATION DETAIL.
2. DO NOT CONNECT CONDUIT TO POST STYLE TEST STATION.
3. BURIED CONDUIT TO BE RIGID PVC COATED STEEL.
4. SEAL BOTH ENDS OF CONDUIT WITH DUCT COMPOUND OR URETHANE FOAM.

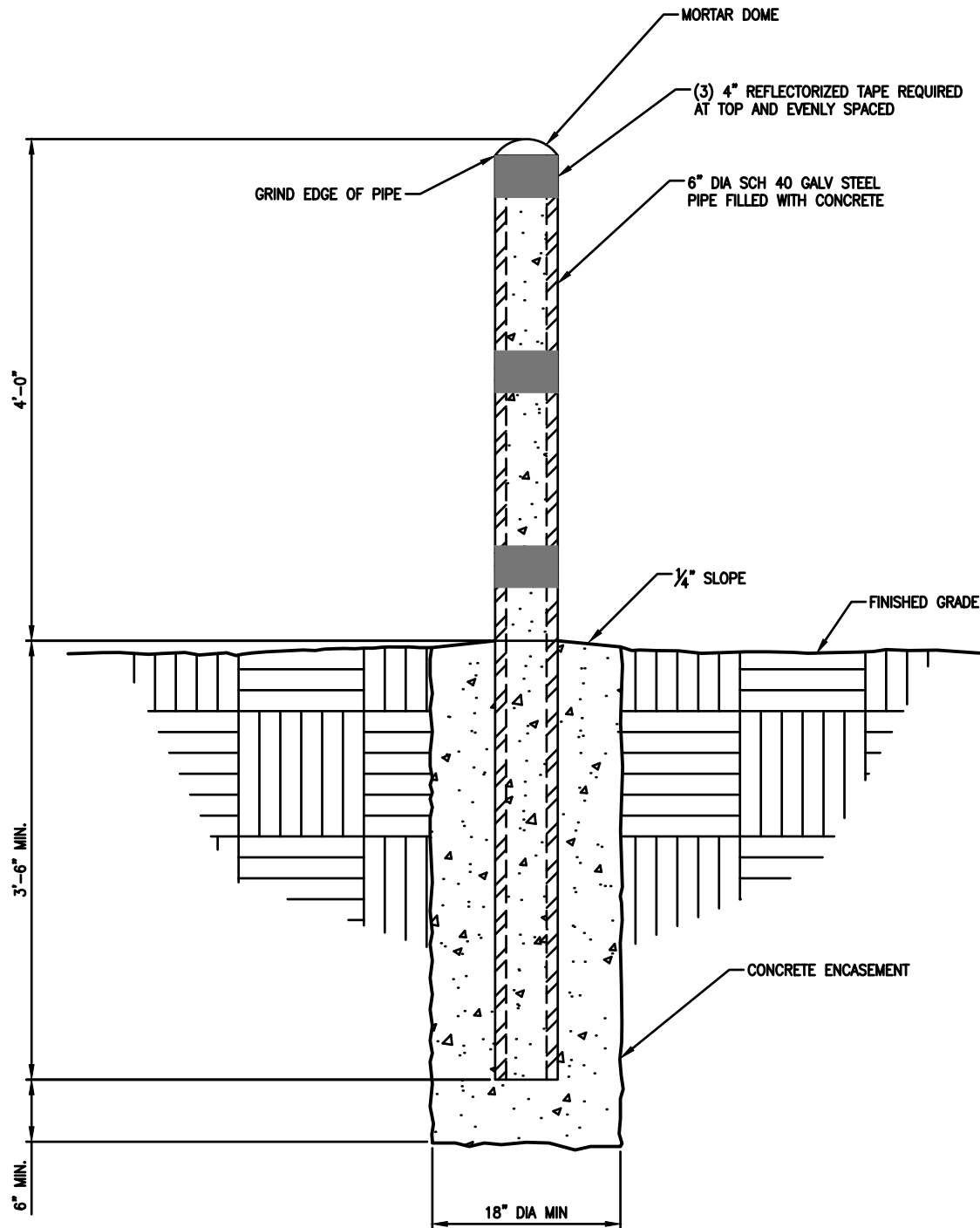
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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

