

# **WATER SYSTEM TECHNICAL SPECIFICATIONS**

**EFFECTIVE JUNE 1, 2026**



**EAST CHERRY CREEK VALLEY  
WATER & SANITATION DISTRICT**  
6201 South Gun Club Road  
Aurora, Colorado 80016  
Phone: 303-693-3800

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**TABLE OF CONTENTS**

<b>SECTION 1.</b>	<b>GENERAL.....</b>	<b>1</b>
1.01	PURPOSE .....	1
1.02	DISTRICT SERVICE AREA .....	1
1.03	AUTHORITY .....	1
1.04	REVISIONS .....	1
1.05	DEFINITIONS .....	1
1.06	ABBREVIATIONS .....	3
<b>SECTION 2.</b>	<b>WATER SYSTEM DESIGN .....</b>	<b>5</b>
2.01	GENERAL .....	5
2.02	WATER SYSTEM PLAN REQUIREMENTS .....	5
2.03	PIPELINE DESIGN .....	5
2.04	WATER DEMANDS AND FIRE FLOW CRITERIA .....	6
2.05	WATER SYSTEM HYDRAULIC DESIGN CRITERIA .....	7
2.06	WATER SYSTEM LOCATION AND ALIGNMENT .....	9
2.07	WATER SYSTEM LAYOUT AT CREEK CROSSINGS .....	12
2.08	CORROSION PROTECTION .....	12
2.09	PIPE RESTRAINT .....	12
2.10	LINE VALVES .....	13
2.11	PRESSURE REDUCING VALVES .....	14
2.12	COMBINATION AIR RELIEF-VACUUM BREAKER VALVES .....	14
2.13	FIRE HYDRANTS .....	14
2.14	FIRE HYDRANT BLOW-OFFS .....	15
2.15	DEAD-END BLOW-OFF .....	15
2.16	WATER SERVICES .....	15
2.17	BACKFLOW PREVENTION .....	17
2.18	PROTECTION OF WATER LINES NEAR SEWER FACILITIES .....	21
2.19	ENCASEMENTS, CASINGS, AND INSULATION .....	21
2.20	CONNECTION TO NON-DISTRICT FACILITIES .....	22
2.21	SUBMETERING POLICY .....	22
<b>SECTION 3.</b>	<b>CONTRACTORS' CONSTRUCTION REQUIREMENTS .....</b>	<b>24</b>
3.01	GENERAL CONSTRUCTION STANDARDS .....	24
3.02	REQUIRED SUBMITTALS .....	25
3.03	STOP WORK ORDERS .....	25
3.04	CURE OF DEFECTS .....	26
3.05	PRECONSTRUCTION MEETING .....	26
3.06	CONSTRUCTION PLANS .....	26
3.07	DEFECTIVE MATERIALS .....	27
3.08	DESIGN REVISIONS DURING CONSTRUCTION .....	27
3.09	CONSTRUCTION WATER .....	27
3.10	RECORD DRAWINGS .....	27
3.11	REPLACEMENT OF EXISTING STREET IMPROVEMENTS .....	28

**TABLE OF CONTENTS (continued)**

3.12	SAFETY AND TRAFFIC CONTROL.....	28
3.13	CONSTRUCTION OBSERVATION .....	29
3.14	GEOTECHNICAL OBSERVATION.....	30
3.15	FEES .....	30
<b>SECTION 4.</b>	<b>WATER SYSTEM MATERIALS, INSTALLATION, AND TESTING ..</b>	<b>32</b>
4.01	GENERAL .....	32
4.02	DUCTILE IRON PIPE (DIP) .....	32
4.03	POLYVINYL CHLORIDE PIPE (PVC).....	33
4.04	DUCTILE-IRON AND GRAY-IRON WATERWORKS FITTINGS .....	34
4.05	MISCELLANEOUS PIPE FITTINGS .....	35
4.06	CONNECTIONS.....	36
4.07	CLAMPS, RODS, AND JOINT RESTRAINT DEVICES .....	38
4.08	GATE VALVES .....	39
4.09	BUTTERFLY VALVES.....	40
4.10	SWING CHECK VALVES .....	42
4.11	PRESSURE REDUCING VALVE AND VAULT INSTALLATION .....	43
4.12	AIR/VACUUM VALVE AND VAULT INSTALLATION .....	44
4.13	TAPPING SLEEVE/CLAMP AND VALVE .....	45
4.14	MARKER POSTS .....	48
4.15	FIRE HYDRANTS .....	48
4.16	CONCRETE KICK BLOCKS .....	50
4.17	FIRE HYDRANT BLOW-OFF .....	51
4.18	BLOW-OFF HYDRANT .....	51
4.19	2-INCH BLOW-OFF ASSEMBLY .....	51
4.20	PRECAST CONCRETE VAULTS/MANHOLES .....	52
4.21	WATER SERVICE CONNECTIONS .....	54
4.22	BACKFLOW PREVENTION DEVICES.....	55
4.23	ENCASEMENTS.....	56
4.24	WATER SYSTEM INSTALLATION .....	56
4.25	WATER SYSTEM TESTING AND ACCEPTANCE .....	68
4.26	CONDUIT CONNECTIONS.....	72
	<b>APPENDIX A – WATER SYSTEM CONSTRUCTION DETAILS</b>	<b>85</b>
	<b>APPENDIX B – WATER SYSTEM PLAN REQUIREMENTS CHECK LIST</b>	<b>87</b>
	<b>APPENDIX C – GENERAL NOTES FOR WATER SYSTEM PLANS</b>	<b>91</b>

## SECTION 1. GENERAL

### 1.01 PURPOSE

This publication provides information relative to engineering, design, materials specifications, and construction procedures for water systems consisting of lines between 6 inches and 12 inches in diameter within the East Cherry Creek Valley Water & Sanitation District (District). Water lines larger than twelve (12) inches in diameter shall be designed by the District. These Specifications are an integral part of the District's Rules and Regulations. The Specifications may be downloaded from the District's website at [www.eccv.org/technical-specifications](http://www.eccv.org/technical-specifications). District's Specifications may also be purchased at the East Cherry Creek Valley Water & Sanitation District office, located at 6201 South Gun Club Road, Aurora, Colorado 80016, at cost.

### 1.02 DISTRICT SERVICE AREA

The East Cherry Creek Valley Water & Sanitation District Service Area is located in Arapahoe County, Colorado. Generally, the District is located west of Gun Club Road, south of Hampden Avenue, east of Parker Road, and north of Arapahoe Road.

### 1.03 AUTHORITY

These Specifications shall be administered by the District and shall include all interpretation, enforcement, revision, waiver and variance with all such actions being finally determined by the District.

### 1.04 REVISIONS

These Specifications are effective as of June 1, 2026. Revisions to these specifications may be made from time to time by the District. Any revisions shall be in effect at the date of issuance by the District. Any person using these specifications should contact the District for information relative to revisions.

### 1.05 DEFINITIONS

As used in these Specifications and the District Rules and Regulations, unless the context clearly indicates otherwise, the words defined below shall have the respective meaning set forth for them:

**Actual Costs:** All direct and indirect costs attributable to any project or material, equipment, administrative, and overhead expenses, calculated in accordance with the rates set forth in the District Rules and Regulations, and all direct payments to third parties, at cost.

**Board or Board of Directors:** The duly constituted Board of Directors of the District.

**Contractor:** Any person who performs any work, either for himself or another, on any water facilities, public or private, within the District, including all

subcontractors, agents, employees, officers, and other representatives of such person.

**Construction Plans:** Plans and Specifications for the construction of a specific Developer/Owner water system project which have been reviewed and signed by the District and the District's Consulting Engineer.

**District:** East Cherry Creek Valley Water & Sanitation District, Arapahoe County, Colorado, its employees, agents, officers, directors, insurers, and professional consultants.

**District Engineer:** The District's Staff Engineer and/or the District's Consulting Engineer.

**District Manager:** The Manager of the District appointed by the Board of Directors, or any other person duly authorized to perform the duties of District Manager.

**District System:** The Plant, facilities, systems, assets, and appurtenant property rights owned or directly controlled by the District.

**Foreign Material:** Any objects or substances other than treated potable water.

**License:** The written authority to receive water at specified premises for specified purposes.

**Licensed Premises:** The land area and improvements thereto to which water service is limited under any particular License.

**Main or Water Main:** Those pipes and appurtenant facilities used for distributing water along public streets or appropriate rights of way deeded or licensed to the District directly to various Licensed Premises.

**Main Extension:** The construction of any facilities, or the facilities themselves, which are intended to become a part of the District System upon acceptance by the District in accordance with the Rules and Regulations.

**Person:** Associations, corporations, firms, partnerships, and bodies politic and corporate, as well as individuals.

**Property Owner/Owner/Developer:** All of these terms shall be synonymous with each other and shall mean any person who, whether solely or with others, owns real property within the District. When property is owned by more than one person, the term includes all owners thereof. As used in these Specifications, the term shall apply to such person only in connection with his ownership of any specific parcel of real property involved in any specific matter governed by these Specifications or the Rules and Regulations. For purposes of clarity, the masculine singular pronoun is used in these Specifications to refer to Property Owner.

**Record Drawings:** A separate set of construction plans marked to indicate completely and accurately the field-installed condition of facility construction in progress, as required by these Specifications.

**Rules and Regulations:** The comprehensive set of operating rules and requirements, as now or hereafter constituted, adopted by the Board of Directors for the purpose of regulating the design, construction, operation, maintenance, use, repair and replacement of the District System.

**Service Lines:** All pipes, fittings, and appurtenances which convey water from the District System to the plumbing of the Licensed Premises. In the case of an inside water meter, the dividing point between the District System and private service line is the plug on the corporation stop tapped into the Main. In the case of an outside water meter, the dividing point is at the water meter.

**Stub-in:** A tap made for the purpose of installing service lines prior to the paving of streets. Such connection shall include fittings necessary to extend the service line to the valve at the property line.

**Tap or Service Connection:** The physical connection to a District Main which, together with the Tap Permit for same, affects water service to any Permitted Premises.

## 1.06 ABBREVIATIONS

These Specifications utilize and otherwise make reference to other Technical Specifications. Where these references are made, they shall refer to the latest edition or revision thereof.

<b>AASHTO</b>	American Association of State Highway and Transportation Officials
<b>ACI</b>	American Concrete Institute
<b>AISC</b>	American Institute of Steel Construction, Inc.
<b>ANSI</b>	American National Standards Institute, Inc.
<b>ASA</b>	American Standards Association
<b>ASTM</b>	American Society of Testing Materials
<b>AWWA</b>	American Water Works Association
<b>IPC</b>	International Plumbing Code
<b>SEMSWA</b>	Southeast Metro Stormwater Authority
<b>OSHA</b>	Occupational Safety Health Administration UL Underwriter's Laboratories
<b>UL</b>	Underwriter's Laboratories
<b>UNI</b>	Uni-Bell Association
<b>UPC</b>	Uniform Plumbing Code

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## **SECTION 2. WATER SYSTEM DESIGN**

### **2.01 GENERAL**

All water lines, appurtenances, and related public water system within the District shall be designed in accordance with these Specifications, and any other applicable Federal, State, and Local regulations. Any deviation from these Specifications shall require the written authorization of the District prior to design or construction. Design of all water system construction plans shall be performed under the direct supervision of a Professional Engineer, registered in the State of Colorado. The intent is to provide a consistently designed, long-term, reliable system which can be easily located and maintained by the District.

### **2.02 WATER SYSTEM PLAN REQUIREMENTS**

Construction plans for water systems shall meet the guidelines set forth in the Water System Plan Requirements check list and General Notes found in the Appendices. The Check List and General Notes are guidelines and as such, some items may not be applicable to all projects as determined by the District.

### **2.03 PIPELINE DESIGN**

All water pipelines in the District shall be either Ductile Iron Pipe (DIP) or Polyvinyl Chloride Pipe (PVC). In general, selection of the type of pipe shall be left to the discretion of the Professional Engineer in charge of the design. However, the District reserves the right to deny the use of certain types of materials in specific circumstances.

#### **A. Ductile Iron Pipe**

Ductile Iron Pipe (DIP) may be used for all sizes of lines in water systems within the East Cherry Creek Valley Water & Sanitation District. Ductile Iron Pipe shall be designed in accordance with ANSI/AWWA C150/A21.50 Specifications, latest revision. All Ductile Iron Pipe shall be polyethylene wrapped. Polyethylene wrapping shall be in accordance with AWWA C-105, latest revision, and have a minimum thickness of 8 mils.

#### **B. Polyvinyl Chloride Pipe**

Polyvinyl Chloride Pipe (PVC) 4-inches through 12-inches in diameter may be used for water system construction within the East Cherry Creek Valley Water & Sanitation District under the following conditions:

1. Where soils have resistivities less than 1000 ohm-cm, or where stray current corrosion may be severe as determined by the District. See "Corrosion Protection" in these specifications for additional information.
2. Where the water system layout, in the District's opinion, does not propose to have a significant number of bends or other fittings which

require pipe restraint. Mechanical Joint Restraint, as shown in the Standard Construction Detail Drawings, shall be used where restraint is required on PVC pipe.

3. In all cases the District shall determine if PVC pipe is acceptable for use on a case-by-case basis.

Where PVC pipe is permitted by the District, PVC pipe shall be designed in accordance with the UNI-BELL "Handbook of PVC Pipe," latest edition.

## **2.04 WATER DEMANDS AND FIRE FLOW CRITERIA**

Water lines shall be designed to transport average annual, peak day, peak hour and fire flow demands in accordance with these Specifications. The criteria presented in following table are minimum criteria, and the District reserves the right to modify the criteria, at any time, for the design of specific projects. Water demand criteria for proposed uses not shown in the table below (i.e. car wash, laundries, auto service stations, supermarkets, places of assembly, hospitals, etc.) shall be approved by the District during system design, on a case-by-case basis using generally accepted planning criteria.

An allowance for irrigation is included in the residential criteria; however, irrigation is not included in the nonresidential criteria (i.e. commercial, office, restaurant, etc.) and shall be added. Irrigation allowances are shown in the table below. Irrigation should be designed to take place during off-peak demand periods and in accordance with seasonal watering restrictions by the District.

The District is included within the South Metro Fire Protection District. It is the Owner's responsibility to contact South Metro Fire Protection District and establish the required fire flow and hydrant locations for each specific project.

<b>WATER DEMAND CRITERIA</b>				
<b>USE</b>	<b>OCCUPANCY</b>	<b>AVERAGE DAY DEMAND</b>	<b>PEAK DAY DEMAND</b>	<b>PEAK HOUR DEMAND</b>
Single-Family	3.2 Persons	167 GPCD	600 GPCD	1028 GPCD
Townhome	2.7 Persons	167 GPCD	600 GPCD	1028 GPCD
Multi-Family	1.7 Persons	167 GPCD	600 GPCD	1028 GPCD
Commercial	N/A	0.5 GPD/SF	1.06 GPD/SF	2.14 GPD/SF
Office	N/A	0.15 GPD/SF	0.35 GPD/SF	0.71 GPD/SF
Senior Living				
Elementary School	700 Stu./Staff	20 GPCD		
Middle School	1070 Stu./Staff	25 GPCD		
High School	2470 Stu./Staff	35 GPCD		
Irrigation	N/A	2.42 Ac-Ft/Ac/Yr (1"/week for 29 weeks)		

### **ABBREVIATIONS**

Ac-Ft/Ac/Yr	Acre Feet per Irrigated Acre per Year
GPCD	Gallons Per Capita Per Day
GPD/SF	Gallons Per Day Per Square Feet
Multi-Family	Attached Single-Family Residential Dwelling (Rented)
N/A	Not Applicable
SF	Square Feet Developed Floor Area
Single-Family	Detached Single Family Residential Dwelling (Owned)
Stu./Staff	Students and Staff
Townhome	Attached Single-Family Residential Dwelling (Owned)

## **2.05 WATER SYSTEM HYDRAULIC DESIGN CRITERIA**

### **A. General**

All water lines shall be designed to transport water during average and peak demand conditions in accordance with these Specifications, and the District's Water Master Plan, using a pipe network reviewed by the District. No public water line shall be less than six inches (6") in diameter unless approved by the District. Water systems shall be looped systems and shall provide a level of service consistent with the District and appropriate Fire Protection District Standards.

### **B. Maximum Head loss Criteria**

The maximum allowable head loss for water lines is shown in the table below.

MAXIMUM ALLOWABLE HEAD LOSS	
PIPE SIZE	MAXIMUM ALLOWABLE HEAD LOSS (per 1000 ft.)
6"	2.0
8"	2.0
12"	2.0
16"	1.5
20"	1.5
24" & larger	1.0
Hazen-Williams "C" factor = 130	

**C. Peak Demand Conditions**

A variety of peak demand or critical demand conditions exist for different types of developments. Peak conditions shall be reviewed by the designing Engineer with the highest demand condition being used to size water lines. Some typical peak demand conditions include peak hour demand and peak day demand plus fire flow.

**D. System Pressure Requirements**

Static pressures within the water system shall range from a minimum of 50 psi to a maximum of 110 psi. During the peak hour demand, pressures shall be a minimum of 45 psi.

During peak day plus fire flow demand conditions, the minimum residual pressure at any fire hydrant shall be 20 psi, minimum. The maximum allowable pressure fluctuation between average demand conditions and peak hour demand conditions shall be 35 psi.

Where static water pressures exceed 80 psi, individual pressure reducing valves shall be installed on water services, as required by the International Plumbing Codes (IPC) or requirements of the agency with jurisdictional authority of the structure. The District requires Developers install individual pressure reducing valves on water services.

**E. Minimum Design Pressures**

Minimum design working pressure shall be 150 psi. Minimum design transient or water hammer pressure shall be: 120 psi for 6 and 8-inch diameter lines, 110 psi for 12-inch diameter lines, and 70 psi for 16-inch and larger diameter lines. Pipe design calculations shall be submitted to the District, upon request.

## **2.06 WATER SYSTEM LOCATION AND ALIGNMENT**

### **A. General Location in Streets**

Where water lines are located in the street right-of-way, they shall be designed to the following guidelines.

In streets running generally north and south, the water line shall be located ten feet (10') east of the street centerline.

In streets running generally east and west, the water line shall be located ten feet (10') north of the street centerline.

Water lines may be designed on curvilinear streets parallel to street centerline using deflected pipe joints. Joint deflections shall be within the manufacturer's maximum recommended deflection per joint. Bending of PVC water pipes to achieve a change in alignment is not permitted.

In streets shaped as a "U" or on streets having unusually sharp turns, the water line will conform to the above Specifications as near as is practical but shall not "zigzag" across the street centerline. The final location shall be determined by the District. Where water lines are proposed to cross the street centerline, they shall be designed to cross the street using 45-degree horizontal bends.

In cul-de-sacs, water lines shall be located in conformance with the "Water Distribution System Typical Plan for Cul-de-sacs" detail.

Where stub outs are to be provided for service to future areas, they shall be located in conformance with the "Stub out Configurations" detail.

In no case shall the water line be designed closer than three (3) feet to the lip of a cross pan, or gutter, or ten (10) feet to any right-of-way line boundary.

### **B. General Location in Easements**

Where water lines are proposed in easements, they shall be designed within the easement boundary to the following minimum requirements. Water easements shall be a minimum of thirty feet (30') wide and shall have legal descriptions and drawings prepared in accordance with these Specifications. Wider easements will be required for water lines installed with other utilities, greater amounts of cover, or other reasons deemed necessary by the District. All easement widths are subject to review and approval by the District. Valves shall be provided at each end of any easement. Easements shall provide easy access by a tandem wheeled maintenance truck. If the water line is the only utility proposed to be constructed within the easement, the alignment shall be on the easement centerline. Where easements straddle a property line, the water line shall be located a minimum of ten (10) feet from one edge of the easement and a minimum of ten (10) feet from the property line. When determining the

location of the utility in the easement, consideration shall be given to excavation, maintenance, and repair requirements. In no case shall the water line be designed closer than ten (10) feet to any easement boundary.

The District requires that all utility easements be a separate "out lot" or parcel, entirely on one lot. Easements divided by a property line of two separate owners, or lots, are not acceptable.

A copy of the Grading Plan and Landscaping Plan showing the proposed conditions of the easements shall be submitted for review by the District. A profile design of the water line in the easement is required by the District.

### **C. Easement Legal Descriptions and Drawings**

Easement legal descriptions and drawings shall be prepared under the direct supervision of a Professional Land Surveyor, Registered in the State of Colorado.

Legal descriptions and drawings shall be prepared on letter sized (8½" x 11") paper and shall be referenced to the nearest section corner. Legal descriptions may also be tied to a recorded plat. The legal description shall be a "meets and bounds" description, accurately describing to a hundredth of a foot, the point of beginning, each easement line bearing and distance, and the total area contained in acres.

Easement drawings shall be presented at a scale sufficient to clearly show all easement boundaries. The drawing shall show the north arrow, referenced section corner, all bearings and distances, total acres, adjacent property identification, street names, and date of preparation.

Easement legals shall bear a professional land surveyor (State of Colorado) seal and signature. The easement legal and drawing shall be included with the District's Standard Easement Deed. A sample copy of the Standard Deed is included in the appendix. The District reserves the right to modify the conditions of the Easement Deed, at any time, for specific projects.

Legal descriptions and drawings should be submitted to the District for review along with closure calculations and a Title Insurance Commitment covering the subject right-of-way. A copy of each document listed in the Title Commitment must be included. All expenses incurred in obtaining Title Insurance shall be paid by the Grantor.

The District will not permit construction of a project until all easements related to the project are fully signed and recorded on the County Records.

#### **D. Relation to other Utilities**

Water lines in streets and easements shall be designed to provide a minimum separation of ten (10) horizontal feet measured between the centerline of any sanitary sewer line and the centerline of any water line or appurtenance. Horizontal edge-to-edge separation with utilities other than sanitary sewer lines shall be five (5) horizontal feet minimum but shall in all cases allow for future excavation of the water line without causing damage to the adjacent utility.

Where water lines are proposed to cross sanitary or storm sewer lines or other utility lines, they shall be designed to cross at an angle close to ninety degrees (90°). The minimum vertical clearance between the edge of any water line and edge of any other water line or utility, shall be eighteen inches (18"). Water lines shall cross above any wet utilities that are not encased.

#### **E. Distribution Looping and Water Quality**

All water systems shall be effectively looped. No dead-end lines will be permitted except for lines extending into cul-de-sacs serving twelve (12) Single Family Equivalent's (SFE's) and with a water main length of 400 or less feet. Water mains less than eight inches (8") in diameter may be allowed on dead-ends on a case-by-case basis by the District if there is determinable water quality benefit and all fire protection requirements are met. A fire hydrant or a blow-off hydrant will be required on all dead-end lines.

For single feed water lines required by construction phasing, meters for no more than 12 SFE's will be released by the District for installation. Release of additional meters will require further progress towards completion of final water line looping and approval by the District.

The District may require water quality sampling stations as needed to assist in gathering compliance samples for regulatory agencies. The number and location of the stations will be coordinated during the review process.

#### **F. Minimum Depth**

The minimum depth of water lines in streets and easements shall be four and one-half feet (4-1 /2') measured from the top of pipe to final street or surface grade. Water lines shall not be designed or constructed with less than four and one-half feet (4-1 /2') of cover. Minimum cover over water lines at air and vacuum valve and vault installations is six feet-eight inches (6'-8") minimum as shown on the standard detail drawings. Maximum depth of water lines shall be reviewed on a case-by-case basis. However, generally no lines shall have more than 10 feet of cover.

## **2.07 WATER SYSTEM LAYOUT AT CREEK CROSSINGS**

Where water lines are proposed to cross creeks or drainageways, they shall be designed to cross perpendicular to the creek or drainage way centerline. Valves shall be provided on each side of the crossing (with no service lines between) to isolate the crossing in the event of a line break. A specific geotechnical investigation shall be performed by the owner for each proposed crossing to evaluate potential 100-year flood scour depths of the creek or drainageway at ultimate development of the drainage basin.

After the investigation has been reviewed by the District, a minimum water line depth will be established, as well as encasement and/or erosion protection requirements. Review by the County, SEMSWA, or Mile High Flood District may be required.

## **2.08 CORROSION PROTECTION**

### **A. Metallic Pipe and Fittings**

All metallic pipes shall be polyethylene wrapped in accordance with these Specifications.

### **B. Connections to Existing Water Systems**

Wherever new water systems are proposed to connect to an existing metallic water line, the connection shall be insulated to prevent the passage of electrical current.

### **C. Crossings with Other Metallic Pipelines**

Wherever metallic water lines are proposed to cross other metallic lines, the designing engineer shall contact the owner of the other metallic line and determine if it is being protected by a cathodic protection system. If the other pipeline system is using a cathodic protection system, the District will require that the owner have an investigation and design performed by a corrosion engineer for the crossing.

## **2.09 PIPE RESTRAINT**

### **A. General**

All horizontal bends, vertical bends, tee branches and dead-end plugs, and other appurtenances as deemed necessary by the Engineer, or the District shall be restrained in conformance with the "Length of Restrained Pipe" detail and "Kick block" detail. "Rodding" using bell and body clamps is not permitted on PVC pipe. PVC pipe restraint shall be accomplished with the use of mechanical joint restraint and rods across pipe joints.

**B. Restraint**

The "Length of Restrained Pipe" detail shows minimum restrained lengths for fittings. The minimum restrained lengths are based on an internal working pressure of 150 psi plus surge pressures and refers to the minimum length of the pipe which must be "tied" together and does not necessarily refer to the length of the restraint required.

**C. Kick blocks**

Kick blocks are required on all bends, tees, and plugs. The minimum bearing areas shall be in conformance with the "Kick block" detail. Kick blocks shall be sized for site conditions using the following minimum criteria:

Internal Working Pressure	= 150 psi
Transient Pressure	= 120 psi for 6- and 8-inch lines
	= 110 psi for 12-inch lines
	= 80 psi for 16 inch and larger lines
Undisturbed Soil Bearing Capacity	= 3,000 psi

**2.10 LINE VALVES**

**A. General**

Line valves are required at the following locations to provide for effective use and maintenance of the water system. Valves on 12 inch and smaller diameter lines shall be direct bury gate valves. Valves of 16 inch diameter and larger lines shall be reviewed by the District on a case by case basis.

All line valves shall be open right.

The District may require valve position indicators as needed.

**B. Location**

Line valves shall be located:

1. Every 500 feet of water line.
2. At street intersections on extended property lines.
3. Between any two fire hydrants, with the valve being located five feet (5') from the fire hydrant tee.
4. In locations so that no more than 18 residential services will be out of service in the event of a single main break.

5. At creek crossings or other special installations to provide for isolation of the system in the event of a line break.
6. At interfaces between different pressure zones where a pressure reducing facility is not required by the District. Such valves shall be normally closed.
7. At phase boundaries where main line construction is phased.
8. At other locations designated by the District.

## **2.11 PRESSURE REDUCING VALVES**

Pressure reducing valve installations (PRV's) are required to control distribution system pressures between different pressure zones. The District shall determine the need for PRV's during review of the Construction Drawings.

## **2.12 COMBINATION AIR RELIEF-VACUUM BREAKER VALVES**

Combination Air Relief-Vacuum Breaker Valves shall be installed at high points in distribution lines 12 inches in diameter or greater, where designated by the District, to control the exhaust or admittance of air into the water system. These valve installations prevent air from accumulating at high points in the system during operation, exhaust large volumes of air when the lines are being filled and prevent water line collapse due to vacuum when a line is being drained or has broken. The District shall determine the location of Combination Air Relief - Vacuum Breaker valve installations during review of the Construction Plans.

## **2.13 FIRE HYDRANTS**

The number and location of fire hydrants in each area shall be determined by the Owner in accordance with the requirements of the Fire Protection Agency and shall be reviewed and accepted by the District. General practice is to install fire hydrants on the northeast corner of street intersections. If hydrants are to be installed at locations other than street intersections, they shall be located on property lot lines. *See ECCV Intersection Valve and Fire Hydrant Location" detail for typical layout* in Appendix A.

Fire hydrant branch lines shall be set at right angles to the main line. The hydrant shall be set at the end of the branch line and shall face the branch line. With the exception of the base, no horizontal or vertical bends, or reducers shall be used in installing fire hydrant branch lines. Under no circumstances shall any size or type of tap be made on a fire hydrant branch line. A minimum of 3 feet horizontal clearance from landscaping shall be maintained to provide access.

Hydrants shall be set to provide 18-25 inches vertical clearance from grade to nozzle centerline.

Dead end water lines eight inches (8") in diameter or greater shall not have more than one fire hydrant connected to it, except as specifically allowed in writing by the appropriate Fire Protection Agency and the District.

Fire hydrants shall be set a minimum of one foot (1') from the street right-of-way line. Where it is not possible to install fire hydrants in streets, they shall be located in easements having a minimum width of ten feet (10'), a maximum length of twenty feet (20') and the easement end line shall extend a minimum of three feet (3') beyond the hydrant.

All valves on hydrants shall open clockwise (open right).

#### **2.14 FIRE HYDRANT BLOW-OFFS**

Where water lines are to be designed across low areas (e.g. streams, gulches), the District may require that a Fire Hydrant Blow-Off Assembly be provided to flush the line. The District shall determine the need for Fire Hydrant Blow-Offs during the plan review process.

#### **2.15 DEAD-END BLOW-OFF**

A Fire Hydrant Blow-Off Assembly shall be provided at all permanent or temporary dead-end lines in the District's Water system. Temporary blow-offs must be approved by the District in writing.

#### **2.16 WATER SERVICES**

##### **A. Meter Pits and Curb Stop Boxes**

All meters shall be set outside in a meter pit subject to review by District personnel for location and access.

In general, meter pits and curb stop boxes shall be located behind the back of sidewalk, or behind the property line where no sidewalk is proposed. Meter pits and curb stop boxes shall not be placed in driveways or roadways without written approval of the District. A minimum of three feet horizontal and five feet vertical clearance must be provided to meter pits. Pits may be constructed of concrete or plastic.

Meter pit lids shall be composite, fiber-reinforced polymer resistant to ultraviolet light degradation. Lids shall be furnished with a worm-gear locking bolt with a five-sided brass nut.

Meter pit domes shall be made of cast iron and provide freeze protection.

Meter setters shall include a keyed inlet valve and double-check valve assembly on the outlet.

*See ECCV ¾" & 1" Service Meter detail for approved materials and dimensions in Appendix A.*

**B. Service Lines**

No connection between the District main and a service line shall be made except in a public street or District easement.

No connections shall be made within 5' of the meter.

Service lines shall not be routed underneath driveways without prior District approval.

Refer to ECCV *Typical Water Services* detail for alignment and material specifications in Appendix A.

**C. Separation**

Water service lines shall be placed in a trench separate from the sanitary sewer services, with 10' minimum horizontal separation. Where water service lines cross sewer services, a minimum of 18" vertical clearance must be provided (water service on top), in addition to sleeving. Sleeves must cross sewer services at substantially perpendicular angles and extend laterally to provide a minimum of 10' linear clearance between end of sleeve and sewer, measured edge-to-edge.

Service lines that cross storm sewers must comply with ECCV *Water Service Storm Crossing* detail in Appendix A.

**D. Irrigation**

All commercial properties require a separate irrigation tap and meter. Irrigation systems must meet ECCV Irrigation Technical Specifications.

Only single-family residences are permitted to use water from their domestic water service for irrigation purposes.

**E. Residential Fire Suppression Systems**

Automatic fire suppression systems designed for single family residences may tap the domestic water service line, provided that the system uses no chemicals, auxiliary water supply, or bypass. A double check valve or reduced pressure principal backflow prevention device listed by the National Fire Protection Agency must be installed on all systems. Fire line connections and backflow prevention device placement are subject to review and approval of the District. All backflow prevention assemblies shall be privately owned and maintained. The appropriate design of residential fire sprinkler systems shall be the sole responsibility of the Applicant. Backflow preventers must be tested annually by a Colorado state-certified backflow assembly tester. *See section 2.17 for details regarding ECCV backflow prevention requirements.*

Sprinkler system and backflow preventer connections shall be made no closer than 5 feet downstream of the meter, with no bypass.

## 2.17 BACKFLOW PREVENTION

### A. General

Backflow, which is the flow of water, or other liquid, or foreign materials into the distribution mains of the District's system from another source is strictly prohibited and shall be prevented by the installation of an appropriate, approved backflow prevention device, purchased, and installed by the consumer at his own expense.

The type of protective device required will depend upon the degree of hazard, as follows:

In case of any premises where there is an auxiliary water supply, the District water system must be protected by an approved air-gap separation or an approved reduced pressure principal backflow prevention assembly.

In the case of any premises where there is any material dangerous to health, which is handled in such a fashion as to create an actual or potential hazard to the District's water system, the District's water system must be protected by an approved air-gap separation or an approved reduced pressure principal backflow prevention assembly. Examples of premises where these conditions exist include, but are not limited to, sewage treatment plants, sewage pumping stations, chemical manufacturing plants, hospitals, mortuaries, irrigation systems, and metal plating facilities.

In the case of any premises where there are "uncontrolled" cross-connections, either actual or potential, the District's water system must be protected by an approved air-gap separation or an approved reduced pressure principal backflow prevention assembly at the service connection.

In the case of any premises where, because of security requirements or prohibitions or restrictions, it is impossible or impractical to make a complete in-plant cross-connection survey, the District's water system must be protected against backflow from the premises by either an approved air-gap separation or an approved reduced pressure principal backflow prevention assembly on each service line to the premises.

1. An approved backflow prevention assembly must be installed on all water service connections that are used exclusively for landscape irrigation, and an approved backflow prevention assembly must be installed as an isolation device on residential, commercial, industrial, institutional, and public facilities that use the public water supply for lawn and landscape irrigation. Because landscape irrigation systems are subject to cross-

connections due to flooding, agricultural chemicals such as fertilizers, pesticides, fungicides, soil conditioners, and from submerged outlets, auxiliary water supplies, ponds, reservoirs, swimming pools, and other sources of stagnant, polluted or contaminated waters, these systems are considered to be actual or potential high or severe hazard situations.

2. Air gap separations or reduced pressure principal backflow prevention assemblies are required for irrigation systems subject to the following conditions:
  - a. Locations subject to flooding
  - b. Systems which are subject to back pressure conditions
  - c. Systems winterized by injection of compressed air
  - d. Systems which inject fertilizers or other chemicals
  - e. Premises that have auxiliary water sources available for irrigation
3. Double check valves or pressure vacuum breakers are not approved for landscape irrigation systems.

Any backflow prevention device required shall be a model and size acceptable to the District. Backflow prevention devices must also be installed according to the manufacturer's instructions. The term approved backflow prevention assembly shall mean a device that has been manufactured in full conformance with the standards established by the American Water Works Association (AWWA) entitled:

*"AWWA C510-07 Double Check Valve Backflow Assembly and AWWA C511-07 Reduced-Pressure Principle Backflow Prevention Assembly",*

and have met completely the laboratory and field performance specifications of the Foundation for Cross-Connection Control and Hydraulic Research (FCCC&HR) of the University of Southern California established by:

*Manual of Cross-Connection Control - Tenth Edition (2012) and List of Approved Backflow Prevention Assemblies dated January 20, 2016, or the most current editions thereof.*

All required backflow prevention assemblies shall be tested by a State Certified Backflow Prevention Tester. These tests shall be conducted per manufacturer's recommendation and results submitted to the District no later than 10 days after testing.

These requirements incorporate herein by reference the Cross-Connection Control Manual of the Colorado Department of Health and the Colorado Primary Drinking Water Regulations of the Colorado

Department of Health, including all amendments made now or hereafter. Whenever there is a conflict between these specifications and the Cross-Connection Control Manual, the most stringent standard shall apply.

Backflow prevention devices that are installed in below-grade vaults must provide sufficient drainage to daylight or sanitary sewer system.

The District must review and approve the proposed backflow prevention device for all applications. Consultation with the District may be required prior to plan submittal for applications.

**B. Applications**

Backflow prevention devices are required at connections as outlined in the following tables.

<b>HAZARDOUS PREMISE ISOLATION</b>		
The following is a list of commercial and industrial premises where hazardous cross-connections continuously occur or where the potential hazard is so great that these premises shall be isolated from the public water supply.		
	<b>Premise</b>	<b>Method of Isolation *</b>
<b>1</b>	Sewage Treatment Plant	Reduced pressure device at meter with air protection at each possible cross-connection within plant.
<b>2</b>	Hospitals, Mortuaries, Clinics, Medical Buildings	Reduced pressure device at meter.
<b>3</b>	Microbiological, chemical, or radiological laboratories	Reduced pressure device at meter or laboratory isolated with RP device or air gapped.
<b>4</b>	Chemical plants using water, Metal Plating Industries, Film Laboratories	Reduced pressure device at meter or processing area isolated with RP device or air gapped.
<b>5</b>	Nursing and Convalescent Homes, Commercial Laundries	Double check valve (Spring Loaded) at meter.
<b>6</b>	Packing Houses and Rendering Plants	Reduced pressure devices at meter.
Normal cross-connection control devices are required within the building to isolate vats, toilets, etc., and protect personnel working within the premises. Cross-connection control devices are also required on fire lines.		

APPLICATION OF BACKFLOW PREVENTION DEVICES IN CROSS-CONNECTIONS AND WHERE CONTAMINATION IS POTENTIALLY HAZARDOUS TO THE POTABLE WATER SUPPLY									
	DEGREES OF HAZARD			TYPES OF PROTECTION					
	Severe	Moderate	Minor	Air Gap	Reduced Pressure Backflow Device	Pressure Vacuum Breaker	Atmospheric Vacuum Breaker	Double Check Valve (Spring Loaded)	Double Check Valve (All Other)
Notes: * Toxic Substance: Any substance (liquid, solid or gaseous) which, when introduced into the water supply system, creates or may create a danger to the health and well being of the consumer ** Non-Toxic Substance: Any substance of a non-poisonous nature that is potable or edible and that may create a moderate minor health hazard to the domestic water system									
I. Direct Water Connections Subject to Pressure									
A. Pumps, tanks and lines handling									
1. Savage and lethal substances	y			y					
2. Toxic substances*	y			y					
3. Non-Toxic Substances**		y		y				y	y
B. Water Connection to Steam and Steam Boiler									
1. Boiler or steam connection to toxic substances*	y			y					
2. Boiler or steam connection to non-toxic substances** (Boiler blow-off through approved gap)		X		X	X			X	X
C. Hot water heating boilers, generators or pressure vessels									
1. Connection to toxic substances*	y			y					
2. Connection to non-toxic substances**		y		y					y
II. Direct or Indirect Water Connections not subject to pressure									
A. Low inlet to receptacles containing toxic substances*	y			y		y			
B. Low inlet to receptacles containing non-toxic substances**			y	y		y			
C. Lawn sprinkler systems (Chemical injection prohibited)			y	y		y			
D. Coils or jackets used as heat exchangers in compressors, deaerators or equipment									
1. In sewer lines	y			y					
2. In toxic substances*	y			y		y			
3. In non-toxic substances**			y	No Protection Required					
E. Flush valve toilets and urinals	y								y
F. Toilet and urinal tanks		y		y					y
G. Valved outlets or fixtures with hose attachments which may constitute a cross-connection:									
1. Toxic substances*	y			y		y			y
2. Non-toxic substances**		y		y		y			y
H. Water connected into domestic water tanks			y	Each Case Treated Separately					
I. Plumbing drainage lines	y			y		y			y
J. Reclaimed or recycled water	y			y		y			y

**C. Design**

Anyone designing systems that require cross connection control shall contact the District to review specific requirements for each installation.

**2.18 PROTECTION OF WATER LINES NEAR SEWER FACILITIES**

**A. Crossings**

Water lines and services shall be designed to cross at least 18-inches above sanitary sewer and storm sewer (collectively “sewer”) lines and services for those facilities. Where water lines or services must cross below sewer lines or services, the District requires that the sewer line be encased in concrete for a minimum of ten feet (10') on each side of the sewer crossing or be constructed of a single piece of pipe at least 20 feet long and centered so there is 10 feet on each side of the crossing in accordance with CDPHE design guidelines. Stability of the water and sewer lines at the point of crossing is critical and care must be taken to ensure proper bedding and compaction of both the water and sewer line trenches.

Thermal protection of water lines at storm sewer crossings may be required depending on the specific project location and design. See *Water Service Storm Crossing* detail in Appendix A.

**B. Separation**

A minimum horizontal edge to edge separation of ten feet (10') shall be maintained between all parallel water and sewer facilities; this includes gravity sanitary or storm sewer, raw surface water pipes, reclaimed pipes, liquid petroleum pipes, septic tank, or subsoil treatment systems.

**2.19 ENCASEMENTS, CASINGS, AND INSULATION**

**A. Concrete Encasements**

Concrete encasements shall be required by the District under the following conditions:

Where water lines are at a depth too shallow to sustain traffic load or any other load to which they are subjected.

At any other location designated by the District.

Concrete encasements shall provide concrete and reinforcement in accordance with these Specifications and shall be of a length to completely span the condition encountered. The concrete encasement detail is generally acceptable for most conditions; however, the District may require a special, site specific concrete encasement detail on a case-by-case basis.

**B. Pipe Casings**

Pipe casing shall be used where bores or protective installations are required by the District. All pipe casings shall be constructed to conform with the "Restrained Casing Spacers" detail.

**C. Water Line Insulation**

The District may require that water lines be insulated from freezing where cover considerations, bridge crossings, or other special freezing related considerations warrant. The limits of the insulation shall be determined by the District. Impermeable Cellular Glass Insulation shall be "Foamglass" manufactured by Pittsburgh Corning or approved equal.

**2.20 CONNECTION TO NON-DISTRICT FACILITIES**

No connection of any District facility to any non-District facility is allowed without the prior express written permission from the District and inspection of construction by the District.

**2.21 SUBMETERING POLICY**

New multi-unit developments are subject to the District's then-current Submetering Policy and shall comply with the same.

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## **SECTION 3. CONTRACTORS' CONSTRUCTION REQUIREMENTS**

### **3.01 GENERAL CONSTRUCTION STANDARDS**

All excavations affecting or involving any part of the District System, and all work on Main Extensions, Taps, or other District facilities shall be performed in conformity with and are subject to the requirements and conditions set forth herein. Whenever any provision of these Specifications or the Rules and Regulations imposes a duty upon a Property Owner, the term "Contractor" set forth in this Section shall be deemed to apply also to the Property Owner.

#### **A. Compliance**

Contractor shall comply with all District, County, State and Federal Rules, Regulations, Technical Specifications.

#### **B. Permits**

The Contractor shall be solely responsible for determining and obtaining any and all permits required for the work from other governmental entities or agencies having jurisdiction and shall perform the work in accordance with any and all applicable ordinances, regulations, laws and orders of, or permits issued by such entities or agencies.

#### **C. Subsurface Structures**

The District will make available to the Contractor record drawings showing the location of its facilities in the vicinity of the work, but the Contractor shall be finally and solely responsible for determining the existence and location of all subsurface structures in such area.

If a Contractor damages any District facilities during construction, he shall immediately notify the District and take such measures as may be reasonably necessary or appropriate to minimize damage to the District System, prevent the escape of water from the District System, and prevent and mitigate damage from fugitive water. The District shall perform all repairs of District facilities and may assess the costs thereof to the Contractor.

Any Contractor who damages District facilities shall indemnify and hold the District harmless against any and all claims for damage resulting there from and shall indemnify and hold the District harmless against any and all claims for damage to any such structures.

#### **D. Warranty**

All materials and workmanship furnished by the Contractor shall conform to these Specifications and to all plans and designs accepted by the District and shall be free from all defects due to faulty or nonconforming materials or workmanship for a period of one year. The one-year period will begin on the substantial completion date granted by the District.

## **E. Independent Investigation**

The contractor shall thoroughly examine the work site to ascertain for himself all soil, geological, groundwater and other conditions to be encountered which might affect the work being undertaken. The Contractor shall enter into such work relying on his own investigation and information, and not on any statements or representations, if any, that have been made by the District.

### **3.02 REQUIRED SUBMITTALS**

No Contractor shall begin any excavation or any other work on any Main Extension, Tap, or other District facilities until he has obtained the prior authorization of the District therefore, and has submitted, in addition to any other materials required elsewhere herein, the following, accepted as to form by the District:

#### **A. Written Agreement**

A document duly signed by Contractor (1) acknowledging his consent to be bound by the provisions of "General Construction Standards"; (2) warranting that the work will conform to such provisions and will be free from defects due to faulty or non-conforming materials and workmanship; and (3) agreeing to pay any and all applicable fees and charges provided by these Specifications and the Rules and Regulations in connection with the work.

#### **B. Insurance Certificates**

Certificates prepared by Contractor's insurance agent in form satisfactory to the District evidencing that policies providing the required coverages, conditions, and minimum limits are in full force and effect. The certificate shall identify the work being performed and shall certify that should any of the coverages afforded under the policies be cancelled before the expiration date thereof, the issuing company will mail 30 days prior written notice to the District. The District reserves the right to request and receive a certified copy of any policy and any endorsement thereto.

#### **C. Fees**

The full amount of all fees payable in advance, or any required costs deposits, or both.

### **3.03 STOP WORK ORDERS**

#### **A. Order**

The District may revoke any authorization for work and issue a Stop Work Order upon a determination that the Contractor has violated or is about to

violate any condition of any plan acceptance, any provision of these Specifications or Rules and Regulations, or any other standard, specification, or rule imposed by the District. A Stop Work Order shall take effect immediately upon the entry thereof by the District and notice to the Contractor and shall remain in full force and effect until rescinded in writing by the District.

**B. Effect**

It is unlawful for any person to do any work in violation of the terms of any Stop Work Order issued pursuant to this section except such as may be permitted by the District in order to render the construction site safe and secure.

**3.04 CURE OF DEFECTS**

**A. Order to Cure**

If the District determines that any part of the work was not performed in conformity with these Specifications, Rules or Regulations or accepted plans, or is defective, of poor or unworkmanlike quality, or is otherwise not in conformity, with any applicable warranty, it may give written notice thereof to the Contractor. Such notice shall specify the non-conformity, direct the Contractor at his cost to perform specified remedial work, and specify the period of time determined by the District reasonably necessary for completion of the remedial work.

**B. District Cure**

If the Contractor fails within the time stated following such notice to cure the nonconformity specified therein, the District, in addition to and without waiving any of its other remedies, may perform the work and charge the Contractor for its actual costs incurred in connection therewith, calculated in accordance with the Rules and Regulations.

**3.05 PRECONSTRUCTION MEETING**

A preconstruction meeting shall be arranged by the District Engineer and held prior to the start of any work. The District Engineer, Contractor, Soils Engineer, Surveyor, and Developer, or Developer's engineer, must be represented at this meeting, which shall generally be held at the District Office. After the preconstruction meeting is held, the Contractor shall, at least 48 hours prior to the start of construction, notify the District of its construction schedule and start date.

**3.06 CONSTRUCTION PLANS**

Construction plans shall be reviewed and signed by the District and the District's Consulting Engineer. The signed plans and a copy of these Specifications shall be kept on the project site by the Contractor at all times.

AutoCAD and pdf drawings must be delivered to the District at the preconstruction meeting. See section 3.10 –Record Drawings for format.

### **3.07 DEFECTIVE MATERIALS**

All materials not conforming to the requirements of these Specifications shall be considered defective. Whether in place or not, such material shall be removed immediately from the site of the work, unless otherwise permitted by the District. Rejected material, the defects of which have been subsequently corrected, shall not be used until the District has reviewed them and found them acceptable. The District will not consider conveyance and acceptance of a project if the contractor fails to comply promptly with any order of the District made under the provisions of this Section.

### **3.08 DESIGN REVISIONS DURING CONSTRUCTION**

Should the Contractor encounter field conditions that prevent construction to occur in conformance with the reviewed and signed plans, a meeting shall be scheduled by the Contractor with the Owner's Engineer and District to discuss an alternative design. The Contractor's construction shall not deviate from the signed plans without the prior review of the District, and the Owner's Engineer.

### **3.09 CONSTRUCTION WATER**

The Contractor shall be responsible for obtaining any water required for various phases of construction. Arrangement and coordination of permits shall be made through the District.

### **3.10 RECORD DRAWINGS**

The Contractor shall maintain on the job site a separate set of full-size Construction Plans marked up to fully indicate field installed conditions. These drawings shall be maintained in a current condition at all times until completion of the work and shall be available for review by the District at all times. All variations from the reviewed and signed Construction Plans, for whatever reason, including those occasioned by optional materials, and those required by coordination between trades, shall be indicated. These variations shall be shown in the same general detail utilized in the original design. Upon completion of the work, the marked up set of drawings shall be furnished to the District and District Engineer for review. After review of the marked-up drawings, the drawings will be returned to the Owner's Engineer with comments. The Owner's Engineer shall use the marked-up plans to prepare half-sized (11 x17") mylars and AutoCAD and pdf files of the drawings. The mylars shall be a reverse read, wash-off (moist erasable) photographic 4 mil mylar reproduction. In addition to half-sized mylars, the Owner's Engineer shall supply an electronic copy of the record drawings (AutoCAD and pdf formats) as well as CAD linework for all water and sewer pipelines and associated appurtenances. This linework shall be tied to plat street centerlines and shall be accurate in relationship to Arapahoe, Douglas, Adams, and/or Denver County parcels. See following paragraph for other accuracy standards. Submit two (2) sets of mylar drawings and two disks of the electronic files.

Required disk format/record electronic files: CAD files (.dwg) shall be provided in the latest commercially available release of AutoCAD. Drawings are to be purged of all extraneous information, shall be "bound" to insert all reference files, shall be accompanied by any non-native fonts, and shall be free of complex file pathing which complicates file openings when transferred from disk. Binding of reference files shall be done using AutoCAD's Xref "Insert" option so as to avoid layer and block name corruption. Files should be on PC compatible CD and should be in Datum NAD 1983 State Plane Colorado Central FIPS 0502 (US Feet) and in decimal units. The subject parcel(s) shall reference a minimum of two physical monuments and the monuments shall be (a) sections corner(s) and/or quarter corner(s).

The following construction information shall be added to the mylars at a letter and pen size that will be legible after reduction is completed.

Date Installed: \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Field Administrator: \_\_\_\_\_  
Soils Engineer: \_\_\_\_\_  
Surveyor: \_\_\_\_\_

These finalized half-size drawings and disks with electronic files must be presented to the District prior to probationary acceptance of the project.

### **3.11 REPLACEMENT OF EXISTING STREET IMPROVEMENTS**

In areas where existing pavement, concrete improvements, storm, or drainage improvements are removed during construction, they shall be replaced in kind to the limits disturbed by water line construction. All replacement shall be in accordance with the appropriate City, County, or State Highway Department requirements.

### **3.12 SAFETY AND TRAFFIC CONTROL**

The Contractor shall determine, initiate, maintain and supervise all measures necessary to protect the public during construction.

Traffic shall be controlled at those locations throughout the project area in order to maintain an efficient and orderly vehicular and pedestrian traffic flow. All traffic control, construction signing, vehicular traffic and residential access, etc., shall be handled in conformance with the Uniform Traffic Control Manual, latest edition, and the appropriate City, County, or State Highway Department Standards.

The Contractor shall furnish, construct, maintain, and finally remove detours, road closures, lights signs, fences, barricades, flares, miscellaneous traffic devices, flagmen, drainage facilities, reconstruct paving and such other items and services as are necessary to adequately safeguard the public, both traveling and otherwise, from hazard and inconvenience. He shall erect and maintain

such warnings and directional signs as may be requested by the City, County, or State Highway Department.

Should the progress of construction require closure of residential access, the Contractor shall notify the residents which may be affected at least 24 hours in advance and provide temporary access. Prior to the start of construction, the Contractor shall notify affected residents as well as the appropriate police and fire departments, giving the approximate starting date expected, completion date, and the name and telephone number of a responsible person representing the contractor who may be contacted at any hour.

### **3.13 CONSTRUCTION OBSERVATION**

The District shall decide any and all questions that may arise during construction as to the quality and acceptability of the materials furnished, the work performed, or the manner of performance of the work.

No observation or testing will be performed by the District outside normal business hours without the express agreement of the District secured in advance. Whenever any observation, inspection or testing is required by any specific provision of these Specifications or the Rules and Regulations, or by the terms of any permit or plan approval, the Contractor shall give the District such notice as is required and shall not cover or otherwise obscure the work until the observation, inspection or testing has been made. The Contractor shall at his cost uncover or otherwise make such work accessible for observation, inspection or testing when ordered to do so by the District if he violates this requirement.

The observations, testing and reviews performed by the District are for the sole and exclusive benefit of the District. No liability shall attach to the District by reason of any observations, testing, or reviews required or authorized by these Specifications or the Rules and Regulations, or by reason of the issuance of any approval or permit for any work subject to this section.

The District is not a guarantor of the construction Contractors' obligations and performance of contract.

Observations of work in progress and on-site visits are not to be construed as a guarantee by the District of the Contractors' performance.

The District is not responsible for safety in, on, or about the Project site, nor for compliance by the appropriate party of any regulations relating thereto.

The District exercises no control of the safety or adequacy of any equipment, building components, scaffolding, forms, or any other work aids used in or about the project, or in the superintending of the same.

### **3.14 GEOTECHNICAL OBSERVATION**

Geotechnical observation and backfill density tests will be performed by the Owner's Soils Engineer to provide acceptable fill control, bedding compaction, and foundation suitability. All supervision necessary to control fill and compaction tests will be at the expense of the Owner. If the first compaction test does not meet with the Specifications, the sub-standard areas shall be reworked, and additional compaction tests will be performed until the Specification is met. Any deviation from the plans, Specifications, or soils report, must be corrected by the Contractor to the satisfaction of the District. Copies of all compaction tests shall be provided to the District on the working day following the test. The location and frequency of compaction testing will be determined by the District on a case-by-case basis.

### **3.15 FEES**

Contractor or Owner will pay the District all fees imposed and assessed by the District for reviews, observation, inspections, tests, approvals, and any other undertakings performed by the District or its professional consultants in connection with the administration and enforcement of these Specifications and the Rules and Regulations.

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## SECTION 4. WATER SYSTEM MATERIALS, INSTALLATION, AND TESTING

### 4.01 GENERAL

All water system materials, construction and testing shall be in accordance with these Specifications. Any material proposed as "an equal" must be reviewed and found acceptable by the District prior to design or construction.

### 4.02 DUCTILE IRON PIPE (DIP)

#### A. General

Ductile iron pipe furnished under this Specification shall be manufactured in strict accordance with AWWA Standard Specifications C150, C151, C111, C115, and C104, latest revision, and shall conform with the following additional requirements:

#### B. Size of Pipe

This Specification shall cover all sizes of ductile iron pipe between six inches (6") and twenty inches (20") in diameter.

#### C. Grade of Iron

Iron used in the manufacture of ductile iron pipe shall have 60,000 psi ultimate strength, 42,000 psi minimum yield strength, and 10% elongation.

#### D. Pressure Class

Pipe Size	Pressure Class
12-inch and smaller	Class 350
16-inch through 20-inch	Class 300
24-inch and larger	Class 300 or Special design

#### E. Cement Mortar Lining

All pipe furnished under this Specification shall have standard thickness of cement mortar lining in accordance with AWWA C104 latest revision.

#### F. Polyethylene Wrapping

Pipe furnished under this Specification shall be polyethylene wrapped in accordance with AWWA C105 and these Specifications.

All potable DIP shall be wrapped in clear polyethylene.

All irrigation and recycled water piping shall be wrapped with transparent purple polyethylene.

**G. Laying Length**

Ductile iron pipes all have a standard laying length of eighteen feet (18') or twenty feet (20').

**H. Joint Type**

Ductile iron pipe joints shall be "Push on joint single gasket," "Mechanical joint single gasket," "Restrained Joint Single Gasket," or "Flanged Joint Single Gasket". The rubber gasket shall conform to the requirements of AWWA C111 latest revision.

**I. Installation**

Installation of Ductile Iron Pipe shall be done per these specifications.

**J. Testing**

Testing requirements for Ductile Iron Pipe is outlined in Section 4.24, "Water System Testing and Acceptance".

Tracer wire shall be installed on all Ductile Iron Pipe in accordance with Section 4.23.F.10 and the tracer wire installation detail.

**4.03 POLYVINYL CHLORIDE PIPE (PVC)**

**A. General**

All polyvinyl chloride pipe (PVC) furnished under these Specifications shall be manufactured in strict accordance with AWWA Standard Specifications C900, latest revision, with the following additional requirements:

**B. Size of Pipe**

This Specification includes PVC pressure pipe four inches (4") through twelve inches (12") in diameter.

**C. Pipe Color**

All potable PVC pipes are to be colored blue. All Irrigation pipe is to be colored purple to aid identification in the field.

**D. Thickness Class**

Pipe furnished under this Specification shall be a minimum of Class 235, SDR 18 with a minimum sustained pressure requirement of 500 psi and a burst pressure requirement of 755 psi at 73.4° F. The pressure class of PVC pipe must be derated due to the temperature of the District's

groundwater supply. This is based on the temperature coefficients for a water temperature of 95°F, as shown in Table A.1 of AWWA C900. The system working (static) pressure must not exceed the derated pipe pressure class.

**E. Laying Lengths**

Pipe shall have a normal laying length of twenty feet (20') or ten feet (10') where designated for curves. Random lengths shall not be acceptable.

**F. Joint Type**

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint. Solvent welded joints are strictly prohibited.

All pipes laid on a curve shall have high deflection bells. Bending the pipe to achieve a radius will not be permitted.

**G. Installation**

Installation of PVC Pipe shall be done as outlined in these specifications.

**H. Testing**

Testing requirements for PVC pipe are outlined in "Water System Testing and Acceptance".

**I. Tracer Wire**

Tracer wire shall be installed on all PVC pipes in accordance with Section 4.23.F.10 and the tracer wire installation detail.

**4.04 DUCTILE-IRON AND GRAY-IRON WATERWORKS FITTINGS**

**A. General**

All bends, tees and related fittings shall be manufactured in accordance with the following AWWA Standards: C104, "Cement-Mortar Lining for Ductile-Iron Pipe and Gray-Iron and Fittings for Water," C110, "Gray-Iron and Ductile-Iron Fittings, 3-Inch Through 48-Inch for Water and Other Liquids," C111, "Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings," C153 "Ductile Iron Compact Fittings, 3-inch through 16-inch, for Water and Other Liquids," with the following additional requirements or exceptions. The use of "wye" fittings in main extension or services is not permitted.

**B. Linings**

All fittings shall be furnished with a cement-mortar lining of standard thickness as defined in the referenced AWWA C104 specifications and shall be given a seal coat of bituminous material.

**C. Type of Joints**

All fittings shall be furnished with mechanical joint ends, push-on joint ends, restrained joint ends, or flanged ends conforming to the referenced AWWA C111 specifications, and in addition the tee-head bolts and hexagon nuts shall be fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt. The bonnet, gland bolts, and nuts shall be in accordance with ASTM F593, Type 304 stainless steel. The hot-dip galvanized process is not acceptable.

**D. Thickness Class**

All fittings shall have a 250-psi pressure rating and shall conform to the dimensions and weights shown in the tables of referenced specifications.

**E. Material**

All fittings shall be made from gray-iron or ductile iron.

**F. Installation of Fittings**

Installation of ductile-iron and gray-iron waterworks fittings is outlined in "Water Line Installation."

**G. Testing of Fittings**

Fittings shall be tested with the water line as outlined in "Water System Testing and Acceptance."

**4.05 MISCELLANEOUS PIPE FITTINGS**

Flanged adapters, plugs, end caps, bulkheads, cut-in sleeves, anchor couplings, and other appurtenances shall be used where appropriate throughout the system, subject to the review of the District. The District does not intend to limit unreasonably, the installation of any type of fitting, joint or proprietary device. However, the installation of any such fitting not specifically identified by these standards is subject to the review of the District, prior to design or construction.

## 4.06 CONNECTIONS

### A. Mechanical Joints

#### 1. General

Mechanical joints furnished under this specification shall conform to ANSI/AWWA C111/A21.11 and shall consist of (1) a bell that is cast integrally with the pipe or fitting, provided with an exterior flange having bolt holes or slots and a socket with annular recesses for the sealing gasket with the plain end of the pipe or fitting, (2) a pipe or fitting plain end, (3) a sealing gasket, (4) a follower gland with bolt holes and (5) tee head bolts and hexagonal nuts fabricated from a high-strength, low allow steel known in the industry as Cor-Ten, Usalloy, or Durabolt.

#### 2. Materials

Chemical and physical properties of mechanical joints shall conform to ANSI/AWWA C110/A21.10.

Couplings shall have gaskets consisting of a rubber compounded material that will not deteriorate from age or exposure to air under normal storage or use conditions. The rubber in the gasket shall be immune to attack by impurities normally found in potable water and shall meet the requirements of ASTM D-3000, AA7O9Z, meeting Suffix B13, Grade 3. Coupling shall be shop coated with Dresser Red "D" primer.

Unless otherwise specified, gray iron glands shall be furnished with ductile iron pipe and fittings. Glands shall have an asphalt coating unless otherwise specified and shall have cast or the manufacturers identification, nominal size, and letters "DI" or word ductile if made of ductile iron, stamped on them.

The dimensions of the bell, socket, plain end and gland lip and the diameter and location of the bolt holes shall be gauged at sufficient intervals to ensure proper seal and operation of the connection.

Tee head bolts and heavy hex nuts shall be fabricated from high strength, low alloy steel conforming to ASTM A307, Grade B, and shall be threaded per ANSI B1.1.

#### 3. Installation

All surfaces shall be cleaned thoroughly to remove all loose rust and foreign material prior to assembly. Lubrication shall be applied to both the gasket and the plain end just prior to slipping the gasket into the plain end and assembling the joint.

Bolts located 180 degrees from each other shall be tightened evenly and alternately with a torque limiting wrench to produce an equal pressure on all parts of the gland until all bolts are within the range of torque specified by the manufacturer.

If effective sealing is not attained at the maximum allowable torque, then the joint shall be disassembled, thoroughly cleaned, re-lubricated and reassembled.

4. Testing

All mechanical joints shall be tested simultaneously with the water main and in accordance with Water System Testing and Acceptance.

**B. Flange Joints**

1. General

Flanges furnished shall conform to ANSI/AWWA C115/A21.15-83, or latest revision and shall be minimum class 125 per ANSI B16.1. Pipe threads shall conform to ANSI B2.1. Flange facings shall have shallow serrations.

2. Materials

Flange chemical and physical properties shall conform to ANSI/AWWA C110/A21.10. The machined faces of all flanges shall be shop coated with a rust preventative compound such as Houghton "Rust-Veto 344" or Rust-Oleum "R-9". Edges and back faces of attached flanges and all surfaces of blind flanges shall be coated with Koppers "Bitumastic Mill Undercoat."

Flanges shall be designed to use a one-eighth inch (1/8") thick rubber gasket, either full face or ring type.

Bolts shall be manufactured from low carbon steel conforming to ASTM A307 Grade B and shall have hex heads. Nuts shall have heavy hex nuts and be threaded per ANSI B1.

3. Installation

Both flange and pipe threads shall be clean prior to application of thread compound. The thread compound shall provide adequate lubrication and sealing properties to provide pressure tight joints.

Flanges shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with uniform bolt stress.

Bolts shall be tightened evenly, maintaining approximately equal distance between flange faces at all points around the connection.

Bolts shall be tightened to within the torque range specified by the manufacturer.

If effective sealing is not attained at the maximum allowable torque, then the joint shall be disassembled, thoroughly cleaned, adjusted, and re-assembled until proper sealing is maintained.

4. Testing

All flange joints shall be tested simultaneously with the water main and in accordance with Water System Testing and Acceptance, and shall be capable of withstanding, without bursting, hydrostatic tests of three times the rated water working pressure.

**C. Insulated Connections**

1. General

Insulated connections shall be provided at locations specified by the District to insulate against the passage of electrical current.

2. Flanges

Insulated flanges, where required, shall have bolt holes three-sixteenths (3/16) inch diameter greater than the bolt diameter. Insulating gaskets shall use full face gaskets with one-piece sleeves and double washers.

3. Mechanical Joints

Mechanical joint connections requiring insulation shall be provided when required in accordance with the "Insulated Joint" detail found in these specifications.

4. Restraint System

Insulated connections for rodding shall be in accordance with the "Insulated Joint" detail found in these specifications.

5. Testing

Once the insulated joint installation is complete, the District shall perform a resistance test across the joint. The resistance shall be not less than 10,000 ohms.

**4.07 CLAMPS, RODS, AND JOINT RESTRAINT DEVICES**

Harness rods shall be mild steel conforming to ASTM A36 or ASTM A193, Grade B7 with hex nuts conforming to ASTM A307, Grade B, Hexagon heavy series. Number, grade and size of rods shall be indicated on the "Length of Restrained Pipe" detail. All clamps shall be coated with a coal tar epoxy compound for

corrosion protection. Harnessing of joints may be accomplished either by use of the clamp and rod system, or by use of a boltless restrained joint system. The restrained joint system shall be reviewed by the District prior to its use. Restrained lengths of pipe for various fittings shall be at least equal to the minimum lengths shown on the "Length of Restrained Pipe" detail. All clamps and rods shall be wrapped with an 8-mil polyethylene tube. Joint restraint on PVC pipe shall be accomplished with the use of mechanical joint restraint and rods across pipe joints.

#### **4.08 GATE VALVES**

##### **A. General**

Valves on 6, 8, and 12-inch diameter lines shall be direct bury double disc gate valves or resilient wedge gate valves.

Direct bury gate valves shall be double-disc or resilient seated, cast or ductile iron bodied, fully bronze mounted with non-rising stem and parallel seats. Gate valves shall conform to AWWA C500 (double disc) or AWWA C509 (resilient seated), as amended, with a minimum working pressure of 200 PSI. Valve stem shall seal with two "O" rings, each of which shall be designed as to allow replacement under full line pressure when the valve is in the fully open position. Valves shall have two-inch (2") square operating nuts and shall open by turning the nut clockwise (right). The bonnet, gland bolts, and nuts shall be in accordance with ASTM F593, Type 304 stainless steel. The hot dip galvanizing process is not acceptable.

##### **B. End Connections**

All buried gate valves shall have mechanical joint ends. Other types of installations may require flanged end connections, where specified by the District.

##### **C. Painting**

Valves shall have a fusion-bonded epoxy coating in accordance with AWWA C509 or AWWA C515 with a minimum DFT of 10 mil. Flange faces shall be shop coated with a rust preventive compound, such as Dearborn Chemical "NO-OX-ID," Houghton "Rust-Veto 344," or Rust Oleum "R-9".

##### **D. Valve Box**

Valve boxes shall be cast iron three-piece adjustable screw type (6" diameter), manufactured by the Tyler Pipe Company series #6860 with #160 oval base, or equal. Valve box covers shall be marked with the word "WATER" and shall have a lip or flange extending into the valve box shaft. No slip-type boxes shall be allowed. The valve box shall be of a design which will not transmit shock or stress to the valve and shall be

centered and plumbed over the operating nut with the box cover set below the pavement to requirements if the appropriate Streets jurisdiction.

**E. Installation**

Gate valves shall be handled in such a manner as to prevent any damage to the valve body or operating mechanism. All joints shall be thoroughly cleaned before installation. Valves shall be located as specified on the signed construction plans. All buried Gate Valves shall be polyethylene wrapped and installed in accordance with these Specifications.

**F. Testing**

Testing of valves shall be performed simultaneously with the water main testing. Each valve shall be operated fully open and fully closed and each section of line between valves shall be hydrostatic tested in accordance with "Water Line Testing and Acceptance" of these Specifications.

**4.09 BUTTERFLY VALVES**

**A. General**

Valves on 16 and 20-inch water lines shall be designed and manufactured in strict compliance with AWWA C504, except as modified herein. Butterfly valves shall be Class 150 B and shall be suitable for service involving long periods of inactivity. The maximum static differential pressure across the valve shall be 150 psi. At 150 psi, the valve shall be bubble tight for flows in both directions.

Direct bury butterfly valves must be reviewed by the District and approved in writing.

Bolts and hex nuts used on the valve and operator shall be the manufacturer's standard, either fabricated from a low-alloy steel for corrosion resistance or electro plated with zinc or cadmium. The hot-dip process, in accordance with ASTM Standard A153, is not acceptable for the threaded portions of the bolts and nuts.

See ECCV Detail Butterfly Valve and Vault Assembly in Appendix A.

**B. Valve Operators**

Valves shall be furnished with manual operators designed and sized to develop output torque for Class 150B operating service and shall be sufficient to seat, unseat and rigidly hold the disc in any intermediate position for the above conditions. In addition, the operator shall be designed for buried service and to operate indefinitely in a fully buried condition.

Operator shall be equipped with a standard AWWA 2-inch square operating nut and shall open by turning the nut clockwise (right).

All gearing shall be totally enclosed and sealed from ground water. The operator shall be designed to operate when submerged in water up to 25 feet. The Contractor shall fill the gear case with lubricant to 80% of full prior to installation. The lubricant shall be formulated for a temperature range of 10°F to 150°F.

The maximum input torque required to fully open or close the valve for Class 150B conditions shall not exceed 150 foot-pounds when applied to the operating nut.

The operator shall be capable of withstanding an overload input torque of 300 ft-lbs. at the fully open or fully closed position without damage to the valve or valve operator.

**C. End Connections**

Buried butterfly valves shall have mechanical joint ends or flanged end connections.

**D. Painting**

All surfaces of the valve shall be clean, dry, and free from grease before painting. All surfaces, exterior and interior, shall be evenly coated with a suitable rust inhibiting primer or black asphalt varnish.

After the above painting is completed, a lubricant compatible with the rubber seal shall be applied to the surface of this seal and the mating metal surface to prevent bonding of the two surfaces during shipment and storage. Following application of the seal lubricant, the valve disc shall be placed in the fully closed position for shipment.

**E. Valve Box**

Valve boxes shall be the three-piece adjustable screw type (6" diameter), manufactured by the Tyler Pipe Company series #6860 with #160 oval base, or equal. Valve box covers shall be marked with the word "WATER" and shall have a lip or flange extending into the valve box shaft. No slip-type boxes shall be allowed. The valve box shall be of a design which will not transmit shock or stress to the valve and shall be centered and plumbed over the operating nut with the box cover set below the pavement to County requirements.

**F. Installation**

Butterfly valves shall be handled in such a manner as to prevent any injury or damage to the valve body or operation mechanism. All joints shall be thoroughly cleaned before installation. Valves shall be located as specified on the signed construction plans. Butterfly valves shall be

installed with the valve shaft horizontal and operating nut vertical. All buried Butterfly Valves shall be polyethylene wrapped and installed in accordance with these Specifications.

**G. Testing**

After shop assembly, each valve shall be given the operation and hydrostatic tests in accordance with AWWA C500. Installed valves shall be fully opened and closed and shall be tested simultaneously with the water line in accordance with these Specifications. Maximum Field Hydrostatic Pressure shall be 150 psi.

**4.10 SWING CHECK VALVES**

**A. General**

Swing check valves shall be manufactured in accordance with AWWA Standard C508, "Swing Check Valves for Ordinary Waterworks Service," with the following additional requirements or exceptions. All valves shall be cast iron or ductile bodied, fully bronze mounted, with no metal-to-metal seating and the disc shall be swing type. The operating design pressure for all sizes shall be 175 psi.

Bolts and hex nuts used for attaching top cap to the body shall be the manufacturer's standard fabricated from a low alloy steel for corrosion resistance. The flat gasket, either ring type or full faced type, required at the body and cap connection shall be fabricated from compressed asbestos sheet with a rubber compound binder.

**B. End Connections**

All check valves shall be furnished with flanged ends. The size and drilling shall be in accordance with ANSI B-16.1 Class 125 specifications. Flanges shall be machined to a flat face or machined to a flat surface with a serrated finish in accordance with AWWA Standard C207.

**C. Painting**

All surfaces of the valve shall be clean, dry, and free from grease before painting. All ferrous surfaces, exterior and interior, except the seating surfaces of flange faces, shall be evenly coated with a suitable rust inhibiting primer or black asphalt varnish. Flange faces shall be shop coated with a rust preventive compound, such as, Dearborn Chemical "NO-OX-ID," Houghton "Rust-Veto 344," or Rust Oleum "R-9".

**D. Installation**

Check valves shall be installed in vaults in a horizontal position with an exterior lever and adjustable spring operator.

## **E. Testing**

Each valve after shop assembly shall be given the operation and hydrostatic tests in accordance with AWWA C508.

Installed valves shall be tested simultaneously with the water line in accordance with these Specifications.

## **4.11 PRESSURE REDUCING VALVE AND VAULT INSTALLATION**

### **A. General**

Pressure reducing valves shall be in conformance with AWWA C530, with AWWA C207 flanges, globe style, Cla-Val Model 90-01, or Singer Series 106-PR for Standard One-Way Flow where specified or approved equal. The pressure reducing valve shall be hydraulically operated with a free-floating guided piston having a seat diameter equal to the size of the valve. The valve shall be fully bronze (NSF 61/372) mounted and all packing shall have rubber seals to provide tight closure and prevent metal to metal friction. An indicator rod shall be furnished as an integral part of the valve to show the position of the piston within the valve body. Valve shall have opening and closing speed controls, pilot piping strainer/filter, and pilot system isolation valves. The valve shall be designed to provide an access opening in the valve body for removing the piston and other internal parts without removing the main valve body from the line. The minimum design operating pressure shall be 150 psi.

The valve body, flanges and covers shall conform to ASTM A126, Class B. Bronze castings and internal trim shall conform to ASTM B-62.

### **B. End Connections**

All valves shall be furnished with flanged ends sized and drilled in accordance with ANSI-B16.1, Class 125. Flanges shall be machined to a flat face with a finish of 250 micro-inches or machined to a flat surface with a serrated finish in accordance with AWWA Standard C207.

### **C. Pilot Valve**

The pilot valve, used to control the operation of the main valve, shall be single seated, diaphragm operated, and spring-loaded. The pilot valve shall be attached to the main valve with piping and isolation gate valves arranged to allow for easy access and for removal of the main valve from the system while the line is under pressure.

### **D. Needle Valve**

The needle valve shall be all bronze and included with the main valve to control the piston travel speed.

**E. Painting**

All surfaces of the valve shall be clean, dry and free from grease and dirt before painting. All cast iron surfaces, except the machined face of the flange, shall be evenly coated with a suitable primer to inhibit rust, or a black asphalt varnish. The face of flanges shall be shop coated with a rust preventive compound, such as, Dearborn Chemical "NO-OX-ID," Houghton "Rust-Veto 344," or Rust-Oleum "R-9".

**F. Installation**

The pressure reducing valve, as specified herein, shall be installed in a concrete vault or manhole structure in conformance with the "Pressure Reducing Valve and Vault Installation" detail.

**G. Testing**

The body of the pressure reducing valve shall be given a hydrostatic test of 1.5 times the rated pressure. A second test of the check seating of the cylinder shall be made at the working pressure. There shall be no leakage past the valve seat during the test.

**4.12 AIR/VACUUM VALVE AND VAULT INSTALLATION**

**A. General**

Combination air/vacuum valves of 1/2", 3/4", 1-inch and 2-inch sizes shall have NSF 61 certified nylon bodies with NPT threads and shall be A.R.I. D-040 or equal.

Combination air/vacuum valves larger than 2" shall be cast iron or ductile iron bodies, stainless steel floats, float arm, guide bushings and connecting hardware, oil resistant natural or synthetic rubber valve seat (BUNA-N or EPDM), with a working pressure of 150 psi unless otherwise indicated. Valves shall be Val-Matic Series 200, GA Industries Figure 945, or equal.

Combination air/vacuum valves of 1-inch and 2-inch shall have NPT threads, larger valves shall be flanged.

If ground water is present, use Val-Matic Floodsafe VM-1300-S valves.

All pipe and fittings in the system shall be copper and/or brass, and all connections shall be threaded.

The ball valve used to isolate the air/vacuum valve assembly shall be a bronze (NSF 61/372) valve with female iron pipe threads as manufactured by MEULLER Series 7700, or equal. Plastic handles will not be accepted.

**B. Painting**

All surfaces of the valve shall be clean, dry and free from grease before painting. All exterior and interior surfaces, except the stainless-steel trim and the seating surface of the flange face shall be evenly coated with a suitable rust inhibiting primer, or a black asphalt varnish.

**C. Installation**

The air/vacuum valve, as specified herein, shall be installed in a concrete manhole structure in conformance with the "Air Release Valve and Vault" detail.

**D. Testing**

Each shop assembled valve shall be given a hydrostatic test two (2) times greater than the rated operating pressure. During the test, air shall be injected into the body chamber of the valve to check its ability to release entrained air to the atmosphere under operating pressure.

After installation, during filling of the line, the air/vacuum valve shall be observed to show that air is being released from the system.

**4.13 TAPPING SLEEVE/CLAMP AND VALVE**

**A. General**

Where a connection is to be made to an existing water main in service for extension of a water main and under operating pressure without interrupting service, a tapping valve and sleeve shall be used to tap the main. All tapping saddles shall be designed and manufactured in accordance with AWWA C223. The working pressure for these pipes and taps is 150 psi.

**B. Tapping Sleeve**

All steel plates used in fabrication of the tapping sleeve shall conform to ASTM Standard Designation A36 or A285, Grade C. Acceptable manufacturers for fabricated steel sleeves are JCM Model 412, Romac Model FTS 420 or Smith Blair 622 or approved equal. The tapping sleeve shall have a testing outlet.

1. Flanges

Flanges shall be fabricated from steel plate, and all dimensions shall conform to AWWA Standard C207, "Steel Pipe Flanges," Class D. Flanges shall be machined to a flat rate with finish of 250 micro-inches or machined to a flat surface with a serrated finish in accordance with AWWA Standard C207, "Steel Pipe Flanges". In addition, the machined face shall also be recessed for tapping valves in accordance with the M.S.S. Standard SP-60.

2. Gaskets

Gaskets shall be compounded from new materials, the shape and cross-section of gasket shall provide adequate seal for the design pressure. Gaskets shall be shop glued to the groove provided in the body section.

3. Fasteners

Corrosion resistant bolts and hex nuts shall be Stainless Steel, USalloy, Dresserloy, Cor-Ten or equal.

4. Testing Outlet

A ¾-inch NPT by welded coupling shall be attached to the outlet nozzle of each tapping sleeve assembly complete with a ¾-inch square head pipe plug.

5. Painting

All surfaces of the sleeve shall be clean, dry, and free from grease and dirt before painting. All surfaces of tapping sleeve except face of flange, bolts, and nuts, shall be given a shop coat of manufacturer's standard coating. Face of flanges shall be shop coated with a rust preventive compound such as Dearborn Chemical "NO-OX-ID," Houghton "Rust-Veto 344," or Rust-Oleum "R-9".

**C. Tapping Valves**

All valves shall be suitable for frequent and infrequent operation. The minimum operating pressure for all sizes shall be 200 psi. Tapping valves shall be manufactured in accordance with the Specifications of AWWA C509 or C515 as applicable, latest revision.

1. Valve Body

Valves shall be resilient seated, cast-iron body, fully bronze-mounted, with non-rising stem.

2. Valve Stems

Valve stems shall be threaded so that valves shall open by turning to the right (clockwise). Each valve shall be furnished with a 2-inch wrench nut, with an arrow showing direction of opening and the word "OPEN" cast on the nut. Stem seal shall consist of two "O"-Rings, designed to allow for replacement of seal above the thrust collar while the valve is under pressure in the fully open position.

3. Bolting Material

Bolts and hex nuts used on the bonnet of the valve shall be in accordance with ASTM 593, Type 304 stainless steel. The hot-dip process is not acceptable.

4. Inlet End of Valve

The inlet end of the valve shall be flanged. All dimensions and drilling of this flange shall conform to ASA B-16.1, Class 125, and the face of the flange shall have a machined projection, in accordance with AWWA C207, for mating to the machined outlet flange of a tapping sleeve.

5. Outlet End of Valve

The outlet end of the valve shall have a standard mechanical joint end conforming to ANSI A-21.11 (AWWA Standard C 111, "Rubber- Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings"). The tee-head bolts and hexagon nuts shall be fabricated from a high- strength low alloy steel, known in the industry as Cor-Ten, Usalloy, or Durabolt. Both ends of the valve shall be sealed and covered for shipment, and the mechanical joint accessories shall be packed inside the body of the valve.

6. Seat Ring Size

Body of the valve and seat opening shall be sized large enough to accommodate the following sizes of shell cutters:

<b>Tapping Valve Nominal Diameter</b>	<b>Shell Cutter Diameter</b>
4"	3 7/8" ± 1/32"
6"	5 13/16 ± 1/32"
8"	7 7/8" ± 1/32"
12"	11 7/8" ± 1/32"

7. Painting

All surfaces of the valve shall be clean, dry, and free from grease before painting. All ferrous surfaces, exterior and interior, except the seating surfaces of flange faces shall be evenly coated with a suitable primer or black asphalt varnish. Flange faces shall be evenly coated with a rust preventive compound such as Dearborn Chemical "NO-OX-ID," Houghton "Rust-Veto 344," or Rust-Oleum "R-9".

**D. Installation**

All tapping sleeve and valves shall be installed in the presence of the District. The tap shall be made with proper equipment at a rate which will not damage the existing line. The Contractor shall provide the District with the tap "Coupon" after tapping. The sleeve shall be installed per the manufacturer's recommendation. If requested by the District, the installed valve shall be left fully opened and the operator buried without a valve box.

**E. Testing**

The sleeve and valve shall be tested simultaneously with the water line in accordance with "Water System Testing and Acceptance".

**4.14 MARKER POSTS**

**A. General**

Marker posts shall be required adjacent to all valves, tees, or other appurtenances installed outside of paved rights-of-way to provide a physical reference for field location.

**B. Materials**

Markers shall be three-inch (3") diameter steel posts painted yellow and filled with concrete, with the appurtenance description, size, type, and distance from the post, stenciled directly on the post in accordance with the "Standard Steel Marker Post" detail. Carsonite marker post may only be used upon approval of the District.

**C. Installation**

Valve marker posts shall be installed at the locations indicated on the signed construction plans and at any other locations required by the District during construction. Marker Post installation shall be in accordance with the "Standard Steel Marker Post" detail.

**4.15 FIRE HYDRANTS**

**A. Materials**

Fire hydrants shall conform to AWWA C 504 mechanical joint. Hydrants shall have an underground 6-inch connection, two 2½ inch hose connections, and pumper connections in conformance with the appropriate local Fire Protection Agency. Threads on the pumper and hose connections shall conform to the requirements of the "National Standard Screw Threads for Fire Hose Couplings and Fittings," published by the Insurance Services Office. Hydrants shall be designed to operate under 150 psi minimum working pressure. Fire hydrants shall be cast or ductile iron with bronze seat mountings and shall have a traffic breakaway

feature incorporated into the barrel and operating shaft at the finished grade elevation. The fire hydrant assembly shall have an auxiliary 6-inch gate valve on the hydrant lateral which conforms to these Specifications and the hydrant lateral shall be 6-inch ductile iron pipe. The operator nut shall be National Standard pentagon shape and measure 1½" from point to opposite flat and shall open by turning clockwise (right).

Acceptable models of fire hydrants in the East Cherry Creek Valley Water & Sanitation District are as follows:

APPROVED FIRE HYDRANTS	
MANUFACTURER	MODEL
Mueller-Centurion	A-423
Waterous-Pacer	WB-67-250

Fire hydrant guards shall be provided at locations designated by the District. All fire hydrants on collection lines shall be painted black.

**B. Installation**

All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to the main line, unless otherwise designated on the reviewed plans. Hydrants shall be located a distance of eighteen inches (18") from the back of a sidewalk. In areas where sidewalks are not planned, fire hydrants shall be placed a minimum of thirty-six inches (36") from the flowline of the curb (measured to centerline of the hydrant).

Hydrants shall be set to finished grade such that the elevation of the breakaway flange is no more than six inches (6"), nor less than four inches (4"), above the finished grade or top of sidewalk. In the event that a hydrant must be raised, a barrel extension kit supplied by the hydrant manufacturer shall be used. When the barrel is raised, the Contractor shall also raise the breakaway coupling on the operating stem to an elevation such that it matches the new elevation of the breakaway flange. The maximum allowable vertical extension shall be eighteen inches. In the event an extension is required in excess of the (18") limit, a new hydrant assembly shall be installed that has been manufactured for the required depth of bury.

Each hydrant shall be connected to the main with a 6-inch branch line controlled by an independent 6-inch gate valve rodded to the tee on the main. In lieu of rodding, a swivel adapter or locked hydrant tee may be used. The branch line shall be restrained and the entire assembly including the hydrant, rodding, or mechanical joints, shall be wrapped with polyethylene. The hydrant shoe and main line tee shall be thrust blocked in accordance with these Specifications (see detail). Care shall be taken

not to plug the weep holes on the hydrant shoe with the polyethylene or thrust block.

A 1½ cubic yard drainage pit shall be excavated below each hydrant base bend and filled with 1½" crushed rock. A polyethylene barrier shall be placed over the crushed rock to prevent backfill material from contaminating the crushed rock.

**C. Testing**

Upon completion of the installation of the fire hydrants and water main, each hydrant shall be tested for leaks by closing all nozzle caps and turning the operating nut to fully open. There shall be no leaks visible from the caps, traffic flange, bonnet or surfacing from the weep holes. Upon completion of the leakage test, the operating nut shall be closed, and a cap removed to allow the hydrant to drain. If the hydrant fails to drain, the Contractor shall excavate the hydrant to check and repair the weep holes, if necessary.

**4.16 CONCRETE KICK BLOCKS**

**A. Materials**

Standard sizes and shapes of thrust blocks are shown on "Kick block" detail. Kick blocks shall be constructed of ready-mix concrete having a minimum 28-day compressive strength of 3000 psi, slump of 2 to 4 inches, and air entrainment of 3 to 5 percent. Mix design shall be reviewed by the District prior to construction.

**B. Installation**

Concrete kick blocks and anchors shall be formed by bulk-heading around the fitting with wood, burlap, or reinforced paper sacks filled with sand or earth. Sacks shall be of a size easily handled when full and shall be left in place in the trench. Wood forms shall be removed before backfilling. No horizontal struts or braces required for trench shoring shall remain in the concrete thrust blocks. Prior to placing concrete, the forms shall be reviewed by the District. Kick blocks shall bear on an undisturbed earth foundation.

When concrete is placed against ground without the use of forms, the ground shall be thoroughly moistened, or a polyethylene vapor barrier placed between the wet concrete and founding earth to prevent the ground from drawing water from the concrete.

Before placing concrete, all equipment for mixing and transporting the concrete shall be clean. All debris, water or ice shall be removed from the excavation to be occupied by the concrete. Concrete shall not be placed on frozen subgrade. Finished concrete shall be reviewed by the District prior to backfill.

Care shall be taken not to cover or block outlets, cover bolts, nuts, clamps, or other fittings with concrete. A bond breaker shall be placed between the pipe and the kick block. The "Kick block" detail indicates the size and shape of kick blocks for various fittings. Bearing surface areas shown are minimum areas for bearing against undisturbed trench wall. When the District determines this is not possible, through over excavation or other causes, concrete shall be placed against backfill compacted in accordance with these Specifications. If, in the opinion of the Owner's Soils Engineer or the District, the soil bearing capacity is not sufficient to provide adequate restraint based on minimum bearing areas shown on the details, then the minimum bearing area shall be increased to a size that will provide adequate restraint.

**C. Testing**

At the District's discretion, concrete cylinders may be sampled from kick block pours and tested at 28 days to show conformance with the compressive strength requirement of 3000 psi. Air entrainment and slump may also be tested during the concrete pour at the District's discretion.

**4.17 FIRE HYDRANT BLOW-OFF**

In special cases, Fire Hydrant Blow-Off Assemblies are required/located at various points in water systems for flushing and draining purposes. All materials, installation and testing requirements shall be in accordance with these Specifications (See Details in Appendix A).

Fire hydrant blow-off on well collection system shall be painted black.

**4.18 DELETED**

**4.19 2-INCH BLOW-OFF ASSEMBLY**

Typically, a 2-inch Blow-off Assembly is used in the District.

**A. Installation**

The blow-off shall be installed at a right angle to the main line and in a direction away from any sanitary sewer line, manhole, or structure. The above referenced construction detail outlines additional installation requirements.

**B. Testing**

Valves used on blow-off assemblies shall be operated and tested simultaneously with the water line in accordance with these Specifications.

## 4.20 PRECAST CONCRETE VAULTS/MANHOLES

### A. General

Precast concrete vaults/manholes and base beams are used to house pressure reducing valves, air/vacuum valves and related piping. All precast concrete vaults/manholes shall be designed for H-20 traffic loading in accordance with AASHTO specifications.

### B. Precast Concrete Materials

All precast concrete sections shall be designed and manufactured in accordance with ASTM C478.

Steel used for reinforcement shall be Grade 60. Circumferential placement shall consist of one line of steel in compliance with ASTM C478 latest revision and shall not be less than 0.12 square inch per linear foot in 48" I.D. manholes, and not less than 0.17 square inch per linear foot in manholes 60" I.D. and greater. Spacing of circumferential steel shall not exceed 6". All splices shall be welded or lapped with not less than 40 diameters of wire.

Slabs shall be reinforced with two layers of steel with a minimum area of 0.12 square inch per linear foot in both directions in each layer. Openings in flat slabs shall be additionally reinforced with a minimum of the equivalent of 0.20 square inch of steel at 90°. Straight rods used to reinforce openings shall have a minimum length equal to the diameter of the opening plus 2". Flat Top covers shall be reinforced with two layers of steel with a minimum area of 0.12 square inch per linear foot in both directions in each layer.

Concrete curing for precast materials shall take place in a steam curing chamber or other moisture-controlled environment. It shall be maintained for such time and at such temperature as needed for concrete to meet the minimum 3000 psi compressive strength requirement. Type II cement shall be used for all components.

Each manhole section shall be placed in accordance with the manufacturer's recommendations in a plumb position. A flexible plastic joint sealing compound (Ram-neck) shall be used between each manhole section and shall be continuous around the entire manhole section circumference. All exterior and interior joints shall be grouted.

Pipes entering through the wall of a manhole section shall be sealed using a 1-inch thickness of mastic (Ram-neck) and shall be restrained, where appropriate and required, to the wall in accordance with the "Wall Clamp" detail.

Grout shall be applied to all joint surfaces in accordance with the manufacturer's mixing and application recommendations. All surfaces receiving grout shall be moistened before grout is placed. Grout shall

have a troweled finish and shall be protected from a rapid moisture loss using a covering of wet rags or polyethylene sheets. The temperature of the grout and the surfaces receiving the grout shall maintain a temperature between 65° F and 85° F until the grout has set.

**C. Steps**

Manhole steps shall be composite material in accordance with Details. Aluminum steps are not allowed. Steps shall be drilled and set during manhole construction.

**D. Intermediate Platforms**

Manhole platforms shall be installed in all manholes or vaults having a depth, ring to invert of 20 feet or more, and at other locations designated by the District. Material requirements and installation shall be in conformance with the "Intermediate Platform" detail.

**E. Ring and Covers**

Cast iron ring and covers shall conform to the details in these specifications. The castings shall weigh not less than 400 pounds and shall conform to ASTM Standard A27. Ring and covers shall be Cast Iron and have a weight of approximately 410 pounds including the ring and cover per "Manhole Ring and Cover" detail.

Ring and covers shall be set to the final grades shown on the plans and shall be securely attached to the manhole riser section with a grout bed and plastic joint sealing compound (Ram-Neck) in pavement, or with a concrete collar in unpaved areas. After the rings are securely set in place, covers shall be installed and the assembly shall be cleaned and scraped of foreign materials.

**F. Exterior Coating Material**

To prevent infiltration in areas of ground water, exterior of vault manhole structures and all joints shall be coated with a waterproof bituminous membrane, or equal. The membrane shall be applied after the joints are grouted and shall lap each joint a minimum of six inches (6"). The Contractor shall submit material specifications for the bituminous membrane to the District for review prior to construction. The exterior coating shall be applied per manufacturer's recommendations.

**G. Base Beams and Slabs**

Where base slabs or base beams are used, the Contractor shall place a minimum of 8 inches of 1½ inch crushed rock under the base for leveling and structural stability.

## **H. Final Grade Adjustments**

Final grade adjustments shall be made using a minimum of four inches (4") of concrete or HDPE grade rings. Grade rings shall make up the riser section providing the riser section does not exceed twelve inches (12") vertically. Brick courses and steel grade rings are not allowed for vertical adjustment. If the riser section exceeds the vertical limitation, the riser and eccentric cone section shall be removed and the appropriately sized barrel section added, followed by cone and grade ring replacement.

Slanted final grade adjustments, to account for street cross slopes, shall be made using brick chips and cement mortar.

## **I. Vent Pipes**

Vent pipes shall be provided in vaults for ventilation, as shown in details. Standpipes shall be located within the street right-of-way or easement boundary at a location acceptable to the District.

### **4.21 WATER SERVICE CONNECTIONS**

The Owner's contractor shall install all taps for service connections following the manufacturer's recommendations.

#### **A. Connection to Asbestos-Cement, Ductile Iron, and Polyvinyl Chloride Pipe**

Tap connections on pipe shall be made with an approved saddle and strap used for each tap connection. Direct taps to these types of pipes will not be permitted. Under no circumstances is a machined-over-all pipe to receive a connection.

#### **B. Tapping Saddles**

All tapping saddles shall consist of a bronze (NSF 61/372) body with two bronze straps or one stainless steel strap and shall be manufactured for connection to ductile iron, steel, polyvinyl chloride, and asbestos cement pipe materials as appropriate. An insulated corporation stop shall be provided between any metallic water main and metallic service line. All saddles shall have the AWWA taper on its threads. A tee connection may be permitted if specifically authorized by the District.

#### **C. Materials**

All components, including pipes, pipe fittings, plumbing fittings, backflow preventers and fixtures used in service lines and in contact with the wetted surfaces shall be "Lead Free" in conformance with NSF/ANSI 372.

Stainless steel double band tapping saddles for use with ductile iron pipe only shall be:

Ford #FS202, #FC202 (6" - 12")

or approved equal.

Double bronze strapped tapping saddles for use with ductile iron and asbestos-cement pipe shall be:

Ford #202, #2025, #202N (6" - 12")

Rockwell #303 (6" - 12")

or approved equal.

Bronze saddles for polyvinyl chloride pipe shall be:

Ford #202BS (6" - 12")

AY McDonald 3845 (6" - 12")

or approved equal.

#### **D. Expansion Loop**

An expansion loop as shown in the construction details, must be left in the service line where it is connected to the corporation stop at the water main as an allowance for expansion and contraction for 0.75-inch and 1-inch service lines.

### **4.22 BACKFLOW PREVENTION DEVICES**

#### **A. General**

Backflow, which is the flow of water, or other liquid, or foreign materials into the distribution mains of the District's potable water system from another source is strictly prohibited and shall be prevented by the installation of an appropriate, approved backflow prevention device, purchased and installed by the tap purchaser at his own expense.

#### **B. Materials**

Only those backflow preventers approved by the Colorado Department of Public Health (CDPHE) may be used in the East Cherry Creek Valley Water & Sanitation District. A listing of acceptable backflow prevention devices is presented in the Appendix. All backflow preventors shall be in conformance with NSF/ANSI 372.

#### **C. Installation**

Backflow preventers shall be installed in conformance with the Cross-Connection Control Manual of the Colorado Department of Public Health. This information is presented in the appendix and outlines general installation procedures for the various types of backflow preventers and also for specific types of installations.

**D. Testing**

Once the backflow preventers have been installed, they shall be reviewed by the District. The Contractor shall schedule the District at least 48 hours prior to the proposed time of inspection.

**4.23 ENCASEMENTS**

**A. General**

Reinforced concrete encasements shall be constructed to the limits shown on the construction drawings. However, should field conditions differ from the reviewed and signed plans (e.g., ground elevations, creek locations), the encasement limits shall be reviewed in the field by the District, prior to any encasement construction.

**B. Materials**

Encasements shall be constructed using a Type II cement concrete having a minimum twenty-eight (28) day design strength of 3000 psi, slump of 2" to 4," and air entrainment of 3 to 5 percent.

Reinforcement steel used in encasements shall be ASTM A-36 steel.

**C. Installation**

Reinforced concrete encasements shall be installed in accordance with the "Concrete Encasement" Detail. The minimum clear distance between steel reinforcement and the edge of the concrete encasement pour shall be three inches (3"). The encasement shall be formed using undisturbed soils or concrete formwork.

Concrete shall be vibrated around steel reinforcement using vibration equipment or manual poling. Concrete shall not be placed on frozen or unstable foundation. Suitable concrete protection shall be provided when temperatures may drop to freezing or lower.

**D. Testing**

Forty-eight (48) hours prior to encasement construction, the Contractor shall submit the concrete mix for review. The District may require that concrete cylinders be poured on-site and tested at twenty-eight (28) days to show conformance with required twenty- eight (28) day compressive strength of 3000 psi, slump and air entrainment may also be tested at the time of the concrete pour, at the District's discretion.

**4.24 WATER SYSTEM INSTALLATION**

**A. Excavation**

1. General

Excavation for pipelines, fittings and appurtenances shall be an open trench excavation to the depth required by the reviewed and signed Construction Plans.

All excavations shall be properly supported in the manner as required by OSHA or as required by State laws and municipal ordinances, and as may be necessary to protect life, property and work.

## 2. Limits of Excavation

Length - Except by expressed written permission of the District the maximum length of open trench shall be 600 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is smaller. The distance is the collective length at any location, including open excavation, pipe laying, appurtenance, construction, and backfill. The trench shall not be left open when the Contractor has left the project site and is not engaged in construction operations. Traffic Barriers shall be placed as required by the representative County, or as stipulated by local conditions, to ensure construction safety at all times.

Width - Trench width at the ground surface may vary with and depend upon the depth, type of soils, and position of surface structures. In general, the minimum clear width of the trench, sheeted or unsheeted, measured at the top of the pipe should be one foot (1') greater than the outside diameter of the pipe. The maximum clear width of the trench at the top of the pipe should not exceed a width equal to the outside pipe diameter plus two feet (2') (see details). If the above defined trench widths must be exceeded, or if the pipe is installed in a compacted embankment, the pipe embankment shall be compacted to 95 percent Standard Proctor Density, to a point at least two and one-half (2.5) pipe diameters from both sides of the pipe or to the undisturbed trench walls, whichever is less.

## 3. Trenching By Hand or Machine

Hand methods for excavation shall be employed in locations directed by the District. The Contractor shall use whatever equipment or hand methods necessary to protect all existing utilities.

## 4. Bracing Excavations

All excavations shall be properly supported in the manner as required by OSHA and other related sections or as required by state laws and municipal ordinances, and as may be necessary to protect life, property, and the work. Excavations shall be so braced, sheeted and supported that they will be safe, and the

ground alongside the excavation will not slide or settle. Excavations shall be so braced or sheeted so as to provide conditions under which workmen may work safely and efficiently at all times.

The sheeting, shoring, and bracing shall be so arranged as to not place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.

Care shall be exercised in the withdrawing or removing of sheeting, shoring, bracing and timbering to prevent the caving in or collapsing of the excavation faces which are being supported.

#### 5. Rock Excavation

Solid rock, boulders, and large stones shall be removed to provide a minimum clearance of at least nine inches (9") below the pipe and fittings.

In general, blasting will be allowed to expedite the work if a permit by the local authority having jurisdiction is granted. All explosives and appurtenances shall be transported, handled, stored, and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to injure any existing structure or facility. The hours of blasting shall be fixed by the District. Owners or occupants of nearby structures or facilities must be notified at least 72 hours in advance of blasting in writing by the Contractor. The notice shall state the date, the time of blasting and who is responsible for the performing blasting.

Blasting shall be controlled so as not to make any excavation unduly large or irregular as to shatter the rock on the bottom or sides of any excavation or surface upon or against which concrete is to be placed. If, in the opinion of the District, blasting is liable to damage rock foundations, supports, or structures, blasting shall be terminated and excavation shall be continued by jackhammering, barring, wedging or other methods.

#### **B. Tunneling and Boring**

Tunneling or boring may be required by the County Highway Department where construction crosses major roadways. Boring and casing materials and construction methods shall be reviewed on a case-by-case basis but will generally conform to the requirements outlined on the "Restrained Casing Spacers" detail in Appendix A.

**C. Grading and Stockpiling**

The Contractor shall control stockpiling and grading in a manner to prevent water from flowing into excavations. Obstruction of surface drainage shall be avoided, and means shall be provided whereby storm water can flow uninterrupted into existing gutters, other surface drains or temporary drains. Excavated material shall not be placed or stockpiled closer than two feet (2') from the top edge of the trench. All grading and stockpiling shall be done in accordance with the approved Grading, Erosion, and Sediment Control Plans and Permits and shall conform to the regulations of any jurisdictional stormwater authorities.

**D. Foundations and Subgrade**

1. General

All manholes or vault foundations and pipe subgrade installation shall be in a stable condition. Any and all questions relative to foundation and subgrade stability shall be coordinated through District and the Developer's Geotechnical Engineer. The Geotechnical Engineer will be responsible for determining if the foundation and/or subgrade is stable prior to the utility installation.

2. Stable Foundations and Subgrades

The trench bottom shall be excavated six inches (6") below the invert of the pipe unless otherwise designated on the plans. Before the pipe is laid, the foundation shall be prepared by backfilling with bedding material conforming to these specifications. The bedding shall be thoroughly tamped to achieve a relative density of 70% as determined by ASTM D2049.

3. Dewatering

The Contractor shall provide and maintain at all times during construction, ample means, and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods which will ensure a dry excavation and preservation of the final lines and grades at the bottoms of excavations. These methods may include well points, sump pumps, suitable rock or gravel drains placed below the bedding, temporary pipelines, and other means, all of which shall be subject to the review of the District.

Dewatering of water line trenches shall commence when groundwater is first encountered, and shall be continuous until such time that, in the opinion of the Owner's Geotechnical Engineer, it is safe to allow the water table to rise. Pipe trenches shall contain sufficient backfill to prevent pipe flotation.

The Contractor shall dispose of the water from the work site in a suitable manner without damage to adjacent property or endangering public health or safety in conformance with a dewatering permit. Obtaining and complying with the dewatering permit is the responsibility of the Contractor. Water shall not be drained into the sanitary sewer system.

4. Foundations in Unstable Soil

When excessively wet, soft, spongy, or similarly unsuitable materials is encountered at the surface upon which the bedding material is to be placed, dewatering shall be performed, and unsuitable materials shall be removed to a depth as determined in the field by the Owner's Geotechnical Engineer and the District.

The degree of soil instability will determine the limits of over excavation. In general, over excavation will be required, and stabilization rock shall be installed as indicated on the "Special Bedding" detail until the foundation and/or subgrade is stable as determined by the Owner's Geotechnical Engineer and the District.

5. Over depth Excavation

Where excavation is inadvertently or otherwise carried below subgrade and/or foundation elevations, suitable provision shall be made to adjust the deeper excavation beneath pipe or structures. Over-depth backfilling with bedding material or on-site material shall be compacted to provide a firm and unyielding foundation, as directed by the Owner's Geotechnical Engineer and the District.

6. Foundations in Rock

Where rock is encountered, it shall be removed below grade. The trench shall be backfilled with clean imported bedding material to provide a compacted foundation cushion. The minimum clearance between rock and the pipe shall be nine inches (9").

**E. Bedding**

1. General

All pipe bedding materials for stable and unstable installation conditions shall be reviewed by the Owner's Geotechnical Engineer and the District prior to delivery of bedding to the construction site. The area indicated in the bedding details from the trench bottom to twelve inches (12") above the pipe shall be referred to as the "pipe zone". Bedding materials and installation shall meet or exceed the requirements of this section.

2. Bedding Material

The pipe bedding, using either squeegee sand or 3/4-inch gravel conforming to these specifications shall be placed in the pipe zone and compacted to the requirements set forth in this section. The following classes of bedding are permitted:

- a. Class A Bedding - Class A (Squeegee) bedding shall be used for the bedding of ductile iron and PVC water main at normal depths of cover (i.e. 4.5 feet to 10 feet of cover). Class A bedding shall consist of placing select bedding material (known as "squeegee") as defined below, from six inches (6") below the bottom of the pipe to a point twelve inches (12") above top of pipe.

Class A (Squeegee) bedding material shall conform to the following limits:

Class A Bedding (Squeegee)	
Sieve Size	Total Percent Passing by Weight
3/8"	100%
No. 200	0-3%

- b. Class B Bedding - Class B bedding shall be reviewed for use by the District for bedding of PVC or ductile iron water lines when depths of cover exceed sixteen (16) feet. Class B bedding shall consist of placing crushed aggregate, as defined below, from nine inches (9") below the bottom of the pipe above the top of the pipe in accordance with the provisions of this section.

Class B bedding shall be clean crushed aggregate conforming to ASTM D 448 No. 67, as follows:

Class B Bedding	
Sieve Size	Total Percent Passing by Weight
1"	100%
3/4"	90%-100%
3/8"	20%-55%
No. 4	0%-10%
No. 8	0%-5%

3. Bedding Installation

The pipe shall be bedded as indicated in the "Standard Bedding" and "Special Bedding" details in Appendix A. The Contractor shall accurately shape the pipe subgrade to fit the bottom of the pipe.

The intent is to relieve the bell of the pipe of all loading and provide continuous bearing of the pipe barrel on the bedding. Use of a drag template shaped to conform to the outer surface of the pipe will be required if other methods do not give satisfactory results.

The pipe shall be centered in the trench, adjusted to line and grade and bedding shall be simultaneously placed on both sides of the pipe so as not to disturb alignment and grade. The bedding material shall be sliced under the haunches of the pipe to fill all voids. The slicing shall be performed when the bedding material covers approximately one-third (1/3) of the pipe's diameter.

#### 4. Bedding Compaction

All bedding material shall be compacted to a minimum Relative Density of 70 percent, as determined by ASTM D2049. Each lift shall be solidly tamped with the proper tools so as not to injure, damage or disturb the pipe. Backfilling shall proceed simultaneously on each side of the pipe. Water settling for compaction is generally not permitted and must be reviewed by the District prior to its use.

#### 5. Bedding Testing Requirements

Bedding material shall be tested by the Owner's Geotechnical Engineer for graduation requirements set forth herein, and test reports shall be submitted to the District prior to delivery of any bedding material to the project site.

Bedding compaction shall be tested using the "Sand Cone Method" in conformance with ASTM D1556 or other methods reviewed by the District. Compaction test results shall be submitted to the District on the working day following the test. If test results do not meet these specifications, the area shall be reworked and retested until these specifications are met. The location and frequency of bedding compaction testing will be determined by the District on a case-by-case basis.

### **F. Water Line Installation**

#### 1. General

Pipe shall be laid without a break in grade from fitting to fitting or to the lines and grades shown on the reviewed and signed construction plans. The interior of the water pipe shall be cleaned of all dirt and superfluous materials of all description as the work progresses.

When pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of

foreign matter into the pipe. These provisions apply during the noon/lunch hours and breaks, as well as overnight and on holidays.

2. Material Review Before Installation

All pipes and fittings shall be carefully examined for cracks, sun damage, and other defects before installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective materials shall be removed from the site.

3. Laying of Water Pipe

Placement of Ductile Iron pipe in the trench shall conform to ANSI/AWWA C600 and these Specifications. Placement of PVC pipe in the trench shall conform to ASTM Standard D2321 or Uni-Bell Standard UNI B5 and these standard Specifications. Under no circumstances shall PVC pipe be dropped or dumped into the trench.

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

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell or coupling, and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with bedding material. Precautions shall be taken to prevent dirt from entering the joint space.

Pipe shall be laid with the bell or coupling ends facing the direction of laying, unless otherwise specified by the District. Where the pipe is laid at a grade of 10% or greater, laying should proceed upward with the bell end or coupling ends of the pipe upgrade if progression of work allows.

4. Alignment and Grade

The water line shall be laid and maintained to the required lines and grades as shown on the approved construction plans.

Water lines laid in curves shall be kept in alignment by placing all the joints or bends on the curve. Short lengths shall be used where necessary to maintain the desired curvature without

exceeding individual joint deflections as specific by the pipe manufacturer. Bends shall be used whenever individual joint deflections would otherwise exceed those specified by the manufacturer.

Where obstructions or field conditions are encountered during construction which interfere to such an extent that an alteration in the alignment is required, the District shall have the authority to change the plans.

#### 5. Pipe Cutting

Pipe shall be cut as necessary to provide for the location of fittings, line, or grade. All cuts shall be straight and true and done so in a workmanlike manner as to provide a smooth end, perpendicular to the flow axis of the pipe, without damaging the pipe or pipe lining. All burrs shall be removed from the ends of the pipe by lightly rasping or filing the pipe end.

#### 6. Deflection at Joints

Wherever it is necessary to deflect the pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb valve stems or where long radius curves are permitted, the amount of deflection at joints allowed shall not exceed that specified by the pipe manufacturer. Correcting horizontal alignments during construction using deflected joints requires prior District review.

All PVC pipes laid on a curve shall have high deflection bells. Bending the pipe to achieve a radius will not be permitted.

#### 7. Joining Mechanical Joint Pipe

The last eight inches (8") of the outside spigot and inside bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grease, grit, excess coating, and other foreign matter from the joint. The plain end, socket, and gasket should be washed with a soap solution to improve gasket seating. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly but before tightening bolts. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand-tighten nuts.

Nuts located 180° apart shall then be evenly and alternately tightened with a torque limiting wrench to produce an equal

pressure on all parts of the gland. The torque for various sizes of bolts shall be as follows:

Bolt Size (inches)	Range of Torque (ft-lbs)
5/8	40-60
3/4	60-90
1	70-100
1 1/4	90-120

8. Jointing Push-On-Joint Pipes

The inside of the bell or coupling and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket, or the coupling end of the pipe.

A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the outside of the spigot end of the pipe or both in accordance with NSF 60/61. The lubricant is supplied in sterile cans and every effort should be made to keep it sterile. Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file or grinder to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.

Small pipes can be pushed into the bell socket with a long bar. Large pipes require additional power, such as a jack, lever puller, or backhoe. The supplier may provide a jack or lever pullers on a rental basis. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.

9. Polyethylene Wrapping

All cast iron or ductile iron pipe, fittings and rodding shall be wrapped with polyethylene wrapping, minimum 8 mil thickness. Polyethylene wrapping shall not be stored in direct sunlight. Polyethylene having a "whitish" tone is not acceptable for use. Suggested installation procedure for polyethylene tube wrapping is as follows:

Pick up the pipe with a sling or pipe tongs. Slip a polyethylene tube which is approximately two feet (2') longer than the pipe over the plain end and leave it bunched up.

Lower the pipe into the trench and construct joint with the preceding pipe. Shallow bell holes are required to allow proper overlap of the tube between joints.

Remove the sling or tong from the center of the pipe, raise the bell a few inches and slip the polyethylene tube along the pipe barrel, leaving approximately one foot (1') of the tube bunched up at each end of the pipe for wrapping the joints.

Overlap each joint by first pulling bunched up tube over the bell, folding it around the adjacent plain end, and securing it in place with two or three wraps of polyethylene adhesive tape. Complete the overlap by repeating the same procedure with the bunched-up tube on the adjacent pipe.

Take up the slack tube along the pipe barrel by folding it over the top of the pipe holding the fold in place with adhesive tape.

Wrap tees, crosses and other fittings with a flat sheet can be accomplished by splitting open a length of polyethylene tube. Pass the sheet under the valve or fitting and bring it up around the body. Joint the seams by bringing the edges together, folding them over twice and securing in place with tape.

Prepare openings for air reliefs, etc., by making an X-shaped cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene, and repair the cut with adhesive tape.

#### 10. Tracer Wire

Install minimum AWG 12 solid copper wire with 0.03 inch of blue PE insulation to the pipe with 2-inch-wide PVC tape. The splicing of tracer wire shall be in accordance with the manufacturer's recommendation.

#### 11. Cautionary Marker Tape

Install 3-inch wide, 4-MIL polyethylene Cautionary Water Line Marker tape, 2 –feet above the top of pipe in the backfill.

### **G. Backfilling**

#### 1. General

All trenches shall be backfilled after pipe, fittings and appurtenances have been installed and reviewed, and after concrete kick blocks have been allowed to cure. When a compaction requirement is specified herein, the optimum moisture content and density shall be determined in accordance with the appropriate ASTM specification.

## 2. Backfill Material

Backfilling shall be done with on-site material, sand or gravel. No oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill unless these materials are scattered and do not exceed 6" in any dimension. Material or perishable, organic, spongy, frozen debris, or otherwise unacceptable nature shall not be used in backfilling. No material greater than 4" in any dimension shall be placed within 1 foot of any pipe, manhole or structure. Backfill material shall be subject to the review of the District.

Permission to use controlled low strength material (CLSM, flow fill, flash fill, etc.) shall be requested from the District in writing and include submittal of proposed mix design from a ready-mixed concrete producer.

Within the street right-of-way, the road subgrade and final grade, including base course and asphalt placement, shall be replaced in strict accordance with any applicable Federal, State, and Local regulations.

## 3. Backfill Installation

In street rights-of-way, the portion of the trench above the "pipe zone" to the finished roadway surface, shall be backfilled, compacted and/or consolidated by methods reviewed by the District to obtain a Standard Proctor Density of 95% (ninety-five percent) or equivalent relative density. In easements and other areas outside street rights-of-ways, the portion of the trench above the "pipe zone" shall be backfilled, compacted and/or consolidated by methods reviewed by the District's geotechnical consultant to obtain a Standard Proctor Density of 90% (ninety percent) or equivalent relative density.

Backfill to be compacted by heavy compaction equipment shall be placed in uniform horizontal lifts not exceeding 15" or as specified by the District. Heavy compaction equipment shall not be used closer than three feet to walls at the top of any structure nor closer than three feet to the top of the pipe. Before each lift is compacted, the material therein shall be brought within 1% above or 3% below the optimum moisture content for the specified compaction.

Flooding, pooling, or jetting shall not be allowed for consolidation of backfill.

Any damage to the pipe as a result of the Contractor's backfill and compaction operation shall be repaired and/or replaced by the Contractor.

#### 4. Backfill Compaction Tests

Compaction tests shall be performed by a qualified testing laboratory at locations designated by the District. All expenses involved in these tests shall be borne by the Contractor or Developer.

Copies of test results shall be provided to the District. In all cases where the tests indicate sub standard compaction, additional compactive effort and tests will be required until these specifications are met. Final acceptance of the lines by the District will be contingent upon satisfactory compaction results. Testing of water lines shall not be performed until backfill conforms to these specifications.

#### H. Final Clean Up

Prior to probationary acceptance, the contractor shall clean street right-of-ways and easements of all rubbish, excess materials, temporary structures and equipment and shall leave the same areas to plus or minus 1/10 of a foot from the elevations that existed prior to construction, or the final grades as shown on the reviewed and signed construction plans.

### 4.25 WATER SYSTEM TESTING AND ACCEPTANCE

#### A. Chlorination

Main extensions and private pipe extensions shall be chlorinated in accordance with AWWA C651, "Disinfecting Water Mains," and the local health authority having jurisdiction, prior to acceptance by the District. The chlorinating agent, and method of application, shall be subject to the review of the District.

Chlorination of the finished pipelines shall be completed prior to the hydrostatic testing. Prior to filling the pipe with water, the pipe shall be clean and free of debris to the satisfaction of the District. All labor, equipment, and materials necessary to chlorinate and complete hydrostatic testing of water lines is the contractor's responsibility.

Chlorine tablets may be used for disinfection in twelve-inch (12") and smaller pipes. If chlorine tablets are used for disinfection, the tablets shall be attached to the inside top of the pipe with Dow Corning 748 Multipurpose Sealant, just prior to the pipe installation in the trench.

<b>NUMBER OF 5g HYPOCHLORITE TABLETS OF 65% STRENGTH REQUIRED FOR A DOSE OF 50 mg/l*</b>			
<b>Pipe Length (feet)</b>	<b>Pipe Diameter</b>		
	<b>6 inch</b>	<b>8 inch</b>	<b>12 inch</b>
13 or less	2	2	5
18	2	3	6
20	2	3	7
* Based on 3¾ gram available chlorine per tablet			

After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for twenty-four (24) hours. At the end of the twenty-four (24) hour period, the water in the pipeline shall be tested by the local health authority or their designated representative to insure a residual chlorine content of not less than twenty-five (25) mg/l. Once chlorination is complete, the pipeline shall be thoroughly flushed to remove the heavily chlorinated water. Care shall be taken when flushing the pipeline to provide adequate drainage and prevent property damage and danger to the public.

Samples of water will be collected for bacteriological examination and residual chlorine content testing before the pipe is put into service. The District will be responsible for the chlorine test and the Contractor will be responsible for the clear water test.

**B. Dechlorination**

Dispose of highly chlorinated water by Dechlorination or other methods in a safe manner and in conformance with the District and National Discharge Elimination System Requirements. Submit proposed disposal and Dechlorination plan to District representative for review. Provide facilities for adequate Dechlorination and disposal of water without damage to adjacent property.

**C. Hydrostatic Testing**

1. Preparation for Testing

Hydrostatic tests shall not be performed on any portion of the pipeline until all field placed concrete has had adequate time to develop design strength.

Pipe shall be field pressure tested to a minimum of 150 psi or 50 psi above the operating pressure of the line whichever is greater, with the exception that hydrostatic test pressure against any butterfly valve shall be 150 psi maximum. All hydrostatic testing shall be done in accordance with AWWA C-600, "Hydrostatic Testing."

The District shall be notified twenty-four (24) hours in advance of testing. All testing shall be performed in the presence of the District.

Only the following methods are acceptable for supplying potable water for hydrostatic testing:

- a. Water may be taken from a nearby pressurized water source which has been previously chlorinated, tested and accepted, such as a fire hydrant.
- b. Water may be delivered to the site in a chlorinated water truck having a minimum capacity of 3000 gallons. The water truck shall be used exclusively for the transportation of potable water.
- c. Any previously tested, chlorinated, and accepted water main which is pressurized and is to serve the new main extension may be tapped on the pressurized side of the closed valve.

In any event, the source and method of supplying water for hydrostatic testing must be reviewed and approved by the District. Use of barrels, sanitary or otherwise, to supply water for hydrostatic testing shall not be allowed.

Prior to notifying the District of intent to begin hydrostatic testing, the pipeline shall be properly backfilled and shall be in a state of readiness for testing. All bulkheads, pumps, taps and appurtenances necessary to fill the pipeline and maintain the required pressure shall be in place. The pipeline shall be filled with water and the test pressure of 150 psi shall be applied to the pipeline by means of a continuously operating pump, equipped with a by-pass valve for regulating pressure. When filling the pipeline, it shall not be filled at a rate which will cause any surges, nor will it exceed the rate at which the air can be released.

All air in the line shall be properly purged. Where blow-offs or hydrants are not available or are not effective in purging air from the line, a tap may be required to be installed to purge the line. The location and size of tap shall be determined by the District.

While the test pressure is maintained, the pipeline shall be examined for any leaks. Any pipe or fitting found to be faulty shall be removed and replaced. Cutting and replacing pavement, excavating, and backfilling may all be necessary to locate and repair leaks discovered by pressure testing of pipe. The Contractor shall be responsible for supplying the labor, equipment, and materials necessary to accomplish the prescribed testing and repair work, if required.

2. Leakage Test

After all visible leaks have been stopped, the full test-pressure shall be maintained for a minimum of (2) continuous hours.

Allowable leakage for pipe with 20-foot-long joints shall not exceed the leakage rate set forth in the following table.

ALLOWABLE LEAKAGE PER HOUR	
Pipe Size (inches)	Leakage Per 1000 feet of Pipe (gallons)
4	0.33
6	0.50
8	0.66
12	0.99
16	1.32
20	1.66

The formula used to determine allowable leakage is as follows:

$$L = \frac{N * D * \sqrt{P}}{7400}$$

Where:

- L is allowable leakage in gallons per hour
- N is the number of joints in the length of pipeline tested
- D is the nominal diameter of the pipe in inches
- P is the average test pressure during the leakage test in pounds per square inch

No leakage is allowed through the bonnet of any line valve. Any valve leaking through the bonnet shall be repaired in place or removed and replaced.

Should testing show a leakage rate in excess of the rates shown the pipeline shall not be accepted. The pipeline shall be repaired, re-chlorinated and re-tested as described in this section until it meets the District's test requirements.

**D. Probationary Acceptance**

Probationary Acceptance of the water system will not be granted by the District until all tests are successful and all construction items listed for correction by the District have been accomplished.

## **E. Final Acceptance**

One Year following the date of Probationary Acceptance, the District shall review the project. All requirements of these Specifications and the District's Rules and Regulations must be complete and acceptable to the District before the District finally accepts the project.

### **4.26 CONDUIT CONNECTIONS**

#### **A. Steel Pipe Connections**

##### **1. Handling**

All pipes, fittings, etc. shall be carefully handled and protected against damage to lining and coating, impact shocks and free fall. All pipe handling equipment shall be approved. Pipe shall not be placed directly on rough ground but shall be supported in an approved manner that will protect the pipe against injury whenever stored at the trench site or elsewhere. No pipe shall be installed where the coating or lining shows cracks that may be harmful as determined by the District. Such damaged coating or lining shall be repaired, or a new undamaged pipe shall be furnished and installed.

##### **2. Qualifications of Welding Procedures**

All welding procedures used to install pipe shall be prequalified under provisions of AWS D1.1 or the ASME Pressure Vessel Code. Welding procedures shall be required for field attachments and field welded joints. Full and complete information regarding location, types, size, and extent of all welds shall be clearly shown on the Shop Drawings.

The Drawings shall clearly distinguish between shop and field welds. Joints or groups of joints in which welding sequence is especially important or technique be carefully controlled to minimize shrinkage stresses and distortion shall be so noted.

Shop Drawings shall specify the groove depths applicable for the effective throat required for the welding process.

Shop Drawings shall clearly indicate by welding symbols or sketches the details of the welded joints and the preparation of parent metal required to make them.

Joints meeting requirements of AWS D1.1, Section 2, shall be so noted on Shop Drawings. Joints not meeting this requirement shall be qualified as outlined in AWS D1.1, Section 5.

If radiographic testing is used in lieu of prescribed AWS bend tests, the weld reinforcements need not be ground or otherwise

smoothed for inspection unless its surface irregularities or juncture with the base metal would cause objectionable weld discontinuities to be obscured in the radiograph. The test coupon shall be radiographed from the top center line to the bottom center line on either side. Radiographic testing shall follow the procedure as specified under AWS D1.1. All film and test specimens shall be furnished to the District.

### 3. Qualifications of Welders

All welding shall be performed by skilled welders, welding operators and tackers who have had adequate experience in the methods and materials to be used. All welders, welding operators and tackers shall be qualified under the provisions of AWS D1.1 or the ASME Pressure Vessel Code using the test procedure for the position in which they are welding. Welders performing field welds for welded joints shall be qualified using test position 6G. All welding completed by welders who are not qualified will be rejected.

Welders, welding operators and tackers shall be qualified by an independent, local, approved testing agency. Connector shall submit evidence of qualification, including proof that each welder, welding operator and tacker has been continuously engaged in the given process of welding for which the welder, welding operator or tacker is qualified with no gaps in experience of more than six months. Welders, welding operators and tackers with gaps in experience of more than six months, and those whose ability is questioned by the District for a specific reason, shall be requalified under the provisions of AWS D1.1 as specified above.

Machines and electrodes similar to those used in the work shall be used in qualification tests. All tests for qualification shall be done in the presence of the testing agency or in the presence of a certified welding inspector appointed by the testing agency. The Connector shall furnish all material and bear the expense of qualifying welders.

### 4. Welding Inspection

All welding inspection shall be the responsibility of the Connector. The Connector shall utilize a Certified Welding Inspector certified in accordance with AWS QC1, "Standard Guide for Qualification and Certification of Welding Inspectors".

All welds shall be visually inspected in accordance with AWWA C206 and AWS D1.1.

Visual inspections shall be performed by the Certified Welding Inspector.

All welds shall be dye-penetrant tested in accordance with AWS D1.1, ASTM E165, and ASNT "Nondestructive Testing Handbook, Volume 2".

Certified Welding Inspectors performing dye-penetrant testing shall be qualified in accordance with ASNT Recommended Practice SNT-TC-1A. Only those qualified at Level II shall perform dye-penetrant testing.

**B. Required Submittals**

Submittals required for the Conduit Connection include:

- Flow Meter
- Reduced Pressure Backflow Preventer
- Control Valve, if applicable
- Coating Repair Material
- SCADA Mounting Details

**C. Site Access**

The site access shall be restored by the Connector after construction. The Connector is responsible for maintaining dust control. Water shall be supplied a minimum of weekly or more as required.

**D. Materials**

The site access shall be restored by the Connector after construction. The Connector is responsible for maintaining dust control. Water shall be supplied a minimum of weekly or more as required.

1. Heat-Shrinkable Sleeves

Heat-Shrinkable Sleeves, if used, shall conform to AWWA C216, Type I or Type II.

2. Joint Mortar

Joint Mortar, shall conform to AWWA C205, Appendix A.

3. Mortar Bonding Agent

A mortar bonding agent shall be 100% Acrylic Polymer Emulsion, water-based, VOC compliant, and listed in ANSI/NSF 61. Mortar bonding agent shall be Acryl 60 or equal.

4. Mortar Seal Compound

Mortar seal compound shall be as listed in ANSI/INSF 61, and shall be "Protex", or approved.

## 5. Tape Coating

Tape coating shall be prefabricated multi-layer Cold Applied Tape Coating. Except as described below, the coating system for straight line pipe shall be in accordance with AWWA C214. The system shall consist of at least 4 layers consisting of the following:

- primer layer
- inner layer tape - corrosion protective tape (20 mils) with black exterior
- outer layer tape - mechanical protective tape (30 mils) with gray exterior, required for pipe 16-inch diameter and larger
- outer layer tape - mechanical protective tape (30 mils) with blue exterior for the PFW distribution system and purple exterior for the NPW distribution system.

The total thickness of the tape coating shall be at least 80 mils for pipe 16-inch diameter and larger, and at least 50 mils for pipe 12-inch diameter and smaller.

For potable water line, the 30-mil blue outer layer wrap shall be pigmented similar to the color Horizon Blue produced by Ameron. For non-potable water line, the 30-mil purple outer layer wrap for the NPW distribution system shall be pigmented similar to the color Pantone 277U.

The 30-mil outer layer wrap shall be capable of withstanding the degradation effects of ultraviolet light when exposed to direct sunlight for a period of 2 years. The manufacturer of the tape shall supply certification of this requirement.

### E. Tape Coating Repair

Tape coating repair shall be made using tape and primer conforming to AWWA C209, Type II. The tape and primer shall be completely compatible with the tape system used for straight line pipe and shall be the same color. When visual inspection shows a portion of the tape-wrap system has sustained physical damage, the damaged areas shall be subjected to an electrical holiday test of 6,000 to 7,000 volts.

Following repair of the damaged area, if the holiday test indicates a holiday still exists, the inner wrap shall be exposed and the exposed area shall be wiped clean with xylol solvent, or equal, and the area coated with tape primer. A patch of 35-mil thick cold-applied tape of sufficient size to cover the damaged area, plus a minimum lap of 2 inches in all directions, shall then be applied. The patched area shall again be tested for holidays. If none are detected, a second layer of 35-mil thick tape shall then be applied over the first patch. The second layer of tape shall overlap the first layer a minimum of 2 inches in all directions.

When the area tests showing no holiday, a notation shall be applied to the area indicating the test is satisfactory.

Polyurethane Coating Repair. Polyurethane coating repair shall conform to *AWWA C222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings*.

Connector shall use Raven Lining Systems' AquataPoxy A-6 or A-7, or equal, for interior lining repair.

Connector shall use Denso Protal 7125, or equal, for exterior coating repair.

## **F. Insulating Flange Sets**

Insulating flange sets shall be provided where shown on the Plans. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a hardened steel washer.

Insulating gaskets shall be JM Red Devil Type E full face gasket or approved equal. Insulating sleeves and washers shall be one piece and shall be made of acetal resin. Hardened steel washers shall be in accordance with ASTM F 436.

## **G. Execution**

### **1. Preparation**

The Connector shall inspect each pipe and fitting to insure that there are no damaged portions of the pipe. The Connector shall remove or smooth out any burrs, gouges, weld splatter or other small defects prior to laying the pipe.

Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the work.

When the pipe is being laid, it shall be turned and placed where possible so that any slightly damaged portion will be on top. The damaged area shall be repaired for the protection of any exposed steel. All damaged areas shall be repaired using approved materials and methods.

### **2. Installation of Valves**

All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. The Connector shall adjust all stem packing and operate each valve prior to installation to insure proper operation.

All valves shall be installed so that the valve stems are plumb and, in the location, shown on the Plans.

3. Installation of Flanged Joints

Before the joint is assembled, the flange faces shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered, and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable, approved, and calibrated torque wrench. All clamping torque shall be applied to the nuts only.

After the flange has been properly assembled, the joint shall be thoroughly cleaned of all foreign material and then wrapped in wax tape.

4. Insulated Joints

Insulated joints and appurtenant features shall be made by the Connector as indicated on the Plans. The Connector shall exercise special care when installing these joints to prevent electrical conductivity across the joint. After the insulated joint is completed, an electrical resistance test will be performed. Should the resistance test indicate a short circuit, the Connector shall remove the insulating units to inspect for damages, replace all damaged portions and reassemble the insulating joint. The insulated joint shall then be re-tested to assure proper insulation.

5. Pipe Cleanup

As pipe laying progresses, the Connector shall keep the pipe interior free of all debris. The Connector shall 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 and disinfecting the completed pipeline.

6. Testing

Contractor to test the Backflow Protection Device and provide testing results to the District.

Disinfection and pressure testing must be accomplished per appropriate specifications section for piping and/or equipment.

## H. Meters

The meter for the Conduit Connection shall be a Badger Turbo Series meter, or Endress & Hauser meter. The Connector must arrange for the meter to be tested by a certified testing entity.

## I. SCADA

The meter for the Conduit Connection shall be a Badger Turbo Series meter, or Endress & Hauser meter. The Connector must arrange for the meter to be tested by a certified testing entity.

### 1. Equipment Provided by ECCV, at Connector's Cost

ECCV shall provide a NEMA 12 SCADA enclosure to be mounted, by the Connector, inside a Connector-provided NEMA 4X above-ground enclosure. The following items of equipment will be provided by ECCV inside the SCADA enclosure, at Connector's cost:

- SCADA PLC
- Radio with Power Supply
- SCADA Panel Uninterruptable Power Supply
- Radio Antenna

### 2. Equipment Provided by Connector

The Connector shall provide the following equipment:

- Adequately sized NEMA 14X, SCADA RTP panel with backplane
- Water on floor, float switch (Gems)
- Intrusion switches for access doors
- Other minor devices such as switches, relays, nameplates, hi/lo thermostat, fuses etc as identified in the specifications.
- Power to site.
- Power Company Meter.
- Wiring from vault(s) to enclosure for flow meter and alarms.

### 3. Controls and Instrumentation

The Connector shall perform the following electrical and instrumentation:

- Install RTP panel.
- Calibrate and span all instruments.
- Verify that all I/O control functions listed in the I/O list and the Control Sequence of Operation described in the specifications and as indicated on the Electrical Drawings, are wired, and tested for proper operation.
- Test equipment and controls.

4. Programming

ECCV shall perform programming and integration, at the cost of the Connector.

## APPENDIX A

### WATER SYSTEM CONSTRUCTION DETAILS

ECCV-1W	Standard Bedding For Water Lines
ECCV-2W	Special Bedding For Water Lines
ECCV-3W	Gate Valve
ECCV-4W	Butterfly Valve Direct Bury
ECCV-5W	Butterfly Valve and Vault
ECCV-6W	PRV and Vault 1 of 2
ECCV-7W	PRV and Vault 2 of 2
ECCV-8W	ARV Valve and Vault
ECCV-9W	ARV Valve and Vault
ECCV-10W	Above Ground Sampling Station
ECCV-11W	Buried Sampling Station
ECCV-12W	Standard Blowoff Assembly
ECCV-13W	Transmission Main Blowoff
ECCV-14W	Fire Hydrant Assembly
ECCV-15W	Fire Hydrant Guards
ECCV-16W	Intersection Valve and Fire Hydrant Locations
ECCV-17W	Fire Hydrant Layout for Cul-De-Sacs
ECCV-18W	Tracer Wire Installation Detail
ECCV-19W	Polyethylene Wrap
ECCV-20W	Length of Restrained Pipe
ECCV-21W	Clamp Details and Dimensions
ECCV-22W	Kick-block Details
ECCV-23W	Adjustable Steel Pipe Valve Support
ECCV-24W	Wall Clamp
ECCV-25W	Insulated Joints, Rods, and Mechanical Couplings
ECCV-26W	Mechanical Joint Restraint
ECCV-27W	Combination Bend Installation
ECCV-28W	Waterline Crossing Existing Sanitary Sewer
ECCV-29W	Utility Crossings
ECCV-30W	24in Manhole Ring and Cover
ECCV-31W	Utility Access Cover with Quarterturn Paddle Lock
ECCV-32W	36" x 24" Double Ring and Cover
ECCV-33W	Compact Composite Step
ECCV-34W	Composite Step
ECCV-35W	P.V.C Vent Pipe
ECCV-36W	Standard Steel Marker Post
ECCV-37W	Carsonite Marker Post
ECCV-38W	Tapping Tee and Valve
ECCV-39W	Domestic Water Tapping
ECCV-40W	Fireline Connection With Domestic Service Tee
ECCV-41W	0.75 and 1 in Traffic Service Meter
ECCV-42W	0.75- and 1-inch Traffic Service Meter Valve Box 1 of 2
ECCV-43W	In Traffic Water Meter 24-inch Ring and Cover
ECCV-44W	Service Line, Stop Box, and Inside Meter Install
ECCV-45W	Remote Reading 0.75- and 1-inch Meter
ECCV-46W	0.75- and 1-inch Service Meter
ECCV-47W	Service Line, Stop Box, and Outside Meter Install

## **WATER SYSTEM CONSTRUCTION DETAILS (Cont.)**

ECCV-48W	1.5- and 2-inch Irrigation Meter in Manhole
ECCV-49W	1.5- and 2-inch Water Meter Manhole with Bypass
ECCV-50W	3- and 4-inch Water Meter Vault
ECCV-51W	3- and 4-inch Irrigation Only Meter in Manhole
ECCV-52W	Irrigation System Backflow Preventer
ECCV-53W	Stub Out Configurations
ECCV-54W	Stub Out Configurations
ECCV-55W	Control Valve and Reduced Pressure Backflow Preventer (1 of 2)
ECCV-56W	Control Valve and Reduced Pressure Backflow Preventer (2 of 2)
ECCV-57W	Meter Vault and SCADA Platform (1 of 2)
ECCV-58W	Meter Vault and SCADA Platform (1 of 2)
ECCV-59W	Pitiless Adapter Detail - DELETED
ECCV-60W	Restrained Casing Spacers
ECCV-61W	Water Service Storm Crossing Detail
ECCV-62W	Large Conduit Dual Body Air Valve Assembly (1 of 3) - DELETED
ECCV-63W	Large Conduit Dual Body Air Valve Assembly (2 of 3) - DELETED
ECCV-64W	Large Conduit Dual Body Air Valve Assembly (3 of 3) - DELETED
ECCV-65W	Large Conduit Combination ARV Assembly (1 of 3) - DELETED
ECCV-66W	Large Conduit Combination ARV Assembly (2 of 3) - DELETED
ECCV-67W	Large Conduit Combination ARV Assembly (3 of 3) - DELETED
ECCV-68W	Large Conduit Direct Piped Air Valve and Combination ARV - DELETED
ECCV-69W	Watermain Abandonment
ECCV-70W	Water Service Line Abandonment

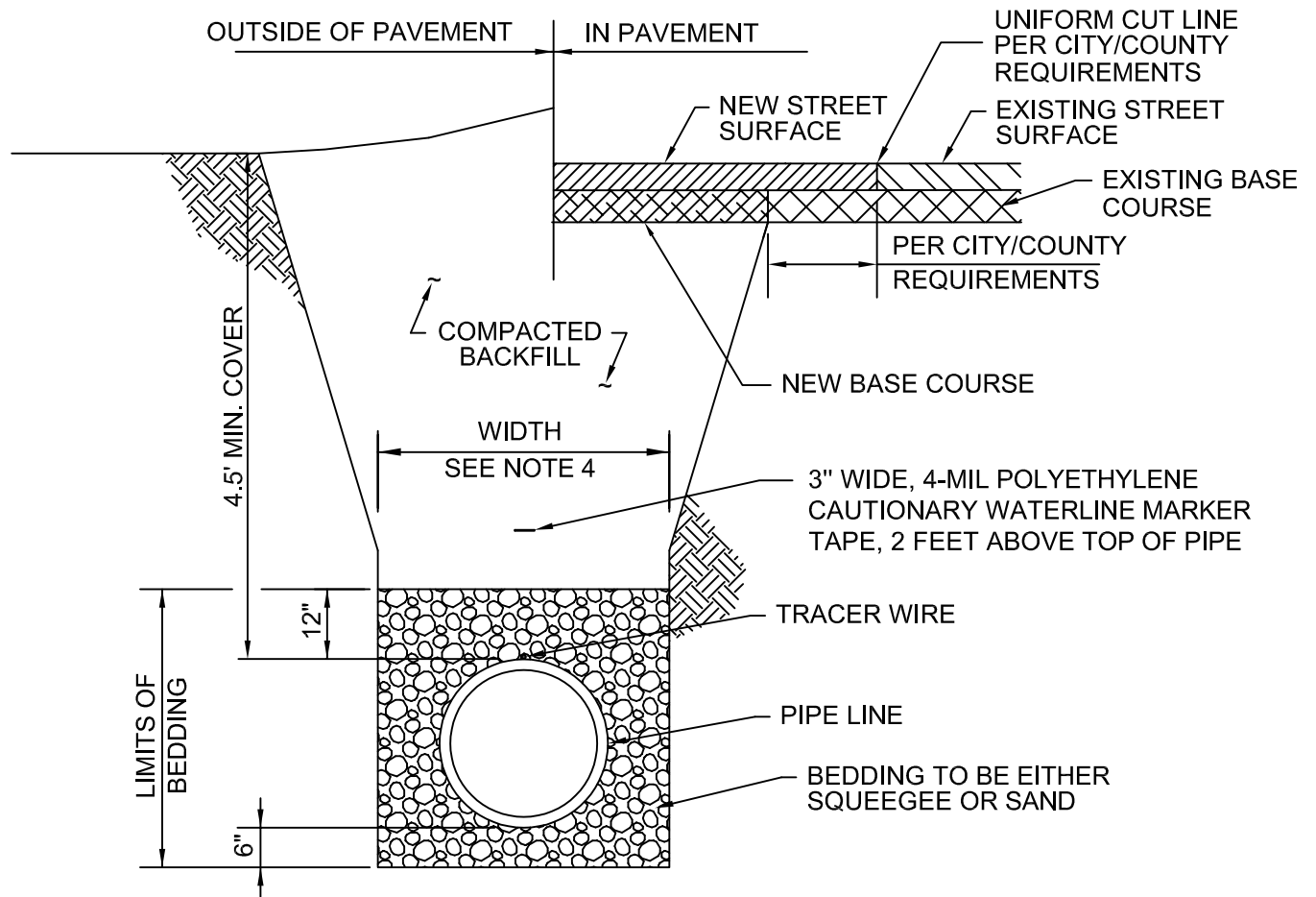
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ECCV-24W	Wall Clamp
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**WATER SYSTEM CONSTRUCTION DETAILS (Cont.)**

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ECCV-49W	1.5- and 2-inch Water Meter Manhole with Bypass
ECCV-50W	3- and 4-inch Water Meter Vault
ECCV-51W	3- and 4-inch Irrigation Only Meter in Manhole
ECCV-52W	Irrigation System Backflow Preventer
ECCV-53W	Stub Out Configurations
ECCV-54W	Stub Out Configurations
ECCV-55W	Control Valve and Reduced Pressure Backflow Preventer (1 of 2)
ECCV-56W	Control Valve and Reduced Pressure Backflow Preventer (2 of 2)
ECCV-57W	Meter Vault and SCADA Platform (1 of 2)
ECCV-58W	Meter Vault and SCADA Platform (1 of 2)
ECCV-59W	Pitiless Adapter Detail - DELETED
ECCV-60W	Restrained Casing Spacers
ECCV-61W	Water Service Storm Crossing Detail
ECCV-62W	Large Conduit Dual Body Air Valve Assembly (1 of 3) - DELETED
ECCV-63W	Large Conduit Dual Body Air Valve Assembly (2 of 3) - DELETED
ECCV-64W	Large Conduit Dual Body Air Valve Assembly (3 of 3) - DELETED
ECCV-65W	Large Conduit Combination ARV Assembly (1 of 3) - DELETED
ECCV-66W	Large Conduit Combination ARV Assembly (2 of 3) - DELETED
ECCV-67W	Large Conduit Combination ARV Assembly (3 of 3) - DELETED
ECCV-68W	Large Conduit Direct Piped Air Valve and Combination ARV - DELETED
ECCV-69W	Watermain Abandonment
ECCV-70W	Water Service Line Abandonment



**TYPICAL TRENCH SECTION**

**NOTES:**

1. MINIMUM COVER TO BE 4.5' BELOW OFFICIAL STREET GRADE.
2. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATIONS.
3. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE.
4. TRENCH WIDTH SHALL NOT BE MORE THAN 16 INCHES OR LESS THAN 12 INCHES WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE LAID THEREIN (BELL OR COUPLING O.D. IF APPLICABLE).
5. SHOULD THE TRENCH BE EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED WITH 2500 P.S.I. CONCRETE FROM TRENCH BOTTOM TO PIPE SPRINGLINE.
6. COMPACTION SHALL BE AS FOLLOWS: PIPE ZONE BEDDING 6" UNDER AND 12" OVER PIPE WILL REQUIRE 90% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, FULL TRENCH SECTION IN ROADWAY OR STREET R.O.W. LIMITS WILL REQUIRE 95% S.P.D. TRENCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET R.O.W. WILL REQUIRE 90% S.P.D.



**STANDARD BEDDING FOR WATER LINES**

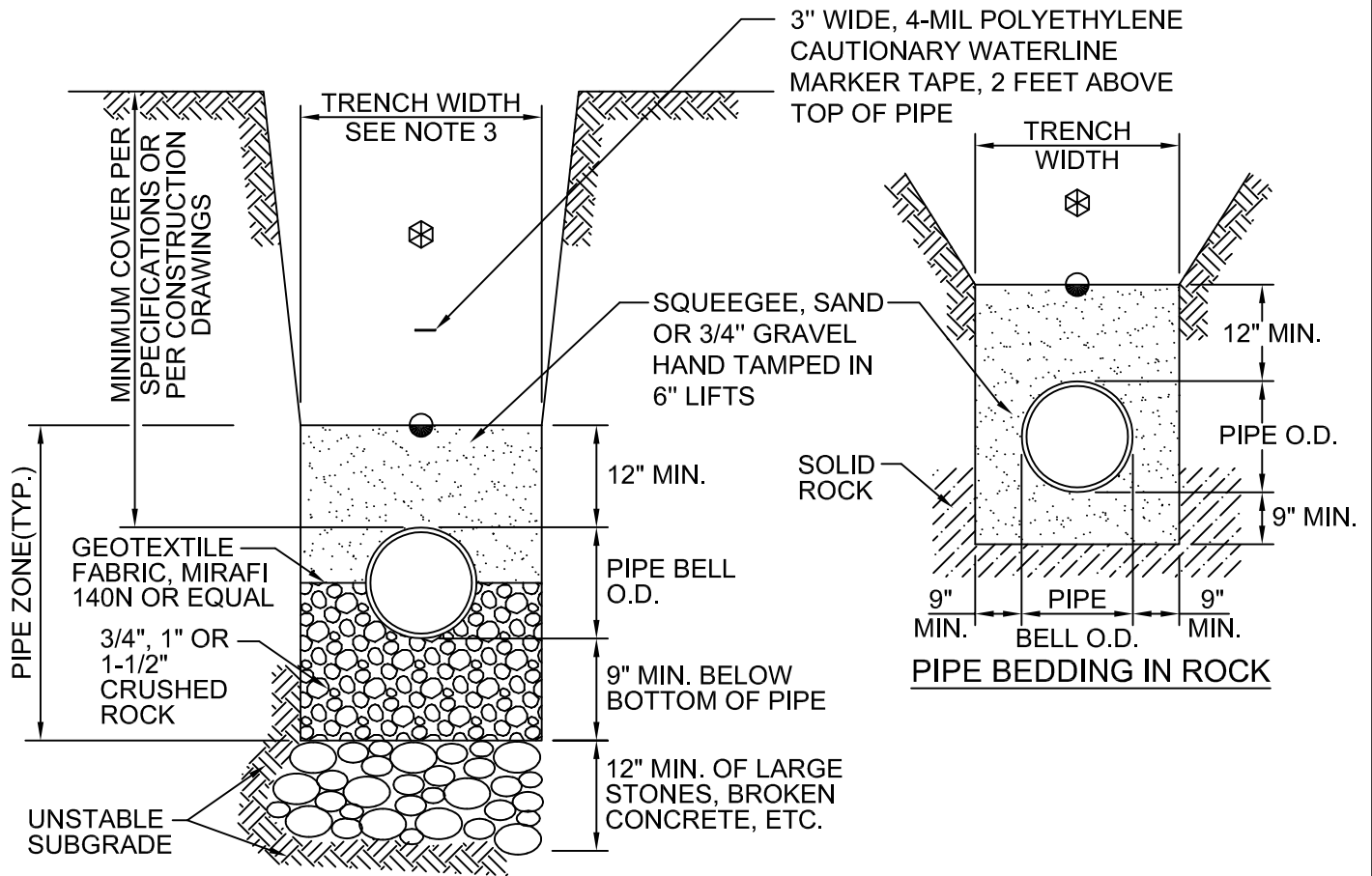
DRAWING NO.: ECCV-1W

DATE: 2024




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**UNSTABLE SUBGRADE**

-  MACHINE COMPACTED TRENCH BACKFILL
-  LIMITS OF SLOPING OR BENCHING OF TRENCH WALLS
-  UNDISTURBED GROUND

**NOTES**

1. MIN. COVER TO BE BELOW FINAL FINISHED GRADE.
2. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN, THE PROTECTION OF OTHERS' UTILITIES AND TO MEET LOCAL, STATE, AND FEDERAL REQUIREMENTS.
3. TRENCH WIDTH SHALL NOT BE MORE THAN 16 INCHES OR LESS THAN 12 INCHES WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE LAID THEREIN (BELL OR COUPLING O.D. IF APPLICABLE).
4. COMPACTION SHALL BE AS FOLLOWS: PIPE ZONE BEDDING 9 INCHES UNDER AND 12 INCHES OVER PIPE WILL REQUIRE 90% S.P.D., TRENCH ZONE ABOVE BEDDING MATERIALS, FULL TRENCH SECTION IN ROADWAY OR STREET R.O.W. LIMITS WILL REQUIRE 95% S.P.D. TRNCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET R.O.W. WILL REQUIRE 90% S.P.D.

	
<b>SPECIAL BEDDING FOR WATER LINES</b>	
DRAWING NO.: ECCV-2W	
DATE: 2024	REV. DATE:

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---	--

18" SQ. x 6" THICK CONC. PAD TO BE 3" MAX. ABOVE EXISTING GROUND OUTSIDE OF PAVEMENT. TOP OF COVER IN PAVEMENT SHALL BE SET IN ACCORDANCE WITH CITY/ COUNTY PAVING REQUIREMENTS.

WORD "WATER" ON COVER APPROX. GROUND LINE

1 (EA) #4 EACH WAY

VALVE BOX WITH WIDE OVAL BASE

GATE VALVE

IF GREATER THAN 5'-0" PROVIDE OPERATING EXTENSION

EXTENSION WITH CENTERING RING

3/4" CRUSHED ROCK (IF REQUIRED)

SEE STANDARD BEDDING DETAILS

2" OF SAND OR SQUEEGEE BEDDING

ELEVATION

NOTES:

1. CARE SHALL BE TAKEN WHEN INSTALLING VALVES TO ASSURE PROPER SUPPORT. 3/4" WASHED ROCK SHALL BE INSTALLED UNDER THE VALVE TO PROVIDE ADDITIONAL SUPPORT IF REQUIRED. DO NOT INSTALL ROCK DIRECTLY AGAINST POLY- WRAP. USE 2" OF BEDDING BETWEEN ROCK AND POLY.
2. VALVES SHALL NOT BE PLACED IN CONCRETE CROSS PANS.
3. VALVES SHALL BE OPEN RIGHT.
4. SEE POLYETHYLENE WRAP DETAIL FOR INSTALLATION OF TRACER WIRE.
5. POLYWRAP VALVE PER STANDARD DETAIL.



**GATE VALVE  
DETAIL**

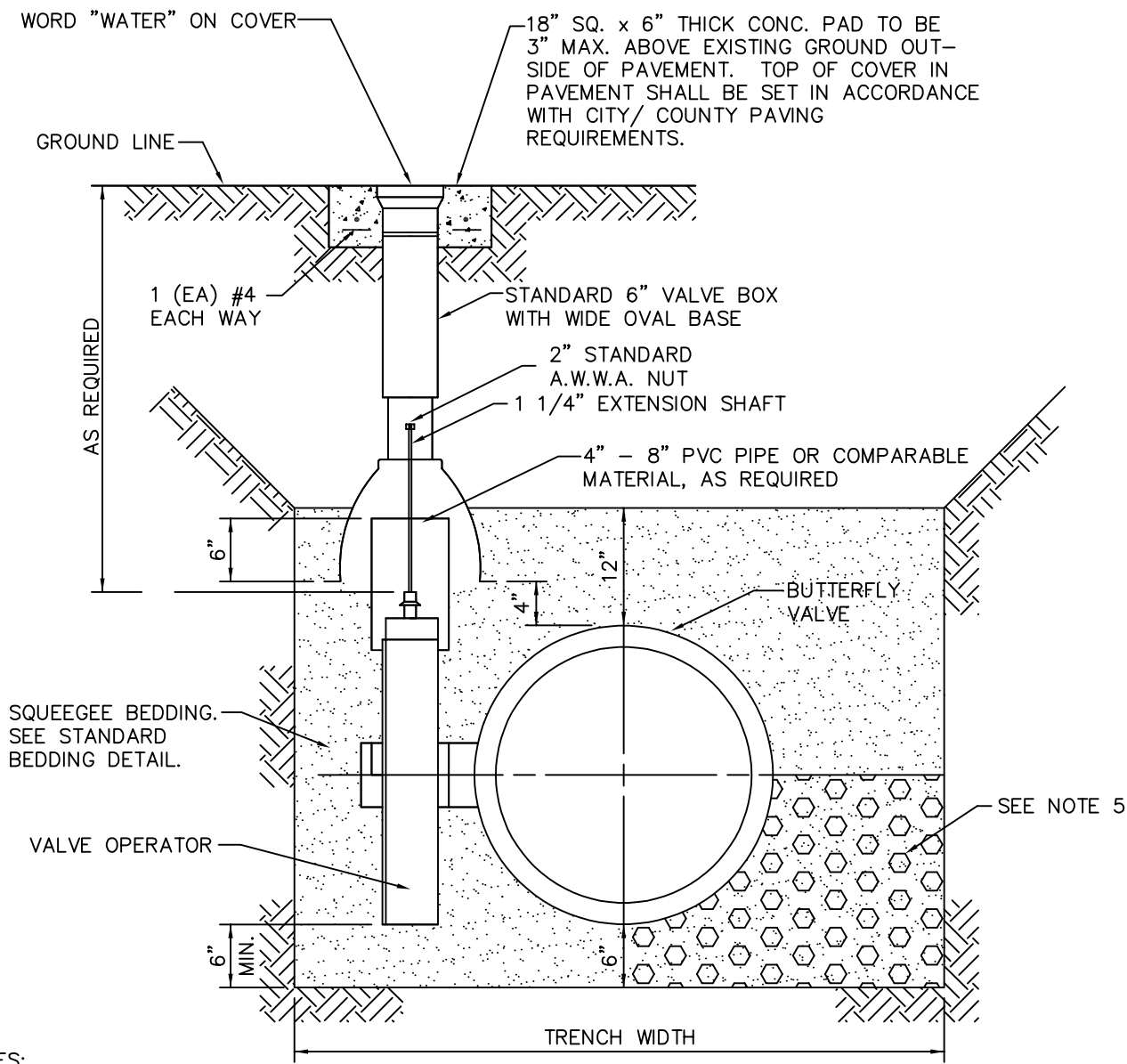
DRAWING NO.: ECCV-3W

DATE: 2024

REV. DATE:



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**NOTES:**

1. BUTTERFLY VALVE SHALL BE OPEN-RIGHT.
2. THE VALVE BOX SHALL NOT BE PLACED DIRECTLY ON THE PVC PIPE.
3. THIS TYPE OF INSTALLATION IS USED FOR 20" AND SMALLER VALVES ONLY.
4. BUTTERFLY VALVE AND OPERATOR SHALL BE POLYETHYLENE WRAPPED.
5. CARE SHALL BE TAKEN WHEN INSTALLING VALVES TO ASSURE PROPER SUPPORT OF THE VALVE. THE DISTRICT MAY REQUIRE 3/4" CRUSHED ROCK TO BE INSTALLED UNDER THE VALVE TO PROVIDE PROPER SUPPORT
6. SEE ECCV TRACER WIRE INSTALLATION DETAIL FOR INSTALLATION OF TRACER WIRE.
7. AWWA 150B OPERATOR MINIMUM NUMBER OF TURNS SHALL BE NO LESS THAN 40.
8. POLYWRAP VALVE PER STANDARD DETAIL.
9. ONLY ALLOWED WITH PRIOR APPROVAL FROM THE DISTRICT.

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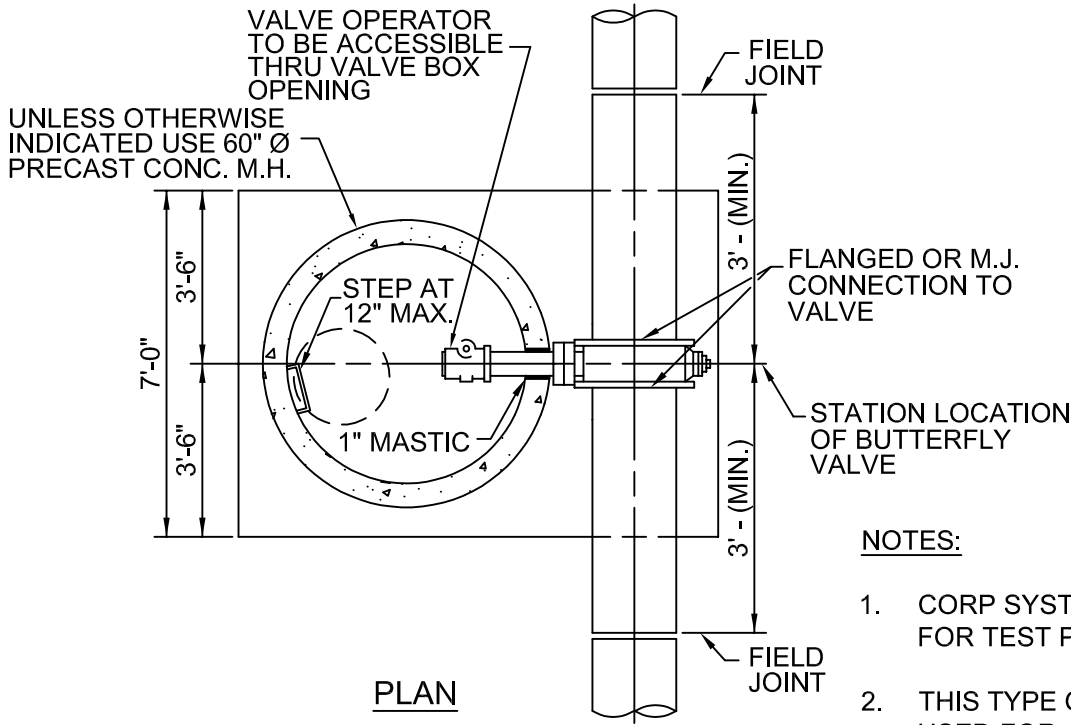


**DIRECT BURY BUTTERFLY VALVE**

DRAWING NO.: ECCV-4W

DATE: 2024

REV. DATE:

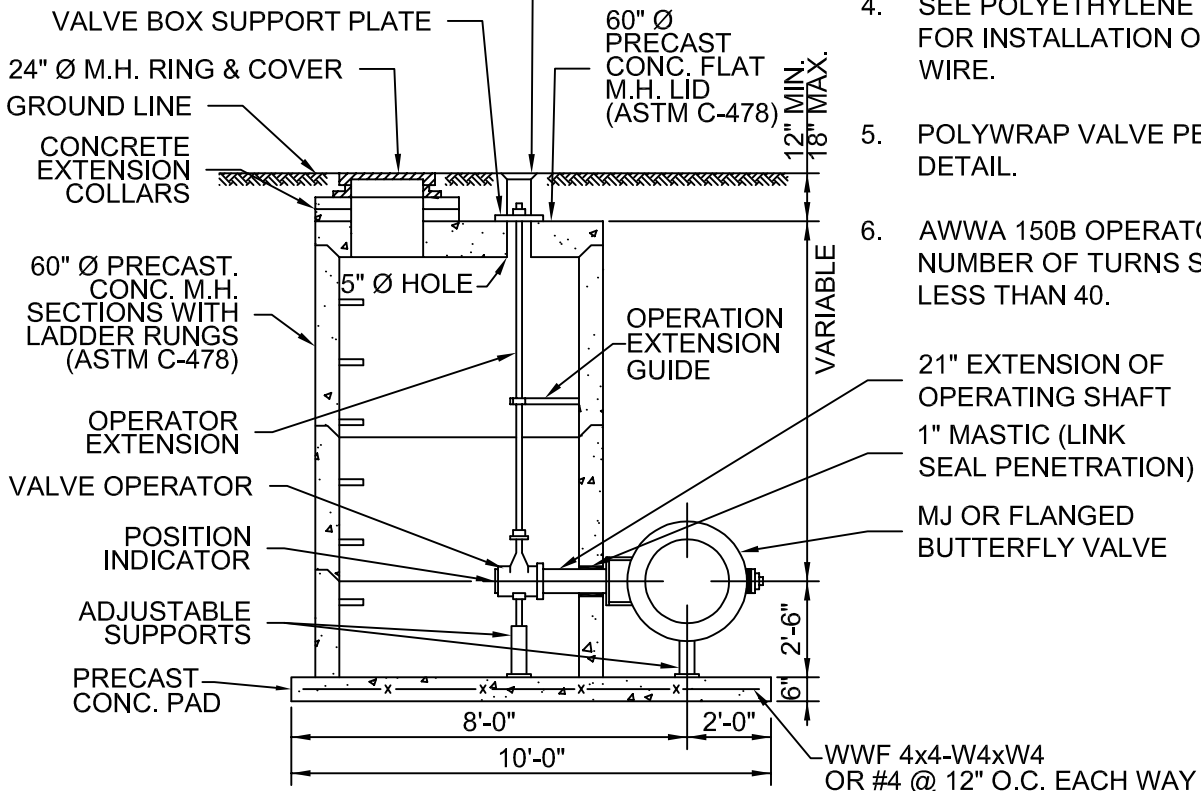


**PLAN**

**NOTES:**

1. CORP SYSTEM TO BE DESIGNED FOR TEST PRESSURE.
2. THIS TYPE OF INSTALLATION IS USED FOR 16" AND LARGER VALVES. BUTTERFLY VALVE SHALL BE POLYETHYLENE WRAPPED.
4. SEE POLYETHYLENE WRAP DETAIL FOR INSTALLATION OF TRACER WIRE.
5. POLYWRAP VALVE PER STANDARD DETAIL.
6. AWWA 150B OPERATOR MINIMUM NUMBER OF TURNS SHALL BE NO LESS THAN 40.

TOP SECTION OF 6" VALVE BOX TO BE DRILLED IN FIELD OR CAST IN PLACE. (EXTENSION IF REQUIRED)



**ELEVATION**



**BUTTERFLY VALVE AND VAULT ASSEMBLY**

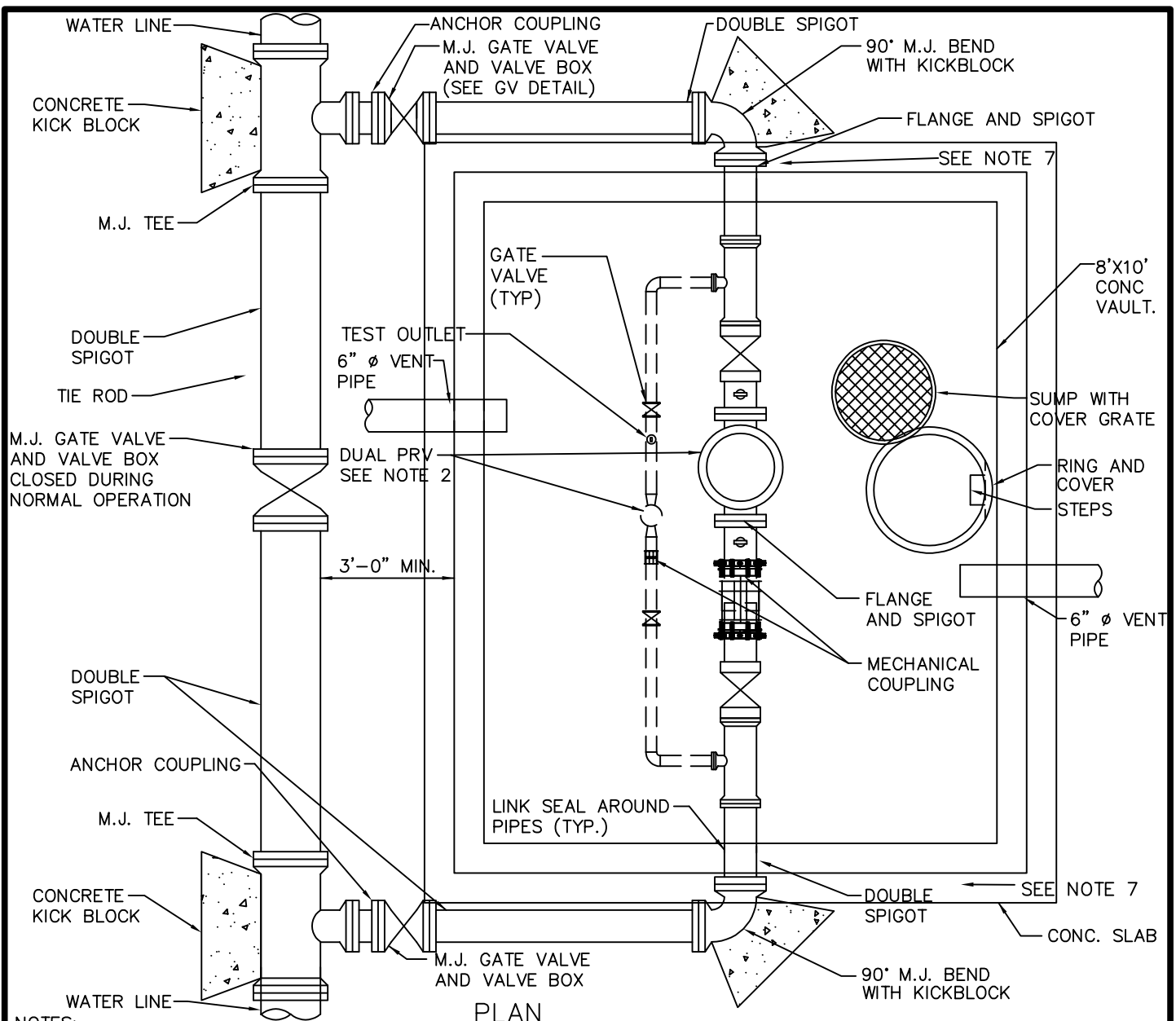
DRAWING NO.: ECCV-5W

DATE: 2024

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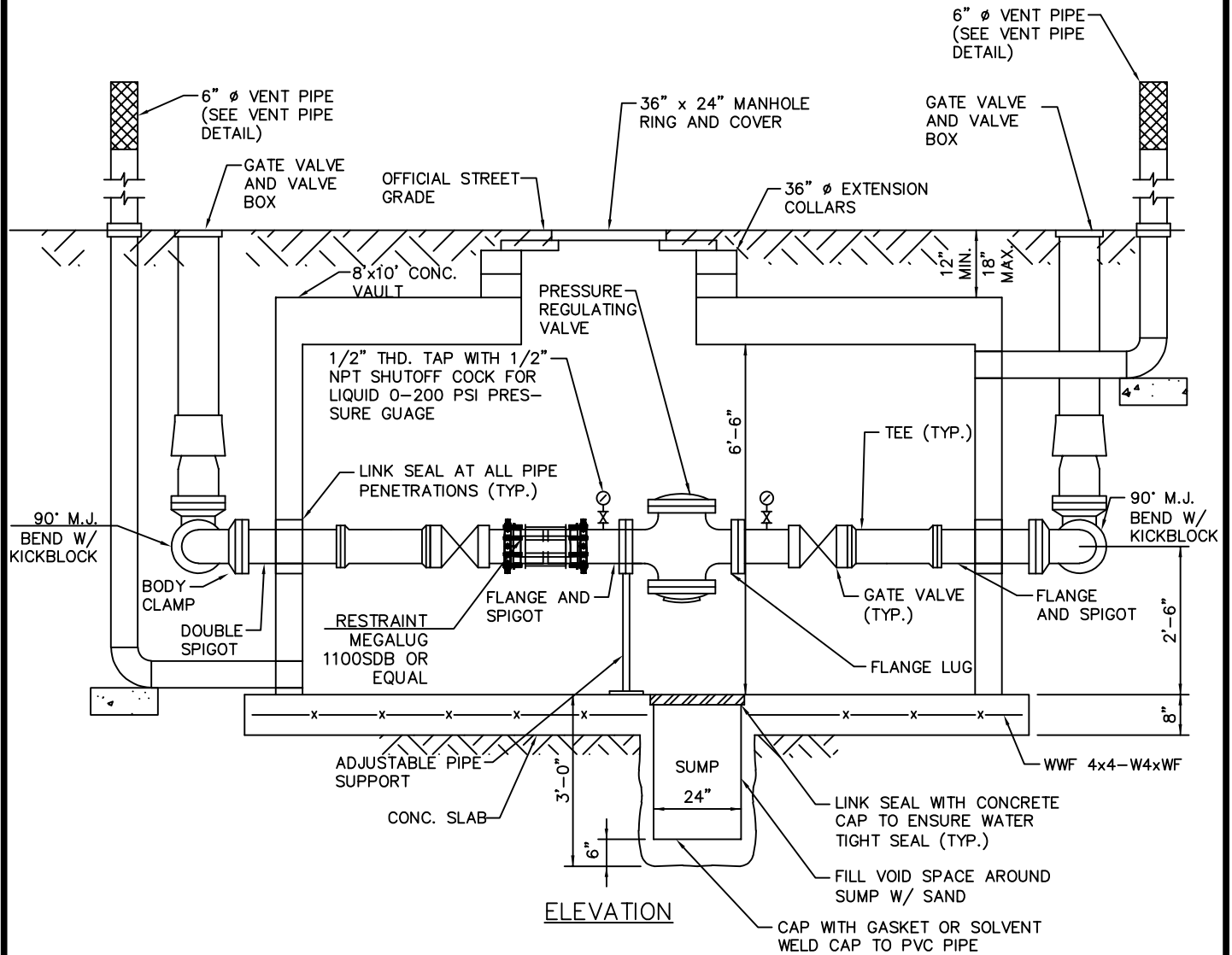
**PLAN**

**NOTES:**

1. THIS DETAILS IS TO BE USED IN CONJUNCTION WITH THE RODDING DETAIL, CLAMP DETAIL, 36" X 24" MANHOLE RING AND COVER DETAIL, VENT PIPE DETAIL, ADJUSTABLE VALVE SUPPORT DETAIL, GATE VALVE DETAIL, AND STEP DETAIL(S).
2. WHERE THE DISTRICT REQUIRES A DUAL PRV INSTALLATION, THE PIPING TO THE SMALLER VALVE SHALL BE THE SAME DIAMETER AS THE VALVE. ALL PIPING SHALL BE DUCTILE IRON OR COPPER PIPE SUITABLE FOR THE SPECIFIC PRESSURE CONDITIONS.
3. PRV VALVES SHALL BE:  
 CLA-VAL MODEL 90-48 WITH THE FOLLOWING OPTIONS:  
 A: X46A FLOW CLEAN STRAINER  
 B: CK2(ISOLATION VALVE)  
 C: CV FLOW CONTROL (CLOSING)  
 D: CHECK VALVES WITH ISOLATION VALVE  
 S: CV FLOW CONTROL (OPENING)  
 V: X101 VALVE POSITION INDICATOR  
 Y: X43 "Y" STRAINER  
 PILOT SYSTEM & PIPING SHALL BE STAINLESS STEEL
4. WHERE DUAL PRV'S REQUIRED, ALLOW CLEARANCE FOR PILOT PIPING
5. ALL PIPING FOR PRV AND CHECK VALVE INSTALLATIONS SHALL BE DUCTILE IRON PIPE AND SHALL BE FULLY RESTRAINED.
6. DO NOT PLACE SUMP DIRECTLY UNDER MANHOLE OPENING.
7. WATER LINE DEPTH AT VAULT MAY NEED TO BE DEEPER THAN 4.5 FT. TO ACCOMMODATE VAULT.
8. ALL PIPING TO BE RESTRAINED. DO NOT USE BURIED RODS.
9. ALL BOLTS AND RODS SHALL BE STAINLESS STEEL.

	
<p><b>PRESSURE REDUCING VALVE AND VAULT (1 OF 2)</b></p>	
<p>DRAWING NO.: ECCV-6W</p>	
<p>DATE: 2024</p>	<p>REV. DATE:</p>

	<p><b>Kennedy Jenks</b></p>
<p>215 Union Boulevard, Suite 500 Lakewood, CO 80228 P: 303.985.3636</p>	



6. THE FOLLOWING INFORMATION SHALL BE SPECIFIED FOR EACH SPECIFIC INSTALLATION:

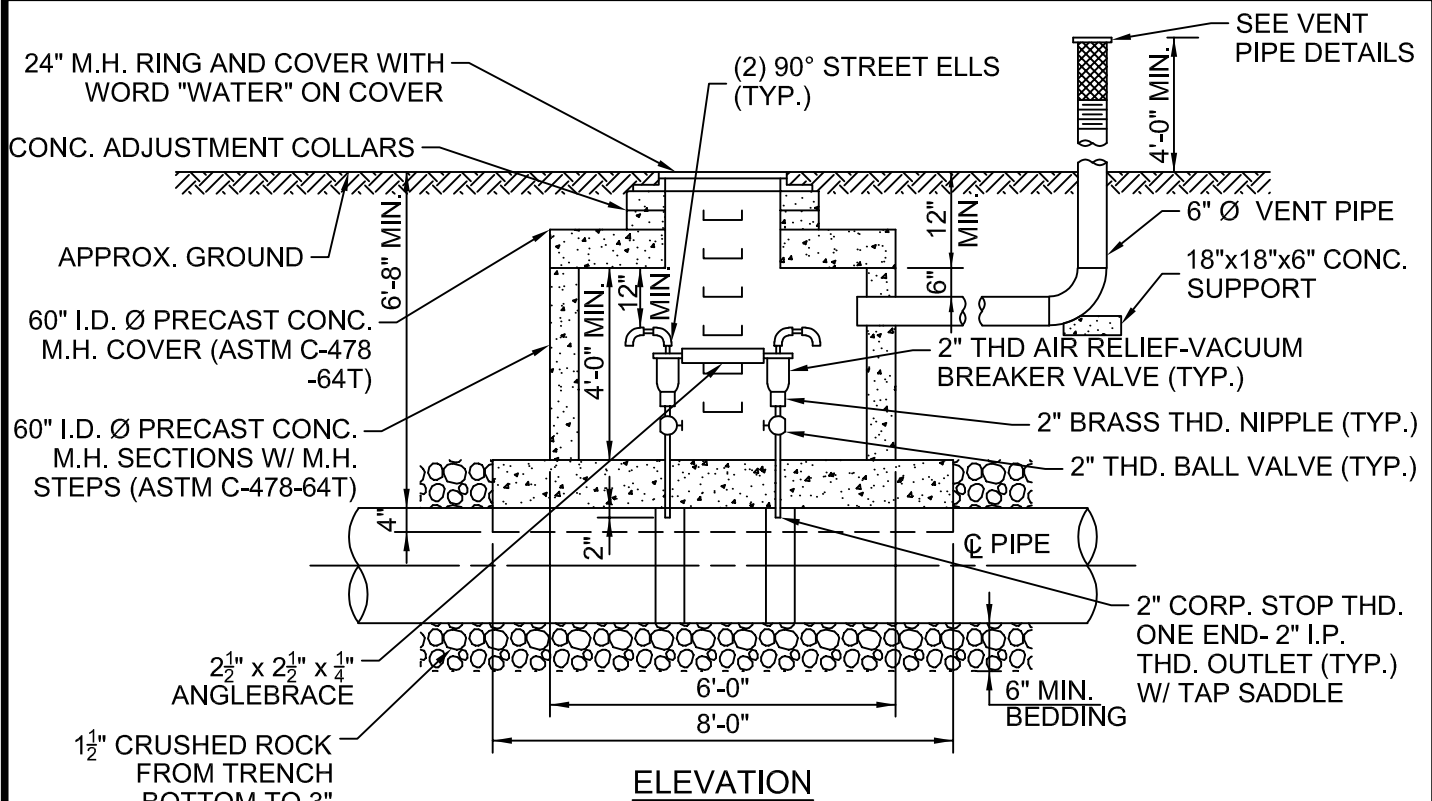
INLET HYDRAULIC GRADIENT = \_\_\_\_\_ FT. USGS

OUTLET HYDRAULIC GRADIENT = \_\_\_\_\_ FT. USGS

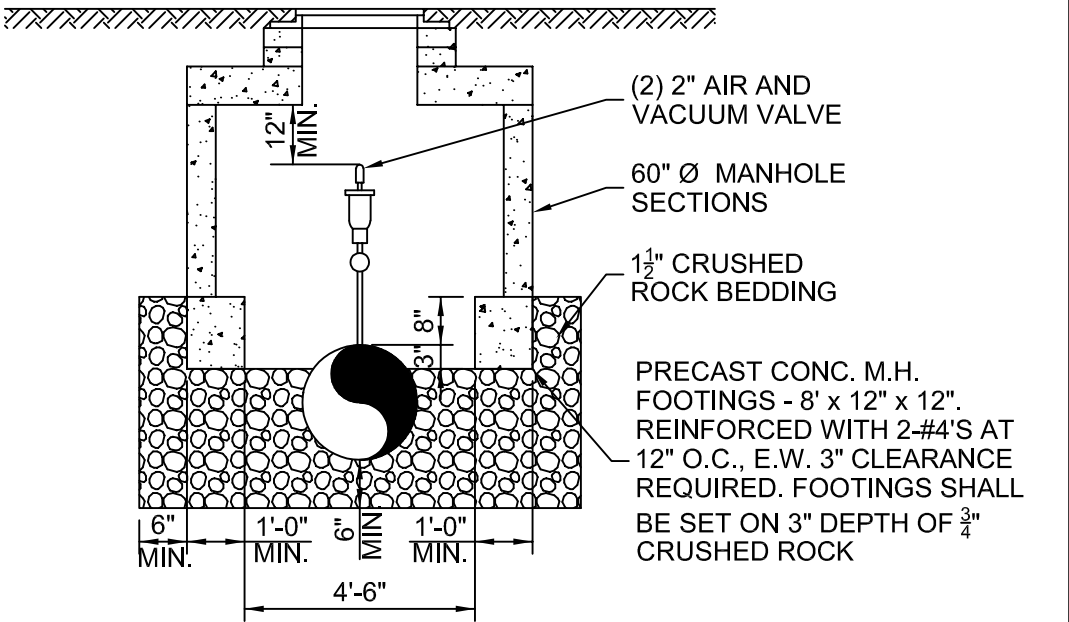
INLET STATIC PRESSURE = \_\_\_\_\_ PSI

OUTLET STATIC PRESSURE = \_\_\_\_\_ PSI

MAXIMUM DESIGN FLOW = \_\_\_\_\_ GPM



**ELEVATION**



**END VIEW**

**NOTES:**

1. PIPE TO BE GRADED SO VALVES ARE AT HIGH POINT IN LINE ON A LEVEL PIPE SECTION WHILE MAINTAINING MINIMUM VAULT DEPTH OF 6'-8". VALVES TO BE PLACED AT CENTER OF A FULL SECTION OF PIPE.
2. DETAIL FOR 16-INCH DIAMETER AND SMALLER PIPE. FOR PIPE LARGER THAN 16-INCH, VALVES, VAULT AND FOOTING SIZES SHALL BE APPROVED BY THE DISTRICT.
3. CONSTRUCT AIR VAC OVER FULL SECTION OF PIPE.
4. THIS DETAIL IS APPLICABLE WHEN WATER TABLE IS NOT AN ISSUE IN THE INSTALLATION AREA OF THE AIR/VAC VAULT.



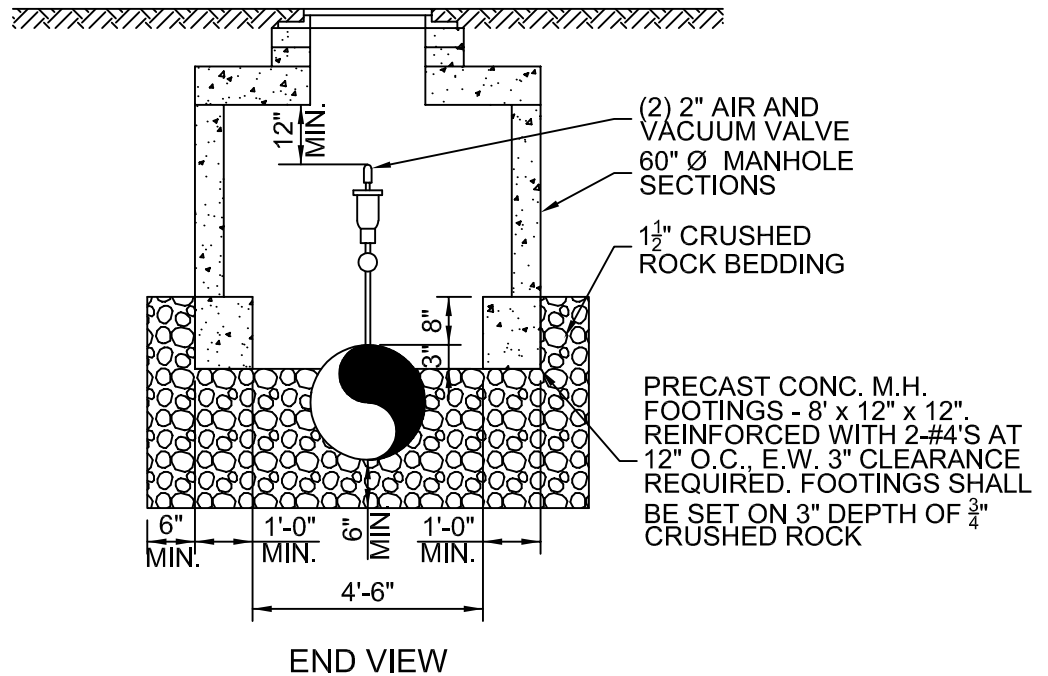
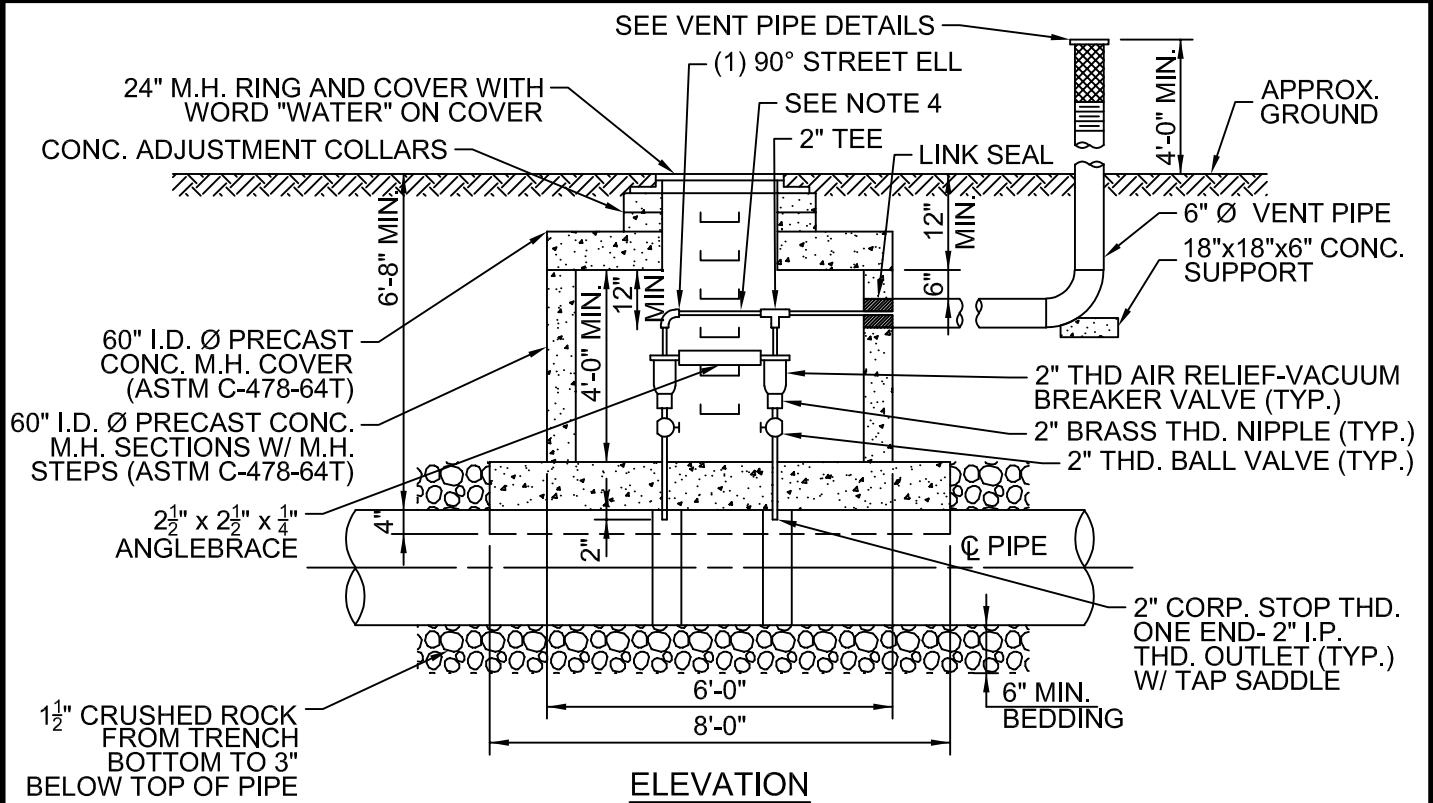
**AIR RELEASE VALVE & VAULT  
16" & SMALLER PIPE (NO WATER TABLE)**

DRAWING NO.: ECCV-8W

DATE: 2024

REV. DATE:

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**NOTES:**

1. PIPE TO BE GRADED SO VALVES ARE AT HIGH POINT IN LINE ON A LEVEL PIPE SECTION WHILE MAINTAINING MINIMUM VAULT DEPTH OF 6'-8". VALVES TO BE PLACED AT CENTER OF A FULL SECTION OF PIPE.
2. DETAIL FOR 16-INCH DIAMETER AND SMALLER PIPE. FOR PIPE LARGER THAN 16-INCH, VALVES, VAULT AND FOOTING SIZES SHALL BE APPROVED BY THE DISTRICT.
3. CONSTRUCT AIR VAC OVER FULL SECTION OF PIPE.
4. AIR RELIEF SHALL BE DIRECTLY CONNECTED TO VENTILATION PIPING AND SEALED WHEN WATER TABLE IS AN ISSUE AT THE SITE.



**AIR RELEASE VALVE & VAULT  
16" & SMALLER PIPE**

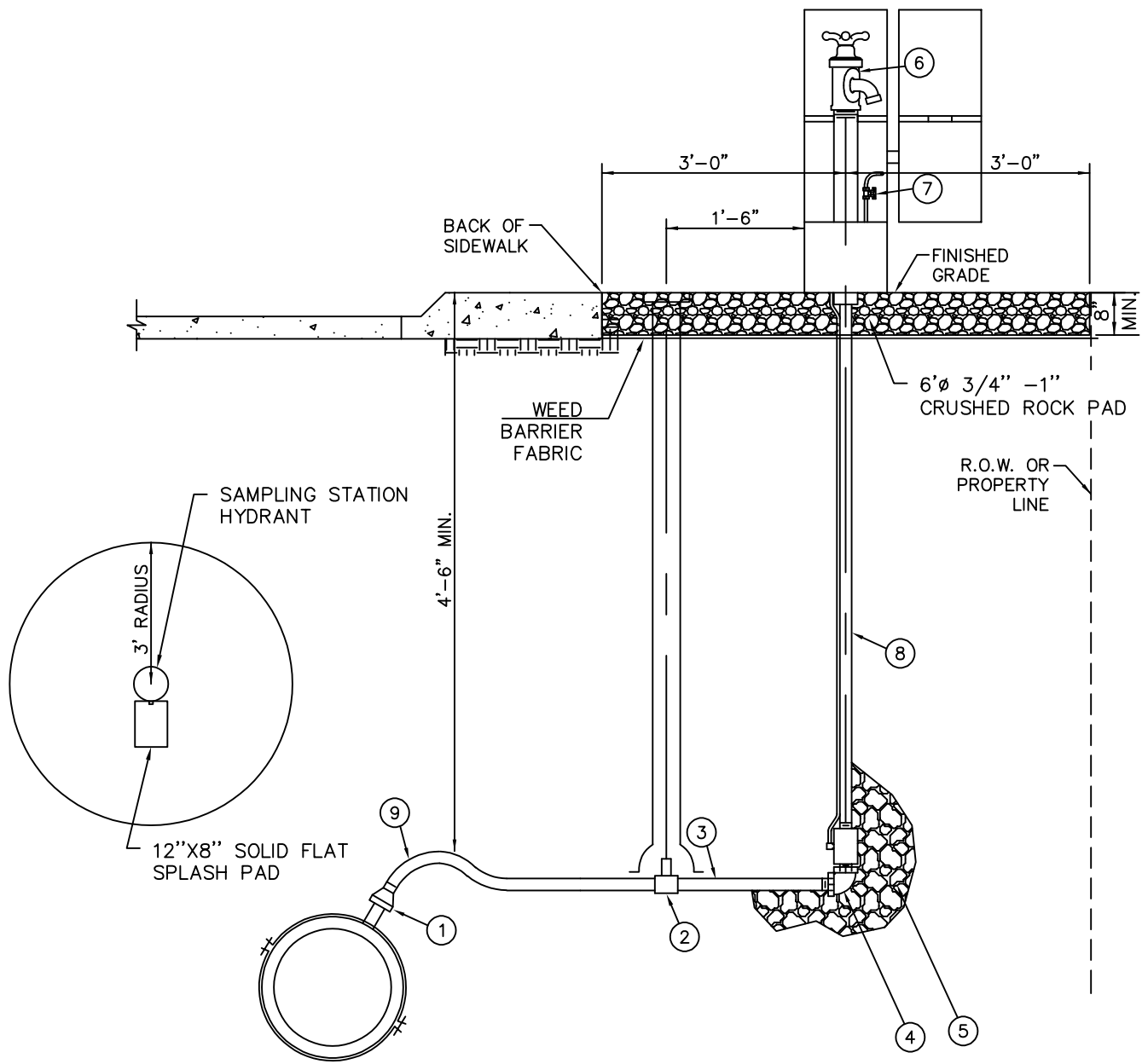
DRAWING NO.: ECCV-9W

DATE: 2024

REV. DATE:



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**NOTES:**

1. SERVICE LINE MUST HAVE MIN. 4'-6" COVER.
2. THERE SHALL NOT BE ANY CONNECTIONS MADE WITHIN 5'-0" OF THE SAMPLE STATION.
3. NO DISSIMILAR METALS WILL BE ALLOWED.
4. SEE TRACER WIRE INSTALLATION DETAIL.

**DESCRIPTION:**

1. CORPORATION STOP WITH INSULATING COUPLING
2. CURB STOP AND BOX
3. SERVICE LINE-COPPER TUBING TYPE 'K' ONLY
4. 3/4" ELBOW MIPT X COPPER
5. 1-1/2 CU. FT. GRAVEL
6. KUPFERLE ECLIPSE 88 SAMPLING STATION FOR COLD WEATHER
7. COPPER VENT TUBE WITH OPTIONAL 1/4" BALL VALVE IN PLACE OF 1/4" PET COCK
8. GALVANIZED STEEL STANDPIPE
9. EXPANSION LOOP

FOR REFERENCE ONLY  
NOT FOR NEW CONSTRUCTION



**ABOVE GROUND SAMPLING STATION**

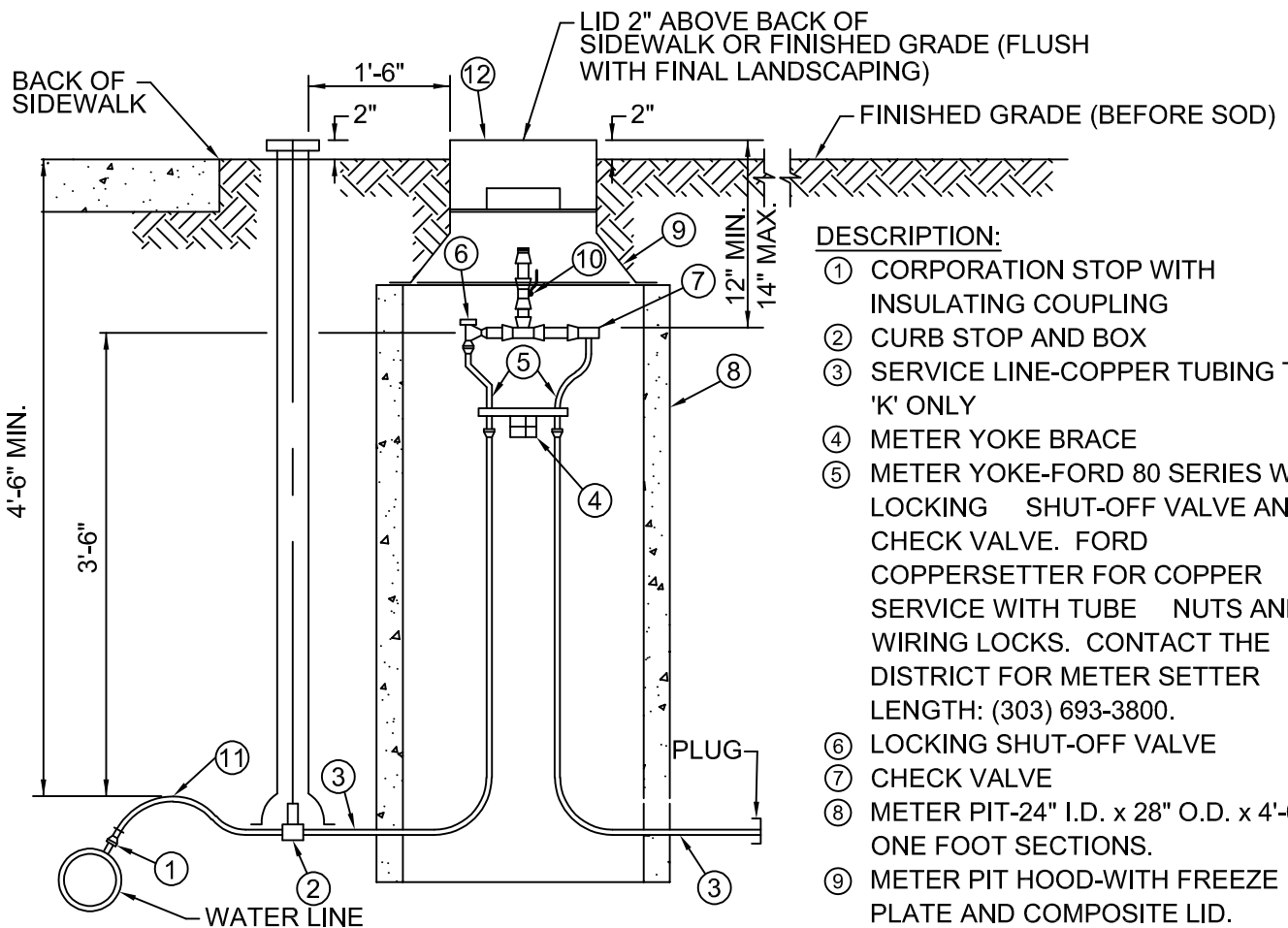
DRAWING NO.: ECCV-10W

DATE: 2024

REV. DATE:



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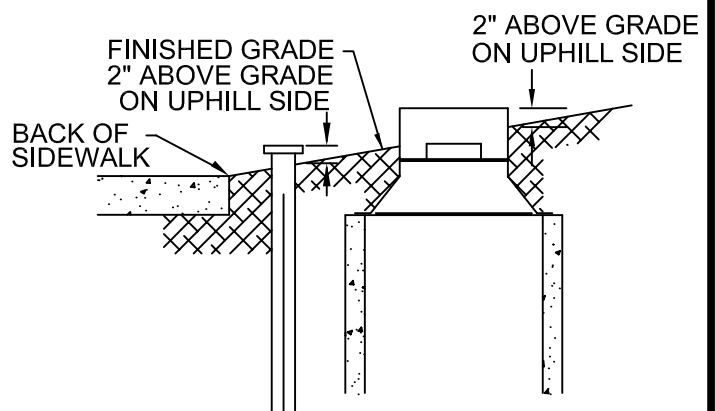


**DESCRIPTION:**

- ① CORPORATION STOP WITH INSULATING COUPLING
- ② CURB STOP AND BOX
- ③ SERVICE LINE-COPPER TUBING TYPE 'K' ONLY
- ④ METER YOKE BRACE
- ⑤ METER YOKE-FORD 80 SERIES WITH LOCKING SHUT-OFF VALVE AND CHECK VALVE. FORD COPPERSETTER FOR COPPER SERVICE WITH TUBE NUTS AND WIRING LOCKS. CONTACT THE DISTRICT FOR METER SETTER LENGTH: (303) 693-3800.
- ⑥ LOCKING SHUT-OFF VALVE
- ⑦ CHECK VALVE
- ⑧ METER PIT-24" I.D. x 28" O.D. x 4'-0" IN ONE FOOT SECTIONS.
- ⑨ METER PIT HOOD-WITH FREEZE PLATE AND COMPOSITE LID.
- ⑩ INSTALL KOPFERLE #94WM SAMPLING ASSEMBLY AND AIR RELEASE/VAC IDLER TEE. CONTACT DISTRICT FOR DETAILS (303) 693-3800
- ⑪ EXPANSION LOOP
- ⑫ NICOR 13" OR REHRIG W003 MOLD P201 COMPOSITE LID

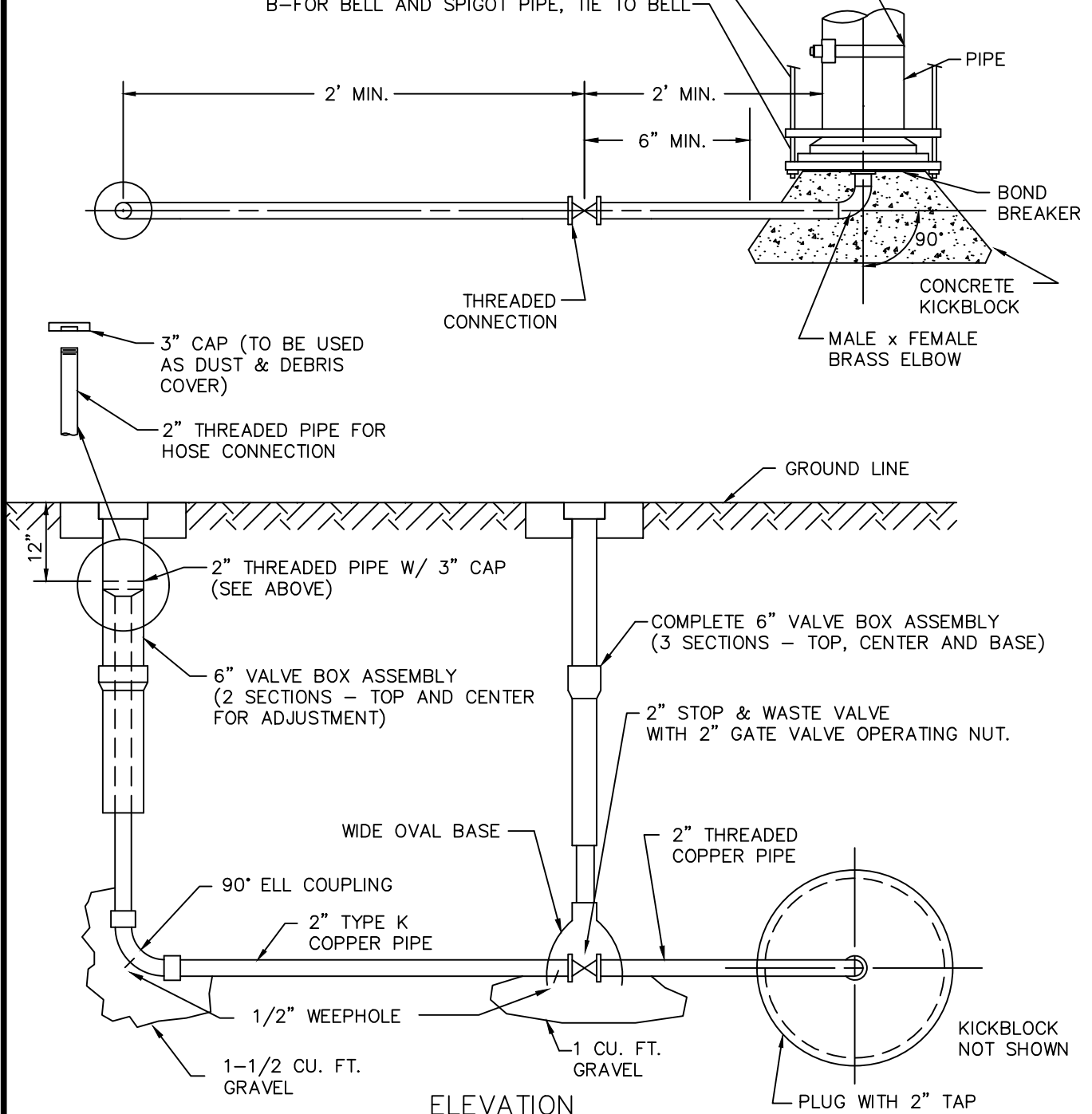
**NOTES:**

- 1. SERVICE LINE MUST HAVE MIN. 4'-6" COVER.
- 2. THERE SHALL NOT BE ANY CONNECTIONS MADE WITHIN 5'-0" OF THE SAMPLING STATION.
- 3. CONCRETE OR PLASTIC METER PITS SHALL BE ACCEPTED.
- 4. FINISHED METER LID ELEVATION MUST BE 2" ABOVE BACK OF SIDEWALK AND/OR FINISHED GRADE AND FLUSH WITH FINAL LANDSCAPING.
- 5. IF THERE IS SUBSTANTIAL SLOPE, THE TOP EDGE OF PIT NEEDS TO BE 2" ABOVE GRADE.
- 6. ALL DIMENSIONS ARE MEASURED FROM BACK OF SIDEWALK. IF NO SIDEWALK IS PROPOSED, USE BACK OF CURB OR PROPERTY LINE. IF NO SIDEWALK OR CURB IS PROPOSED CONTACT DISTRICT FOR LOCATION.
- 7. BEDDING IS REQUIRED FROM MAIN TO AND INCLUDING METER.
- 8. **NO FLARE FITTINGS.**



FOR SIDE OUTLET, USE INSULATING 2" CORP STOP, FORD FB-600 MUELLER H-15,000 OR EQUAL. SERVICE SADDLE MUELLER H-13,400 OR FORD S-90 OR EQUAL (NOT REQUIRED FOR DI PIPE) INSTALLED AT SPRING LINE.

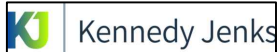
NOTE:  
 PLUG SHALL BE MECHANICALLY RESTRAINED:  
 A-FOR SLEEVE TYPE MACHINED COUPLING PIPE, TIE BACK TO NEXT COUPLING  
 B-FOR BELL AND SPIGOT PIPE, TIE TO BELL



ELEVATION

NOTES:

1. POSITION BLOW-OFF AWAY FROM SANITARY SEWER.
2. WEEPHOLES SHOULD NOT BE USED WHEN BLOW-OFF IS USED FOR TEMPORARY PURPOSES.
3. VALVES SHALL OPEN RIGHT.
4. 1/4 TURN BALL VALVES WILL NOT BE PERMITTED.



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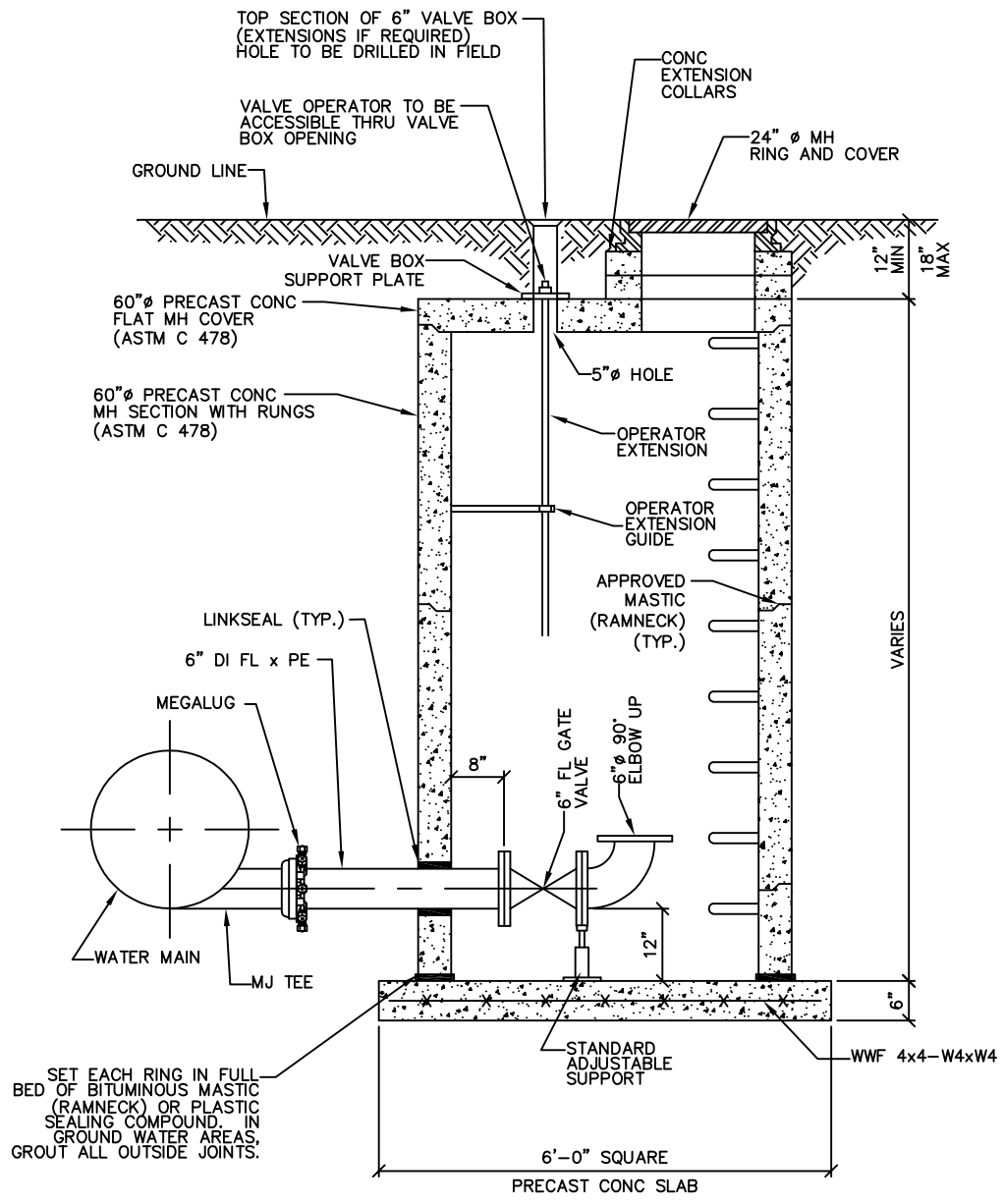


**STANDARD BLOWOFF ASSEMBLY  
 12" AND SMALLER WATERLINES**

DRAWING NO.: ECCV-12W

DATE: 2024

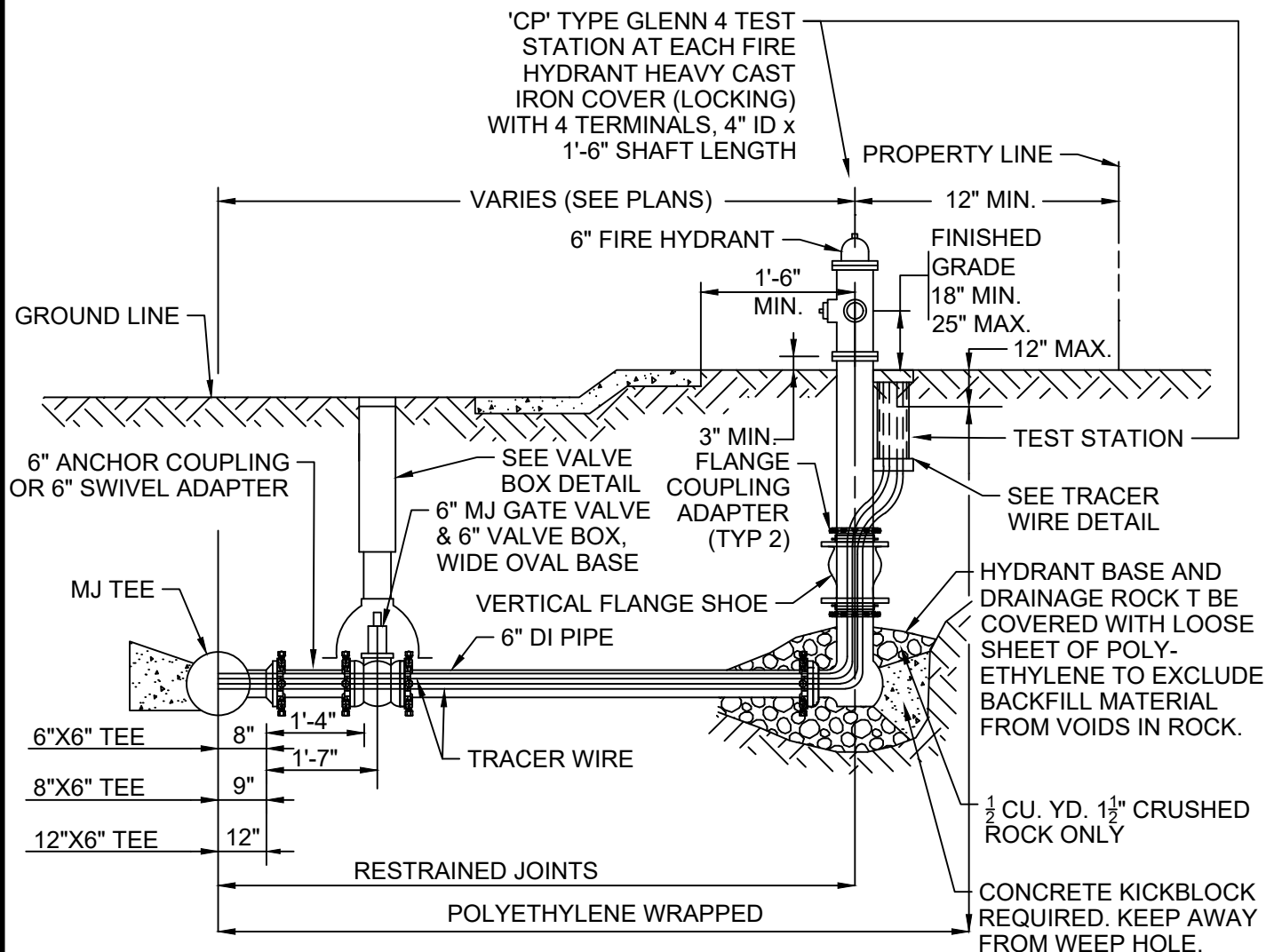
REV. DATE:



ELEVATION

NOTE:

1. SEE ECCV DETAIL ON TRACER WIRE INSTALLATION.

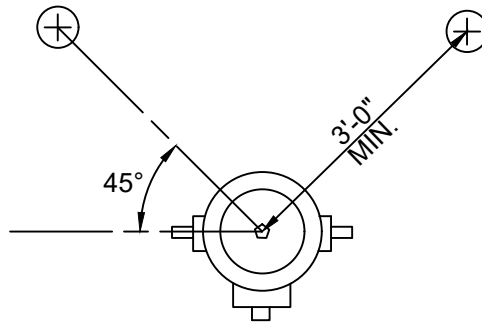


MANUFACTURER	MODEL NO.
MUELLER COMPANY	CENTURION MODEL 423
WATEROUS COMPANY	PACER WB-67-250

**THREAD SIZES FOR CONNECTIONS**

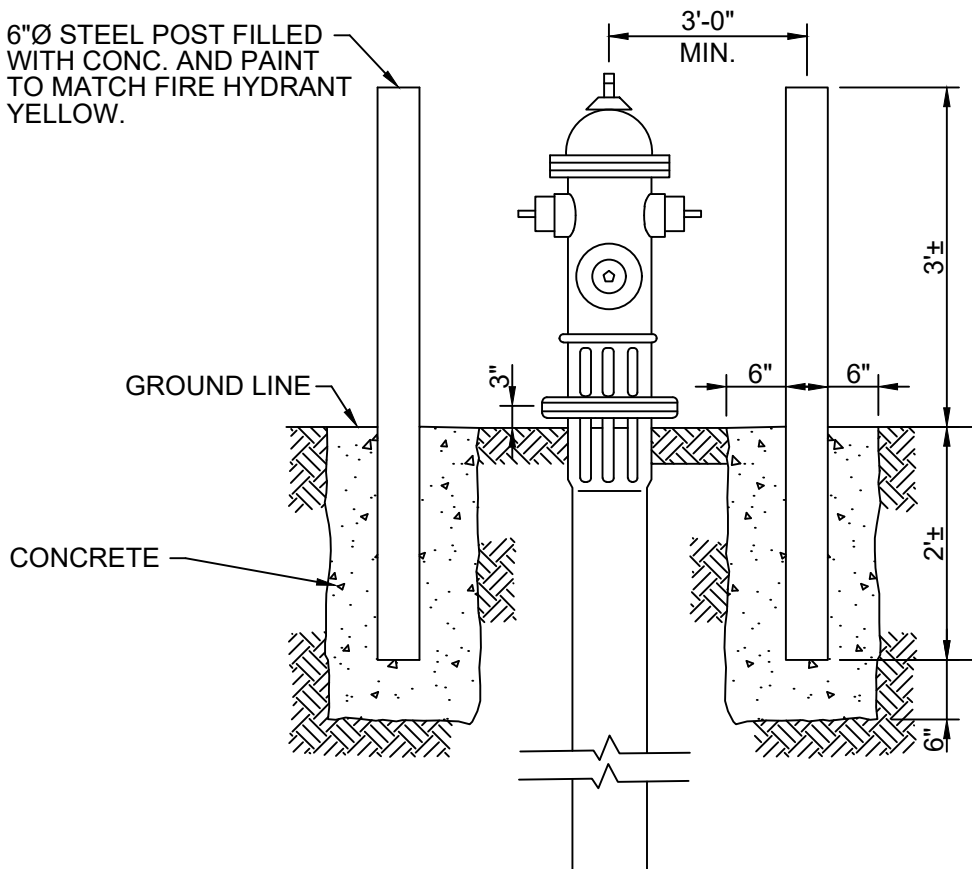
FIRE DISTRICT	PUMPER CONNECTION	HOSE CONNECTION
SOUTH METRO	4 1/2" NAT. STD.	2 1/2" NAT. STD.

- NOTE:**
1. FIRE HYDRANTS SHALL BE UNOBSTRUCTED TO THE STREET AND A MINIMUM CLEARANCE OF 3' ON ALL SIDES.
  2. INSTALL TRACER WIRE PER STANDARD DETAIL.
  3. INSTALL FIRE HYDRANT GUARDS PER STANDARD DETAIL.



PLAN

6"Ø STEEL POST FILLED WITH CONC. AND PAINT TO MATCH FIRE HYDRANT YELLOW.



ELEVATION

NOTES:

1. TO BE USED IN COMMERCIAL OR INDUSTRIAL AREAS WHERE HYDRANTS ARE UNPROTECTED FROM THE MAINFLOW OF TRAFFIC. STEAMER CONNECTION ON FIRE HYDRANT SHOULD FACE THE STREET.
2. FIRE HYDRANTS SHALL BE 3' UNOBSTRUCTED ACCESS FROM PUBLIC R.O.W. AND A MINIMUM CLEARANCE OF 3' ON ALL SIDES.



**FIRE HYDRANT GUARDS**

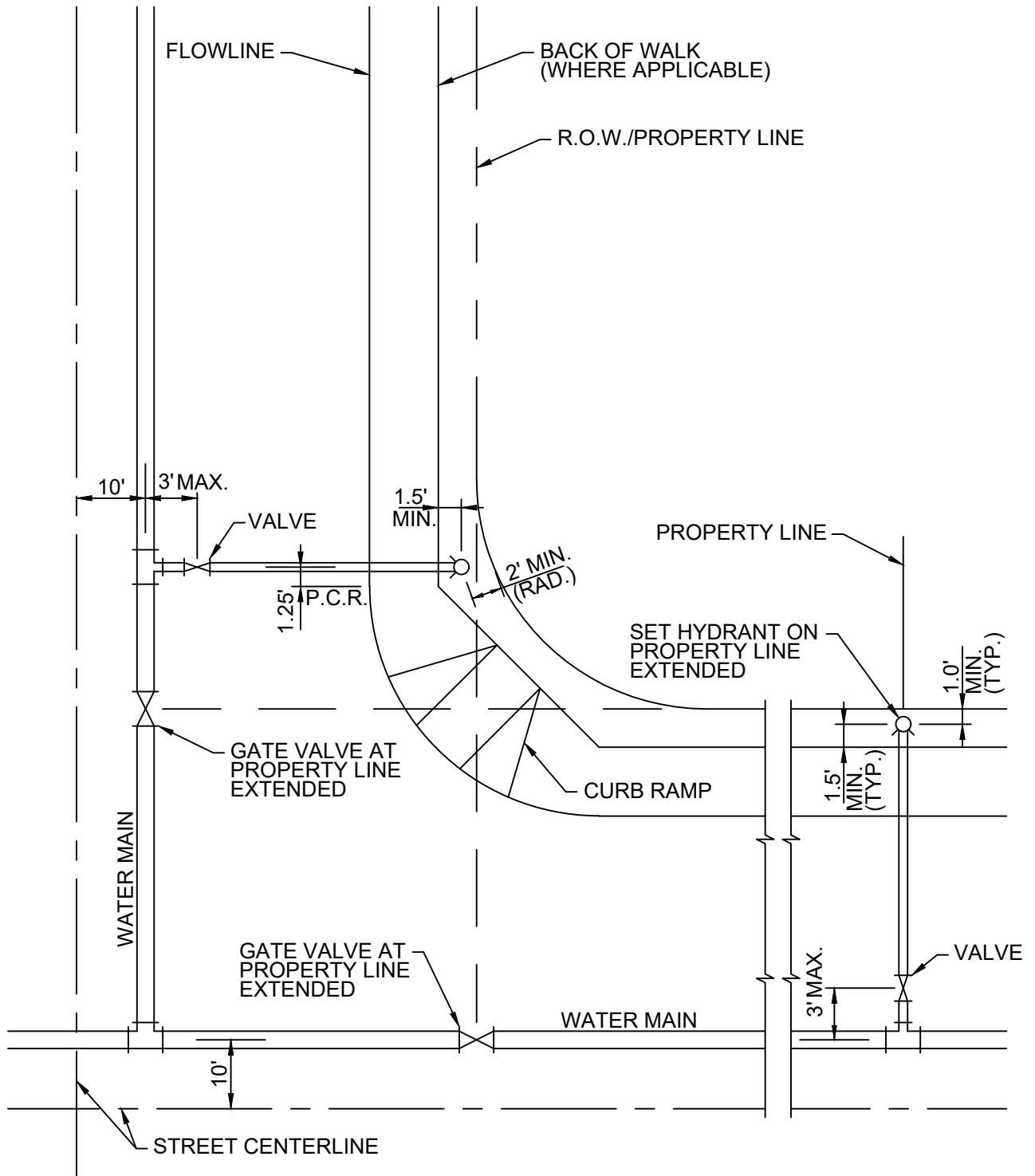
DRAWING NO.: ECCV-15W

DATE: 2024

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**INTERSECTION VALVE AND  
FIRE HYDRANT LOCATION**

DRAWING NO.: ECCV-16W

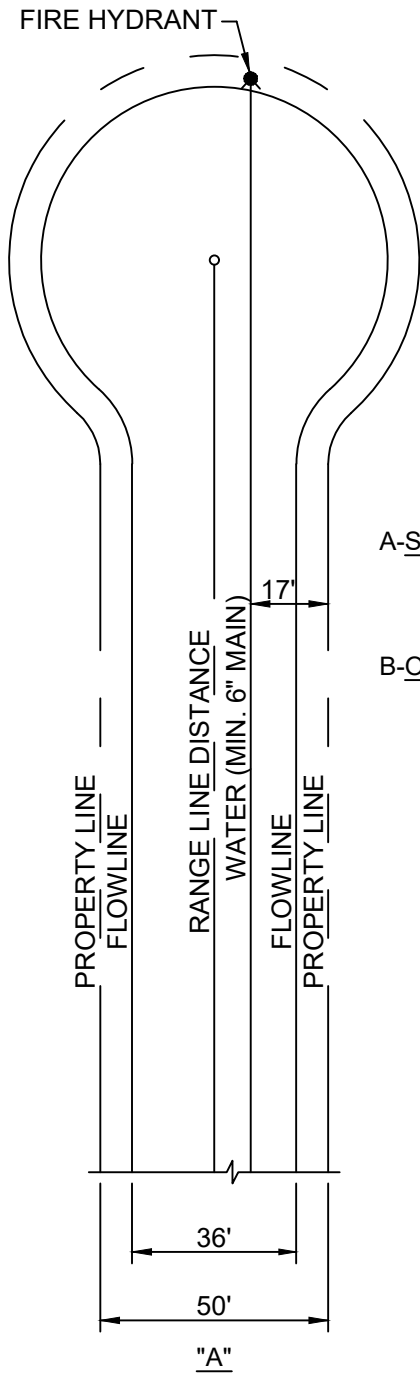
DATE: 2024

REV. DATE:

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ONLY ALLOWED WITH  
DISTRICT APPROVAL



**NOTE:**

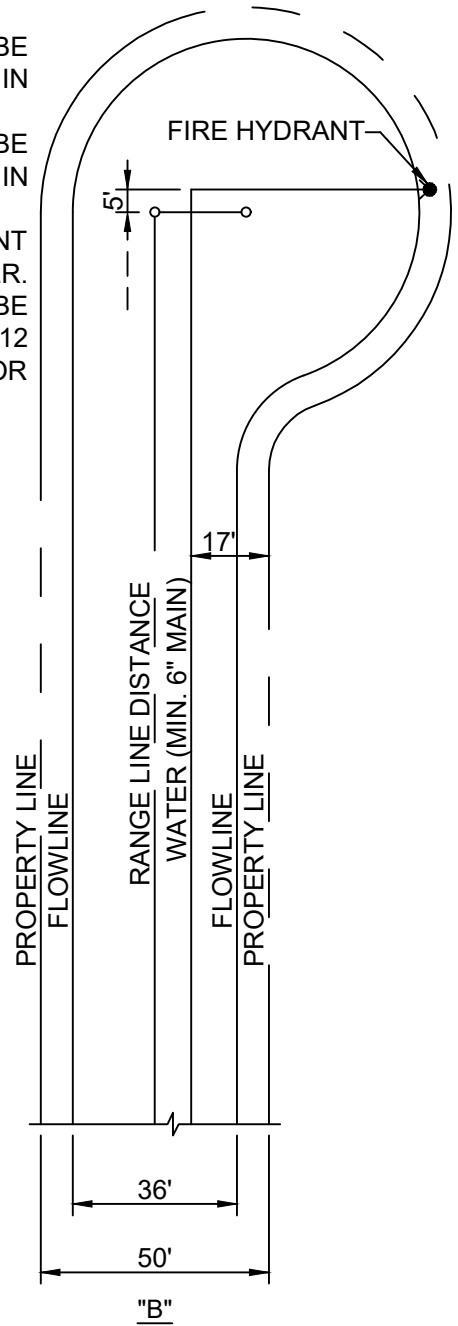
1. FIRE HYDRANTS ARE TO BE USED ON ALL WATER MAINS IN CUL-DE-SACS.
2. BLOW-OFFS SHALL NOT BE USED ON WATER MAINS IN CUL-DE-SACS.
3. POSITION FIRE HYDRANT AWAY FROM SANITARY SEWER.
4. FIRE HYDRANTS SHOULD BE PLACED AT A MAXIMUM OF 12 RESIDENTIAL SERVICES OR 400 LF ON DEAD END LINE.

**A-STRAIGHT LINE CUL-DE-SAC:**

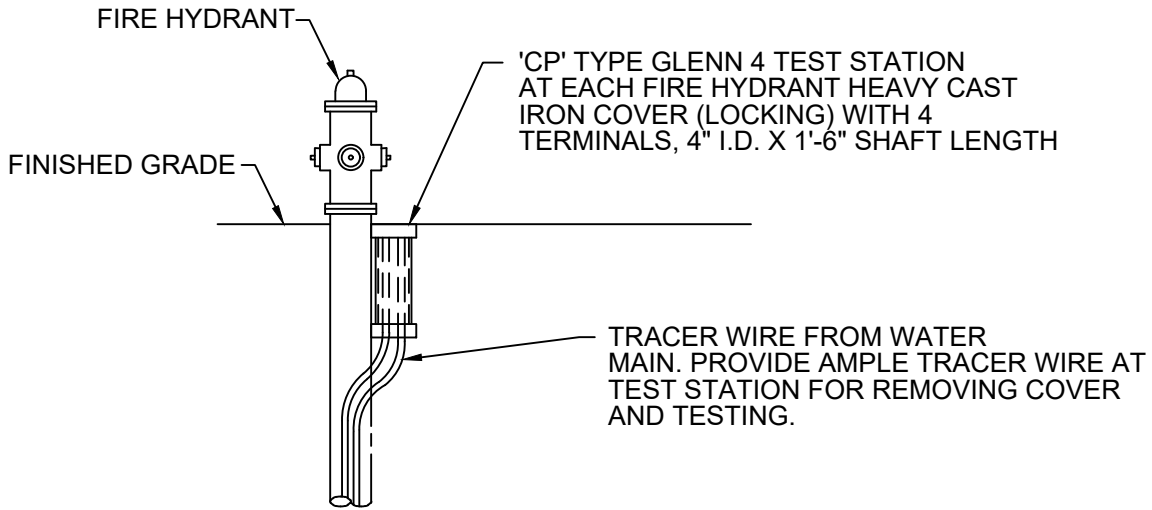
LAY PIPE TO CONSTRUCT FIRE HYDRANT BEHIND CURB AND GUTTER OR SIDEWALK

**B-OFFSET CUL-DE-SAC:**

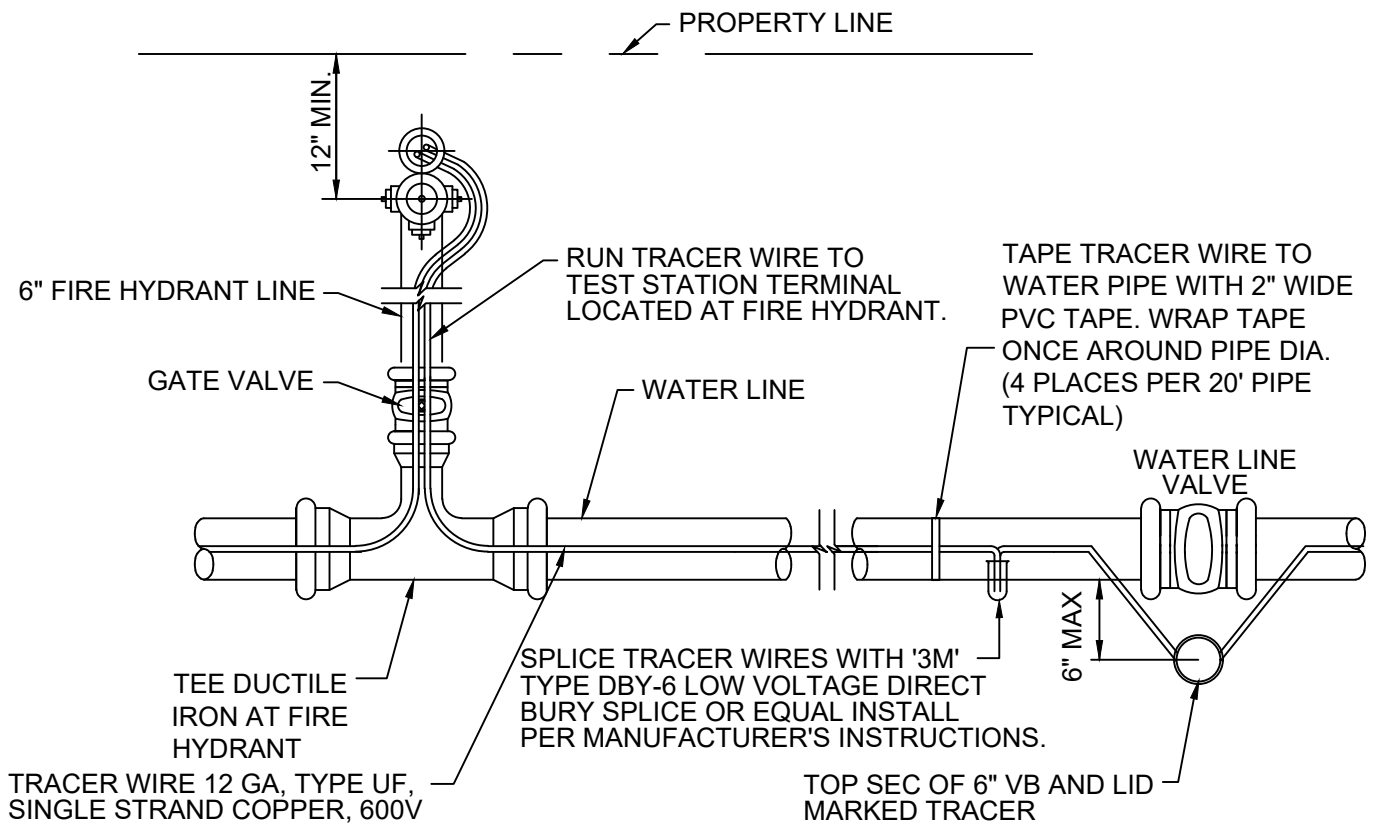
LAY PIPE TO 5' BEYOND P.I. THEN LAY PIPE TO CONSTRUCT FIRE HYDRANT BEHIND CURB AND GUTTER OR SIDEWALK



**FIRE HYDRANT LAYOUT FOR CUL-DE-SACS**



PROFILE



PLAN VIEW



**TRACER WIRE  
INSTALLATION DETAIL**

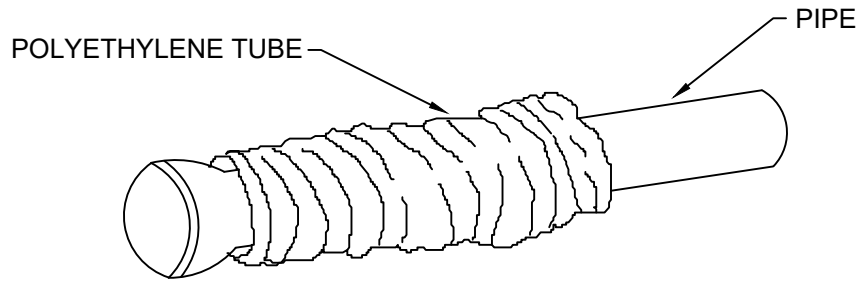
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DATE: 2024

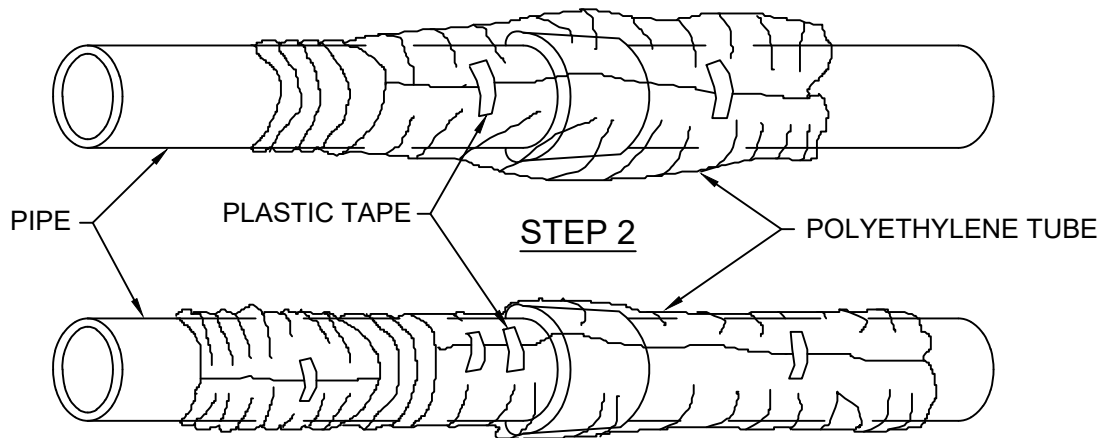
REV. DATE:

**K** Kennedy Jenks

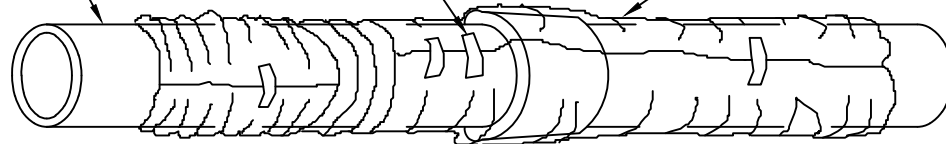
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STEP 1



STEP 2



STEP 3

FIELD INSTALLATION - POLYETHYLENE WRAP

- STEP 1- PLACE TUBE OF POLYETHYLENE MATERIAL ON PIPE PRIOR TO LOWERING IT INTO TRENCH.
- STEP 2- PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE.
- STEP 3- OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF PIPE AND TAPED IN PLACE.

NOTE:

ALL BURIED DUCTILE IRON PIPE, FITTINGS, VALVES, FIRE HYDRANT ASSEMBLIES, AND RODDING SHALL BE POLYETHYLENE WRAPPED.



**POLYETHYLENE WRAP**

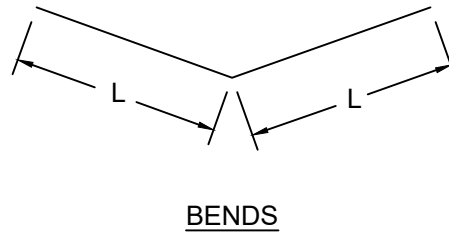
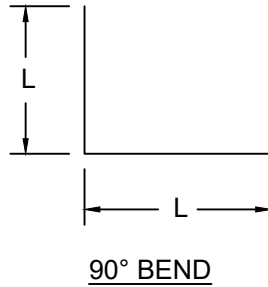
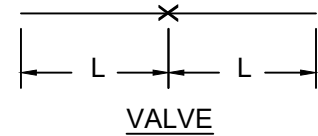
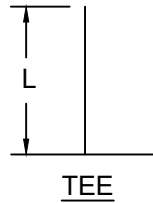
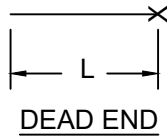
DRAWING NO.: ECCV-19W

DATE: 2024

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Lakewood, CO 80228 P: 303.985.3636



**NOTES:**

1. LENGTHS OF TIED PIPE MEASURED EACH WAY FROM VALVES AND BENDS.
2. CLAMPS, RODS AND MEGALUGS NOT ALLOWED FOR 24" AND LARGER PIPES.
3. D=DIAMETER, L=LENGTH, G=GRADE, MS=MILD STEEL, HS=HIGH STRENGTH
4. MINIMUM 4.5' GROUND COVER REQUIRED.
5. BASED ON 150 PSI INTERNAL PRESSURE
6. MS= MILD STEEL ROD ASTM A 36.
7. HS= HIGH STRENGTH ROD ASTM A 193 GRADE B7.
8. NUTS SHALL BE ASTM A 307 GRADE A OR B HEXAGON HEAVY SERIES.
9. SEE TIE ROD DETAIL DRAWING. ALSO, TIE ROD COUPLING DETAIL, CLAMP DETAIL AND SET CLAMP DETAIL.
10. LENGTH REFERS TO THE AMOUNT OF PIPE WHICH MUST RESTRAINED TOGETHER AND IS NOT NECESSARILY THE LENGTH OF THE RODS.
11. LENGTH OF RESTRAINED PIPE CHART IS ALSO FOR THE LENGTH OF JOINT RESTRAINT FOR MEGALUGS.
12. CROSSES MUST BE RESTRAINED IN ALL APPLICABLE DIRECTIONS.

**ROD DIAMETER, GRADE & LENGTH OF RESTRAINED PIPE**

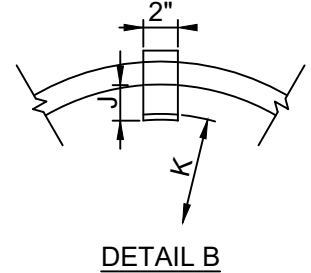
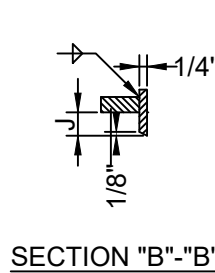
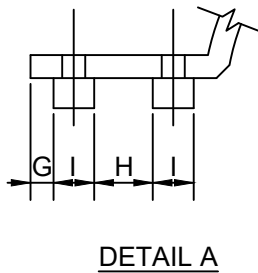
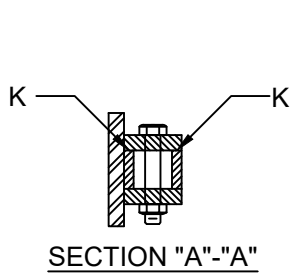
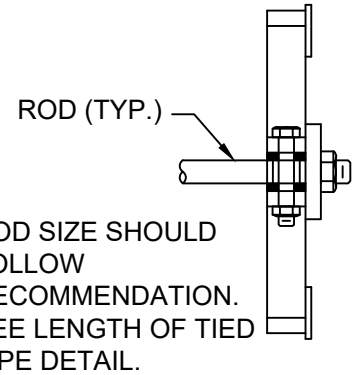
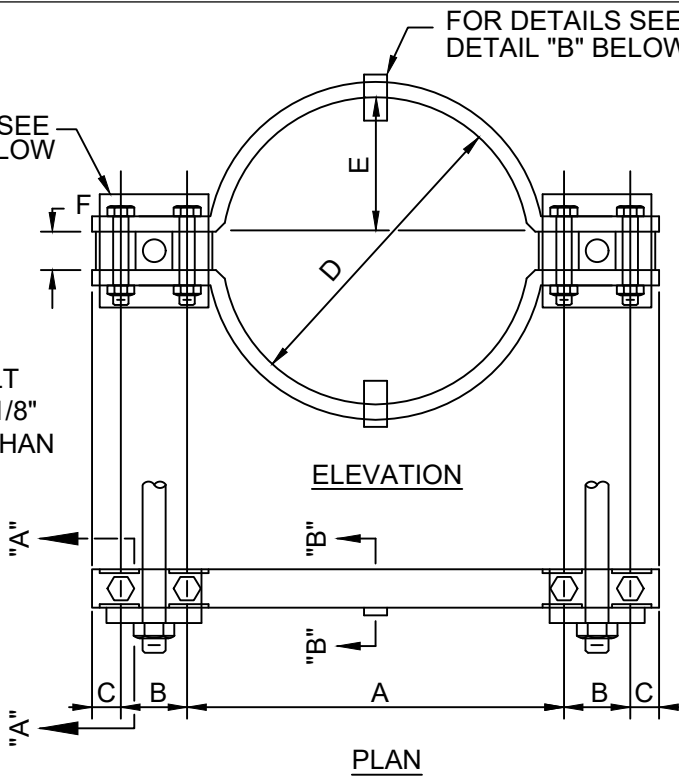
NOMINAL PIPE Ø	4"	6"	8"	12"	16"	20"	24"
FITTING	L	L	L	L	L	L	L
90° BEND, TEE, DEAD END	30'	45'	60'	86'	108'	132'	155'
VALVE	30'	45'	60'	86'	108'	132'	155'
45° BEND	9'	13'	18'	25'	32'	39'	45'
22.5° BEND	2'	4'	5'	7'	8'	10'	12'
11.25° BEND	2'	2'	2'	2'	2'	3'	3'

13. 12" AND SMALLER IN LINE VALVES AND TEES SHALL HAVE A MECHANICAL JOINT RESTRAINT DEVICE ON EACH SIDE OF THE FITTING OR VALVE.
14. A SECOND VALVE WILL BE REQUIRED TO BE CLOSED WHEN EXCAVATING NEXT TO AN EXISTING VALVE.
15. ON PLUGS, TEES AND BENDS A KICKBLOCK SHALL BE USED IN ADDITION TO RESTRAINT.
16. WHEN REDUCERS ARE USED ON A VALVE INSTALLATION THE LENGTH OF RESTRAINT SHALL BE BASED ON THE SIZE OF THE PIPE NOT THE SIZE OF THE VALVE.

FOR DETAILS SEE  
DETAIL "A" BELOW

FOR DETAILS SEE  
DETAIL "B" BELOW

NOTE: ALL BOLT  
HOLES TO BE 1/8"  
LARGER DIA. THAN  
BOLT.



**TABLE OF DIMENSIONS FOR CLAMPS**

PIPE SIZE	BAR SIZE	A		B		C		D		E		F		G		H		I		J		K		BOLT SIZES	
		BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP	BELL CLAMP	BODY CLAMP
4	1 1/2 X 1/2	9	7 3/8	3	4	1 1/2	1 1/2	6 1/4	4 3/4	2 5/8	1 7/8			3/8	3/8	1 1/4	1 1/4	2 1/4	2 1/2	5/8	2 1/2	3 X 1 1/2	2 1/2 X 3/8		
6	2 X 1/2	11 1/4	9 5/8	3	4	1 1/2	1 1/2	8 1/2	6 7/8	3 3/4	2 15/16					1 1/4	1 1/4	2 1/4	2 1/2	1/2	3 3/4	3 1/2 X 1/2	3 1/2 X 1/2		
8	2 1/2 X 1/2	13 5/8	11 7/8	3 1/2	4	1 1/2	1 1/2	10 3/4	9 1/8	4 7/8	4 1/16					1 1/4	1 1/4	2 1/4	2 1/2	5/8	4 3/4	4 1/2 X 1/2	4 X 1/2		
12	2 1/2 X 5/8	18 1/4	16 3/8	3 1/2	4	1 1/2	1 1/2	15 1/8	13 1/4	7 1/16	6 1/8					1 1/4	1 1/4	2 1/4	2 1/2	13/16	6 3/4	4 1/2 X 5/8	4 1/2 X 5/8		
16	3 X 3/4	23 1/8	20 3/8	4	4 1/2	1 1/2	1 1/2	19 3/4	17 3/8	9 1/4	8 1/16	1 1/4	1 1/4	1/4	1/4	1 1/2	1 1/2	2 1/2	2 3/4	15/16	9 15/16	5 1/2 X 5/8	5 1/2 X 5/8		
20	3 X 3/4	27 1/2	25	4	4 1/2	1 1/2	1 1/2	24 1/8	21 5/8	11 5/16	10 1/16	1 1/2	1 1/2	3/8	3/8	1 3/4	1 3/4	2 1/4	2 1/2	1	11 1/16	5 1/2 X 5/8	5 1/2 X 5/8		
24	RODS AND CLAMPS NOT ALLOWED																								

NOTE: ALL DIMENSIONS IN INCHES.

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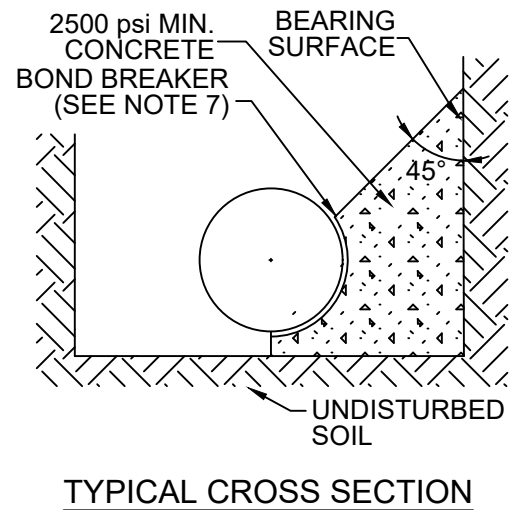
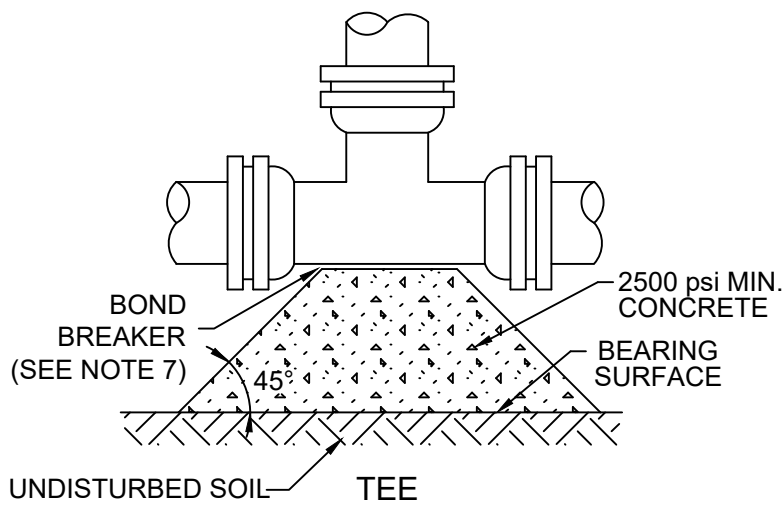
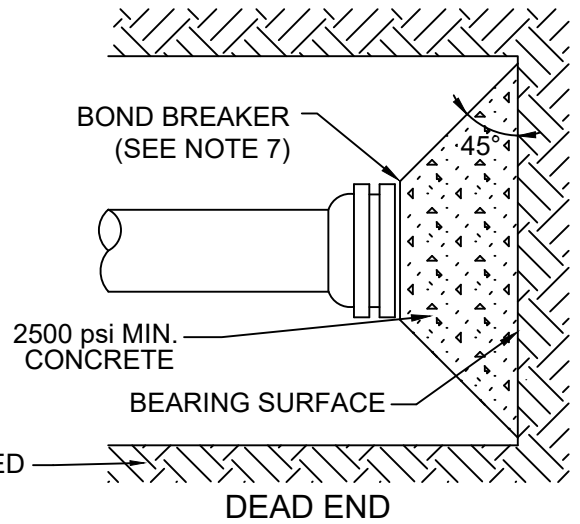
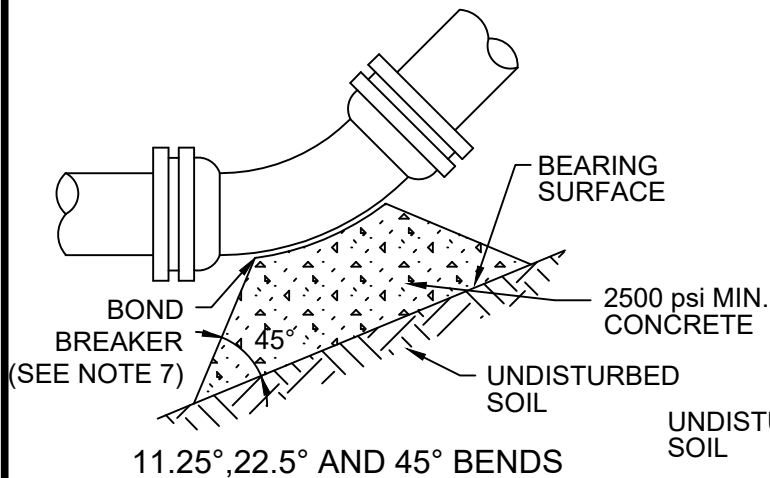


**CLAMP DETAILS  
& DIMENSIONS**

DRAWING NO.: ECCV-21W

DATE: 2024

REV. DATE:



**NOTES:**

1. ALL MAINS AND ALL BENDS SHALL BE BOTH RODDED AND KICKBLOCKED.
2. BEARING SURFACE AREAS SHOWN IN CHART ARE MINIMUM.
3. BASED ON 150 PSI INTERNAL PIPE PRESSURE PLUS WATER HAMMER.  
 4", 6" AND 8" WATER HAMMER= 120 P.S.I.  
 12" WATER HAMMER= 110 P.S.I.  
 16" AND 20" WATER HAMMER= 70 P.S.I.
4. SOIL BEARING CAPACITY = 3,000 LB / SQ. FT.
5. ALL 90° BENDS SHALL BE RESTRAINED.
6. NA = NOT APPLICABLE.
7. BOND BREAKER BETWEEN CONCRETE AND WET TAP SADDLE-8 MIL POLYETHYLENE.
8. CONCRETE SHALL NOT COME IN CONTACT WITH THE BOLTS OF THE FITTINGS.
9. PROVIDE APPROPRIATE CORROSION PROTECTION. REFER TO POLYETHYLENE WRAP DETAIL.

**MINIMUM BEARING SURFACE AREA  
(IN SQUARE FEET)**

SIZE OF PIPE	B E N D S				TEE OR DEAD END
	11.25°	22.5°	45°	90°	
4"	1.00	1.00	1.00	2.00	1.50
6"	1.00	1.25	2.25	4.25	3.00
8"	1.00	2.00	4.00	7.50	5.25
12"	2.25	4.50	8.75	16.00	11.25
16"	3.75	7.50	14.50	27.00	19.00
20"	5.00	10.00	19.50	35.50	25.00
24"	7.00	14.00	27.75	51.00	36.00



**KICKBLOCK  
DETAILS**

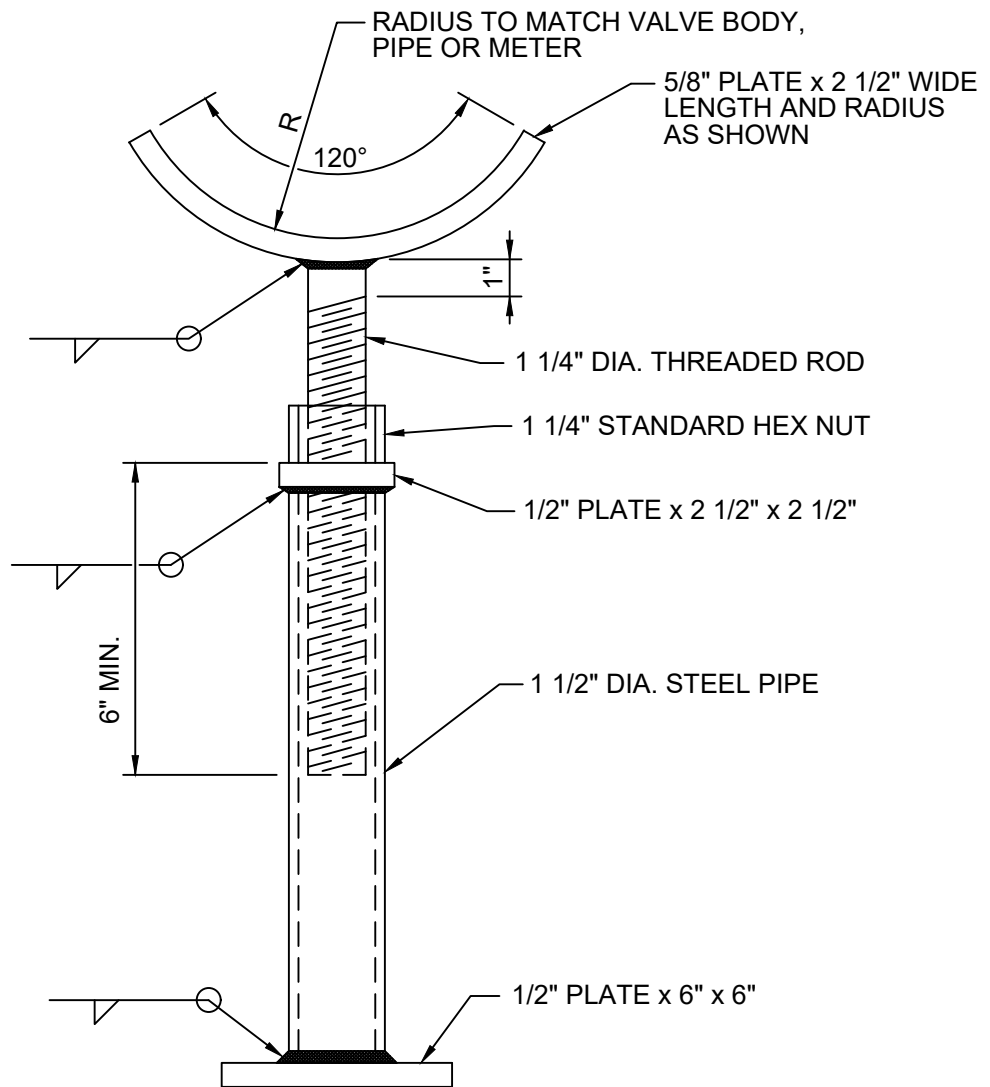
DRAWING NO.: ECCV-22W

DATE: 2024

REV. DATE:



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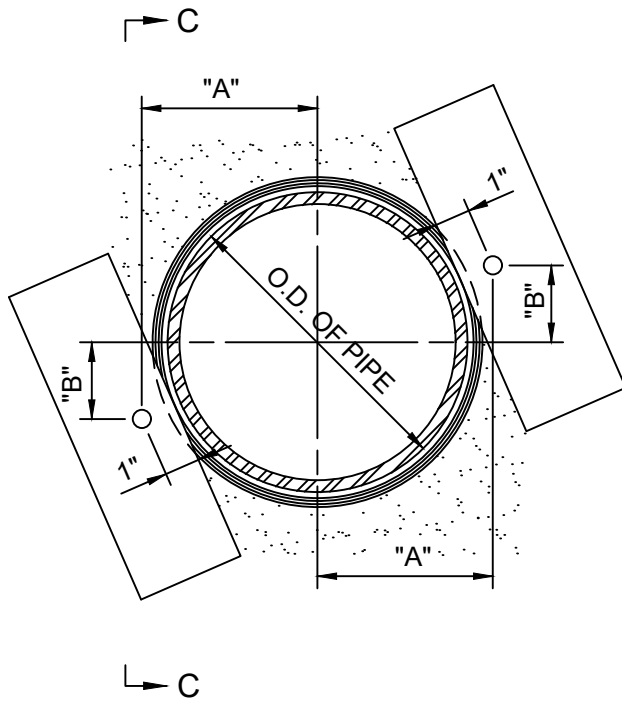
**ADJUSTABLE STEEL PIPE  
VALVE SUPPORT**

DRAWING NO.: ECCV-23W

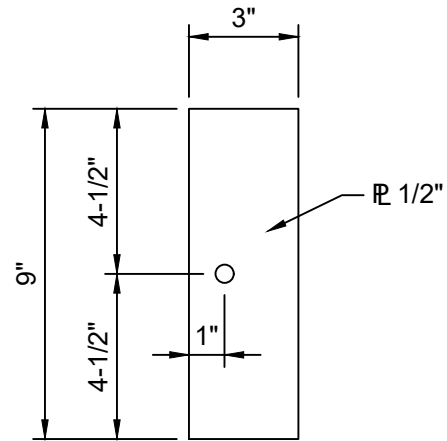
DATE: 2024

REV. DATE:

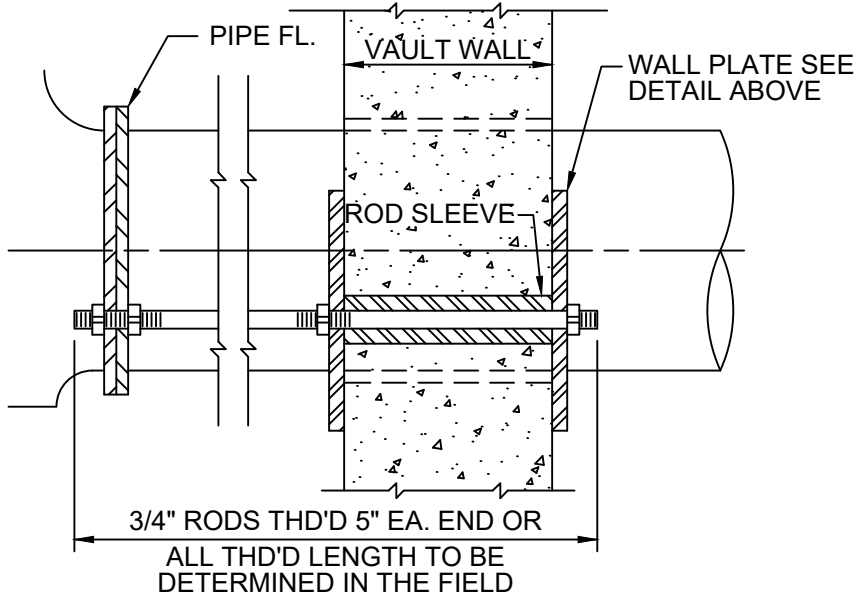
PIPE SIZE	RODS NO. AND SIZE	WALL ROD SLEEVES	"A"	"B"
4"	2-3/4" Ø	1"	3-1/2"	1-7/16"
6"	2-3/4" Ø	1"	4-3/8"	1-13/16"
8"	2-3/4" Ø	1"	5-7/16"	2-1/4"
10"	2-3/4" Ø	1"	8-3/16"	2-3/16"
12"	2-3/4" Ø	1"	8-3/16"	2-3/16"



**EXTERIOR  
ELEVATION**



**WALL PLATE**



**SECTION C-C**

**NOTE:**

1. FOR PIPE DIAMETERS LARGER THAN 12", A SPECIAL DESIGN SUBMITTAL MUST BE REVIEWED AND ACCEPTED BY ECCV.
2. ONLY ALLOWED WITH DISTRICT APPROVAL.

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**ECCV**  
Water & Sanitation District

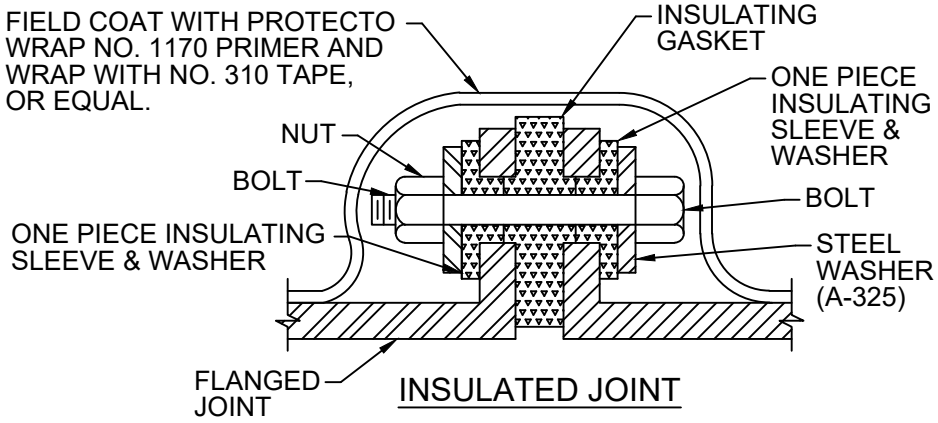
**WALL  
CLAMP**

DRAWING NO.: ECCV-24W

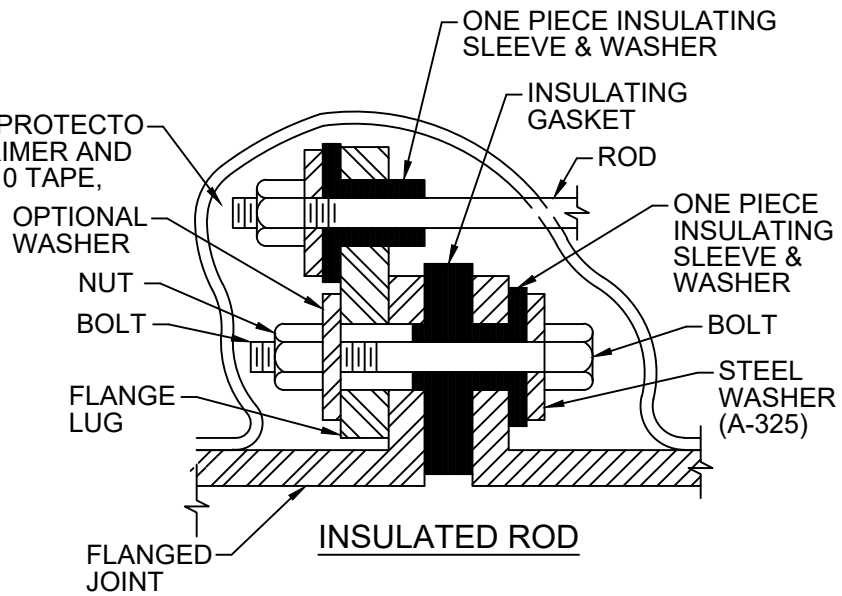
DATE: 2024

REV. DATE:

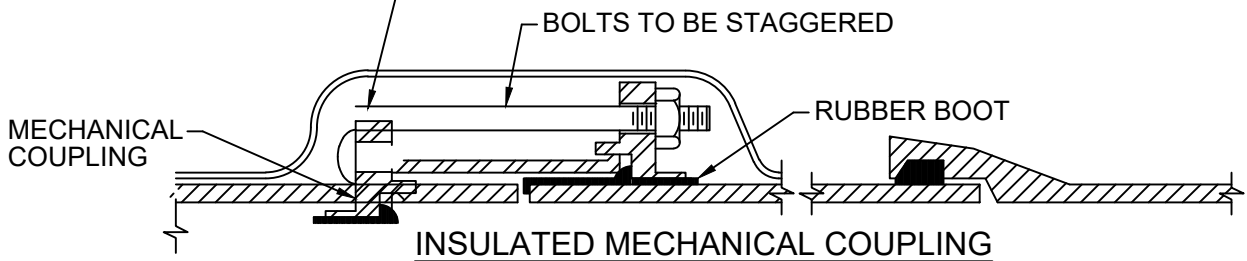
FIELD COAT WITH PROTECTO WRAP NO. 1170 PRIMER AND WRAP WITH NO. 310 TAPE, OR EQUAL.



FIELD COAT WITH PROTECTO WRAP NO. 1170 PRIMER AND WRAP WITH NO. 310 TAPE, OR EQUAL



FIELD COAT WITH PROTECTO WRAP NO. 1170 PRIMER AND WRAP WITH NO. 310 TAPE, OR EQUAL.



**INSULATED JOINTS, RODS, AND MECHANICAL COUPLINGS**

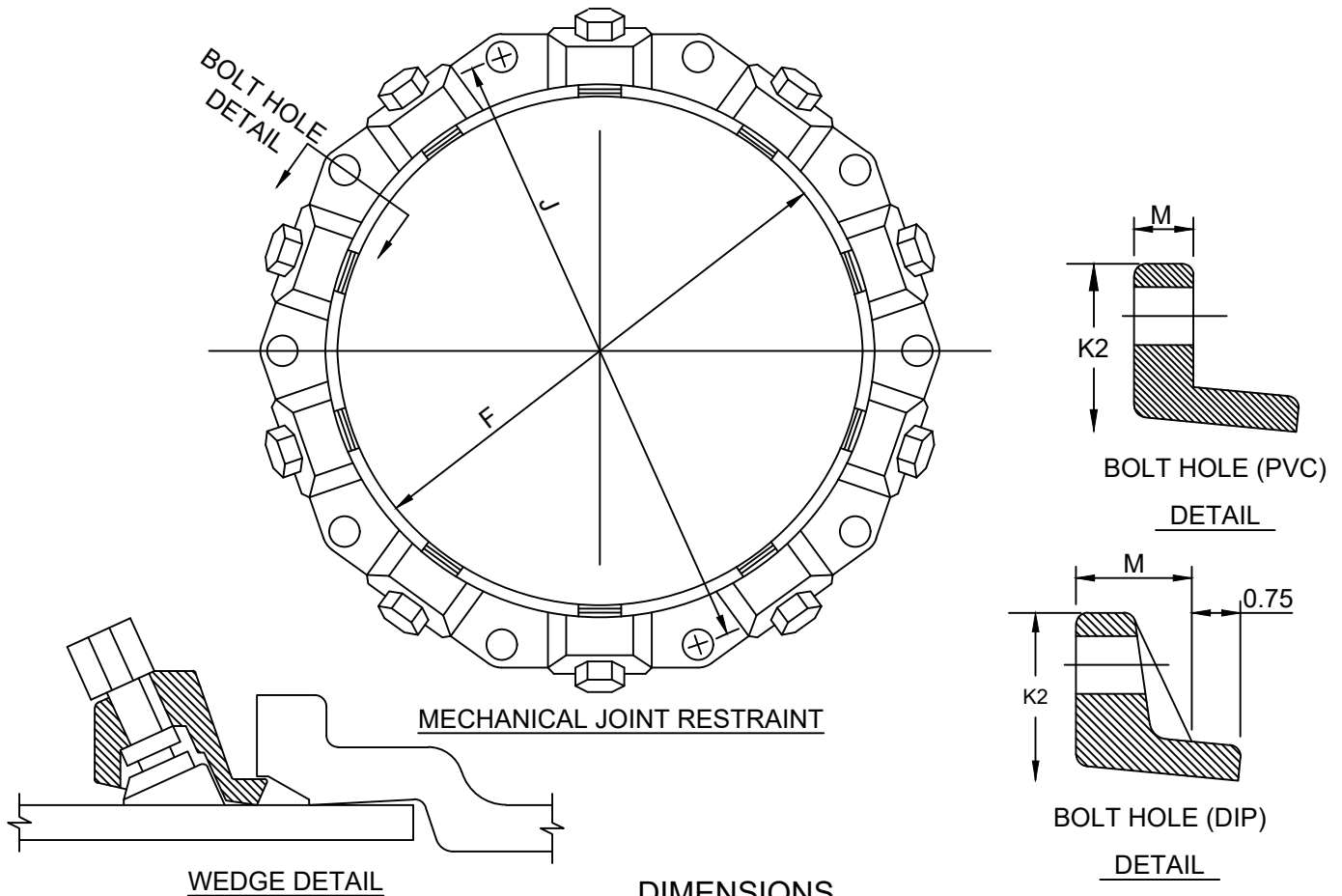
DRAWING NO.: ECCV-25W

DATE: 2024

REV. DATE:

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**DIMENSIONS**

	NOMINAL PIPE SIZE	NO. OF BOLTS	NO. OF WEDGES	K2 INCHES	J INCHES	F INCHES	M INCHES	
PVC	4"	4	4	9.13	7.50	4.90	0.50	PVC
	6"	6	6	11.13	9.50	7.00	0.50	
	8"	6	6	13.38	11.75	9.15	0.62	
	10"	8	8	15.63	14.00	11.20	0.62	
	12"	8	8	17.88	16.25	13.30	0.75	
	16"	12	12	22.63	21.00	17.58	0.88	
DI	4"	4	2	9.12	7.5	4.90	0.75	DI
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	

DIMENSIONS FOR 16" AND 20" D.I. PIPE NOT SHOWN

**NOTE:**

USE EBBA IRON "MEGALUG", SERIES 2100 (D.I.P. MECHANICAL JOINTS,) SERIES 1700 (D.I.P. PUSH ON JOINTS,) 2000PV (P.V.C.) 1900 (P.V.C. PUSH ON JOINTS) OR APPROVED EQUAL

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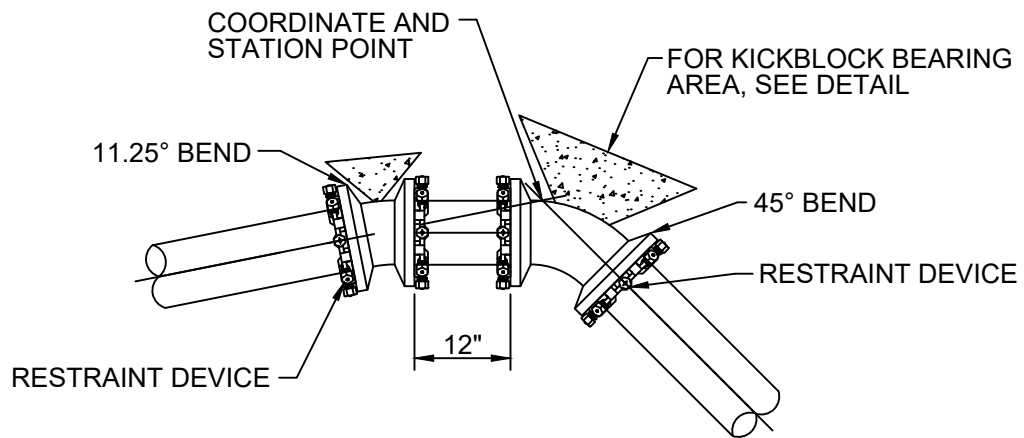


**MECHANICAL JOINT RESTRAINT**

DRAWING NO.: ECCV-26W

DATE: 2024

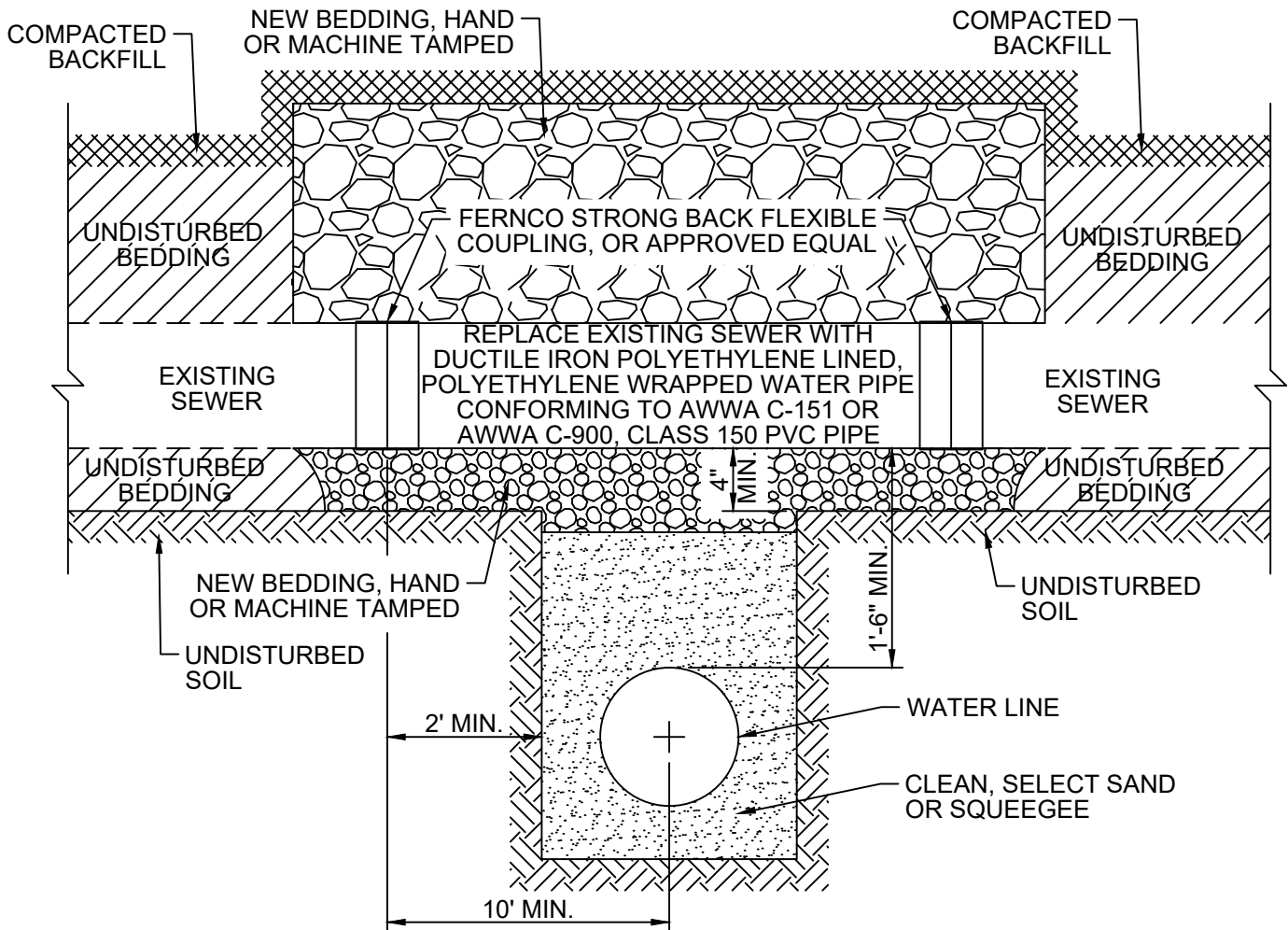
REV. DATE:



**NOTES:**

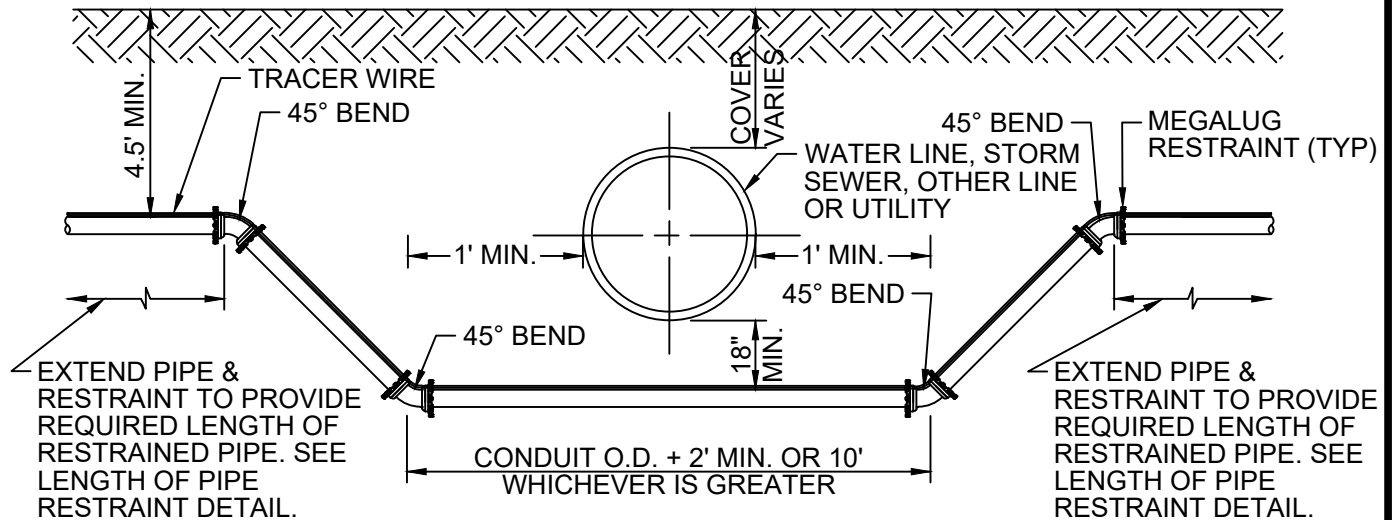
1. ALL RESTRAINT AND PIPE ARE TO BE WRAPPED WITH 8 MIL. POLYETHYLENE.
2. DO NOT COVER RESTRAINT WITH CONCRETE KICKBLOCK.

ONLY ALLOWED WITH  
DISTRICT APPROVAL



**NOTES:**

1. THIS STANDARD APPLIES ONLY FOR NON-PRESSURIZED SANITARY SERVICE TAPS AND SANITARY SEWERS EIGHT (8) INCH AND SMALLER SANITARY SEWERS MAY NOT BE CUT WITHOUT THE EXPRESSED CONSENT OF THE DISTRICT. A DISTRICT REPRESENTATIVE WILL BE ON SITE DURING CONSTRUCTION.
2. DUCTILE IRON PIPE USED TO REPLACE SECTION OF SANITARY SEWER SHALL BE PLACED IN A TRENCH, BEDDED, BACKFILLED AND COMPACTED IN ACCORDANCE WITH THE DISTRICT SPECIFICATIONS.



**NOTES:**

1. ALL CONDUIT CROSSINGS USING VERTICAL BENDS SHALL USE POLYETHYLENE WRAPPED DUCTILE IRON PIPE OR P.V.C.
2. WHERE LINE COVER EXCEEDS 7.5 FEET AT THE LOW POINT OF THE CONDUIT CROSSING, VERTICAL BENDS ARE REQUIRED.
3. WHERE WATER LINE COVER IS LESS THAN 7.5 FEET AT THE LOW POINT OF THE CONDUIT CROSSING, PIPE JOINTS MAY BE DEFLECTED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS IN LIEU OF VERTICAL BENDS. THE LIMITS OF THE DEPRESSED AREA SHALL BE DOCUMENTED ON THE "RECORD DRAWINGS".
4. CATHODIC PROTECTION SHALL BE IN ACCORDANCE WITH THE REFERENCED SPECIFICATION.
5. LONGITUDINAL BENDING OF PIPE IS NOT ACCEPTABLE.
6. THERMAL INSULATION, WHERE REQUIRED BY THE DISTRICT, SHALL BE FOAMGLAS, THICKNESS TO BE DETERMINED. TWO (2) FEET WIDE FOAM BOARD OVER PIPE FOR ENTIRE LENGTH THAT IS UNDER STORM SEWER.
7. INSTALL TRACER WIRE PER STANDARD DETAIL.

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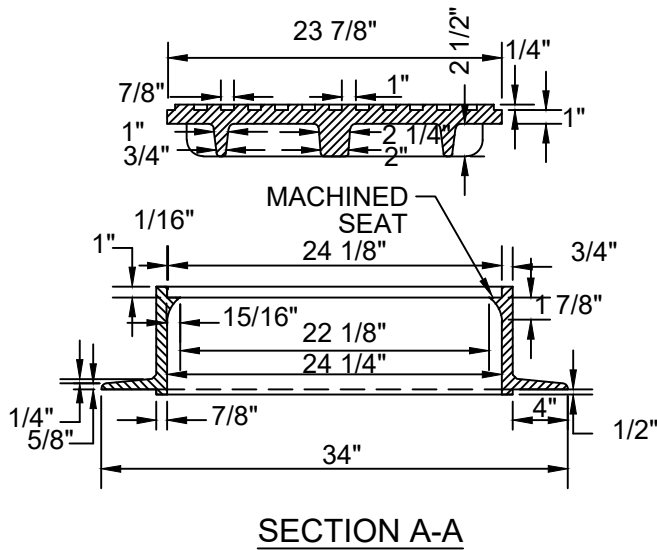
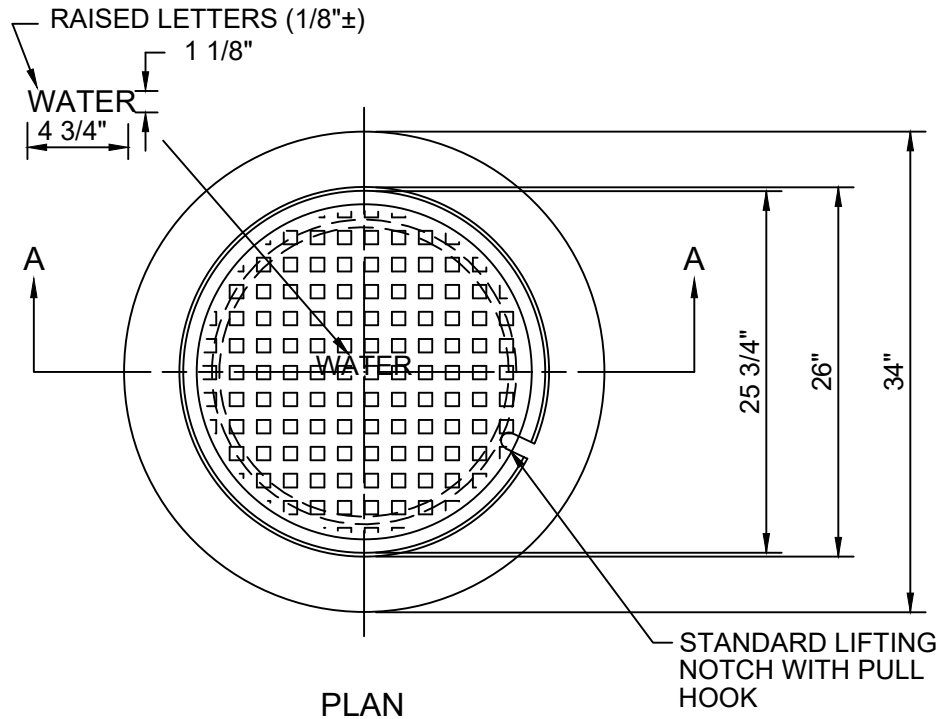


**UTILITY  
CROSSINGS**

DRAWING NO.: ECCV-29W

DATE: 2024

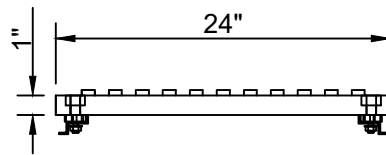
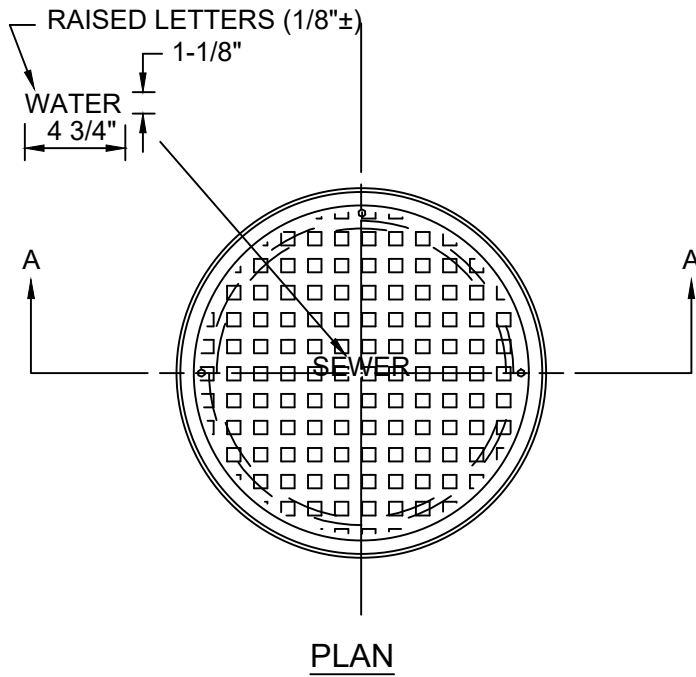
REV. DATE:



**NOTES:**

1. CASTING SPECIFICATIONS: ASTM A-48 WITH A MINIMUM TENSILE STRENGTH OF 25 KSI (CLASS 25)
2. CASTINGS SHALL BE AS SPECIFIED BELOW OR EQUAL:
 

MANUFACTURERS	CAT. #
NEENAH	R-1706
DEETER	1258
3. NO ALUMINUM WILL BE ALLOWED.
4. NO DISSIMILAR METALS WILL BE ALLOWED.



SECTION A-A

NOTES:

1. PADDLE LOCK MANHOLE COVER SHALL BE USED AS REQUIRED BY DISTRICT.
2. MATERIAL TO BE FIBER REINFORCED POLYMER. LOAD RATING AASHTO H-20/25 EN124 D400. LOCK TO BE QUARTER TURN PADDLE LOCK.
3. CASTINGS SHALL BE AS SPECIFIED BELOW OR EQUAL:  
MANUFACTURERS      CAT #  
 GMI COMPOSITES INC.    2400CAEE29

**KJ** Kennedy Jenks

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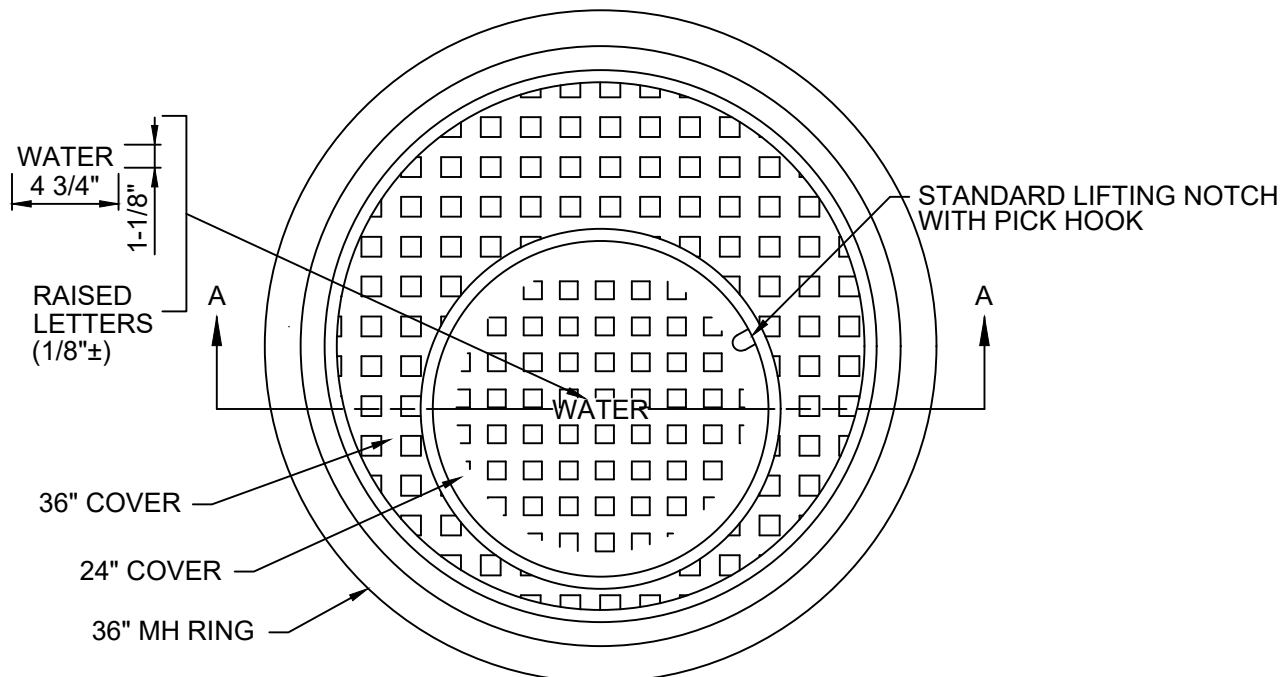


**UTILITY ACCESS COVER WITH  
 QUARTERTURN PADDLE LOCK**

DRAWING NO.: ECCV-31W

DATE: 2024

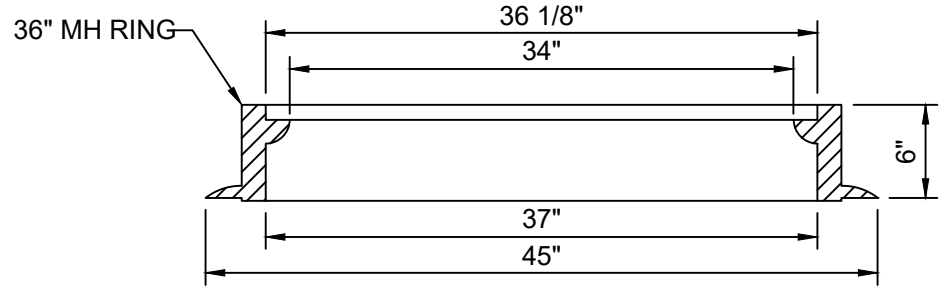
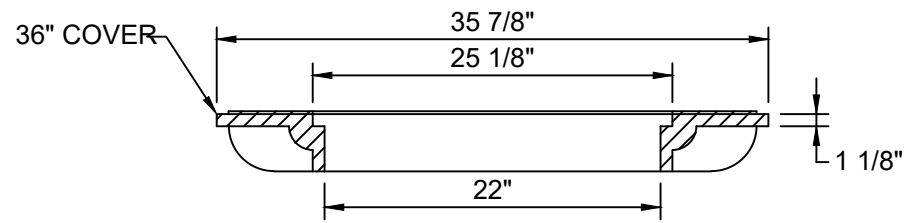
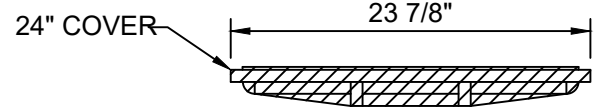
REV. DATE:



**PLAN**

**NOMINAL WEIGHT**

RING	=280#
36" COVER	=250#
24" COVER	=165#
<b>TOTAL</b>	<b>=695#</b>



**SECTION A-A**

**NOTES:**

1. CASTING SPECIFICATIONS: ASTM A-48 WITH A MINIMUM TENSILE STRENGTH OF 25 KSI (CLASS 25).
2. NO ALUMINUM WILL BE ALLOWED.
3. NO DISSIMILAR METALS WILL BE ALLOWED.
4. OFFSET LID IS PREFERRED BY THE DISTRICT. CENTERED LID ON APPROVAL ONLY BY THE DISTRICT.
5. CASTINGS SHALL BE AS SPECIFIED BELOW OR EQUAL:

MANUFACTURER	CAT. NO.
NEENAH	R-1741-D

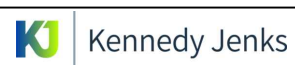


**36"x24" DOUBLE RING AND COVER**

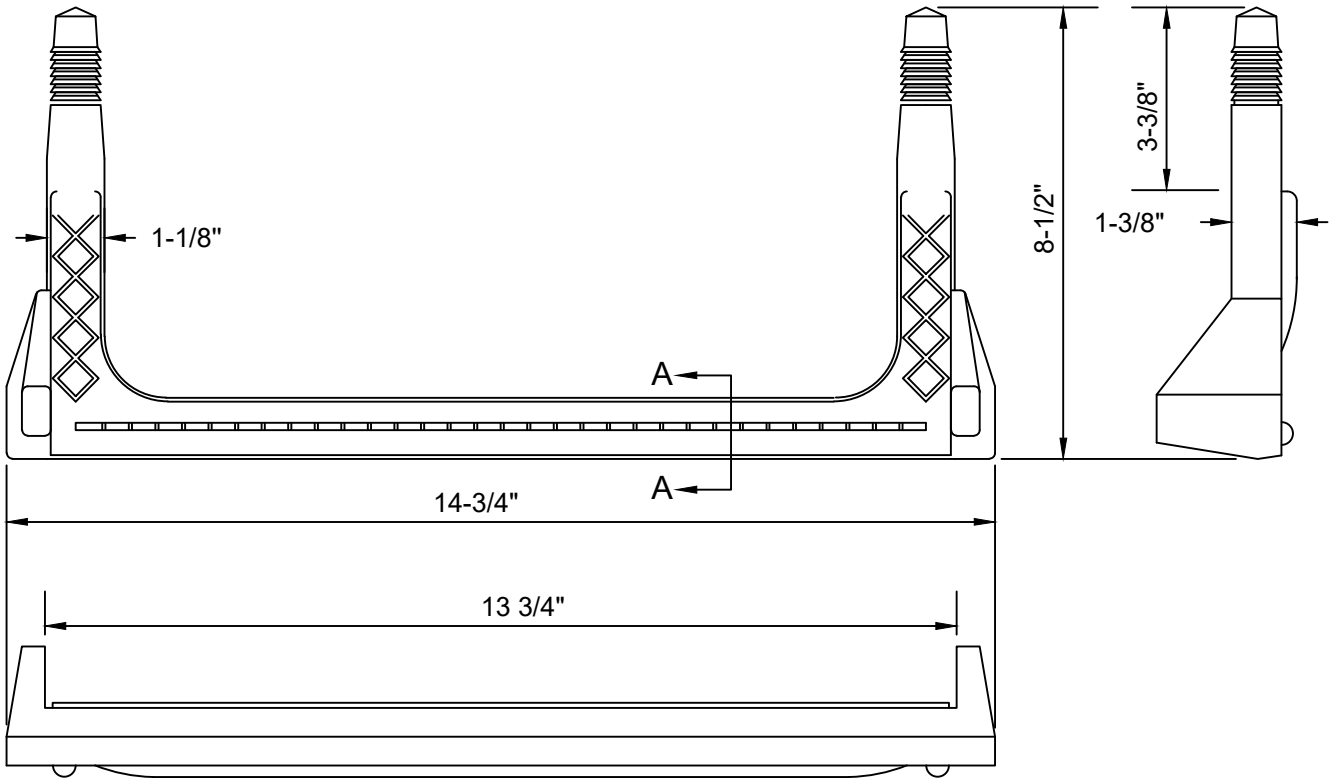
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DATE: 2024

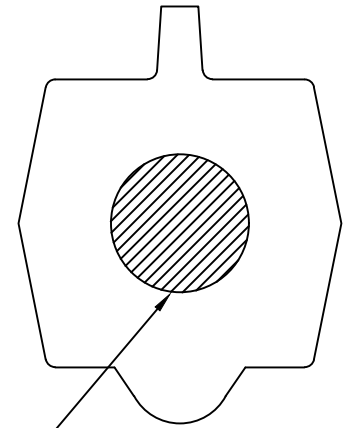
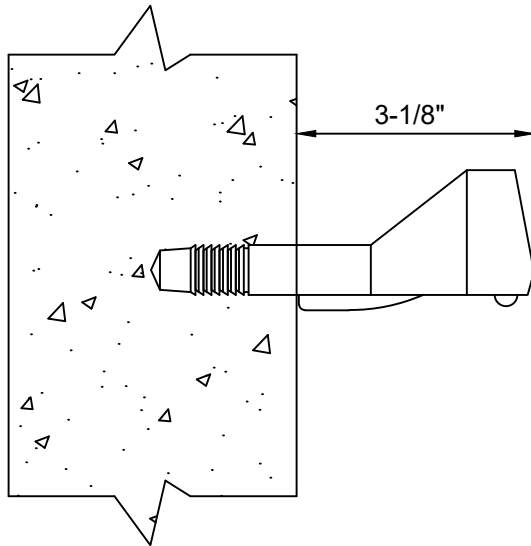
REV. DATE:



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COPOLYMER POLYPROPYLENE PLASTIC



1/2" GRADE 60 STEEL  
REINFORCEMENT

SECTION A-A

NOTES:

1. AS MANUFACTURED BY M.A. INDUSTRIES. PART NO. PS2-PF-HH.
2. THIS STEP SHALL BE USED WHENEVER 20 INCHES OF CLEARANCE CANNOT BE MAINTAINED AT THE TOP STEP, USING THE COMPOSITE STEP DETAIL. MEASUREMENTS SHALL BE TAKEN FROM THE FACE OF THE STEP TO THE INNER WALL OF THE MANHOLE.

**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636

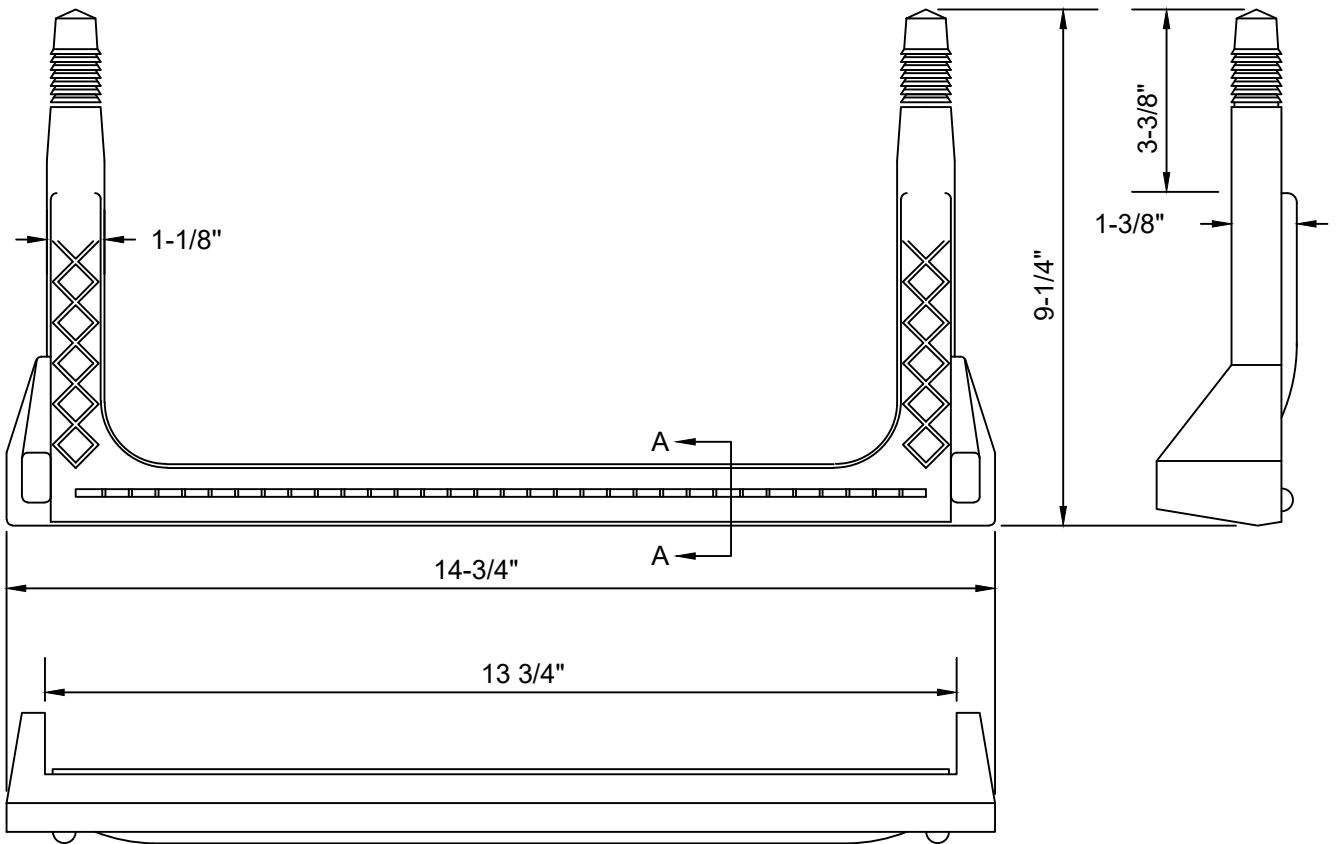


**COMPACT COMPOSITE  
STEP**

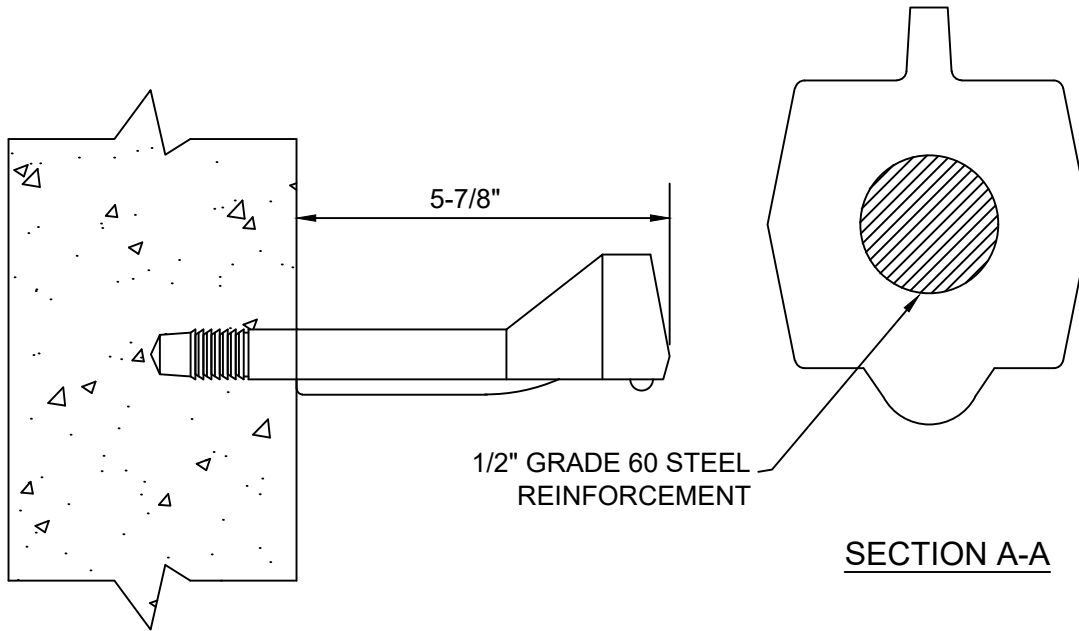
DRAWING NO.: ECCV-33W

DATE: 2024

REV. DATE:



COPOLYMER POLYPROPYLENE PLASTIC



NOTES:

1. AS MANUFACTURED BY M.A. INDUSTRIES. PART NO. PS2-PF.
2. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO REPLACE TOP STEPS AS NECESSARY WITH MODEL NO. PS2-PF-HH (SEE COMPACT COMPOSITE STEP) IF 20" OF CLEARANCE CANNOT BE MAINTAINED.

**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636



**COMPOSITE STEP**

DRAWING NO.: ECCV-34W

DATE: 2024

REV. DATE:

**NOTES:**

VENT PIPES TO BE LOCATED IN THE FIELD AS SHOWN ON THE DRAWINGS. VENT PIPE SHALL BE MODEL "HUSKY RESIDENTIAL STREET VENT ASSEMBLY" MANUFACTURED BY BLUE WATER SOLUTIONS. NO SUBSTITUTIONS.

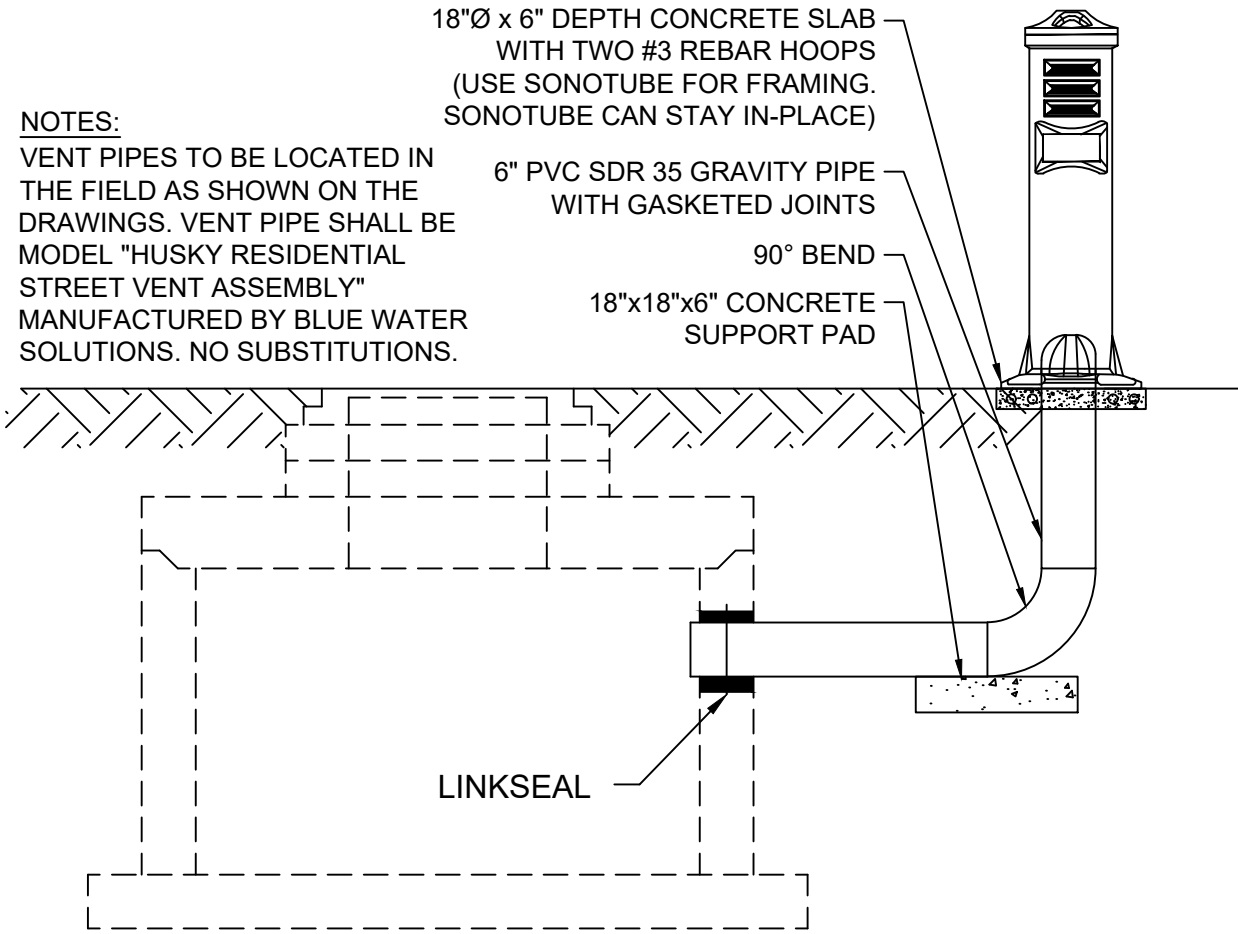
18"Ø x 6" DEPTH CONCRETE SLAB WITH TWO #3 REBAR HOOPS (USE SONOTUBE FOR FRAMING. SONOTUBE CAN STAY IN-PLACE)

6" PVC SDR 35 GRAVITY PIPE WITH GASKETED JOINTS

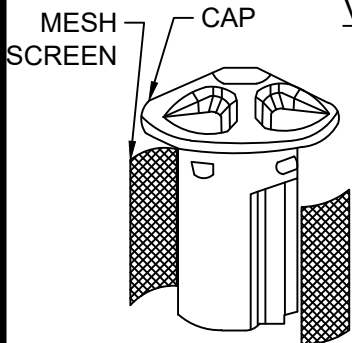
90° BEND

18"x18"x6" CONCRETE SUPPORT PAD

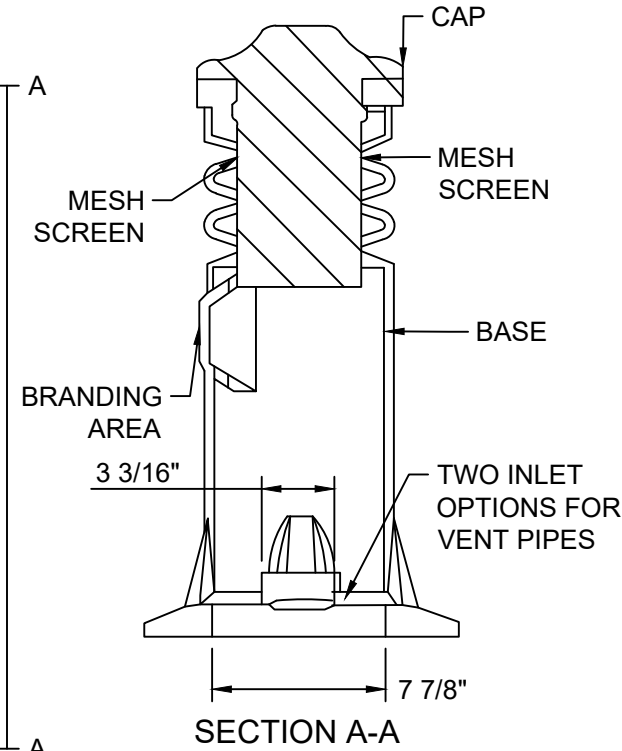
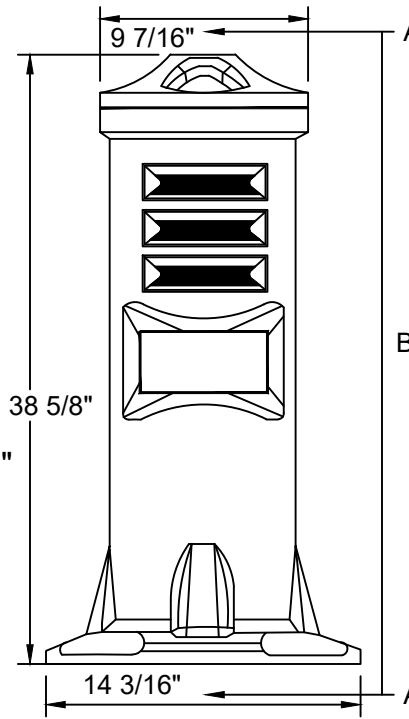
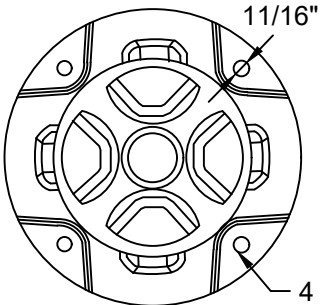
LINKSEAL



**VENT PIPE INSTALLATION**



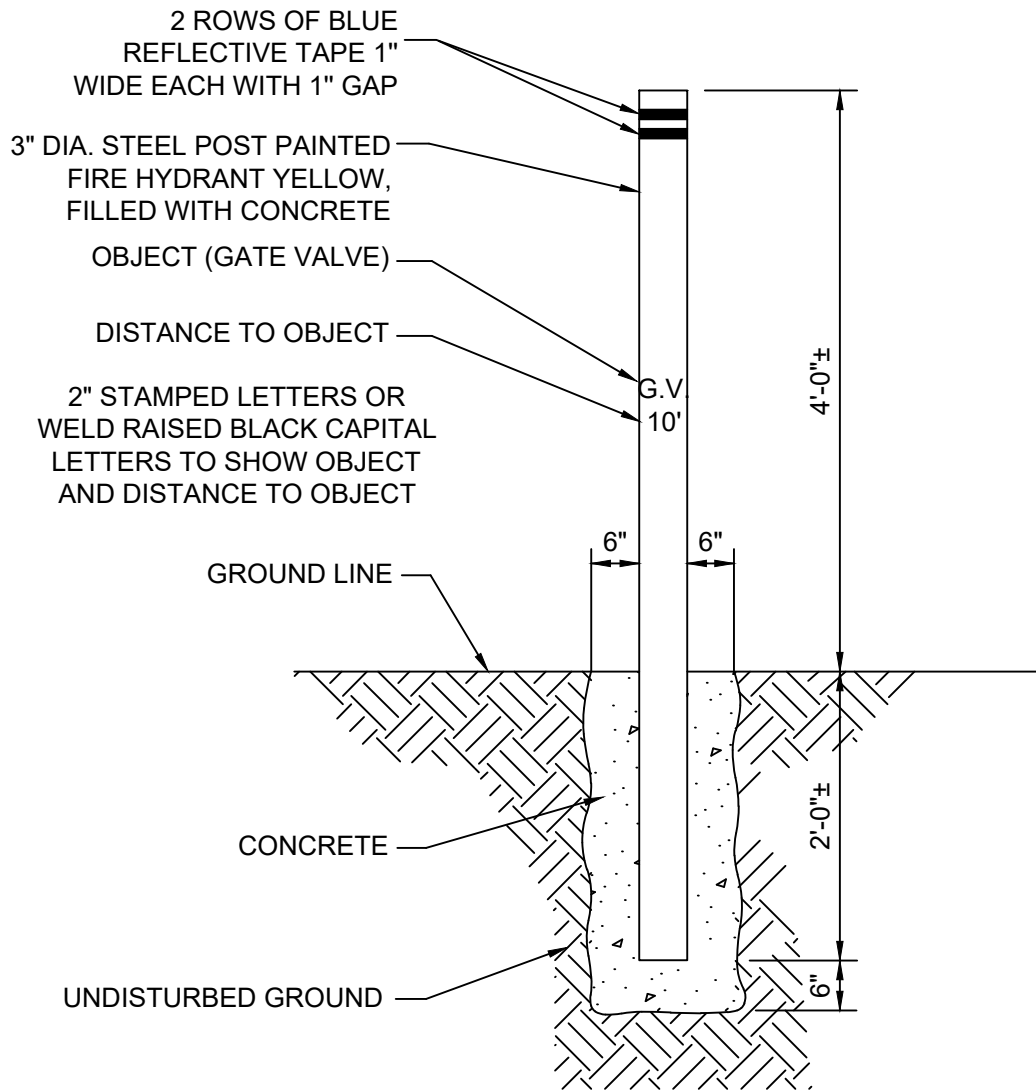
STAINLESS STEEL SCREEN MESH THICKNESS = 0.028" PATTERN (LWD) = 0.027" OPEN AREA = 44%



**ECCV**  
Water & Sanitation District  
**P.V.C. VENT PIPE**

**Kennedy Jenks**  
215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636

DRAWING NO.: ECCV-35W  
DATE: 2024  
REV. DATE:



**NOTE:**

1. MARKER POSTS SHALL BE INSTALLED AT THE LOCATIONS INDICATED ON THE SIGNED CONSTRUCTION PLANS AND AT ANY OTHER LOCATIONS REQUIRED BY THE DISTRICT DURING CONSTRUCTION.

**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636

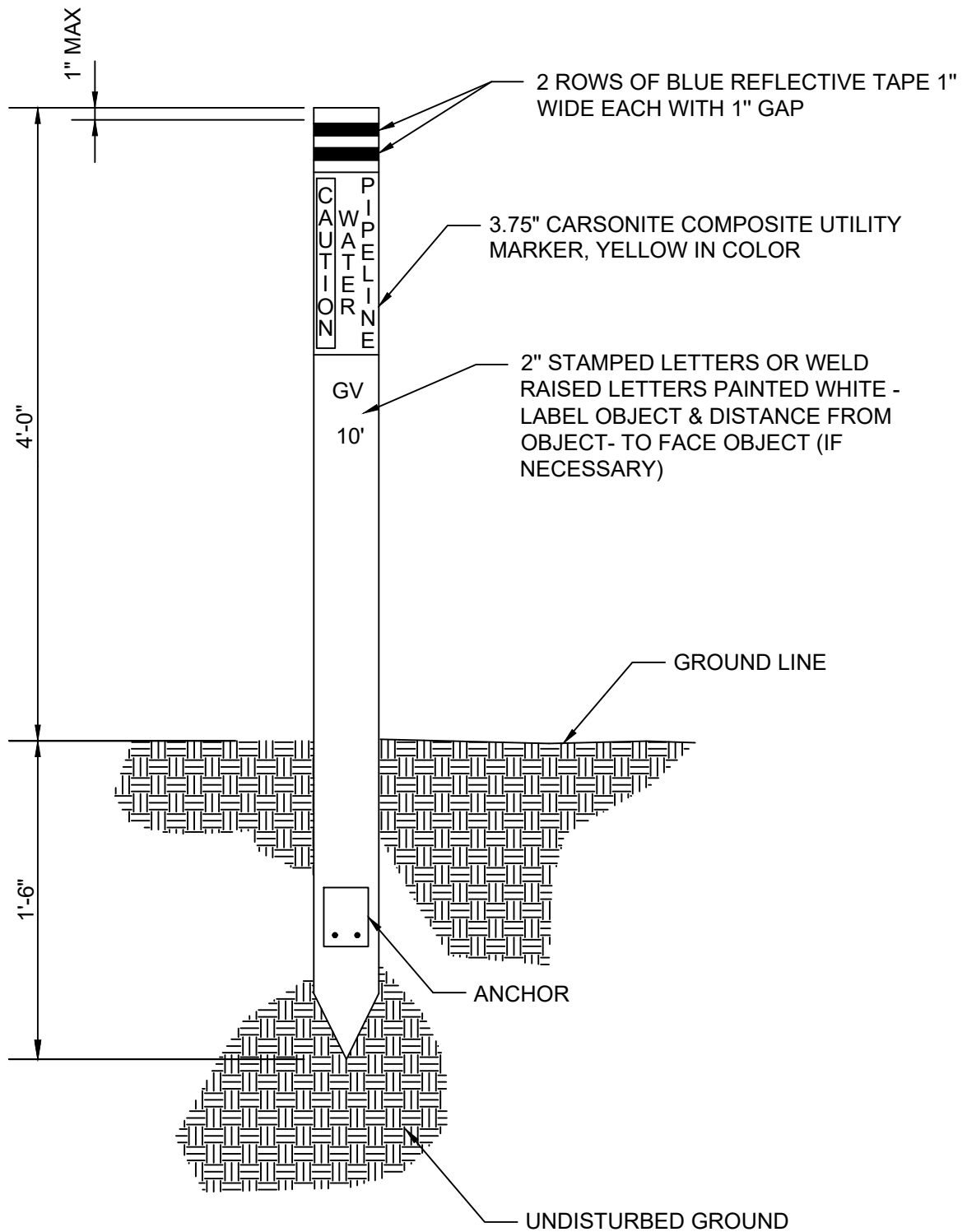


**STANDARD STEEL  
MARKER POST**

DRAWING NO.: ECCV-36W

DATE: 2024

REV. DATE:



**NOTE:**

1. MARKER POSTS SHALL BE INSTALLED AT THE LOCATIONS INDICATED ON THE SIGNED CONSTRUCTION PLANS AND AT ANY OTHER LOCATIONS REQUIRED BY THE DISTRICT DURING CONSTRUCTION.
2. TO BE USED ONLY WITH PRIOR DISTRICT APPROVAL.

**K** Kennedy Jenks

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Lakewood, CO 80228 P: 303.985.3636

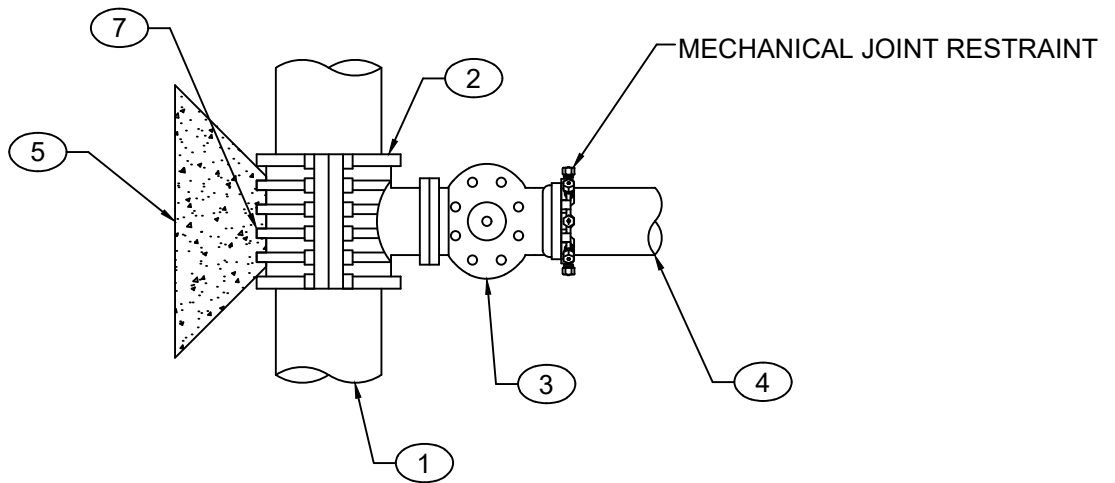


**CARSONITE MARKER  
POST DETAIL**

DRAWING NO.: ECCV-37W

DATE: 2024

REV. DATE:



1. EXISTING MAIN
2. STAINLESS STEEL TAPPING SLEEVE, STAINLESS STEEL BOLTS AND NUTS (COATING SHALL COMPLY WITH AWWA C213). ROMAC TYPE SST III OR APPROVED EQUAL.
3. TAPPING VALVE RESILIENT WEDGE
4. DOUBLE SPIGOT PIPE
5. CONCRETE KICKBLOCK (SEE KICKBLOCK DETAIL)
6. BOND BREAKER BETWEEN CONCRETE AND WET TAP SADDLE 8-MIL POLYETHYLENE
7. STAINLESS STEEL TAPPING VALVE/RESILIENT WEDGE SLEEVE SHALL BE REQUIRED - ROMAC SST III OR MUELLER H-304

**NOTE:**  
DISTRICT MUST BE NOTIFIED AT LEAST 24 HOURS BEFORE TAPPING. A DISTRICT REPRESENTATIVE MUST BE ONSITE DURING TAPPING.



**TAPPING TEE  
AND VALVE**

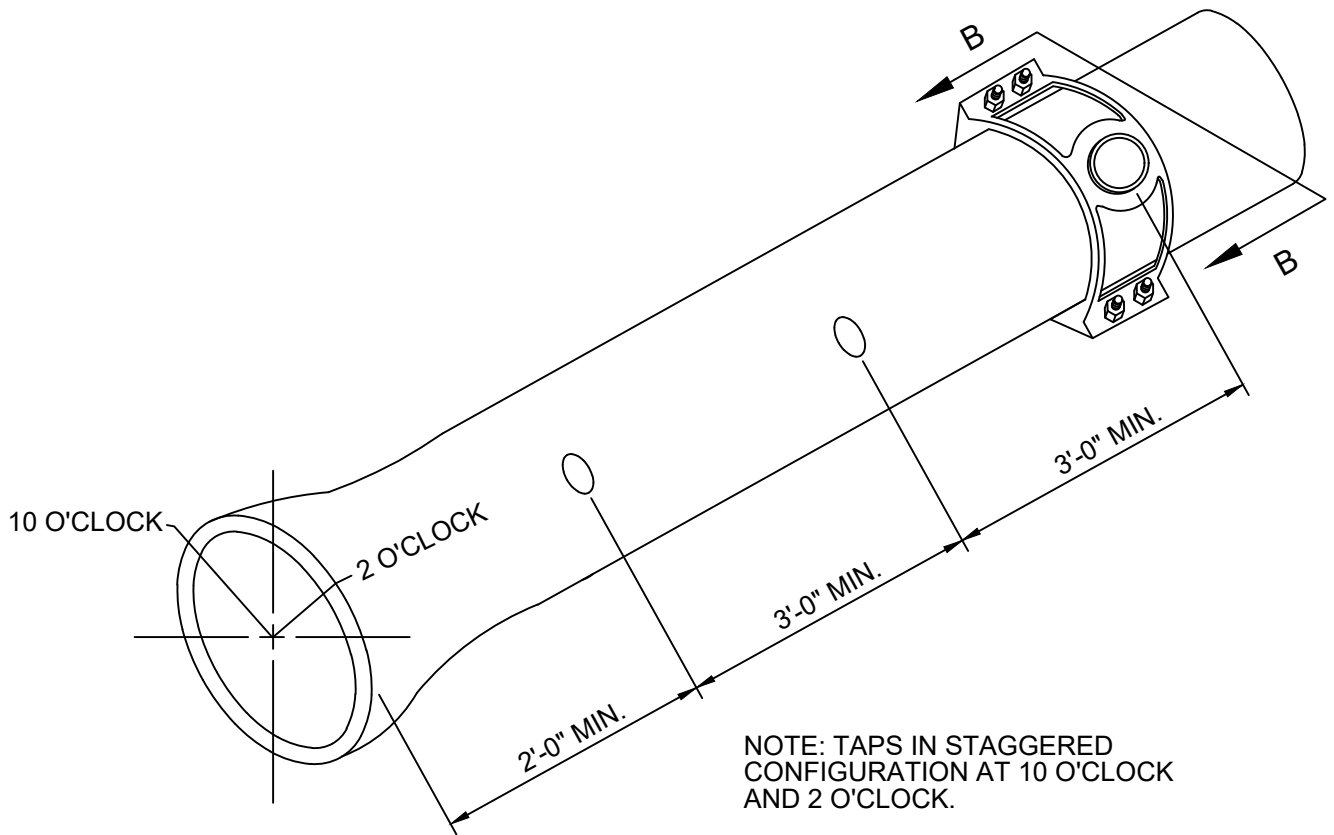
DRAWING NO.: ECCV-38W

DATE: 2024

REV. DATE:

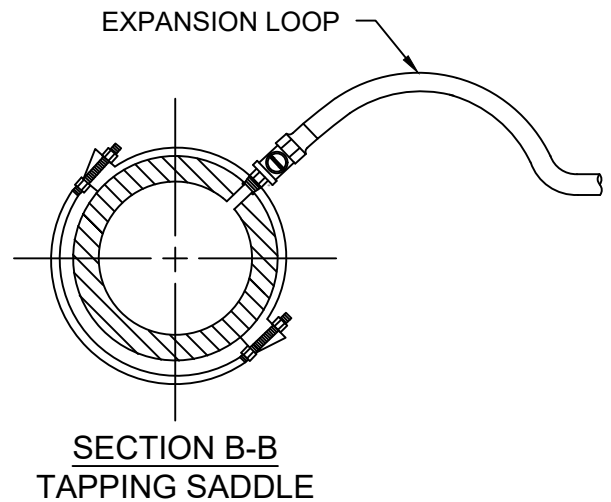


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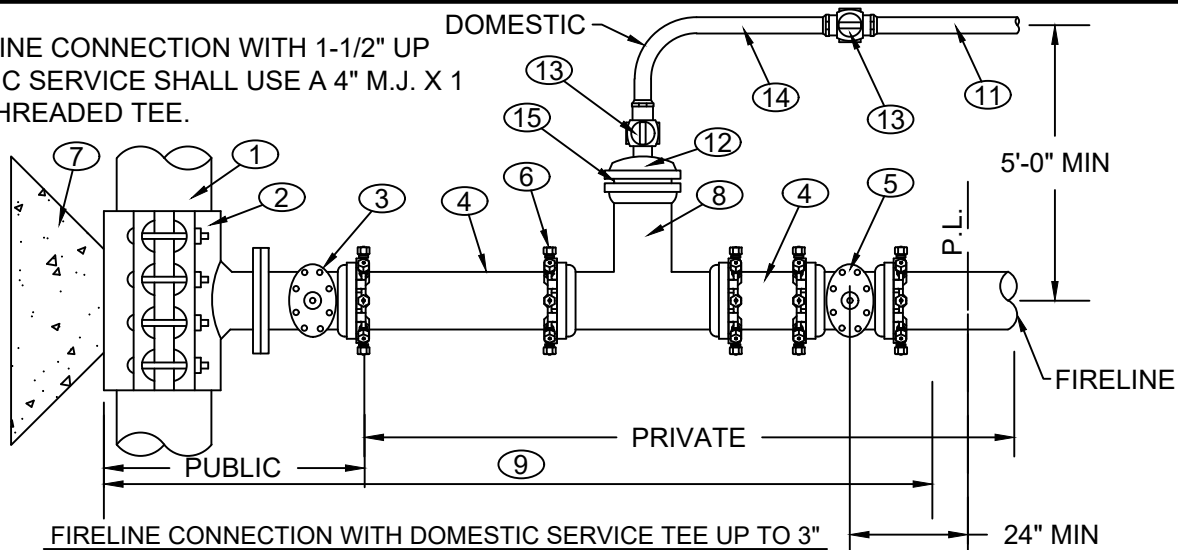


**NOTES:**

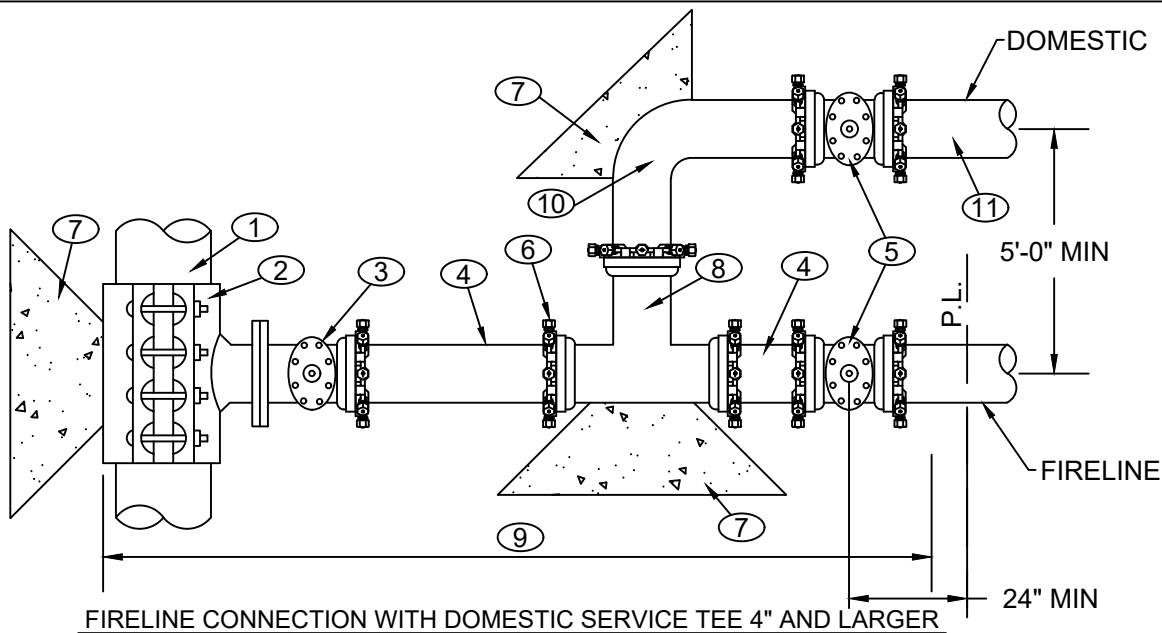
1. WATER SERVICE TAPS SHALL BE MADE AT EITHER THE 2 O'CLOCK OR THE 10 O'CLOCK POSITION ON THE CIRCUMFERENCE OF A WATER MAIN.
2. THE MINIMUM DISTANCE BETWEEN A TAP MADE AT THE 2 O'CLOCK POSITION AND THE ONE MADE AT THE 10 O'CLOCK POSITION SHALL BE 18-INCHES MEASURED ALONG THE PIPE.
3. THE MINIMUM DISTANCE BETWEEN SUCCESSIVE TAPS MADE EITHER AT THE 2 O'CLOCK OR THE 10 O'CLOCK POSITION SHALL BE 3- FEET.
4. THE MINIMUM DISTANCE FROM EITHER THE BELL OR THE SPIGOT END OF A PIPE TO A TAP SHALL BE 2- FEET.
5. A MAXIMUM OF 4 WATER SERVICE TAPS SHALL BE ALLOWED PER LENGTH OF PIPE.
6. ALL TAPS REQUIRE A TAPPING SADDLE. REFER TO WATER SPECIFICATIONS SECTION 4.21.
7. TAPS TO BE MADE UNDER NORMAL LINE PRESSURE.
8. COMPRESSION FITTINGS ONLY.



NOTE: 4" FIRELINE CONNECTION WITH 1-1/2" UP TO 2" DOMESTIC SERVICE SHALL USE A 4" M.J. X 1 1/2" UP TO 2" THREADED TEE.



FIRELINE CONNECTION WITH DOMESTIC SERVICE TEE UP TO 3"



FIRELINE CONNECTION WITH DOMESTIC SERVICE TEE 4" AND LARGER

- |                           |   |
|---------------------------|---|
| ① EXISTING MAIN           | ⑧ DOMESTIC SERVICE TEE                      |
| ② TAPPING SLEEVE          | ⑨ POLYETHYLENE WRAPPED DUCTILE IRON PIPE    |
| ③ TAPPING VALVE           | ⑩ 90° FITTING                               |
| ④ DOUBLE SPIGOT PIPE      | ⑪ CONTINUE PER APPLICABLE METER DETAIL      |
| ⑤ PROPERTY LINE VALVE     | ⑫ PLUG TAPPED TO DOMESTIC SIZE. (UP TO 3")  |
| ⑥ MEGALUG OR EQUAL (TYP.) | ⑬ CORP STOP (UP TO 3")                      |
| ⑦ CONCRETE KICKBLOCK      | ⑭ COPPER TUBING (UP TO 3")                  |
|                           | ⑮ INSULATOR COUPLING (IF DISSIMILAR METALS) |

**NOTES:**

1. DOMESTIC SERVICE TO MEET ECCV STANDARDS
2. TAP AND SERVICE LINE SHALL BE INSPECTED BY ECCV.
3. BACKFLOW PREVENTION ON FIRELINE SHALL BE INSPECTED BY ECCV.
4. INSPECTION OF THE REMAINDER OF THE LINE SHALL BE INSPECTED BY THE FIRE DEPARTMENT
5. FIRELINE MUST MEET FIRE DISTRICT REQUIREMENTS.
6. FIRELINE AND DOMESTIC SERVICE MUST MEET LINE TESTING REQUIREMENTS.
7. FIRELINE IS TO BE DUCTILE IRON.
8. **NO FLARE FITTINGS.**

FOR REFERENCE ONLY  
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**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636

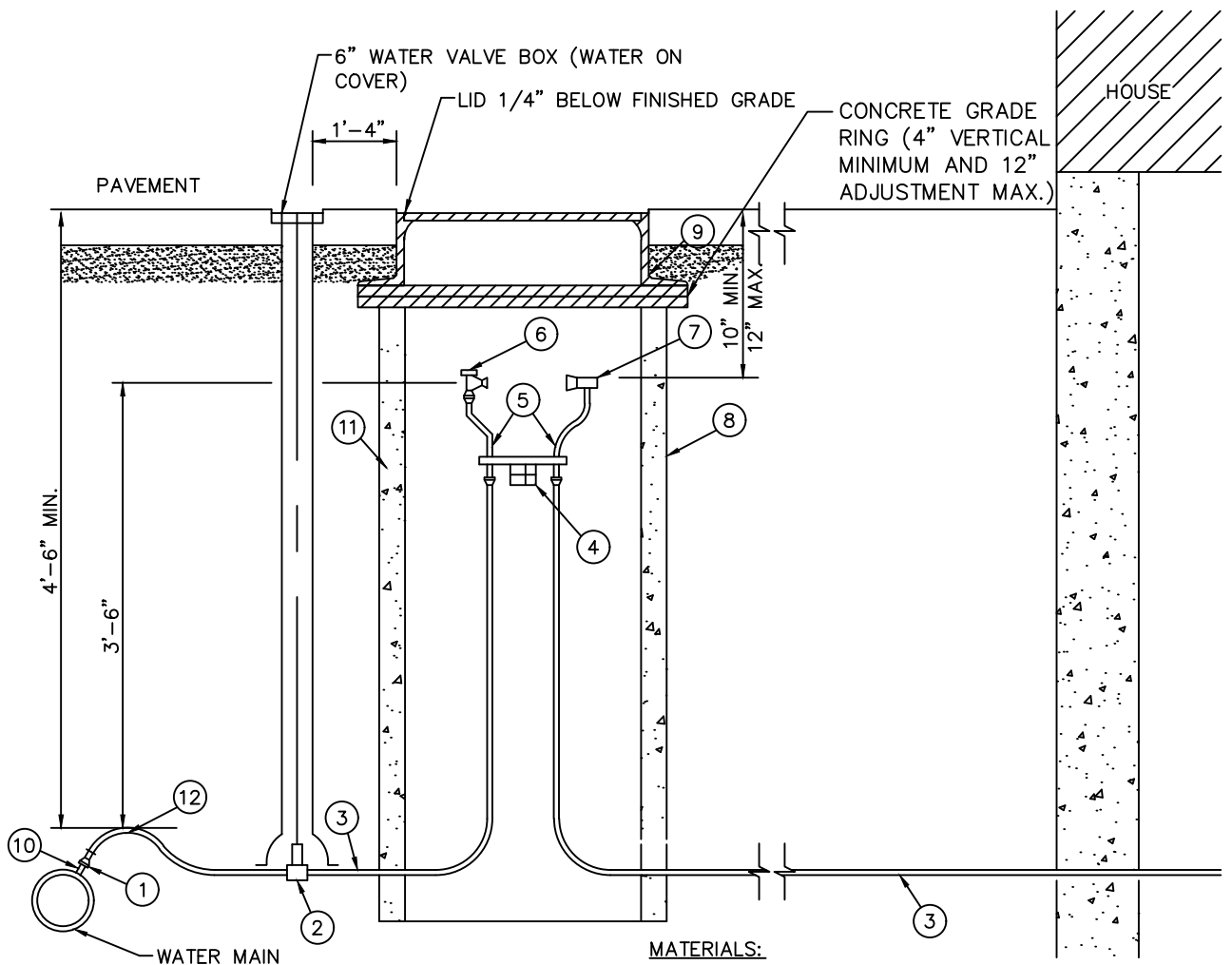


**FIRELINE CONNECTION WITH  
DOMESTIC SERVICE TEE**

DRAWING NO.: ECCV-40W

DATE: 2024

REV. DATE:

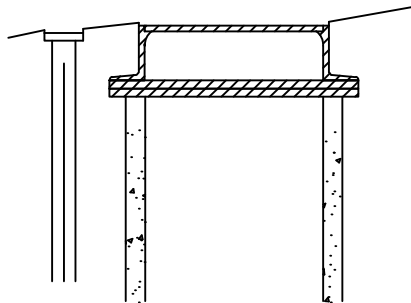


**MATERIALS:**

- ① CORPORATION STOP WITH INSULATING COUPLING (USED FOR DUCTILE IRON MAINS ONLY)
- ② CURB STOP AND WATER VALVE BOX
- ③ SERVICE LINE—COPPER TUBING TYPE 'K' ONLY
- ④ METER YOKE BRACE
- ⑤ METER YOKE—FORD 80 SERIES WITH LOCKING SHUT-OFF VALVE AND CHECK VALVE. FORD COPPERSETTER FOR COPPER SERVICE WITH TUBE NUTS AND WIRING LOCKS. CONTACT THE DISTRICT FOR METER LENGTH (303-693-3800).
- ⑥ LOCKING SHUT-OFF VALVE
- ⑦ CHECK VALVE
- ⑧ METER PIT—24" I.D. x 28" O.D. x 4'-0" IN ONE FOOT SECTIONS.
- ⑨ CAST IRON METER PIT HOOD WITH FREEZE PLATE AND METER PIT LID EJ #2405 (ECCV-59W (3 OF 3)).
- ⑩ ALL CONNECTIONS REQUIRE A TAPPING SADDLE. SADDLES SHALL BE EITHER A FORD MODEL 202BS OR AN AY-MCDONALD MODEL 13845 OR APPROVED EQUAL.
- ⑪ CONCRETE ADJUSTMENT RINGS AS NEEDED. SEAL WITH CAULK.
- ⑫ EXPANSION LOOP

**NOTES:**

- 1. SERVICE LINE MUST HAVE MIN. 4'-6" COVER.
- 2. THERE SHALL NOT BE ANY CONNECTIONS MADE WITHIN 5'-0" OF THE METER.
- 3. ONLY CONCRETE METER PITS SHALL BE ACCEPTED.
- 4. FINISHED METER LID ELEVATION MUST BE 1/4" BELOW FINISHED GRADE.
- 5. IF THERE IS SLOPE, THE TOP EDGE OF PIT NEEDS TO BE SLOPED TO MATCH.
- 6. IF NO SIDEWALK OR CURB IS PROPOSED CONTACT DISTRICT FOR LOCATION.
- 7. PRIOR APPROVAL BY DISTRICT REQUIRED.
- 8. **NO FLARE FITTINGS.**



**KJ** Kennedy Jenks

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**3/4" & 1" IN-TRAFFIC  
SERVICE METER (1 OF 3)**

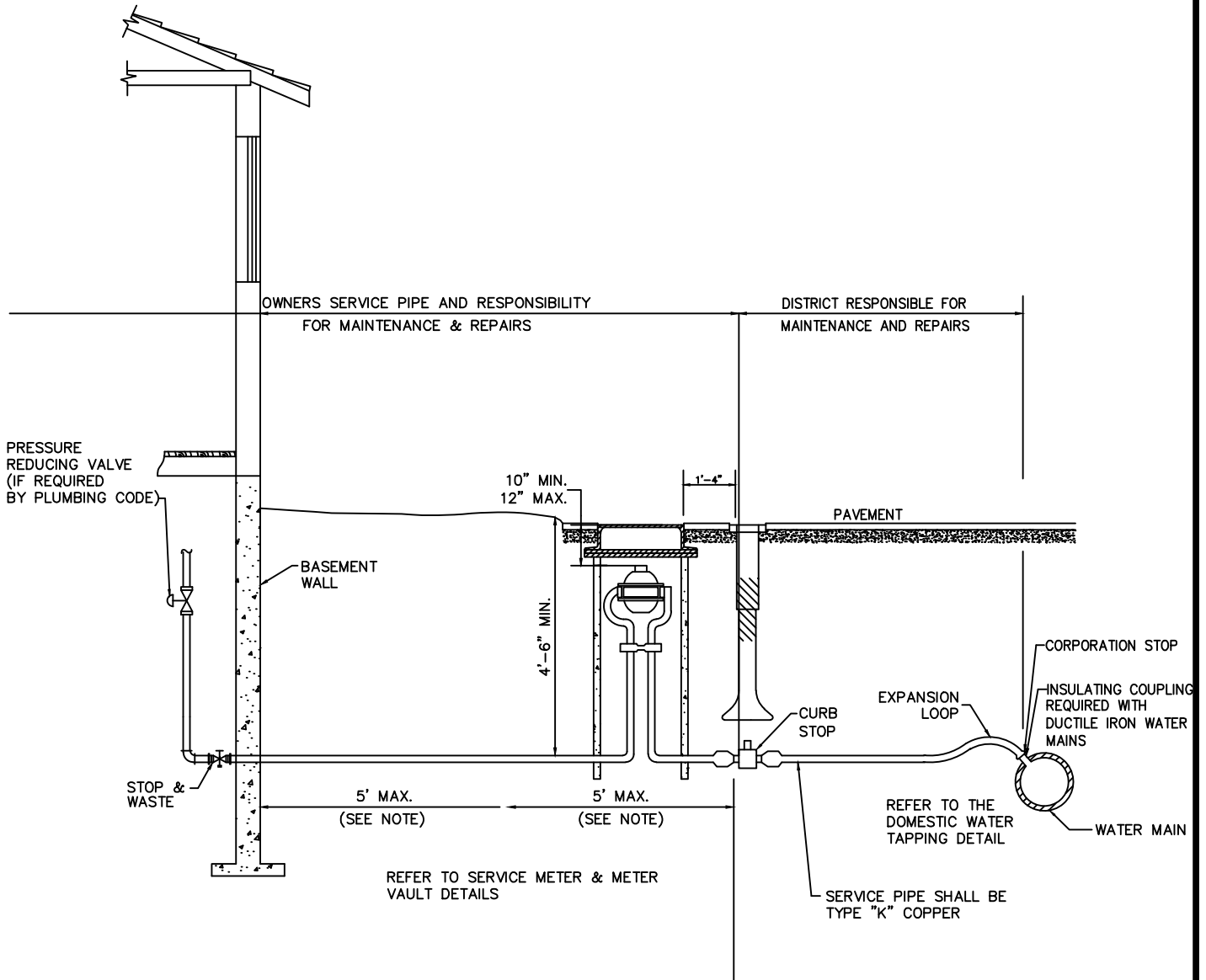
DRAWING NO.: ECCV-41W

DATE: 2024

REV. DATE:

**NOTE:**

1. PLACEMENT OF WATER VALVE BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE OF THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.
2. OWNER'S RESPONSIBILITY FOR LEAK REPAIR SHALL BE FROM THE HOME TO THE HOME SIDE OF THE METER PIT.
3. THE DISTRICT'S RESPONSIBILITY SHALL BE THE WATER MAIN, THE CORPORATION STOP, AND WHERE NEEDED, THE DOUBLE STRAP TAPPING SADDLE & THE SERVICE LINE TO THE BACK OF THE HOME SIDE OF THE METER PIT. THE WATER DISTRICT WILL FIX LEAKS ONLY OCCURRING BETWEEN THE HOME SIDE OF THE METER PIT AND THE WATER MAIN.
4. THE DISTRICT WILL ALSO BE RESPONSIBLE FOR THE MAINTENANCE & REPAIR OF THE WATER METER.
5. IF NO SIDEWALK OR CURB IS PROPOSED CONTACT DISTRICT FOR LOCATION.
6. NO FLARE FITTINGS.



**IN TRAFFIC SERVICE LINE, VALVE BOX & OUTSIDE METER INSTALLATION FOR 3/4" & 1" METERS (2 OF 3)**

DRAWING NO.: ECCV-42W

DATE: 2024

REV. DATE:

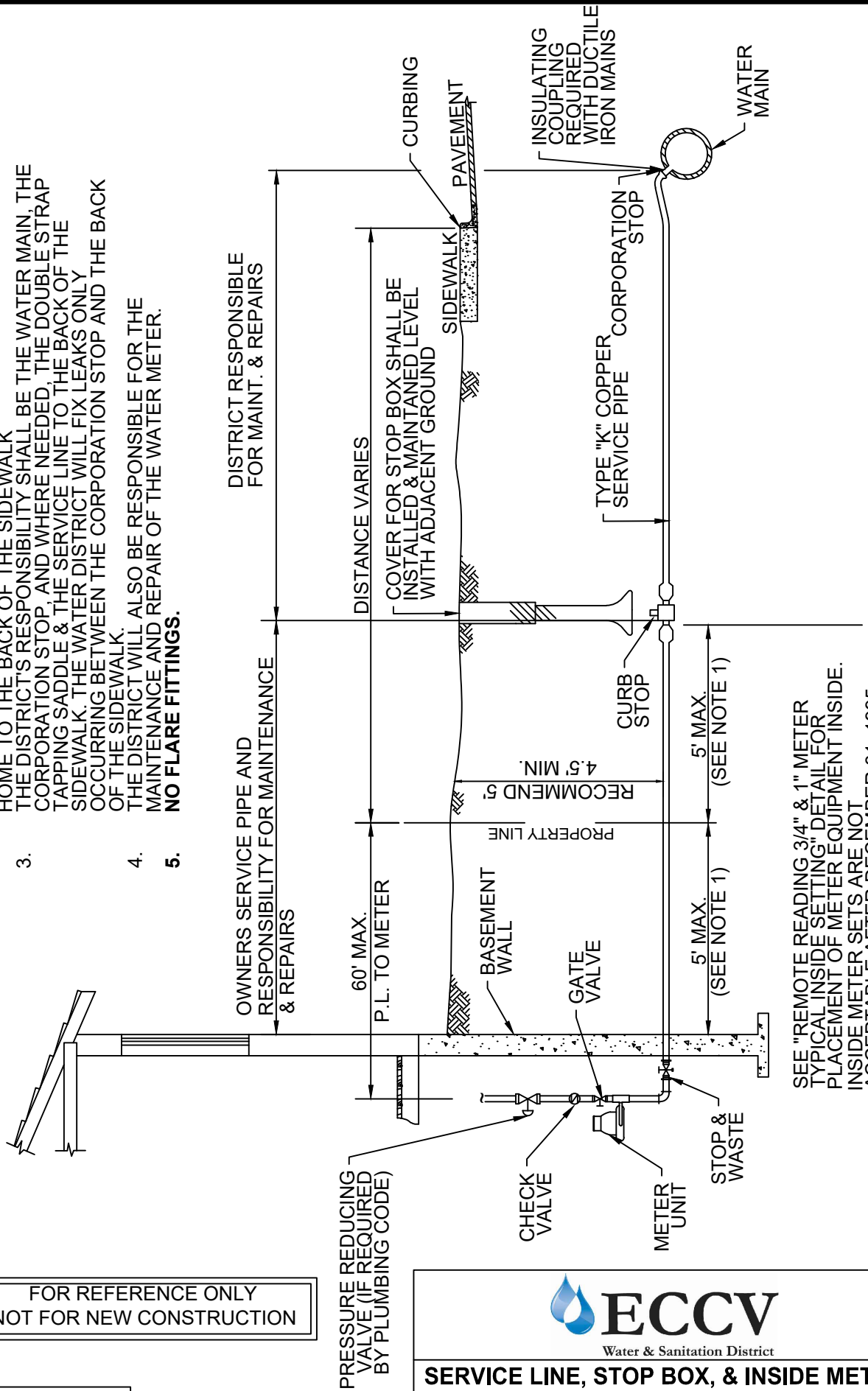
**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636



**NOTES:**

1. PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE OF THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF THE STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.
2. OWNER'S RESPONSIBILITY FOR LEAK REPAIR SHALL BE FROM THE HOME TO THE BACK OF THE SIDEWALK.
3. THE DISTRICT'S RESPONSIBILITY SHALL BE THE WATER MAIN, THE CORPORATION STOP, AND WHERE NEEDED, THE DOUBLE STRAP TAPPING SADDLE & THE SERVICE LINE TO THE BACK OF THE SIDEWALK. THE WATER DISTRICT WILL FIX LEAKS ONLY OCCURRING BETWEEN THE CORPORATION STOP AND THE BACK OF THE SIDEWALK.
4. THE DISTRICT WILL ALSO BE RESPONSIBLE FOR THE MAINTENANCE AND REPAIR OF THE WATER METER.
5. **NO FLARE FITTINGS.**



SEE "REMOTE READING 3/4" & 1" METER TYPICAL INSIDE SETTING" DETAIL FOR PLACEMENT OF METER EQUIPMENT INSIDE. INSIDE METER SETS ARE NOT ACCEPTABLE AFTER DECEMBER 31, 1995

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**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636

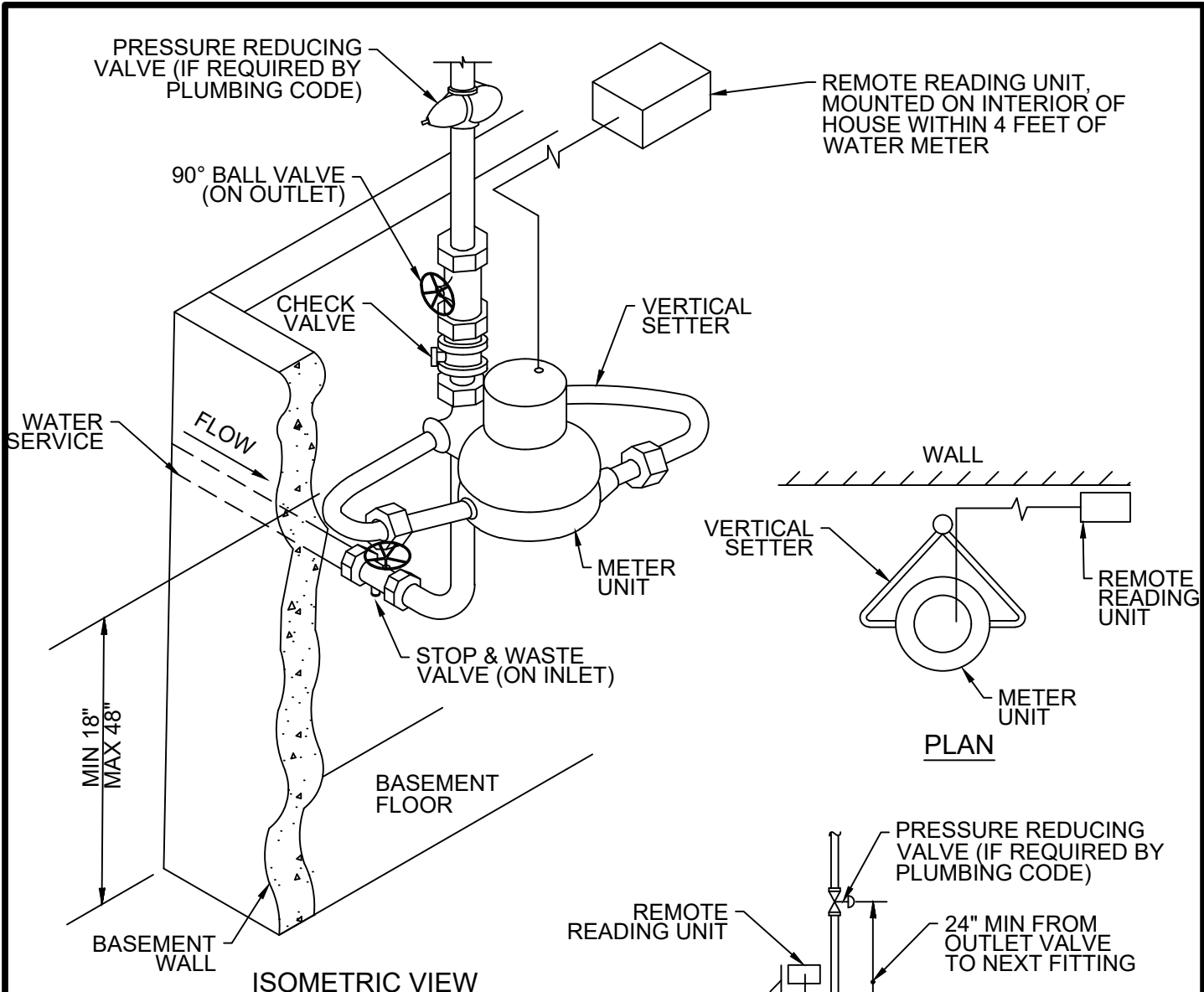


**SERVICE LINE, STOP BOX, & INSIDE METER INSTALLATION FOR 3/4" AND 1" METERS**

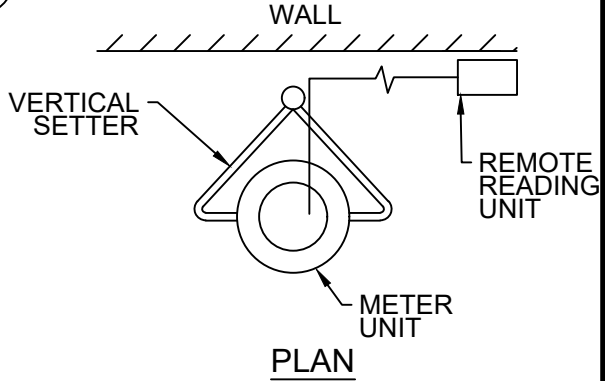
DRAWING NO.: ECCV-44W

DATE: 2024

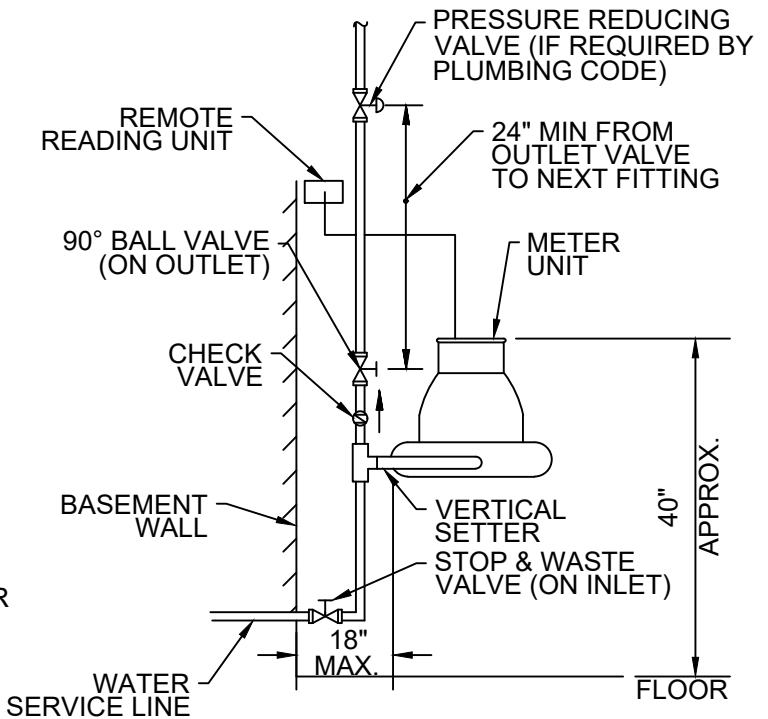
REV. DATE:



**ISOMETRIC VIEW**



**PLAN**




**ELEVATION**

**NOTES:**

1. ALL METER LOCATIONS TO BE IN BASEMENTS AND NOT CRAWL SPACES.
2. A FLOOR DRAIN SHALL BE PLACED NEAR THE METER INSTALLATION FOR NEW SERVICES. A FLOOR DRAIN IS NOT REQUIRED FOR A METER IN EXISTING SERVICES.

INSIDE METER SETS ARE NOT ACCEPTABLE AFTER DECEMBER 31, 1995


FOR REFERENCE ONLY  
NOT FOR NEW CONSTRUCTION



**REMOTE READING 3/4" & 1" METER  
TYPICAL INSIDE SETTING**

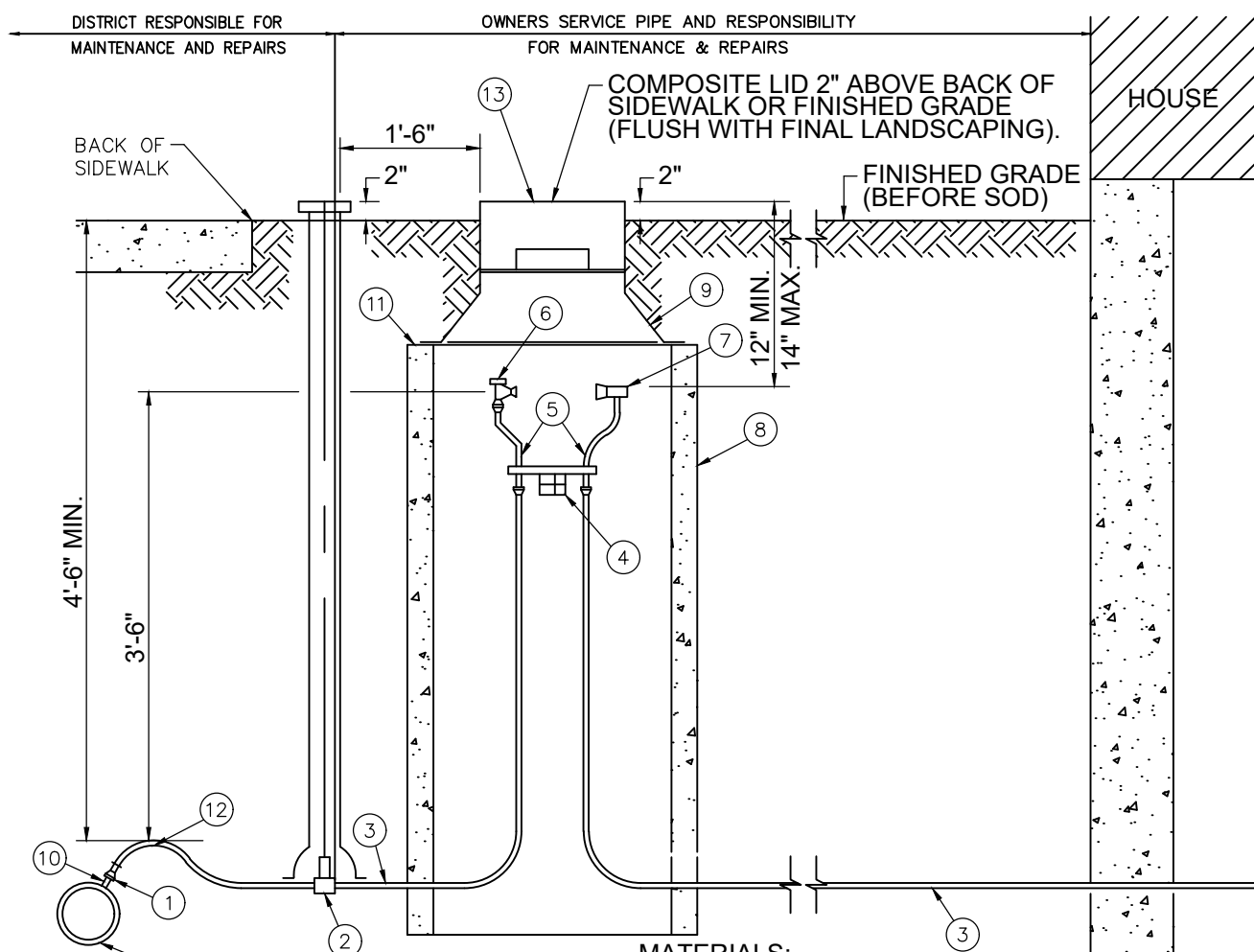
DRAWING NO.: ECCV-45W

DATE: 2024      REV. DATE:



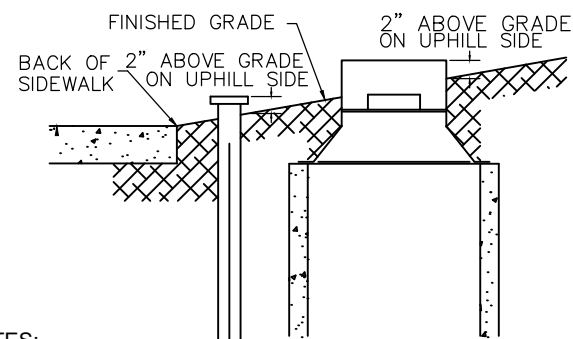
**Kennedy Jenks**

215 Union Boulevard, Suite 500  
Lakewood, CO 80228 P: 303.985.3636



**MATERIALS:**


- ① CORPORATION STOP WITH INSULATING COUPLING (USED FOR DUCTILE IRON MAINS ONLY)
- ② CURB STOP AND BOX
- ③ SERVICE LINE-COPPER TUBING TYPE 'K' ONLY
- ④ METER YOKE BRACE
- ⑤ METER YOKE-FORD 80 SERIES WITH LOCKING SHUT-OFF VALVE AND CHECK VALVE OR MCDONALD 731 SERIES. COPPERSETTER FOR COPPER SERVICE WITH TUBE NUTS AND WIRING LOCKS. CONTACT THE DISTRICT FOR METER LENGTH (303-693-3800)
- ⑥ LOCKING SHUT-OFF VALVE
- ⑦ CHECK VALVE
- ⑧ METER PIT-24" I.D. x 28" O.D. x 4'-0". (PLASTIC ALLOWED)
- ⑨ CAST IRON METER PIT HOOD WITH FREEZE PLATE AND COMPOSITE METER PIT LID
- ⑩ ALL CONNECTIONS REQUIRE A TAPPING SADDLE. SADDLES SHALL BE EITHER A FORD MODEL 202BS OR AN AY-MCDONALD MODEL 3845 OR APPROVED EQUAL
- ⑪ CONCRETE OR PLASTIC ADJUSTMENT RINGS AS NEEDED. SEAL WITH CAULK.
- ⑫ EXPANSION LOOP
- ⑬ NICOR 13" OR REHRIG W003 MOLD P201 COMPOSITE LID



**NOTES:**

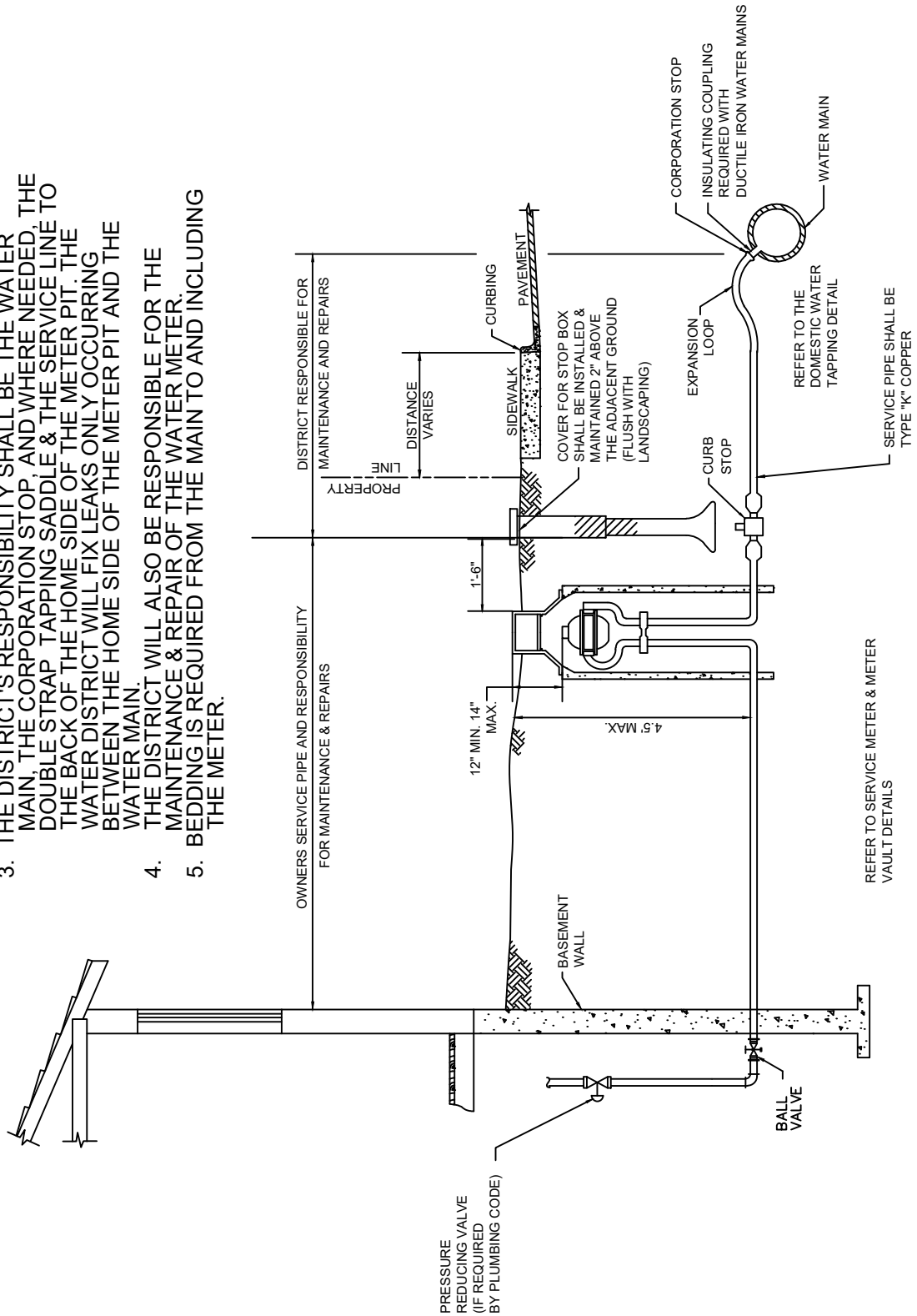
- 1. SERVICE LINE MUST HAVE MIN. 4'-6" COVER.
- 2. THERE SHALL NOT BE ANY CONNECTIONS MADE WITHIN 5'-0" OF THE METER.
- 3. CONCRETE OR PLASTIC METER PITS SHALL BE ACCEPTED
- 4. FINISHED METER LID ELEVATION MUST BE 2" ABOVE BACK OF SIDEWALK AND/OR FINISHED GRADE AND FLUSH WITH FINAL LANDSCAPING.
- 5. IF THERE IS SUBSTANTIAL SLOPE, THE TOP EDGE OF PIT NEEDS TO BE 2" ABOVE GRADE.
- 6. IF LANDSCAPING IS NOT YET INSTALLED, RAISE CURB STOP BOX 2-INCHES ABOVE GRADE.
- 7. BEDDING IS REQUIRED FROM MAIN TO END AND INCLUDING METER.
- 8. 3/4" X 5/8" METER: REQUIRES 7.75" SPREAD (OR USE ADAPTOR FOR 9" SPREAD)
- 9. METER PITS AND CURB BOXES ARE NOT TO BE PLACED IN CONCRETE, MAINTAIN 3' CLEARANCE WITH NO SHRUBS.
- 10. COMPRESSION FITTINGS ARE REQUIRED.
- 11. **NO FLARE FITTINGS.**

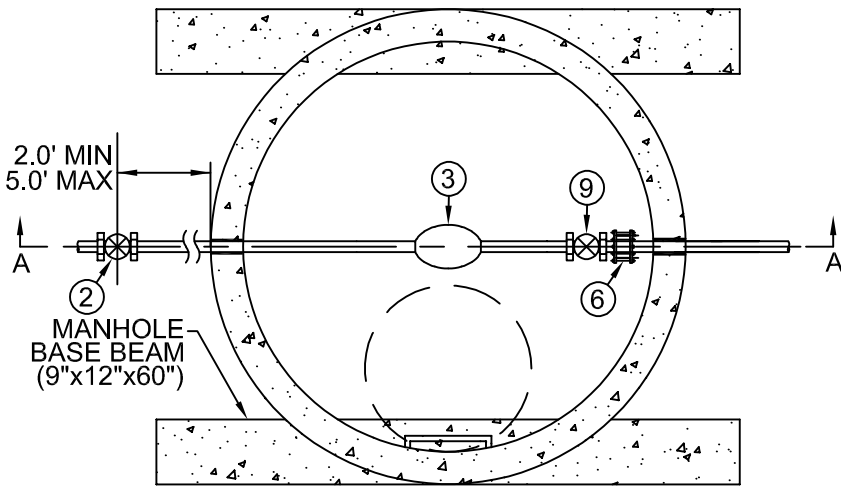
**Kennedy Jenks**  
 215 Union Boulevard, Suite 500  
 Lakewood, CO 80228 P: 303.985.3636

	
<p><b>3/4" &amp; 1"</b> <b>SERVICE METER</b></p>	
<p>DRAWING NO.: ECCV-46W</p>	
<p>DATE: 2024</p>	<p>REV. DATE:</p>

**NOTE:**

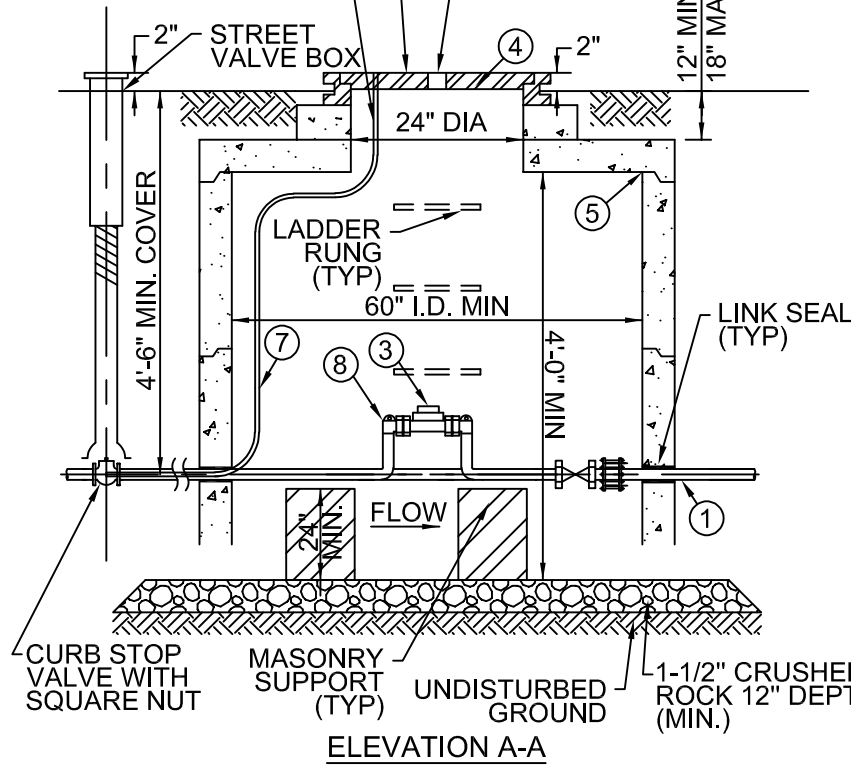
1. PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE OF THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.
2. OWNER'S RESPONSIBILITY FOR LEAK REPAIR SHALL BE FROM THE HOME TO THE HOME SIDE OF THE METER PIT.
3. THE DISTRICT'S RESPONSIBILITY SHALL BE THE WATER MAIN, THE CORPORATION STOP, AND WHERE NEEDED, THE DOUBLE STRAP TAPPING SADDLE & THE SERVICE LINE TO THE BACK OF THE HOME SIDE OF THE METER PIT. THE WATER DISTRICT WILL FIX LEAKS ONLY OCCURRING BETWEEN THE HOME SIDE OF THE METER PIT AND THE WATER MAIN.
4. THE DISTRICT WILL ALSO BE RESPONSIBLE FOR THE MAINTENANCE & REPAIR OF THE WATER METER.
5. BEDDING IS REQUIRED FROM THE MAIN TO AND INCLUDING THE METER.





PLAN

LID 2" ABOVE FINISH GRADE (BEFORE LANDSCAPING)  
 BRING TRACER WIRE TO SURFACE FOR ACCESS WITHOUT ENTERING  
 2" HOLE IN CENTER FOR METER READING DEVICE.



ELEVATION A-A

**MATERIALS:**

- ⑧ 12" COPPERSETTER / METER YOKE WITH BYPASS:
  - FORD "CUSTOM SETTER" METER UNIT
  - 1 1/2" MODEL NO. VBH76-12-11-66-NL, METER SPACING = 13"
  - 2" MODEL NO. VBH77-12-11-77-ML METER SPACING = 17"
  - YOKE SHALL HAVE LOCKING ANGLE BALL METER ON INLET & ANGLE CHECK VALVE ON OUTLET
- ⑨ BALL VALVE WITH HANDLE

**NOTES:**

1. WATER METER FURNISHED BY DISTRICT. INSTALLATION TO BE DONE BY CONTRACTOR
2. SERVICE LINE MUST HAVE MIN. 4.5 FEET OF COVER.
3. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE MAIN TO THE METER PRIOR TO BACKFILLING.
4. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE METER TO THE BUILDING PRIOR TO BACKFILLING.
5. CONCRETE SHALL NOT BE LAID IN FLOOR OF METER MANHOLE.
6. MANHOLE BASE BEAMS REQUIRED FOR INSTALLATIONS IN DRIVEWAYS OR PARKING AREAS.
7. FIELD SOLDERED JOINTS OR PLASTIC PIPE ARE NOT ALLOWED IN METER MANHOLE.
8. DISTRICT PERSONNEL SHALL INSPECT THE CORPORATION STOP AND INSULATING COUPLING PRIOR TO BACKFILLING.
9. NO TAPS OR CONNECTIONS ALLOWED WITHIN 5 FEET OF THE METER.
10. ALL BOLTS SHALL BE STAINLESS STEEL.
11. NO BACKFLOW PREVENTION ASSEMBLY ALLOWED IN METER PIT
12. NO FLARE FITTINGS
13. BYPASS NOT PERMITTED FOR IRRIGATION ONLY METER SETTINGS.

**MATERIALS:**

- ① WATER SERVICE LINE - COPPER TUBING (TYPE K) 4.5 FEET MIN. COVER
- ② CURB STOP VALVE WITH 2" SQUARE NUT AND ARCH-PATTERN BUFFALO STYLE VALVE BOX
- ③ WATER METER
- ④ RING AND COVER - 24" DEETER #1258 OR CASTINGS INC. C.I.24 RECESSED OR EQUAL, "WATER" CAST INTO COVER. LIDS SHOULD HAVE 2" HOLE IN THE CENTER. ALL COVERS SHOULD BE H-20 TRAFFIC LOADING RATED.
- ⑤ PRECAST 60" ID MANHOLE - ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP, AND CONCRETE ADJUSTMENT RINGS.
- ⑥ COPPER TUBE COMPRESSION UNION
- ⑦ TRACER WIRE



**1-1/2" AND 2" IRRIGATION ONLY METER IN MANHOLE WITHOUT BYPASS**

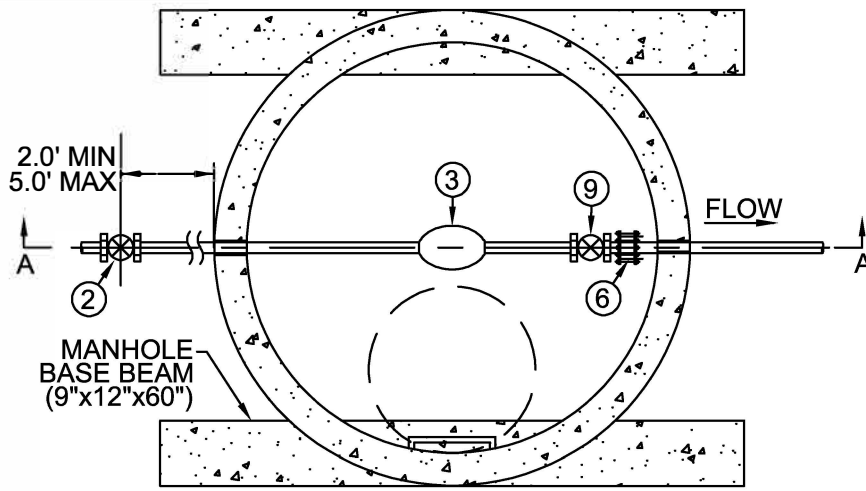
DRAWING NO.: ECCV-48W

DATE: 2024

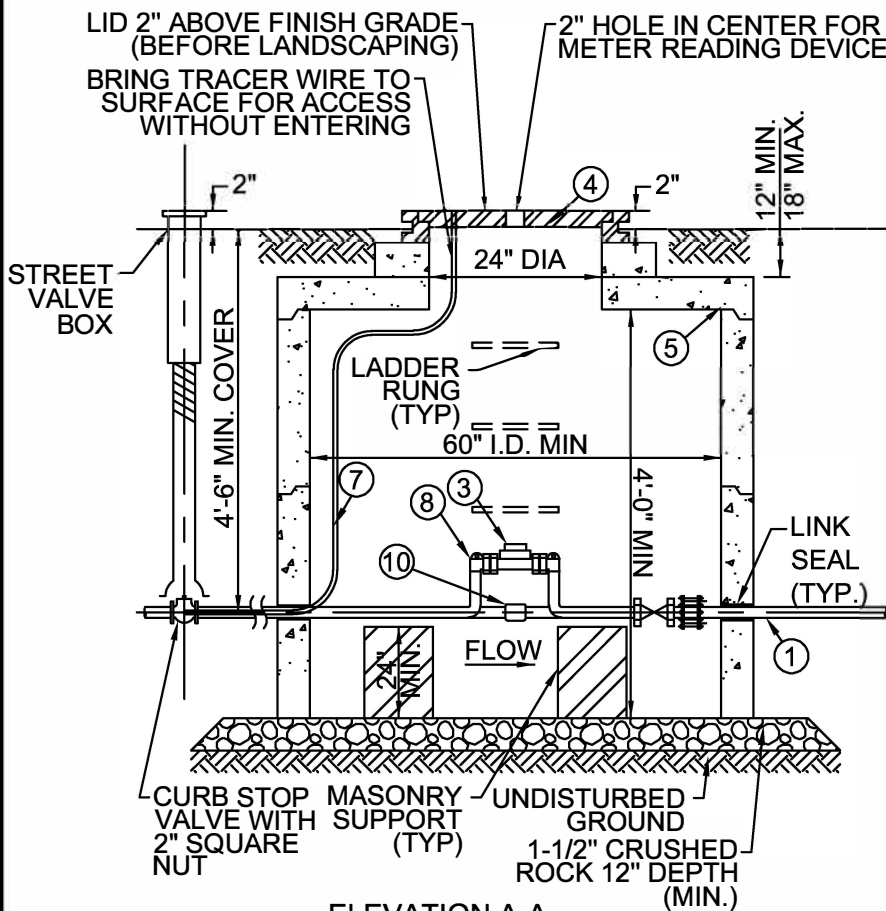
REV. DATE: 2025

**Kennedy Jenks**

215 Union Boulevard, Suite 500  
 Lakewood, CO 80228 P: 303.985.3636



PLAN



ELEVATION A-A

**MATERIALS:**

- ⑧ 12" COPPERSETTER / METER YOKE WITH BYPASS:
  - FORD "CUSTOM SETTER" METER UNIT
  - 1½" MODEL NO. VBH76-12B-11-66-NL, METER SPACING = 13"
  - 2" MODEL NO. VBH77-12B-11-77-ML METER SPACING = 17"
  - YOKE SHALL HAVE LOCKING ANGLE BALL METER ON INLET & ANGLE CHECK VALVE ON OUTLET
- ⑨ CHECK VALVE
- ⑩ LOCKING BYPASS VALVE

**NOTES:**

1. WATER METER FURNISHED BY DISTRICT. INSTALLATION TO BE DONE BY CONTRACTOR
2. SERVICE LINE MUST HAVE MIN. 4.5 FEET OF COVER.
3. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE MAIN TO THE METER PRIOR TO BACKFILLING.
4. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE METER TO THE BUILDING PRIOR TO BACKFILLING.
5. CONCRETE SHALL NOT BE LAID IN FLOOR OF METER MANHOLE.
6. MANHOLE BASE BEAMS REQUIRED FOR INSTALLATIONS IN DRIVEWAYS OR PARKING AREAS.
7. FIELD SOLDERED JOINTS OR PLASTIC PIPE ARE NOT ALLOWED IN METER MANHOLE.
8. DISTRICT PERSONNEL SHALL INSPECT THE CORPORATION STOP AND INSULATING COUPLING PRIOR TO BACKFILLING.
9. NO TAPS OR CONNECTIONS ALLOWED WITHIN 5 FEET OF THE METER.
10. ALL BOLTS SHALL BE STAINLESS STEEL.
11. NO BACKFLOW PREVENTION ASSEMBLY ALLOWED IN METER PIT
12. NO FLARE FITTINGS.

**MATERIALS:**

- ① WATER SERVICE LINE - COPPER TUBING (TYPE K) 4.5 FEET MIN. COVER
- ② CURB STOP VALVE WITH 2" SQUARE NUT AND ARCH-PATTERN BUFFALO STYLE VALVE BOX
- ③ WATER METER
- ④ RING AND COVER - 24" DEETER #1258 OR CASTINGS INC. C.I.24 RECESSED OR EQUAL, "WATER" CAST INTO COVER. LIDS SHOULD HAVE 2" HOLE IN THE CENTER. ALL COVERS SHOULD BE H-20 TRAFFIC LOADING RATED.
- ⑤ PRECAST 60" ID MANHOLE - ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP, AND CONCRETE ADJUSTMENT RINGS.
- ⑥ COPPER TUBE COMPRESSION UNION
- ⑦ TRACER WIRE



**1-1/2" AND 2" WATER METER MANHOLE WITH BYPASS**

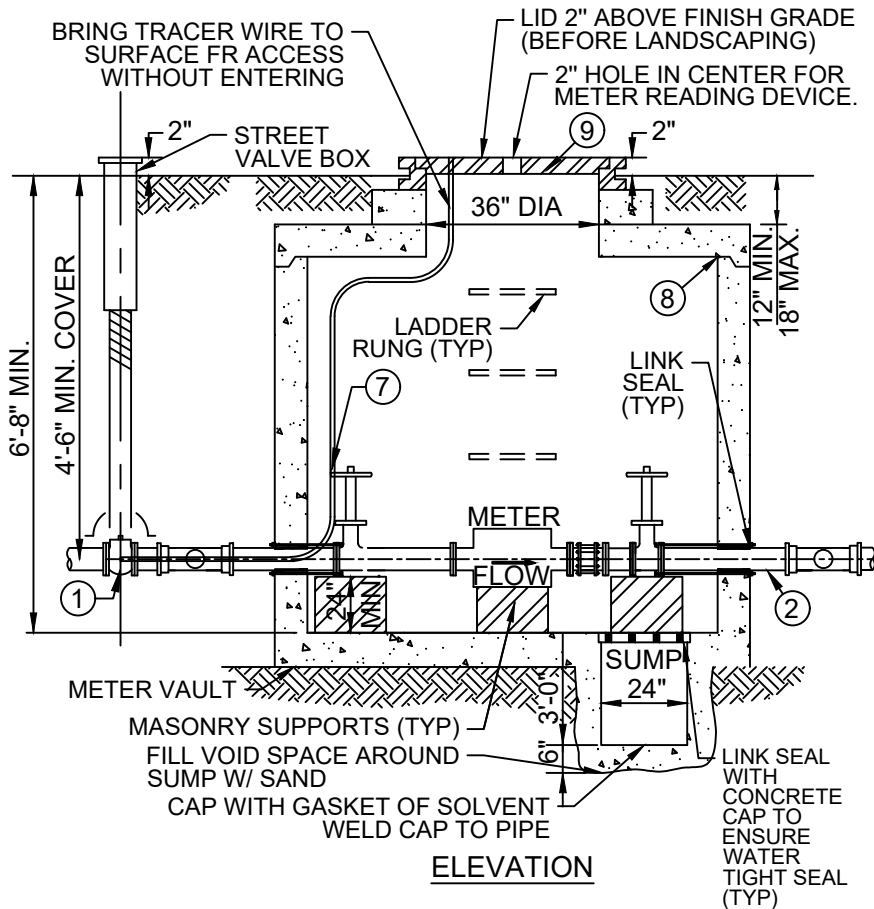
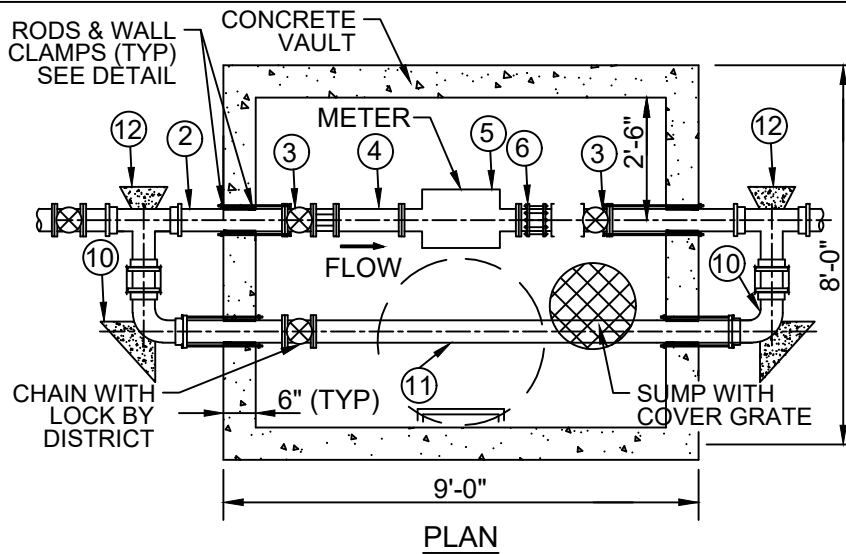
DRAWING NO.: ECCV-49W

DATE: 2024

REV. DATE: 2025

**Kennedy Jenks**

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Lakewood, CO 80228 P: 303.985.3636



**NOTES:**

1. WATER METER FURNISHED BY DISTRICT. INSTALLATION TO BE DONE BY CONTRACTOR
2. SERVICE LINE MUST HAVE MIN. 4.5 FEET OF COVER.
3. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE MAIN TO THE METER PRIOR TO BACKFILLING.
4. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE METER TO THE BUILDING PRIOR TO BACKFILLING.
5. GEOTECHNICAL NOTE: A SOILS REPORT WILL BE REQUIRED FOR METERS 3" AND LARGER
6. FIELD SOLDERED JOINTS OR PLASTIC PIPE ARE NOT ALLOWED IN METER MANHOLE.
7. DISTRICT PERSONNEL SHALL INSPECT THE CORPORATION STOP AND INSULATING COUPLING PRIOR TO BACKFILLING.
8. NO TAPS OR CONNECTIONS ALLOWED WITHIN 5 FEET OF THE METER.
9. BYPASS NOT REQUIRED FOR IRRIGATION ONLY METER SETTINGS.
10. ALL BOLTS SHALL BE STAINLESS STEEL.
11. NO BACKFLOW PREVENTION ASSEMBLY ALLOWED IN METER PIT
12. NO FLARE FITTINGS.

**MATERIALS:**

- ① FOR 3" METER- CORPORATION STOP AND CURB STOP WITH SQUARE NUT FOR 4" METER- TEE OR WET TAP AND 4" GATE VALVE
- ② FOR 3" METER- WATER SERVICE LINE COPPER TUBING (TYPE K) OR DIP FOR 4" METER- WATER SERVICE LINE DIP
- ③ FLANGED HAND WHEEL GATE VALVE, OPEN LEFT
- ④ MINIMUM OF FIVE DIAMETERS OF STRAIGHT PIPE
- ⑤ BADGER COMPOUND WATER METER PROVIDED BY ECCV, PAID BY CONTRACTOR/ OWNER
- ⑥ DRESSER COUPLING
- ⑦ TRACER WIRE

**MATERIALS:**

- ⑧ PRECAST CONCRETE VAULT ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP, AND CONCRETE ADJUSTMENT RINGS.
- ⑨ RING AND COVER - 24"x36" NEENAH R-1740-D2 OR EQUAL, "WATER" CAST INTO COVER. LIDS SHOULD HAVE A 2" HOLE IN THE CENTER. ALL COVERS SHOULD BE H-20 TRAFFIC LOADING RATED.
- ⑩ TEE OR BEND WITH KICKBLOCK
- ⑪ BYPASS



**3" AND 4" WATER METER VAULT WITH BYPASS**

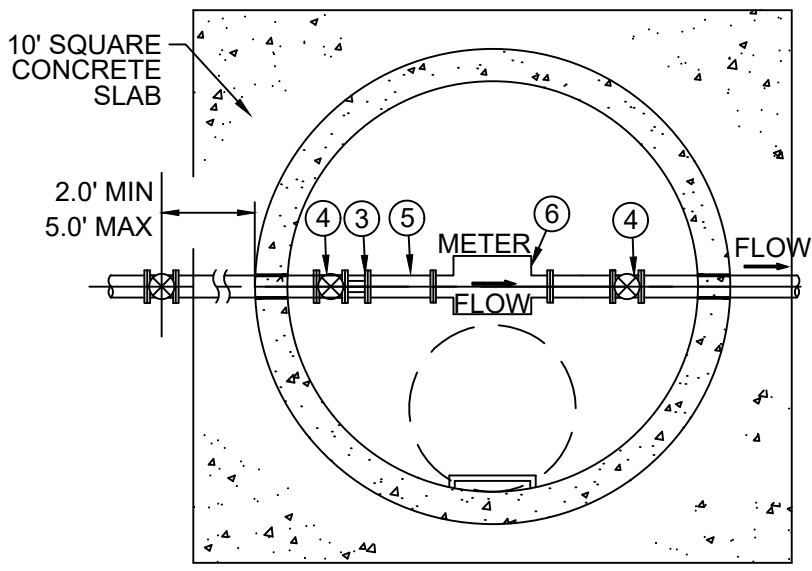
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DATE: 2024

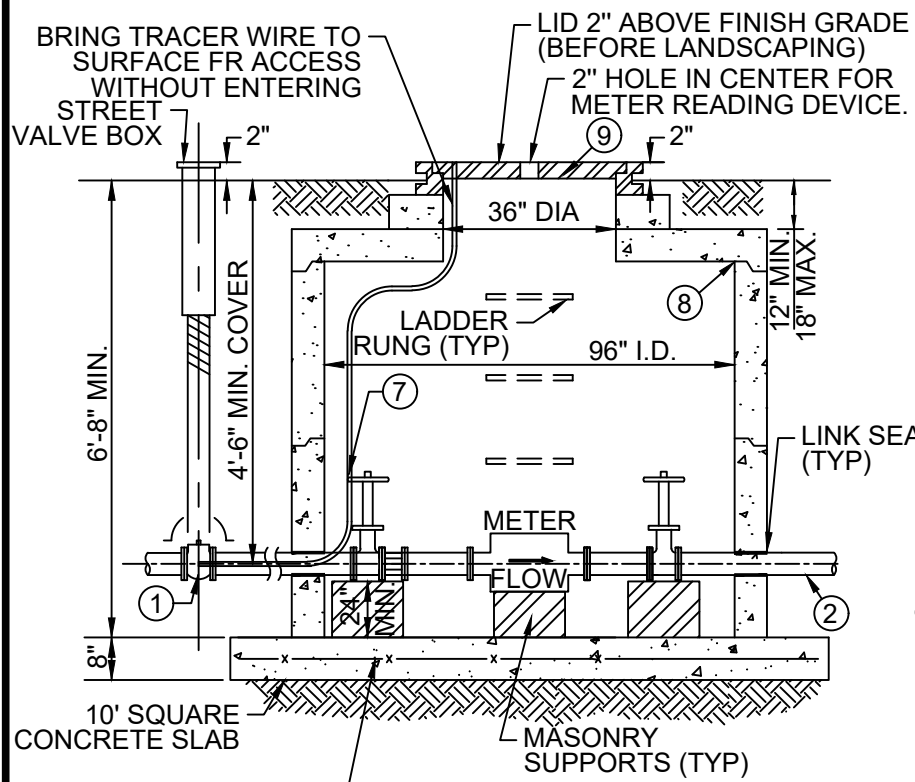
REV. DATE:

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Lakewood, CO 80228 P: 303.985.3636



**PLAN**



**ELEVATION**

- NOTES:**
1. WATER METER FURNISHED BY DISTRICT. INSTALLATION TO BE DONE BY CONTRACTOR
  2. SERVICE LINE MUST HAVE MIN. 4.5 FEET OF COVER.
  3. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE MAIN TO THE METER PRIOR TO BACKFILLING.
  4. DISTRICT PERSONNEL SHALL INSPECT THE SERVICE LINE FROM THE METER TO THE BUILDING PRIOR TO BACKFILLING.
  5. CONCRETE SHALL NOT BE LAID IN FLOOR OF METER PIT, USE A SLAB.
  6. GEOTECHNICAL NOTE: A SOILS REPORT WILL BE REQUIRED FOR METERS 3" AND LARGER
  7. FIELD SOLDERED JOINTS OR PLASTIC PIPE ARE NOT ALLOWED IN METER MANHOLE.
  8. DISTRICT PERSONNEL SHALL INSPECT THE CORPORATION STOP AND INSULATING COUPLING PRIOR TO BACKFILLING.
  9. NO TAPS OR CONNECTIONS ALLOWED WITHIN 5 FEET OF THE METER.
  10. BYPASS NOT REQUIRED FOR IRRIGATION ONLY METER SETTINGS.
  11. ALL BOLTS SHALL BE STAINLESS STEEL.
  12. NO BACKFLOW PREVENTION ASSEMBLY ALLOWED IN METER PIT
  13. NO FLARE FITTINGS.

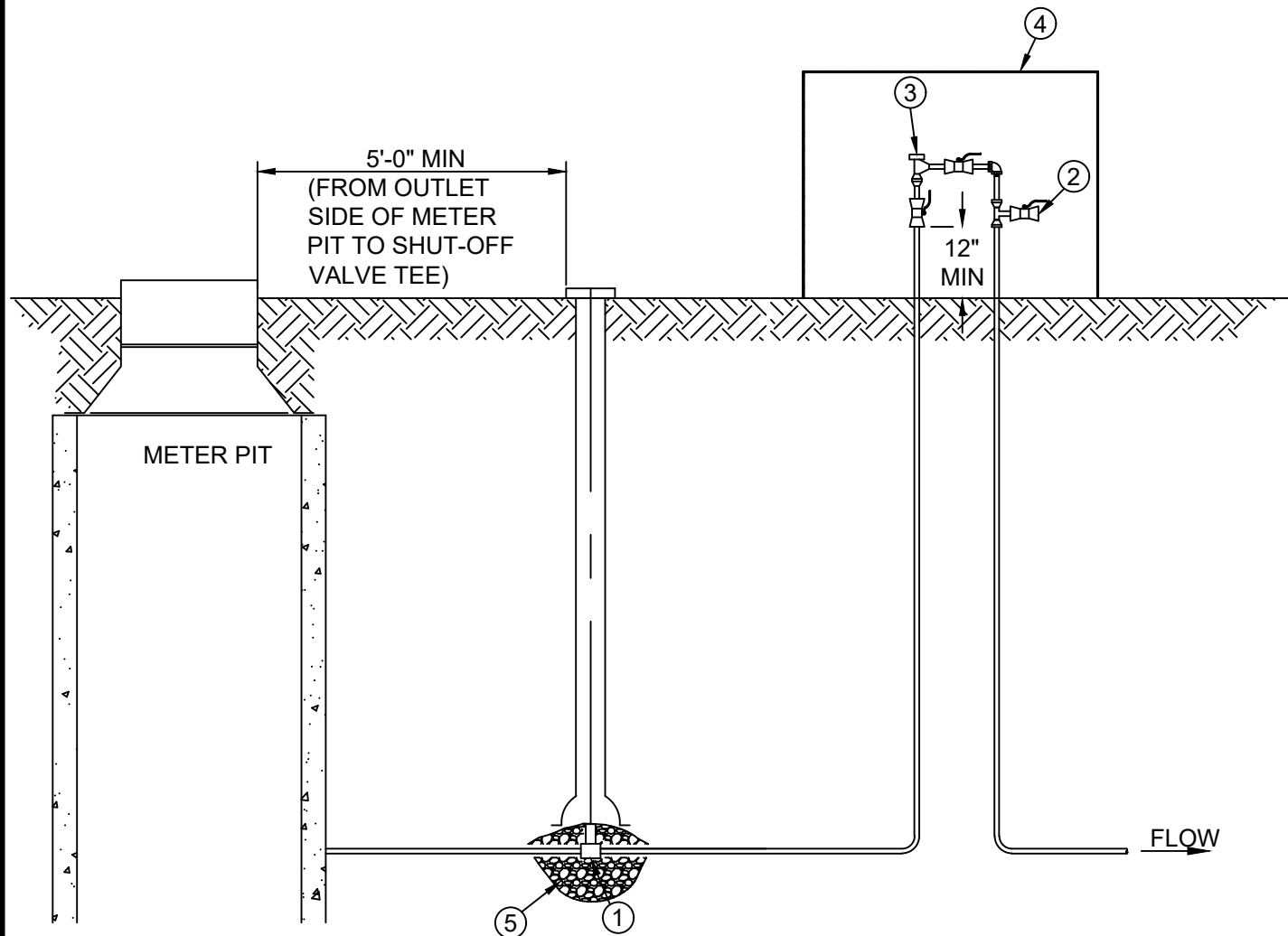
- MATERIALS:**
- ① FOR 3" METER- CORPORATION STOP AND CURB STOP WITH SQUARE NUT FOR 4" METER- TEE OR WET TAP AND 4" GATE VALVE
  - ② FOR 3" METER- WATER SERVICE LINE COPPER TUBING (TYPE K) OR DIP FOR 4" METER- WATER SERVICE LINE (DIP)
  - ③ WATER STRAINER
  - ④ FLANGED HAND WHEEL GATE VALVE, OPEN LEFT
  - ⑤ MINIMUM OF FIVE DIAMETERS OF STRAIGHT PIPE
  - ⑥ BADGER COMPOUND WATER METER PROVIDED BY ECCV, PAID BY CONTRACTOR/ OWNER
  - ⑦ TRACER WIRE- BRING WIRE TO SURFACE FOR ACCESS WITH ENTERING MANHOLE

- MATERIALS:**
- ⑧ PRECAST 96" ID MANHOLE- ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP, AND CONCRETE ADJUSTMENT RINGS.
  - ⑨ RING AND COVER - 24"x36" NEENAH R-1740-D2 OR EQUAL, "WATER" CAST INTO COVER. LIDS SHOULD HAVE A 2" HOLE IN THE CENTER. ALL COVERS SHOULD BE H-20 TRAFFIC LOADING RATED.



**3" AND 4" IRRIGATION ONLY METER IN MANHOLE**

DRAWING NO.: ECCV-51W  
 DATE: 2024  
 REV. DATE:

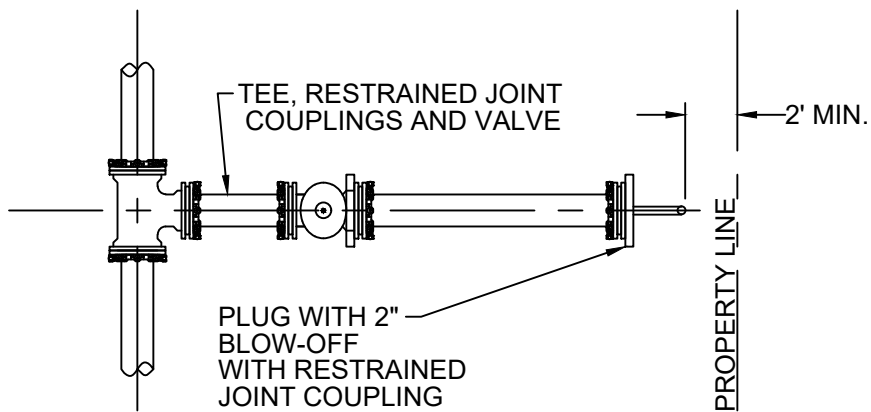
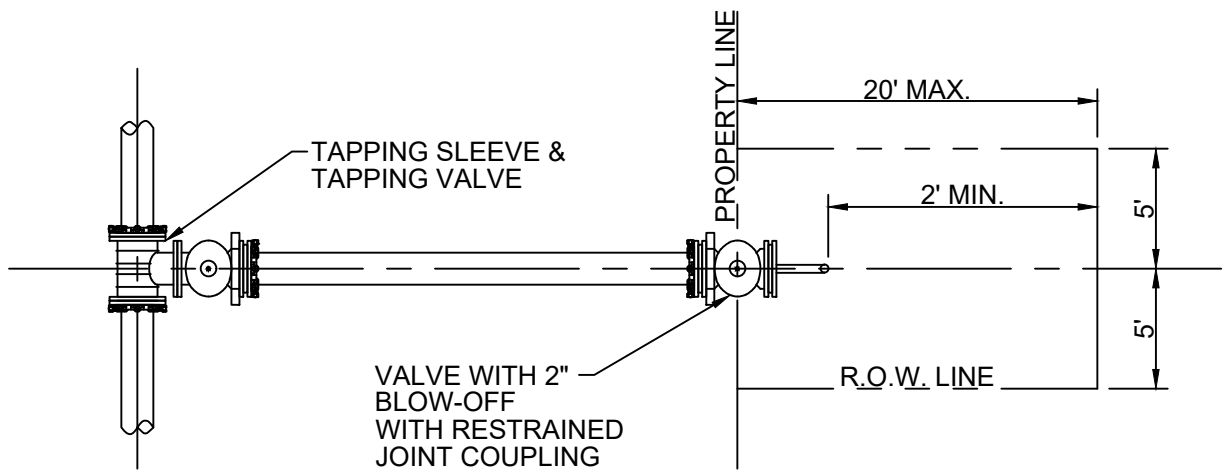


**DESCRIPTION:**

- ① IRRIGATION SHUT-OFF VALVE. STOP AND WASTE WITH CHECK DEVICE ON WASTE LINE. (FORD BC11-333SW-NL, MCDONALD 72017, PROLINE SERIES 105-18NL, B&K 905-104 OR APPROVED EQUAL.
- ② FLUSH/INJECTION PORT WITH VALVE AND PLUG. VALVE TO MATCH SERVICE SIZE.
- ③ REDUCED PRESSURE ZONE DEVICE.
- ④ BACKFLOW PREVENTER CAGE.
- ⑤ INSTALL 1/4 CU. YARD OF 1 1/2" CRUSHED ROCK AND MIRIFI FABRIC UNDER AND AROUND VALVE.

**NOTES:**

- 1. CONTRACTOR MAY INSTALL ANY SIZE AIR-INJECTOR PORT UPSTREAM OF REDUCED PRESSURE ZONE DEVICE.
- 2. ALL INJECTOR EQUIPMENT MUST BE LOCATED IN BACKFLOW PREVENTER CAGE.



**KJ** Kennedy Jenks

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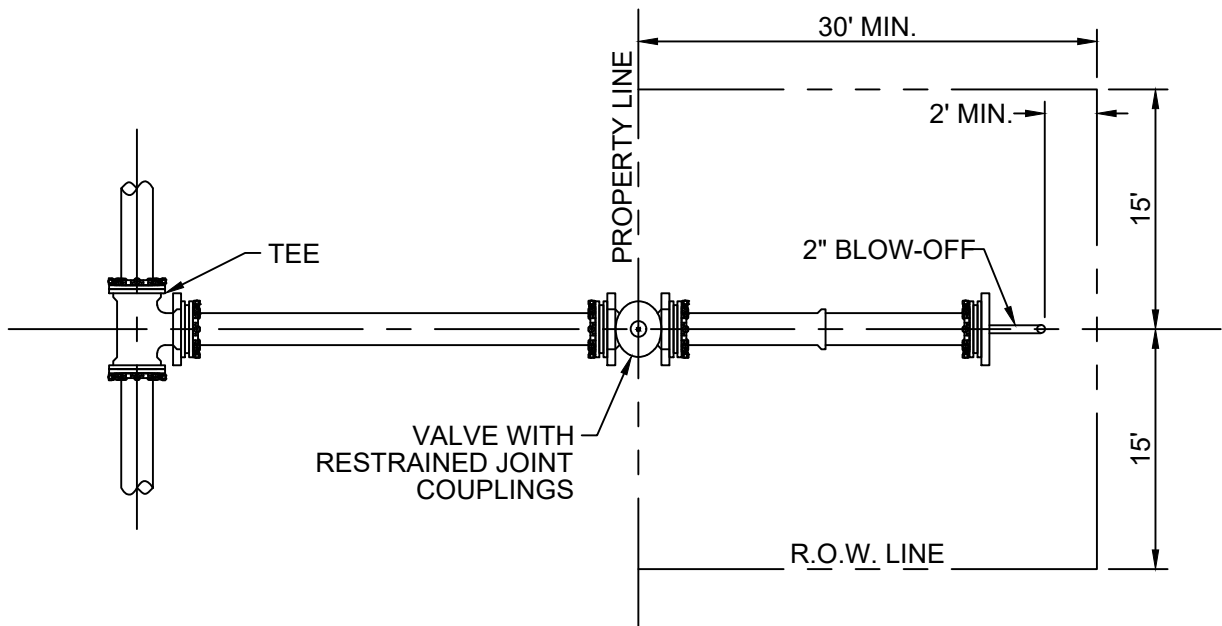
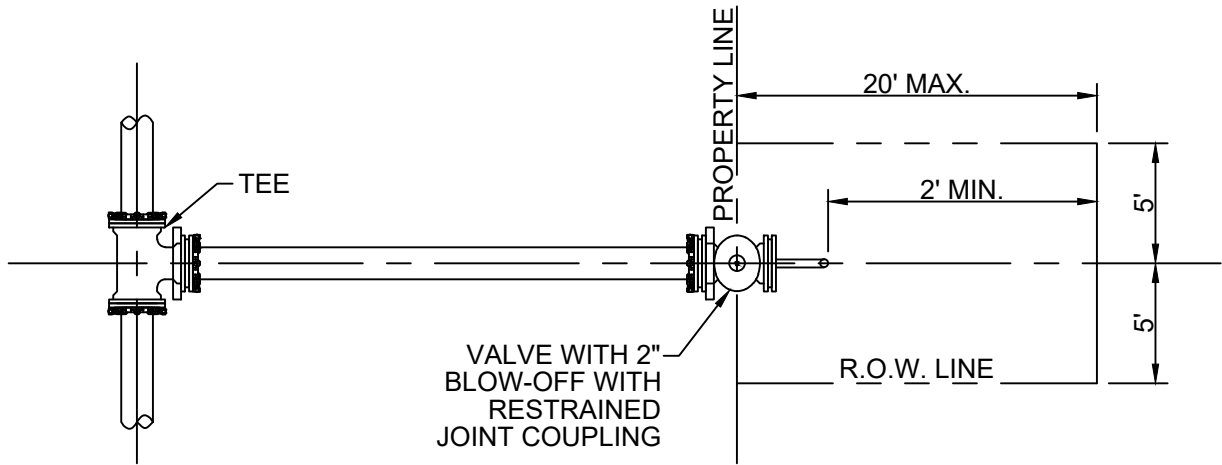


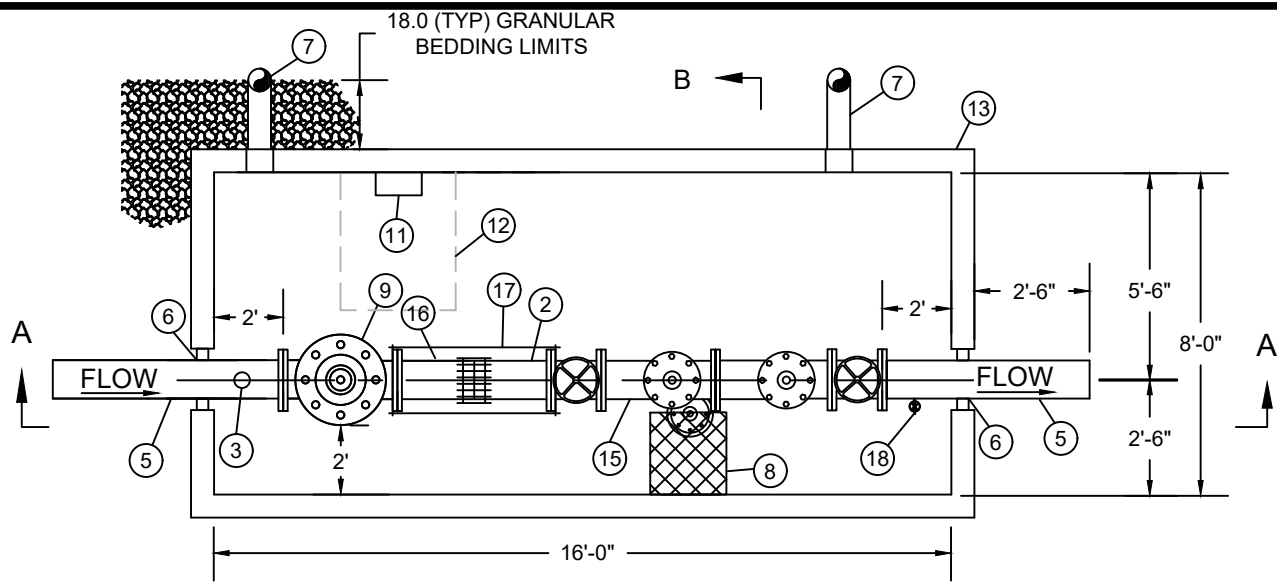
**STUB-OUT  
CONFIGURATIONS (1 OF 2)**

DRAWING NO.: ECCV-53W

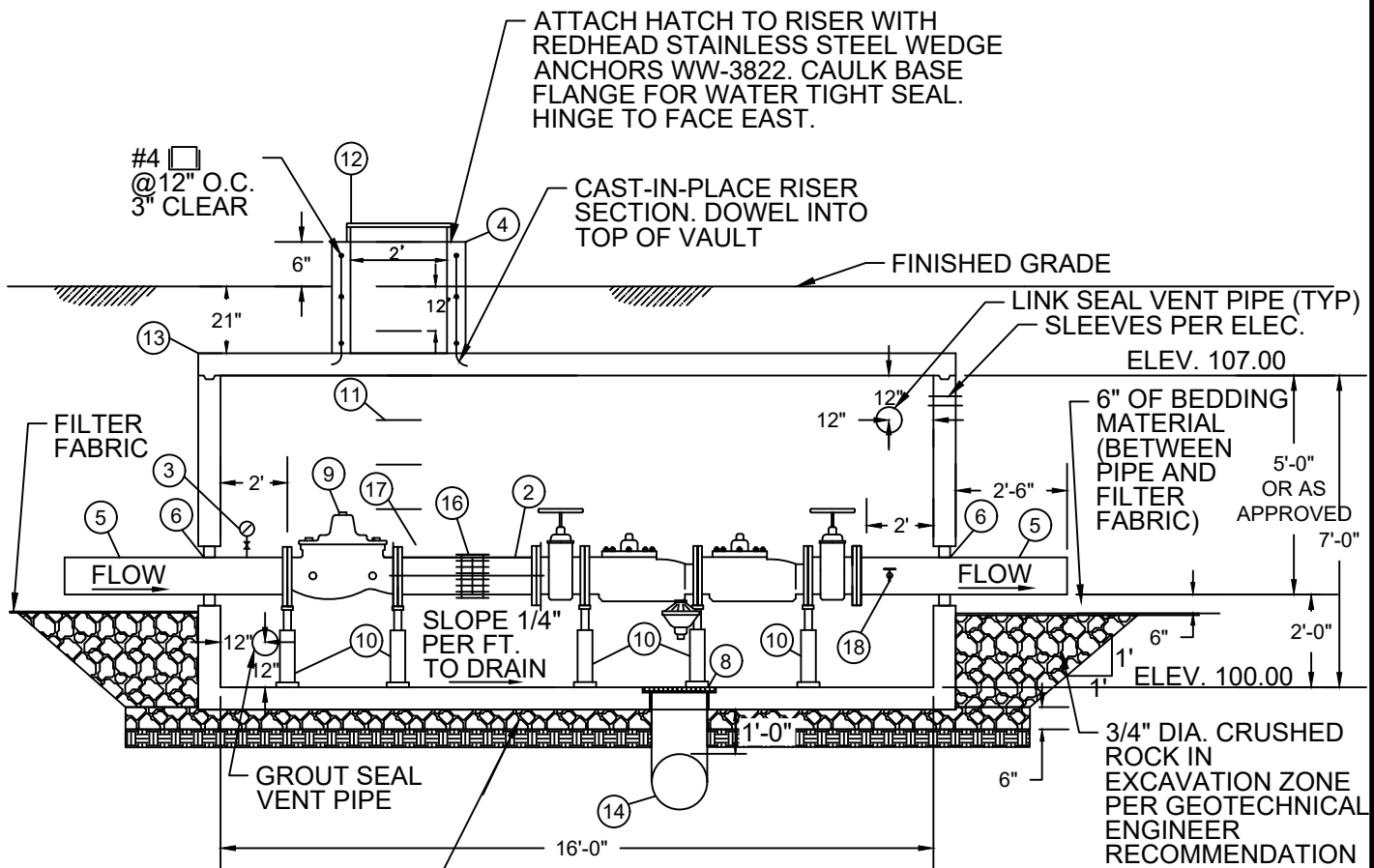
DATE: 2024

REV. DATE:





**CONTROL VALVE /  
REDUCED PRESSURE BACKFLOW PREVENTER VAULT  
PLAN VIEW**



**SECTION A-A**

LEVELING COURSE OF 3/4" CRUSHED ROCKER UNDER VAULT PER GEOTECHNICAL ENGINEER RECOMMENDATION

ATTACH HATCH TO RISER WITH REDHEAD STAINLESS STEEL WEDGE ANCHORS WW-3822. CAULK BASE FLANGE FOR WATER TIGHT SEAL. HINGE TO FACE EAST.

#4 @ 12" O.C. 3" CLEAR

CAST-IN-PLACE RISER SECTION. DOWEL INTO TOP OF VAULT

LINK SEAL VENT PIPE (TYP) SLEEVES PER ELEC.

ELEV. 107.00

6" OF BEDDING MATERIAL (BETWEEN PIPE AND FILTER FABRIC) 5'-0" OR AS APPROVED 7'-0"

3/4" DIA. CRUSHED ROCK IN EXCAVATION ZONE PER GEOTECHNICAL ENGINEER RECOMMENDATION

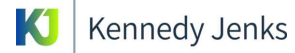


**CONTROL VALVE AND REDUCED PRESSURE BACKFLOW PREVENTER VAULT (1 OF 2)**

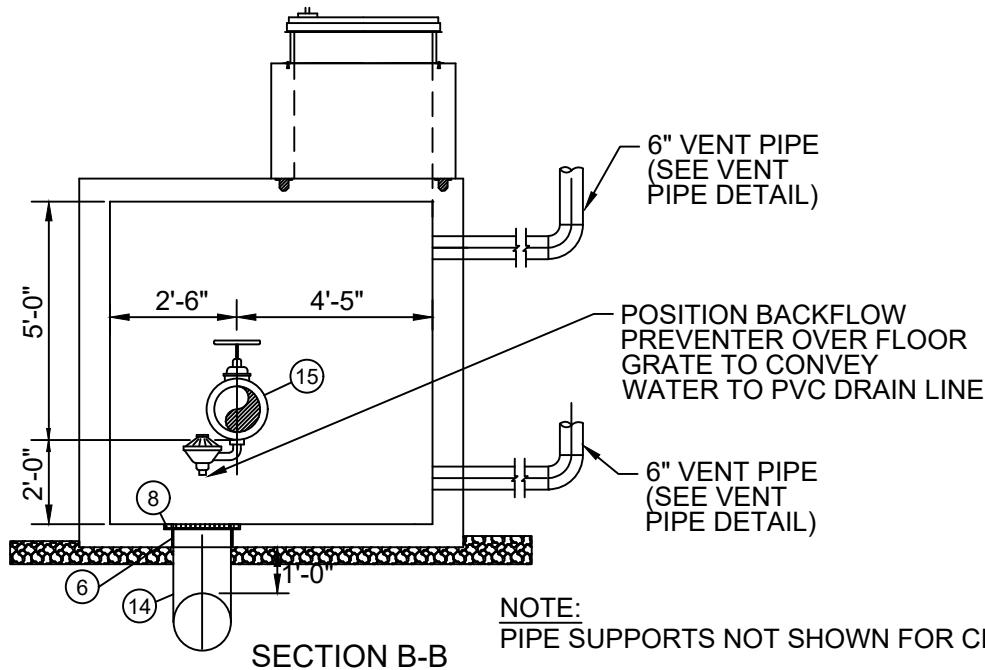
DRAWING NO.: ECCV-55W

DATE: 2024

REV. DATE:



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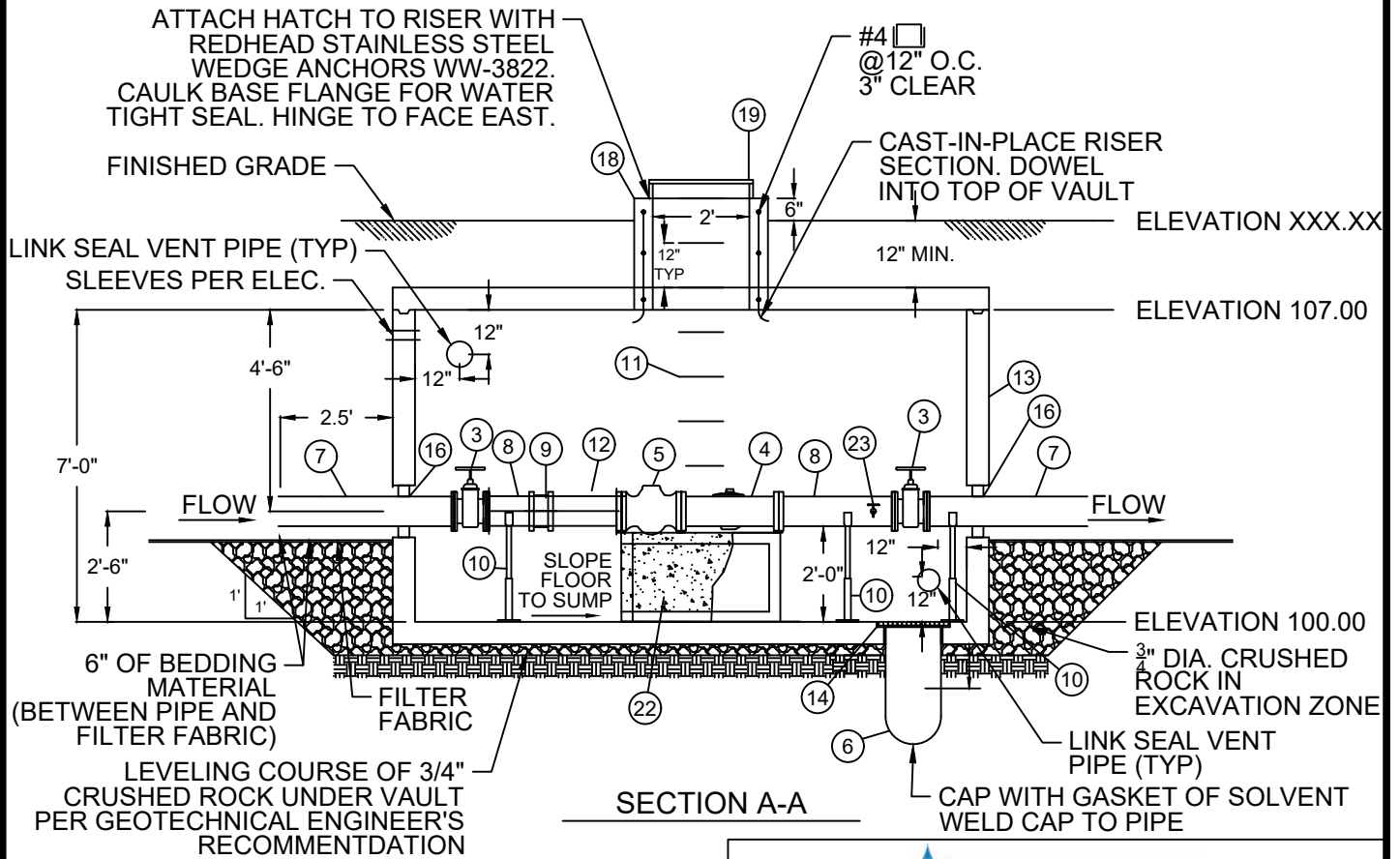
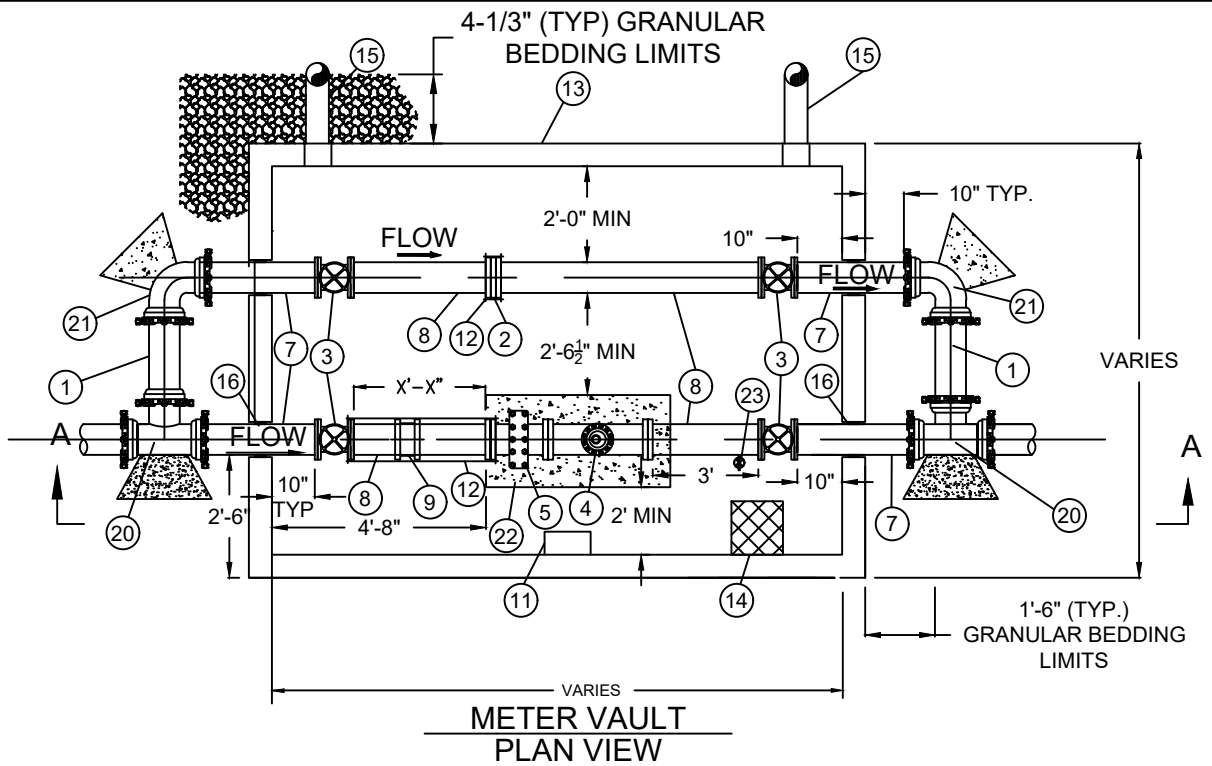


### NOTES

1. GRANULAR BEDDING FOR THE PERIMETER DRAIN SYSTEM IF REQUIRED SHOULD CONTAIN LESS THAN 5% PASSING THE NO. 200 SIEVE, LESS THAN 50% PASSING THE NO. 4 SIEVE AND HAVING A MAXIMUM SIZE OF 2 INCHES. WRAP THE PERIMETER DRAIN BEDDING IN MIRAFI FILTER FABRIC, OR APPROVED EQUAL.
2. VERIFY ALL QUANTITIES.
3. ALL PIPE INSIDE VAULT SHALL BE CLASS 53 DUCTILE IRON.
4. RESTRAIN ALL FITTINGS AND JOINTS.
5. CONTROL VALVE OPERATING REQUIREMENTS - NORMAL OPERATION FLOW RANGE = X TO X GPM AT X PSI. MAX INTERMITTENT FLOW = X GPM
6. PAINT ALL NEW FERROUS BASED PIPE FITTINGS, VALVES, AND APPURTENANCES. CLEAN ALL FERROUS MATERIALS BY HAND IN ACCORDANCE WITH SSPC-SP2 AND PRIME. ALL CHIPPED AND/OR DAMAGED PAINT ON NEW COLOR PIPE SHALL BE REPRIMED, AND COLOR REPAINTED. PAINT SHALL BE ALKYD ENAMEL APPLIED IN TWO COLOR COATS IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
7. ALL BURIED DUCTILE IRON SHALL BE POLYETHYLENE WRAPPED.
8. PROVIDE CONDUITS FOR ELECTRICAL CONNECTION. SEE ELECTRIC DRAWINGS.
9. GROUT ALL VAULT PENETRATIONS FOR USING NON-SHRINK GROUT.
10. CONTACT ECCV FOR BACKFLOW PREVENTER DEVICE LOCATION APPROVAL PRIOR TO INSTALLATION.
11. ECCV TO PROVIDE PADLOCKS FOR HATCH

### LIST OF MATERIALS

NO.	DESCRIPTION
1	MEGA FLANGE EBBA IRON SERIES 2100
2	FL x FL DIP
3	PRESSURE GAUGE
4	CONCRETE RISER (RECTANGULAR)
5	FL x PE DIP
6	WALL PENETRATION (LINK SEAL)
7	6" VENT PIPE
8	FLOOR GRATE COVER (1" THICK FIBERGLASS W 1 1/2" SQUARE GRID) OR APPROVED EQUAL. CUT TO ALLOW FOR REMOVAL WHEN PIPING INSTALLED. LINK SEAL FOR WATER TIGHT SEAL.
9	CONTROL VALVE (IF REQUIRED)
10	ADJUSTABLE PIPE SUPPORT
11	MANHOLE STEPS
12	36" x 24" BILCO SECURITY SERIES ROOF SCUTTLE, MODEL S-50C, ALUMINUM, LOCKABLE. NO SUBSTITUTIONS ACCEPTED.
13	PRECAST AMCOR METER VALT LENGTH VARIES MINMUM 7'x8' (HxW)
14	DRAIN LINE TO DAYLIGHT. FILL VOID SPACE AROUND SUMP WITH SAND
15	REDUCED PRESSURE PRINIPAL BACKFOW PREVENTER ASSEMBLY WITH LEFT HAND MOUNT
16	RELIEF VALVES (CLA-VAL, MODEL RP-4, OR APPROVED EQUAL). GATE VALVES TO BE NRS (OPEN RIGHT)
17	COUPLING. PROVIDE 1/2" SEPARATION BETWEEN FL x PE SPOOLS AT COUPLING RODDING. TWO (2) 3/4" DIA. M.S. RODS AND FOUR (4) FLANGE LUGS PER DISTRICT STANDARDS
18	SAMPLE TAP SPIGOT (90° OUTLET TO FLOOR)



**METER VAULT (UP TO 12") AND  
SCADA PLATFORM (1 OF 2)**

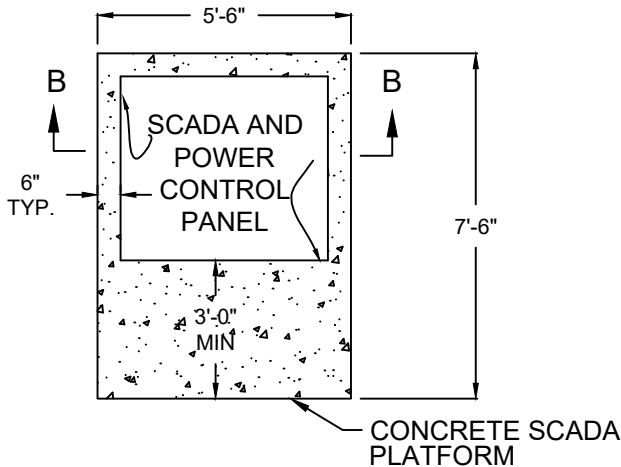
DRAWING NO.: ECCV-57W

DATE: 2024

REV. DATE:

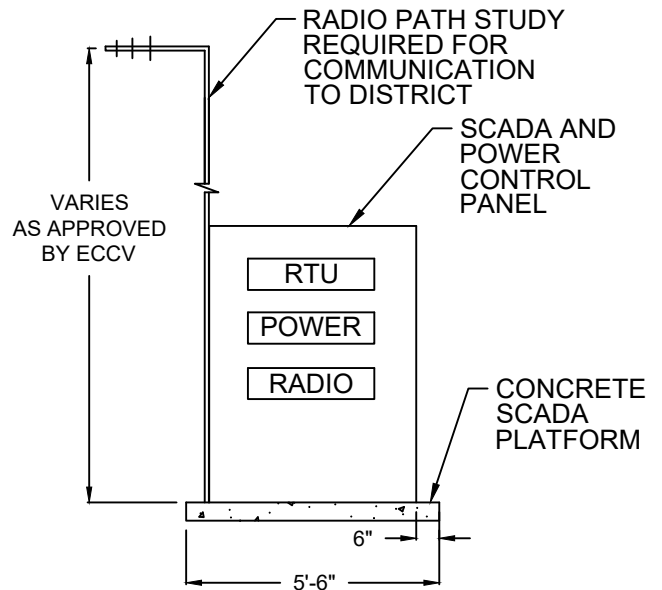


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**SCADA PLATFORM  
PLAN VIEW**

(ADJUST LOCATION PER SITE)



**SECTION B-B**

**NOTES:**

1. VERIFY ALL QUANTITIES.
2. ALL PIPE INSIDE VAULT SHALL BE CLASS 53 DUCTILE IRON.
3. RESTRAIN ALL FITTINGS AND JOINTS.
4. METER OPERATING REQUIREMENTS - NORMAL OPERATION FLOW RANGE= x TO x GPM.
5. METER MUST BE CALIBRATED AND TESTED PRIOR TO INSTALLATION.
6. PAINT ALL NEW FERROUS BASED PIPE FITTINGS, VALVES, AND APPURTENANCES. CLEAN ALL FERROUS MATERIALS BY HAND IN ACCORDANCE WITH SSPC-SP2 AND PRIME. ALL CHIPPED AND/OR DAMAGED PAINT ON NEW COLOR PIPE SHALL BE REPRIMED, AND COLOR REPAINTED. PAINT SHALL BE ALKYD ENAMEL APPLIED IN TWO COLOR COATS IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
7. ALL BURIED DUCTILE IRON PIPE SHALL BE POLYETHYLENE WRAPPED.
8. PROVIDE CONDUITS FOR ELECTRICAL AND METER MODULE CONNECTION.
9. ECCV TO PROVIDE PADLOCKS FOR HATCH.
10. COORDINATE WITH ECCV ON SCADA SYSTEM REQUIREMENTS FOR METERING VAULT ENTRANCE ALARMS, COMMUNICATION, SCADA PROGRAMMING.
11. ALARMS SHALL BE TRANSITIONED THROUGH SCADA AND SHALL INCLUDE VAULT INTRUSION, WATER ON THE FLOOR AND POWER FAILURE.
12. COORDINATE WITH POWER COMPANY FOR POWER SUPPLY TO SCADA PANEL.
13. BYPASS PIPING TO BE SUPPORTED WITH PIPE SUPPORTS ON EACH SIDE OF VALVES.
14. RODS, CLAMPS, AND FLANGE LUGS PER DISTRICT STANDARDS. TWO (2)  $\frac{3}{4}$ " DIA. M.S. RODS, ONE (1) CLAMP, AND (2) FLANGE LUGS USED FROM FL TO PE THROUGH VAULT.

**LIST OF MATERIALS**

NO.	DESCRIPTION
1	CLASS 50 DI PIPE
2	BLIND FLANGE WITH PLUG
3	FL GATE VALVE WITH HANDWHEEL. RIGHT OPEN (CLOCKWISE)
4	FL x FL TURBINE METER WITH AWWA STRAINER
5	FL x FL STRAINER FOR METER
6	24" SUMP. FILL VOID SPACE AROUND SUMP W/ SAND
7	FL x PE DI PIPE
8	FL x FL DI PIPE
9	COUPLING. PROVIDE $\frac{1}{2}$ " SEPARATION BETWEEN FL x PE SPOOLS AT COUPLING
10	ADJUSTABLE PIPE SUPPORT.
11	MANHOLE STEPS.
12	RODDING. TWO (2) $\frac{3}{4}$ " DIA. M.S. RODS AND FOUR (4) FLANGE LUGS
13	12'-6" (L) x 6'-0" (W) x 7'-0" (H) AMCOR PRECAST METER VAULT. VERIFY VAULT SIZE.
14	FLOOR GRATE COVER (1" THICK FIBERGLASS W $1\frac{1}{2}$ " SQUARE GRID) OR APPROVED EQUAL. CUT TO ALLOW FOR REMOVAL WHEN PIPING INSTALLED. LINK SEAL FOR WATER TIGHT SEAL.
15	6" STEEL VENT PIPE.
16	WALL PENETRATION. USE LINK SEAL.
17	NOT USED
18	PRECAST CONCRETE RISER (RECTANGULAR)
19	36" x 24" BILCO SECURITY SERIES ROOF SCUTTLE, MODEL S-50C, ALUMINUM, LOCKABLE. NO SUBSTITUTIONS ACCEPTED.
20	MJ TEE WITH KICKBLOCK
21	MJ 90° BEND WITH KICKBLOCK
22	4'x2' CONCRETE BLOCK TO SUPPORT METER AND STRAINER. PROVIDE $\frac{1}{2}$ " SPACE BETWEEN BLOCK AND METER ASSEMBLY AND INSTALL SHIMS
23	SAMPLE TAP SPIGOT



**METER VAULT (UP TO 12") AND  
SCADA PLATFORM (2 OF 2)**

DRAWING NO.: ECCV-58W

DATE: 2024

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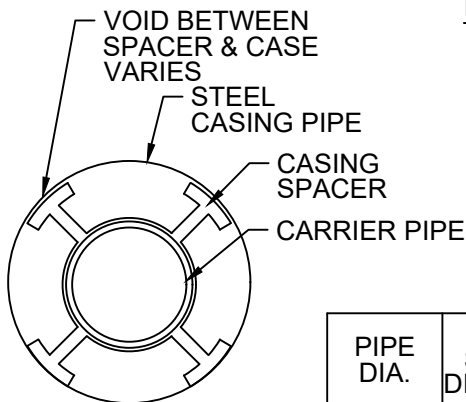
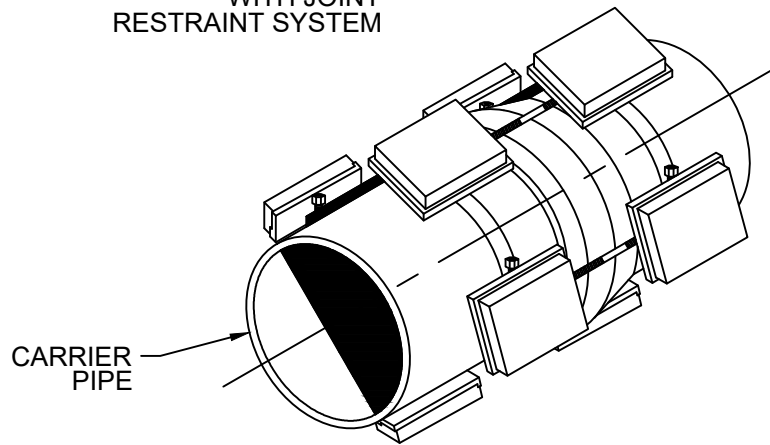
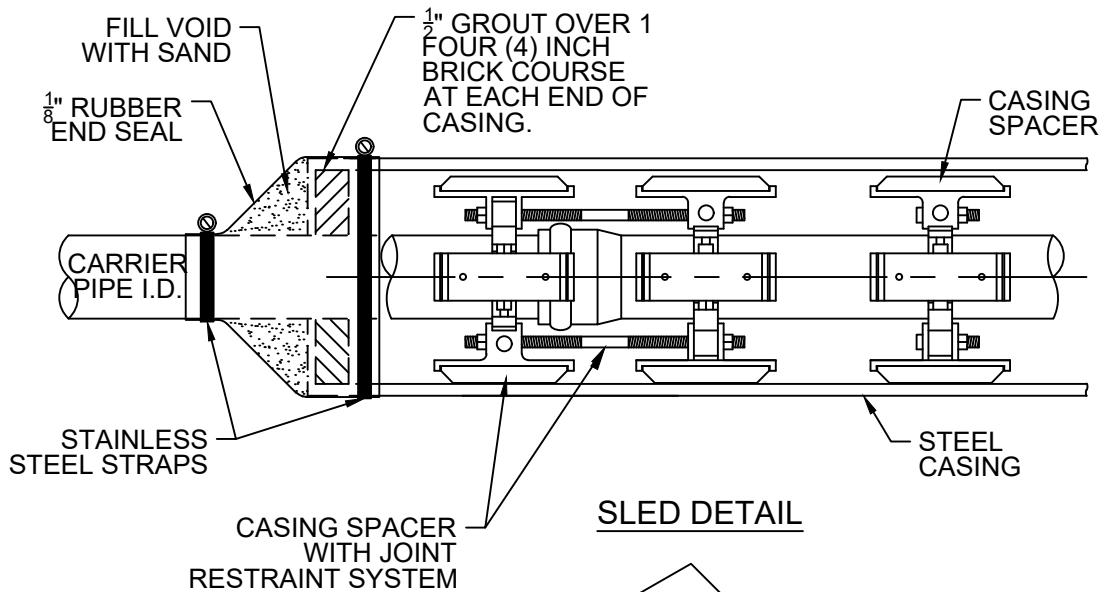
**ECCV**

Water & Sanitation District

DRAWING NO.: ECCV-59W

DATE: 2024

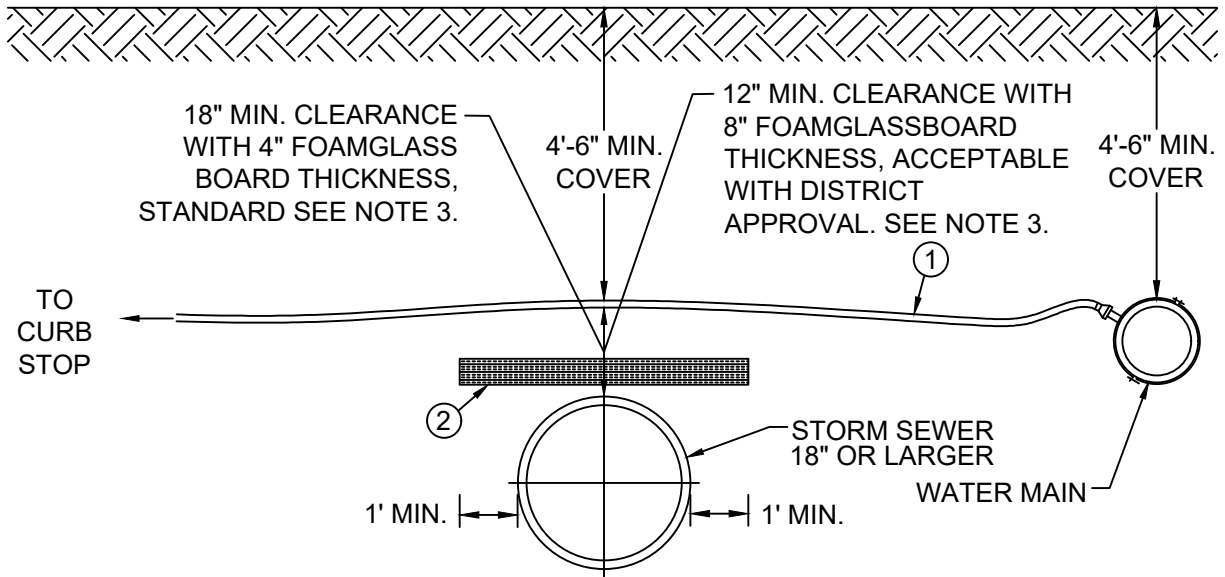
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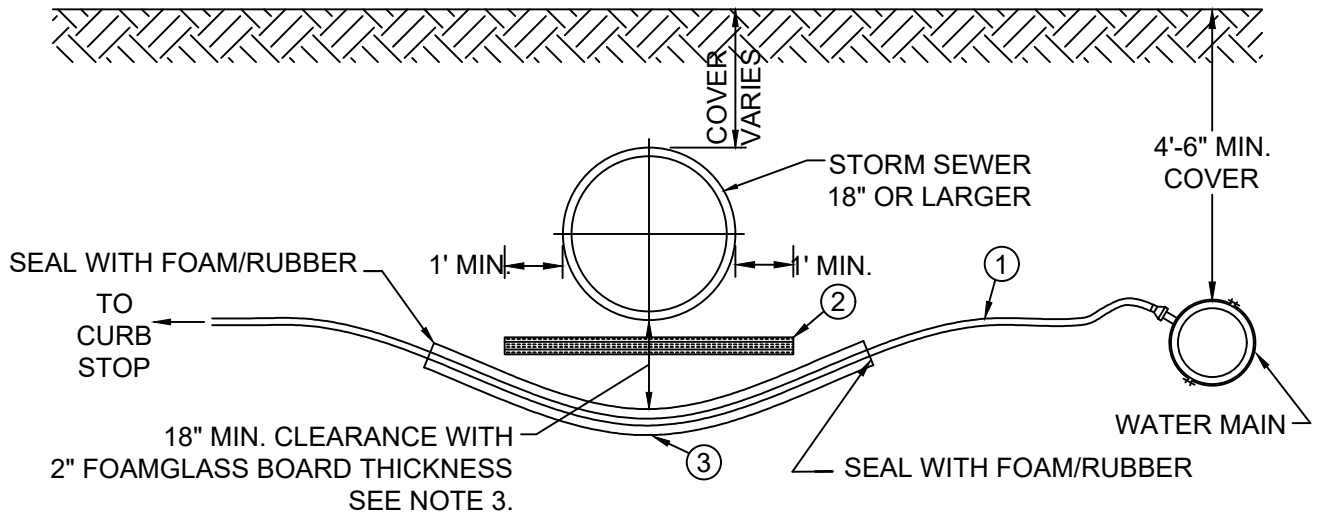
**NOTES:**

1. CASING SPACERS SHOULD BE INSTALLED WITHIN ONE FOOT OF BELL AND SPIGOT JOINT AND ONE IN CENTER OF PIPE.
2. PROVIDE UNIFLANGE RESTRAINED CASING SPACERS 1300 & 1390 OR EQUAL.

PIPE DIA.	CASING SPACER DIMENSION	CASING O.D.	PIPE WALL THICKNESS
6"	13.375"	16"	0.375"
8"	17.125"	18"	0.375"
12"	21.875"	24"	0.375"
16"	28.375"	30"	0.375"
24"	38.250"	40"	0.375"



**SERVICE CROSSING OVER STORM SEWER**



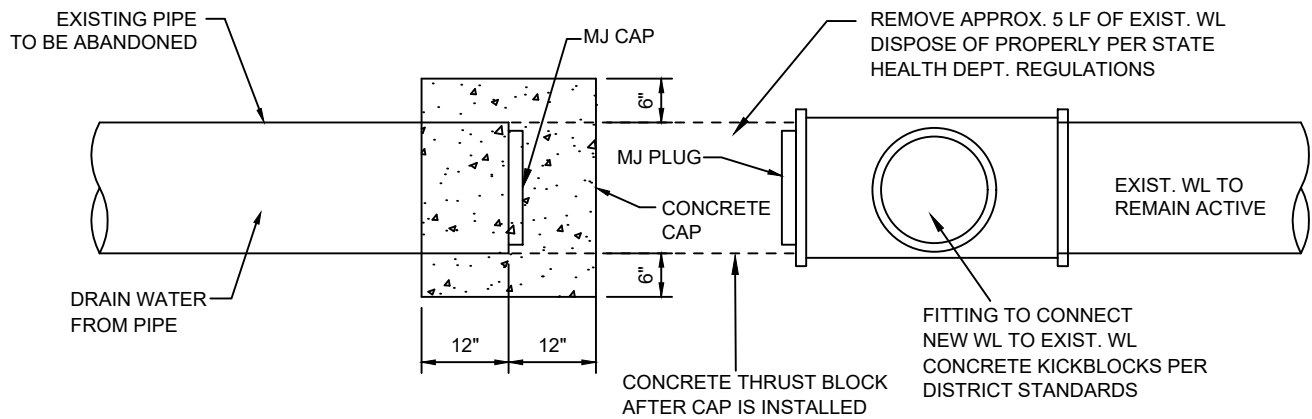
**SERVICE CROSSING UNDER STORM SEWER**

**MATERIAL DESCRIPTION:**

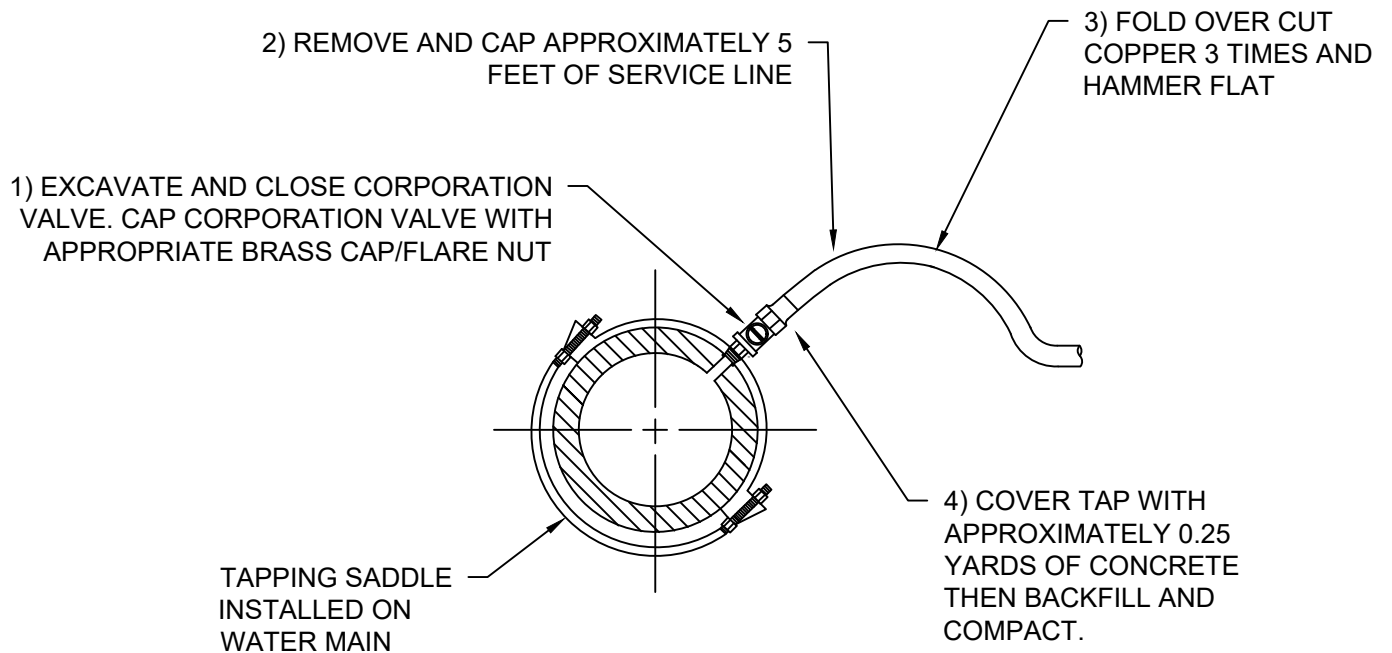
- ① SERVICE LINE - COPPER TUBING TYPE 'K' ONLY
- ② FOAMGLASS BOARD, WIDTH TO EQUAL TRENCH (APPROX. 3' TO 4')
- ③ 3" HDPE SLEEVE (SEALED WITH FOAM OR RUBBER)

**NOTES:**

1. SERVICE LINE MUST HAVE MIN. 4'-6" COVER AT ANY POINT ALONG LINE.
2. SEE 3/4" & 1" SERVICE METER DETAIL FOR ADDITIONAL INFORMATION.
3. MAINTAIN 2" MIN. CLEARANCE FROM FOAMGLASS BOARD TO BOTH STORM AND WATER SERVICE PIPES.
4. **NO FLARE FITTINGS.**



NOTE: VERIFY EXISTING PIPE IS DRAINED PRIOR TO INSTALLATION OF PLUG/CAP



**NOTES:**

1. EXCAVATE THE TAP AND CLOSE CORPORATION VALVE AT THE TAP.
2. REMOVE MINIMUM 5 FEET OF SERVICE PIPE AND CAP LINE.
3. POUR CONCRETE AROUND CUT SERVICE CONNECTION AFTER RE-ESTABLISHING THE POLY-WRAP. BACKFILL AND COMPACT.

**K** Kennedy Jenks

215 Union Boulevard, Suite 500  
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**WATER SERVICE LINE  
ABANDONMENT**

DRAWING NO.: ECCV-70W

DATE: 2024

REV. DATE:

## APPENDIX B

### WATER SYSTEM PLAN REQUIREMENTS CHECK LIST

#### GENERAL REQUIREMENTS

1. Sheet size (24" x 36").
2. Vicinity Map.
3. Location Map.
4. Index to drawings.
5. List of quantities.
6. List of agencies, including surveyor, soils engineer and involved agencies for the project.
7. General notes. (Refer to Appendix.)
8. Professional Engineer seal and signature on title sheet and each electrical and structural sheet (if included).
9. North arrow on vicinity map, location map and each plan view.
10. Title block on each sheet.
11. Benchmark, including U.S.G.S. datum, location, elevation and monument type.
12. Street alignment, existing and proposed, shown on overall plan.
13. Street names.
14. Horizontal curve data for street centerline and all curbs shown on plan, or recorded plat included in plan set.
15. Street grades, existing and proposed shown on profile.
16. Typical street cross-section(s).
17. Street addresses for all lots and/or buildings indicated on plan, or address plat included in plan set.
18. Lot and block numbers.
19. Property, easement, and tract lines shown on plan.
20. Private improvements identified.
21. Existing improvements identified.
22. Match lines and sheet references are called out in plan and profile.
23. Street cross-pans shown.
24. Center line of drainage channel(s) shown.
25. 100-year flood plain limits shown.
26. Recorded plat and signed address plat submitted.
27. Project in conformance with overall water system master plan.
28. Submit final plans in electronic format as .pdf or ACAD with final plans for acceptance/signing.
29. A signed Conveyance and Acceptance Application must be submitted to the District before the plans can be accepted for construction. Four (4) originals shall be provided.

#### WATER LINE REQUIREMENTS

##### A. General

1. Water line horizontal alignment generally 10' south and west of street centerline; 3' min. from lip of flow line or cross pan; 10' min. from R.O.W: line.

2. All water lines shown in plan and where required, profile. Profiles are required for lines 12-Inches or larger and for all lines at crossings with sanitary sewers, storm sewers and other utilities.
3. Water easement drawings and legal descriptions submitted with PLS seal and signature affixed.
4. Water system notes included (refer to attached).
5. Water system details included.
6. Signature of Fire Marshall on cover sheet with required Fire Flow.
7. Service tap locations, including size, to buildings, shown on as-builts.

B. Water Plan View

1. Scale: 1 " = 50' minimum
2. Pipe size and material called out.
3. All valves, fittings, fire hydrants, wet taps, thrust blocks, length of restraint, blow-offs and other appurtenances called out.
4. Water line linear footage between valves, fittings and appurtenances called out.
5. Radius of deflected water line called out. (3 degrees maximum deflection per joint for DIP; no horizontal deflection allowed for PVC).
6. Water lines dimensioned from street centerline or property line, and from other utilities, curb and gutter and other appurtenances.
7. Connections to existing system shown on plan and tied to property corner or section corner.
8. At least a 10' workable easement margin on each side of the water line.
9. Valves located at property line extensions. Valves required to isolate all fire hydrants, both ends of a water line through an easement or creek crossing and spaced to minimize the number of units put out of service during water line maintenance and repair work.
10. Valve and fitting markers included for water line.
11. Fire lanes called out.
12. PRV size and inlet and outlet pressures shown.
13. Match lines and sheet references.
14. All utility improvements including sanitary sewer and storm sewer, shown on plans.
15. Required length of restraint called out at each fitting and/or shown graphically.

C. Water Profile View (Required For Lines 12-Inches or Larger and for all lines at crossings with sanitary sewers, storm sewers and other utilities.)

1. Maximum Scales: 1 "=50' (horizontal)  
1 "=5' (vertical)
2. Water line stationed.
3. Pipe size, linear footage and grade called out between grade breaks.
4. Water line grades checked.
5. Top of pipe elevations called out at all grade breaks, fire hydrants, blow-offs, air and vacuum valves, plugs, connections to existing water system and match lines.
6. 4½' minimum cover from finished grade to top of pipe.
7. 6½' minimum cover for air and vacuum valve vaults.
8. Blow-offs at all low points.
9. Air relief valves at appropriate high points.

10. Restrained pipe length shown on profile.
11. Connections to existing system shown on profile.
12. Crossings with other utilities shown on profile (1½-foot minimum separation from outside of pipe to outside of pipe).
13. Match lines and sheet references.

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## APPENDIX C

### East Cherry Creek Valley Water & Sanitation District

#### GENERAL NOTES FOR WATER SYSTEM PLANS

1. All water lines and system plans and construction shall conform with the East Cherry Creek Valley Water & Sanitation District (the District) Specifications and shall be subject to construction observation by District personnel or representatives. Copies of the District Technical Specifications may be obtained from the District Manager. The Owner, his Engineer or Contractor, shall schedule a preconstruction meeting with the District Manager and District Engineer at least 48 hours prior to the start of construction. Accepted construction plans reviewed and signed by the District Manager and District Engineer, will be distributed at the preconstruction meeting. No construction will be permitted until all easements are signed and recorded and the preconstruction meeting has been held.
2. The Contractor shall be responsible for the protection of all utility lines whether shown on the plans or not. The Contractor shall coordinate his activities with the affected utility companies and shall notify the Utility Notification Center, phone number: 303-534-6700, 48 hours prior to starting construction.
3. Distance for water lines is the horizontal distance between center of fitting to center of valve, meter, etc. Therefore, distances shown on the plans are approximate and could vary due to vertical alignment and fitting dimensions.
4. Contractor shall have in his possession at all times one (1) signed copy of plans approved by the District Manager and the District Engineer.
5. As-built drawings as required in the specifications are to be submitted by the Contractor prior to probationary acceptance of the construction.
6. The Contractor shall be responsible for removing and replacing any existing signs, structures, fences, etc., encountered on the job and restoring them to their original condition.
7. The Contractor is responsible for:
  - A. notifying the District 48 hours in advance of any need to shut down any portion of the existing water system.
  - B. notifying the District 48 hours in advance for observations.
  - C. in case of an emergency after working hours, call the District office at 303-693-3800 for recorded instructions.
8. Prior to installation of water mains, road construction must have progressed to at least the "subgrade" stage. Subgrade is defined as an elevation of no more than eight inches below the finished street grade. All valve boxes and fire hydrants will be adjusted to the final finished grade by the Contractor.

9. The pipe specified by the Owner or his Engineer for the water lines in the project is Class \_\_\_\_\_ pipe. All water lines shall have a minimum of four and one-half (4½) feet of cover and be located a minimum of ten (10) feet from the sanitary sewer (edge to edge), and three (3) feet from the edge of concrete curb and gutter pan.
10. Probationary acceptance of the new water lines is contingent upon receiving copies of:
  - A. water line trench compaction test results,
  - B. record drawings, and
  - C. Health Department tests (chlorine and/or clear water as required).
11. Theoretical static water pressures are estimated to range from \_\_\_\_\_ PSI at USGS elevation \_\_\_\_\_ to \_\_\_\_\_ PSI at USGS elevation \_\_\_\_\_, based upon hydraulic gradient of USGS elevation \_\_\_\_\_. The District has provided only the hydraulic gradient elevation. This hydraulic gradient, which was provided at the time of plan review, may change in the future as overall water system operations warrant.
12. All water line valves shall be set at the intersection of the extended property line and water line, except where that point falls in the flow line of a concrete cross pan. In that case, the valve shall be located so that surface drainage does not infiltrate the valve box. Valve boxes shall be set at an elevation in accordance with City/County paving requirements.
13. Polyethylene wrapping shall be installed around a II ductile iron pipe, fittings, valves, fire hydrant barrels, and rods and clamps. The polyethylene shall have a minimum thickness of eight (8) mils.
14. All water lines shall be chlorinated in accordance with A.W.W.A. C-651, "Disinfecting Water Mains." The preferred method is to use sufficient chlorine tablets to produce a 50 MG/L solution. The tablets shall be adhered to the top of the pipe with Permatex Clear RTV 66B. The chlorination of the water line shall be performed prior to the hydrostatic testing.
15. All water lines shall be hydrostatically tested in accordance with A.W.W.A. C-600 Section 4, "Hydrostatic Testing." All water lines shall be tested to a minimum of 150 psi. The test shall be scheduled by the District and coordinated with any other reviewing or approving agency. The allowable leakage rates are as follows:

ALLOWABLE LEAKAGE PER HOUR	
Pipe Size (inches)	Leakage Per 1000 feet of Pipe (gallons)
4	0.33
6	0.50
8	0.66
12	0.99
16	1.32
20	1.66

16. Existing valves in the District may only be operated by District personnel.
17. The District, its representative and/or the District Engineer, is not a guarantor of the constructing Contractor's obligations and performance of contract.
18. It shall be the Design Engineer's responsibility to resolve construction problems with the District due to changed conditions encountered by the Contractor during the progress of any portion of the proposed work. If, in the opinion of the District, proposed alterations to the signed construction plans involves significant changes to the character of the work, or to the future contiguous public or private improvements, the Design Engineer shall be responsible for submitting revised plans to the District for review prior to any further construction related to that portion of the work.
19. The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and property; that this requirement shall apply continuously, and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold harmless from any and all liability, real or alleged, in connection with the performance or work on this project, excepting for liability arising from the sole negligence of the Owner, the Engineer, or the County.
20. The Owner is responsible for all costs associated with plan review and construction observation.
21. Observations of work in progress and on-site visits are not to be construed as a guarantee by the District or District Engineer of the Contractor's contractual commitment.
22. The District and/or District Engineer is not responsible for safety in, on, or about the project site, nor for compliance by the appropriate party of any regulations relating thereto.
23. The District and/or District Engineer exercises no control of the safety or adequacy of the equipment, building components, scaffolding, forms or any other work aids used in or about the project, or in the superintending of the same.
24. The Contractor shall be responsible for removing any groundwater encountered during the construction of any portion of this project. Groundwater shall be

pumped, piped, removed, and disposed of in a manner which does not cause flooding of existing streets nor erosion.

26. All connections to ECCV's water system must be in conformance with the District's Backflow Prevention Program.

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