TEST STATION ROADWAY OFFSET

DETAIL 158

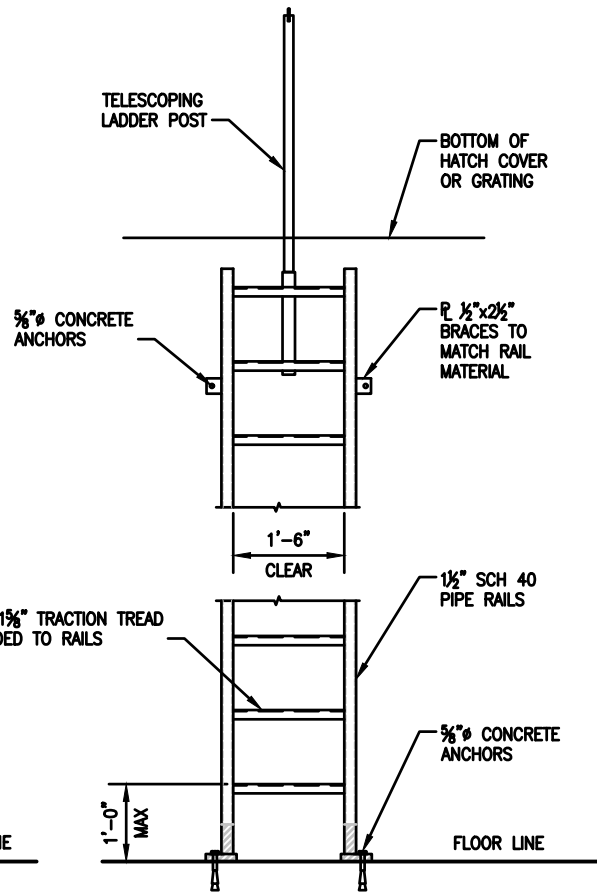
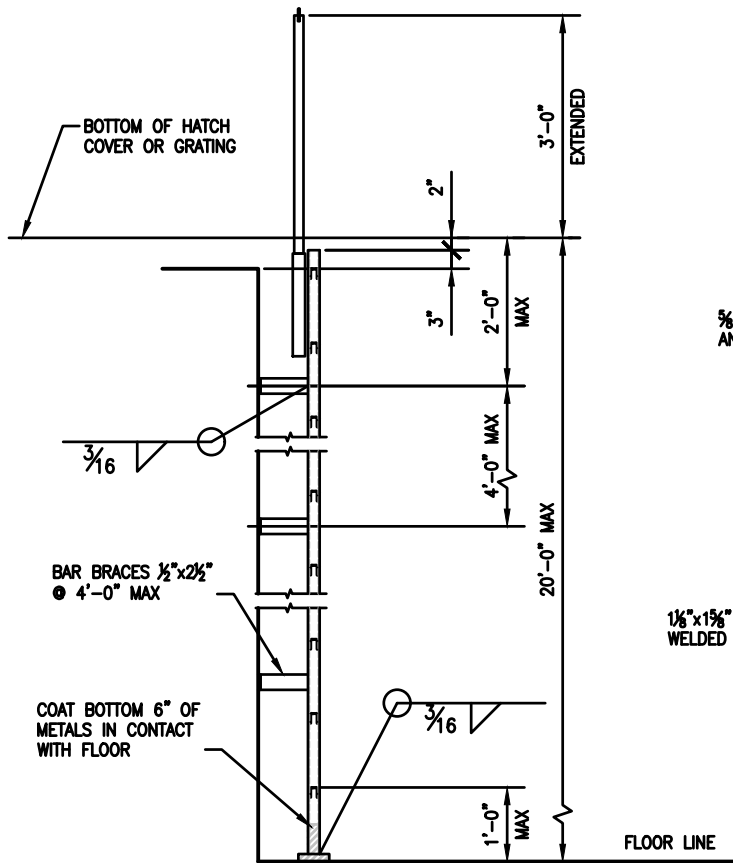
CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:



NOTES:

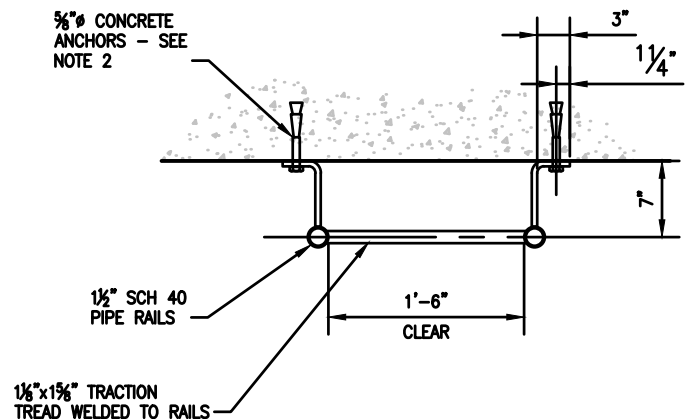
1. MARKER POSTS SHALL BE INSTALLED BY VALVES AND VAULTS IN UNIMPROVED AREAS AND IN LOCATIONS SPECIFIED BY THE ENGINEER IN THE FIELD TO PROTECT SURFACE FEATURES.

#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	DETAIL 160
#	#	#	#	#		
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NO.	DESCRIPTION	BY	APR.	DATE	BOLLARD	CAD DWG: PWS DETAILS.DWG
						DATE: OCT 2026
						DRAWN BY: S. SANDERS
						DESIGN BY:
						SCALE:



LADDER NOTES:

1. LADDER MATERIAL SHALL BE STAINLESS STEEL UNLESS INDICATED OTHERWISE ON THE PLANS.
2. USE 316 STAINLESS STEEL FOR ANCHORS & FASTENERS.
3. FABRICATE AND INSTALL LADDERS TO COMPLY WITH OSHA AND ANSI STANDARDS.



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NO.	DESCRIPTION	BY	APR.	DATE

PINEVIEW WATER SYSTEMS STANDARDS

FIXED LADDER (STEEL)

DETAIL 161

CAD DWG: PWS DETAILS.DWG
DATE: OCT 2026
DRAWN BY: S. SANDERS
DESIGN BY:
SCALE:

DESIGN CRITERIA – NOTES					
①	ACCESS RAMP	⑬	HYDROPNEUMATIC SURGE TANK	③①	OVERHEAD SKYLIGHT/HATCH FOR EACH PUMP AND MOTOR REMOVAL
②	INLET STRUCTURE	⑭	WET WELL ACCESS SHALL MEET OSHA & INTERNATIONAL BUILDING CODE REQUIREMENTS	③②	TRENCH-TYPE WET WELL SHOWN
③	ACCESS ROAD	⑮	NORMALLY OPERATING FILTRATION UNITS	③③	WET WELL LOWERED AT FINAL PUMP FOR SELF-CLEANING WET WELL
④	ACCESS GATE	⑯	PRESSURE GAUGE AND PRESSURE TRANSMITTER		
⑤	CANAL TURNOUT	⑰	VARIABLE FREQUENCY DRIVES		
⑥	PUMP MOTOR	⑱	FLOW METER COMPATIBLE WITH PWS SCADA		
⑦	OUTLET STRUCTURE	⑲	GLOBE STYLE CHECK VALVE		
⑧	PERMANENT FILTER BYPASS	⑳	FILTRATION UNIT ISOLATING VALVE (TYP)		
⑨	FILTER BACKWASH DISCHARGE	㉑	AIR VALVE AS REQUIRED AT LOCALIZED HIGH POINTS		
⑩	FILTER BYPASS ISOLATION VALVE	㉒	CONTROL PANELS AS REQUIRED FOR SCADA		
⑪	ROLLUP DOOR	㉓	SYSTEM ISOLATION VALVES AS REQUIRED		
⑫	BOOSTER PUMP/LOW FLOW PUMP AS REQUIRED	㉔	DISMANTLING JOINTS AS NECESSARY FOR ISOLATION VALVE AND FLOW METER MAINTENANCE		
⑬	NORMAL OPERATION PUMP	㉕	AIR VALVES FOR PROTECTION OF PUMPS DURING SURGE EVENTS		
⑭	REDUNDANT PUMP	㉖	FILTRATION BACKWASH ISOLATION VALVE		
⑮	SLOT FOR FUTURE PUMP AS REQUIRED	㉗	SYSTEM PIPING TO CUSTOMER		

#	#	#	#	#	PINEVIEW WATER SYSTEMS STANDARDS	DETAIL 180
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NO.	DESCRIPTION	BY	APR.	DATE	DESIGN CRITERIA – FIGURE	CAD DWG: PWS_DETAILS.DWG
						DATE: OCT 2026
						DRAWN BY: S. SANDERS
						DESIGN BY:
						SCALE: