FORT COLLINS-LOVELAND WATER DISTRICT

Water System Standards

Design Criteria, Construction Specifications, and Review and Acceptance Process

1st Edition

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CHAPTER 1 –GENERAL PROVISIONS

1.1 AUTHORITY AND ADOPTION

A. These Standards, with all future amendments, shall be known as the Fort Collins-Loveland Water District (District) Water System Standards (Standards).

B. These Standards shall be the governing Standards for Public Water Systems that are designed and installed in conjunction with the District's Development Review Process and are within the District's service area.

C. These Standards shall be used in conjunction with the current standards of the local governing jurisdiction. In the event of a conflict between standards, the more stringent standard shall apply.

D. The General Manager and/or District Engineer, or authorized representative, shall have the authority on behalf of the District to determine that all planning, design, materials, installation, testing and documentation of Public Water Systems are pursuant to these Standards.

1.2 INTENT AND OBJECTIVES

A. The intent of these Standards is to establish minimum acceptable criteria. The District's review of plans, reports and drawings or the inspection of installation and construction of Public Water Systems pursuant to these Standards shall not constitute a representation, warranty or guarantee by the District that such systems are free from defects or will operate adequately for the purpose intended.

B. In the event of a conflict between these Standards and Appendix B – Technical Specifications, Appendix B shall govern with respect to products, materials, and construction execution, and these Standards shall govern with respect to design criteria and administrative process, unless otherwise determined in writing by the District Engineer.

C. These Standards consist of General Provisions (Chapter 1), Development Review and Plan Requirements (Chapter 2), Design Criteria (Chapter 3), Construction, Acceptance and Warranty (Chapter 4), the Development Process Guide (Appendix A), Technical Specifications (Appendix B), Approved Materials (Appendix C) and Typical Drawings (Appendix D). The interpretation of these Standards shall be made by the District.

D. Order of Precedence. In the event of a conflict among the documents, the following order shall govern, from highest to lowest: (1) applicable federal, state (including CDPHE) and local codes and regulations, and the more stringent of the District's or the local governing jurisdiction's standards per Section 1.1C; (2) these Standards (design criteria and administrative process); (3) Appendix B – Technical Specifications; (4) Appendix D – Typical Drawings; (5) Appendix C – Approved Materials and the

manufacturer's printed instructions. Where a manufacturer's instructions are more restrictive for a specific product, those instructions shall control for that product. The District Engineer may resolve conflicts in writing.

1.2.1 Objectives of Standards

A. Minimum Standards. These Standards shall be the minimum criteria for planning, design, materials, installation, inspection, testing and documentation of Public Water Systems within the District's service area. These standards are to be used in conjunction with the following:

1. Colorado Department of Public Health and Environment (CDPHE) Standards, latest edition
2. The latest codes for the local governing jurisdiction as listed below:
    - City of Fort Collins Land Use Code: https://www.fortcollins.gov/Government/City-Code-and-Charter/Land-Use-Code
    - Larimer County Land Use Code: https://www.larimer.gov/planning/land-use-code
    - Larimer County Urban Area Street Standards: https://www.larimer.gov/engineering/standards-and-guides/urban-area-street-standards
    - City of Loveland Unified Development Code: https://www.lovgov.org/services/development-services/development-code
    - Timnath Land Use Code: https://timnath.org/planning/
    - Town of Windsor Charter and Municipal Code: https://library.municode.com/co/windsor/codes/charter_and_municipal_code

B. Pavement Cut and Surface Restoration. Pavement cut, patching, and surface restoration within any public right-of-way shall comply with the requirements of the street authority having jurisdiction over the affected roadway (e.g., LCUASS, City of Fort Collins, City of Loveland, Larimer County, Weld County, Town of Timnath, or Town of Windsor). Where a roadway is subject to more than one jurisdiction, or jurisdiction is unclear, the more stringent restoration requirement shall apply, and the Contractor shall obtain all required street-cut permits before beginning work.

1.2.2 Alternative Resource Standards

A. Upon first obtaining written permission and approval from the District, the following alternate and/or additional Resource Standards may be used when certain planning, design, materials and installation may not be specifically addressed in these Standards:

- AASHTO – American Association of State Highway and Transportation Officials
- ACI – American Concrete Institute
- AISC – American Institute of Steel Construction
- AWWA – American Water Works Association (Most Current)

- ASTM – American Society for Testing and Materials
- ASCE – American Society of Civil Engineers
- ASME – American Society of Mechanical Engineers
- CDOT – Colorado Department of Transportation Standard Specification for Road and Bridge and M & S Standards
- IPC – International Plumbing Code (Per governing jurisdiction)
- IBC – International Building Code (Per governing jurisdiction)
- IFC – International Fire Code (Per governing jurisdiction)
- Other, as approved by the District.

1.3 REVISIONS AND INTERPRETATION

The Criteria may be amended as new technology is developed or as a need for revision is demonstrated and proven through experience and use. The District will maintain these Criteria and any amendments thereto and will post these Criteria and amendments on the District's website. The District does not keep a database of holders of these Criteria. It shall be the responsibility of each holder to verify the most current Criteria are being used for any project.

1.4 DEFINITIONS OF TERMS AND ABBREVIATIONS

When the following words, phrases, or abbreviations appear in these Standards, they shall have the following definition and meaning:

ANSI - American National Standards Institute

Appurtenance - Any item, except Public Water main(s), that are considered to be attached and/or serve as a functional part of the Public Water System.

ARV - Air Relief Valve

ASTM - American Society for Testing and Materials

AWG - American Wire Gauge

AWWA - American Water Works Association

BO - Blow Off

Board of Directors - Fort Collins-Loveland Water District's legally authorized decision-making governing body practicing authority in accordance with Title 32-1-1001(1) of the Colorado Revised Statutes.

BOC - Back of Curb

BOW - Back of (side)Walk

Capital Project - A project to construct, replace, or modify the Public Water System that is funded by the District or led by another jurisdiction, rather than through the Development Review Process.

CCP - Civil Construction Plans – Plans prepared by the Design Engineer, which depict materials, methods and other data required to install Public Improvements pursuant to LCUASS, these Standards and applicable District rules and regulations. Typically, CCPs are associated with the District's Development Review process. CCPs used for installation of any Public Improvement

(including Public Water infrastructure) shall be signed by the Design Engineer and District Utility Planning Engineer, and as such are designated as final CCPs.

CDOT - Colorado Department of Transportation

CDPHE - Colorado Department of Public Health & Environment

Construction Costs - The cost of all items and labor necessary to complete installation of Public Improvements, including Public Water Systems pursuant to these Standards.

Construction Staking - The act and use of material involved in the placement of identification markers. Such markers shall show horizontal and vertical location(s) of Public Water Systems and all related appurtenances. All Construction Staking shall be performed by, or under the direct supervision of, a licensed Professional Land Surveyor in the State of Colorado.

Contractor - The person, firm or organization to whom a construction contract is awarded by the Developer to do work within a Development Project Area or to whom a Right-of-way Work Permit has been issued by the local governing jurisdiction. Agents, employees, workers or sub-contractors employed by the Contractor are also bound by the terms of these Standards.

Days - Calendar days unless stipulated as Working Days. Working Day: 7 a.m. to 6 p.m., Monday through Friday, excluding District-observed holidays.

Design Engineer – The Professional [Civil] Engineer, licensed by the State of Colorado who signs the final Civil Construction Plans, as submitted through the District's Development Review Process. The Design Engineer may also sign the Record Drawings.

Developer – The person or entity responsible for planning, design and installation of Public Water Systems within Public Rights-of-way, Easements or within any portion of an approved Development Project Area. For purposes of these Standards, "Developer" includes any applicant for Work on the Public Water System, including builders, property owners, and Project Managers for Capital Projects, unless the context requires otherwise.

Development – See Definition contained in the development or land-use code of the local governing jurisdiction as well as "Development Project Area" herein.

Development Agreement – An agreement between the District and the Developer defining certain Public Improvement requirements, costs and other related Development Review Process issues.

District Utility Planning Engineer - Qualified person(s) or contractor appointed by the District Engineer to perform the following; Review plans and specifications on behalf of the District, Coordinate with the development community as directed, and Interpret District Standards as required. The District Utility Planning Engineer may be authorized to act on behalf of the District when designated

Development Project Area – An area approved by the District for re-development or development, pursuant to these Standards and the District's rules and regulations. The Development Project Area may include installation of Public Improvements, including Public Water Systems, pursuant to these Standards and final signed Civil Construction Plans.

Development Review Process – The process, pursuant to applicable District rules and regulations, whereby certain residential, commercial and industrial development is regulated and approved.

DI or **DIP** – Ductile Iron Pipe

District – Fort Collins-Loveland Water District (FCLWD) a Title 32 Colorado Special District serves an area that encompasses approximately 60 square miles with boundaries that range from south of Harmony Rd. to 57th Street in Loveland, then east from the foothills to the Larimer-Weld County line. The people served reside in parts of Fort Collins, Loveland, Timnath, Windsor and Larimer County. The District is self-governed by an elected Board of Directors.

District Engineer – The engineer at the District responsible for review of all Utility Plans associated with design and construction of proposed water lines and water line improvements within the District.

District General Manager – The General Manager of the Fort Collins-Loveland Water District.

Easement – A right granted to the District to use certain property for purposes of ownership, maintenance, access, inspection and other related incidentals associated with Public Water or Wastewater Systems. The right granted may be exclusive or non-exclusive, depending on the nature and situation within a Development Project Area. When not depicted on a Final Plat, the District shall require the use of separate approved easement agreements/forms. The agreements/forms must be obtained from the District, prior to use and/or execution and recordation.

Fees – Monetary charges which compensate the District for services rendered or infrastructure constructed.

Fence - A permanent barrier of wood, masonry, stone, wire, metal or other manufactured material, or combination of materials, erected to enclose, partition, beautify, mark, or screen areas of property within any portion of a Development Project Area.

Final Acceptance - A construction milestone, documented by a Final Acceptance letter issued by the District, achieved when the requirements of Section 4.6.3 have been met. Upon Final Acceptance, the District assumes ownership, operation, and maintenance of the Public Water System improvements, and the Warranty Period begins.

Final Plat - A land surveying document depicting the subdivision of real property, normally accompanied by approved final signed Civil Construction Plans.

General Manager - The General Manager of the Fort Collins-Loveland Water District.

GMA - Growth Management Area – The area of real property identified in Inter-Governmental Agreements (IGAs) with Larimer County.

GPM - Gallons Per Minute

HDPE - High Density Polyethylene, typically for a certain pipe.

ID - Inside Diameter

Improvement Agreement - See also Development Agreement.

Inspector - An authorized representative of the District, assigned to make inspections to assure installation and materials are completed in compliance with these Standards and District approved signed final Civil Construction Plans.

Landscaping - Materials including, without limitation, grass, ground cover, shrubs, vines, trees, and non-living materials, commonly used in landscape development, as well as attendant irrigation systems.

LCUASS - Larimer County Urban Area Street Standards, most current edition.

LFRA - Loveland Fire Rescue Authority

Major Structure - A major structure is a component of the Public Water System that will bring direct benefits to an identifiable area, such as water booster pump stations, control valves, significant crossings, storage tanks, and transmission pipe larger than 12-inch diameter.

May - A permissive condition

Minor Works - Work limited to taps two (2) inches and smaller, service line size changes, meter pit or setter changes, and fire service line relocations or re-taps, involving no new public main and no modification or extension of a public main or easement, processed pursuant to Appendix A.

MJ - Mechanical Joint

NONC - Notice of Non-Compliance - A written notice from the Inspector identifying non-compliance of certain workmanship or materials. May also contain written corrective actions, pursuant to these Standards.

NSF - National Sanitation Foundation

OD - Outside Diameter, typical of a certain pipe.

Original Cost of Design and Construction - The Opinion of Cost prepared by the Design Engineer for the proposed waterline and associated Public Water System appurtenances and submitted with the CCPs.

OSHA - Occupational Safety and Health Administration, Federal jurisdiction.

Oversize Reimbursement Agreement - A Reimbursement agreement between the Developer and the District establishing certain costs that are eligible for reimbursement by the District.

PC - Point of curvature

PCR - Point of curb return

PE - Polyethylene, a typical pipe material

PE - Professional Engineer – A Professional [Civil] Engineer, licensed by the State of Colorado. (See also, Design Engineer)

Permittee – The holder of a valid permit issued in accordance with a governing jurisdiction's related processes.

PFA - Poudre Fire Authority

PI - Point of Intersection

Pipe Zone - A certain portion of the Public Water trench identified in the District's Standard Drawings.

PLS - Professional Land Surveyor – A Professional Land Surveyor, licensed by the State of Colorado.

Point of Contact - Representative appointed by an entity to represent that entity during Construction phase, from Pre-Construction Meeting thru Final Warranty.

Pre-Construction Meeting - A meeting convened prior to beginning any Work within an approved Development Project Area. The meeting shall include the Developer/Contractor and the District's Inspector and shall facilitate the review of signed Civil Construction Plans and any proposed Work necessary to install Public Water Systems.

Private Improvements - Improvements, which may be installed within a Development Project Area but are not owned, operated or maintained by the District.

Product Data - Manufacturer's standard printed information including specifications, catalog, cut sheets, and installation instructions.

Project - May also be used interchangeably with the term Development Project Area.

Project Manager - The District (or lead agency) representative who performs the duties assigned to the Developer by these Standards for a Capital Project.

Project Supervisor - The person appointed by the Developer or Contractor for management and control of the work and material within a Development Project Area.

Property - That portion of land within a Development Project Area that may also include installation of Public Water Systems and other Public Improvements.

PRV - Pressure Relief/Regulating/Reduction Valve

PSI - Pounds per Square Inch, a unit of pressure

PT - Point of tangent

Public Improvements - Any facility, improvement and related appurtenance that, upon Final Acceptance by the District, is owned, maintained and operated by the District. (See also, Public Water Systems herein)

Public Improvements Opinion of Cost (Cost Estimate) - Unit costs based on those approved by the District and assigned to materials and related quantities contained in the CCP. The Cost Estimate shall be broken down by construction phase, when applicable, for each project and shall be submitted by the Design Engineer at the time of first plan review by the District.

Public Water System - Water facilities, improvements and related appurtenances that, upon Final Acceptance, are owned, operated and maintained by the District.

Public Water System Master Plan - A plan and related document, prepared and maintained by the District, that depict major infrastructure requirements, functions, and operations.

Punch List, Initial or Final - A written list of Work or material items compiled by the Inspector, which do not conform to these Standards, the CCPs or other associated District Codes that govern the Development Project Area. The Developer/Contractor shall bring all such items into conformance with these Standards prior to either Initial or Final Acceptance.

PVC - Polyvinyl Chloride, a typical pipe material

Record Drawings - Original signed final CCPs, updated and certified by [the] Design Engineer, which depict actual materials, locations and dimensions of the Public Water system.

Re-development - Removal or modification of existing improvements and installation and construction of new improvements as defined in the development or land-use code of the local governing jurisdiction.

Reimbursement Agreement - An agreement, between the Developer who initially installs certain Public Water main(s) and the District, for the purpose of collecting reimbursement to the Developer from certain future Developers that may potentially connect to said main(s).

Remove - Remove and dispose of in a manner consistent with local ordinances, laws, and regulations.

Report - A bound document, the contents of which may contain certain necessary analyses, surveys, tests, exhibits, and other pertinent data supporting the subject matter.

Right-of-way - See LCUASS 1.7.

Right-of-way Work Permit - A document issued by the governing jurisdiction that allows a Developer/Contractor to construct Public Improvements or Private Improvements within a Right-of-way or Easement dedicated or granted to the District.

Roadway - The portion of the highway, arterial, collector, or local street, including shoulders, intended for vehicle and/or bicycle use.

Samples - Physical examples of materials submitted to the District for review.

SDR/DR - Standard Dimension Ratio, defined as a quotient of: minimum outside diameter of a pipe divided by the minimum wall thickness of the same pipe. Higher SDR quotient numbers result in thinner pipe wall thicknesses and lower pressure ratings.

Service Line - All pipe, fittings, and appurtenances for conveying water from the distribution mains to the premise and/or meter as applicable.

Shall - A mandatory condition

Shop Drawings - Drawings, diagrams, schedules, and other data specifically prepared or assembled by or for the Contractor to illustrate how work will be performed,

Should - An advisory condition, recommended, but not required

Sidewalks - Paved or otherwise improved areas for pedestrian use located within the Right-of-way or Easement.

Standard Drawings - Drawings included as part of these Standards that depict typical and normal materials, certain installation methods and locations associated with a specific portion of the Public Water System.

Standard Street Specifications - Refer to the current Design Criteria and Standards for Streets of the agency having jurisdiction.

Standards - These Water System Standards, inclusive of all codes and other referenced standards.

Structure - Any item constructed or erected with a fixed location below, upon, or above grade, including but not limited to any type of permanent foundation, traffic signal poles, fences, retaining walls, buildings, inlets, vaults, utility poles, bridges, drainage facilities.

Sub-contractor - A person or entity supplying labor, materials, design or other items directly related to the Development Project Area that is employed by the Contractor.

Substantial Completion - A construction milestone, documented by a Substantial Completion acceptance letter issued by the District, achieved when the requirements of Section 4.6.2 have been met. Substantial Completion permits the sale of water taps for the Development Project Area.

SWO - Stop Work Order – A written instruction/notice from the District revoking the Developer's and/or Contractor's right to continue work within an approved Development Project Area.

Tap - The physical connection to a Public Water System pipe.

Utility - A public or private organization that services maintains infrastructure for a public commodity, examples are: water, sewer, communication, gas, electric.

Variance - A deviation or alteration from these Standards that has been duly and properly approved by the District.

Warranty Period - The two (2) year period commencing on the date of Final Acceptance, during which the Developer is responsible for repair of defects and damage in the Public Water System improvements pursuant to Section 4.6.4.

WIDA - Water Impact and Demand Analysis Report

WMP - Water Master Plan (See Public Water System Master Plan)

Work - All installation and construction activity, including materials, labor, supervision and use of tools and equipment necessary to complete installation and construction of Public Water Systems, within an approved Development Project Area.

WSFR - Windsor Severance Fire Rescue

1.5 VARIANCES AND APPEALS

A. Variances. Any design or installation that does not conform to these Standards requires a variance approved by the District. Variance requests shall be prepared by the Design Engineer and submitted in writing to the District Engineer, and shall identify:

1. the standard to be varied and the reason compliance is not feasible or not in the public interest;
2. the proposed alternate design or criteria; and
3. justification that the variance will not be detrimental to public health, safety, and welfare, will not reduce the design life of the improvement, and will not increase the District's maintenance obligations.

B. Variances will be considered administratively on a case-by-case basis. The District will provide a written approval or denial, and all approved variances shall be listed in the general notes of the CCPs.

C. Appeals. Any person aggrieved by a decision made in the administration, interpretation, or enforcement of these Standards may request reconsideration by the District General Manager and may thereafter appeal to the Board of Directors by

written request submitted to the District General Manager. The Board will consider the appeal at a regular or special meeting of the Board, and the Board's determination shall be final. An appeal to the Board must be submitted in writing within thirty (30) days of the decision being appealed. Any technical or design data submitted in support of a variance request or appeal shall be prepared, stamped, and signed by a Professional Engineer licensed in the State of Colorado.

D. Future Procedures. The Board may adopt formal variance or appeal procedures by resolution at any time; upon adoption, such procedures shall govern over this Section.

1.6 ENFORCEMENT AND INSPECTION

A. These Standards are enforceable by the District at any point in the District's Development Review, Construction, and Acceptance processes, including installation and inspection of Public Water Systems.

B. Inspection services during construction are provided by the District.

C. The Developer and Contractor are responsible for obtaining all related Federal, State, and Local permits required to perform all work related to the development project.

1.7 CONTRACTOR LICENSING

A. The District may establish, by resolution of the Board of Directors, a contractor licensing program governing persons performing Work on Public Water Systems.

B. The Contractor shall hold all licenses and permits required by the local governing jurisdiction for the Work performed, including without limitation Right-of-way Work Permits, the qualification requirements of Section 4.1.1 for large-diameter mains, and the Colorado Division of Fire Prevention and Control registration required for underground fire service line installation (see Section 3.4.5D.6)

1.8 WATER SYSTEM EXTENSION, OVERSIZE AND REIMBURSEMENT

1.8.1 General

A. As determined necessary by the District, Public Water System mains and related appurtenances shall be installed to the farthest point(s) of a Development Project Area and within all Rights-of-way. Such installation is intended to facilitate the orderly continuation of the Public Water System and to provide adequate service to properties beyond a Development Project Area.

B. All Public Water System mains and major structures providing service to or within a Development Project Area shall be installed at the sole cost of the Developer except when eligible for reimbursement in accordance with District rules and regulations and these Standards.

1.8.2 Oversizing

A. If the District requires a Developer to install Public Water System mains or other related infrastructure at a size or capacity greater than necessary to serve the Development Project Area, the District will cooperate with the Developer to determine, through a written agreement or other means approved by the District General Manager, an appropriate reimbursement to the Developer for the incremental cost of those improvements.

B. The Design Engineer shall determine the size required to serve the Development Project Area, taking into account the Public Water System Master Plan and industry standards for hydraulic design. Required oversizing will be identified by the District during the Development Review Process.

C. The District's reimbursement shall be limited to the difference between (i) the cost to furnish and install the Public Water System main at the size required to serve the Development Project Area, and (ii) the cost to furnish and install the oversized main required by the District. The cost of appurtenance that would be required to serve the Development Project Area regardless of main size, including, but not limited to, service lines and saddles, fire hydrants and hydrant leads, surface repairs, trenching and backfill common to either size, and traffic control, shall not be eligible for reimbursement. The Contractor shall provide itemized costs for the main at both the required size and the oversized size; both cost submittals shall be subject to review and approval by District Engineering staff and documented in the agreement approved by District General Manager.

1.8.3 Third-Party Reimbursement

Where a Developer installs Public Water System improvements that materially benefit property other than the Development Project Area, the Developer may request that the District consider a reimbursement agreement. Any such agreement shall be in a form approved by the District General Manager and District's legal counsel, and its terms and conditions including eligible costs, apportionment, duration, and collection shall be established in the agreement.

CHAPTER 2 –DEVELOPMENT REVIEW AND PLAN REQUIREMENTS

2.1 DEVELOPMENT REVIEW PROCESS

2.1.1 Design Submittals

2.1.2 General Submittal Criteria and Procedures

A. For all projects involving water utility construction or modification within the District service area, the Developer shall submit CCPs and any other application materials to the local governing jurisdiction. The Developer is responsible for following all submittal and review procedures required by the local jurisdiction. In addition to those requirements, the requirements of this section shall apply.

B. With prior approval of the District, CCPs associated only with this District may be submitted directly to the District.

C. Refer to Appendix A for the District's Plan Review Checklist and General Water Utility Notes.

2.1.3 Criteria for Major Structure Projects

A. Prior to starting any design for Major Structure Projects, the Developer shall have their design and construction management firms meet with the District to discuss the Major Structure Project. Examples of Major Structures include, but are not limited to:

1. Flow Control Valves
2. Pump Stations
3. Butterfly Valve vaults
4. River, railroad, or highway crossings.
5. Storage Tanks
6. Transmission Mains (larger than 12-inch)

2.2 DESIGN SUBMITTALS AND CONTENT

2.2.1 General Requirements

The Developer is responsible for meeting all requirements established by the local governing jurisdiction. In addition, the Developer shall provide materials and content as described in the sections below.

2.2.2 Soils Investigation/Geotechnical Report

When required by the District through the Development Review Process, and where applicable, the Report shall identify mitigation measures necessary for trench/bedding and stabilization not specifically addressed in these Standards and address any high groundwater condition.

2.2.3 Water Design Report

Refer to Section 3.2.2 of these Standards for the content and requirements for the Water Impact and Demand Analysis (WIDA) report.

2.2.4 Opinion of Cost

A waterline Opinion of Cost shall be prepared by the Design Engineer and submitted with the CCPs. The Opinion of Cost shall include the estimated cost of the proposed waterline and associated Public Water System appurtenances.

2.3 CIVIL CONSTRUCTION PLAN REQUIREMENTS

2.3.1 General

A. All plans that include modifications to existing or proposed Public Water Systems, regardless of the sheet title are considered CCP and such shall contain the District's signature block.

B. In cases where CCPs include Public Water Systems or may be exclusively for Public Water Systems, the CCPs shall be prepared and submitted pursuant to these Standards.

C. To further aid in the preparation of CCPs, refer to Appendix A.

2.3.2 Specific Requirements

The following specific requirements shall apply when preparing CCPs inclusive of, or exclusively for Public Water Systems.

A. Vertical datum - the CCP shall use NAVD 88.

B. Horizontal datum – the CCP shall use NAD 83.

C. Coordinate system – the District coordinate system is EPSG 2876 (NAD 83 State Plane Colorado North, U.S. survey feet).

2.3.3 Cover Sheet and Construction Notes

A. Include the District Signature block (posted on District website and in Appendix A).

B. District Standard Construction Notes shall be annotated onto CCPs. See Appendix A.

C. Horizontal and Vertical datum shall be called out in the general notes. The coordinate system used shall be identified in a note on the cover sheet. If the CCP is prepared on a modified state plane, ground, or other project-specific coordinate system rather than true grid, the CCP shall include the information necessary to relate the project coordinates to EPSG 2876, including:

1. the combined or project scale factor and the base point or projection origin to which it is applied;
2. the rotation, if any, relative to grid north, and the point of rotation; and
3. at least one published control point common to both the project system and EPSG 2876, with its coordinates shown in each system.

2.3.4 Utility Plan(s)

A. If the proposed Development is relatively small in nature the construction information for the Public Water System can be shown on an overall Utility Plan.

B. The plan sheet(s) shall be numbered sequentially, clearly integrated into the CCPs, and shall depict all applicable notes.

C. Plan view sheet(s) are required for all sizes of Public Water systems. Scale may be 1 inch = 50 feet, or larger. These sheets may also include details and designs for lowerings, crossings, and other special configurations pursuant to these Standards.

D. Plan and profile sheet(s) are required for all Public Water Systems 8” diameter and larger, except as required by Section 3.3.4 for all water mains subject to crossings and lowerings. Plan view scale may be 1 inch = 50 feet, or larger with profile view scale shown in consistent and relative units to the plan view scale.

E. All construction and/or sequence phasing shall be clearly annotated such that each phase is depicted in a “stand alone” manner. In some cases, Public Water Systems may be required to extend beyond a particular phase to mitigate acceptable redundancy for water. In these cases, CCP plan sheets shall clearly show all applicable phase lines, design, details, Rights-of-way, Easements and any other items necessary to properly accommodate such extension beyond a particular phase. Existing and proposed property, Rights-of-way, Easements and Tract lines that are adjacent and/or encompass the proposed Public Water System. All such lines shall be consistent with a proposed or recorded Final Plat or other lawful property description instrument, duly recorded with Larimer County. All lines shall be clearly referenced and dimensioned relative to one another.

F. Longitudinal stationing based on centerline of main, for all Public Water Systems appurtenances (e.g. service lines and associated taps, all fittings, fire hydrants, vaults, blow-offs, air-vacs, manholes, etc.). In general, stationing shall read in ascending order in the direction of the north arrow or to the right.

G. Horizontal locations for all proposed and existing Public Water Systems shall be identified by linear dimensions. In some cases, additional horizontal dimensioning may be required for purposes of clarity and further reference. For proposed Public Water Systems, horizontal bearings and distances may also be used in conjunction with linear dimensioning. Horizontal coordinates (northing/easting) will not be allowed, except in cases of open fields or larger parking areas.

H. Roadway, Right-of-way and/or access-way names in bold font.

I. Proposed finished surface contours in area(s) over and nearby all proposed Public Water Systems. This requirement is especially critical for areas beyond the typical street section (e.g. from back of curb or walk towards private property).

J. Existing structures, dry and wet utilities and ground surfaces (shown as phantom lines and shapes). All existing items shall be dimensioned in a manner that clearly shows their relationship to all portions of proposed Public Water Systems. Examples of existing items include, but are not limited to, the following:

1. Water, wastewater, irrigation water, reclaimed water, storm drainage, electrical, cable television, communications, gas, oil, steam, petroleum, traffic control devices and any related appurtenances.
2. Overhead power or communication lines.
3. Existing ground contours.
4. Fence lines and gates.
5. Ditches or swales with contour lines.
6. Curbs and gutters, sidewalks, cross pans.
7. Pavement limits.
8. Bridges or culverts.
9. Guardrails.
10. Signs.
11. Landscape features (trees, shrubs, hedges, turf, flowerbeds, etc.).
12. Other items deemed appropriate by the District.

K. All fittings (crosses, tees, valves, bends, blow-offs, air-vacs, fire hydrants, etc.).

L. Service lines with diameter and longitudinal stationing of connection point to the main.

M. Location and size of associated meter pits/vaults. If pits/vaults cannot be located pursuant to the District's Standard Drawings' typical dimensions, provide necessary horizontal and linear dimensions or stationing to depict non-standard locations.

N. Steel casings with diameter, thickness, length, and longitudinal stationing of beginning and ending of casing. Show location of cathodic protection test stations and label anode design. Include/show type of pipe carrier/skid system.

O. Longitudinal stations for beginning and ending of lowerings and vertical sweeps.

P. Type and class of pipe material, length between fittings, diameter and slopes, as applicable.

Q. Limits of special bedding, if required.

R. Complete horizontal curve data for water main(s).

S. Match lines with stationing and sheet numbering.

T. Construction Phase lines with relative stationing.

U. Designate separation between different pressure zones, as applicable.

V. Hatching or beginning and ending stationing for all portions of the water main being restrained by restrained joint fittings.

2.3.5 Utility Profile(s)

A. Existing ground contour profile; dashed and denoted as such.

B. Proposed finished grade contour profile, solid line and denoted as such.

C. Existing structures, dry and wet utilities, with elevations and sizes.

D. Longitudinal station and vertical elevations of all existing structures and utilities in close proximity or crossing the proposed main. Vertical clearance dimensions between the proposed main and the associated structure or utility may also be required.

E. Longitudinal stationing for all fittings, valves, and related appurtenances with vertical flow line elevations.

F. Longitudinal stationing and top of pipe elevations of all points of vertical change, grade breaks, and vertical bends.

G. Lengths and diameter for all portions of main(s).

H. Depth for all portions of main(s) where the main consistently follows finish contour elevations. Within locations a main does not consistently follow finish contour elevations, grades/slopes shall be annotated for all portions of such mains.

I. Size and longitudinal station for each connection (including individual service taps) to the proposed main.

J. Longitudinal stations and vertical top of pipe elevations for each component (fittings, pipe sections, beginning and ending of casing, bends, etc.) of each lowering, crossing, or vertical sweep.

K. Groundwater barriers with longitudinal stationing.

L. Limits of any special bedding.

M. Limits and type of any insulation.

2.3.6 Typical Detail Drawings

A. Appendix D includes Typical Detail Drawings; these drawings shall be used when typical scenarios for design and construction warrant such use. When used, Standard Drawings shall be annotated onto Utility Detail sheet(s) of CCPs and referenced on each CCP plan sheet. Each Standard Drawing depicted on Utility Detail sheet(s) shall include the entire content of the original approved drawing (e.g. borders, title blocks, dates, notes, etc.).

B. Non-standard design for Public Water Systems (e.g. lowerings, crossings, special fittings, deflections, etc.) shall be depicted on the appropriate plan and/or profile sheet(s).

2.3.7 Landscape Plan

A. All existing and proposed water systems and services.

B. All existing and proposed landscaping, trees, and bushes with types denoted.

C. All existing and proposed (if any) irrigation meters and meter size denoted. If the landscape area is proposed to be irrigated off of the domestic meter then denote the domestic meter and meter size.

2.4 DISTRICT APPROVAL OF FINAL UTILITY PLANS

An electronic version, in a format acceptable to the District, of the final Utility Plans shall be provided to the District at the time that the final CCPs are signed. The electronic plans shall include all approval signatures and Design Engineer's seal and signature.

2.5 REVISIONS TO SIGNED CCPS

Requests to revise Public Water Systems included within signed CCPs shall be made in conformance with the following criteria:

A. Field Revisions

1. Field revisions are changes to the Public Water System and Civil Construction Plans that occur after final signature approval and during the construction of the proposed improvements.
2. Field revisions shall be coordinated with the Inspector and approved in writing by the District Engineer prior to any modification.
3. All field revisions shall be documented and recorded in the record drawings as described in Section 2.3.
4. If the Inspector does not approve the Field revision, the Developer/Contractor shall immediately comply with the originally signed final CCPs and these Standards, as applicable.

B. Major Revisions

1. Major revisions shall be revisions to the signed CCPs which are not deemed field revisions and which affect the functional aspects of the Public Water System. Major revisions cannot be approved solely by the District. The Developer/Contractor shall be required to submit the appropriate documents to the governing jurisdiction's Planning Division for review by relevant authorities. Additionally, any Work related to a major revision cannot be allowed to continue until such time as the District has approved the major revision.
2. Examples of major revisions include, but are not limited to:
   a. A change in horizontal or vertical location(s) that also may require a change in an approved Right-of-way, Easement or other previously approved configuration within a Final Plat.
   b. A change in size or configuration of a main serving areas either beyond an approved Development Project Area or within an approved Development Project Area which substantially differs from the final signed CCPs.

c. Other major changes the District deems beyond the scope of the original approval through the District's Development Review Process.

2.6 EXPIRATION OF PLANS

Expiration of Plan Set – CCP and revised CCP pages pertaining to Water Systems Improvements for the District shall be valid for a period of three (3) years from the date of approval shown in the District's signature block on the Civil Construction Plans. CCPs not constructed within this period shall require resubmittal and re-approval by the District.

2.7 OFF-SITE EASEMENTS

Where a Development Project Area requires Public Water System improvement on property outside the Development Project Area, the Developer shall obtain and dedicate the necessary easements to the District at no cost to the District and free of restrictions that would interfere with the District's ownership, operation, maintenance, or replacement of the improvements. All off-site easements shall be on the District's approved easement form (or dedicated by plat), and shall be recorded with the County Clerk and Recorder prior to the District's signature on the final CCPs.

2.8 DITCH AND RAILROAD CROSSINGS

A. Where a Public Water System main crosses a ditch, canal, or railroad, the Developer shall obtain all permits, licenses, agreements, and approvals required by the owner of the facility being crossed and shall pay all associated fees and costs. Evidence of the owner's approval shall be provided to the District prior to the District's signature on the final CCPs.

B. The terms of any crossing agreement or license shall be transferable to successors and assigns. Upon Final Acceptance, the Developer shall assign the crossing rights, and dedicate or transfer the water main, to the District.

C. The owner of the facility being crossed may impose additional or more stringent requirements.

CHAPTER 3 –DESIGN CRITERIA

3.1 GENERAL

A. This chapter specifies the minimum standards necessary for system analysis, layout, and design of Public Water Systems. Water main sizes and general system layout will typically be provided by the District, based on dynamic analysis using the District's hydraulic model and proposed demands related to the Development Project Area.

B. In addition to these Standards, alternate Resource Standards may be used or required pursuant to Section 1.2.2 of these Standards.

3.1.1 Conformance to Standards and Master Plans

A. All Public Water Systems shall conform to these Standards and other applicable Codes and Standards approved by the District.

B. Where these Standards are not specific, alternate and/or additional Resource Standards may be used, provided the more stringent requirement is used. The District shall approve the use of any alternate and/or additional Resource Standard prior to inclusion of such standard within any Development Project Area or CCP.

3.1.2 Typical Detail Drawings for Public Water Systems

See Appendix D.

3.1.3 Acceptable Materials

See Appendix C.

3.2 ANALYSIS CRITERIA

3.2.1 Water Impact and Demand Analysis (WIDA)

A. The District's ability to serve a water-intensive user is highly dependent on the location in the District's system and the demand pattern showing the relationship between peak flow, average flow, diurnal pattern and annual volume. Not all demand patterns, locations or rates and volumes can be served. Water intensive users are classified by their actual water use pattern, and may be identified by declaration of an applicant during the development review process, by tenant occupancy, or may not be known until actual water use is observed.

B. A Water Impact and Demand Analysis (WIDA) report is required for:

1. Individual taps one and one-half (1.5) inches in diameter or larger.
2. Development projects consisting of multiple taps.

C. The District reserves the right to change the tap classification of a customer tap at any time if a water intensive user is identified. Approval of a tap purchase or tenant occupancy for a water intensive user is subject to the District's sole discretion to determine whether adequate water supply, treatment and transmission capacity are available, or whether suitable arrangements to provide that capacity have been made.

3.2.2 Contents & Format of the WIDA

A. If it is determined a WIDA is required for the project, the Developer shall coordinate with the District to determine the required contents and format of the WIDA for the project. At a minimum, this shall include:

1. Calculated water demands for initial and future phases.
2. Hydraulic modeling analysis for the proposed water system design showing all distribution lines and all looping connections to the existing water system. The

analysis needs to include irrigation demands if dedicated irrigation meters are proposed. Hydraulic modeling shall evaluate the following scenarios:

a. Static
b. Maximum Day Demand
c. Peak Hour
d. Peak Hour + Fire Flow

B. Any Major Structure improvements, e.g. PRV's, zone breaks, transmission mains, or pump stations, etc. Identify any needs for oversizing pipes in conjunction with the Master Plan.

1. The design shall verify the Minimum Hydraulic Performance Criteria.

3.2.3 Minimum Hydraulic Performance Criteria

A. Static Pressure

1. The distribution system shall be designed to provide a minimum static pressure of 45 psi and a maximum static pressure of 125 psi. Design shall account for normal tank operating levels and PRV seasonal settings.

B. Maximum Day Demand

1. The distribution system shall be designed to limit MDD pipe velocities to 5 ft/s with minimum system pressures of 40 psi.

C. Fire Flow

1. Fire flow evaluations shall assume fire flow demand plus Peak Hour system demand.
2. The distribution system shall be designed to provide a residual pressure of 20 psi at the ground and velocities in water mains throughout the distribution system shall not exceed 10 ft/s during fire flow.

a. Pump Station suction pressures shall remain above 30 psi in all conditions.

D. Discuss the proposed design results. Identify needs for any Major Structure improvements. Identify any needs for oversizing pipes in conjunction with the Master Plan.

E. Discuss and identify any alternate water sources and or delivery systems for irrigation water.

F. Discuss any deviation from these Standards and provide justification for any proposed variances. All such variances must be approved by the District prior to approval of the Development Project Area.

G. Provide an overall plan depicting the following information:

1. Map Scale (max 1 inch = 200 feet), North Arrow, and Vicinity Map.
2. Proposed and existing Easements and Rights-of-way.

3. Proposed and existing water system layout. Mains and appurtenances with sizes, flows, node pressures and demands (minimum and maximum).
4. Pressure zone(s) and contours.
5. Underlying land uses, zoning, and densities.
6. Other existing and proposed utilities that might affect the proposed system layout or performance.

3.3 WATER SYSTEM DESIGN AND LAYOUT

3.3.1 General

A. The District's Public Water System includes distribution and transmission mains with related appurtenances. Other specific Public Water System components may include pressure reduction valves (PRVs), booster pump stations, and storage facilities.

B. In addition to the requirements in these Standards, each Development Project Area shall have redundant sources of water supply. Redundant supply provides a combination of adequate fire flow, uninterrupted customer service and acceptable water quality. Redundancy is typically achieved by making at least two separate and distinct connections to the existing Public Water System. The District, depending on required flows and/or other constraints or system capacities in the area of the proposed Development Project Area, may require a greater number of connections. Additionally, within internal portions of the Development Project Area, other separate and additional redundant connections shall be required wherever possible.

C. Additionally, it is critically important within each Development Project Area that the site layout be designed in a manner that accommodates acceptable access for future maintenance by the District. For each Development Project Area, the Design Engineer shall make provisions regarding applicable utility and hard surface separation requirements, as well as Easement and/or Tract widths, noted in these Standards.

3.3.2 Distribution and Transmission Mains

A. Distribution Mains deliver potable water to individual customers and may be tapped along their length with individual service connections. Distribution mains normally have in-line valves placed frequently to lessen the impacts associated with shut downs, line breaks and potential service interruptions. Distribution mains are typically sized to provide domestic, fire protection, and irrigation flows to and throughout the Development Project Area. Use of other systems such as reclaimed water (purple pipe) or irrigation ditches may reduce the need to deliver irrigation demand through the Public Water System. However, the District must first approve such alternate systems.

1. Allowable Sizes. 6, 8, 12 and 16-inch diameters. Appendix B and Appendix C addresses allowable materials and installation requirements for pipe.
2. Residential. The minimum allowable pipe size shall be 6-inch diameter.

3. Commercial/Industrial and Medium Density Residential. The minimum allowable pipe size shall be 8-inch diameter.
4. Overall System layout. The general minimum requirements for system layout shall be as follows:
    a. Section Lines or close proximity minimum size shall be 16-inch diameter.
    b. Quarter (1/4) and Sixteenth (1/16) Section Lines or close proximity minimum size shall be 12- inch diameter.
    c. Master Plan sizing layout may override these general Standards. The District may also require oversizing of certain mains, beyond those identified in the Master Plan recommendations.

B. Transmission Mains are large diameter mains that move water through the system between supply and storage points, between pressure zones and between Distribution mains. There should be no individual service taps allowed on Transmission mains; the District must first approve any type of connection to a Transmission main.

3.3.3 Horizontal Layout

A. Location.

1. Within the platted right-of-way and improved public streets, main(s) should generally be located on the north or west side of the street centerline, offset 5 feet from the centerline on local streets and 10 feet on all other street classifications, pursuant to Standard Drawing W-01. Utility locations within public streets shall also conform to LCUASS Chapter 12, where applicable.
2. Main(s) may be located within a parkway or tree lawn area with prior approval from the District.
3. Main(s) located within parking areas or open space should be located symmetrically within an Easement.

B. Separation

1. Wet utilities (e.g. public wastewater, public or private stormwater, public or private reclaimed water and any related appurtenance) running parallel to a public water main and/or related appurtenance shall not be closer than 10 feet. This distance shall be measured from the nearest outside edge of each pipe or related appurtenance. Refer to Standard Drawing W-03 for water main protection zones at parallel and crossing conditions.
2. Dry utilities (e.g. natural gas, electric, cable TV, telephone/ communications and all any appurtenance) running parallel to a public water main and/or related appurtenance, shall not be closer than 6 feet (outside edge to outside edge). This distance shall be measured from nearest outside edge of each pipe or relative appurtenance. Light Poles require 6-foot separation.
3. Other Features

a. Minor Structures: For curb & Gutter, sidewalks, medians and other minor structures, public water mains should generally be designed to run parallel distribution to and be a minimum of 5 feet horizontally from hard surface improvements (e.g. front or back of sidewalk, lip or back of any type of curb and gutter, etc.).
b. Buildings: Public water infrastructure should be a minimum of 12.5 feet horizontally from the outside edge of any building.
c. Landscaped Features: The outside edges of any shrub or bush (upon maturity) shall not be allowed within 4 feet of the nearest outside edge of a public water main and/or any related appurtenance. The outside edge of any tree trunk (upon maturity) shall not be allowed within 10 feet of the nearest outside edge of a public water main and/or any related appurtenance.
d. Berms greater than 2 feet high and/or with side slopes steeper than 4:1 shall not be allowed within 10 feet of a public water main and any related appurtenance.
e. Permanent signs, walls, etc. shall not be allowed within 10 feet of a public water main and any related appurtenance.

C. Alignments

1. Straight. In general public water mains shall be laid with straight alignments using manufactured bends. Manufactured Bends shall be DIP mechanical joint (MJ) type.
2. Pipe-joint deflection. Mains proposed within curved portions of ROWs or easements may be designed utilizing pipe-joint deflections.
   a. Pipe-joint deflections shall meet the manufacturer's recommendations for deflection limits and requirements.
   b. CCP plan & profile views. When pipe is deflected at each joint to accommodate horizontal curvilinear alignments, each curved alignment section shall be labeled with curve data. Data shall include PC and PT stations (labeled as Begin Joint Deflection and End Joint Deflection respectively), radius, delta, length, joint deflection per joint and pipe segment lengths.
   c. Pipe bending. Longitudinal, barrel portion pipe bending shall not be allowed.

3.3.4 Vertical Layout

A. Cover. Normal bury depth for all water mains shall be five (5) feet minimum and six (6) feet maximum, as measured from finished grade to top of pipe. Crossings and lowerings with less than five (5) feet of cover shall be subject to frost protection requirements noted in these Standards.

B. Alignment/Grade. When utilizing manufactured bends, water mains shall be designed to maintain a uniform positive or negative grade between all bends (high and low points).

1. For all profiles provided in the CCPs, all portions of uniform grade/pipe shall be denoted mathematically by percent or decimal of slope. All bends shall be denoted with a top-of-pipe, vertical datum elevation, and a horizontal reference station.

C. Crossings. When a water main crosses another public or private utility, irrigation or drainage ditch, the crossing design shall protect the main and utility's structural integrity, prevent contamination of the main and mitigate future system impacts and costs of repair. The agency responsible for the utility, ditch, railroad or other structure crossed may also impose additional criteria.

1. All crossings shall be clearly identified and dimensioned on the plan view and profile views on the CCPs.
2. Water crossing over Wastewater/Stormwater/other Non-Potable Systems:
   a. When a public water main crosses these types of systems, the water main shall cross above, with a minimum 18 inches vertical clearance from such system, and maintain cover pursuant to 3.3.4A of these Standards.
   b. A vertical clearance of less than 18 inches may be allowed, with prior approval from the District. In these cases, the District shall require one or more protective measures, which may include encasement, joint wrap, frost protection, or the use of a solid steel casing pipe. Refer to Standard Drawing W-31 for typical joint wrap.
3. Water crossing under Wastewater/Stormwater/other Non-Potable Systems:
   a. Public Water mains crossing under should be avoided to the extent possible, and shall only be allowed with District approval.
   b. When a public water main crosses under these types of systems, the water main shall maintain 18 inches of vertical clearance from such systems.
   c. The joints of the non-potable utility shall be wrapped 10 ft either way from the crossing, at a minimum. Where the 18-inch separation cannot be achieved at a sewer crossing, the crossing shall be constructed per Appendix B, Section 33 14 13, Subsection 3.3.J.
   d. Water mains crossing under or lowered under large utilities of 24-inch diameter or larger shall be required to be installed in a casing pipe.
   e. A vertical clearance of less than 18-inch will only be allowed with District approval.

D. Lowerings. In cases where a main cannot meet the separation requirements of the previous section, the main shall be lowered to cross underneath a wet or dry utility.

1. All lowerings are subject to clearance and frost protection requirements noted in these Standards.
2. Lowerings may be designed utilizing either manufactured bends or pipe- joint deflections (also known as vertical sweeps).
   a. Manufactured Bends shall be DIP mechanical joint (MJ) type.

b. Pipe-joint deflection for DI pipe. Each pipe-joint deflection shall not exceed 80% of that allowed by the Ductile Iron Pipe Research Association's (DIPRA) current publication.
c. Pipe-joint deflection for PVC pipe. Each pipe-joint deflection shall not exceed one (1) degree per length of pipe. If the Design Engineer would like to use a greater degree of deflection then they shall provide written information on the allowable joint deflection, along with written instructions on how the pipe shall be installed, by the manufacturer of the PVC pipe. Approval of this method may be allowed on a case-by- case basis.
d. All lowerings shall be noted on the CCPs and specifically shown and designed in a "to-scale, engineered" profile view. Each profile view shall show horizontal stations for each bend, fitting, valve, casing ends and any deflections. Each profile view shall also show vertical distances and vertical elevations (to top of pipe), relative to the finish grade and to the utility(s) being crossed. Plan and Profile views shall show horizontal and vertical distances to other utilities or structures in the immediate area of the lowering. If pipe-joint deflection is used, each curved alignment section shall be labeled with curve data. Data shall include PC and PT stations (labeled as Begin Joint Deflection and End Joint Deflection respectively), radius, delta, length, joint deflection per joint and pipe segment lengths.

3. Ditch Crossings/Lowerings. Crossings with Named Ditch Companies may require that the Ditch Company be contacted for their approval of each crossing. In addition to the requirements of these Standards, the Ditch Company may modify or add to the requirements of these Standards, provided the requirements are more stringent.
   a. Steel Casing. The casing shall be of sufficient length so that the ends of the casing may be exposed without excavating in the ditch Right-of- way or easement; a minimum of 10 feet beyond any toe or top of slope of the ditch. Refer to Section 3.4.11 Steel Casing Pipes and Standard Drawing W-16 for additional requirements.
   b. Cut-Off Wall. A clay or concrete cut-off wall shall be placed on both ends of the casing pipe; extending vertically 1 foot above the maximum free surface water elevation of the ditch (or as required by the Ditch Company).
   c. Cover, shall be 3 feet or more from the flow line of the ditch to the top of the casing pipe.
   d. Valves. The crossing shall be isolated by valves near each end of the crossing/casing. Typically, in-line valves should be placed approximately 40 feet from each end of the casing pipe.
   e. Rehabilitation. All ditches shall be restored per Appendix B, Section 33 05 07, Subsection 3.5.

3.3.5 Frost Protection

A. General.

To protect from frost, public water mains require a minimum of five (5) feet of cover, from top of pipe to finished grade.

1. Large Open Conduits. To protect from frost, public water mains require a minimum of three (3) feet of clearance between large open conduits (e.g. stormwater boxes, pipes, and culverts greater than 24" in diameter) and other open channels that are exposed to the atmosphere and/or free flow of air.
2. Crossings/Lowerings. If 18-inch minimum clearance is provided at a crossing, insulation is required for large open conduits (36-inch diameter and larger).
3. Casings. Insulation is not required between open conduits and casings.

B. Where minimum cover cannot be achieved insulation shall be required, see Standard Drawing W-17.

3.3.6 Dead End Stubs

A. The maximum length and size of a dead-end main shall be determined relative to the number of service lines and fire protection needs; however, in no instance shall a Public Water System main or fire hydrant lead having no permanent taps/services exceed 250 feet. All temporary stubs used for phasing shall be considered dead-ends.

B. In cases where a main cannot meet these criteria, the main shall be designed to create a looped/redundant Public Water System with appropriate connections to an alternate portion of the District's existing or proposed Public Water System.

C. All dead-ends/stubs shall terminate with a fire hydrant or blow-off assembly. A temporary 2-inch blow-off can be used for temporary stubs at phase lines which have no services.

D. A tee post shall be placed at the terminus of all dead ends/stubs.

3.3.7 Access Roads

A. Access shall be encompassed by a Right-of-Way, Easement, or Tract.

B. Access Roads shall be in the form of a permanent, paved public street. Alternatively, access roads may be a permanent, road base material placed on a compacted stable subgrade, meeting the following minimum criteria.

1. Access roads shall be minimum fifteen (15) feet wide and a maximum longitudinal slope of 8%. Access road shall have a crown slope or cross slope between 2% and 4%. Vertical Clearance for vehicular travel shall be at a minimum 14 ft.
2. Access road materials shall be road base conforming to CDOT Class 5 or Class 6. Road base material may be sourced from recycled concrete or asphalt.
3. Access roads shall have a minimum turning radius of 40 feet on centerline.

3.4 APPURTENANCES

3.4.1 Valves

A. Gate valves shall be used on water mains whenever possible. Butterfly valves shall be used on water mains 16-inch diameter and larger. Valves, including butterfly valves, shall be direct bury unless otherwise required by the District. Refer to Standard Drawings W-04 for typical gate valves and W-05 for typical buried butterfly valves. Placement of valves shall be as follows:

1. Typically, on each branch of all crosses and tees, for intersecting mains.
2. No further than 600 feet apart, on Distribution mains.
3. No further than 1,200 feet apart, on Transmission mains.
4. Fire service lines and fire hydrant leads shall have a valve placed at the tee, on the main. Fire service line valves shall be supplied with a valve box and locking lid assembly.
5. Valves shall be placed on both sides of all encased crossings.
6. A valve shall be placed at the terminus of a cul-de-sac in cases where a fire hydrant is required at the end of a cul-de-sac. The valve shall be located no closer than 5 feet from lip of gutter, or edge of pavement.

B. Valve box installation requirements, including plastic wrap and open-field valve box treatment and marking, are specified in Appendix B, Section 33 14 20.

C. Valves and valve boxes shall not be located within any portion of a concrete gutter pan or cross-pan. Additionally, valves and valve boxes shall not be located closer than 2 feet to any lip of gutter or cross-pan.

D. Butterfly valve actuators/nuts shall be located on the north(erly) and west(erly) sides of all mains.

E. Where butterfly valves are installed in vaults, refer to Standard Drawing W-5A for typical butterfly valve vaults and Standard Drawing W-5B for large-diameter butterfly valve vaults. Unless otherwise required by the District, all valves shall open counterclockwise (left) to open, consistent with Standard Drawing W-04. Where the governing fire authority requires its fire hydrants to operate in the opposite direction, hydrant operation shall follow that fire authority's requirement as provided in Section 3.4.3.

3.4.2 Tapping Saddles & Valves

A. For connections to an active water main, the new lateral is permitted to be equal in size to the existing main, provided the wet-tap used to make the connection is one nominal pipe diameter less than the main size being tapped. (eg a 8"x6" tap).

B. If there is a key facility as determined by FCLWD that could be put out of water the District Engineer may allow a size-on-size wet tap and will provide written approval.

C. For connections where the new lateral is larger than the existing main, a Tee connection is required.

3.4.3 Fire Hydrants

A. Spacing, locations, and design requirements. The spacing, locations, and general design requirements for Fire Hydrants shall be determined by the governing fire authority.

B. Locations. Refer to the local fire authority or district for location guidelines.

C. Clearance / Cover

1. Fire hydrants shall be placed pursuant to Standard Drawing W-29.
2. There shall be no permanent surface obstruction within 10 feet of the nearest edge of a fire hydrant. Shrubs and bushes (upon maturity) cannot be within four (4) feet, tree trunks (upon maturity) cannot be within 10 feet of the nearest edge of a fire hydrant. In addition, a five (5) foot operational clear radius around each fire hydrant assembly shall be kept free of posts, fences, vehicles, growth, trash, storage, and other materials or things, per Appendix B, Section 33 14 19.
3. Hydrants shall be located within a Right-of-way or Easement.
4. Fire hydrant leads shall have a minimum of 5 feet of cover from top-of-pipe to finish contour elevation.
5. In high traffic areas, and areas in the opinion of the District are high risk, bollards shall be placed to protect fire hydrants. Bollards shall be placed 48-inches from hydrant center to center (Section 3.4.14).
6. Where the requirements of the governing fire authority's adopted fire code are more restrictive than these Standards, the fire code shall govern.

3.4.4 Thrust Restraint / Devices

A. Wet-tap connections shall be restrained by a concrete thrust block. All other fittings (e.g. bends, reducers, tees, crosses, plugs/caps, fire hydrant tees to boots, valves, etc.) shall be restrained by an approved mechanical joint restraint devices. Refer to Standard Drawing W-TB, W-13.

B. Mechanical Joint Restraint

1. At a minimum, mechanical joint restraint devices shall meet the required restrained length as listed in Standard Drawing W-13.
2. Required pressure for use in determining the minimum restrained length:
   a. For Fire lines, The Design shall use a minimum pressure of 200 psi and a safety factor of 1.5.

b. For all other lines, the Design shall use a minimum pressure of 150 psi and a safety factor of 1.5. The required restrained length shall be designated on the plan by stationing.
c. The required restrained length shall be designated on the plan by stationing.

3. For mains sizes larger than 12 inch: the Design Engineer shall specify the type of fitting joint, pursuant to these Standards, and in certain cases, may also be required to provide thrust/restraint calculations to determine if other and/or alternate thrust/restraint systems are necessary.

C. Concrete Thrust Blocks: Refer to Standard Drawing W-TB for details and design of typical thrust block configurations. Thrust blocks shall only be used at Wet-tap connections and at other locations approved by the District Engineering staff.

3.4.5 Services

A. General

1. All public portions of service lines shall be installed a minimum of 5 feet below finish contour elevation.
2. The material type on the private portion of the service line can change 5 feet past the water meter pit/vault. Tracer wire shall be required to be installed on all non-metallic pipes.
3. Services can cross through adjacent lots as long as they are within a private dedicated utility easement.
4. Domestic services taps shall be made off the Public Water System main and shall not be connected to any portion of a fire hydrant lead or fire service line.
5. Booster Pumps/Tanks: Booster pumps for domestic service that are proposed external to the building are allowed with an air gap/reduced pressure (RP) device only. Booster pumps are allowed only with written approval from the District and a water demand study from the applicant. Booster Pumps are prohibited on irrigation systems.
6. All pipe, fittings, valves, meters, and appurtenances with wetted surfaces shall be lead-free in accordance with Section 1417 of the federal Safe Drinking Water Act and certified to NSF/ANSI/CAN 372.

B. Domestic Service Types/Scenarios:

1. Residential Single Family, Duplex or Townhome: A type of dwelling unit whereby each unit is situated upon its own separate, platted lot, shall be serviced individually by one tap, service line and meter (including meter pit) for each platted lot.
2. Residential Multi-Family Campus: A type of dwelling structure containing three or more residences within a building situated upon a single platted lot, shall be serviced by one tap, service line and meter for each Multi-Family building. Irrigation shall be served off a separate irrigation service line and meter.

3. Commercial Campus: A building with one or more internal tenant spaces where the building is situated on its own separate, platted lot shall be serviced individually by one tap, service line and meter (including meter pit or vault) for each platted lot. District approval of irrigation service off of commercial buildings will be evaluated for all taps above three-quarter (¾) inch diameter during the Development process, by tenant occupancy, or upon review of actual water use. Commercial taps one and one-half (1.5) inches and larger are subject to analysis per Section 3.2.
4. Accessory Structures: Accessory Dwelling Units (ADU), Accessory Living Areas (ALA), and other accessory structures are governed by land use code, with definitions established by the land use jurisdiction. Depending on the proposed use and location, an accessory structure may be served by extension of the existing residential tap, or may require its own tap, service line, and meter. The District will determine on a case-by-case basis whether extension of the existing residential tap is permitted. Commercial use of any accessory structure will require backflow prevention.

C. Irrigation Services

1. Irrigation Services: Taps and service lines may be made off the Public Water System main with a dedicated meter or off the customer side of a domestic service line.
2. Irrigation System Design - Pressures in the water system fluctuate through the year. Historically high demand peak irrigation season is June through August. The Design Engineer is responsible to verify the minimum water system pressures occurring seasonally and throughout the day, especially during peak demand periods.
    a. Contact District Staff to determine a preliminary design pressure range based off of our design model. The design model uses a conservative time extended period simulation of the max day demand.
    b. Use the low end of the preliminary design pressure range for the irrigation design.
    c. The applicant will be responsible to verify the final pressure at the time of final design.
    d. Dedicated irrigation system meters shall be designed based on the available flow through the meter at the project site, but shall not exceed the flows set forth set by the manufacturer.

D. Fire Services

1. Approved fire sprinkler systems
    a. NFPA 13 (Commercial) and NFPA 13R (Low-rise residential structures up to and including 4 stories). These fire service lines:
        - Shall have separate, dedicated taps off the Public Water System main.
        - Shall not be tapped off any portion of a domestic service line.

- Shall be 4 inches to 12 inches, unless hydraulic calculations from the licensed fire-sprinkler designer can confirm a smaller diameter can meet supply requirements.
- Shall be designed with an isolation valve at the point of connection to the Public Water System main. All isolation valves shall have locking type lids inserted in the valve box assembly.
- The minimum tap and valve size shall be 4 inches.

b. NFPA 13D and P2904 fire sprinkler systems are approved to protect one- and two-family dwellings. These fire systems can be designed using the domestic water line or a separate fire service line. A tank and pump system may also be used for NFPA 13D systems but these are not directly connected to the Public Water System. Water supply requirements are specified in NFPA 13D or the International Residential Code (P2904 systems).

- A property requiring a new domestic service line and a new fire line connection may be served from a single tap off of the Public Water System at the District's discretion.

2. The District owns the fire line isolation valve on the District's water main. Fire service lines shall be considered privately owned and maintained from the isolation valve, continuing on to a building structure (reference Appendix B, Section 33 14 13, Subsection 3.6).
3. Fire service lines shall be located a minimum of five (5) feet from any domestic service line.
4. Fire service lines shall not be tapped off any portion of a fire hydrant lead.
5. Fire service lines are not required to be metered however the District may choose to have a meter installed for fire hydrants that are located outside right-of-way and not easily accessible. The meter will be installed at the Developers' costs but will be unbilled.
6. Companies installing underground fire service lines from the Public Water System main to the fire sprinkler risers must be registered as State of Colorado Fire Suppression System Contractor – Underground per current requirements of Colorado Division of Fire Prevention and Control.

3.4.6 Meters

A. Types

1. Single Meter (3/4" and 1") Configuration and pit dimensions are detailed in Standard Drawing W-08.
2. Single Meter (1-1/2" and larger) Configuration and vault dimensions are detailed in Standard Drawings W-10 and W-11.

3. Double Meter (3/4”) Two 3/4" meters may be installed in a single pit. Configuration and pit dimensions are detailed in Standard Drawing W-09. Meters 1” and larger are not permitted to be within the same meter pit.

B. Location

1. Meter pits and vaults shall not be installed within any parking area or parking stall, driveway, alley, or sidewalk area. In certain cases, and with prior written approval of the District, pits and vaults may be installed within these areas, provided appropriate easements, access, and traffic loads are adequately accommodated.
2. If there is an existing meter inside of a building, the service line from the curb stop to the meter is considered private. Upon redevelopment the District may require that the meter be relocated outside of the building.
3. Trees and structures (e.g. trees (upon maturity), boulders, retaining walls, drainage facilities, utility vaults, poles, etc.) shall not be within ten (10) feet of any outside edge of a meter pit or vault.
4. Shrubs and bushes (upon maturity) shall not be within 4 feet of any outside edge of a meter pit or vault.

C. Couplings & Fittings

1. Existing meters located within a building - other than a curb stop valve, there shall be no more than one additional coupling/splice in a service line between the corporation stop and meter.
2. Meter Pit located outside of the building - couplers or fittings are not permitted between the corporation stop and meter.

D. Meter/Service Line/Tap sizes

1. For all single meter installations (except for 3 inch meters), the tap/valve and service line shall be the same nominal size as the meter.
2. For 3 inch meter installations, the tap/valve and service line shall be 4 inch diameter with a 4”x3” reducer before the meter.
3. The District supplies meters three-quarter inch (3/4”) through two inches (2”). Meters larger than two (2) inches shall be purchased and provided by the Developer or contractor.

E. Meter Sizing

1. All meters depicted in CCPs shall be sized by the Design Engineer to properly accommodate projected peak flows for domestic and, in some cases, irrigation use.
2. Meter and service line sizing shall be based on the current version of the I.P.C.
3. The maximum allowable flow rate for any meter shall be per Positive Displacement guidelines in accordance with AWWA Manual M22 and provided below:

Meter size (inches)	Max Flow Rate (GPM)
3/4	30
1	50
1 1/2	100
2	160
3	400
4	800
6	1,600

4. The final capacity of a water meter in the District's system is based upon system pressure and tap diameter and there is no guarantee of a meter capacity based upon a given size.

F. Frost Protection

1. All meter pits and vaults shall be furnished with frost protection. Refer to Standard Drawings W-08 thru W-12 in Appendix D and Appendix C for approved materials in installation requirements.

3.4.7 Air Relief Valves

On all water mains, a combination air valve, air- release valve and air/vacuum valve, (ARV's) shall be provided at all high points. ARV's placement and design shall use AWWA M-51 design criteria. ARV's shall be placed in manholes or vaults. See Standard Drawings W-19 through W-27 for double 2-inch ARV and 20-inch-diameter access configurations (steel and DIP/PVC).

3.4.8 Blow-Off Assemblies/Structures

A. On Transmission mains, in-line blow-off valves are required at severe low points, lowerings and/or at crossings. The District will assist the Design Engineer in determining sizes and placement of blow-off valves/assemblies. Refer to Standard Drawing W-30A and W-30B.

B. 2-inch temporary construction blow-offs can be used for stubs at phase lines which have no services.

1. The main between the temporary blow-off and the nearest inline valve shall be emptied of water after final testing and acceptance.

2. Temporary blow-off construction requirements are specified in Appendix B, Section 33 14 13, Subsection 3.5.D. Temporary blow-offs shall be abandoned at the main prior to acceptance of the waterline; the location shall be marked with a tee post.

C. Air-relief valve chambers (manholes/vaults) and blow-off assemblies shall not be connected to, or allowed to discharge directly into, a sanitary sewer. Discharge shall be conveyed in an approved manner that prevents any cross-connection.

3.4.9 Pressure Reducing Valves

Pressure reducing valves shall be installed with prior approval from the District.

3.4.10 Backflow Prevention Assemblies

A. To prevent contamination of the District's potable water system, a backflow prevention assembly shall be installed where backflow or back-siphon from a private water user's system may exist.

B. Private Backflow Prevention Assembly shall be placed on the customer side of the water meter and installed per District Cross-Connection Control Manual. Refer to Standard Drawing W-32 for the typical backflow enclosure.

C. Each backflow prevention assembly shall be tested upon installation by a Certified Cross-Connection Control Technician in accordance with Section 11.39 of the Colorado Primary Drinking Water Regulations (5 CCR 1002-11), and passing test results shall be provided to the District before the assembly is placed in service.

D. Refer to https://fclwd.com/resources/backflow-prevention/ for additional requirements and resources concerning backflow prevention

3.4.11 Steel Casing Pipes

A. Casing may be required by the District at crossings that include, but are not limited to large diameter utility crossings (24-inches and larger), ditch crossing, and railway crossings. Refer to Standard Drawing W-14.

B. The District reserves the right to require a specific pipe material for any public water main installation.

C. All joints of the water main within the casing shall be restrained together to be able to retract the pipe in the future.

D. Each casing pipe installation shall be specifically designed by the Design Engineer.

E. Cathodic protection of steel casing pipes is required for Major Crossings such as for railroads, rivers, ditches, bridges and large stormwater culverts (nominal diameters greater than 24") or if required by the District.

1. Cathodic Protection design shall be shown on the plans per section 3.4.12.

3.4.12 Corrosion Control for Metallic Pipe and Fittings

A. Soil-Test Evaluation

1. In all cases where metallic pipe will be used (DIP or Steel), the Design Engineer shall have a certified Geotechnical Engineer perform a soil-test evaluation in strict accordance with AWWA C105, Appendix A (also commonly known as a 10-point soils test) and submit the results of the evaluation to the District for consideration and review.
2. The Water-Saturated Soil Box method shall be used to measure the resistivity of the soil.
3. The distance between sample locations shall be at the discretion of the District, however testing frequency shall not be less than one test for every 400 linear feet of pipe.
4. Soil samples shall be taken at pipe depth.
5. Soil samples shall be tested in saturated condition.

B. Cathodic Protection (CP) Design

1. If the results of the 10-point soils test concludes the soil is corrosive to metallic pipe (10 points or greater), the Design Engineer shall submit to the District for approval a comprehensive plan with proposed design for cathodic protection. The design shall be completed by a registered PE and AMPP (formerly NACE) certified Cathodic Protection Technologist or higher.
2. Anodes & CP Test Stations: Shall be installed as specified by the results of the CP design. Refer to Standard Drawing W-15 for cathodic protection details.
3. Active cathodic protection shall not be permitted unless approved by the District Engineer.
4. Isolation and Joint Bonding: requirements are specified in Appendix B, Section 33 05 07, Subsection 3.4.
5. Polyethylene Encasement: Required for all DIP and/or fitting. See Appendix B for approved encasement materials.
6. Steel Casing: CP is required for all new installations of steel casing pipe. The Engineer shall provide CP design on the plans. A soil resistivity analysis shall be performed in all cases per Section 3.4.12A. A minimum of one magnesium anode and CP test station are required at each end of the steel casing pipe, per Appendix B, Section 33 05 07.

3.4.13 Groundwater Barriers

A. Groundwater barriers for the water system are not typically required. However, in cases of high groundwater, the District reserves the right to require groundwater

barriers for the water system. This requirement may be enforced by the District at any time during the project. Reference Standard Drawing W-18.

B. Groundwater barriers shall be designed to impede passage of groundwater through the entire portion of the excavated trench.

C. Groundwater barriers shall extend through the full depth of the granular bedding/pipe zone material and project 1 foot beyond each side of the trench wall. Groundwater barriers shall extend to a point 1 foot above the maximum peak wet season level of sub-surface groundwater as determined by the design engineer, but not less than 3 feet above the top of the pipe. This requirement applies in all cases, including those locations near or adjacent to a natural waterway, pond/lake, or irrigation ditch. Other requirements may apply due to specific criteria from each ditch company.

3.4.14 Traffic Bollards

A. Traffic bollards shall be placed in high-risk areas to protect above-grade Public Water System features. High-risk areas include but are not limited to; parking lots, street sections without curbs, electrical and communication panels.

B. Bollard materials, coating, footing, and installation requirements are specified in Appendix B, Section 32 39 13. Bollards protecting fire hydrants shall be placed 48-inches from hydrant, center to center.

3.4.15 Sampling Stations

A. As part of the Development Review Process, the District may require dedicated water quality sampling stations within a Development Project Area. Sampling stations support the District's routine bacteriological monitoring under Colorado Primary Drinking Water Regulations (5 CCR 1002-11) and water quality investigations.

B. Sampling stations will typically be required, at the District's discretion, at one or more of the following locations:

1. Dead-end mains or other areas of reduced circulation;
2. Remote extremities of the Development Project Area relative to existing District sampling locations;
3. Pressure zone boundaries or other locations identified by the District during review of CCPs.

C. Sampling stations shall be installed by the Developer at the Developer's cost and shall conform to Standard Drawing W-12 and the Approved Materials List (Appendix C).

D. Sampling stations shall be located within a Right-of-way or Easement, shall not be located within any parking area, driveway, sidewalk, or traffic area, and shall be accessible to District staff at all times.

E. Sampling station service connections shall be tapped directly off the Public Water System main, shall not be metered, and shall not serve any other use.

F. Upon Final Acceptance, sampling stations shall be owned, operated, and maintained by the District.

3.5 EASEMENTS/TRACTS

A. Easements or Tracts shall encompass all portions of the Public Water System that may extend beyond or outside a platted right-of-way.

B. Easements, when dedicated by a Final Plat, shall be designated as Public Utility Easements, exclusively for the Public Water System.

C. Tracts, when encompassing public water mains and related appurtenances, shall also be designed as Public Utility Easements.

3.5.1 Width of Easements or Tract/Main Location

A. The minimum width for an Easement and Tract shall be 20 feet. At the District's direction, a wider easement may be required for large diameter pipes (16-inch and larger) and/or waterlines exceeding 7 feet deep.

B. Mains located between two private lots and not within a Tract, shall be placed within an Easement. The Easement shall be situated entirely on one lot or the other with the main located within the Easement as noted in 3.5.1A, herein.

C. Easements containing more than one water main shall be increased by an additional 6 feet for each additional main.

D. Waterlines shall be centered within the Easement unless otherwise approved by the District.

3.5.2 Hydrants & Meters and Other Appurtenances

Hydrants, meter pits, meter vaults and other related appurtenances shall generally be centered within a designated Easement. At a minimum, Easements shall extend 10 feet beyond all sides of any hydrant, hydrant lead, meter pit, vault or other Public Water System appurtenance.

3.5.3 Restrictions within Easements and Tracts.

A. Permitted Improvements. Pavement, sidewalks, bike paths, minor swales and berms and certain landscape features may be allowed within an Easement or Tract that encompasses a Public Water System main.

B. Landscape Restrictions See Section 3.3.3.

C. Prohibited Improvements. Structures, e.g. permanent concrete base "kiosk" or clustered mailboxes, sheds, light poles, overhanging decks, buildings (with permanent or temporary foundations), permanent fences and other substantial structures, shall not

be allowed within any portion of an Easement or Tract designated to encompass a Public Water System.

CHAPTER 4 – CONSTRUCTION, ACCEPTANCE, AND WARRANTY

4.1 PRE-CONSTRUCTION REQUIREMENTS

4.1.1 Contractor Qualifications for Large-Diameter Mains

A. For water lines 16” in diameter and larger the installation contractor must show reasonable qualifications and experience in the installation of similar infrastructure. Qualification statements shall be submitted to the District for approval prior to construction.

B. The qualification document shall include at least three similar size projects (diameter and lengths shall be equal to or larger) that show the District that the Contractor is qualified and capable of the installation.

C. Information to be included in the qualification document is listed below

1. Name and date of project
2. Detailed description of project (including pipe length, size, etc.)
3. Location of project
4. Project owner
5. Project designer
6. Current contact information for reference.

4.1.2 Material Submittals

A. Following District approval of the CCPs and prior to scheduling the Pre-Construction Meeting, the Developer/Contractor shall submit all required material submittals to the District for review and approval. Materials shall not be delivered to the site or installed until submittals have been approved by the District.

B. At a minimum, submittals shall include product data, cut sheets, shop drawings, and/or manufacturer certifications for the product categories listed in Appendix B, Section 01 33 00.

C. Where certified material test reports are required to be furnished by a manufacturer or supplier, the Developer/Contractor shall furnish duplicate copies of the reports to the Inspector for approval prior to actual use or installation of such material.

D. The District shall review submittals within the review period established in Appendix B, Section 01 33 00, and either approve or reject the submittals. Rejected materials shall not be brought to the site or used in the installation.

E. Approval of submittals does not relieve the Developer/Contractor of responsibility for compliance with these Standards.

4.1.3 Pre-Construction Meeting

A Pre-construction meeting between the District and the Developer/Contractor shall occur prior to beginning any Work within an approved Development Project Area and shall not take place until the District has received and approved the prerequisite documents described in the Development Process Guidelines (Appendix A). At a minimum, the Contractor installing the Public Water System infrastructure shall attend. Scheduling, required attendees, prerequisite documents and submittals, designation of the project's Point(s) of Contact, and other meeting logistics shall be as set forth in Appendix A.

4.2 FIELD INSPECTIONS

The District shall inspect all Public Water Systems installed pursuant to these Standards.

4.2.1 District Inspection Authority and Duties

A. The Contractor shall provide advance notice prior to starting any Work, per Appendix B, Section 01 10 00, Subsection 1.5.

B. The Inspector shall have access to the area of installation, materials, labor and tools at all times and shall be authorized to inspect and enforce these Standards. Access shall be provided in a manner that does not impede or prohibit such access by the Inspector. All materials, labor, tools and methods of installation are subject to inspection and approval by the Inspector. The Inspector shall have the authority to reject materials, tools, workmanship and/or certain methods of installation not in compliance with these Standards; any such noncompliance shall be remedied immediately pursuant to the Inspector's written instructions. Rejected workmanship or installation methods shall be satisfactorily corrected, and any rejected materials and tools shall be removed from the premises. If rejected materials and tools are not removed within the period established in Appendix B, Section 01 10 00, Subsection 1.8, the Inspector has the authority to have these materials and tools removed from the site at the expense of the Developer/Contractor.

C. The Developer/Contractor shall not cover any portion of the Public Water System until the Inspector has had an opportunity to inspect all workmanship and materials.

D. If the Inspector considers it necessary or advisable to examine workmanship or materials that have been previously installed and/or completed, and are deemed not pursuant to these Standards, the Inspector may require the Developer/Contractor to remove, expose, excavate, or otherwise make available certain workmanship areas or materials for examination or further testing by the Inspector. In this case, the Developer/Contractor shall supply all labor, equipment and materials to complete the requested removal, exposure or excavation at their expense. Additionally, if such workmanship or material is found not pursuant to these Standards, the

Developer/Contractor shall incur all expenses necessary to bring the workmanship or materials into compliance with these Standards.

E. Inspection of workmanship and materials is intended to aid in the compliance with these Standards. Such inspection, however, shall not relieve the Developer/Contractor from any obligations related to the requirements of these Standards. Responsibility for the replacement of materials not in compliance with these Standards shall rest entirely with the Developer/Contractor during installation and, as applicable, throughout the warranty period.

F. The Inspector and the Developer/Contractor are not authorized to waive or substantially modify any portion of the signed final CCPs without first preparing and submitting and receiving written approval from the District Engineer. The District maintains the right to require changes be submitted to the local jurisdiction's planning department as an amendment to the development.

G. The Developer/Contractor shall abide by all District and relevant OSHA safety requirements and programs.

H. The Developer shall be responsible for the cost of re-tests, excessive inspection, and inspection performed outside District working hours, per Appendix B, Section 01 10 00, Subsection 1.7.L. District working hours (Operations Department) are 7:00 a.m. to 3:30 p.m. Monday through Friday exclusive of holidays. Such work shall be coordinated with the Inspector and the District will notify the Contractor when such costs are being incurred.

I. Contractor shall make reasonable efforts to allow safe and timely access to all inspections. In addition to making visual inspections, Inspectors shall have access and ability to:

1. Perform or request tests
2. Take GPS data points

4.2.2 Work Requiring Inspection

At a minimum the following Work shall be witnessed and inspected by the Inspector:

A. All water facilities including but not limited to; fittings, joint restraints, service taps, meter pits, valves, tracer wire, subgrade and bedding, field testing.

B. Inspector has the right to require witness of any Work involving the Public Water System, including Work that is adjacent, crossing, or parallel to the Public Water System.

C. Substantial Completion Walk-Through: Contractor shall schedule a Substantial Completion Walk-Through with the Inspector. Walk-Through shall include the creation of a punch list (as necessary), and verification that all Public Water System infrastructure is to grade and accessible with an all-weather driving surface. For

roadway facilities, minimum acceptable accessibility requirement is road base material with preventative measures taken to avoid damage to facilities until pavement is installed.

D. Final Walk-Through: Contractor shall schedule a Final Walk-Through with the Inspector. Walk-Through shall include final inspection of the Public Water System infrastructure. Roadway facilities shall be completed, with all surface features in final condition.

4.3 MATERIALS TESTING AND SPECIAL INSPECTION

4.3.1 Material/Soil Testing Reports

A. These Standards state the minimum requirements for material and soil sampling, testing, and inspection. All geotechnical tests shall be made and certified by an approved testing laboratory and all test reports, analyses, and recommendations shall be prepared by an Engineer. All costs pertaining to testing shall be the responsibility of the Developer/Contractor.

B. Whenever, at the discretion of the District, additional tests or data are required beyond the minimum identified in these Standards or on the signed CCPs, the costs of such tests initially shall be the responsibility of the District. In the case where such tests or additional data show a failure to meet these Standards or approved CCPs, the Developer/Contractor ultimately shall be responsible for such costs, along with all costs associated with necessary mitigation measures. In the event the Inspector does not approve any material proposed to be used by the Developer/Contractor, said materials shall be immediately removed from the Development Project Area.

4.3.2 Inspection for Major Structures

Construction of a Major Structure or improvements to a Major Structure may require Inspection services beyond what District staff can provide. Therefore, if required by the District, a District approved 3rd Party Professional Inspection services company shall be contracted for the Inspection services. The 3rd Party Professional Inspector's services shall be paid for by the Developer responsible for paying for the Major Structure; however, the 3rd Party Inspector's contract shall be between the 3rd Party Inspection company and the District.

4.4 TESTING REPORTS

4.4.1 Required

A. Water Mains require the following reports:

1. Bacteriological Test results (from a State Certified Laboratory); 1st Test provided by the District
2. Water Line Pressure Test report (for the hydrostatic test results).

B. All new water mains shall be disinfected and flushed in accordance with AWWA C651 before being placed in service, with bacteriological sampling performed after disinfection.

C. Refer to the Technical Specifications in Appendix B (Section 33 13 00) for required testing procedures.

4.4.2 Submittal Process

A. If a District Water Line Pressure Test report is required. The Inspector shall provide the Test Form which will contain the specific required pressure test values. After the test is complete the Contractor shall sign the bottom of the form indicating the test results.

B. A copy of any and all required reports shall be provided to the Inspector prior to substantial completion and final acceptance.

4.5 RECORD DRAWINGS

4.5.1 Required

Record Drawings for Public Water Systems are required for all CCPs that have been signed as approved for construction by the District. Generally, Record Drawings are required for all Public Water System facilities, including but not limited to water mains, service lines, meter pits, fire services, fire hydrants, valves, fittings, casings, backflow prevention assemblies, sampling stations, and corrosion test stations. Refer to Section 4.5.3 for the required content of Record Drawings.

4.5.2 Maintenance of CCPs and Other Documents by the Contractor

A. CCPs and other documents shall be maintained in a clean, dry, legible condition and in good order.

B. Changes or revisions from the final CCPs should be recorded concurrently, as installation progresses.

C. All CCPs and other documents used for the preparation of Record Drawings shall be available for review by the Inspector, upon request.

4.5.3 Content of Record Drawings

A. The CCPs shall be updated with all design changes that occurred after plan approval.

B. All changes and revision shall be marked legibly and shall be denoted by clouding, boxes, or other visible ways of clarifying the change or revision.

C. Record Drawings shall be submitted in the same coordinate system as the approved CCPs. Refer to Section 2.3 for the coordinate system requirements.

D. Record Drawings shall include, at a minimum, the following:

1. Locations of all water lines and points associated with the water lines.

2. All water mains with designated sizes and materials.
3. All service lines from the main to the meter with designated sizes.
4. All fire lines with designated sizes and materials.
5. All fire hydrant assemblies with tees, water lines and gate valves
6. All valves including but not limited to air release valves, blow off valves, butterfly valves, check valves, gate valves, pressure reducing valves with designated sizes.
7. All fittings with designated sizes including but not limited to horizontal and vertical bends, couplings, reducers, crosses, tees, plugs, and water services.
8. All casings with designated sizes, materials, and lengths.
9. Location of cathodic protection / corrosion test stations.
10. All water meters and meter pits with designated sizes and locations.
11. All backflow prevention assemblies with designated sizes, types, and locations.
12. All sampling stations with locations.
13. Depth of cover over water mains and, where it varies materially from design, at points of change.
14. All thrust restraint, including the type and extent of restrained-joint pipe, mechanical joint restraints, and thrust blocks.
15. Horizontal locations shall be defined by Northing and Easting coordinates in accordance with the datum in Section 2.3.2B and the coordinate system in Section 2.3.2C.
16. Vertical locations shall be defined by elevation in feet in accordance with the datum in Section 2.3.2A.

E. Record Drawings should be prepared by the original Design Engineer.

1. Record Drawings submitted by a Professional Land Surveyor are prohibited; however, a Professional Land Surveyor may provide certain data to assist the Design Engineer with preparation of Record Drawings.

F. Record Drawings shall include a copy of the originally signed CCP title sheet, and all sheets related to the Public Water System.

1. Do not submit any CCP Record Drawing sheets specifically depicting streets, storm drain, and grading to the District for Record Drawing review.

G. Each Sheet (including the title sheet) must be clearly labeled RECORD DRAWING in bold font. Below or very near the RECORD DRAWING label, a statement, signed and sealed by the Design Engineer, must be annotated as follows:

“These Record Drawings have been prepared based on information provided by the Contractor and on field observations. To the best of my knowledge, information, and belief, they depict the constructed condition of the Public Water System, including any noted changes or revisions, in

general conformance with the design and construction documents." [Design Engineer seal, signature, date]

4.5.4 Submittal Process

A. The following shall be submitted to the District for review and approval before final submittal:

   1. One electronic copy in PDF format and AutoCAD format of the entire drawing set with the Public Water Record Drawing sheets in place of the originals per the Development review Process found in Appendix A, together with a digital GIS dataset matching the District's schema.

B. The Inspector or District Utility Planning Engineer shall have ten (10) working days either to approve the Record Drawing submittal or contact the Design Engineer if changes are required. Subsequent approvals/disapprovals shall also be within five (5) working days.

C. If further changes are deemed necessary, the Inspector or District Utility Planning Engineer will contact the Design Engineer and request a resubmittal. Upon revising the Record Drawings the Design Engineer shall resubmit the Record Drawings to the Inspector pursuant to section 4.5.4B.

D. If no further changes are required to the initially submitted Record Drawings, said drawings shall be approved by the Inspector and remain property of the District.

4.5.5 District GPS Verification

The District may perform GPS surveying of installed appurtenances and features of the water utilities. The purpose of such surveying is for internal records and verification of record drawings. GPS surveying by the District does not preclude the Developer from providing approved Record Drawings as listed in the sections above.

4.6 ACCEPTANCE AND WARRANTY

4.6.1 General

A. Substantial Completion and Final Acceptance is required for Public Water Systems shown in CCPs that have been signed as approved for construction by the District. Generally, Substantial Completion and Final Acceptance is required for all water mains, meter pits, fire services, and fire hydrants.

B. Projects improving the Public Water System that do not include purchasing a tap from the District or considered minor work shall be issued Substantial Completion and Final Acceptance coincidentally.

4.6.2 Substantial Completion

A. Substantial Completion is required for the sale of any water tap.

B. Once Public Water System infrastructure has been installed, tested, and verified, the Developer may request Substantial Completion, provided the Developer has completed the following:

1. All testing completed and approved by District Inspectors.
2. All facilities meet the accessibility requirements defined in Section 4.2.2C.
3. Substantial Completion Walk-Through per Section 4.2.2C.
4. Record Drawings accepted by District prior to Substantial Completion request in accordance with Section 4.5.
5. Substantial Completion Request Letter. The Developer shall provide a letter addressed to District Engineering staff requesting Substantial Completion. At a minimum, this letter shall include:
    - The lot(s), blocks(s), parcel numbers, and street addresses as recorded with the county and the associated tap size and type. If there are more than four parcels for approval, this information must be presented in a table in both PDF and Excel formats.
    - Supporting exhibits showing the locations of the lots listed above.
    - Sizes and locations of any multifamily, irrigation, and / or conservation taps.

C. The Developer is responsible for all utility locates until Final Acceptance of the improvements.

D. The Developer is responsible for all facility repairs until Final Acceptance of the improvement and through the following two (2) year warranty period.

E. Where reimbursement agreements exist, the District may withhold approvals until the Developer pays such reimbursements.

4.6.3 Final Acceptance

A. Once a project is approved for Substantial Completion, the Developer has six months to gain Final Acceptance. Failure to comply with the completion date may result in suspension of all remaining tap sales, future phases, and / or future projects with the Developer until all requirements are satisfied.

B. The following items are required for Final Acceptance

1. Punch List
2. All punch list items have been addressed and verified by the District Inspector
3. Tracer wire has been tested and verified by the District.
4. All facilities are operational and accessible with finished pavement in place.
5. A Final Walk-Through has been completed by the District's representative, developer or developer's representative, and contractor's superintendent to confirm that the

facilities meet the requirements in these Standards. It is the Contractor's responsibility to schedule the Final Walk-Through.

6. Easements have been recorded with the county (reception number must be provided)
7. Final Acceptance Request Letter
8. The Developer shall provide a letter addressed to District Engineering staff requesting Final Acceptance. At minimum, this letter shall include
9. Cost of the public water infrastructure
10. Substantial Completion Letter from the District

C. Once the District issues Final Acceptance, the District is responsible for utility locate request.

D. Final Acceptance initiates the start of a two (2) year warranty period for the Developer.

4.6.4 Warranty Period

A. The Warranty period for Public Water System improvements shall be two (2) years and shall start from the date that Final Acceptance occurs.

B. It is the responsibility of the Developer to repair any damaged or broken infrastructure throughout the Warranty Period.

C. At any time during the Warranty Period the District may notify the Developer of needed repairs.

1. If the repair areas are considered to be an imminent danger to public health, safety, and welfare, the Developer shall act within 24 hours to complete the repair.
2. If the work is not considered a safety issue, the Developer has 10 working days to schedule the work, and 60 calendar days to complete the work. Time extensions may be granted due to weather constraints.
3. If the Developer does not complete the warranty repairs in the time frame specified, the District may choose to make the repairs. If so, the District will invoice the Developer for all costs of the related work and any applicable Board-adopted fees.
4. A new warranty period shall not be applied to any repair work performed during the warranty period.

D. Prior to the completion of the Warranty period, the District will conduct an inspection of the project and note any repairs needed. The District will inform the Developer of the required repairs and the Developer will cause the repairs to be completed.

E. If no repairs are needed, the warranty period will expire at the termination of the two (2) years with no further action by the District or Developer/Contractor.

APPENDIX A – DEVELOPMENT PROCESS GUIDELINES

FORT COLLINS • LOVELAND
WATER DISTRICT

Development Process Guidelines

Guide for taking your project from Review to Final Completion

7/30/2026

1. FCLWD Development Process

Every development project begins with a developer submitting plans to their local agency, who then forwards the design plans to District Engineering staff for review. District Engineering reviews plans against the enclosed plan review checklist while also considering future operational challenges that a design may cause. Once the review is complete, District Engineering sends the comments to the local agency to forward back to the applicant. Once all comments are addressed, District Engineering can sign the plans (preferably electronically).

Depending on the size and scope of the development project District Engineering staff may require a Water Impact and Demand Analysis Report (WIDA). When required, construction plans will not be reviewed without an accompanying WIDA report, or signed without an accepted WIDA report. For content and requirements of the WIDA report see Chapter 3.2 of the District's Development Standards. A checklist is included in the next section of this document for guidance only.

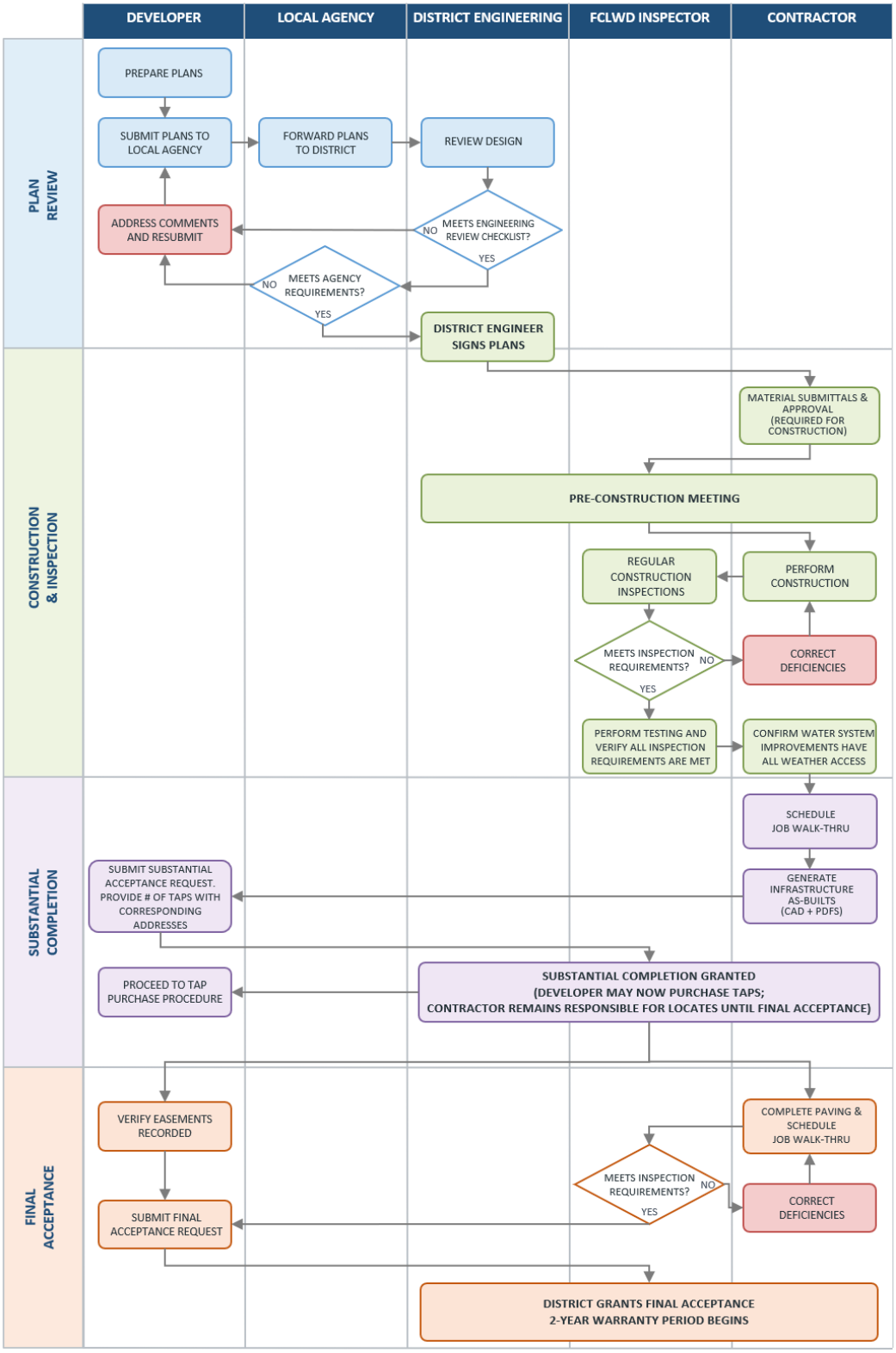
After construction plans are approved by District Engineering staff via signature, the development project may move to the construction phase. This document provides the necessary steps that the developer must follow throughout the construction process. This starts with a pre-construction meeting and ends with final acceptance of the public infrastructure.

The District and developer share three critical milestones for every project. The first milestone is **a Pre-Construction meeting**. Contractors may not start water construction prior to attending a pre-construction meeting with District staff. The second milestone is **Substantial Completion**. Acceptance of Substantial Completion officially allows the District to sell service taps for the project. The Developer remains responsible for locating and protecting the Work until Final Completion is Accepted. The third and final milestone is **Final Completion.** Acceptance of Final Completion initiates the developer's two-year warranty period on the infrastructure associated with that project, during which time the developer is responsible for maintenance of the infrastructure if necessary.

The enclosed packet provides more detailed information on the specific requirements required to cross each of the three major milestones.

DEVELOPMENT REVIEW PROCESS

FORT COLLINS-LOVELAND WATER DISTRICT



2. Engineering Plan Review

FCLWD engineering staff reviews all utility construction design plans to ensure that the proposed design conforms to the standard construction specifications as well as the below plan review checklist. Please submit your design plans to your local review agency (Loveland, Fort Collins, Windsor, Timnath or Larimer County). Your local agency will coordinate with the District to incorporate review of the water utilities into the project. Once all comments are addressed, Engineering signs off on plans.

Cover Sheet:

- ☐ Include District signature block (posted on District website)
- ☐ District Engineer, to be Point of Contact for FCLWD
  5150 Snead Dr., Fort Collins, CO, (970) 226-3104

Water Utility Notes as printed on drawings (typically on a stand-alone notes sheet or the utility plan sheet):

FORT COLLINS-LOVELAND WATER DISTRICT NOTES

1. ALL CONSTRUCTION OF WATER INFRASTRUCTURE SHALL BE PERFORMED ACCORDING TO THE FORT COLLINS-LOVELAND WATER DISTRICT STANDARDS AND SPECIFICATIONS.

2. CONSTRUCTION OF WATER INFRASTRUCTURE REQUIRES A PRE-CONSTRUCTION MEETING WITH DISTRICT INSPECTION STAFF PRIOR TO CONSTRUCTION.

3. CONTRACTOR SHALL NOTIFY DISTRICT INSPECTORS PRIOR TO STARTING WORK. ADDITIONALLY, CONTRACTOR SHALL NOTIFY DISTRICT INSPECTORS (2) TWO BUSINESS DAYS PRIOR TO CONNECTING TO ANY EXISTING DISTRICT INFRASTRUCTURE.

4. ALL WATER LINES SHALL BE A MINIMUM OF (5) FIVE FEET AND A MAXIMUM OF (6) SIX FEET BELOW FINAL GRADE.

5. ALL COMMERCIAL, IRRIGATION, MULTI-FAMILY AND FIRE SPRINKLER LINES SHALL HAVE A BACKFLOW PREVENTION DEVICE AS APPROVED BY THE DISTRICT.

6. THE RUNNING HYDROSTATIC PRESSURE TEST SHALL BE WITNESSED BY DISTRICT INSPECTORS. WATERLINE BACTERIA TESTS SHALL ALSO BE TAKEN BY DISTRICT INSPECTORS.

7. ALL DISTRICT VALVES SHALL BE OPERATED BY DISTRICT STAFF ONLY.

8. ONCE THE SYSTEM IS OPERATIONAL, ALL TESTS HAVE PASSED, AND AS-BUILT DRAWINGS (PDF AND DWG) HAVE BEEN APPROVED BY THE DISTRICT, THE CONTRACTOR SHALL REQUEST “SUBSTANTIAL COMPLETION” WITH A LETTER TO THE DISTRICT. THIS SHALL INCLUDE THE TOTAL NUMBER OF TAPS TO BE APPLIED FOR, WITH CORRESPONDING SERVICE ADDRESSES FOR EACH TAP.

9. ONCE ALL PUNCH LIST ITEMS ARE COMPLETE AND EASEMENTS ARE RECORDED, THE CONTRACTOR SHALL REQUEST “FINAL ACCEPTANCE” WITH A LETTER TO THE DISTRICT THAT INCLUDES THE DOLLAR VALUE OF THE WATER IMPROVEMENTS.

Water Impact and Demand Analysis Report:

Report Components:

- ☐ Overall Plan
- ☐ Calculated Water Demands (initial, interim, and final)
- ☐ Irrigation Sources
- ☐ Appropriate Performance Criteria used
- ☐ Design Assumptions
- ☐ Hydraulic Modeling analysis for proposed water system
- ☐ Major Improvements Identified and sized
- ☐ Variance Requests Justification

Utility Plans:

Water Mains:

- ☐ Water mains are within Right-of-Way (ROW) or utility easement (20' wide easement for water mains of any size)
- ☐ 10' separation (horizontal) from any sewer, storm, or non-potable water
- ☐ 10' separation (horizontal) from tree trunks
- ☐ 6’ separation (horizontal) from dry utilities
- ☐ 1.5' separation (vertical) from any other utilities
- ☐ Material called out as PVC for pipes up to 12”. For pipes larger than 12” the District holds the right to require alternate pipe materials as site conditions warrant.
- ☐ Gate Valves used for lines 12" or smaller; butterfly valves 14” or larger.
- ☐ Plan and profile included for lines 8" and larger
- ☐ High points along water mains incorporate a form of air release (combo air vac preferred)
- ☐ Joint restraints used on all fittings with required length of restrained pipe per FCLWD restraint length table, aside from when connecting to existing mains which require thrust blocks.
- ☐ Subdivisions must have more than 1 point of connection to an existing main (i.e., looping)
- ☐ 5' minimum burial depth, 6' maximum.
- ☐ Casing is required when line crosses under a pipe greater than 24”.

Water Services:

- ☐ Water services are consistent size and continuous material (no couplers other than the setter) all the way from the tap on the main to 5' downstream of the meter pit. After 5', the water line is considered private, and the developer can change size and material as desired.
- ☐ Service line to be perpendicular to the main until 5' downstream of the meter pit.
- ☐ Meter Pit to be within ROW or utility easement (20' wide easement for water lines of any size)
- ☐ Meter pit size to match District requirements for the service line size (i.e., 24" pit for 3/4" and 1" service lines; 48" meter vault for 1-1/2" and 2" services; larger vaults for services 3" and larger)
- ☐ No curb stop upstream of the water meter pit
- ☐ 10' separation (horizontal) from any sewer, storm, or non-potable water
- ☐ 10' separation (horizontal) from tree trunks
- ☐ 6' separation (horizontal) from dry utilities
- ☐ 1.5' separation (vertical) from any other utilities
- ☐ A note that reads "All commercial, irrigation, and fire sprinkler lines shall have a backflow prevention device as approved by the District."
- ☐ All Irrigation services shall have a curb stop downstream of meter pit or vault.

Fire Sprinkler Lines:

- ☐ Material is PVC from main to valve (line is private downstream of valve)
- ☐ A Gate Valve shall be located directly off the tap on the water main.
- ☐ Reduced Pressure Principle Backflow Prevention Device is required and may be located in building.

Hydrants:

- ☐ Hydrant and associated line are in the ROW or 20' wide utility easement.
- ☐ Hydrant dead-end length does not exceed 250'
- ☐ Hydrant is at least 2' from back of curb.
- ☐ Valve is located upstream of the hydrant with no services in between the valve and hydrant.
- ☐ Distance from above ground utilities such as electric transformers, pedestals, or light poles shall be 10' on either side.

3. Pre-Construction Meeting

After construction plans are approved by District engineering staff via signature, the development project may move to the construction phase. Prior to any water utility construction, the development team must attend a pre-construction (pre-con) meeting with District staff. This is an opportunity to communicate District expectations and answer any initial questions the developer may have.

Prior to scheduling a pre-construction meeting, the District needs the following documents:

- Signed Construction Plans, in the following formats:
  - Electronic PDF
  - Two (2) 11”x17” plan sets delivered to FCLWD

- Material submittals for all material related to water utility construction, approved by District Staff

Once District staff receives and approves all of the above documentation, then they will begin scheduling a pre-construction meeting. Review times on material submittals may take five to ten business days. Please schedule accordingly.

At a minimum, the contractor installing the public infrastructure must be at the pre-construction meeting. The owner and engineer may attend as well. At the pre-construction meeting, the project team will establish one official point of contact between the District and the developer moving forward. This single point of contact will be the team’s representative as the project moves through substantial and final completion, and will be responsible for any corrections, punch-list or warranty items on the project.

4. Substantial Completion

After the pre-construction meeting has passed and the water utility infrastructure has been tested and verified by District inspectors, the developer may apply for Substantial Completion. Substantial Completion is formally achieved when the District sends the Developer (or their representative) a Substantial Completion Acceptance Letter. Substantial Completion allows the District to begin selling service taps for the approved project. To receive Substantial Completion approval, the developer must complete the following:

- *Field Inspection:*
  - All water facilities must be tested and verified by District inspectors according to standard construction specifications to confirm the facilities meet the requirements.
  - All facilities are to grade and accessible with an all-weather surface. For roadway facilities, minimum acceptable accessibility requirement is road base material, with preventative measures taken to avoid damage to facilities until asphalt is installed.
  - A "Substantial Completion" walk through has been completed by the District's inspector, developer or developer representative, and contractors' superintendents. It is the developer's or developer's representative's responsibility to schedule the walk through.

- *As-Built Drawings:*
  - Verification that as-built CAD and PDF drawings have been sent to and approved by District Engineering. Please see the requirements on the next sheets for as-built CAD and PDF requirements.

- *Substantial Completion Request Letter:*
  - Provide a letter addressed to District Engineering staff requesting Substantial Completion. At a minimum, this letter shall include:
    - The lot(s), block(s), Larimer County Parcel Numbers, and street addresses as recorded with the County. If there are more than 4 parcels for approval, this information must be presented in a table in both PDF and Excel formats.
    - Supporting exhibits showing the locations of the lots listed above.
    - Sizes & locations of any multifamily, irrigation and/or conservation taps

Special Circumstances:
Not all projects that improve the Public Water System install water service taps. Projects that are not expected to purchase water service taps may be required to achieve Final and Substantial Completion at the same time.

Requirements for CAD and PDF Record Drawings
June 2026

Minimum Requirements for CAD Record Drawings

General

- District Coordinate System (Northern Colorado, US Feet) - NAD 83
- Drawing must be in model space.
- No Referenced Drawings or Attachments in drawing; everything should be bound in.
- Delete old linework.
- All proxy AEC objects must be exploded into basic AutoCAD objects.

Water Utilities

- Locations of all water lines and points associated with the water.
- Show all water mains with designated sizes and materials.
- Show all fire lines with designated sizes and materials.
- Show all valves including but not limited to air release valves, blow off valves, butterfly valves, check valves, gate valves, pressure reducing valves with designated sizes.
- Show all service lines from the main to the meter with designated sizes.
- Show all fittings with designated sizes including but not limited to horizontal and vertical bends, couplings, reducers, crosses, tees, plugs and water services.
- Show all fire hydrant assemblies with tees, water lines and gate valves.
- Show all casings with designated sizes, materials, and lengths.
- Show location of cathodic protection / corrosion test stations.

Minimum Requirements PDF Record Drawings

- Certified Record Drawings shall be submitted by the Design Engineer to the Water Inspector for review and approval.
- Cover sheet shall be labeled "DRAWINGS OF RECORD" and be stamped by a registered P.E. in the State of Colorado.
- Construction information shall be recorded concurrently with construction progress.
- Record Drawings shall include, as a minimum, the following:
  - Field dimensions, elevations, and details.
  - Modifications (clearly noted as changed)
  - Details which are not on the original Construction Drawings.
  - Horizontal and vertical locations of underground utilities and appurtenances.
    - Northing-Easting Coordinates for Horizonal
    - Provide Northern-Easting coordinates to at least one permanent surface object such as property pin.
  - Depths of various elements of work in relation to project datum.
  - All dimensions shall be referenced to property pins or surface improvements if coordinates cannot be provided.

5. Final Acceptance

Once a project is approved for Substantial Completion, the Developer has six (6) months to gain Final Acceptance. Final Acceptance initiates the start of a two-year warranty period for the developer. The developer is responsible for repairing any infrastructure during this warranty period. The following is a list of items required for Final Acceptance:

- *Punch List Items:* Verification that all water punch list items are complete per the following checklist:
    - Tracer wire has been tested and verified by the District.
    - All facilities are operational and accessible.
    - A "Final" walk through has been completed by the District's inspector, developer or developer's representative, and contractor's superintendents to confirm that the facilities meet the requirements published in the Standard Construction Specifications. It is the developer's or developer's representative's responsibility to schedule the walk through.

- *Easements Recorded:* Verification that any easements and easement agreements associated with the project have been recorded (a reception number is acceptable).

- *Final Acceptance Request Letter:* Provide a letter addressed to District engineering staff requesting Final Acceptance. At a minimum, this letter shall include:
    - Cost of the public water infrastructure
    - Substantial Completion Letter from the District

Final Completion is formally achieved when the District sends the Developer (or their representative) a Final Completion Acceptance Letter. Upon achieving Final Acceptance, the District is responsible for utility locate requests and the developer is required to repair any damaged or broken infrastructure until two (2) years after Final Acceptance.

Warranty Expiration Process:

Prior to the expiration of the 2-year warranty, (typically two months before expiration), the District will conduct an inspection of the project and note any repairs needed. The District will inform the developer of the required repairs and the developer will cause the repairs to be completed. If no repairs are required, the warranty period will expire with no further action by the District or the developer. The warranty period shall extend if noted repairs are not completed.

APPENDIX B – TECHNICAL SPECIFICATIONS

FORT COLLINS-LOVELAND WATER DISTRICT

Water System Standards

APPENDIX B

TECHNICAL SPECIFICATIONS

1st Edition – September 2026

5150 Snead Drive, Fort Collins, CO 80525 • 970-226-3104

Revision History

Rev (Date)	Description of Change	Author
June 2026	1st Edition – Initial Draft	
September 2026	1st Edition – Final Draft	

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DIVISION 01 – GENERAL REQUIREMENTS

Section 01 10 00 – Summary

Part 1 – General

1.1 Scope

A. The purpose of this document is to present the Fort Collins-Loveland Water District's criteria for the construction of water mains, water services and all appurtenances associated with these mains and services. It is for the use of the District, Developers, Design Engineers, and Contractors as guidelines for the construction of said mains, services, and appurtenances.

B. These specifications are intended to be sufficiently detailed to provide adequate definition of the work to be performed and to ensure the quality of that work.

1. The Contractor and his representatives shall be responsible for understanding the provisions and the content of these Specifications.

C. These specifications are composed of written Material Specifications and Typical Drawings. The interpretation of these specifications shall be made by the District.

1. Every attempt shall be made to avoid conflicts between the standards and drawings during design. However, when requested in writing the District shall provide a letter of interpretation.

D. In the event that a conflict occurs between water mains, services, and other utilities, as identified during construction, the Contractor shall contact the District to interpret these specifications or to determine if the standards of other utilities or departments apply.

1.2 Specification Documents

A. Interpretation

1. These Specifications contain many command sentences which are directed at the Contractor unless otherwise stated.
2. The Contractor shall request clarification, in writing to the District, of all apparent conflicts. The District will not be responsible for any explanations, interpretations, or supplementary data provided by others.
3. Most recent issue of standards.

1.3 Coordination with the District

A. The Contractor is responsible for coordinating a pre-construction meeting with the District.

B. The Contractor is responsible for coordinating the work with the District.

C. Connections to existing pipelines.

1. All connections to existing water mains shall be made at a time authorized by the District.

1.4 Work Sequence

A. Contractor shall coordinate the sequence of activities, considering work by others; possible easement requirements; permit requirements; and District requirements.

B. Contractor shall coordinate the beginning of work, excavation near ditches, railroads, road cuts, etc. with the District, affected parties, and utilities prior to beginning construction.

C. Contractor shall coordinate pipe filling, chlorination testing and pressure testing with the District.

1.5 Notifications

A. Contractor shall contact the District, all utilities and affected parties at least 48 hours (exclusive of holidays and weekends) prior to working in areas adjacent to underground utilities.

B. Contractor shall verify vertical and horizontal locations of all existing utilities prior to installation of District facilities.

C. Contractor shall give the District a minimum of 48 hours' notice (exclusive of holidays and weekends) prior to commencement of work.

D. Contractor shall coordinate all inspections and testing with the District.

1.6 Safety and Protection

A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. Contractor shall take all reasonable and necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. Employees and other persons onsite who may be affected.

B. The work and materials or equipment to be incorporated therein, whether in storage on or off the site.

C. Other property at the site or adjacent thereto, including, but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

D. Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

1.7 Special Requirements

A. All items and work not covered by these specifications shall be discussed with the District, and the Contractor shall receive approval from the District, in writing, prior to beginning work.

B. All work must be acceptable by the District prior to being placed in service.

C. District furnished material.

1. When the District furnishes any materials, the Contractor shall be responsible for such materials once they have been picked up or delivered to the job site.

D. The Contractor shall be responsible for the careful inspection of "District furnished material" at the time of delivery.

E. Contractor shall repair, in a manner acceptable to the District, or replace any "District furnished material", which has been damaged or stolen, at the Contractor's expense.

F. The District is responsible for the quality and operational design aspects of "District furnished material".

G. Contractor shall warrant all work, for a period of two (2) years, after Final Acceptance of the work.

1. Contractor may perform such maintenance and repairs by subcontract.

H. If the Contractor chooses to subcontract the warranty work, he shall submit to the District a copy of the subcontract or the work authorization as evidence of the contractor's faithful intention during the warranty period established in Section 01 10 00, Subsection 1.7.G.

I. Field changes from the approved plans shall not be permitted without prior permission from the District.

J. The Developer, Developer's Engineer or Developer's Contractor is responsible to coordinate a pre-construction meeting with the District at least five (5) days, exclusive of holidays and weekends, prior to construction.

K. The Developer, Developer's Engineer or Developer's Contractor is responsible to submit an electronic PDF format set of approved CCP to the District prior to or with material submittals.

L. The Developer shall be responsible for the cost of re-tests, excessive inspection, and inspection performed outside the Operations Department hours stated below. Operations Department hours

are 7:00 a.m. to 3:30 p.m. – Monday through Friday. Business office hours are 8:00 a.m. to 4:30 p.m. – Monday through Friday exclusive of holidays. The District will notify the Contractor when such costs are being incurred.

M. No work shall take place on weekends or holidays without prior authorization from the District.

N. Contractor shall provide all materials, equipment and other items required to isolate and accomplish total separation of new construction from existing facilities.

O. The Contractor shall be responsible for all construction staking for all work related to water utility infrastructure.

P. Prior to commencing work, Contractor shall designate, in writing, an authorized representative who shall have complete authority to represent the Contractor and shall always be on the construction site during work activities.

Q. The Contractor shall hold all licenses and registrations required under Section 1.7 of the Standards prior to performing any Work.

1.8 Quality Control

A. Inspection.

1. The District shall make periodic checks to verify the quality and progress of the work. The authorized agents and their representatives of the District shall be provided safe access to the work, whenever it is in preparation or progress. The Contractor shall provide for such access and for inspection, including maintenance of temporary and permanent access.
2. Materials and equipment rejected by the District shall be identified and marked for removal by the Contractor or Supplier, and shall be removed from the site within five (5) working days.
3. The Contractor shall coordinate any after hours, weekend or holiday inspections with the District staff a minimum of five (5) days in advance. The Developer shall be responsible for the overtime pay for District employees. The District will notify the Contractor when such costs are being incurred.

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

Section 01 33 00 – Submittal Procedures

Part 1 – General

1.1 Description

A. This section establishes requirements for preparation, submission, review, and processing of submittals.

B. Submittals include, but are not limited to:

1. Construction Schedules
2. Shop Drawings
3. Product Data
4. Certificates and Test Reports
5. Operation and Maintenance (O&M) Data

C. At a minimum, product submittals shall include product data, cut sheets, shop drawings, and/or manufacturer certifications for the following categories (per Section 4.1.2 of the Standards):

1. Pipe and fittings, including material classification and manufacturer
2. Valves, including gate valves, butterfly valves, air release valves, blow-off valves, check valves, and pressure reducing valves
3. Fire hydrant assemblies
4. Meter pits and service line components
5. Joint restraint systems
6. Tracer wire and warning tape
7. Casing pipe, if applicable
8. Cathodic protection and corrosion test station components, if applicable
6. As-Builts and Record Drawings

C. Contractor shall not procure, fabricate, or install materials or equipment requiring submittal review until submittals have been returned as Accepted by the District.

1.2 Related Documents

A. Section 01 60 00 – Product Requirements

B. All technical Specifications requiring submittals.

1.3 Submittal Schedule

A. Prior to attending the Pre-Construction Meeting Contractor shall have all materials submitted and accepted by the District. District Inspector reserves the right to delay Pre-Construction Meeting until submittals are accepted.

B. District review time shall be no more than 10 Working Days.

1. Projects with a scope that includes construction of or modification to a Major Structure may take more time for District review if submittals are received in large quantities.
2. For Major Structures (including storage tanks, pump stations, and treatment facilities), the Developer or Design Engineer shall obtain CDPHE Water Quality Control Division design review approval (or an applicable waiver) prior to construction, per Colorado Regulation 11 (5 CCR 1002-11) and CRS 25-1.5-202, and shall furnish evidence of such approval to the District.

1.4 Submittal Format

A. Submittals shall be submitted in pdf format via electronic mail.

B. Physical samples shall be delivered to the District office building.

C. Each Submittal shall include:

1. Cover sheet
    a. Contractor Name
    b. District Name
    c. Project / Development Name and Phase
    d. Date
    e. Submittal Number
    f. Revision Number (if applicable)
2. Information sufficient to confirm product complies with District Standards and Project Specifications:
    a. Manufacturer Name
    b. Model Numbers
    c. Sizes
    d. Material
    e. Compliance Standards (AWWA, NSF, ASTM, etc.)

1.5 Contractor Review and Certification

A. All submittals shall be reviewed by the Contractor prior to submission to the District.

B. Submittals without Contractor review will not be reviewed by the District.

C. Contractor is responsible for all errors, omissions, and compliance with District Standards and Federal, State, and local regulations.

D. Contractor shall clearly call out portions of submittal that are known to the Contractor to be a deviation from District Standards.

1.6 District Review

A. The District reviews all materials for compliance with District Standards; acceptance does not relieve the Contractor of responsibility for errors.

B. Returned submittals shall be marked by the District:

1. **NET – No Exceptions Taken** All products and work including the submittal are acceptable and no further action required from the Contractor.
2. **MCN – Make Corrections Noted** All products and work including the submittal are acceptable with the corrections noted in writing by the District. Contractor performs the Work in accordance with the Notes provided by the District. Re-submittal is not required from the Contractor, unless the Contractor takes exception to the notes.
3. **R&R – Revise and Resubmit** The District shall note why the submittal does not meet District Standards and the Contractor shall make corrections to their submittal and resubmit. Resubmittals that do not address District comments may cause the District to pursue damages for extended time to review the submittals.
4. **Rejected** Submittal is non-compliant.

1.7 Large-Diameter Mains (16 Inches and Larger)

A. In the case of water mains which are sixteen (16) inches and larger, the Developer shall submit construction specifications not covered by the District's specifications for review, prior to approval of construction drawings. The basis for developing these specifications shall be this document.

B. The Developer shall also submit qualifications and experience of the selected contractor that meets or exceeds the requirements outlined in Section 4.1.1 of the Water System Standards, Contractor Qualifications for Large-Diameter Mains, and approved by the District before the start of construction.

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

Section 01 60 00 – Product Requirements

Part 1 – General

1.1 Description

A. This section addresses the material, equipment, and workmanship needed to complete the installation of the water main and all associated appurtenances.

1.2 Materials and Equipment

A. Contractor shall furnish all materials, equipment, labor, and incidentals necessary for the execution, disinfection, testing, and completion of the work.

B. A list of materials and equipment approved by the District is found in Appendix C. In addition to these materials and equipment, the Contractor may request "APPROVED EQUAL" materials and equipment. Such materials and equipment shall be approved in writing by the District prior to use or installation.

C. All materials and equipment shall be of good quality and new, except as otherwise approved by the District.

1. When requested by the District, the Contractor shall furnish satisfactory evidence (including manufacturer's certification) as to the kind and quality of materials and equipment, and their compliance with these specifications.
    a. The District shall test any manufacturer's material it deems necessary.
    b. It is the Contractor's responsibility to ensure the manufacturer's materials supplied meet these specifications.
2. Prior to using existing materials, written approval must be obtained from the District.

D. All materials and equipment shall be installed and used in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor, except as otherwise provided in these specifications.

E. The specification of materials and equipment shall be understood to be representative of a quality of performance, operation, and construction acceptable to the District.

1. Requests for substitution shall include detailed product literature and a description of benefits which might be achieved by this substitution.

F. In approving materials or equipment for installation, the District assumes no responsibility for injury or claims resulting from failure of the materials or equipment to comply with the applicable National, State, and local safety codes or requirements, or the safety requirements of a recognized agency, or failure due to faulty design concepts, or defective workmanship.

G. All pipe, fittings, valves, hydrants, meters, appurtenances, coatings, linings, gaskets, and joint lubricants in contact with potable water shall be certified to NSF/ANSI/CAN 61 and shall meet the lead-free requirements of SDWA §1417, with certification to NSF/ANSI/CAN 372 (and NSF/ANSI/CAN 600 where applicable). Certification marks shall be documented in the product submittals (reference Section 01 33 00).

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

Section 01 73 00 – Execution

Part 1 – General

1.1 Description

A. This section addresses the general procedural requirements governing execution of the work to be performed.

Part 2 – Products

Not Used

Part 3 – Execution

3.1 Existing Conditions

A. The existence and location of District utilities indicated as existing are not guaranteed. It is the responsibility of the Contractor to verify existence and location of all underground utilities prior to construction.

B. The Contractor shall be responsible for all utility locates and calling Colorado 811.

C. The Contractor shall notify the District and Design Engineer of discrepancies in existing utility locations during construction.

3.2 Construction

A. All work shall be performed in accordance with the current codes and standards of the local jurisdiction as well as the latest edition of OSHA.

B. In the event that work is being performed that does not comply with the local jurisdiction, or OSHA, the District has the right to issue a Stop Work Order, revoking the Developer's and/or Contractor's right to continue work within an approved development project area.

C. Unless otherwise indicated by the District, the Contractor shall install all materials in accordance with the manufacturer's written instructions and recommendations and these specifications. In the event of a conflict between the manufacturer's recommendations and these specifications, the more stringent requirement will apply.

END OF SECTION

Section 01 74 00 – Cleaning and Waste Management

Part 1 – General

1.1 Description

A. Site cleanup shall be executed during the progress of the work, and at the completion of the work.

1.2 Execution

A. Construction materials shall be neatly stored.

B. Containers shall be provided for the collection of wasted material and debris.

1. Containers shall be stored out of the right-of-way.

C. Volatile wastes shall be stored in clearly marked, covered metal containers, and removed daily.

D. Construction materials, equipment, waste containers, construction buildings, parking, etc., shall only be allowed within the limits of the construction easement.

1. Any off-site storage of construction material, equipment, waste containers, construction buildings, parking, etc. shall be allowed only after the Contractor has obtained the written permission of the property owner.

E. Upon completion of the construction, the job site shall be restored to its original condition or better.

1. Contractor shall restore any land which will not be paved with asphalt, or concrete, to its original condition.
    a. All topsoil shall be restored to its original quality.
    b. Any areas which are stripped of vegetation prior to, or during construction, shall be reseeded.
2. All exterior paved surfaces shall be broom cleaned and left in good repair.

1.3 Disposal

A. To maintain an orderly site, waste material and debris shall be removed periodically.

B. All waste material and debris shall be disposed of in accordance with Federal, State, and Local jurisdictions.

C. Hazardous material remediation shall be completed in accordance with the Federal and State regulations.

1. The Developer/Contractor shall be responsible for any permits necessary to complete the removal of hazardous materials.
2. All hazardous waste materials removal shall be done by qualified personnel.
3. A copy of pertinent disposal information (i.e. a copy of the permit, transport manifest, final abatement report, etc.) shall be submitted to the District.

D. Reference Section 02 82 13 – Asbestos Cement Pipe Handling for Asbestos Cement Pipe Handling.

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS

Section 02 82 13 – Asbestos Cement Pipe Handling

Regulatory Basis: Work involving asbestos cement (AC) pipe is subject to EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) for asbestos, and Colorado Department of Public Health and Environment (CDPHE) Regulation 8. Contractor shall verify current requirements with CDPHE prior to construction.

Part 1 – General

1.1 Background and Introduction

A. Background:

1. Asbestos Cement Pipe (ACP or AC pipe) is a mixture of Portland cement and asbestos fibers greater than 1% asbestos by weight. It was introduced into North America in 1931, and by 1953 the American Water Works Association (AWWA) had established standards for ACP use and installation. The Environmental Protection Agency (EPA) has determined that asbestos, in an airborne condition, is a hazardous material and established laws/guidelines for the handling and disposal of the material. The Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) establishes requirements for the removal and disposal of regulated asbestos containing materials.

B. Scope:

1. Contractor shall comply with the requirements of the Asbestos NESHAP found within 40 CFR Sections 61.140 through 61.157. Nothing in this specification shall be construed to void any provision of a contract or other law, ordinance, regulation, or policy whose requirements are more stringent, including State law in the location of the project.
2. ACP is defined under NESHAP as a Category II, non-friable, non-regulated material in its intact state but which may become friable upon removal, demolition, and/or disposal. EPA has generally defined "friable" as material, when dry, that may be crumbled, pulverized, or reduced to powder by hand pressures. Consequently, if the Contractor's removal/disposal process renders the ACP friable, it is regulated under the disposal requirements of 40 CFR Section 61.150 and the Contractor becomes the "Generator" of the regulated material. Further, if more than 260 linear feet, 160 sq. ft, or 35 cu. ft. of ACP is removed, a NESHAP notification must be filed with the CDPHE Air Pollution Control Division on the state notification form at least ten (10) working days prior to the activity. Colorado Regulation 8 trigger levels may be more stringent than the federal thresholds; the Contractor shall verify current CDPHE requirements.
3. Work required in the Contract Documents includes activities which may affect existing AC pipe. Contractor is responsible as applicable for identifying, abandoning, drilling, cutting, removing, handling, transporting and disposing of the AC waste material in accordance with all applicable Federal, State, and Local regulatory requirements.
4. When ACP is to be removed, it shall be done in such careful and prudent manner that it remains intact and non-friable. The Contractor is responsible to employ those means, methods, techniques, and sequences to ensure this result to the maximum extent possible. However, if the actions of the Contractor cause the material to become friable and therefore subject to federal, state, local and other applicable regulations, that Contractor shall be defined as the Generator of the hazardous material.

1.2 Section Includes

A. AC pipe handling plan submittal requirements.

B. Permits for handling and disposal of AC pipe.

C. Training Requirements for handling of AC pipe.

D. Documentation Requirements.

E. Abandonment of AC Pipelines.

1.3 Related Sections

A. Section 01 10 00 – Summary.

1.4 Submittals

A. Prior to notice to proceed the Contractor shall develop their AC Pipe Handling and Disposal Plan to document the Contractor's plan for handling, cutting, removing, abandoning AC Pipe to complete the Work contained in the Contract Documents. Contractor shall submit the AC Pipe Handling and Disposal Plan to the District. The regulatory deliverable to agencies is the NESHAP/Regulation 8 notification (reference Subsection 1.1.B.2) and any required permits, not the Handling and Disposal Plan. The AC Pipe Handling and Disposal Plan shall document compliance with all applicable federal, state, and local regulations, and shall generally include the following:

1. AC pipeline components to be connected, cut, tapped, removed or abandoned. Identify lengths of pipeline to be removed, and size of taps to be made.
2. Plan for procedures if a pipeline suspected of containing asbestos (AC) is encountered.
3. Procedures for identifying if the pipeline condition in-situ has rendered the material friable.
4. Details of scheduling of activities relative to excavation and installation of Work adjacent to known or suspected ACP.
5. Contingency plans for activities that damage or crush AC pipelines, which would render the material friable.
6. Procedures for verification that the AC material is contained and no friable material is generated.
7. Procedures for cutting, modifying, removing and handling of AC pipe.
8. Training certifications for employees doing AC pipe handling or working on AC pipe or waste materials (e.g., OSHA, State Department of Labor, etc.).
9. Jobsite notices to protect adjacent activities or others on-site.
10. Location of landfill identified for AC disposal and documentation of the landfill's approval by the State of Colorado to accept asbestos-containing materials (6 CCR 1007-2).
11. Procedures for record keeping and documentation of chain of custody for AC materials to be removed and disposed of in a landfill. Plan shall include submittals of all chain-of-custody documentations, landfill receipts, etc., with the Contractor identified as the Generator and copies submitted to Owner and Engineer.
12. All permits obtained by the Contractor including any permit conditions and approvals for execution of the Work.

1.5 References

A. 29 CFR 1910.1001

B. 29 CFR 1926.1101

C. 40 CFR 61.140 to 61.157 (Subpart M) – National Emission Standard for Asbestos

D. CDPHE Air Quality Control Commission Regulation No. 8, Part B (5 CCR 1001-10) – Asbestos

E. CDPHE Solid Waste Regulations, 6 CCR 1007-2 (asbestos waste disposal)

1.6 Permits

A. Varies by Jurisdictional Agency (Federal, State, Local), and based on quantity and condition of ACP material to be modified or removed.

B. Contractor shall determine all necessary permits required for execution of the Work and include in the AC Pipe Handling and Disposal Plan.

C. All permits and chain of custody documentation shall be provided to the District.

Part 2 – Products

Not Used

Part 3 – Execution

3.1 Preparation

A. Furnish, install, and prepare for operation, all necessary tools, machinery, appliances, equipment, containment systems, etc. as identified in AC Pipe Handling and Disposal Plan and equipment to properly contain, handle and dispose of AC materials.

3.2 AC Pipe Handling and Modification

A. Contractor shall perform work on AC pipe in such a manner that is in compliance with the Contractor's AC Pipe Handling and Disposal Plan and all applicable federal, state and local regulations.

B. All Workers working on AC pipelines shall be trained for and certified in proper procedures for working with Asbestos materials, as identified in the AC Handling and Disposal Plan. AC pipe removal shall be conducted as OSHA Class II asbestos work per 29 CFR 1926.1101: a designated competent person shall be on site during all AC pipe work; an initial exposure assessment shall be performed; wet methods shall be used during cutting and snapping; and abrasive sawing shall not be used without engineering controls.

C. Compliance with all aspects of worker safety and health regulations, including, but not limited to, the OSHA Asbestos Standard 29 CFR 1926.1101 is the responsibility of the Contractor.

D. Cease operations and notify the District, Engineer and regulatory agencies immediately upon observation of conditions that may indicate the presence of hazardous conditions outside those identified or anticipated in the AC Handling and Disposal Plan. E. If asbestos-containing debris or asbestos-contaminated soil is encountered (including historic AC pipe shard fields), the Contractor shall stop work in the affected area and manage the material in accordance with CDPHE asbestos-contaminated soil requirements (6 CCR 1007-2, Section 5.5).

3.3 Verification

A. Contractor's superintendent shall routinely observe AC pipe work to verify performance requirements are being met and that conditions are in accordance with the Contractor's AC Pipe Handling and Disposal Plan. Contractor shall provide documentation in the type and frequency as required for compliance with all applicable federal, state, and local regulations.

B. Notify the District and Design Engineer of any observations that may jeopardize the Work or are not in accordance with the Contract Documents or the AC Handling and Disposal Plan.

3.4 AC Pipe Disposal or Abandonment

A. Comply with all State and Federal and Local requirements, including (at a minimum):

1. 40 CFR Subpart M 61.150 – Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.
2. Contain and handle all AC waste materials in conformance with the AC Handling and Disposal Plan.

3. Conduct record keeping and documentation of chain of custody for AC materials removed and disposed of in a landfill.
4. AC waste material shall be disposed of only at a landfill approved by the State of Colorado to accept asbestos-containing materials, in accordance with CDPHE Solid Waste Regulations (6 CCR 1007-2).
5. Retain all chain-of-custody documentations, landfill receipts, etc., and provide a copy to the District.
6. Waste material from AC Pipe (e.g. entire sections of pipe sections cut to install fittings, trimmed ends, tapping coupons, etc.) shall be removed, contained and handled as Asbestos waste material in conformance with the AC Handling and Disposal Plan.

B. Pipes specifically identified to be abandoned-in-place shall be abandoned per the Contractor's AC Pipe Handling and Disposal Plan.

C. If sections of ACP are to be left in the ground and abandoned in place, the Contractor shall inspect the visible sections that remain to ensure they are intact and non-friable. The pipe shall be abandoned per Federal, State and local regulations, which may include filling the abandoned line with grout (minimum 1000 psi compressive strength). The ends of the ACP shall be encapsulated, and any friable ACP shall be lawfully recorded, removed, and disposed of. ACP shall NOT be crushed and left in place. If ACP is crushed or otherwise caused to become friable, it shall be removed in conformance with the AC Handling and Disposal Plan.

D. Record drawing (as-built) information for all AC pipelines abandoned-in-place shall be documented and identified on the contractor's as-built record drawing information and submitted to the District.

3.5 Termination

A. Contractor is responsible for proper handling and disposal of AC pipe. If contamination occurs due to the Contractor's activities, all costs associated with fines, fees, legal proceedings and cleanup activities shall be the sole responsibility of the Contractor. No additional payments will be made by the District.

B. Comply with any termination requirements of any State and Federal permits and in Conformance with the AC Handling and Disposal Plan.

END OF SECTION

DIVISION 03 – CONCRETE

Section 03 30 00 – Cast-in-Place Concrete

Part 1 – General

1.1 Description

A. This section covers cast-in-place concrete for thrust restraints, encasement, and cut-off walls, including forms, reinforcing steel, finishing, and curing, and other appurtenant work.

B. For specifications on concrete surfacing and/or pavement refer to the governing jurisdiction.

Part 2 – Products

2.1 Cement

A. All cement shall be Portland Cement.

1. Portland Cement shall conform to ASTM C150.
2. Portland Cement shall be Type I/II or Type V.
    a. 12-, 24-, or 48-hour concrete mixtures may be used with prior approval of the District.

2.2 Aggregates

A. All fine and coarse aggregate shall conform to ASTM C33/C33M.

2.3 Water

A. All water shall be free from objectionable quantities of silt, organic matter, alkali, salts, and other impurities or conform to ASTM C1602/C1602M.

2.4 Slump

A. Concrete slump shall be kept as low as possible, consistent with proper handling and thorough consolidation. Prior to the addition of admixtures slump shall be a minimum of two (2) inches and a maximum of four (4) inches, unless approved otherwise by District staff.

2.5 Admixtures

A. An air-entraining agent shall be used in all concrete.

1. All air-entraining agents shall conform to ASTM C260.
    a. Total air content shall be five (5) to eight (8) percent.

B. A water-reducing admixture may be used.

1. A water-reducing admixture shall conform to ASTM C494, for Type A or Type D chemical admixture.
2. The water-reducing admixture shall not contain any calcium chloride.
3. The water-reducing admixture shall be compatible with the cement being used.

C. Accelerators

1. Accelerators shall conform to ASTM C494 (Type C or E). Cold-weather concreting practices shall conform to ACI 306.1.
    a. If calcium chloride is used as an accelerator, the amount used should not exceed 2%, by weight, of the cementitious material.
    b. Calcium chloride shall be in solution prior to adding it to the batch process.

D. Fly-Ash

1. When fly-ash is used in concrete, the cement replacement shall not exceed 20%.
    a. Class C or Class F fly-ash shall conform to ASTM C618.

E. Any admixtures except air entraining agents and accelerators must be approved by the District.

2.6 Concrete Reinforcement

A. All deformed reinforcing bars shall conform to ASTM A615.
1. All bars shall be either Grade 40 or 60.

B. All welded steel wire fabric shall conform to ASTM A1064/A1064M.

Part 3 – Execution

3.1 General

A. Concrete mixture shall be designed and specified by the Design Engineer.
1. Concrete shall have a minimum of 6 sacks per cubic yard and shall be allowed to develop a minimum compressive strength of 3,000 psi at 28 days.

B. Concrete shall have a maximum allowable water/cement ratio of 0.50, by weight.
1. The water cement ratio may be increased to 0.56, by weight, if a water-reducing agent is used.
    a. Reference Section 03 30 00, Subsection 2.5.

3.2 Placing

A. Concrete shall not be placed unless the air temperature adjacent to the concrete placement is 30 degrees Fahrenheit and rising.
1. The temperature of the mix shall not be less than 50 degrees Fahrenheit, nor more than 90 degrees Fahrenheit at the time of the placement.
2. If heated water and/or an accelerator is used, the above temperature restrictions may be waived.
    a. Water shall not be heated to a temperature exceeding 150 degrees Fahrenheit.

B. Concrete shall be placed when the temperature of the plastic concrete can be maintained at 90 degrees Fahrenheit, or lower, unless approved by the District.
1. To facilitate the placement of concrete in hot weather, the aggregate or the water may be cooled.

3.3 Finishing

A. Vault bases shall be trowel finished.

3.4 Curing

A. Finished concrete shall be cured by protecting it against moisture loss, rapid temperature change, and from rain, flowing water, and mechanical damage for a minimum of 72 hours after placement.
1. Concrete shall be maintained at a minimum temperature of 50 degrees Fahrenheit during the curing period.
2. The Contractor is responsible for protecting the concrete from traffic and the elements.

END OF SECTION

Section 03 40 00 – Precast Concrete

Part 1 – General

1.1 Description

A. This section addresses precast concrete products.

B. Reference Section 33 14 13, Subsection 2.9.

1.2 Product Delivery, Storage and Handling

A. All precast concrete parts shall be handled, stored, and protected in a manner which will prevent damage to materials.

Part 2 – Products

2.1 Precast Concrete Products

A. Barrels, boxes, and flat slab tops of vaults and meter pits shall conform to and be designated as ASTM C478 and shall be made with Type I/II cement.

1. Reference Section 33 14 13 – Public Water Distribution System, Subsection 2.9.
2. Flat, slab tops will be used on all vaults and meter vaults unless otherwise approved, in writing, by the District.

B. Concrete and Reinforcing Materials.

1. Reference Section 03 30 00, Subsection 2.6 and Part 3.
2. Reference ASTM C478.

Part 3 – Execution

Not Used

END OF SECTION

DIVISION 31 – EARTHWORK

Section 31 23 16 – Excavation

Part 1 – General

1.1 Description

A. This section addresses excavation and trenching, including preparation of sub grades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines, service lines and appurtenances.

B. Reference Detail W-02, Typical Trench Bedding in Appendix D.

C. Reference Section 31 23 19 – Dewatering.

1.2 Quality Assurance

A. Soil compaction tests shall be performed in accordance with:

1. Larimer County Urban Area Street Standards
    a. City of Fort Collins
    b. Larimer County
    c. City of Loveland
2. Town of Timnath
3. Town of Windsor
4. Weld County
5. ASTM D6938 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods.
6. ASTM D1556/D1556M – Standard Test Methods for Density of Soil in Place by the Sand-Cone Method.

B. Construction Staking.

1. Construction staking shall be performed under the supervision of a licensed land surveyor.
2. All survey notes and construction staking notes shall be entered into bound, hard cover field books.
3. Adequate staking shall be provided to establish acceptable horizontal and vertical control.
4. Offsets shall be staked so that vertical and horizontal alignment may be checked.
5. All survey data, which is developed by the Contractor or the Design Engineer in performing surveys which are required by the work, shall be available to the District for examination and reproduction throughout the construction period.

1.3 Job Conditions

A. Drainage and Groundwater.

1. Water that is encountered in the trench shall be removed to the extent necessary:
    a. provide firm sub grade.
    b. permit connections to be made in dry conditions.
    c. prevent the entrance of water into the pipeline.
2. Surface runoff shall be diverted as necessary to keep excavations and trenches free from water during construction.

3. The excavation or trench shall be kept free from water until the structure, or pipe, to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

B. Sequencing.

1. Pipeline installation shall be performed within 300 linear feet of trench excavation.
    a. This distance may be amended, with the District's approval, based upon job conditions.
2. Initial trench backfill shall be performed within 300 linear feet of pipeline installation.
    a. This distance may be amended, with the District's approval, based upon job conditions.
3. Backfill shall be completed, at the end of each day, to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
4. Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening is to be minimized.

C. Underground Obstructions.

1. The Design Engineer and/or Contractor shall field verify all Record Drawing information obtained from the District.
2. Contractor shall notify each Utility Owner and request utilities to be field located by surface reference.
    a. The request for the location of utilities shall be made a minimum of 48 hours prior to trenching or excavation (exclusive of holidays and weekends).
    b. Contractors shall call in locates (Colorado 811) prior to starting any excavations.
3. The Contractor shall expose and verify the size, location, and elevation of underground utilities and other obstructions, sufficiently in advance of construction to permit changes to be made to the Construction Drawings.
    a. In the event there is a conflict, the Contractor shall notify the District and the affected utility company.
    b. In the event there is a conflict, the proposed work may be modified, at the District's discretion.
4. Existing improvements, adjacent property, utilities, trees, and plants that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.
5. If the Contractor removes any underground obstructions, the following shall apply:
    a. Drainage culverts may be salvaged, and reused in an appropriate location, if written approval is obtained from the District and the owner of the utility.
        1) All other underground obstructions shall be replaced as directed by the affected utility.
        2) All field drains shall be repaired or replaced to their original condition, or better.

1.4 Maintenance and Correction

A. Contractor shall maintain and repair all trench settlement, resulting from Contractor negligence, which occurs within the warranty period established in Section 01 10 00, Subsection 1.7.G, and make necessary repairs to pavement, sidewalks or other structures which may be damaged because of trench settlement.

Part 2 – Products

A. Bedding zone materials, stabilization material, fire hydrant bedding, ground water barrier material, and trench backfill material are specified in Section 31 23 35 – Trenching, Backfilling, and Compacting.

Part 3 – Execution

3.1 Preparation

A. Topsoil shall be stripped from areas which are to be disturbed by construction, and stockpiled.

1. Topsoil shall be segregated from non-organic trench excavation material, and debris.

3.2 Trenching

A. Trenches shall be excavated by open cut methods, except where boring or tunneling is shown on drawings, or approved by the District.

B. Care shall be used when operating mechanical equipment in locations where it may cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground.

C. Mechanical equipment shall be operated in such a manner that the bottom elevation of the trench can be maintained with uniform trench widths and vertical sidewalls of the bedding zone.

D. Trench alignment shall be sufficiently accurate to permit pipe to be aligned properly with an eight (8) inch minimum clearance between the pipe and the sidewalls of the trench or trench box.

1. The trench sidewall shall not be undercut in order to obtain clearance.

E. Preparation of trench bottom.

1. Trench bottom shall be graded uniformly to provide clearance for each section of pipe.
2. Loose material, water, and foreign objects shall be removed from the trench.
3. The Contractor shall provide a firm sub grade, which is suitable for placement of bedding material.
4. If the trench bottom is judged to be unstable by the District and/or the Contractor, the unstable material shall be removed and replaced with an acceptable stabilization material.
    a. The over-excavation depth shall be a minimum of 6-inches.
    b. Reference Section 31 23 35, Subsection 2.1.
5. The Contractor shall over-excavate a minimum of six inches below the bottom of the pipe wherever the trench bottom is rock, or other unsuitable material.
6. Over-excavation shall be backfilled and compacted with acceptable Stabilization Material.
    a. Reference Section 31 23 35, Subsection 2.1.

F. Stockpiling excavated materials.

1. If native backfill material is permitted by the governing jurisdiction.
    a. Suitable material for backfilling shall be stockpiled in an orderly manner, and stored a minimum of two (2) feet from the edge of the trench.
    b. Excess excavated materials not suitable or not required for backfilling shall be disposed of away from the immediate work area.
    c. Excavated material shall not be stockpiled against or over existing structures or appurtenances.

G. Pipe bedding, ground water barriers, backfilling, compaction, and field quality control shall conform to Section 31 23 35 – Trenching, Backfilling, and Compacting.

END OF SECTION

Section 31 23 19 – Dewatering

Part 1 – General

1.1 Description

A. This section addresses the controlling of groundwater, site drainage, and storm flows during construction. Contractor is cautioned that the Work involves construction in and around drainage channels, local rivers, and areas of local drainage. These areas are subject to frequent periodic inundation.

1.2 References

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
    a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).

1.3 Submittals

A. Contractor shall submit to the District a Water Control Plan two (2) weeks prior to execution of the Project. At a minimum, the Water Control Plan shall include:

1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment, methods, standby equipment and power supply, means of measuring inflow to excavations, pollution control facilities, discharge locations to be utilized, and provisions for immediate temporary water supply as required by this section.
2. Drawings showing locations, dimensions, and relationships of elements of each system.
3. Design calculations demonstrating adequacy of proposed dewatering systems and components.
4. If system is modified during installation or operation, revise or amend and resubmit Water Control Plan.
5. An approved copy of the discharge permit from the State of Colorado Department of Public Health & Environment (CDPHE).

1.4 Permits

A. Contractor shall obtain all necessary permits prior to starting dewatering operations.

1. If groundwater will be discharged into an irrigation ditch, pond, stream, or waterway, or will drain to an irrigation ditch, pond, stream, or waterway, a Colorado Department of Public Health and Environment (CDPHE) dewatering permit will be required.
2. Permit applications may take up to 30 days to be reviewed by CDPHE.
3. Contractor is required to complete and process the Discharge Monitoring Report (DMR) that is typically a part of the dewatering permit.
4. Upon finishing the work, the Contractor shall be responsible for completing a CDPHE Discharge Termination Notice.

Part 2 – Products

2.1 Materials

A. Onsite materials may be used within the limits of construction to construct temporary dams and berms. Materials such as plastic sheeting, sand bags, and storm sewer pipe may also be used if desired by Contractor if permitted by the state and/or local jurisdiction.

B. Potable waterline pipe is not permitted to be used for dewatering purposes.

C. Sanitary sewer may be permitted for the use of dewatering, if permission is granted by the owner. Written approval for the use of the sanitary sewer shall be provided to the District prior to any dewatering into the sanitary sewer.

Part 3 – Execution

3.1 General

A. The Contractor shall be responsible for obtaining all the testing and permitting for dewatering activities.

B. For all excavation, Contractor shall provide suitable equipment and labor to remove water, and keep the excavation dewatered so that construction can be carried on under dewatered conditions.

1. Water control shall be accomplished such that no damage is done to adjacent channel banks, structures, or property.
2. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

C. Contractor is responsible for investigating and becoming familiar with all site conditions that may affect the WORK including surface water, potential flooding conditions, level of groundwater and the time of year the work is to be done.

D. Contractor shall conduct operations in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses.

1. The Contractor has investigated the risk arising from such waters and has prepared accordingly, and assumes all of said risk.

E. At no time during construction shall Contractor affect existing surface or subsurface drainage patterns of adjacent property.

1. Any damage to adjacent property resulting from Contractor's alteration of surface or subsurface drainage patterns shall be repaired by Contractor at no additional cost to Owner and/or the District.

F. Pumps and generators used for dewatering and water control shall be quiet equipment enclosed in sound deadening devices meeting the requirements of the local jurisdiction.

G. Contractor shall remove all temporary water control facilities when they are no longer needed or at the completion of the Project.

H. All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to:

1. What is specified by the governing jurisdiction.
2. In areas where there is no governing jurisdiction compact to ninety-five percent (95%) of Maximum Standard Proctor Density (ASTM D698) except where replacement by other materials and/or methods are required.

I. The Contractor is responsible for any and all dewatering treatment when required.

3.2 Construction

A. Surface Water Control:

1. Surface water control generally falls into the following categories:
    a. Normal low flows along the channel.
    b. Storm/flood flows along the channel.
    c. Flows from existing storm drain pipelines.

d. Local surface inflows not conveyed by pipelines.

2. Contractor shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems.
    a. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. Contractor is responsible to ensure that any such worsening of flooding does not occur.
    b. Contractor is solely responsible for determining the methods and adequacy of water control measures.
3. At a minimum, Contractor shall be responsible for diverting the quantity of surface flow around the construction area so that the excavations will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout.
    a. It shall be Contractor's responsibility to determine the quantity of water which shall be diverted to protect the Work from damage caused by stormwater.
4. Contractor shall, at all times, maintain a flow path for all channels.
    a. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding, or alter historic flow routes.

B. Groundwater Control:

1. Contractor shall install adequate measures to maintain the level of groundwater below the foundation subgrade elevation and maintain sufficient bearing capacity for all structures, pipelines, earthwork, and rockwork.
    a. Such measures may include, but are not limited to, installation of perimeter subdrains, pumping from drilled holes or by pumping from sumps excavated below the subgrade elevation.
    b. Dewatering from inside the pipeline being installed shall not be allowed. Dewatering into the sanitary sewer system may be allowed if approved by the sewer provider and written documentation is provided to the District prior to the start of dewatering activities.
2. Contractor shall dispose of groundwater as follows:
    a. Obtain discharge permit for water disposal from authorities having jurisdiction.
    b. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.
    c. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.
3. Any temporary dewatering trenches or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by Design Engineer per the specification of the governing agency.

END OF SECTION

Section 31 23 35 – Trenching, Backfilling, and Compacting

Part 1 – General

1.1 Description

A. This section addresses excavation and trenching; including subsurface drainage, dewatering, preparation of sub grades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines, service lines and appurtenances.

B. Reference Detail W-02, Typical Trench Bedding, in Appendix D.

1.2 Quality Assurance

A. Soil compaction tests shall be performed in accordance with:

1. ASTM D6938 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods.
2. ASTM D 1556 - Standard Test Methods for Density of Soil in Place by the Sand- Cone Method.

B. Construction Staking.

1. Construction staking shall be performed under the supervision of a licensed land surveyor.
2. All survey notes and construction staking notes shall be entered into bound, hard cover field books.
3. Adequate staking shall be provided to establish acceptable horizontal and vertical control.
4. Offsets shall be staked so that vertical and horizontal alignment may be checked.
5. All survey data, which is developed by the Contractor or the Design Engineer in performing surveys which are required by the work, shall be available to the District for examination and reproduction throughout the construction period.

1.3 Job Conditions

A. Drainage and Groundwater.

1. Dewatering requirements, permits, and groundwater management during trench excavation shall conform to Section 31 23 19 – Dewatering.

B. Sequencing.

1. Pipeline installation shall be performed within 300 linear feet of trench excavation.
    a. This distance may be amended, with the District's approval, based upon job conditions.
2. Initial trench backfill shall be performed within 300 linear feet of pipeline.
    a. This distance may be amended, with the District's approval, based upon job conditions.
3. Backfill shall be completed, at the end of each day, to the extent that no damage from hydrostatic pressure, floatation, or other cause will result.
4. Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening is to be minimized.

C. Underground Obstructions.

1. The Design Engineer and/or Contractor shall field verify all Record Drawing information obtained from the District.
2. Contractor shall notify each Utility Owner and request utilities to be field located by surface reference.
    a. The request for the location of utilities shall be made a minimum of 48 hours prior to trenching or excavation (exclusive of holidays and weekends).

3. The Contractor shall expose and verify the size, location, and elevation of underground utilities and other obstructions, sufficiently in advance of construction to permit changes to be made to the Construction Drawings.
    a. In the event there is a conflict, the Contractor shall notify the District and the affected utility company. In the event there is a conflict, the proposed work may be modified, at the District's discretion.
4. Existing improvements, adjacent property, utilities, trees, and plants that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.
5. If the Contractor removes any underground obstructions, the following shall apply:
    a. Drainage culverts may be salvaged, and reused in an appropriate location, if written approval is obtained from the District.
    b. All other underground obstructions shall be replaced as directed by the affected utility.
    c. All field drains shall be repaired or replaced to their original condition, or better.

1.4 Maintenance and Correction

A. Contractor shall maintain and repair all trench settlement, resulting from Contractor negligence, which occurs within the warranty period established in Section 01 10 00, Subsection 1.7.G, and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of trench settlement.

Part 2 – Products

2.1 Stabilization Material

A. If the existing soil in the trench bottom is judged to be unstable by the District and/or the Contractor, the unstable material shall be removed and replaced with an acceptable stabilization material.
    1. The over-excavation depth shall be a minimum of six (6) inches.
    2. Stabilization material is crusher-run rock, conforming to ASTM D448, or CDOT #357.

SIZE	PERCENT PASSING
2-1/2”	100
2”	95 – 100
1”	35 – 70
½”	10 – 30
#4	0 – 5

B. Geosynthetics may be used in conjunction with stabilization material, with the prior written approval of the District.

2.2 Bedding Zone Materials

A. The bedding zone shall extend from either a minimum of four (4) inches below the invert of the pipe or 1/4th the outside diameter of the pipe whichever is greater to twelve (12) inches above the pipe.
    1. Reference Detail W-02, Typical Trench Bedding in Appendix D.

B. Granular pipe bedding material shall be uniformly graded crushed material, conforming to the following gradation for all pipes 24-inches in diameter and smaller.

1. Squeegee / Pea Gravel

SIZE	PERCENT PASSING
1”	100
3/4”	100
3/8”	90 – 100
#4	0 – 40
#8	0 – 5

2. Or approved equal.

C. Granular pipe bedding material shall be designed and specified by the design engineer for all pipes larger than 24-inch in diameter.

D. Granular pipe bedding material may be modified by the design engineer based on site conditions.

E. Select soils shall be either trench backfill material (which is free of rocks, clods, stones greater than 1-1/2 inches in any dimension, and which meets the other requirements of trench backfill material), or granular material.

2.3 Fire Hydrant Bedding Materials

A. Fire hydrant bedding shall be placed per Detail W-29, Typical Fire Hydrant Detail, in Appendix D. Bedding material shall meet the gradations listed in Section 33 14 19, Subsection 2.3.

2.4 Ground Water Barriers

A. If compacted soil is used for ground water barriers, it shall meet the following soil classification.

1. SC – clayey sands, sand-clay mixtures.
2. CL – inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
3. CH – inorganic clays of high plasticity, fat clays.

B. Concrete used for ground water barriers shall develop a minimum compressive strength of 2,000 psi after twenty-eight (28) days. Concrete ground water barriers must be approved, in writing, by the District.

2.5 Trench Backfill Material

A. Trench backfill material and procedures beyond the waterline pipe bedding zone shall be completed in accordance with the governing jurisdiction.

B. If there is no governing agency to provide backfill procedures and materials, follow the geotechnical report recommendations or the direction of the Design Engineer.

C. If geotechnical report is not available the following procedures and materials shall be used.

1. Trench backfill material shall be placed from a point twelve (12) inches above the pipe to twelve (12) inches below the ground surface or to the bottom of the pavement sub grade, whichever is greater.
2. Trench backfill material shall be either soil excavated from the trench, or imported soil.
    a. Any soil used for trench backfill, shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, and any rocks or stones which are larger than six (6) inches, in any dimension.
        1) Rocks or stones which are six (6) inches or larger may be used in trench backfill material with prior written approval of the District.

3. If imported soil is used for trench backfill, it shall meet CDOT specifications for Class #1 structural backfill.

SIZE	PERCENT PASSING
2”	100
#4	30 – 100
#50	10 – 60
#100	5 – 20

Part 3 – Execution

3.1 Preparation

A. Topsoil shall be stripped from areas which are to be disturbed by construction, and stockpiled.

1. Topsoil shall be segregated from non-organic trench excavation material, and debris.

3.2 Trenching

A. Trenches shall be excavated by open cut methods, except where boring or tunneling is shown on drawings, or approved by the District.

B. Care shall be used when operating mechanical equipment in locations where it may cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground.

C. Mechanical equipment shall be operated in such a manner that the bottom elevation of the trench can be maintained with uniform trench widths and vertical sidewalls of the bedding zone.

D. Trench alignment shall be sufficiently accurate to permit pipe to be aligned properly with an eight (8) inch minimum clearance between the pipe and the sidewalls of the trench or trench box.

1. The trench sidewall shall not be undercut in order to obtain clearance.

E. Preparation of trench bottom.

1. Trench bottom shall be graded uniformly to provide clearance for each section of pipe.
2. Loose material, water, and foreign objects shall be removed from the trench.
3. The Contractor shall provide a firm sub grade, which is suitable for placement of bedding material.
4. If the trench bottom is judged to be unstable by the District and/or the Contractor, the unstable material shall be removed and replaced with an acceptable stabilization material.
    a. The over-excavation depth shall be a minimum of 6-inches.
    b. Reference paragraph 2.1.
5. The Contractor shall over-excavate a minimum of six inches below the bottom of the pipe wherever the trench bottom is rock, or other unsuitable material.
6. Over-excavation shall be backfilled and compacted with acceptable Stabilization Material.
    a. Reference paragraph 2.1.

F. Stockpiling excavated materials.

1. Suitable material for backfilling shall be stockpiled in an orderly manner, and stored a minimum of two (2) feet from the edge of the trench.
2. Excess excavated materials not suitable or not required for backfilling shall be disposed of away from the immediate work area.
3. Excavated material shall not be stockpiled against or over existing structures or appurtenances.

3.3 Pipe Bedding

A. Placement and compaction.

1. Reference Detail W-02, Typical Trench Bedding, in Appendix D.
2. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the water main at all points between bell ends, or pipe joints.
    a. Pipe shall not be supported by the bells.
    b. A minimum of four (4) inches of bedding shall be placed prior to the installation of the pipe.
3. To prevent lateral displacement, granular bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.
    a. Bedding material shall not be dropped onto unsupported pipe.
4. Granular bedding material shall be consolidated under and around the pipe.

3.4 Ground Water Barriers

A. Ground water barriers shall be constructed in such a manner as to impede passage of water through bedding material for the full depth of the granular bedding material, and the full width of the trench.

1. Ground water barriers shall be approximately four (4) to eight (8) feet long and spaced not more than four hundred (400) feet apart.
2. Ground water barriers shall extend through the full depth of the granular bedding/pipe zone material and project one (1) foot beyond each side of the trench wall. Ground water barriers shall extend to a point one (1) foot above the maximum peak wet-season level of subsurface groundwater as determined by the Design Engineer, but not less than three (3) feet above the top of the pipe. This requirement applies in all cases, including locations near or adjacent to a natural waterway, pond/lake, or irrigation ditch.

3.5 Backfilling and Compaction

A. All trench backfill shall be compacted.

1. Backfill of pipe and appurtenances and around vaults and valve boxes shall be compacted with equipment and in a manner which can produce the required results.

B. Backfill material shall be deposited in uniform horizontal layers which shall not exceed six (6) inches (compacted depth), in all areas, unless otherwise approved by the District.

C. Methods and equipment which are appropriate for the backfill of material shall be utilized.

1. Backfill equipment or backfilling methods which may damage the pipe shall not be used.

D. Compaction shall not be performed by jetting or water settling.

E. Sheeting removal (if Contractor elects to use sheeting).

1. Do not remove sheeting prior to backfilling.
2. Use effective methods to protect the construction, other structures, utilities and property during the sheeting removal.
3. Voids left by sheeting removal shall be filled with dry sand.
4. Unless otherwise approved by the District, sheeting that is left in place shall be cut off at an elevation six (6) feet below finish grade.

F. Topsoil shall be replaced to the depth of stripping over all areas which are to be reseeded.

G. Excess excavated material and materials not suitable for backfill shall be disposed of properly.

3.6 Field Quality Control

A. This section applies to all water lines and appurtenances that are maintained by the District, and located within public right-of-way, or within easements on private property.

B. Field moisture/density control.

1. Field tests will be conducted to determine compliance of moisture/density requirements in accordance with ASTM D6938 (Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods).
2. Moisture/density tests are the responsibility of the Contractor and shall be performed by a private Geotechnical Consultant.
    a. The method of testing of the compacted material and the validity of the results shall be the responsibility of the Geotechnical Consultant.
    b. Test results shall be submitted to the District by the Contractor or the Geotechnical Consultant within 24 hours of the test, or by the end of the next working day.
        1) Copies of the field work sheets are acceptable.
    c. Summarized test results shall be submitted to the District prior to the initial acceptance of the water system.
3. Moisture/density tests shall be performed in accordance with the governing jurisdiction standards.
4. If there is no governing agency or standards for moisture/density the minimum guidelines shall be met:
    a. Moisture/density tests shall be performed at a depth of two (2) feet above the top of the pipe bedding and in two (2) foot increments up to the final grade.
    b. Moisture/density tests shall be performed at a minimum of two hundred (200) linear feet, as measured along the length of the pipe, or as determined by the District.
    c. Moisture/density tests in the vicinity of vaults and valve boxes shall be performed at a maximum of one (1) foot away from the vault sections or valve box.
        1) Tests shall be performed in random directions from the vault or valve box, on separate lifts.
        2) A minimum of one (1) test shall be performed for every two (2) feet of vertical backfill material.
    d. Moisture/density tests shall be performed below the finished subgrade, and a minimum of one time for each service line installed, unless otherwise specified by the District Engineer.
5. All failed test areas shall be re-compacted and retested.

C. Compaction shall be performed in accordance with the following:

1. Ground water barrier material: 95% of maximum density (ASTM D698).
2. Pipe bedding – Compacted granular material: 80% of relative density (ASTM D4253 and D4254).
3. Bedding zone: 90% of maximum dry density.
4. Trench backfill.
    a. Paved roadways, sidewalks and other areas which are to be paved:
        1) Meet the minimum specified requirements of the governing agency.
        2) In areas where there is no governing agency: 95% of maximum dry density.
    b. Gravel roadways:
        1) Meet the minimum specified requirements of the governing agency.
        2) In areas where there is no governing agency: 95% of maximum dry density.
    c. Fields and landscaped areas:

1) Meet the minimum specified requirements of the governing agency.

2) In areas where there is no governing agency: 90% of maximum dry density.

d. Under footings, foundations, or structures:

1) Meet the minimum specified requirements of the governing agency.

2) In areas where there is no governing agency: 100% of maximum dry density.

e. All other locations:

1) Meet the minimum specified requirements of the governing agency.

2) In areas where there is no governing agency: 95% of maximum dry density.

D. Moisture Content

1. Meet the minimum specified requirements of the governing agency.
2. In areas where there is no governing agency:
   a. All compacted backfill shall be within 2% (+/-) of the optimum moisture content of the soil as determined by ASTM D698. Variances may be requested by submitting a report and recommendation from a private Geotechnical Consultant accompanied with a letter that specifically identifies the variance. Submittals should be directed to the District Engineer.
   b. Water shall be added to the material, or the material shall be harrowed, disked, bladed, or otherwise worked to ensure uniform moisture content, as specified.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 32 01 10 – Pavement Repair and Resurfacing

Part 1 – General

1.1 Description

A. This section addresses surface obstructions which the Contractor must remove and replace, such as pavement, drives, curbs, gutters, sidewalks, and similar surfaces, as required to perform the work.

B. The words Standard Street Specifications, as used herein, refer to the current Design Criteria and Standards for Streets of the agency having jurisdiction.

C. Standard Street Specifications

1. Larimer County Urban Area Street Standards
    a. City of Fort Collins
    b. Larimer County
    c. City of Loveland
2. Town of Timnath
3. Town of Windsor
4. Weld County

Part 2 – Products

2.1 Aggregate, Asphalt and Concrete

A. All materials and workmanship, such as but not limited to aggregate, bituminous material, and concrete, which are used in the repair of surface obstructions, shall conform to the specifications of the agency having jurisdiction. Contact the District for specifications if jurisdiction has not been established.

Part 3 – Execution

3.1 Pavement Resurfacing and Repairs

A. All paving shall be completed per the governing jurisdiction's standards.

3.2 Manhole Frames and Valve Boxes

A. Prior to placing the base course, manhole frames and water valve boxes shall be raised to final grade. Manholes/vaults shall be adjusted using a minimum of 4" and a maximum of 8" of HDPE adjustment rings. The adjustment rings shall be installed in accordance with the manufacturer's recommendations.

B. All foreign matter shall be removed from the manholes and valve boxes immediately.

C. All valve boxes and manhole covers shall be straight and properly aligned.

1. Valve boxes shall be inspected by placing a valve key on the operating nut to assure a proper alignment and that the valve box is plumb.

3.3 Asphalt and Concrete, Including Base and Gravel Surfacing

A. The Contractor shall remove, dispose of, and restore asphalt, concrete pavement, curbs, drives, sidewalks, and gravel surfacing in accordance with the local jurisdiction's Standard Street Specifications.

1. Contractor shall repair any damage to existing pavement, curbs, drives, or sidewalks which was caused by the work, as shown on the Construction Drawings, or as directed by the District.

B. Concrete drives, curbs, gutters, sidewalks, alleys and similar structures shall be removed, disposed of, and restored in accordance with the agency having jurisdiction. The following minimum thicknesses shall apply if jurisdiction has not been established:

1. Driveways and slabs shall be:
    a. Per the governing jurisdiction; or
    b. A minimum six (6) inches thick.
2. Patios shall be:
    a. Per the governing jurisdiction; or
    b. A minimum four (4) inches thick.
3. Gutters shall be:
    a. Per the governing jurisdiction; or
    b. A minimum six (6) inches thick.
4. Concrete bases for brick pavers and concrete pavement shall be:
    a. Per the governing jurisdiction; or
    b. A minimum six (6) inches thick.
5. Sidewalks shall be:
    a. Per the governing jurisdiction; or
    b. A minimum six (6) inches thick.
6. Cross pans shall be:
    a. Per the governing jurisdiction; or
    b. A minimum eight (8) inches thick.

C. Reference Section 03 30 00 – Cast-in-Place Concrete.

3.4 Field Quality Control

A. Reference the Standard Street Specifications of the agency having jurisdiction.

END OF SECTION

Section 32 39 13 – Bollards

Part 1 – General

1.1 Description

A. This section addresses traffic bollards installed to protect above-grade Public Water System features (fire hydrants, meter vaults, electrical and communication panels).

B. Locations where bollards are required are established in Section 3.4.14 of the Standards.

Part 2 – Products

2.1 Materials

A. Bollards shall be 4-inch diameter Schedule 40 steel pipe, 6.5 feet in length, filled with concrete with a minimum compressive strength of 2,500 psi.

B. Bollards shall be epoxy coated. The color shall match the hydrant color of the governing fire authority, or be safety yellow.

Part 3 – Execution

3.1 Installation

A. Bollard footings shall meet the following criteria:

1. 15-inch diameter.
2. 42-inch deep.
3. Bollard centered in the footing.
4. Bollard set six (6) inches above the bottom of the footing.
5. Footing material consisting of concrete with a minimum compressive strength of 2,500 psi.
6. Footing smooth trowel finished with a positive slope away from the bollard.

B. Bollards shall be spaced four (4) feet on center, unless approved otherwise, and shall not be placed directly over pipe.

C. Bollards protecting fire hydrants shall be placed 48 inches from hydrant, center to center. *(Product and installation requirements moved from Standards §3.4.14, June 2026.)*

END OF SECTION

DIVISION 33 – UTILITIES

Section 33 05 06 – Testing Piping Systems

Part 1 – General

1.1 Description

A. This Section covers the hydrostatic pressure testing of water distribution mains, appurtenances, fire service lines, and water service lines larger than 2-inch diameter.

B. All water mains, appurtenances, fire service lines, and water service lines larger than 2-inch diameter shall be tested. For service lines larger than 2-inch diameter, the piping up to and including the isolation valves at the meter vault shall be tested; the water meter shall not be in place during testing.

C. Once the pipeline has been filled, disinfected, flushed, and bacteriological tests have passed, and backfilling has been completed and approved, a hydrostatic pressure test shall be conducted.

D. The Inspector shall provide the District Test Form containing the specific required test pressure values pursuant to Section 4.4 of the Standards. The District shall witness all testing. The Contractor shall sign the completed Test Form indicating the test results.

1.2 Quality Assurance

A. Testing shall conform to AWWA C600 (ductile iron) and AWWA C605 (PVC), latest editions, and these Standards. In case of conflict, the more stringent requirement, as determined by the District, shall govern.

1.3 Sequencing

A. Testing shall not occur until at least seven (7) days have elapsed since the last concrete thrust restraint was cast, or 72 hours where high-early-strength concrete was used, or until a minimum compressive strength of 2,500 psi is achieved. (The 2,500 psi value is an early-strength threshold for testing only; the 28-day design strength remains 3,000 psi per Section 03 30 00.

B. The pipeline shall remain filled with water for a minimum of 24 hours prior to the hydrostatic pressure test.

C. Contractor is responsible for purging air out of the pipe test section prior to the scheduled test start time. Inspector may cancel and reschedule the test if air in the pipe is affecting the test pressure.

D. The Contractor shall give the District a minimum of 48 hours' notice prior to testing.

Part 2 – Products

2.1 Equipment

A. The Contractor shall provide all equipment, personnel, and water required to perform the test. Pressure testing equipment shall be approved by the District prior to commencing testing.

1. Test equipment shall be capable of maintaining a continuous internal pipe pressure within 5 psi of the specified test pressure and accurately measuring makeup water added over the test period.
2. The maximum allowable pressure gauge increment shall be 5 psi.
3. A water meter, calibrated within the preceding six (6) months (calibration records available on request), shall be used to measure water added in maintaining test pressure.

Part 3 – Execution

3.1 Pressure Test

A. Makeup water ("leakage") is the quantity of water that must be added to the pipeline, or any valved section thereof, to maintain a pressure within 5 psi of the specified test pressure after air has been expelled and the pipe has been filled with water.

B. Test Pressure and Duration.

1. For ductile iron and PVC pipe, the minimum test pressure shall be 150 psi measured at the lowest point of the test section, or 1.25 times the working pressure at the lowest point, whichever is greater, unless a higher pressure is specified on the District Test Form.
2. The test pressure shall be maintained within 5 psi for a minimum of two (2) hours.

C. Allowable Makeup Water. The maximum allowable makeup water for each test section shall be determined by the following formula (AWWA C605):

$L = ND\sqrt{P} / 7{,}400$

- L = allowable makeup water (gallons per hour)
- N = number of joints in the test section
- D = nominal pipe diameter (inches)
- P = average test pressure (psi)

D. Test Section Length. The maximum length of pipe per test shall be 1,000 feet, unless an alternate length is approved in writing by the District.

E. Testing Against Valves. Unless written approval is given by the District, the hydrostatic pressure test shall be performed against all valves within the new piping system, including connections to existing facilities. Testing through fire hydrants is not allowed without District approval.

3.2 Passing

A. If the test discloses makeup water greater than allowed, or any visible leak, the defective materials and joints shall be located and repaired, and the test repeated until passing.

B. All visible leaks shall be repaired regardless of allowable makeup water.

C. Except for visible leaks, passing shall be based on maximum allowable makeup water per test section.

3.3 Wet Tap Pressure Test

A. All wet taps of live water mains shall be pressure tested after the tapping sleeve and valve are installed and before the tap is cut, at a minimum of 150 psi for ten (10) continuous minutes with no visible leakage or pressure loss (reference Section 33 14 18, Subsection 1.3).

END OF SECTION

Section 33 05 07 – Trenchless Install of Utility Piping

Part 1 – General

1.1 Description

A. This section is a minimum guideline and addresses trenchless pipe installation and the furnishing of casing pipe.

B. Each trenchless crossing shall be designed by a registered professional engineer and/or geotechnical engineer based on geotechnical data gathered in close proximity to the installation location. All geotechnical data shall be compiled in a geotechnical report stamped and sealed by a professional engineer.

C. Reference Detail W-14, Typical Pipe Casing, in Appendix D.

1.2 Quality Assurance

A. Design Criteria.

1. The permitting agency shall supersede any criteria listed in this specification section.
2. All trenchless utility installations shall be designed, stamped and sealed by a professional engineer registered in the state of Colorado.
3. Plan and profiles design drawings shall be provided for all trenchless installations.
4. Geotechnical information for every crossing and/or trenchless installation shall be obtained.
5. A geotechnical report with recommended trenchless methods shall be provided.
6. Specified thickness for pipe and casings listed in this section are based upon the superimposed loads and not upon the loads which may be encountered during the specified installation method.
    a. Increased pipe strength shall be provided as necessary to withstand additional loads based on the method of installation.

B. Construction Criteria.

1. Owner/Contractor shall obtain the necessary permits from the appropriate agencies, prior to commencing construction.
2. Owner/Contractor shall obtain the bonds or the indemnity which are required by the permits, for protection against any damage and interference with traffic and service, which are caused by the construction activities.
3. All utilities shall be potholed prior to the trenchless utility installation.
4. Contractor shall provide an "inadvertent return flow plan" if drilling fluid is being used in the trenchless installation method.
5. All excavations shall conform to the trenching, backfilling and compaction requirements set forth in Section 31 23 16 – Excavation and Section 31 23 35 – Trenching, Backfilling, and Compacting.
6. Post installation profiles of all the trenchless utilities (pipe and/or casing) shall be provided and incorporated into the record drawing for the project.

Part 2 – Products

2.1 Restrained Joint Pipe

A. Restrained joint pipe shall be used in all trenchless pipe installations, unless written approval is obtained from the District.

1. Approved pipe manufacturers can be found in Appendix C.

2.2 Casing Pipe – Smooth Steel

A. The yield point of smooth steel casing pipe shall be:

1. Determined by the agency granting the crossing permit.
2. If there are no governing agency requirements the minimum yield point shall be 35,000 psi.

B. Smooth steel casing pipe shall be:

1. Determined by the agency granting the crossing permit.
2. If there are no governing agency requirements the casing pipe shall conform to ASTM A139/A139M, Grade B (No hydro).
    a. Clean used pipe, which is in good condition, and conforms to the requirements of this specification may be used with the prior approval of the Design Engineer and District.

C. The minimum wall thickness of smooth steel casing pipe shall be:

1. Determined by the agency granting the crossing permit.
2. Wall thickness shall be determined by the engineer of record based on project-specific loading conditions.
3. Reference Detail W-14, Typical Pipe Casing in Appendix D.

D. The ends of smooth steel casing pipe shall be beveled for field welding.

1. All field welds shall be painted with an epoxy polyamide exterior coating, or a coal-tar enamel exterior coating, which conforms to AWWA C203, Section 2.
    a. The minimum thickness of the exterior coating shall be per the agency granting the crossing permit.
    b. If there is no standard listed, the minimum thickness of the exterior coating shall be sixteen (16) mil.

E. Smooth steel casing pipe shall have an epoxy polyamide exterior coating, or when required by the Construction Drawings, a coal-tar enamel exterior coating.

1. If the permitting agency allows it and Contractor elects to omit the exterior coating, 1/16 inch shall be added to the required thickness of the casing pipe.
2. If there is no permitting agency the Contractor may elect to omit the exterior coating, 1/16 inch shall be added to the required thickness of the casing pipe.

F. Restrained joint C900 PVC may be permitted as casing pipe for casings sixteen (16) inches and under if:

1. Allowed by the permitting agency and with written approval from the District.
2. There is no permitting agency; only written approval from the District will be required.

2.3 Accessories

A. Casing Seals.

1. Casing seals shall be constructed of high-density rubber with stainless steel straps.
    a. See Appendix C for approved materials; or an approved equal.

B. Casing Spacers.

1. Casing spacers shall be twelve (12) inches in length with stainless steel bodies and polymer runners. There shall be three (3) per joint.
    a. See Appendix C for Approved Materials List; or an approved equal.
2. The carrier pipe barrel shall be supported in accordance with Detail W-14, Typical Pipe Casing, in Appendix D, and as modified on the approved Construction Drawings.

Part 3 – Execution

3.1 Trenchless Utility Installation

A. General

1. Vertical and horizontal offset staking shall be provided.
2. Pipe shall be installed at the grade and alignment shown on the Construction Drawings. Post pipe profiles shall be provided to the District and incorporated in the record drawings.
    a. Grade and alignment shall not deviate by more than 0.3 feet from that shown on the Construction Drawings.
3. Bore pits and shaft design shall be provided by a registered professional engineer.

3.2 Casing Installation

A. General.

1. Vertical and horizontal offset staking shall be provided at both ends of bored or jacked crossings.
2. Casing pipe shall be installed at the grade and alignment shown on the Construction Drawings.
    a. Grade and alignment shall not deviate by more than 0.3 feet from that shown on the Construction Drawings.
3. Casing pipe shall be installed as indicated in the Construction Drawings.
    a. The casing pipe shall extend a minimum of 10 feet past both edges of the object requiring the casing pipe to be installed.
    b. Open trench installation of the casing pipe shall be in accordance with Section 31 23 16 – Excavation.
4. The earth which is displaced by the casing pipe shall be disposed of properly.

B. Smooth Steel Pipe.

1. Contractor shall provide a smooth, continuous, and uniform casing pipe with no exterior voids.
2. Each section of casing pipe shall be welded with a full penetration butt weld around the entire circumference of the joint to form a watertight continuous conduit capable of resisting all stresses, including jacking stresses.
3. Design Engineer shall design and indicate on the plans the anode size for all steel casing pipes.
    a. A minimum fifty (50) pound high potential magnesium anode shall be installed at each end of the casing pipe, using a cad weld method.

C. Grouting.

1. All spaces between the casing pipe and the earth shall be filled with grout.
    a. Grout connections on the interior of the casing pipe shall be provided at ten (10) feet (O.C.) intervals.
2. Grouting operations shall be performed in a sequence which will preclude any deflections which exceed 5 percent of the tunnel diameter.
3. After the grout is in place, each hole shall be plugged in order to prevent the backflow of grout.

3.3 Carrier Pipe Installation

A. Carrier pipe shall be installed at the grade shown on the Construction Drawings (CCP).

B. Each section of pipe shall have a minimum of three (3) casing chocks.

C. Carrier pipes that exceed 20 L.F. shall have mechanical joint restraints installed at each joint.

D. The annular space between the casing and the carrier pipes shall be left vacant.

E. The ends of the casing pipe shall be sealed with casing seals.

3.4 Cathodic Protection

A. Soil-Test Evaluation

1. In all cases the Design Engineer must have a certified Geotechnical Engineer perform a soil-test evaluation in strict accordance with AWWA C105. The results and recommendations of the evaluation shall be submitted to the District for consideration and review.
2. The Water-Saturated Soil Box method shall be used to measure the resistivity of the soil.
3. The distance between sample locations shall be at the discretion of the District, except that the testing frequency shall not be less than one test for every four hundred (400) linear feet of pipe, per the Standards.
4. If the soil-test evaluation concludes that the soil is corrosive to steel casing pipe, the Design Engineer must submit a comprehensive plan with a proposed design for cathodic protection. The design shall be in accordance with AMPP SP0169 (latest revisions).

B. Magnesium Anodes

1. At a minimum, one anode shall be installed at each end of the casing pipe.
2. Anodes shall be installed vertically in native soils, a minimum of three feet laterally from the pipe to be protected.
3. Place the top of the anode below the centerline of the pipe. However, anode spacing, and lateral distance can be adjusted to maintain adequate clearance from permanent structures and obstacles with the approval of the District.
4. Anodes shall be backfilled and tamped with native soil in 6-inch layers. Sand is not permissible.
5. Wet down each anode with 5 gallons, minimum, of fresh water after backfilling and tamping.

C. Wiring

1. Underground wires, cables and connections shall be buried with 6-inch minimum separation from other underground structures.
2. Splices and repairs to damaged cable associated with a cathodic protection system shall be sealed against moisture penetration using 2-1/2 lapped layers of tape alternating between rubber and plastic tape.
3. Wiring shall be backfilled with material free from rocks and debris that could damage the insulation.

D. Brazing (Cad Weld)

1. Brazing techniques shall comply with the anode manufacturer's recommendations. Only proper size cartridges and welders will be permissible.
2. Prior to brazing, an area of the structure three inches square shall be cleaned to bright metal with a grinder or file.
3. The slag shall be removed from the completed braze with a hammer.
4. The adequacy of each braze shall be demonstrated by gently striking the top of the connection with a one-pound hammer.
5. The cleaned piping surface, including the brazed connection and exposed copper wire, shall be coated with a coal tar compound.

E. Test Stations

1. Wires shall be brought to the surface and terminated in a CP test station.
2. Test Station shall not be in traffic or pedestrian areas.

3. Provide a minimum of 48 inches of slack, coiled in each box.
4. See Appendix C for approved materials; or approved equal.

F. Joint Bonding: all ductile iron pipe joints shall be bonded with copper wires.

G. Insulation: protected water mains shall be insulated from unprotected mains in all cases as necessary. Insulating flanges shall be required for pipe connections of dissimilar metals, or at the discretion of the District. Insulators shall also be required at the outlet end of corporation stops. *(Moved from Standards §3.4.12, June 2026.)*

H. Reference Detail W-15, Cathodic Protection Details in Appendix D.

3.5 Crossings of Irrigation Ditches

A. Cut-off walls at casing ends shall be constructed in accordance with Section 03 30 00 and the geometry shown on the approved Construction Drawings (reference Section 3.3.4 of the Standards).

B. All ditches shall be restored according to the ditch owner's criteria and to the satisfaction of the District. *(Execution content moved from Standards §3.3.4.D, June 2026.)*

END OF SECTION

Section 33 05 20 – Ductile Iron Pipe

Part 1 – General

1.1 Description

A. This section addresses ductile iron pipe. District approval is required for the use or installation of ductile iron pipe. Pipe shall be furnished complete with all fittings, flanges, specials and other accessories.

1.2 Product Delivery, Storage and Handling

A. Handling

1. Slings, pipe tongs or skids shall be used for handling pipe.
2. Pipe or fittings shall not be dropped.
3. Care must be taken to prevent damage to the pipe and fittings by impact, bending, compression, or abrasion.
4. Damaged pipe or fittings shall not be installed.

B. Storage

1. Lubricant shall not be stored and used in a manner which will contaminate the lubricant.
2. Rubber gaskets shall be stored in a location which protects them from deterioration or damaged.
3. The maximum stacking heights of pipe as listed in AWWA C600 shall not be exceeded.

Part 2 – Products

2.1 Pipe

A. All ductile iron pipe, with push-on joints, shall be manufactured in accordance with AWWA C151/A21.51. All ductile iron pipe, with flanged, flat faced joints, shall be manufactured in accordance with AWWA C115/A21.15.

B. Ductile iron pipe which is twelve (12) inches and smaller in diameter shall have a working pressure rating of 350 psi. Ductile iron pipe which is larger than twelve (12) inches in diameter shall have a working pressure rating of 250 psi.

C. Flanged ductile iron pipe with threaded flanges shall be Class 53 pipe.

D. All ductile iron pipe shall have nominal laying lengths of either eighteen (18) or twenty (20) feet.

1. Random pipe lengths are not acceptable, except when using restrained joint pipe.

2.2 Fittings and Couplings

A. All fittings and couplings shall be manufactured in accordance with AWWA C104, C110, and C111.

B. All fittings and couplings shall have one of the following types of connections:

1. Flanged joint.
2. Mechanical joint with mechanical restraints.

C. All fittings and couplings shall be made of either gray-iron or ductile iron, and have a minimum working pressure rating of 250 psi.

2.3 Joints

A. All mechanical and push-on joints shall be manufactured in accordance with AWWA C111/A21.11.

1. Unless specified otherwise, all gaskets shall be as recommended by the manufacturer.
2. Lubricant shall be that which is specified by the pipe manufacturer.

3. All nuts and bolts shall be Type 316 stainless steel; joint materials shall be manufactured in accordance with AWWA C111/A21.11.

B. All ductile iron pipe with threaded flanged joints shall be manufactured in accordance with AWWA C115/A21.15.

1. All flanges shall be sized and drilled in accordance with ASME B16.1: Gray Iron Pipe Flanges and Flanged Fittings, Class 125.

2.4 Tracing Wire

A. Tracer wire and test stations shall conform to Section 33 14 13, Subsections 2.2 and 2.3.

2.5 Pipe Lining

A. All ductile iron pipe shall have a standard thickness cement mortar lining.

1. Ductile iron pipe which is twelve (12) inches and smaller in diameter shall have a cement mortar lining with a minimum thickness of 1/16 inch.
2. Ductile iron pipe which is larger than twelve (12) inches in diameter shall have a cement mortar lining with a minimum thickness of 3/32 inch.

B. All ductile iron pipe lining shall conform to AWWA C104/A21.4.

2.6 Pipe Coatings

A. All ductile iron pipe shall have a bituminous coating on the pipe exterior, unless otherwise specified.

1. The minimum thickness of the bituminous coating shall be one (1) mil.

2.7 Joint Restraining Devices

A. Push-on and mechanical joints may be restrained with the use of:

1. Megalugs, EBAA Iron Inc.
2. Uni-Flange, Uni-Flange Corp.
3. Approved equal

2.8 Polyethylene Encasement

A. The polyethylene used in polyethylene encasement shall conform to AWWA C105/A21.5.

B. The minimum thickness of the polyethylene shall be 8 mil.

C. Polyethylene encasement shall be installed in accordance with AWWA C105/A21.5.

Part 3 – Execution

3.1 Installation

A. Reference Part 3 of Section 33 14 13.

END OF SECTION

Section 33 05 29 – Plastic Pressure Pipe

Part 1 – General

1.1 Description

A. This section addresses plastic pressure pipe and includes the acceptable materials and construction practices which may be used in the installation of plastic pressure pipe.

1. All pipe shall be furnished complete with all fittings, specials, and other accessories.

1.2 Product Delivery, Storage and Handling

A. Handling

1. Pipe shall not be handled in a manner which will cause damage to the pipe.
2. Pipe or fittings shall not be dropped.
3. Care must be taken to prevent damage to the pipe and fittings by impact, bending, compression, or abrasion.
4. Damaged pipe or fittings shall not be installed.

B. Storage

1. Lubricant shall not be stored or handled in a manner which will cause contamination to the lubricant.
2. Rubber gaskets shall be stored in a location which protects them from deterioration.
3. Pipe shall be stored in accordance with the manufacturer's specifications.
4. Pipe shall be stored on a surface which provides even support for the pipe barrel.

a. Pipe shall not be stored in such a way as to be supported by the bell.

5. Pipe which has a longitudinal deflection greater than 1/8 inch per foot shall not be used.
6. Pipe which exhibits any signs of ultraviolet deterioration shall not be used.

Part 2 – Products

2.1 Pipe

A. The only sizes of plastic pressure pipe which will be allowed are four (4) inch through sixteen (16) inch (inclusive).

1. Four (4) inch pipe is limited to irrigation and special-use applications approved by the District; the minimum distribution main size is six (6) inches per the Standards.

B. All plastic pressure pipe shall be manufactured in accordance with AWWA C900 (DR 18).

C. The outside diameter of plastic pressure pipe shall be based upon equivalent outside diameters of ductile iron pipe.

D. Plastic pressure pipe shall have a dimension ratio of 18 (DR 18), Pressure Class 235 per AWWA C900.

E. All plastic pressure pipe shall have a nominal laying length of 20 feet.

1. Random pipe lengths are not acceptable.

2.2 Fittings and Couplings

A. All fittings and couplings shall be manufactured in accordance with AWWA C153, C111, C550, C116 and C104.

B. All fittings and couplings shall have one of the following types of connections:

1. Flanged joint (not for buried service).

2. Mechanical joint with mechanical restraints.

C. All fittings and couplings shall be made of ductile iron, with a minimum working pressure rating of 250 psi.

D. All transition couplings shall have a fusion bonded epoxy coating and 316 stainless steel fasteners. Reference AWWA C213.

2.3 Joints

A. All joints on plastic pressure pipe shall be push-on, using an integral bell with an elastomeric-gasket.

2.4 Tracing Wire

A. Tracer wire and test stations shall conform to Section 33 14 13, Subsections 2.2 and 2.3.

2.5 Joint Restraining Devices

A. Push-on joint restraints as approved in Appendix C, or approved equal.

B. Mechanical joint restraints as approved in Appendix C, or approved equal.

C. Integrally Restrained Joint Pipe as approved in Appendix C, or approved equal.

Part 3 – Execution

3.1 Installation

A. Reference Section 33 14 13.

B. PVC pipe shall not be installed when the air temperature or the soil temperature is 32 degrees F or less, unless otherwise approved by the District; pipe shall not be installed under any circumstances when the temperature is less than 15 degrees F (reference Section 33 14 13, Subsection 1.4.D).

END OF SECTION

Section 33 13 00 – Disinfection of Waterlines

Part 1 – General

1.1 Description

A. This section addresses the filling and disinfection of potable water distribution lines.

B. The Contractor is responsible for the disinfection and testing of water lines.

1.2 Product Delivery, Storage and Handling

A. Reference the Forewords to AWWA B300 and AWWA C651.

B. Hypochlorite should be handled with extreme care.

Part 2 – Products

2.1 Materials

A. Hypochlorite. Reference AWWA B300. All hypochlorite used for disinfection of potable water lines shall be certified to NSF/ANSI/CAN 60.

B. Adhesive Hypochlorite Tablets. Hypochlorite tablets adhered to the interior of the pipe shall not be permitted.

Part 3 – Execution

3.1 General

A. The Contractor, with District approval, shall satisfactorily disinfect and flush new water lines prior to placing them in service, in accordance with AWWA C651.

B. Filling pipe.

1. The Contractor shall coordinate with District staff to operate existing valves to fill the pipe; the Contractor shall open air blow-offs, service lines and hydrants. Only District Staff are permitted to operate District valves.
2. District personnel shall witness testing and operation.
3. Where permanent air vents are not available, the Contractor shall install corporation stops at high points in the water line, to evacuate air.
    a. All corporation stops, which were installed to facilitate evacuation of air from the water main, shall be removed and tapping saddles plugged after the water main is filled, prior to pressure testing.

3.2 Preliminary Flushing

A. Preliminary flushing shall not be performed if granular method of disinfection is approved by the District.

B. The pipelines shall be flushed at a minimum velocity of 2.5 ft/sec., to remove foreign material prior to disinfection.

3.3 Methods

A. General.

1. The District shall:
    a. Review and approve the disinfection method proposed by the Contractor.
    b. Sample and test water from the pipe system extremities until clear, potable water is obtained.

2. The Contractor shall:
    a. Propose the method of chlorination.
    b. Allowable methods for disinfection:
        1) Hypochlorite solution.
        2) Hypochlorite granules (tablets shall not be allowed).
    c. Properly dispose of flushed water.

B. Granule Method

1. The granule method consists of placing calcium hypochlorite granules in the water main during construction and filling the main with potable water when installation is completed.
    a. The granule method shall not be used if trench water or foreign material has entered the water line, or if the water temperature is below forty-one degrees Fahrenheit (41°F/5°C). If either condition is present, the continuous-feed method of chlorination shall be used.
    b. The granule method shall not be used for extensions which are over 1,000 feet in length, or for water lines which are larger than 12-inches in diameter, without prior permission of the District.
    c. During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and in each section of pipe.
        1) The quantity of granules used shall be as shown in the granule-dosing table of AWWA C651, reproduced below.

Calcium Hypochlorite Granule Dosing (per AWWA C651)

PIPE DIAMETER (INCHES)	CALCIUM HYOPCHLORITE GRANULES (OZ)
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 & larger	D^2 x 15.1

(Where "D" is the inside pipe diameter in feet)

    d. Granules shall be placed in sufficient number and amount to produce a minimum chlorine concentration in the treated water of 50 milligrams per liter.
    e. Introduce water into the pipes at a velocity no greater than one (1) ft./sec.
    f. The chlorinated water shall be retained in the lines for a minimum of 48 hours, at which time the treated water must contain no less than 25 milligrams per liter of chlorine throughout the entire length of the main. The chlorinated water shall be flushed within five (5) days unless otherwise approved by the District.

C. Continuous-Feed Method

1. The continuous-feed method consists of:
    a. Prior to being chlorinated, the main shall be filled to eliminate air pockets, and shall be flushed to remove particulates. The flushing velocity shall not be less than 2.5 feet per second.
    b. Chlorine can be applied in advance of preliminary flushing by swabbing joints with bleach or placing calcium hypochlorite granules in the pipe in areas where contamination is suspected. In any such case, the Contractor shall take appropriate action to ensure that the flushed water is dechlorinated.

c. Introduce water into the pipes at a velocity no greater than one (1) ft./sec. Completely fill the main with potable water to remove all air pockets, flush the completed main to remove particulates, and then refill the main with potable water that has been chlorinated to 25 mg/L.

d. The chlorinated water shall be retained in the main for a 24-hour holding period, after which there shall be a free chlorine residual of not less than 10 mg/L in collected samples.

1) Reference the dechlorination procedures of AWWA C651.

e. Prior to and during the disinfection process, valves shall be positioned so that the chlorine solution in the newly constructed main will not flow into water mains in active service.

3.4 Final Flushing

A. After the applicable retention period, the heavily chlorinated water shall be flushed from the water lines until the chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is less than one (1) milligram per liter. The Contractor shall be responsible for all necessary permits and to ensure that no environmental damage occurs.

1. Reference AWWA C651 for a list of approved neutralizing chemicals.

3.5 Bacteriological Tests

A. The District shall coordinate sampling from the pipeline after final flushing, and prior to the hydrostatic pressure test (reference Section 33 05 06, Subsection 1.1) and placing water lines in service, to test for bacteriological quality to show the absence of coliform and heterotrophic organisms.

1. The District shall be given a minimum of 48 hours advance notice, prior to collecting samples.
2. Samples may only be taken Monday – Thursday, exclusive of weekends and holidays.

B. The number, and location of samples, shall be determined by the District based upon AWWA C651.

3.6 Repetition of Procedure

A. If the initial disinfection fails to produce satisfactory samples, the main shall be re-flushed and re-sampled. If the samples are still not satisfactory, the main shall be re-chlorinated by the continuous-feed method of chlorination until satisfactory results are obtained.

B. If the residual is less than 25 milligrams per liter, the water lines shall be re-chlorinated by the continuous-feed method of chlorination and retested.

END OF SECTION

Section 33 14 13 – Public Water Distribution System

Part 1 – General

Pipe Material Specifications: Ductile iron pipe is specified in Section 33 05 20 – Ductile Iron Pipe. Plastic pressure pipe (PVC/HDPE) is specified in Section 33 05 29 – Plastic Pressure Pipe. See those sections for approved materials, standards, and installation requirements.

1.1 Description

A. This section addresses the acceptable products, materials, and construction practices which may be used in the installation of water distribution mains.

1.2 Quality Assurance

A. Water system installations shall conform to the regulations of the Colorado Department of Public Health and Environment, Water Quality Control Commission.

B. The distribution system shall maintain a minimum residual pressure of twenty (20) psi at all points under all flow conditions, per CDPHE Design Criteria for Potable Water Systems §8.2 and the Standards.

C. Construction staking.

1. Reference Section 31 23 16, Subsection 1.2.
2. Horizontal alignment shall not deviate by more than six (6) inches.
3. Vertical alignment shall not deviate by more than three (3) inches, as measured from the pipe invert.
4. The minimum effective area of thrust blocks shall be as specified in Detail W-TB, Typical Concrete Thrust Blocks in Appendix D. Thrust blocks are required at wet-tap connections (reference Subsection 3.4), and shall otherwise be used only by special District approval.

1.3 Product Delivery, Storage and Handling

A. Reference Section 33 05 20 – Ductile Iron Pipe, Section 33 05 29 – Plastic Pressure Pipe, and Section 33 14 18 – Service Lines, Meters, and Appurtenances.

1.4 Job Conditions

A. Foreign material (debris, tools, clothing, or other material), including trench water, shall not be permitted in the pipe.

B. In order to prevent water, debris, and animals from entering the pipe, the open ends of the pipe shall have a watertight plug installed when pipe laying is not in progress.

C. Effective measures shall be used to prevent uplifting or floating of the pipeline prior to completion of the backfilling operations.

D. Pipe shall not be installed under the following conditions:

1. When the trench contains water.
2. When weather conditions are unsuitable.
3. Temperature is less than 15° Fahrenheit. District approval is required when the temperature is 32° Fahrenheit or less.
4. When the trench bottom is unstable.

E. Pipe and appurtenances shall be protected against dropping and damage.

1. Pipe and appurtenances shall not be used if they are damaged.

Part 2 – Products

2.1 Pipe

A. Water mains and fire hydrant laterals 16-inches and smaller

1. Shall be PVC C900 DR18. Full pipe specification: see Section 33 05 29 – Plastic Pressure Pipe.
2. See Section 33 05 29 – Plastic Pressure Pipe.
3. See Appendix C for approved materials.

B. Water mains larger than 16 inches

1. Materials shall be approved by the District. Where ductile iron pipe is used, see Section 33 05 20 – Ductile Iron Pipe.
2. See Appendix C for approved materials.

C. The same type of pipe material shall be used for each size pipe.

1. Pipe material shall not be interchanged, except where another type of pipe material is specifically indicated.

2.2 Tracer Wire

A. Tracer wire shall be a single 12 AWG high-strength copper-clad steel wire with a blue high-density polyethylene (HDPE) jacket, rated for open trench installation, buried directly with the pipe. Solid copper wire may be used.

B. Tracing wire will be connected at all piping intersections to form one continuous system. Connections will need to be water tight.

C. Tracing wire will surface into a test station at all Fire Hydrant locations. Additional locations may be required depending on available Fire Hydrant locations.

D. See Appendix C for approved materials.

2.3 Testing Stations

A. Test stations shall not be located in traffic or pedestrian areas.

B. See Appendix C for approved materials.

2.4 Fittings and Couplings

A. PVC Pipe

1. All fittings and couplings shall be manufactured in accordance with AWWA C153, C111, C550, C116 and C104.
2. All fittings and couplings shall have one of the following types of connections:
    a. Flanged joint (not for buried service).
    b. Mechanical joint.
3. All fittings and couplings shall be made of ductile iron, with a minimum working pressure rating of 250 psi.
4. All fittings and couplings shall have a fusion bonded epoxy coating and 316 stainless steel fasteners. Reference AWWA C116 and C550.
    a. Except that Restrained Joint Fittings may be enamel coated, with District Approval.

B. Ductile Iron Pipe

1. All fittings and couplings shall be manufactured in accordance with AWWA C104, C110, and C111.
2. All fittings and couplings shall have one of the following types of connections:
    a. Flanged joint. (Not allowed in buried applications unless approved by the District.)

b. Mechanical joint with mechanical restraints.

3. All fittings and couplings shall be made of either gray-iron or ductile iron, and have a minimum working pressure rating of 250 psi.
4. All fittings and couplings shall have a fusion bonded epoxy coating and 316 stainless steel fasteners. Reference AWWA C116 and C550.

2.5 Valves

A. All valves and valve appurtenances (gate valves, butterfly valves, tapping valves, valve boxes, air release/vacuum relief valves, and check valves) shall conform to Section 33 14 20 – Valves.

2.6 Fire Hydrants

A. Reference Section 33 14 19 – Fire Hydrants.

2.7 Blow-Offs

A. All permanent blow-offs shall be per Detail W-30A or W-30B in Appendix D and the approved materials list in Appendix C, or as approved on the Construction Drawings.

1. Hydrants used for blow-off shall match the specifications of the jurisdictional fire agency (e.g., color, operating nut configuration, etc.).

2.8 Service Lines, Meters, Appurtenances

A. Reference drawings W-08 through W-11 in Appendix D.

B. Service line materials, tapping saddles, corporation stops, and service installation shall conform to Section 33 14 18 – Service Lines, Meters, and Appurtenances.

C. Tapping Sleeves

1. Tapping sleeves and valves are required for connections to existing water mains unless otherwise indicated on the Construction Drawings or approved by the District.
2. Tapping sleeves for PVC and Ductile Iron pipe shall be stainless-steel construction with a stainless steel or ductile iron flange.
    a. See Appendix C for approved materials.
    b. Tapping sleeves for steel pipe shall be a weld-on type.

2.9 Concrete Vaults and Manholes

A. Mortar

1. Mortar shall be Sand-Cement grout using the following ratio:
    a. One (1) part Portland cement; conforming to ASTM C150, Type I/II.
    b. Two (2) parts sand; conforming to ASTM C144.
    c. One half (1/2) part hydrated lime; conforming to ASTM C207, Type S.

B. Grout

1. Grout shall be one of the following:
    a. Pre-mixed non-metallic grout: see Appendix C for approved materials; or approved equal.
    b. Job-mixed grout shall use the following ratio:
        1) One (1) part Portland Cement; conforming to ASTM C150, Type I/II.
        2) One (1) part sand; conforming to ASTM C144.
        3) One (1) part shrinkage correcting aggregate; see Appendix C for approved materials.

C. Steps

1. All steps shall be made of the following materials:
    a. Copolymer polypropylene plastic conforming to ASTM C478 and ASTM C497.
    b. See Appendix C for approved materials.
    c. All steps shall be spaced twelve (12) inches apart (O.C.).
    d. The maximum distance from the cover to the topmost step shall be twenty four (24) inches.
    e. The maximum distance from the floor of the manhole to the lowest step shall be eighteen (18) inches.

D. Pipe Penetration Seals.
1. See Appendix C for approved materials; or approved equal.

Part 3 – Execution

3.1 Inspection

A. Pipe barrel and fittings shall be free of dirt or other foreign objects prior to installation.

B. Pipe and fittings shall be inspected for cracks, dents, abrasions, or other flaws prior to installation.

C. Pipe and fittings with damaged linings or coatings shall be rejected.
1. Defective pipe shall be marked and remain on the site until removal is approved by the District.

3.2 Preparation

A. Excavation. Reference Section 31 23 16 – Excavation.

B. Connections. The location and elevation of the existing utilities shall be verified prior to construction.

C. Joints
1. Dirt, oil, grit, and other foreign matter shall be removed from the inside of the bell and outside of the spigot.
2. A thin film of lubricant shall be applied to the inside of the gasket and the spigot end of the pipe, per the manufacturer's recommendations.
3. The lubricated joint shall be kept clean until joined.
4. The pipe shall have a depth mark prior to the assembly to ensure that the spigot end is inserted to the proper depth of the bell end joint.
5. Stabbing the pipe shall not be allowed.
6. Previously completed joints shall not be disturbed during the jointing operation.
    a. After the initial acceptance of the water main, the Contractor shall be responsible for the repair of any leak, resulting from improper workmanship or materials, which are discovered within the warranty period established in Section 01 10 00, Subsection 1.7.G.

3.3 Pipe Installation

A. All pipes shall be installed with the bells pointing in the direction that the work is progressing.

B. The Contractor shall employ effective measures to prevent the separation of joints during bedding and backfilling operations.
1. Bedding material shall not be dropped onto unsupported pipe, which has been set to alignment and grade.
2. Pipe shall be laid and maintained at required lines and grades as specified in the approved Construction Drawings (CCP).

C. Ductile iron pipe shall be installed with a polyethylene encasement; see drawing W-06 Field Installation of Polyethylene for reference.

D. Tracing wire shall be installed with all water mains.

E. The pipe shall be secured in place with the specified bedding consolidated under and around the pipe.

F. The pipeline shall be installed so that a uniform positive or negative grade is maintained between the designed high and low points.

G. The minimum depth of cover shall be five (5) feet from the finished grade to the top of the pipe, except as otherwise indicated on the Construction Drawings.

H. The maximum depth of cover shall be six (6) feet from the finished grade to the top of the pipe, except as otherwise indicated on the Construction Drawings.

I. Concrete encasements shall be provided where indicated on the Construction Drawings only. Written District approval is required for all other cases.

1. Cast-in-Place Concrete. Reference Section 03 30 00 – Cast-in-Place Concrete.

J. A minimum vertical separation of eighteen (18) inches, with the water main above the sewer, shall be maintained at all sewer crossings (CDPHE Design Criteria for Potable Water Systems §8.8). Where the 18-inch separation cannot be achieved, or where the sewer must be above the water main, the crossing shall be constructed by the following method and requires District approval:

1. One length of water pipe, with a laying length of twenty (20) feet or greater, shall be installed.
    a. The pipe shall be centered on the crossing such that no pipe joints are within ten (10) feet.
2. The sewer at the crossing shall be constructed of waterworks-grade pressure pipe or encased in a continuous sleeve.
3. Suitable backfill or other structural protection shall be provided to prevent settling or failure of the higher pipe.

3.4 Thrust Restraint

A. Concrete thrust blocks are required at wet-tap connections; all other fittings shall be restrained by an approved mechanical joint restraint device. Thrust blocks shall otherwise be used only where approved by the District and indicated on the construction plans, reference Standard Drawings W-TB (Typical Concrete Thrust Blocks) and W-13.

B. Concrete anchorage and blocking.

1. Fire hydrants shall be supported on a concrete block and mechanically restrained; concrete anchorage in lieu of mechanical restraint requires District approval. Signed construction drawing does not constitute approval for use in other locations.
2. The concrete thrust block bearing surface shall be excavated into undisturbed soil.
    a. All loose soil shall be disposed of, and the location where the thrust block is to be poured shall be carefully shaped to provide a uniform bearing surface of the required size.
    b. The concrete thrust block bottom shall be flat, and sides shall be vertical.
    c. If soil is to be disturbed, making a concrete thrust block unusable, alternate restraining systems must be approved by the District prior to pipeline installation.
3. The concrete thrust block shall be formed to provide access to fittings and hydrants.
4. Concrete shall be separated from fittings and hydrants by an 8-mil polyethylene film.
    a. Concrete shall not be poured directly on or over fittings, nuts, bolts, flanges, etc.
5. The District shall be notified 24 hours before concrete is placed.

C. Restraining Devices

1. The Design Engineer shall determine the length of pipe to be restrained for each situation where mechanical restraint systems are installed.
2. All auxiliary fire hydrant / blow-off valves shall be restrained to prevent the movement of the valve during hydrant / blow-off removal or maintenance.

D. Where connections are made to existing pipe, or valves are inserted into existing pipe, thrust walls shall be installed.

1. Reference drawings TW-01 and TW-02 Typical Thrust Walls.

3.5 Installation of Pipeline Appurtenances

A. Valves, hydrants, taps, and other appurtenances to the water distribution lines shall be installed at the locations shown on the Construction Drawings, or as approved by the District to accommodate field conditions.

1. Measurements of the actual location of appurtenances shall be made prior to backfilling for recording in the Project Record Drawings.

B. Dead-end water lines shall terminate with a fire hydrant or blow-off assembly per Section 3.3.6 of the Standards. Maximum dead-end length 250 feet. A tee post shall be installed at the terminus of all dead ends and stubs, per the Standards.

1. Dead-end water lines that will be extended in the future shall have a valve which controls that section of waterline left in the on position.
    a. If the waterline is to be extended in the future, the fire hydrant may be installed temporarily, until the extension occurs.

C. Fire hydrants that have been in service for more than two (2) years shall not be relocated and reused; all hydrants removed from service shall be offered to the District as salvage.

D. Temporary blow-offs which are installed by the Contractor during construction shall be abandoned at the main prior to acceptance of the waterline.

1. A 2-inch tap with a 90-degree vertical bend may be made directly into the cap of the main. The bend shall be connected to a short section of 2-inch diameter pipe with a 2-inch curb stop valve; this valve shall be closed after the blow-off is completed.
2. All fittings for temporary 2-inch blow-offs shall be brass.
3. Stubs shall have appropriately designed restrained joints. An adequately sized concrete thrust block may be poured behind the stub with District approval.

E. Install fiberglass marker posts at all line valves, air valves, and at intervals not to exceed 1,000 feet, or as determined by the District.

F. Tapping Saddles (2-inches and smaller)

1. Tap location and spacing shall conform to Section 33 14 18, Subsection 3.2.

G. Tapping Sleeves

1. Wet taps shall be one nominal pipe size smaller than the main being tapped, except as approved in writing by the District Engineer for key facilities (reference Section 3.4.2 of the Standards). Approved size-on-size taps shall use a cutting bit one (1) inch smaller than the main.
2. Where more than one tapping sleeve is to be used on the same side of a pipe, the tapping sleeves must be located on separate sticks of pipe.
3. Where more than one tapping sleeve is to be used opposite sides of a pipe, the distance between the tapping sleeves shall be a minimum of five (5) feet.

4. Water mains 12 inches and smaller:
    a. Tapping sleeves shall be a minimum of 24-inches from the back of the bell, the spigot insert line, and/or joint restraint hardware.
    b. The distance between a tap and a tapping sleeve shall be a minimum of five (5) feet.
5. Water mains larger than 12-inches:
    a. Tapping sleeves shall be a minimum of 36-inches from the back of the bell, the spigot insert line, and/or joint restraint hardware.
    b. The distance between a tap and a tapping sleeve shall be a minimum of five (5) feet.

3.6 Fire Lines

A. The District owns the fire line valve on the District's water main and the owner is responsible for all facilities beyond the valve.

B. The fire line Back-Flow-Prevention device (BFPD) with flow detection must be located within a maximum 300 feet of the District water main. The BFPD is to be located on the fire line riser at the piping entrance into the building or structure.

C. Fire lines shall be installed at the location shown on the District approved construction drawings, or as directed by the District.

D. All materials and testing shall, at a minimum, conform to District specifications or as directed by the jurisdiction having authority.

E. District representative must be on-site to witness BFPD testing on new fire lines.

3.7 Cross-Connection Control

A. Connections to District facilities shall conform to the latest edition of the District Cross-Connection Control Manual. Only those backflow prevention assemblies described in Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (FCCC&HR) most current "List of Approved Backflow Prevention Assemblies" and, in the case of single-family residences, those assemblies bearing the approval of the American Society of Sanitary Engineering (ASSE), are approved by the Backflow coordinator for use as hereinafter set forth in these Rules and Regulations.

B. Only such approved backflow prevention assemblies shall be used, and no substitutions will be allowed.

1. Reference: Colorado Department of Public Health and Environment / Water Quality Control Division.
2. Reference: Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (FCCC&HR).
3. Reference: American Society of Sanitary Engineering (ASSE).
4. Reference: District Cross-Connection Control Manual.

C. Reference Drawing W-32, Backflow Enclosure.

3.8 Protection of Metal Surfaces

A. If the supplied material has not been factory coated, or the coating has been damaged by installation, the material shall be protected by one of the following methods:

1. Two coats of coal tar epoxy paint shall be applied to ferrous metal rods, rebar, clamps, bolts, nuts, and other accessories which are subject to submergence or contact with earth or fill material and are not encased in concrete.
    a. The first coat of coal tar epoxy paint shall be applied to a dry, clean surface.

b. The first coat of coal tar epoxy paint shall be allowed to dry before the second coat is applied.

B. Ferrous metal rods, rebar, clamps, bolts, nuts, and other accessories which are subject to submergence or contact with earth or fill material, and not encased in concrete shall be protected with coal tar epoxy paint or a rubberized spray-on undercoating and wrapped by a minimum 8 mil polyethylene film.

END OF SECTION

Section 33 14 18 – Service Lines, Meters, and Appurtenances

Part 1 – General

1.1 Description

A. This section addresses the materials and installation of corporation stops, service lines, meters, meter setters and meter pits. All material shall be lead free with the manufacturer's identifying mark as lead free.

1.2 Product Delivery, Storage and Handling

A. The product shall be handled, stored, and protected in a manner which will prevent damage to materials, coatings and finishes.

B. All material shall be kept clean and free from dirt.

1.3 Installation of Service Taps

A. The Contractor shall not make any taps without prior permission from the District.

B. Reference the following typical drawings in Appendix D, and as modified on the approved Construction Drawings, for services of less than 3-inches in diameter:

1. Detail W-08, Typical Meter Pit Installation.
2. Detail W-09, Typical Double Meter Pit.
3. Detail W-10, Typical Setting for 1-1/2" & 2" Meters.

C. All taps shall be made with a tapping saddle in accordance with these specifications and the manufacturer's recommendations, unless otherwise approved by the District.

1. A static pressure test of 150 psi for ten (10) continuous minutes, with no visible leakage or pressure loss, shall be performed prior to the wet tap on all existing water mains.
2. Service taps on live mains will be made only under the direct supervision of the District. The Contractor shall coordinate with the District Representative.
3. The District reserves the right to make taps in lieu of the Contractor and the right to deny permission for any main to be tapped.

D. Tapping equipment shall be of good quality, used for the purpose intended and used in accordance with manufacturer's instructions.

1. Reference Section 01 60 00.

1.4 Maintenance and Correction

A. The Contractor shall maintain and repair all service lines, meter pits, and any associated appurtenances which leak, were installed incorrectly, or otherwise prove to be defective, for the duration of the warranty period established in Section 01 10 00, Subsection 1.7.G.

1.5 Meter Pits and Vaults

A. Meter pits, meter vaults, and concrete vaults/manholes are specified in Section 33 19 00 – Water Utility Metering Equipment, Subsection 1.5.

B. Meter pits or vaults are required for all service lines.

Part 2 – Products

2.1 Tapping Saddles

A. 3/4 inch, inclusive, through 2-inch, inclusive, tapping saddles shall be constructed of materials in accordance with one of the following descriptions:

1. Ductile Iron and Asbestos Cement pipe saddles shall have a brass body with double silicon bronze straps.
2. Poly Vinyl Chloride pipe saddles shall have a brass body with a stainless steel strap.
3. Thread-O-Lets may be used for weld-on tap saddles for steel pipe;

a. Nuts, bolts and accessories shall be in accordance with Manufacturer Specifications.

4. Thread-O-Let saddle outlet threads shall be IP thread with insulated couplings, all other outlet threads on tapping saddles shall be "cc" type only.

B. 3-inch and larger taps, reference Section 33 14 13, Subsection 2.8.C.

C. See Appendix C for approved materials.

2.2 Corporation Stops

A. All corporation stops shall conform to AWWA C800.

1. All corporation stops shall be constructed of brass and shall be a ball valve type.
2. Corporation stop inlet threads for tapping saddles shall be "cc" type only.
3. All corporation stop outlets shall use compression style connections, with a positive stop.
4. Corporation stops shall be used for all taps which are two (2) inches and smaller.

B. See Appendix C for approved materials.

2.3 Service Lines

A. Copper pipe shall be used for service lines up to two (2) inches.

B. All copper services shall conform to AWWA C800 and ASTM B88, Type K.

1. Type K Copper shall be used for copper services.

2.4 Couplings

A. All couplings shall use compression style connections, with a positive stop.

B. All couplings shall be constructed of brass.

C. See Appendix C for approved materials.

2.5 Meter Setters

A. Meter setters are specified in Section 33 19 00 – Water Utility Metering Equipment, Subsection 2.2.

Part 3 – Execution

3.1 General

A. The Contractor shall make all taps and install the service line to the permanent facilities prior to disinfection and pressure testing of the water main.

B. The Contractor shall adjust meter pits to the horizontal location and to the final grade as determined by the grade stake.

1. Reference Section 33 19 00, Subsection 3.3, for meter pit installation.
2. Grade stakes shall not be disturbed prior to inspection of the service by the District.

C. The Contractor shall mark the location of the water service with a scored "W", four (4) inches high, into the face of the curb and gutter, per Detail W-07, Sidewalk Marking, in Appendix D.

3.2 Service Line Taps

A. Tap location and spacing (taps 2-inches and smaller):

1. On water mains 12 inches and smaller, taps shall be a minimum of 24-inches from the back of the bell, the spigot insert line, and/or joint restraint hardware.
2. On water mains larger than 12-inches, taps shall be a minimum of 36-inches from the back of the bell, the spigot insert line, and/or joint restraint hardware.
3. Multiple taps shall be staggered a minimum of 18-inches apart lengthwise and offset 90° from each other; the minimum spacing along the same line is 36-inches.
4. The distance between a tap and a tapping sleeve shall be a minimum of five (5) feet.

B. Ductile Iron Pipe Taps

1. Corporation stops shall be installed by means of a tapping saddle unless otherwise indicated on the approved Construction Drawings or as directed by the District representative.

C. PVC Pipe Taps

1. Corporation stops shall be installed by means of a tapping saddle unless otherwise indicated on the approved Construction Drawings or as directed by the District representative.

3.3 Service Lines

A. All service lines shall be a minimum of five (5) feet, and a maximum of six (6) feet, below the final grade.

1. Service lines (3/4-in. through 2-in.) shall be uniform in size from the corporation stop to five (5) feet past the meter pit.

B. Couplings or fittings are not permitted between the corporation stop and the meter where the meter is located in an exterior meter pit or vault. For existing meters located within a building, no more than one coupling/splice (other than the curb stop valve) is permitted between the corporation stop and the meter (per the Standards).

C. When backfilling the service trench, sand shall be used at a minimum of four (4) inches under and six (6) inches above any given location of the service line.

1. Sand shall conform to ASTM C 33.
2. Reference Section 31 23 35, Subsection 2.2.B.1 for bedding zone gradation.

D. Service trenches shall be subject to compaction specifications.

1. Reference Section 31 23 35, Subsections 3.5 and 3.6.

3.4 Meter Pits and Vaults

A. Meter pit and vault installation, location restrictions, clearances, and cover grade requirements are specified in Section 33 19 00 – Water Utility Metering Equipment, Subsections 1.5 and 3.3.

3.5 Inspection

A. The Contractor shall insure that the corporation stop and any couplings remain exposed until after the inspection and the approval for backfill is given by the District.

B. All tap and service inspections shall be scheduled with the District.

1. A minimum of 48 hours notice is required on all tap and service inspections.

C. The water shall be turned on by the District, only after the service line and meter setting is approved.

3.6 Service Line Material Documentation

A. For every existing service line exposed during the Work, the Contractor shall record the pipe material, size, and location of both the District-side and customer-side portions, and shall submit this documentation to the District with the Record Documents (Standards Section 4.5), in support of the District's service line inventory under the federal Lead and Copper Rule Revisions and Improvements (40 CFR 141 Subpart L).

END OF SECTION

Section 33 14 19 – Fire Hydrants

Part 1 – General

1.1 Description

A. This section addresses dry-barrel fire hydrants and includes the acceptable products, materials, and construction practices which may be used in the construction and installation of fire hydrants.

1.2 Product Delivery, Storage and Handling

A. Fire hydrants shall be handled, stored, and protected in such a manner as to prevent damage to materials, coatings, and finishes.

B. All fittings and joints shall be kept free from dirt, oil, and grease.

Part 2 – Products

2.1 General

A. All fire hydrants shall be manufactured in accordance with AWWA C502.

B. The auxiliary gate valve on the hydrant lateral shall be a six (6) inch resilient seat gate valve with a valve box.

1. If the operating nut on the auxiliary gate valve is more than six (6) feet below finish grade, a riser stem shall be used.
2. Reference Section 33 14 13.

C. The hydrant tee on the main line shall be a swivel tee.

1. Tapping sleeves and valves are acceptable when connecting to an existing water main.
2. Reference Section 33 14 13.

D. See Appendix C for approved materials.

2.2 Materials and Construction

A. All fire hydrants shall be a dry-barrel type with a break-away traffic flange, designed for a working pressure of 250 psi.

B. All fire hydrants shall have a minimum main valve opening size of 5-1/4 inches.

C. Shoe inlets shall be six (6) inches, with mechanical joint fittings.

D. Fire hydrant laterals shall be buried a minimum of five (5) feet, unless specifically directed by the District.

1. The maximum bury depth for fire hydrant laterals is six (6) feet, unless specifically approved by the District.

E. The fire hydrant pumper nozzle shall be 4-1/2 inches in diameter with four (4) threads per inch.

1. Pumper nozzle threads shall be right-handed and National Standard Thread.

F. The fire hydrant hose nozzles shall be 2-1/2-inch diameter with 7-1/2 threads per inch.

1. Hose nozzle threads shall be right-handed.

G. Operating Style

1. Reference specific fire protection authority as required:
    a. Poudre Fire Authority (PFA)
    b. Loveland Fire Rescue Authority (LFRA)
    c. Windsor Severance Fire Rescue

H. All fire hydrants shall be factory coated to the specific color, and shall have the opening direction, required by the local Fire Protection Agency. The Design Engineer is responsible for confirming the required opening direction with the governing Fire Protection Authority.

2.3 Hydrant Gravel

A. Hydrant gravel shall be a well graded crushed stone or gravel, conforming to ASTM D448, CDOT #67, or 3/4" Rock as listed below:

1. CDOT #67

SIZE	PERCENT PASSING
1”	100
3/4”	90 – 100
3/8”	20 – 55
#4	0 – 10
#8	0 – 5

2. 3/4" Rock

SIZE	PERCENT PASSING
1”	95 – 100
1/2”	25 – 65
#4	0 – 10
#8	0 – 5

Part 3 – Execution

3.1 Installation

A. All fire hydrants shall be installed in accordance with Detail W-29, Typical Fire Hydrant Detail in Appendix D, and as modified on the approved Construction Drawings.

B. The Developer's Engineer shall provide offset staking for both vertical and horizontal control.

C. The joining of laterals, valves, and hydrants shall be handled in the same manner as pipe.

1. The fire hydrant shall be installed vertically plumb with the pumper nozzle facing the direction shown on plans.
2. The fire hydrant shall be set to the elevation staked, to ensure that the bury line is at the final grade.

D. All fire hydrants shall be supported on a minimum of eighteen (18) inches of compacted hydrant gravel.

E. The fire hydrant shall be supported with a concrete block.

F. Fire hydrants shall be mechanically restrained.

G. Hydrant gravel shall be placed to a depth of twelve (12) inches above the hydrant shoe.

1. Hydrant drain holes shall remain free of obstructions.

H. Fire hydrants shall not be placed in concrete sidewalks or pavement.

I. There shall not be a post, fence, vehicle, growth, trash, storage, or other material or thing, within a five (5) foot radius of the fire hydrant assembly. This is an operational clear zone; permanent surface obstructions, trees, and shrubs (at maturity) are further restricted by the 10-foot permanent-obstruction zone in the Standards (Design Criteria – Fire Hydrants).

1. The ground surrounding the fire hydrant shall slope away from the hydrant at a minimum grade of 2%, toward the street.

J. After installation of the fire hydrant is complete, the oil/grease reservoir shall be checked to ensure that it is full.

1. If it is necessary to fill the reservoir, it shall be filled with the oil/grease which is specified by the hydrant manufacturer.

K. If a hydrant is raised, no more than one (1) extension section can be used, unless approved by the District.

1. Each fire hydrant extension installed shall be inspected, by the District, prior to re-installation of the fire hydrant body assembly.

3.2 Operation

A. Fire hydrants which have been accepted by the District shall be operated by District personnel only, unless otherwise authorized by a District representative.

END OF SECTION

Section 33 14 20 – Valves

Part 1 – General

1.1 Description

A. This section addresses valves, valve operators, valve boxes, and valve appurtenances used for water distribution lines.

1.2 Product Delivery, Storage, and Handling

A. Precautions shall be taken to prevent damage to materials during delivery and storage.

B. Valves shall be stored off of the ground and away from materials that could contaminate potable water systems.

C. Precautions shall be taken to keep all joints and internal parts clean.

Part 2 – Products

2.1 General

A. All valves shall open counter-clockwise (left). Fire hydrant opening direction is governed by the local Fire Protection Authority (reference Section 33 14 19).

1. All nuts and bolts shall be stainless steel.

B. All buried valves shall have a two (2) inch square operating nut.

1. All operating nuts shall be painted black.

C. The operating nut on all valves shall be between four (4) and six (6) feet below finish grade.

1. If, in order to achieve the operating nut depth noted above, it is necessary to use a riser stem, the riser stem shall not be pinned and shall use one centering plate per riser.

D. Any valve which will be placed in a vault shall have a valve operator which is specifically approved by the District for vault service, furnished with a handwheel or accessible operating-nut extension and a sealed, permanently-lubricated gear case suitable for a below-grade, potentially wet vault.

2.2 Gate Valves

A. All gate valves shall be a resilient seat type and manufactured in accordance with AWWA C509 or AWWA C515.

1. All gate valves shall have a fusion bonded epoxy coated interior and exterior, in accordance with AWWA C550.
2. All gate valves shall have a ductile iron body and 316 SST bolts.
3. Approved manufacturers of gate valves are listed in Appendix C.

B. All gate valves shall be provided with two O-ring type stem seals, in accordance with AWWA C509 or C515.

C. All gate valves shall be provided with mechanical joint connections unless otherwise specified.

2.3 Tapping Valves

A. All tapping valves shall be resilient seat type and manufactured in accordance with AWWA C509.

B. All tapping valves shall be provided with two O-ring type stem seals in accordance with AWWA C509.

C. All tapping valves shall be equipped with an alignment ring on the flanged side of the valve.

2.4 Butterfly Valves

A. Butterfly valves shall be used when the pipe is larger than twelve (12) inches in diameter.

B. All butterfly valves shall conform to AWWA C504.

1. All butterfly valves shall have an epoxy coated interior and exterior.
2. All flanged butterfly valves shall be the short body type.
3. All butterfly valves shall be Class 150B.
4. The operator torque shall be as specified in Appendix A, of AWWA C504.
5. All butterfly valves shall be provided with mechanical joint connections unless otherwise specified.
6. The operator nut shall be located north and/or west of the water line.
7. Approved manufacturers of butterfly valves are listed in Appendix C.

2.5 Valve Boxes

A. Main Line Valves

1. Valve boxes shall be cast iron, two-piece, threaded (screw-type), with a 5-1/4 inch shaft and the word "WATER" cast into the lid.
2. Valve boxes shall be heavy-duty cast iron with a total weight of no less than 110 lbs.
3. All valve box sections and parts shall be uniform to one manufacturer per box installed.
4. Non-threaded paving rings are not accepted by the District.
5. Approved models and manufacturers of valve boxes are listed in Appendix C.

2.6 Air Relief/Vacuum Relief Valves

A. Reference Detail W-19 and Details W-20 through W-27 in Appendix D, as applicable. All air relief and vacuum relief valves shall conform to AWWA C512.

B. Materials and Construction.

1. Air relief and vacuum relief valves shall have an integral type assembly which will function both as an air release and vacuum valve.
2. All air relief and vacuum relief valves shall be rated at a working pressure of 150 psi and a minimum hydrostatic test pressure of 250 psi.
3. The size of air relief and vacuum relief valves shall be as noted on the Construction Drawings (CCP).
4. Taps for air relief valves and vacuum relief valves shall be made as indicated on the Construction Drawing (CCP), unless otherwise directed by the District.
5. All piping shall be brass.
6. Connections:
    a. The inlet connection for air relief and vacuum relief valves shall be the diameter as identified on the approved construction drawings conforming to AWWA C800.
    b. Connections on the outlet side of air relief and vacuum relief valves shall be threaded and shall be protected to minimize entry of debris and dirt into the valve.
    c. Vent and drain piping shall be down-turned and insect-screened, terminating above grade and above the 100-year flood elevation. Air valve vaults and blow-off chambers shall not be connected directly to any storm or sanitary sewer; chamber drainage shall be to grade or to an absorption pit located above the seasonal groundwater table (CDPHE Design Criteria §8.6).
7. The working parts and seats of air relief and vacuum relief valves shall be brass, stainless steel, or other non-corroding material.

8. The float of air relief and vacuum relief valves shall be non-corroding material.

C. Manufacturers

1. Acceptable air release and vacuum relief valves, and their manufacturers are listed in Appendix C.

2.7 Check Valves

A. Check Valves will be evaluated on a case-by-case basis.

Part 3 – Execution

3.1 Installation

A. Valves and valve boxes shall be examined for cracks, dents, abrasions, and other flaws prior to installation.

1. Defective valves and valve boxes shall be marked and removed from the site.

B. Valves

1. See Sheet W-04 "TYPICAL GATE VALVE" and Sheet W-05 "TYPICAL BURIED BUTTERFLY VALVE" in Appendix D.
2. Valves shall be located within 18 inches of tees and crosses.
3. With the exception of tapping valves, flanged valves shall not be buried.
4. The valve shall be installed in such a manner that the operating nut is perpendicular to the ground surface.
5. The joined valve shall be supported in place on compacted granular material.
    a. Reference Section 31 23 35.

C. Tapping Valves

1. Tapping valves shall be installed in accordance with the manufacturer's recommendations.
2. Tapping valves and sleeves are to be pressure tested to 150 psi, for 10 minutes (reference Section 33 05 06, Subsection 3.3), with no visible leakage or loss of pressure, prior to proceeding with the wet tap.

D. Valve Boxes

1. Valve boxes shall be installed on all buried valves.
2. Valve boxes shall be installed so that no stress is transmitted to the valve.
3. Valve operators which are mounted to one side of the valve shall be located to the North or West of the valve.
4. Valve boxes which are to be set over the valve shall be centered, plumb and directly over the operating nut and valve with the top of the box on grade.
    a. The soil around the valve box shall be carefully compacted around the barrel, to minimize misalignment and the settling of the backfill.
    b. Other valve box types shall be adjusted as required on the Construction Drawings.
5. Valve boxes shall be wrapped in plastic.
6. Valves within open field areas, or areas to be developed in the future, shall have the valve box lid depressed six (6) inches below finished grade and covered with plastic, or be at grade with a two (2) foot diameter by four (4) inch thick concrete pad around the valve box. The location shall be marked with a flexible composite (Carsonite or approved equal) marker post with a reflective label reading "FCLWD WATER MAIN (OFFSET FT)."

3.2 Air Relief/Vacuum Relief Valves

A. Air relief and vacuum relief valves shall be installed at high points, and as shown on the Construction Drawings (CCP).

B. Air relief and vacuum relief valves shall be installed in accordance with Detail W-19 and Details W-20 through W-27 in Appendix D, as applicable, and as modified on the approved Construction Drawings (CCP).

C. Where vents are required in residential areas see Detail W-28, Typical Vent, in Appendix D.

3.3 Pressure Regulating Valves

A. Pressure regulating valves shall be evaluated on a case-by-case basis.

3.4 Operation

A. Valves which have been accepted by the District shall be operated by District personnel only, unless otherwise authorized by District representative.

END OF SECTION

Section 33 19 00 – Water Utility Metering Equipment

Part 1 – General

1.1 Description

A. This section addresses the materials and installation of water meters, meter setters, and meter pit and vault structures. Corporation stops, curb stops, service lines, and service tapping are specified in Section 33 14 18 – Service Lines, Meters, and Appurtenances.

1.2 Product Delivery, Storage and Handling

A. The product shall be handled, stored, and protected in a manner which will prevent damage to materials, coatings, and finishes.

B. All material shall be kept clean and free from dirt.

1.3 Installation of Service Taps and Service Lines

A. Service tapping, corporation stops, service line materials, and service line installation shall conform to Section 33 14 18 – Service Lines, Meters, and Appurtenances.

1.4 Maintenance and Correction

A. The Contractor shall maintain and repair all meter pits, meter vaults, and any associated appurtenances which leak, were installed incorrectly, or otherwise prove to be defective, for a period of two (2) years after Final Acceptance of the work.

1.5 Meter Pits and Vaults

A. 3/4-inch and 1-inch meter pits shall be installed by the contractor unless otherwise directed by the District.

1. Meter pits shall be twenty-four (24) inches in diameter for 3/4-inch meters and for 1-inch meters, a minimum of forty-eight (48) inches in length, and shall be constructed of rigid polyethylene, or an approved equal.
    a. See Appendix C for approved materials; or approved equal.
2. Meter pit cover bodies shall be constructed of aluminum, with a cast iron outer lid that shall have a 2" centered hole cut out, and an inner 2" plastic drop lid.
    a. The minimum allowable opening for meter pit covers shall be eleven (11) inches diameter.
    b. All meter pit covers shall have a 27/32" worm-lock operator with a Standard Waterworks pentagon head.

B. 1-1/2-inch and 2-inch meter vaults shall be installed by the contractor unless otherwise directed by the District.

1. Meter vaults shall be constructed from standard forty-eight (48) inch inside diameter precast concrete manhole sections.
    a. Reference Section 03 40 00 – Precast Concrete.
2. Meter vault covers shall be aluminum with a recessed 2-inch hole and a recessed 2-inch hole and a twenty-four (24) inch diameter opening, unless approved by the District.
    a. All meter vault covers shall have the word "WATER" cast in the lid.
    b. Ring section of the cover shall be sealed to the top section of the vault.

C. 3-inch and larger meter vaults shall be installed by the contractor unless otherwise directed by the District.

1. Meter vaults shall be constructed from precast concrete box sections designed for AASHTO HL-93 loading and water tight. Water tight seals shall be installed at all pipe penetrations.
    a. Minimum vault dimensions:

METER SIZE	INSIDE DIMENSION (WxLxH)
3”	7’ x 9’-6” x 7’
4”	7’ x 11’ x 7’
6”	8’ x 13’ x 7’
Larger	Determined by District

2. Meter vault covers shall be aluminum with a twenty-four (24) inch diameter opening, unless approved by the District.
    a. All meter vault covers shall have the word "WATER" cast in the lid.
3. Water tight vaults shall be provided unless otherwise indicated.

D. All meter pits and vaults shall have frost protection installed under the lid.

1.6 Meters

A. Meters ¾-inch to 2-inch shall be supplied by the District and set after the tap has been purchased.

B. Meters larger than 2-inch shall be supplied by the Developer and installed with the construction of the meter vault and piping. After installation the service will be valved off and locked by the Inspector until the tap is purchased.

Part 2 – Products

2.1 Tapping Saddles, Corporation Stops, Service Lines, and Couplings

A. These materials are specified in Section 33 14 18 – Service Lines, Meters, and Appurtenances.

2.2 Meter Setters

A. All 3/4-inch and one (1) inch meter setters shall have an angle ball valve with a padlock wing located on the inlet side, vertical inlet and outlet connections, a dual check valve assembly on the outlet, and positive stop compression style lower connections in accordance with the manufacturer's accessory options.
    1. 3/4-inch setter height: 7 inches.
    2. 1-inch setter height: 10 inches.
    3. See Appendix C for approved materials.

B. All 1-1/2-inch and two (2) inch meter setters shall have an angle ball valve with a padlock wing, a dual check valve assembly on the outlet, and a built-in locking bypass. Outlet connections shall be horizontal with positive stop compression connections.
    1. See Appendix C for approved materials.

C. Meter setter face-to-face (flange-to-flange) distances:

METER SIZE	INSIDE DIMENSION
3/4”	7-1/2”
1”	10-3/4”
1-1/2”	13”
2”	17”

2.3 Meters

A. Water meters shall conform to the applicable AWWA C700-series standard (including AWWA C715 for electromagnetic and ultrasonic meters) and shall be certified lead-free to NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372.
    1. See Appendix C for approved meters and AMI endpoints.

Part 3 – Execution

3.1 General

A. The Contractor shall adjust meter pits to the horizontal location and to the final grade as determined by the grade stake.
    1. Grade stakes shall not be disturbed prior to inspection of the service by the District.

B. The Contractor shall mark the location of the water service with a scored "W", four (4) inches high, into the face of the curb and gutter, per Detail W-07, Sidewalk Marking, in Appendix D.

3.2 Service Taps and Service Lines

A. Service tap installation, service line installation, and inspection shall conform to Section 33 14 18 – Service Lines, Meters, and Appurtenances.

3.3 Meter Pits and Vaults

A. Exterior meter settings shall be installed according to the manufacturer's recommendations, and in accordance with Details W-08 through Detail W-10 in Appendix D.

B. Meter pits and vaults shall not be installed in any street, alley, parking area, driveway, or sidewalk, unless otherwise authorized by the District.

C. There will be no trees, boulders, or structures (retaining walls, etc.) within a ten (10) foot radius, and no shrubs or bushes (at maturity) within four (4) feet, of the meter pit or vault.

D. The ground surrounding meter pits and vaults shall slope away from the lid at a minimum grade of two (2) percent, toward the street.

E. There will be no plumbing connections inside the meter pit or vault.

F. All tees, connections, and couplings shall be a minimum of five (5) feet from the meter box, pit, or vault wall on the downstream side.

G. Meter pit and vault covers shall be adjusted to one half (1/2) inch above final grade.

H. Concrete meter vaults.
    1. Reference Section 33 14 13, Subsection 2.9 and Section 03 40 00, Subsection 2.1.

END OF SECTION

Fort Collins-Loveland Water District • 970-226-3104

APPENDIX C – APPROVED MATERIALS LIST

Pipe Fittings and Valves

Pipe Fitting (MJ)

Sigma Corporation	C153 / C110
SIP Industries (add)	C153 / C110
Star Pipe Products	C153 / C110
Tyler Union	C153 / C110

Foster type adapters

INFACT Corp	Foster Adaptor

Pipe Joint Restraints (Push-On)

EBBA Iron Incorporated	1900 Series
Romac Industries Incorporated	611 Series
Star Pipe Products	1100 Series

Pipe Joint Restraints (Mechanical)

EBBA Iron Incorporated	Megalug 2000PV / 1100
Ford Meter Box Co	Uni-Flange (Series 1500)
Sigma	One-Lok
Star Pipe Products	Stargrip
US Pipe	Field Lok (DIP Only)

Tapping Sleeves (DI or AC Pipe)

Ford Meter Box Co	FTSS
Mueller	Hymax H-304 MJ
Romac Industries, Inc.	SST III

Tapping Sleeves (PVC Pipe)

Ford Meter Box Co	FTSS
Mueller	Hymax H-304 MJ
Romac Industries, Inc.	SST III

Tapping Sleeves (Steel Pipe)

Ford Meter Box Co	FWS
Romac Industries, Inc.	FTS445

Tapping Gate Valves

American AVK	Series 45
American Cast Iron Pipe Company	Series 2500
Clow Valve Company	C515
M & H Valve Company	C515
Mueller Company	T2361

Gate Valves

American AVK	Series 45 & Series 55
American Flow Control	Series 2500
M & H Valve Company	C515
Mueller	2361

Butterfly Valves

American AVK	Series 816
Clow Valve Co.	Style 4500 / 1450
DeZurik	BAW
Mueller	Lineseal XPII
Pratt	HP250II

Combination Air/Vacuum Release Valves

ARI Flow Control	D-040 or D-46
DeZurik	APCO High Performance Combination Air Valve (ASU)
VENT-O-MAT	RBX Air Release Valve

Flow Control Valves

Cla-Val	90-01 Series

Valve Stem Extension

ProSelect	Stem Extension W/ Center Plate

Valve Boxes

Castings Inc.	6850
EJIW	8550
Star Pipe Products	5.25" Shaft
Tyler Union	6850

Pipe Materials

Polyvinyl Chloride Pipe (PVC)

Diamond Plastics	C900 & C905 Trans-21
J-M Eagle	Blue Brute C900
VinylTech	C900 Blue
Westlake Pipe and Fittings	AquaSpring C900

Integral Restraint Joint Polyvinyl Chloride (PVC) Pipe

Diamond Plastics	Lok-21
IPEX, Inc.	TerraBrute C900
J-M Eagle	Eagle Loc 900RL
Westlake Pipe and Fittings	AquaSpring Certa-Lok C900/RJIB

Repair Coatings

Raven Lining Systems (PPG)	AquataPoxy A-6
Sherwin-Williams	Sherplate 600

Hydrants and Blow-offs

Loveland Fire Rescue Authority

American AVK Co.	Series 2700 or Series 2780
American Flow Control	Waterous Pacer
Mueller Co	Super Centurion 250
1. LFRA Hydrants shall be Orange - Federal Standard 595 Color #12473.	
2. LFRA Hydrants shall open clockwise (right).	

Poudre Fire Authority

American AVK Co.	Series 2700 or Series 2780
American Flow Control	Waterous Pacer
Mueller Co	Super Centurion 250
1. PFA Hydrants shall be Safety Yellow -Federal Standard 595 Color #13591	
2. PFA hydrants shall open clockwise (right) with a 7/8-inch tapered square operating nut	

Windsor Severance Fire Rescue

American AVK Co.	
American Flow Control	Waterous Pacer
Mueller Co	Super Centurion 250
1. WSFR Hydrants shall be Safety Red - Federal Standard 959 Color #11120	
2. WSFR Hydrants shall opening counterclockwise (left) with a 1-5/16 inch pentagon operating nut	

2-inch Blow-off Hydrant

The Kupferle Foundry Company	Eclipse No. 85 Box Hydrant

Service Line Pipe/Fittings/Meter Pits

DI & AC Pipe	
A.Y. McDonald	3825
Ford Meter Box Co.	Style 202B
Mueller Co.	Series BR@B
Note: All service line saddles shall have stainless steel straps	

PVC Pipe	
A.Y. McDonald	
Ford Meter Box Co.	202BS
Mueller Co.	Series BR2S
Note: All service line saddles shall have stainless steel straps	

Steel Pipe	
Bonney Forge	

Service Lines	
3/4" – 2"	Type K Copper - AWWA C800
3" and larger	PVC or DIP
Size	Materials

Curb Stop	
A.Y. McDonald	76104Q
Ford Meter Box Co.	B44-xxxM-Q-NL
Mueller Co.	Mark II Oriseal H15155N
Note: ball valve, QCTS compression only, located in the meter pit	

Corporation Stop	
A.Y. McDonald	74701BQ
Ford Meter Box Co.	B1000-Q
Mueller Co.	H15008N
Note: ball valve, QCTS compression only	

Service Line Coupler	
A.Y. McDonald	
Ford Meter Box Co.	C44-xx-Q-NL
Mueller Co.	H15403N
Note: QCTS compression only	

Meter Setters (3/4")	
3/4"	
A.Y. McDonald	731-2--WDQQ33 NL
Ford Meter Box Co.	VBHC82W-44-33-Q-NL
Mueller Co.	B-2474-2AN

Meter Setters (Double Meter Pit)	
A.Y. McDonald	721D2--JDQQ43X992X480
Double Meter Pit	

Ford Accessories	
Ford Meter Box Angle Bell Valve	
Ford Meter Box Dual Angle Check Valve	HHAA34-323-G
Ford Meter Box Idlers	Idler #2
Ford Meter Box U Branch	U48-43-7.5-G
1. QCTS compression x QCTS compression, with padlock wing and check valve	
2. 3/4" lay length = 7.5", 1" lay length = 10.75", 1.5" lay length = 13.25", and 2 "lay length = 17.25"	

Meter Setters (1 1/2" to 2")

1 1/2" to 2"	
A.Y. McDonald	
Ford Meter Box Co.	
Mueller Co.	

Meters (1.5" to 6")

Sensus (by Xylem)	Cordonel

Meter Pits (3/4" & 1")

Sigma	RMP2448-W

Meter Pits (Double Meter Pit)

Sigma	RMP2448-W

Meter Pit Bonnet

Castings Inc.	CI7016
Castings Inc.	M70A24 (Meter Pit Adaptor)

Meter Vaults

Meter Vault (1 1/2" Service and Larger)

See Details

Manhole Ring & Covers (Standard)

Castings Inc.	
D&L Foundry & Supply	A-1019
Neenah	R-1706

Manhole Ring & Covers (Watertight)

Castings Inc.	MH-310-24 Bolt Down CI, MH-400-24 CI
D&L Foundry & Supply	E-1161
Neenah	R-6464-F
WATER shall be cast into all covers and shall be predrilled for touch read and plugged by the manufacturer.	

Manhole Adjusting Rings

Ladtech Inc. or an approved equal

Manhole Steps

Neenah

Grout

Dayton Superior	1107 Advantage Grout
Euclid Chemical	NS Grout
Master Builders	Master Flow 100 (or better)
Quikcrete	Non-Shrink General Grout
Sika	Sika Emaco 1060
Sika	Sika Grout 212

Pipe Penetration Seals

Garlock (GPT)	Link-Seal

Tracer Wire and Appurtenances

Disinfection	
ClorMor	Cal-Shock
DryTec	Granular Calcium Hypochlorite
HTH	Calcium HypoChlorite Granular

Tracer Wire	
Copperhead	High Strength 1245
Trident	Pro-Trace HS-CCS PE45

Test Stations (Tracer Wire)	
CP Test Services	NM-4

Test Stations (Cathodic Protection)	
Brooks Products	1-RT (Body) & 1-RT-CI (Cover)

Ground Rod	
Copperhead Industries	ANO-12

Foam Insulation	
Dupont	Highload 100 XPS
Owens Corning	Formular NGX 1000
Soprema	Sopra XPS 100

Casing Pipe

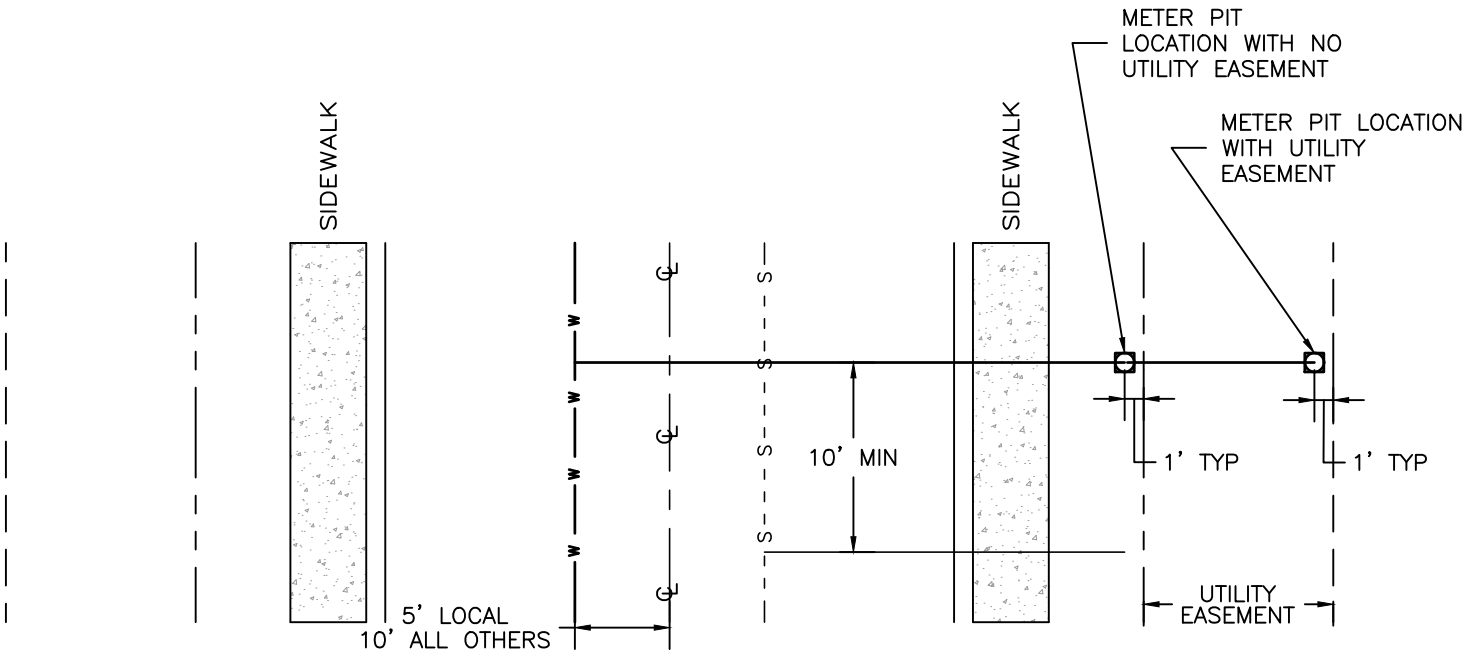
Casing Pipe Material
Casing size and wall thickness to be designed and specified by the Design Engineer and called out on the construction plans

Casing Seals	
Advance Products & Systems, Inc	Innerlynx Model S-316
Advance Products & Systems, Inc	Model AC
Canusa	Seal Kit CSK
Cascade Waterworks Mfg	CCES
CCI	ESC, ESW
Garlock (GPT)	Model Link-Seal
PowerSeal Pipeline Products Corp	End Seal

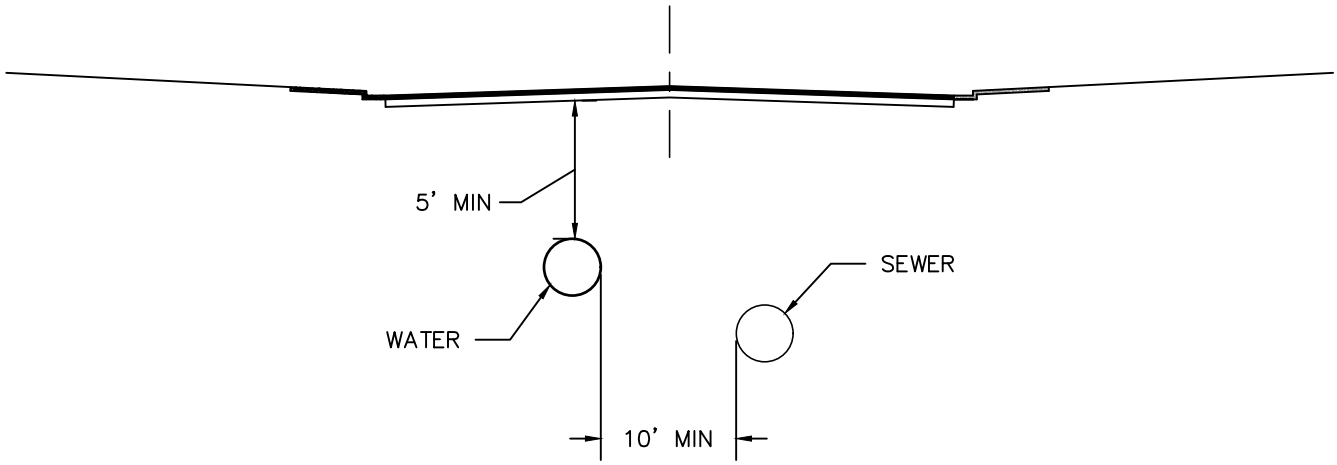
Casing Spacers (Standard)	
Cascade Waterworks Manufacturing	Model CCS
PowerSeal Pipeline Products Corp	4810

Casing Spacers (Restrained)	
Cascade Waterworks Manufacturing	Model CCS-JR

APPENDIX D – TYPICAL DRAWINGS



PLAN



SECTION

TYPICAL UTILITY SERVICE LOCATION

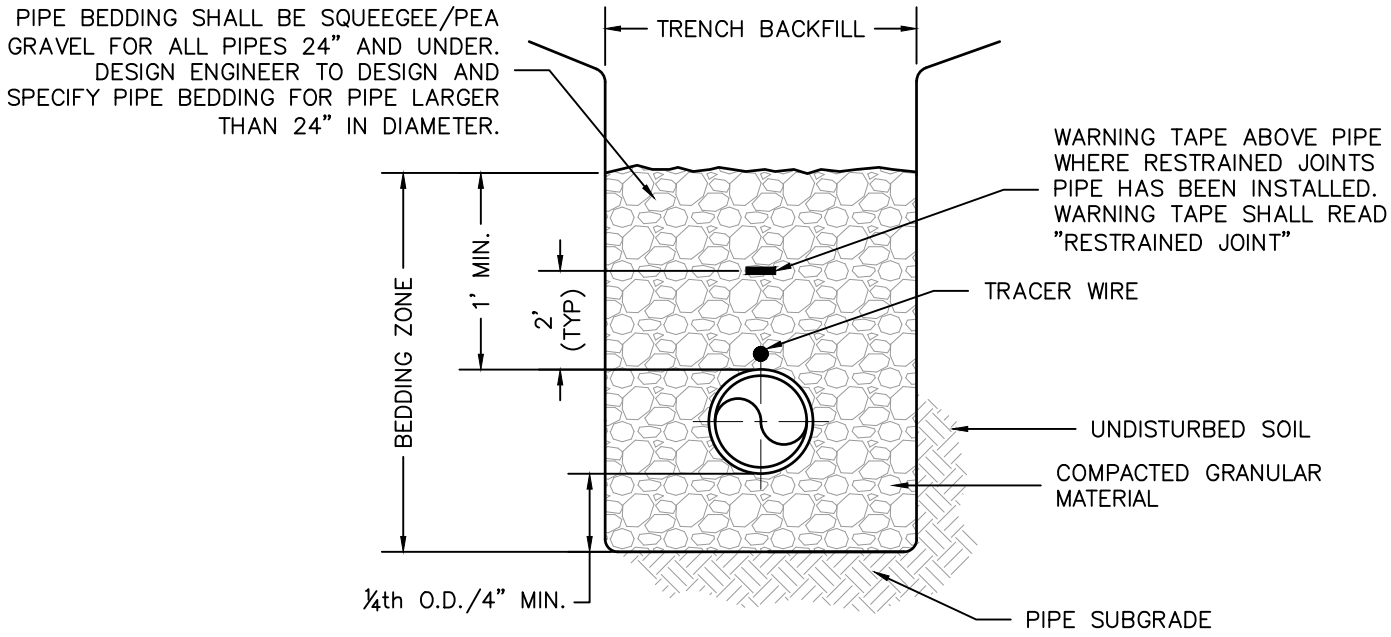
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

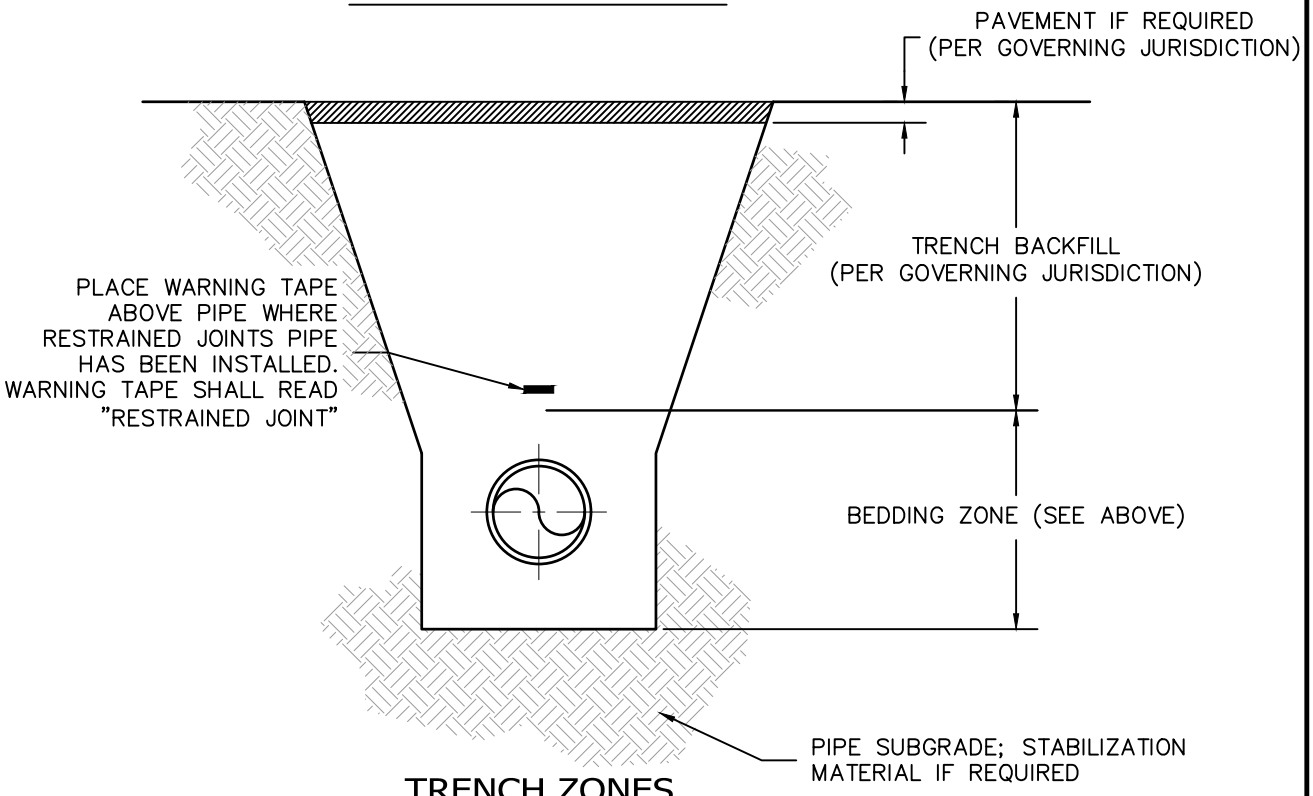
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DATE REVISED:	2026
	1ST EDITION

DRAWING

W-01



PIPE BEDDING ZONES



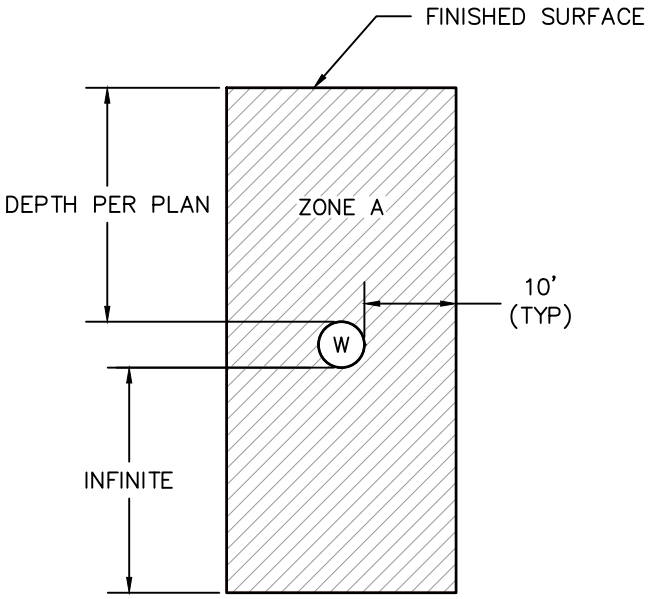
TRENCH ZONES

TYPICAL TRENCH BEDDING

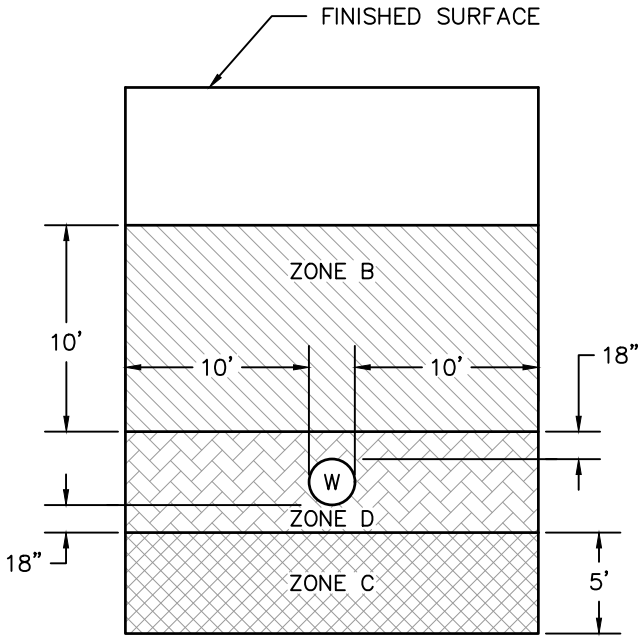
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE	**DRAWING**
DATE APPROVED: 06/2026	**W-02**
DATE REVISED: 2026	
1ST EDITION	



PARALLEL



CROSSING

ZONE A	ZONE A:	WASTEWATER AND STORMWATER MAINS SHALL NOT BE PERMITTED IN THIS ZONE. DRY UTILITIES MAY BE PERMITTED NOT CLOSER THAN 6' HORIZONTALLY.
ZONE B	ZONE B:	WASTEWATER AND STORMWATER PIPE JOINTS SHALL BE FULLY WRAPPED OR FULLY ENCASED PER DETAIL W-31. DRY UTILITIES MAY BE PERMITTED IN THIS ZONE, WITH APPROVAL FROM THIS DISTRICT.
ZONE C	ZONE C:	WASTEWATER AND STORMWATER PIPE JOINTS SHALL BE PRESSURE RATED WATERTIGHT TYPE ONLY. JOINT ENCASEMENT OR WRAP MAY BE REQUIRED, ON A CASE BY CASE BASIS.
ZONE D	ZONE D:	TYPICALLY PROHIBITED OR BY SPECIAL APPROVAL ONLY. MAY REQUIRE FULL CONCRETE ENCASEMENT OR STEEL CASING PIPE.

NOTES:

1. (W) INDICATES PRESSURIZED POTABLE WATER MAIN. DIMENSIONS ARE FROM OUTSIDE EDGE OF WATER MAIN TO OUTSIDE EDGE OF WASTEWATER, STORMWATER MAIN.
2. PRESSURIZED WASTEWATER OR STORMWATER MAINS / SYSTEMS CROSSING A WATER MAIN SHALL BE APPROVED ON A CASE BY CASE BASIS.
3. WHEN A WASTEWATER OR STORMWATER MAIN CROSSES OVER A WATER MAIN, THE PIPE SEGMENT SHALL BE CENTERED OVER THE WATER MAIN.

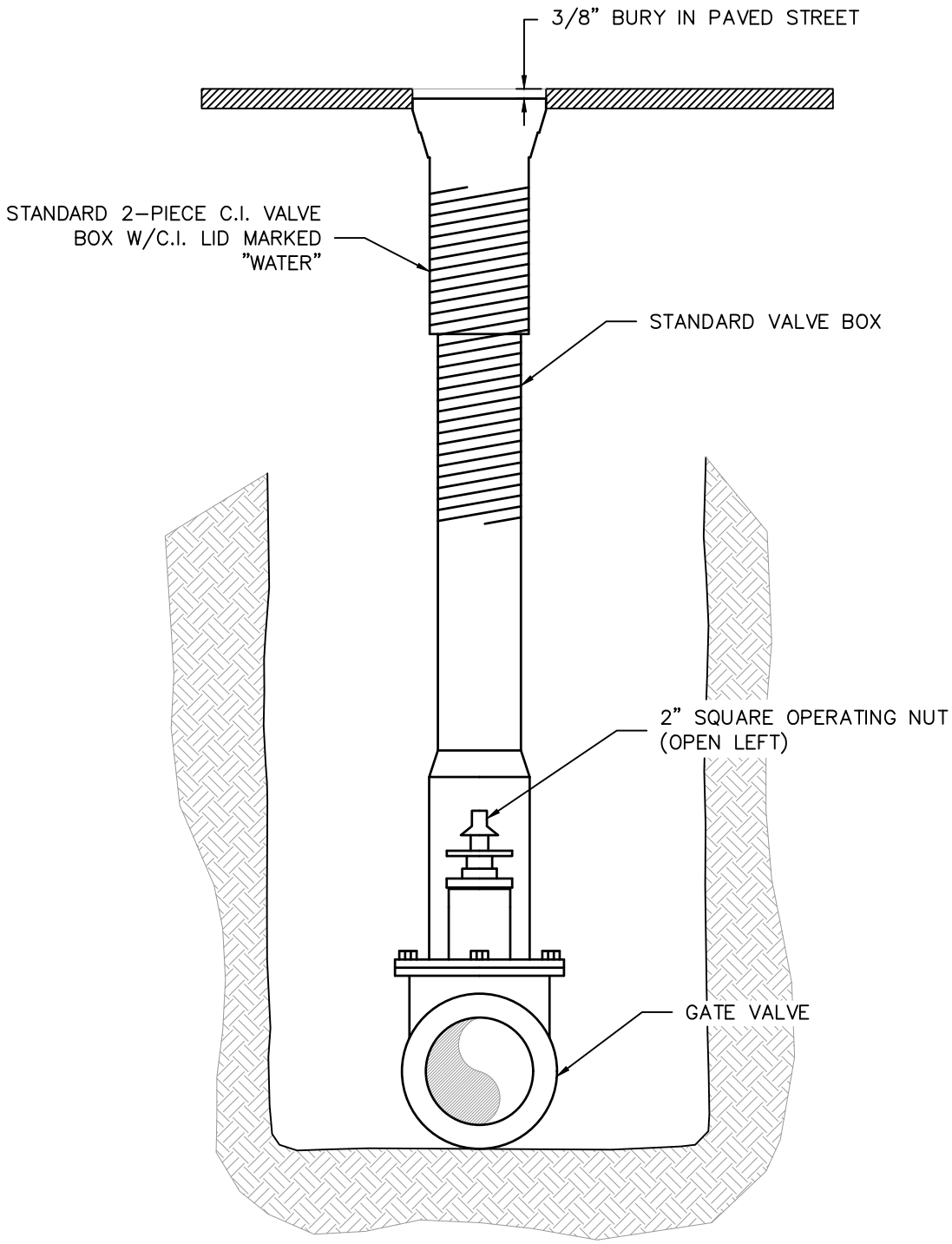
NOTE: NOT TO SCALE

WATER MAIN PROTECTION ZONES

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE	**DRAWING**
DATE APPROVED: 06/2026	**W-03**
DATE REVISED: 2026	
1ST EDITION	



NOTES:

1. ALL VALVES SHALL BE ENCASED IN A MINIMUM 8 MIL. POLYETHYLENE WRAP. A 2" WIDE, 10 MIL THICK POLYETHYLENE PRESSURE–SENSITIVE TAPE SHALL BE USED TO CLOSE SEAMS, SECURE TO PIPE OR HOLD OVERLAPS.
2. ALL VALVE BOXES SHALL BE OF CAST IRON CONSTRUCTION, TWO PIECE THREADED ADJUSTABLE DESIGN PER DISTRICT STANDARDS. ALL–THREAD RODS AND NUTS SHALL BE 316 STAINLESS STEEL.
3. VALVE OPERATOR EXTENSIONS SHALL BE ADDED TO ANY VALVES THAT ARE OVER 6 FEET DEEP. THE OPERATOR SHALL BE EXTENDED IN ACCORDANCE WITH SECTION 33 19 00 2.2 C.

TYPICAL GATE VALVE

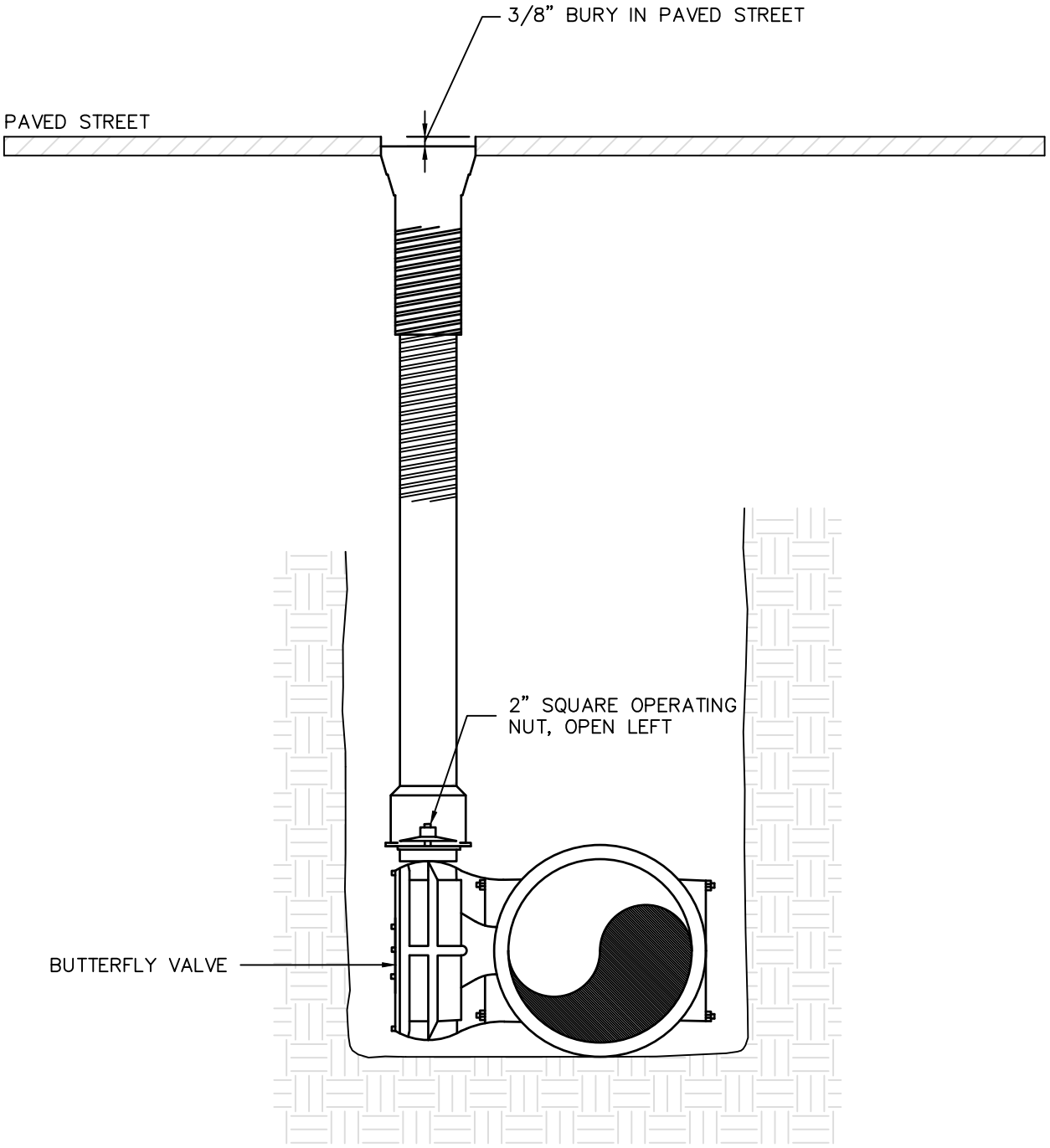
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
DATE APPROVED:	06/2026
DATE REVISED:	2026
	1ST EDITION

DRAWING

W-04



NOTES:

1. VALVE BOX SHALL BE CENTERED AND PLUMB OVER THE OPERATIONAL NUT.
2. VALVE BOX TO BE PLACED NORTH OR WEST OF THE MAINS WHEN POSSIBLE.
3. GEARING OF THE VALVE SHALL BE SUCH THAT THE NUMBER OF TURNS TO OPEN THE VALVE ARE EQUAL TO THE VALVE SIZE MULTIPLIED BY 3.
4. VALVE OPERATOR EXTENSIONS SHALL BE ADDED TO ANY VALVES THAT ARE OVER 6 FEET DEEP. THE OPERATOR SHALL BE EXTENDED TO WITHIN 3 FEET OF THE SURFACE.

TYPICAL BURIED BUTTERFLY VALVE

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

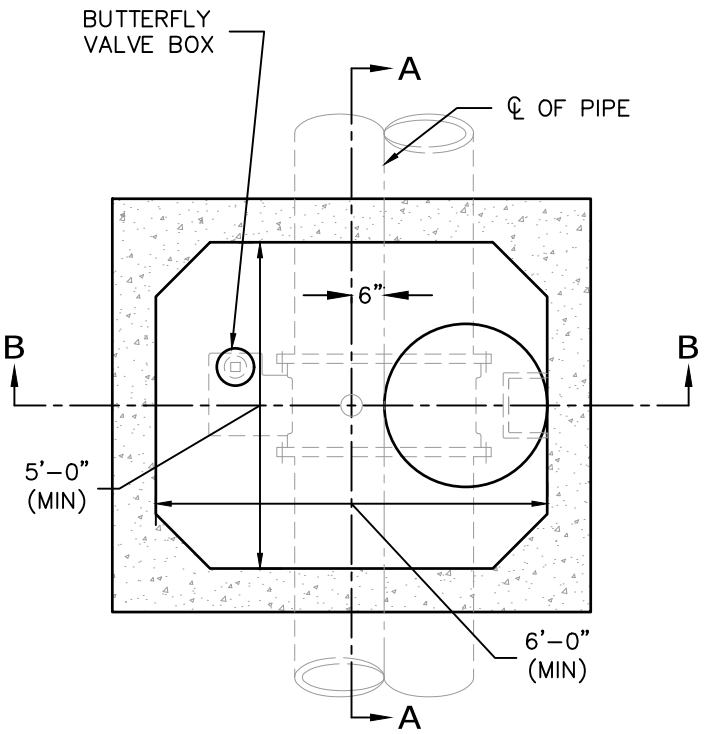
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DATE APPROVED:	06/2026
DATE REVISED:	2026
	1ST EDITION

DRAWING

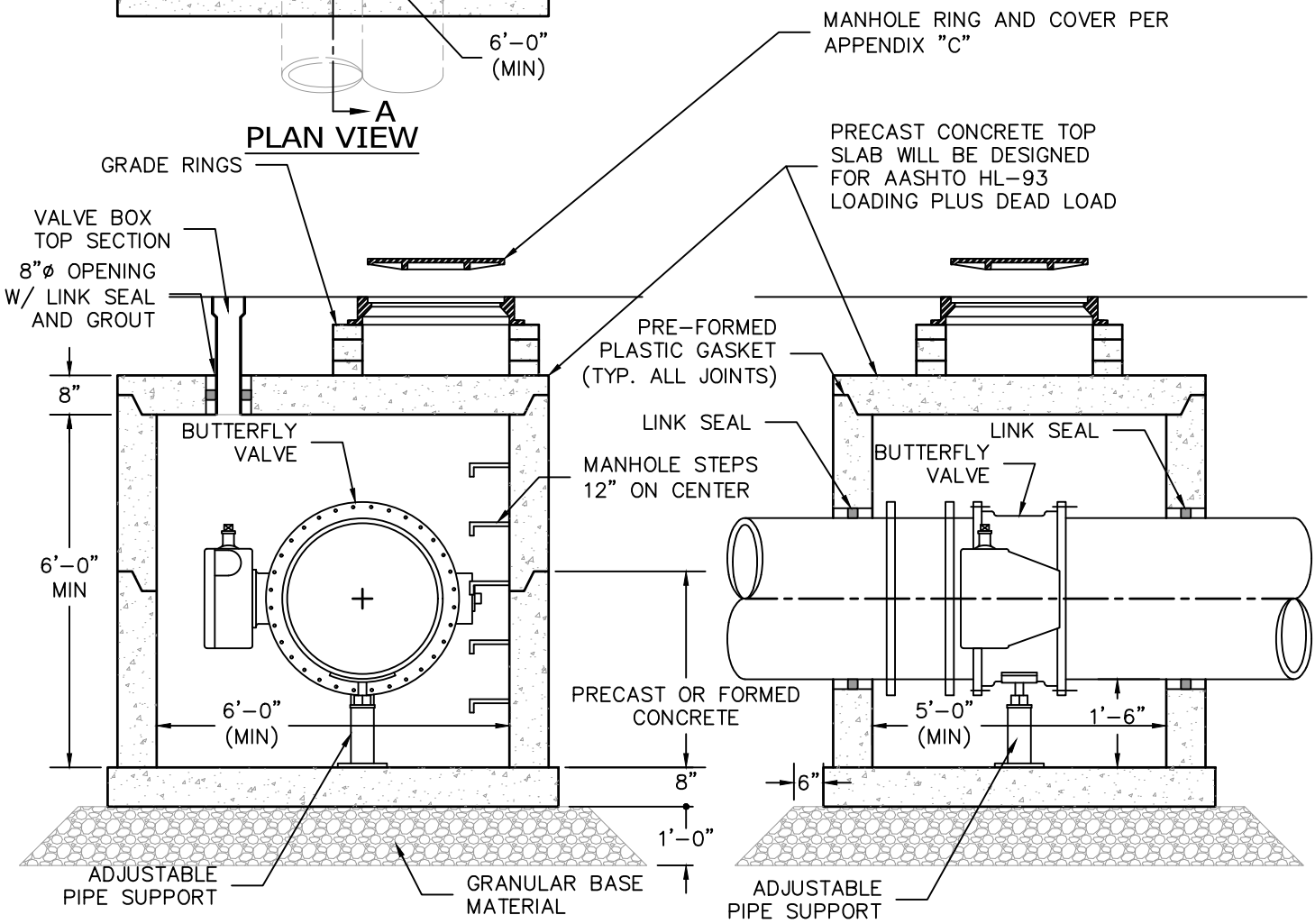
W-05

NOTES:

1. EXTERNAL VAULT DIMENSION VARY BASED ON PRECAST REQUIREMENTS.
2. BUTTERFLY VALVE OPERATORS SHALL BE LOCATED ON THE NORTH OR WEST SIDE OF THE PIPE.
3. BUTTERFLY VALVE BOX TO BE CORE DRILLED IN THE FIELD AFTER VALVE INSTALLATION AND VALVE BOX TOP SECTION INSTALLED OVER THE BUTTERFLY VALVE OPERATING NUT. BOX TO BE LINK SEALED & GROUTED.
4. MECHANICAL JOINT BUTTERFLY VALVES SHALL BE INSTALLED USING MEGALUG RESTRAINTS.
5. BUTTERFLY VALVES INSTALLED WITH FLANGED CONNECTIONS SHALL INCLUDE A RESTRAINED FLANGED COUPLING ADAPTER OR DISMANTLING JOINT ON ONE SIDE
6. A 6' ø PRECAST MANHOLE WITH A FLAT LID MAY BE SUBSTITUTED FOR 16" BUTTERFLY VALVES, WITH THE APPROVAL FROM THE DISTRICT. VAULT SIZES FOR LARGER DIAMETER PIPE SIZE TO COORDINATED WITH THE DISTRICT



PLAN VIEW



SECTION A-A

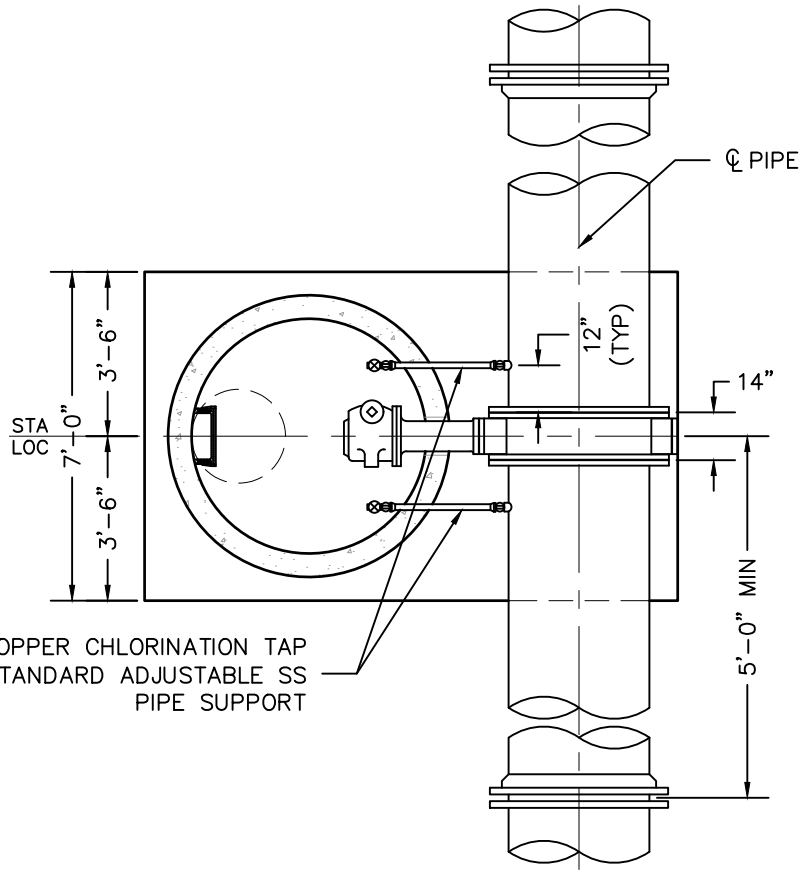
SECTION B-B

TYPICAL BUTTERFLY VALVE VAULT

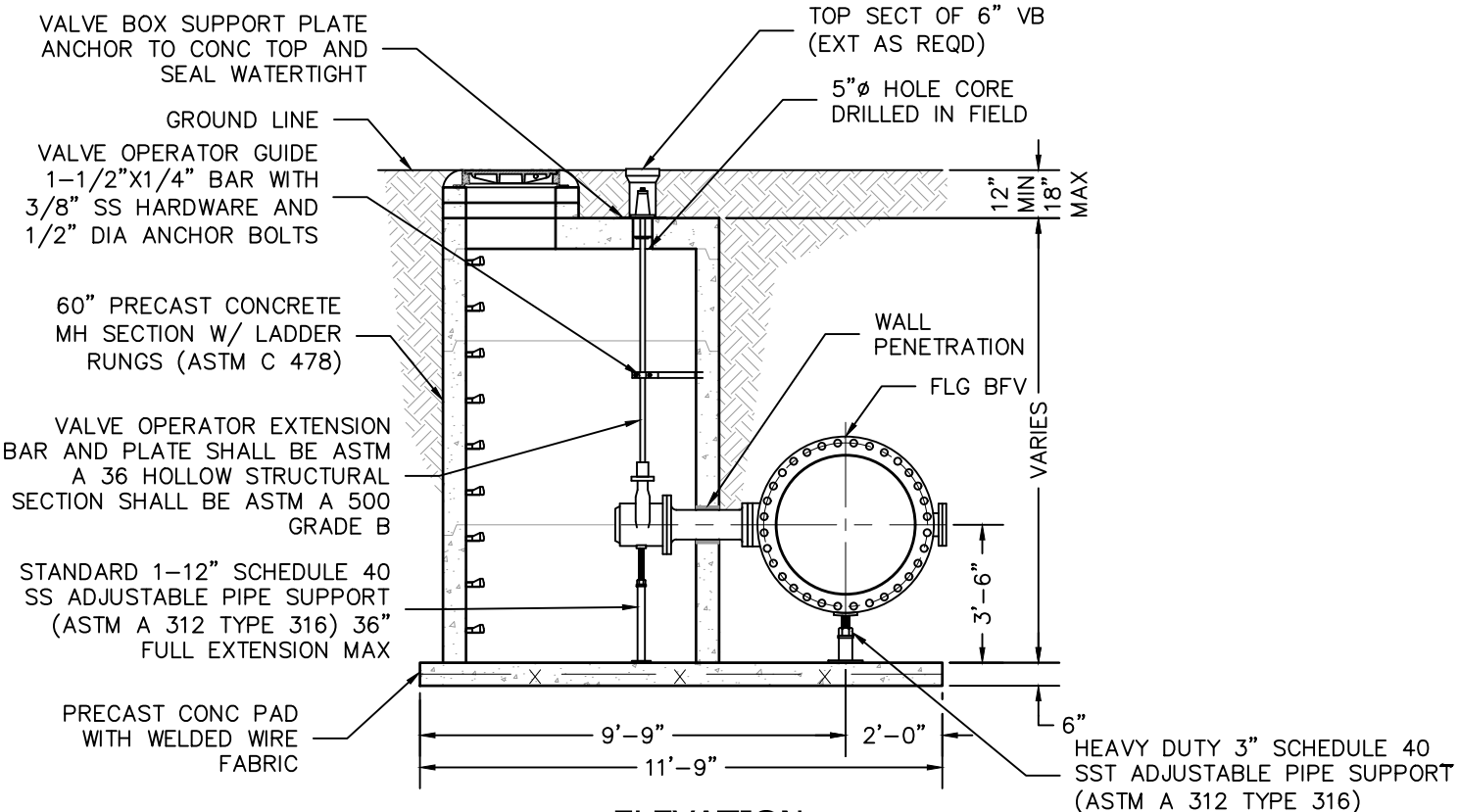
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE	**DRAWING**
DATE APPROVED: 06/2026	**W-5A**
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PLAN VIEW



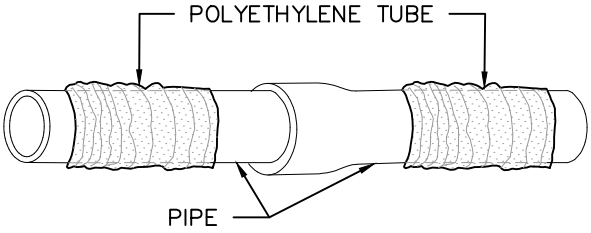
ELEVATION

TYPICAL LARGE DIA BUTTERFLY VALVE VAULT

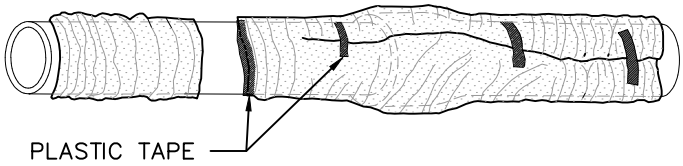
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

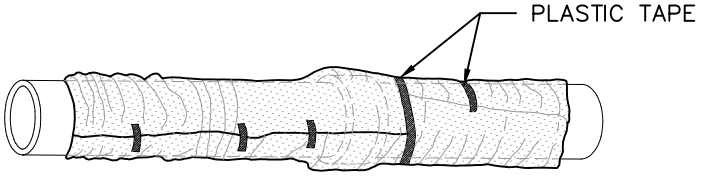
SCALE: NOT TO SCALE	**DRAWING**
DATE APPROVED: 06/2026	**W-5B**
DATE REVISED: 2026	
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STEP 3



STEP 4



STEP 5

STEP 1- CUT 8 MIL POLYETHYLENE TUBE TO A LENGTH APPROXIMATELY 2–FT LONGER THAN THE PIPE SECTION.

STEP 2- PLACE POLYETHYLENE TUBE ON PIPE PRIOR TO LOWERING IT INTO TRENCH.

STEP 3- LOWER PIPE INTO TRENCH AND MAKE UP THE PIPE JOINT WITH THE PRECEDING SECTION OF PIPE. A SHALLOW BELL HOLE MUST BE MADE AT THE JOINTS TO FACILITATE INSTALLATION OF THE POLYETHYLENE TUBE.

STEP 4- 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. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF PIPE AND TAPED IN PLACE.

STEP 5- 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.

STEP 6- CAREFULLY BACKFILL WITH CLEAN MATERIAL THAT WILL NOT DAMAGE ENCASEMENT.

TAPS: MAKE TAPS BY WRAPPING THREE LAYERS OF COMPATIBLE TAPE AROUND THE PIPE TO COVER THE TAPPING MACHINE AREA. INSTALL CORPORATION STOP THROUGH THE TAPE AND POLYETHYLENE.

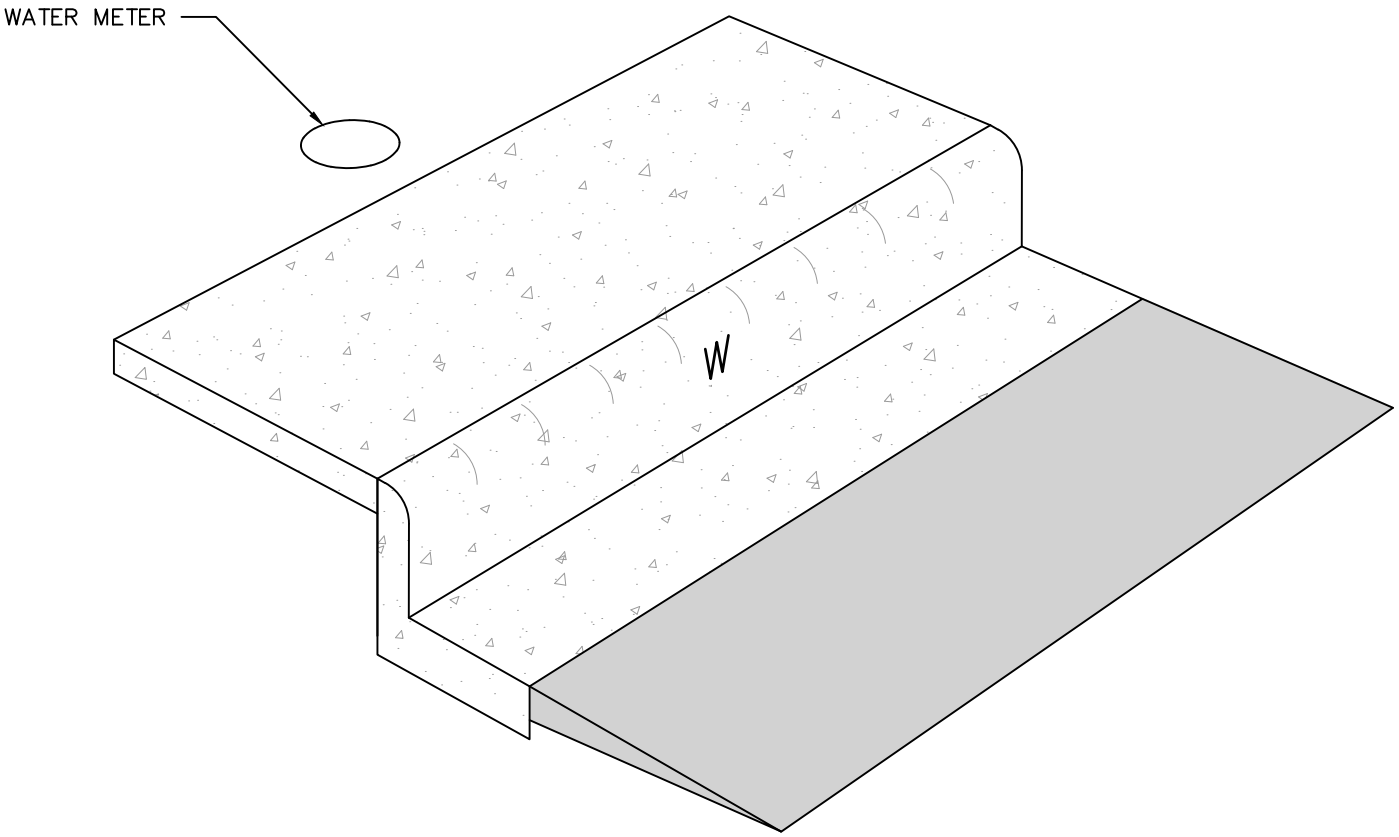
FIELD INSTALLATION OF POLYETHYLENE

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE
DATE APPROVED: 06/2026
DATE REVISED: 2026
1ST EDITION

DRAWING
W-06



NOTES:

1. WATER SERVICE TO BE CAST OR CUT INTO CURB HEAD; MARK "W"

SIDEWALK MARKING

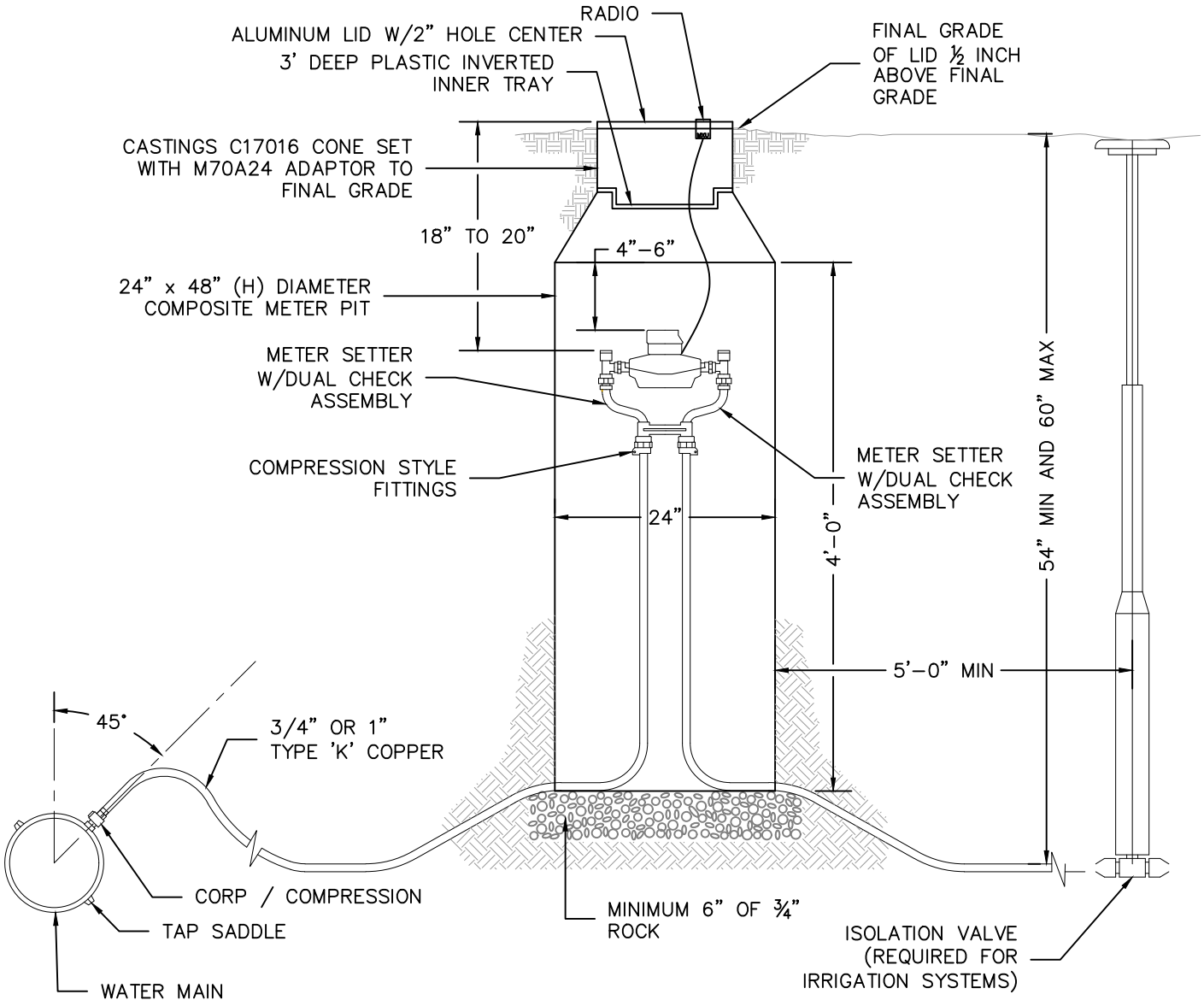
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
DATE APPROVED:	06/2026
DATE REVISED:	2026
	1ST EDITION

DRAWING

W-07



NOTES:

1. METER PITS SHALL NOT BE LOCATED IN AREAS SUBJECT TO TRAFFIC OR PEDESTRIAN WALKWAYS
2. NO LANDSCAPING (SHRUBS, BOULDERS, ETC.) SHALL BE WITHIN 5 FEET OF METER PIT. NO TREES SHALL BE WITHIN 10 FEET OF THE METER PIT.
3. GROUND SURROUNDING METER PIT SHALL SLOPE AWAY FROM LID.
4. NO PLUMBING CONNECTIONS ARE TO BE MADE IN METER PIT.
5. LAWN SPRINKLER CONNECTIONS ARE TO BE AT LEAST 5 FEET FROM METER PIT ON THE OUTLET SIDE.
6. IRRIGATION SYSTEMS REQUIRE AN ISOLATION VALVE DOWNSTREAM OF THE PIT, MINIMUM OF 5 FEET.
7. VALVES TO BE OPERATED BY DISTRICT PERSONNEL ONLY, WITH EXCEPTION TO THE IRRIGATION ISOLATION VALVES.
8. SEE TYPICAL SERVICE LOCATION DETAILS W–01

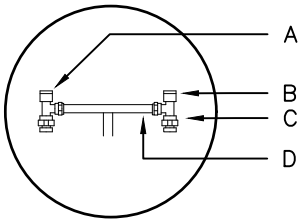
TYPICAL METER PIT INSTALLATION

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

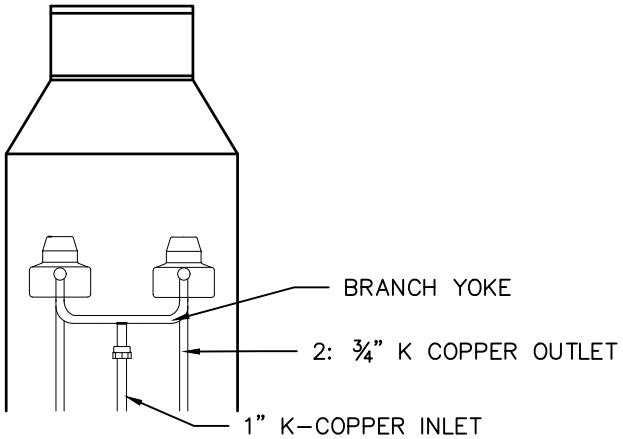
TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
DATE APPROVED:	09/2026
DATE REVISED:	2026
	1ST EDITION

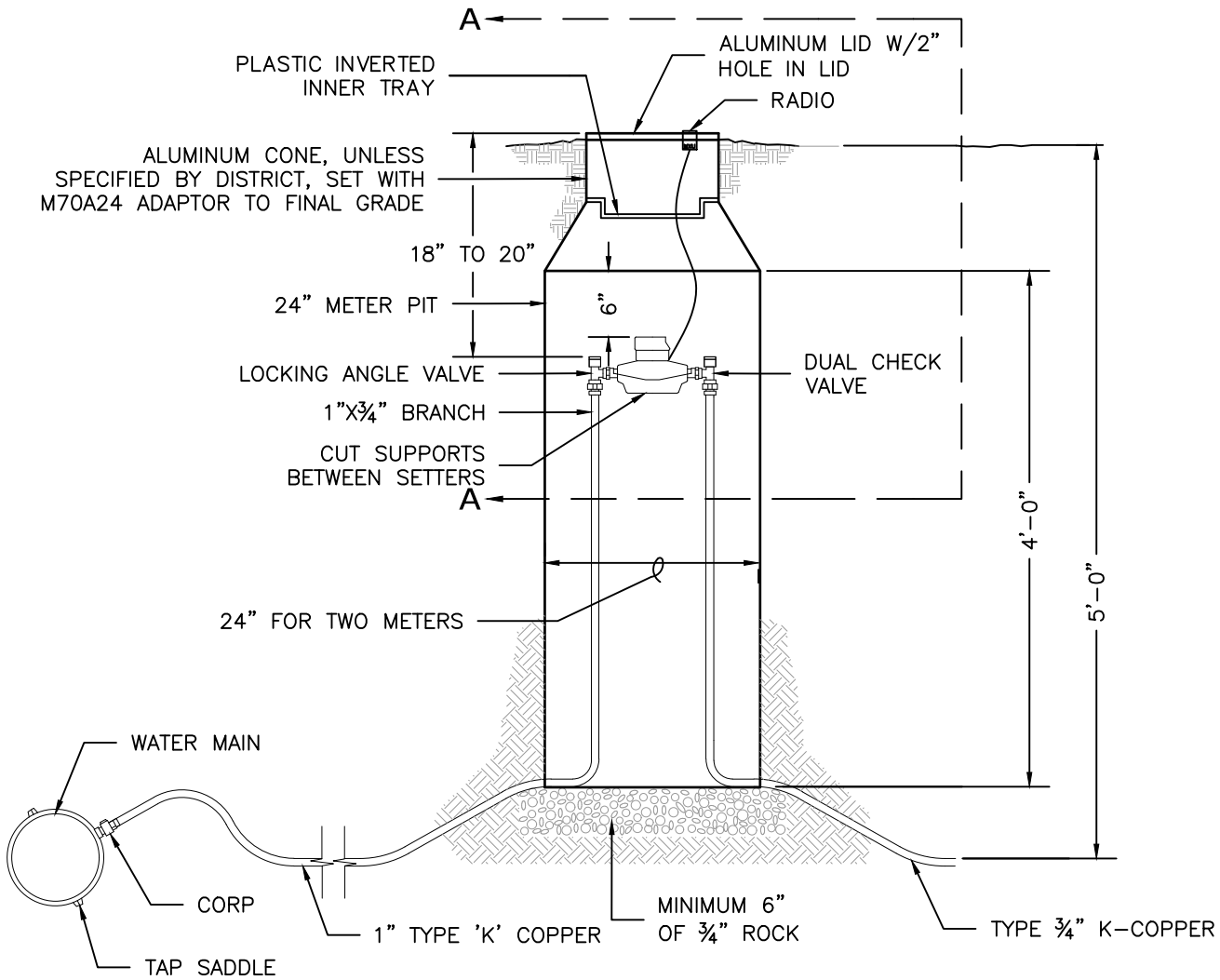
DRAWING
W-08



ITEM	NAME	CAT. NO.
A	FORD ANGLE DUAL CHECK VALVE	HHAA34–323–G
B	FORD ANGLE BALL VALVE	BA13–332W
C	FORD "U" BRANCH	U48–43–7.5–G
D	FORD METER IDLERS	IDLER #2



SECTION A-A



NOTES:
1. SEE TYPICAL UTILITY SERVICE LOCATION DETAIL W–01

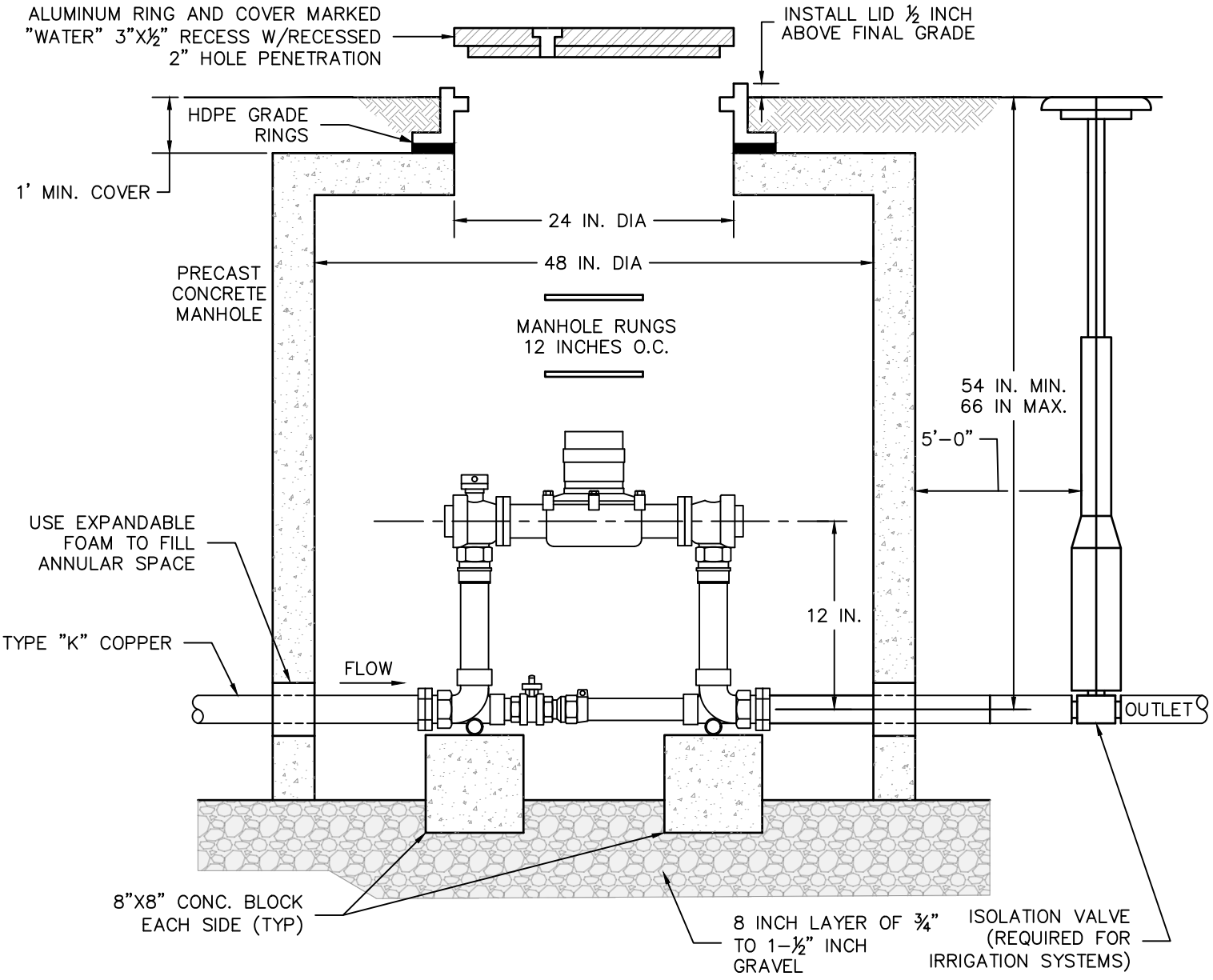
TYPICAL DOUBLE METER PIT

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE
DATE APPROVED: 06/2026
DATE REVISED: 2026
1ST EDITION

DRAWING
W-09



NOTES:

1. METER SETTING DEVICES TO BE "CUSTOM SETTERS" WITH BY-PASS AND FLANGED BALL VALVES. METER SETTERS TO BE SUPPORTED BY 2 – 18" LENGTHS OF 1" IRON PIPE INSERTED THROUGH EYELETS AND SET ATOP 8" X 8" CONCRETE BLOCKS.
2. THIS METER IS NOT TO BE INSTALLED IN ANY STREET, ALLEY, PARKING AREA OR DRIVEWAY.
3. NO LANDSCAPING (SHRUBS, BOULDERS, ETC.) IS TO BE WITHIN 5 FEET OF METER PIT. NO TREES SHALL BE WITHIN 10 FEET OF THE METER PIT.
4. GROUND SURROUNDING METER PIT SHALL SLOPE AWAY FROM LID.
5. NO PLUMBING CONNECTIONS ARE TO BE MADE IN METER PIT.
6. LAWN SPRINKLER CONNECTIONS ARE TO BE AT LEAST 5 FEET FROM METER PIT ON THE OUTLET SIDE.
7. IRRIGATION SYSTEMS REQUIRE AN ISOLATION VALVE DOWNSTREAM OF VAULT, MINIMUM OF 5 FEET.
8. VALVES TO BE OPERATED BY DISTRICT PERSONNEL ONLY, WITH EXCEPTION TO THE IRRIGATION ISOLATION VALVE.

TYPICAL SETTING FOR 1-1/2" & 2" METERS

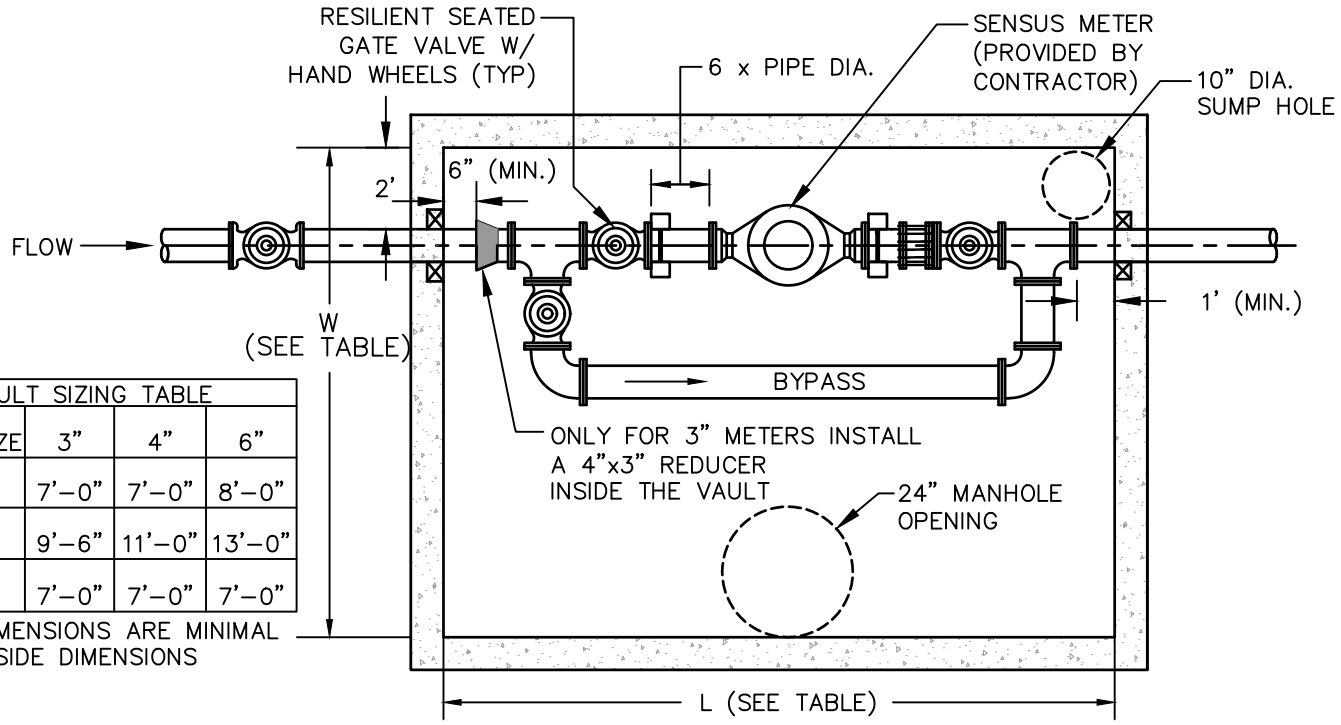
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
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TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
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	1ST EDITION

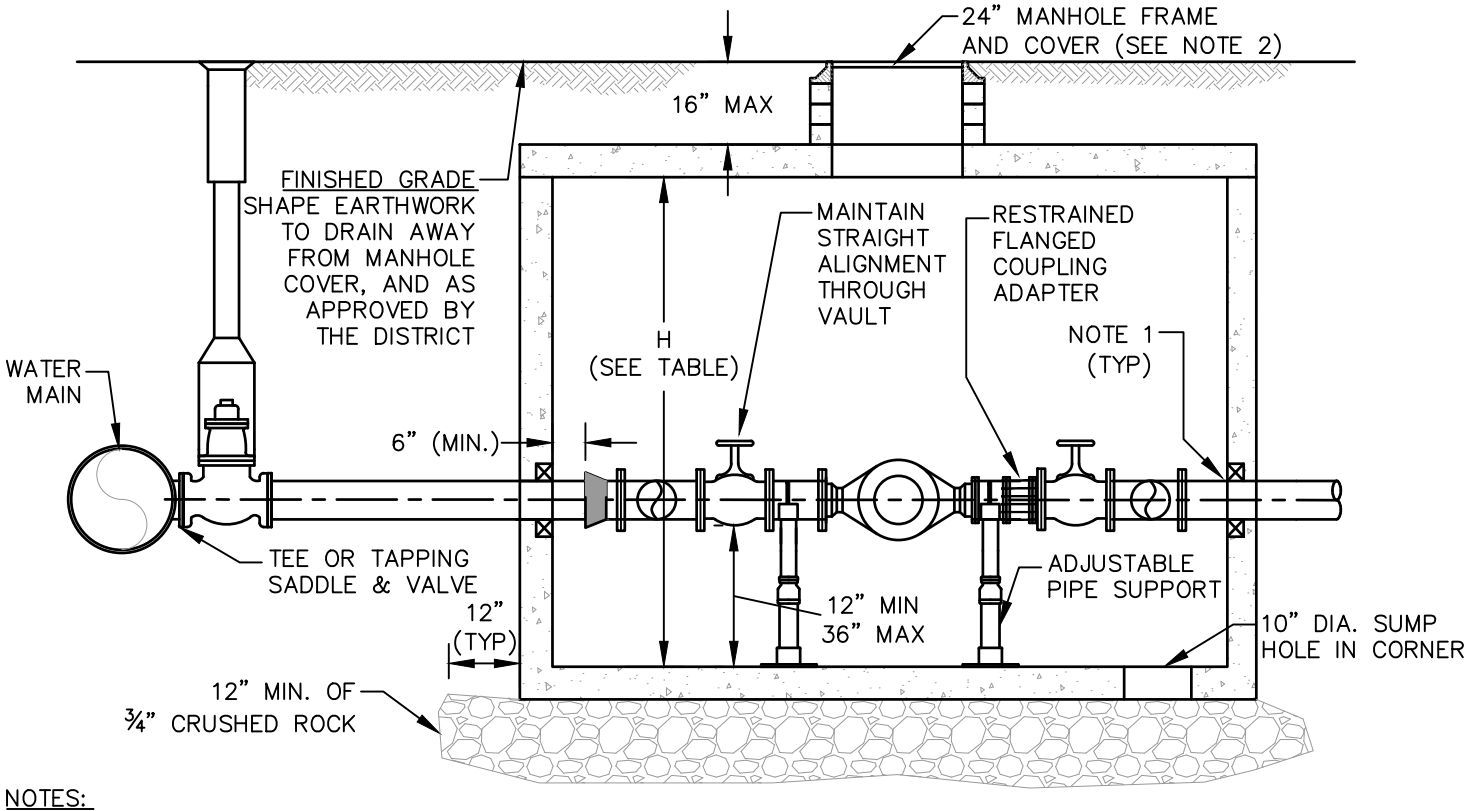
DRAWING

W-10



VAULT SIZING TABLE			
METER SIZE	3"	4"	6"
WIDTH	7'–0"	7'–0"	8'–0"
LENGTH	9'–6"	11'–0"	13'–0"
HEIGHT	7'–0"	7'–0"	7'–0"

NOTE: DIMENSIONS ARE MINIMAL INSIDE DIMENSIONS



NOTES:

1. SEAL EACH VAULT PENETRATION WITH LINK–SEAL UNIT USING 316 S.S HARDWARE.
2. BURY VAULT 16" BELOW SURFACE. ADJUST MANHOLE COVER TO GRADE WITH CONCRETE GRADE RINGS. DRILL HOLE THROUGH COVER FOR REMOTE READ DEVICE.
3. ALL JOINTS WITHIN VAULT SHALL BE FLANGED CONNECTIONS.
4. VAULT SHALL BE DESIGNED FOR AASHTO HL–93 LOADING. FLOORS AND WALLS SHALL BE MONOLITHIC AND DESIGNED IN ACCORDANCE WITH ASTM C858. CONCRETE FC=4000 PSI MIN.
5. SEPARATION BETWEEN METER VAULTS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.

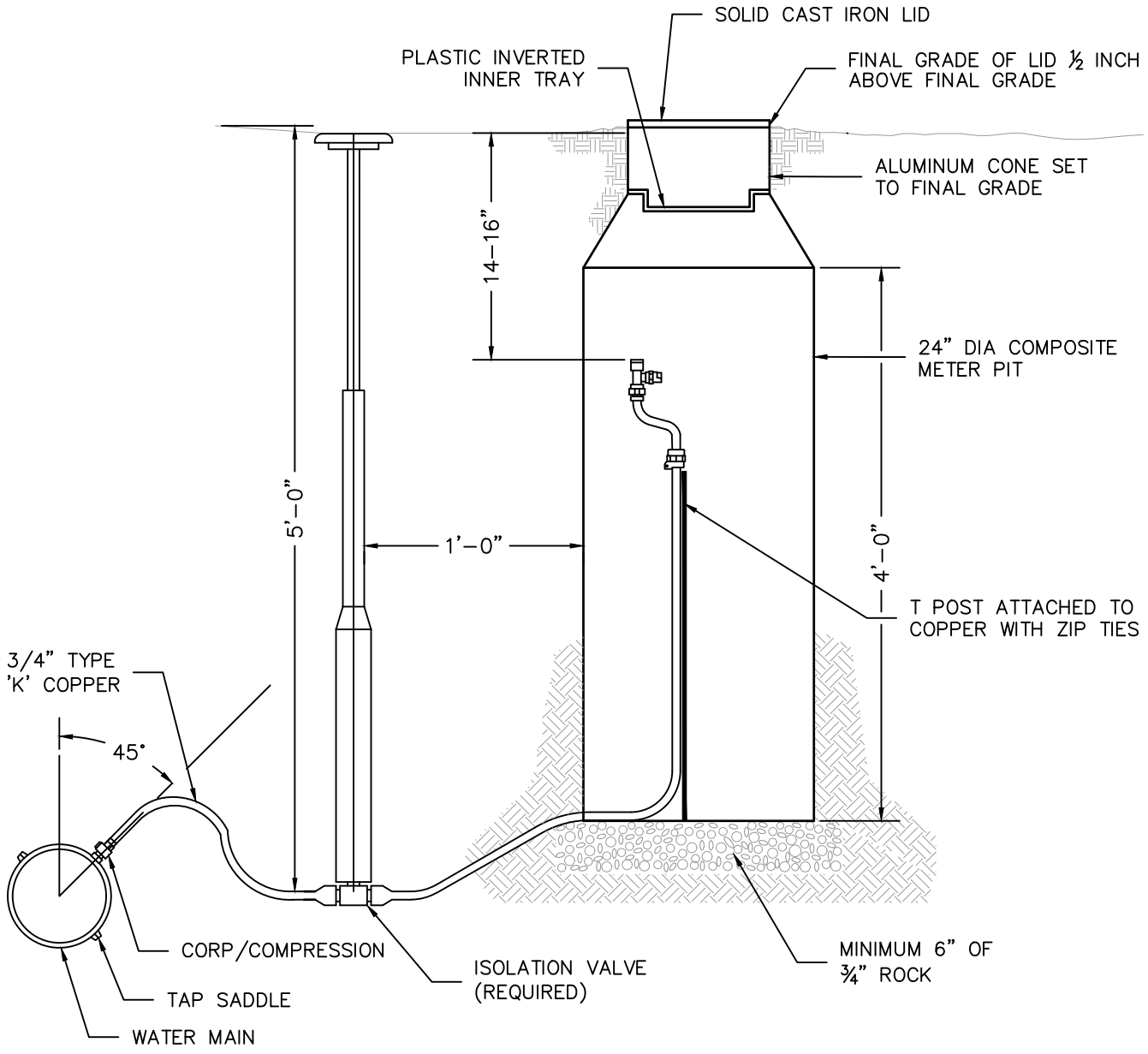
TYPICAL INSTALLATION FOR 3", 4" AND 6" METER VAULTS

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE
DATE APPROVED: 06/2026
DATE REVISED: 2026
1ST EDITION

DRAWING
W-11



NOTES:

1. METER PITS SHALL NOT BE LOCATED IN AREAS SUBJECT TO TRAFFIC OR PEDESTRIAN WALKWAYS.
2. NO TREES OR BOULDERS SHALL BE WITH IN 10 FEET OF THE METER PIT. ALL OTHER LANDSCAPE (SHRUBS, DECORATIVE GRASSES, ETC.) SHALL NOT BE WITHIN 5 FEET OF THE METER PIT.
3. GROUND SURROUNDING THE METER PIT SHALL BE SLOPED AWAY FROM THE LID.
4. SAMPLE STATION LOCATIONS WILL BE DETERMINED BY THE DISTRICT.

TYPICAL SAMPLING STATION

FORT COLLINS-LOVELAND WATER DISTRICT 5150 SNEAD DRIVE FORT COLLINS, CO 80525 970.226.3104	**TYPICAL CONSTRUCTION DETAILS**	SCALE: NOT TO SCALE DATE APPROVED: 06/2026 DATE REVISED: 2026 1ST EDITION	**DRAWING** **W-12**

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

HORIZONTAL JOINT RESTRAINT LENGTHS TABLES

TYPICAL CONSTRUCTION DETAILS

PIPE TESTED AT 150 PSI												
FITTING TYPE	4"	6"	8"	10"	12"	16"	18"		20"		24"	
							PVC	DIP	PVC	DIP	PVC	DIP
11.25° BEND	1'	2'	2'	3'	3'	4'	4'	4'	4'	4'	5'	5'
22.5° BEND	2'	3'	4'	5'	5'	7'	7'	8'	8'	9'	9'	10'
45° BEND	4'	6'	8'	9'	11'	14'	15'	16'	16'	17'	19'	20'
90° BEND	10'	14'	18'	21'	25'	32'	36'	37'	39'	41'	45'	48'
VALVES, F.H., CAPS, PLUG, TEE	32'	45'	60'	72'	85'	110'	122'	149'	134'	164'	158'	193'
REDUCERS	6"x4" = 24' on 6"	8"x6" = 25' on 8"	10"x8" = 24' on 10"	12"x10" = 25' on 12"								
	8"x4" = 43' on 8"	10"x6" = 44' on 10"	12"x8" = 45' on 12"									
	10"x4" = 58' on 10"	12"x6" = 62' on 12"										
	12"x4" = 74' on 12"											

PIPE TESTED AT 200 PSI												
	4"	6"	8"	10"	12"	16"	18"		20"		24"	
FITTING TYPE							PVC	DIP	PVC	DIP	PVC	DIP
11.25° BEND	2'	2'	3'	3'	4'	5'	5'	5'	6'	6'	6'	7'
22.5° BEND	3'	4'	5'	6'	7'	9'	10'	10'	11'	11'	12'	13'
45° BEND	6'	8'	10'	12'	14'	18'	20'	21'	22'	23'	25'	27'
90° BEND	13'	18'	24'	28'	33'	43'	47'	50'	52'	55'	60'	63'
VALVES, F.H., CAPS, PLUG, TEE	43'	60'	80'	96'	113'	147'	162'	198'	179'	218'	254'	257'
REDUCERS	6"x4" = 31' on 6"	8"x6" = 34' on 8"	10"x8" = 32' on 10"	12"x10" = 33' on 12"								
	8"x4" = 57' on 8"	10"x6" = 59' on 10"	12"x8" = 60' on 12"									
	10"x4" = 78' on 10"	12"x6" = 82' on 12"										
	12"x4" = 98' on 12"											

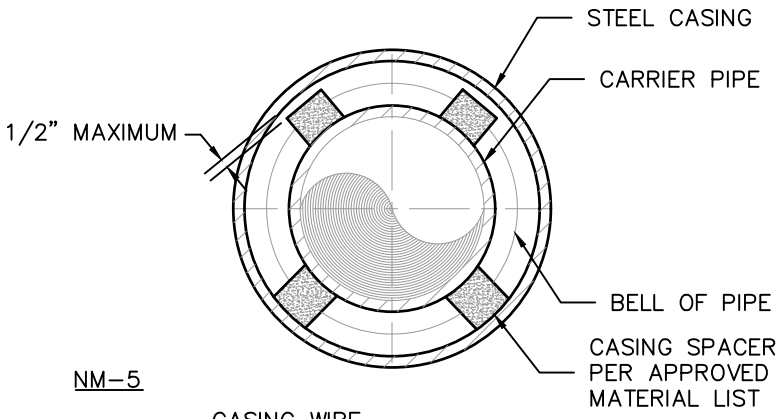
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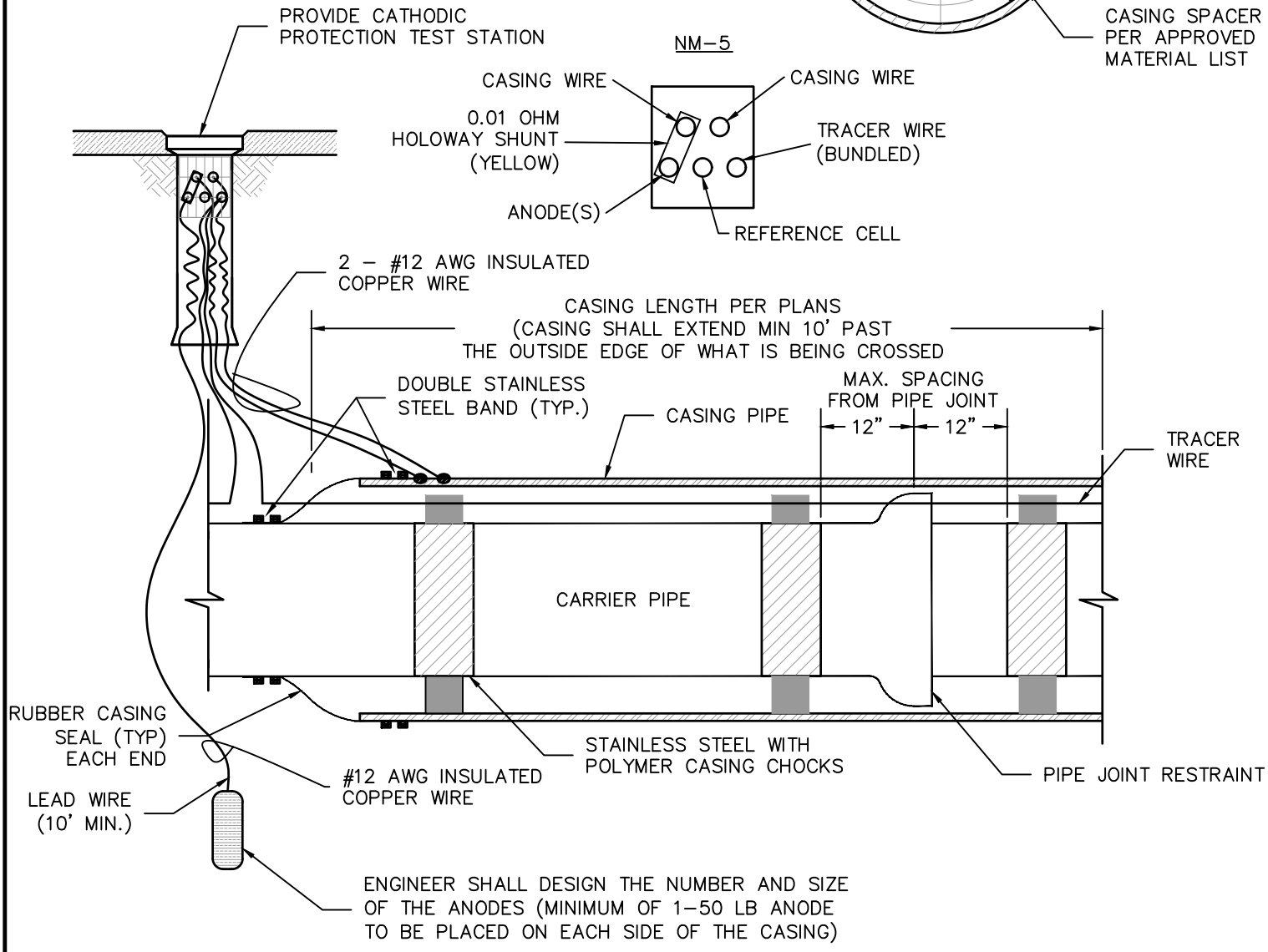
1. JOINT RESTRAINT REQUIRED FOR VERTICAL DEFLECTIONS SHALL BE DETERMINED BY THE DESIGN ENGINEER.
2. ALL PIPES IN CASING SHALL BE FULLY RESTRAINED.
3. THE JOINT RESTRAINTS LISTED IN THE TABLES ABOVE ARE MINIMUM DISTANCES. THE DESIGN ENGINEER SHALL REVIEW AND DETERMINE IF A GREATER LENGTH OF PIPE RESTRAINT IS NEEDED.
4. ALL JOINT RESTRAINT LENGTH SHALL BE CALLED OUT ON THE CONSTRUCTION PLAN AND PROFILE SHEETS OR WATER UTILITY PLAN.
5. ALL JOINT RESTRAINT DISTANCES ABOVE ARE DERIVED FROM EBAA IRON'S, JOINT RESTRAINT LENGTH CALCULATOR, WWW.EBAA.COM, USING THE DEFAULT CATEGORY SELECTIONS; PIPE MATERIAL=PVC (OR POLY WRAPPED DIP IF LISTED ABOVE), SOIL TYPE=ML, SAFETY FACTOR=1.5 TO 1,TRENCH TYPE=5, DEPTH OF BURY=5, PSI=150 OR 200.
6. FORT COLLINS–LOVELAND WATER DISTRICT RESERVES THE RIGHT TO CHANGE OR MODIFY THE JOINT RESTRAINT LENGTH REQUIREMENTS AT ANY TIME.
7. NOTE THAT 10" DIAMETER PIPE IS LISTED FOR WORK ON EXISTING PIPES ONLY. 10" DIAMETER PIPE SHALL NOT BE USED IN NEW CONSTRUCTION.

SCALE: NOT TO SCALE
DATE APPROVED: 06/2026
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DRAWING
W-13

ANODE LEADS	BLACK
PIPELINE TEST WIRES	RED FOR STEEL BLUE FOR DI
CASINGS	ORANGE
REF ELECTRODE	YELLOW
TRACER WIRE	WHITE





NOTES

1. EACH BARREL SECTION OF PIPE WITHIN THE CASING SHALL HAVE A MINIMUM OF THREE (3) CASING CHOCKS. THE MIDDLE CHOCK SHALL BE CENTERED BETWEEN EACH PIPE JOINT.

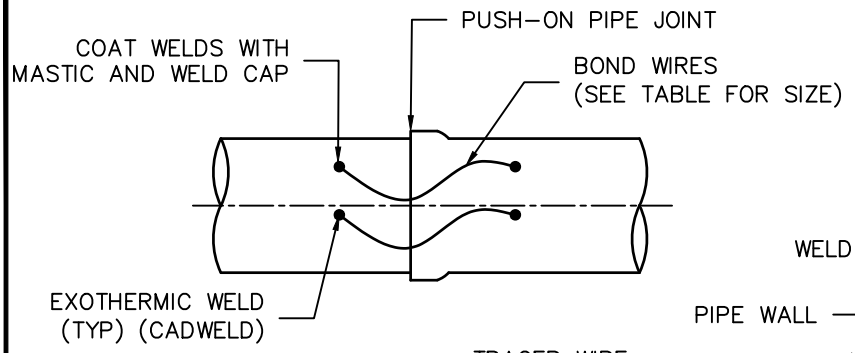
TYPICAL PIPE CASING

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5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

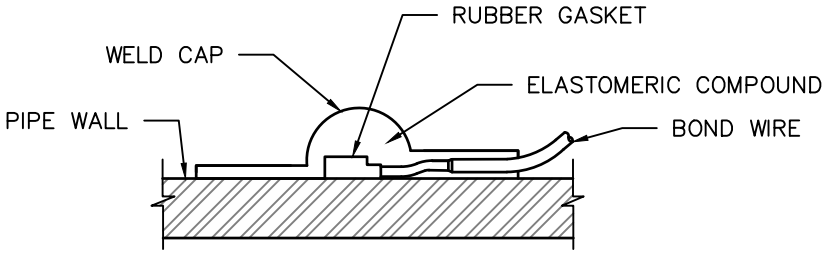
TYPICAL CONSTRUCTION DETAILS

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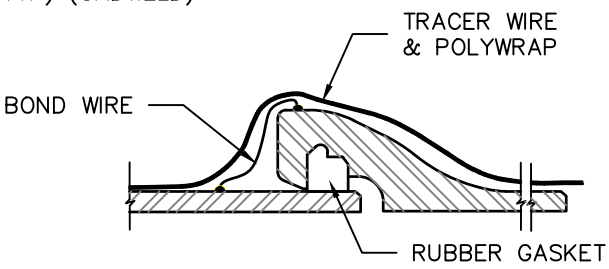
DRAWING
W-14



PIPE SIZE	BOND WIRE SIZE
4"–12"	#8
16"–36"	#4
42" AND LARGER	#2

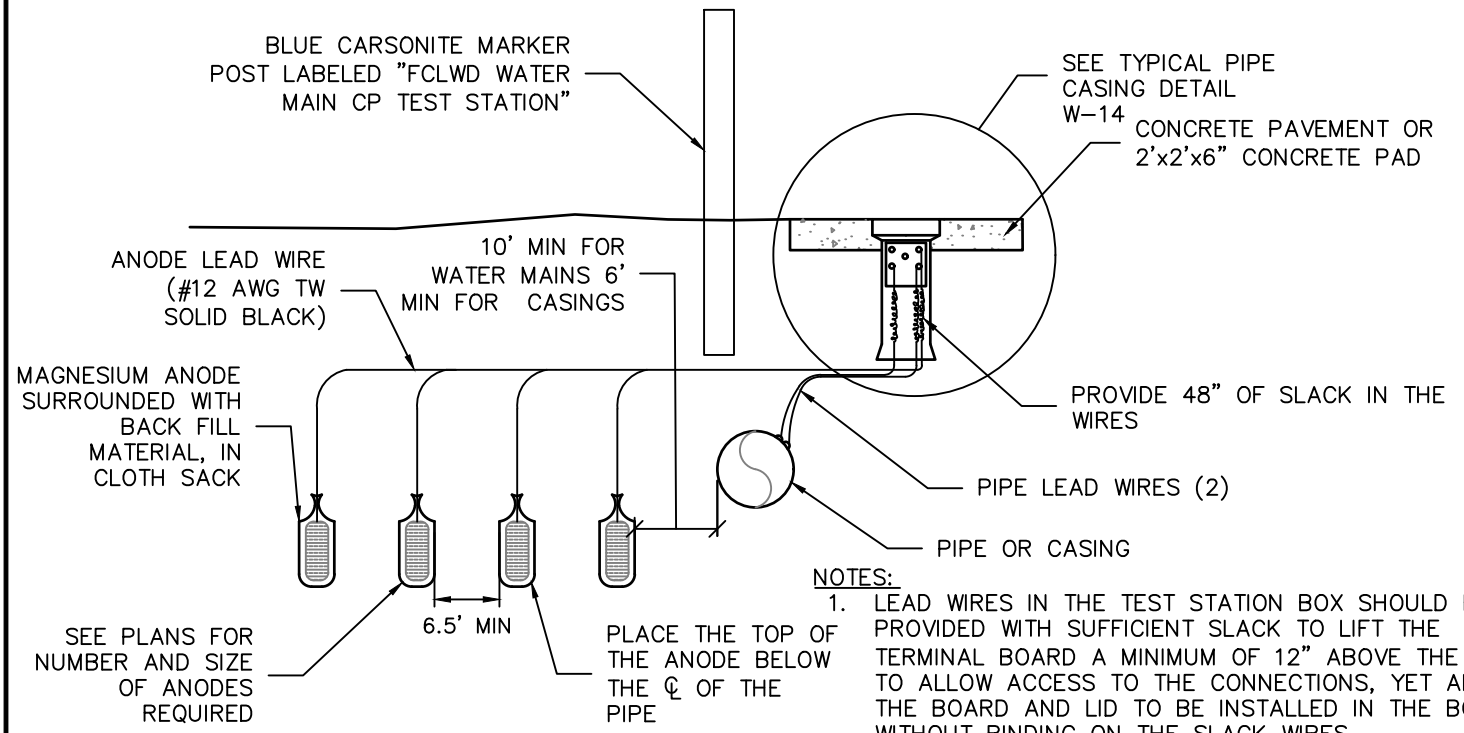


EXOTHERMIC WELD (CADWELD) CONNECTION DETAILS



PIPE JOINT DETAIL

NOTES:
1. JOINT BONDS ARE REQUIRED FOR NEW CATHODICALLY PROTECTED PIPE AT JOINTS AND FITTINGS.
2. ALL CATHODICALLY PROTECTED PIPE SHALL BE PROTECTED FROM NON PROTECTED METALLIC PIPE WITH INSULATING FLANGES.
3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT THE PIPING IS ELECTRICALLY ISOLATED.



ANODE AND TEST STATION DETAIL

NOTES:
1. LEAD WIRES IN THE TEST STATION BOX SHOULD BE PROVIDED WITH SUFFICIENT SLACK TO LIFT THE TERMINAL BOARD A MINIMUM OF 12" ABOVE THE BOX TO ALLOW ACCESS TO THE CONNECTIONS, YET ALLOW THE BOARD AND LID TO BE INSTALLED IN THE BOX WITHOUT BINDING ON THE SLACK WIRES.
2. LEAD WIRES BURIED IN THE GROUND SHALL ALSO BE PROVIDED WITH SUFFICIENT SLACK TO PREVENT STRESSING OF THE WIRE DUE TO SETTLEMENT.
3. PERMANENT, LEGIBLE IDENTIFICATION MARKERS SHALL BE ATTACHED TO EACH LEAD WIRE IN THE TEXT STATION.
4. PIPE LEAD WIRES SHALL BE ATTACHED APPROXIMATELY 12" APART ON THE TOP CENTERLINE OF THE PIPE.
5. THE ANODES SHALL BE WETTED WITH A MINIMUM OF 5 GALLONS OF WATER BEFORE BACKFILLING.

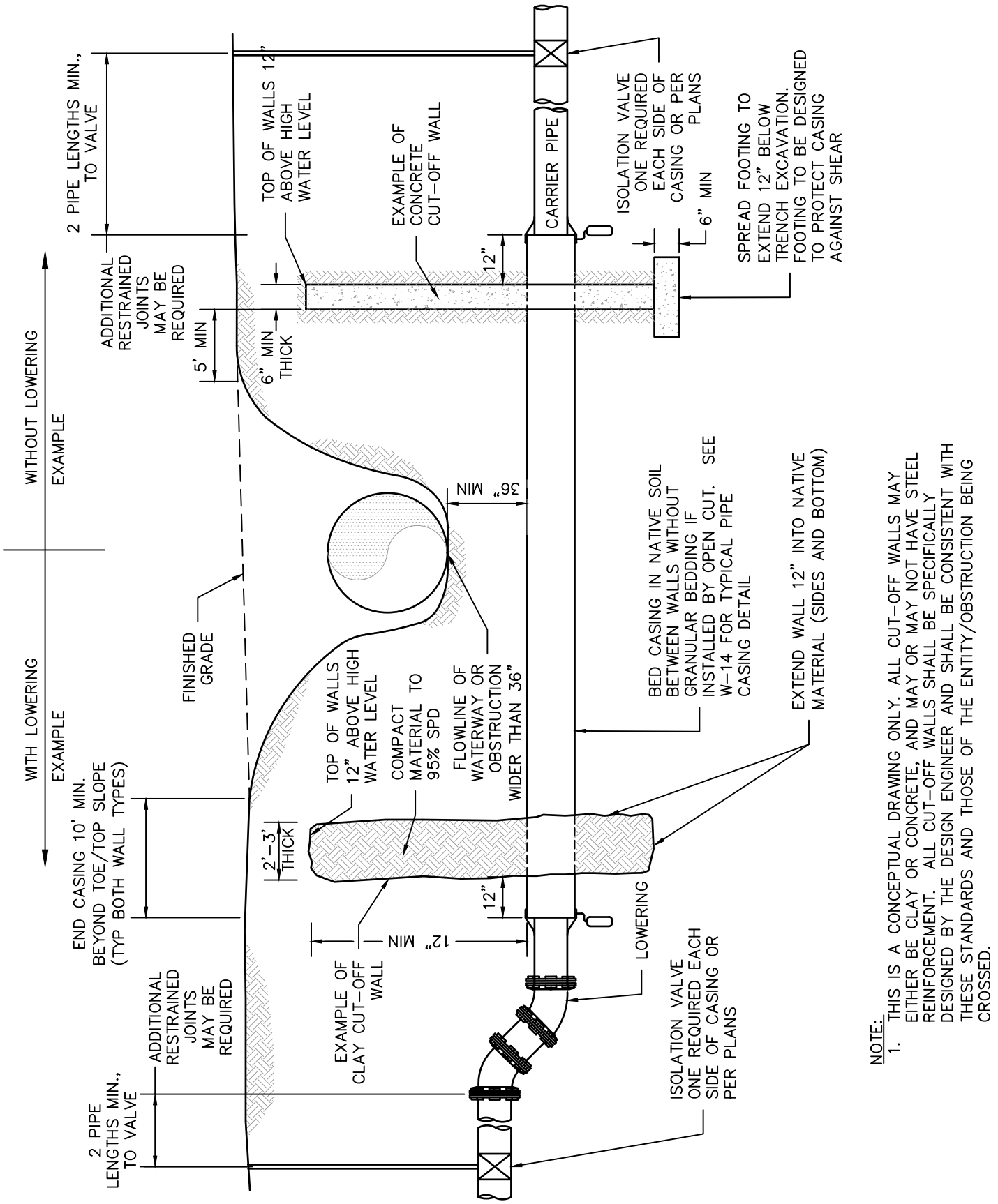
CATHODIC PROTECTION DETAILS

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

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DRAWING
W-15



NOTE:
1. THIS IS A CONCEPTUAL DRAWING ONLY. ALL CUT-OFF WALLS MAY EITHER BE CLAY OR CONCRETE, AND MAY OR MAY NOT HAVE STEEL REINFORCEMENT. ALL CUT-OFF WALLS SHALL BE SPECIFICALLY DESIGNED BY THE DESIGN ENGINEER AND SHALL BE CONSISTENT WITH THESE STANDARDS AND THOSE OF THE ENTITY/OBSTRUCTION BEING CROSSED.

DITCH / OBSTRUCTION WATERMAIN CROSSING WITH CASING

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5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

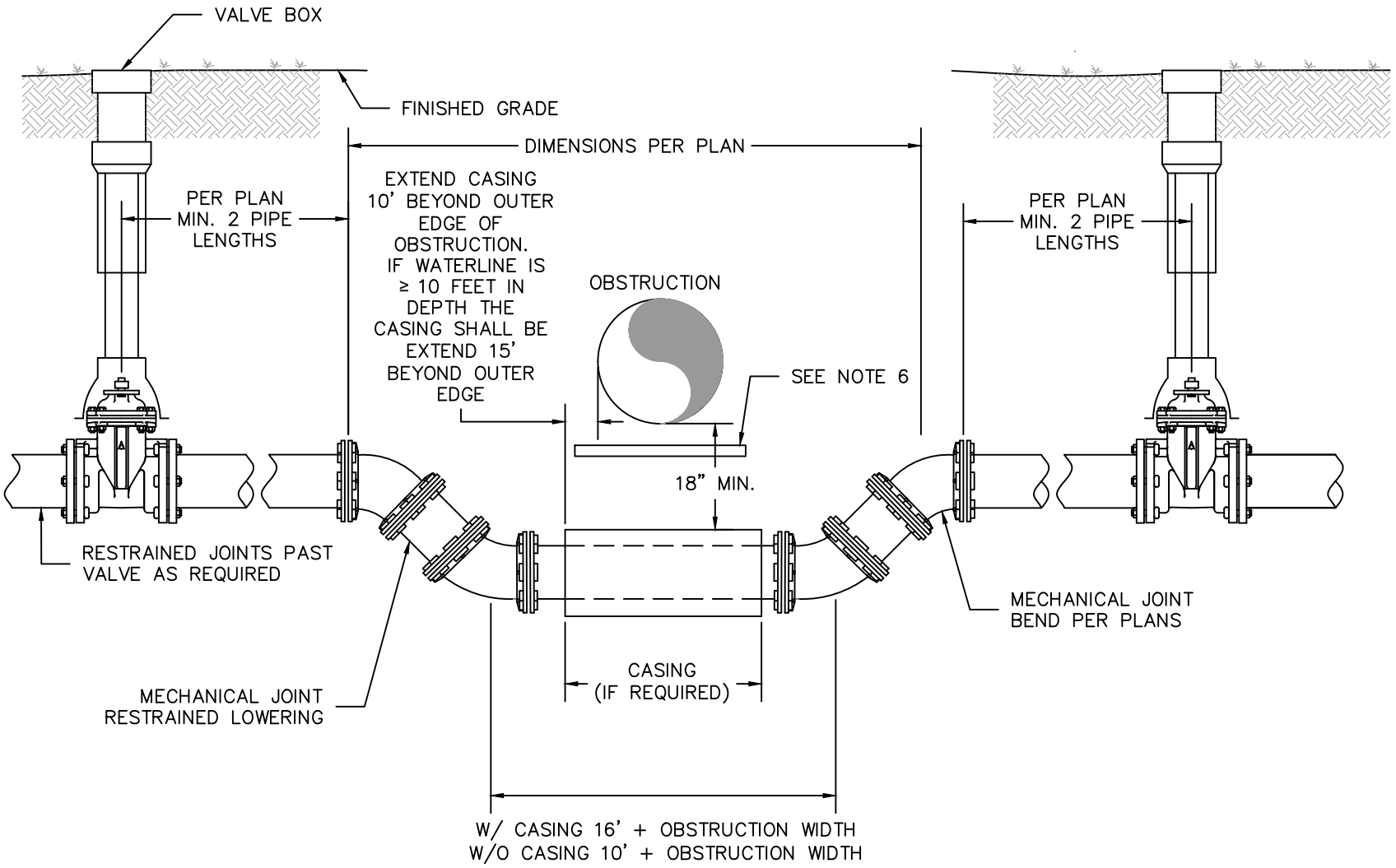
TYPICAL CONSTRUCTION DETAILS

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1ST EDITION	

FORT COLLINS-LOVELAND
WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL WATERLINE LOWERING

TYPICAL CONSTRUCTION DETAILS

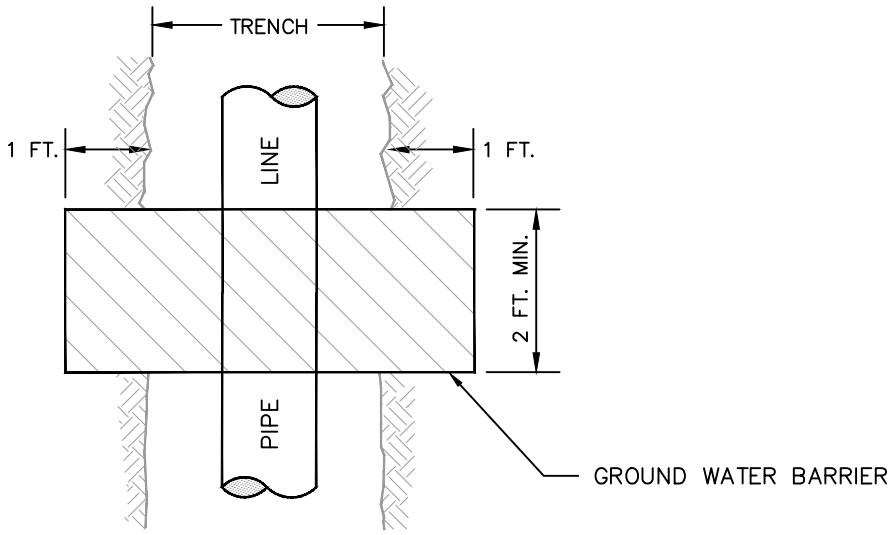


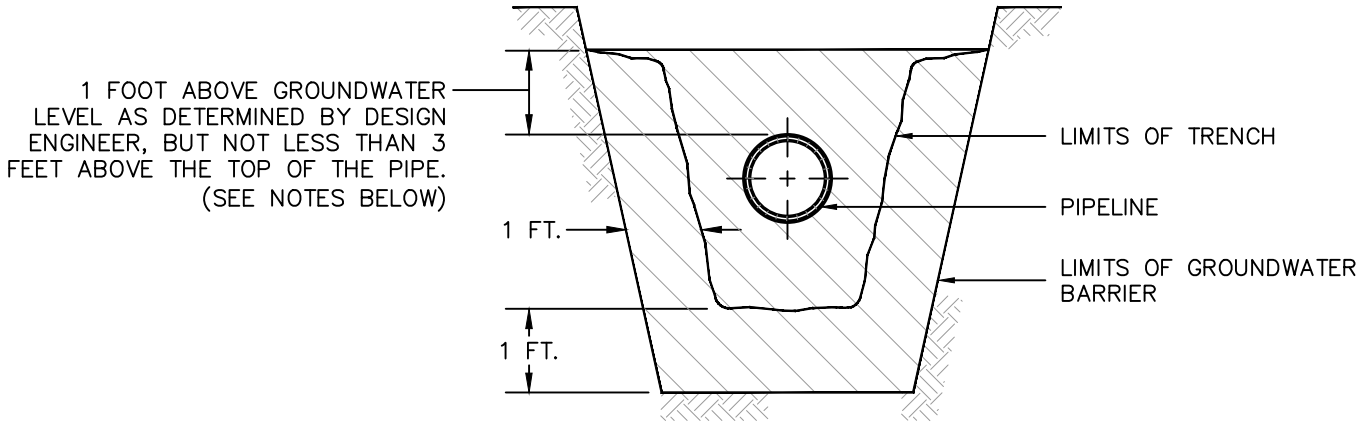
NOTES:

1. IF CASING IS USED, ALL JOINTS WITHIN THE CASING SHALL BE RESTRAINED BY USE OF MECHANICAL JOINT RESTRAINTS.
2. ALL METALLIC PIPE, FITTINGS, AND APPURTENANCES SHALL BE WRAPPED IN 8 MIL POLYETHYLENE.
3. REQUIREMENTS FOR LARGER THAN 16" DIAMETER PIPE WILL BE DETERMINED ON A CASE BY CASE BASIS.
4. ALL FITTINGS, VALVES, PIPE LENGTHS, CASING ENDS, ETC. SHALL BE HORIZONTALLY DIMENSIONED OR STATIONED AND HAVE VERTICAL ELEVATIONS TO TOP OF PIPE.
5. FOR DITCH CROSSINGS, CUTOFF WALLS MAY BE REQUIRED. CROSSING DESIGN MUST BE APPROVED BY DITCH COMPANY.
6. FREEZE PROTECTION SHALL BE PROVIDED IF REQUIRED. ENGINEER TO PROVIDE DETAILS.

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DATE APPROVED: 06/2026
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W-17





NOTES

1. WALL EXTENDS A MINIMUM OF 12" INTO UNDISTURBED SOIL ON EACH SIDE AND ON BOTTOM OF TRENCH.
2. BARRIERS ARE TYPICALLY LOCATED UPSTREAM OF MANHOLES FOR WASTEWATER MAINS.
3. THE GROUNDWATER BARRIER SHALL EXTEND TO A POINT ONE FOOT ABOVE THE GROUNDWATER LEVEL AS SHOWN IN THE APPROVED PROJECT GEOTECHNICAL INVESTIGATION REPORT.

GROUND WATER BARRIER

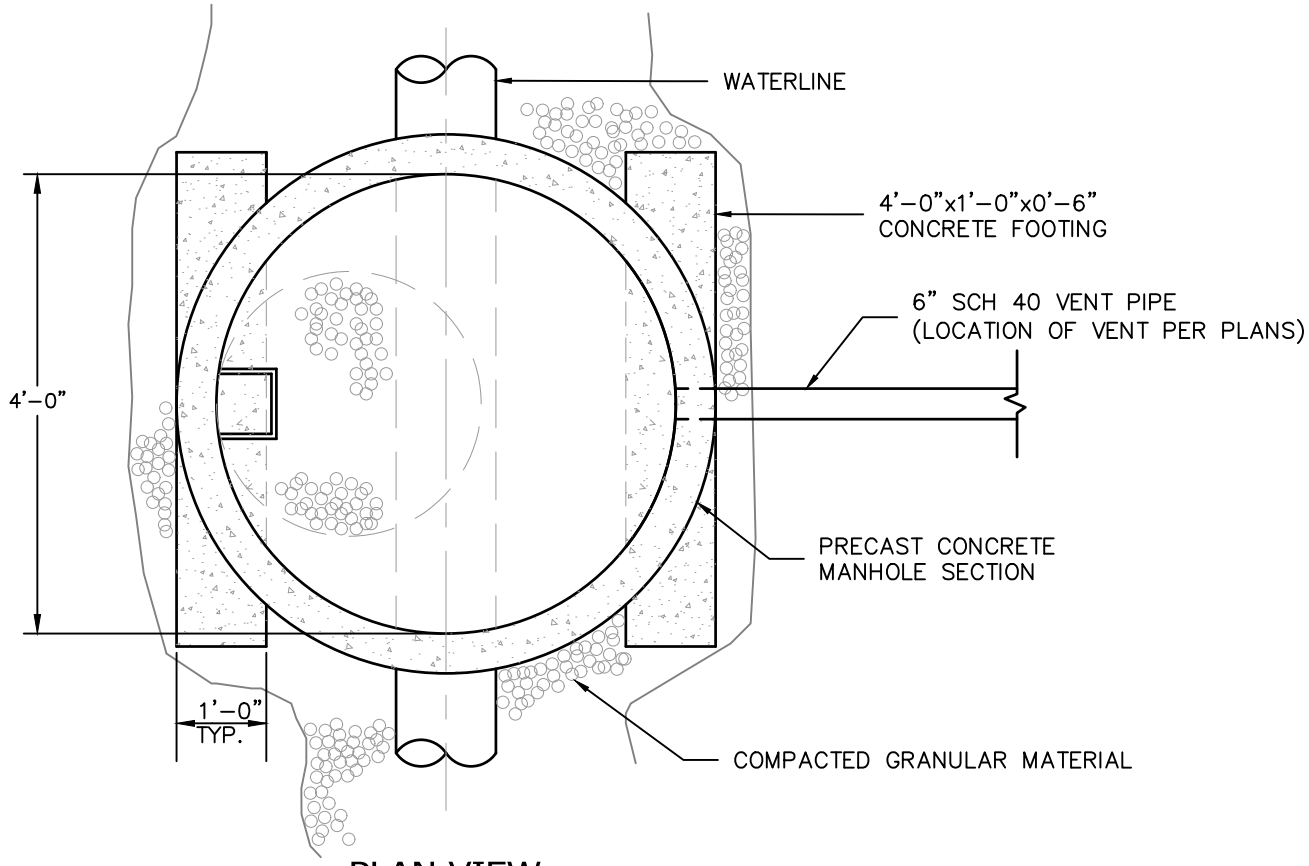
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

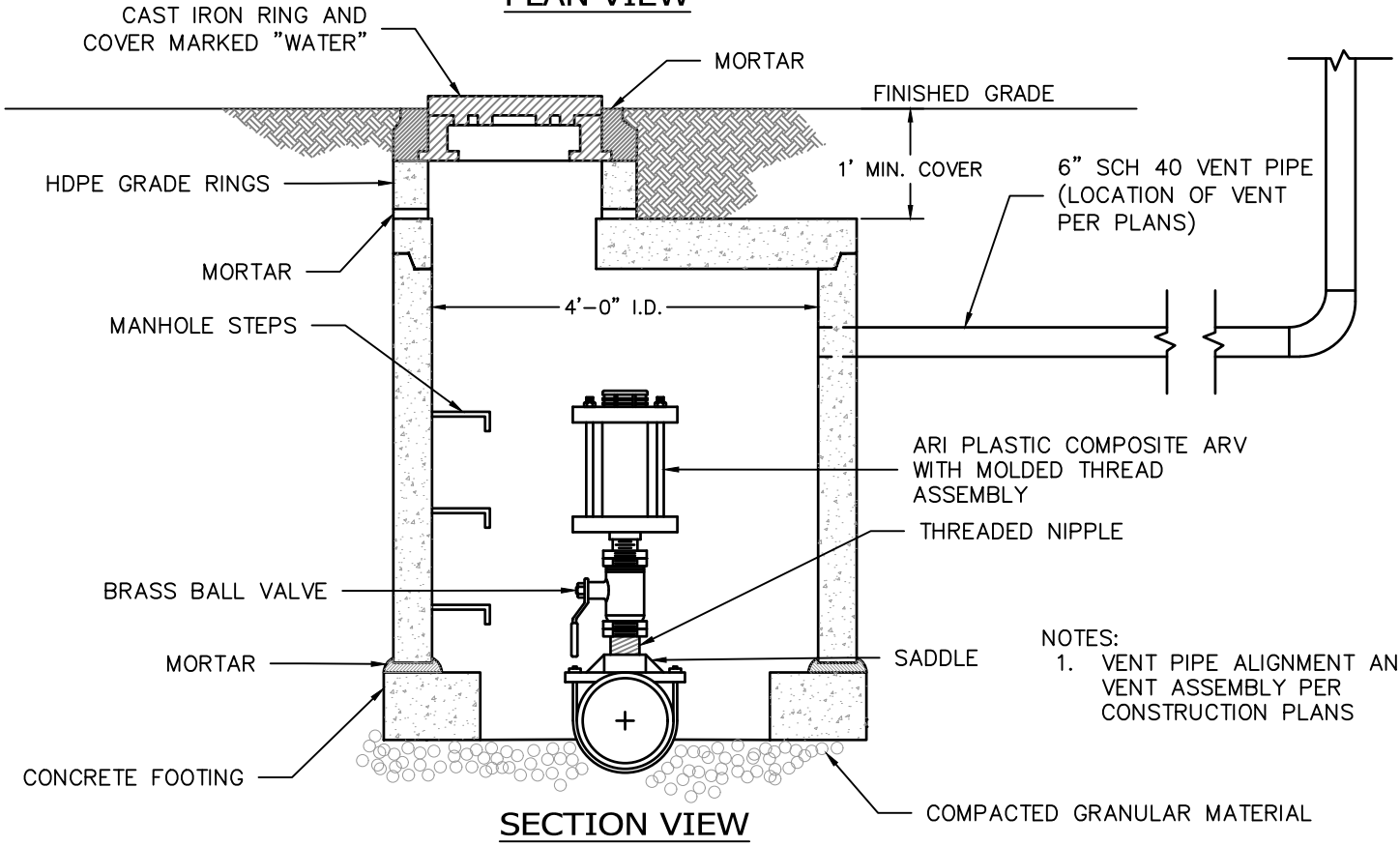
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DATE APPROVED:	06/2026
DATE REVISED:	2026
	1ST EDITION

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W-18



PLAN VIEW

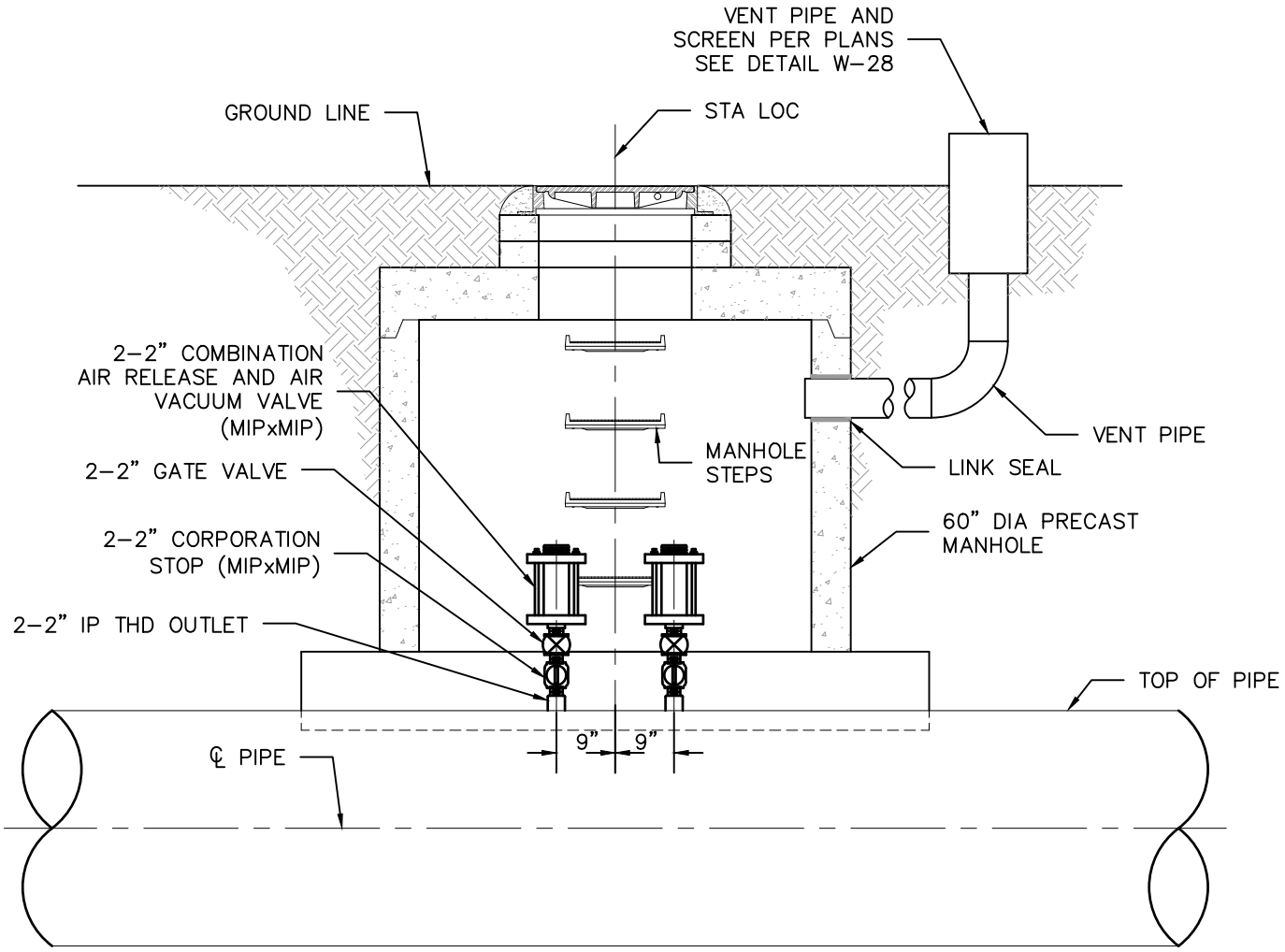


NOTES:
1. VENT PIPE ALIGNMENT AND VENT ASSEMBLY PER CONSTRUCTION PLANS

SECTION VIEW

TYPICAL AIR RELEASE VALVE

FORT COLLINS-LOVELAND WATER DISTRICT 5150 SNEAD DRIVE FORT COLLINS, CO 80525 970.226.3104	**TYPICAL CONSTRUCTION DETAILS**	SCALE: NOT TO SCALE DATE APPROVED: 06/2026 DATE REVISED: 2026 1ST EDITION	**DRAWING** **W-19**



DOUBLE 2 INCH ARV - STEEL

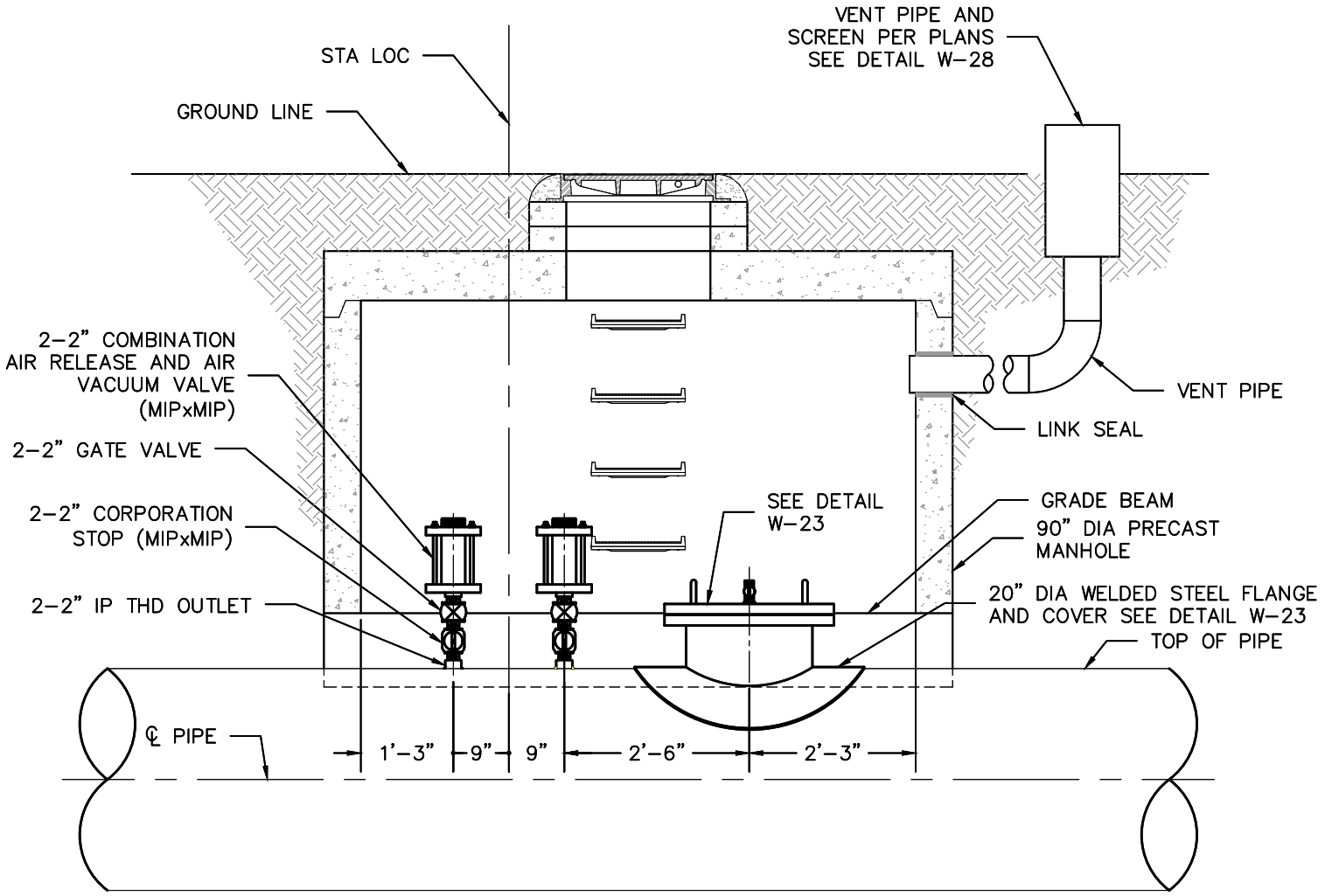
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

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	1ST EDITION

DRAWING

W-20



DOUBLE 2 INCH ARV WITH ACCESS - STEEL

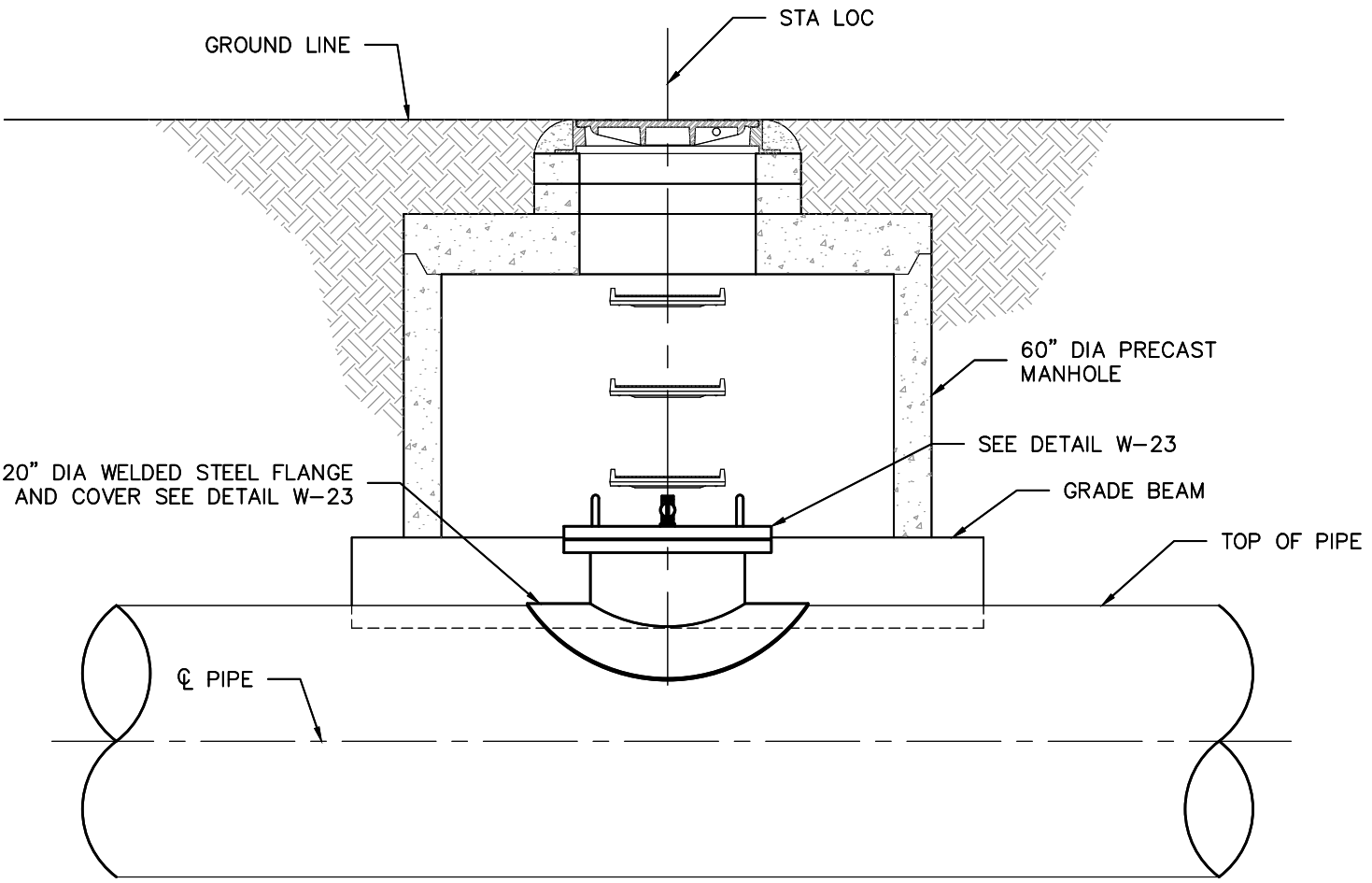
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

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DATE APPROVED:	06/2026
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W-21



20 INCH DIA ACCESS - STEEL

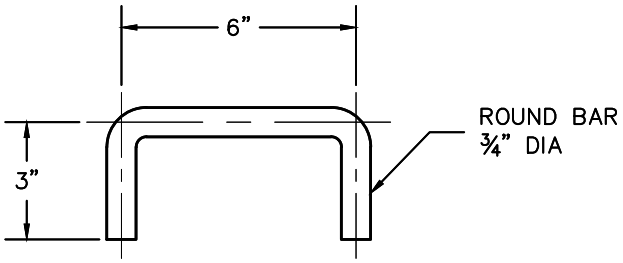
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

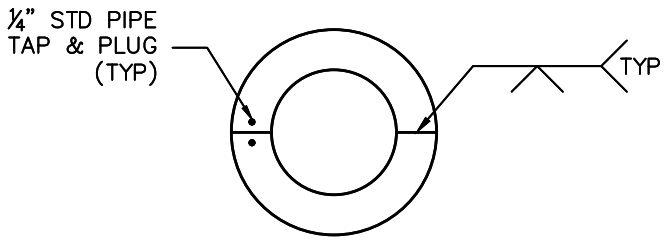
SCALE:	NOT TO SCALE
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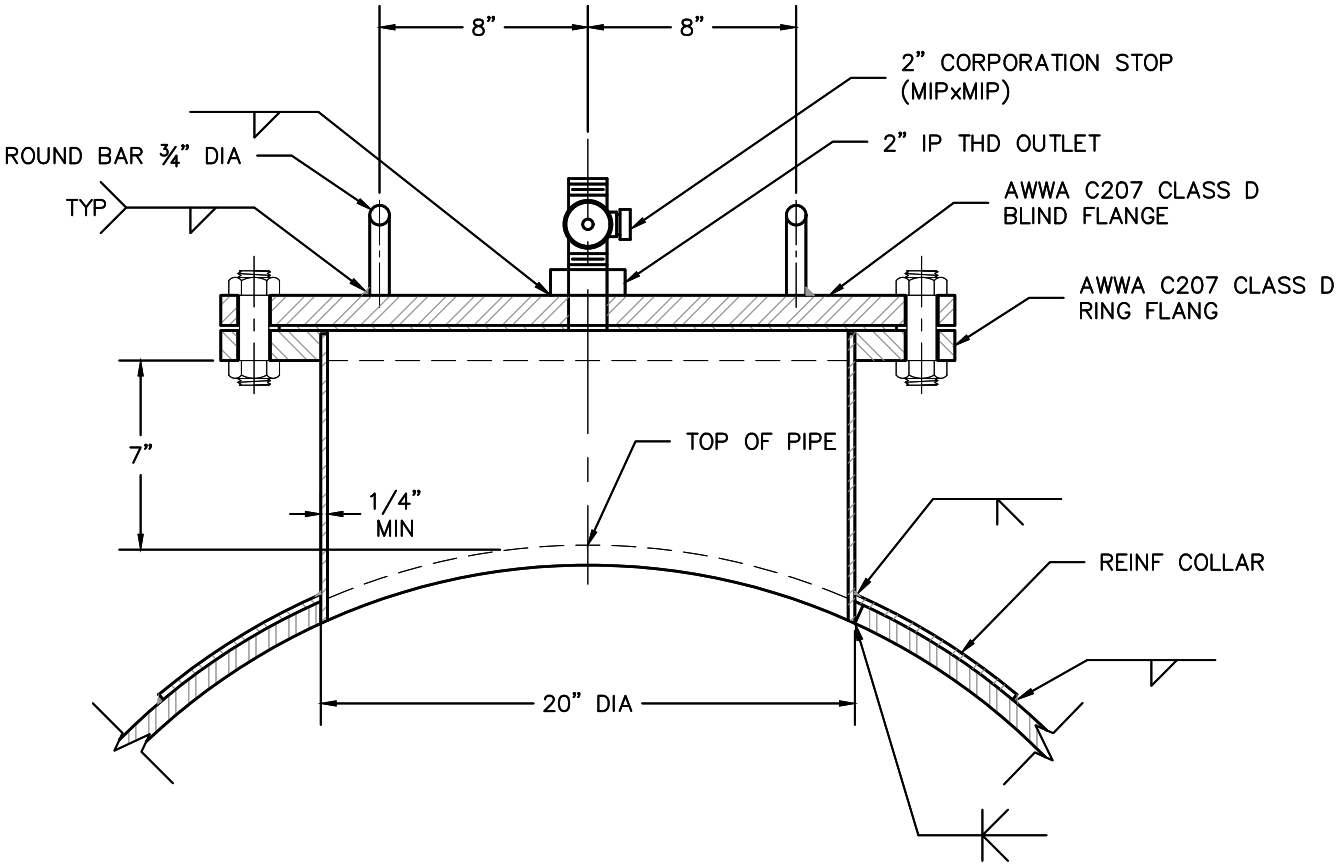
W-22



HANDLE



REINFORCING COLLAR



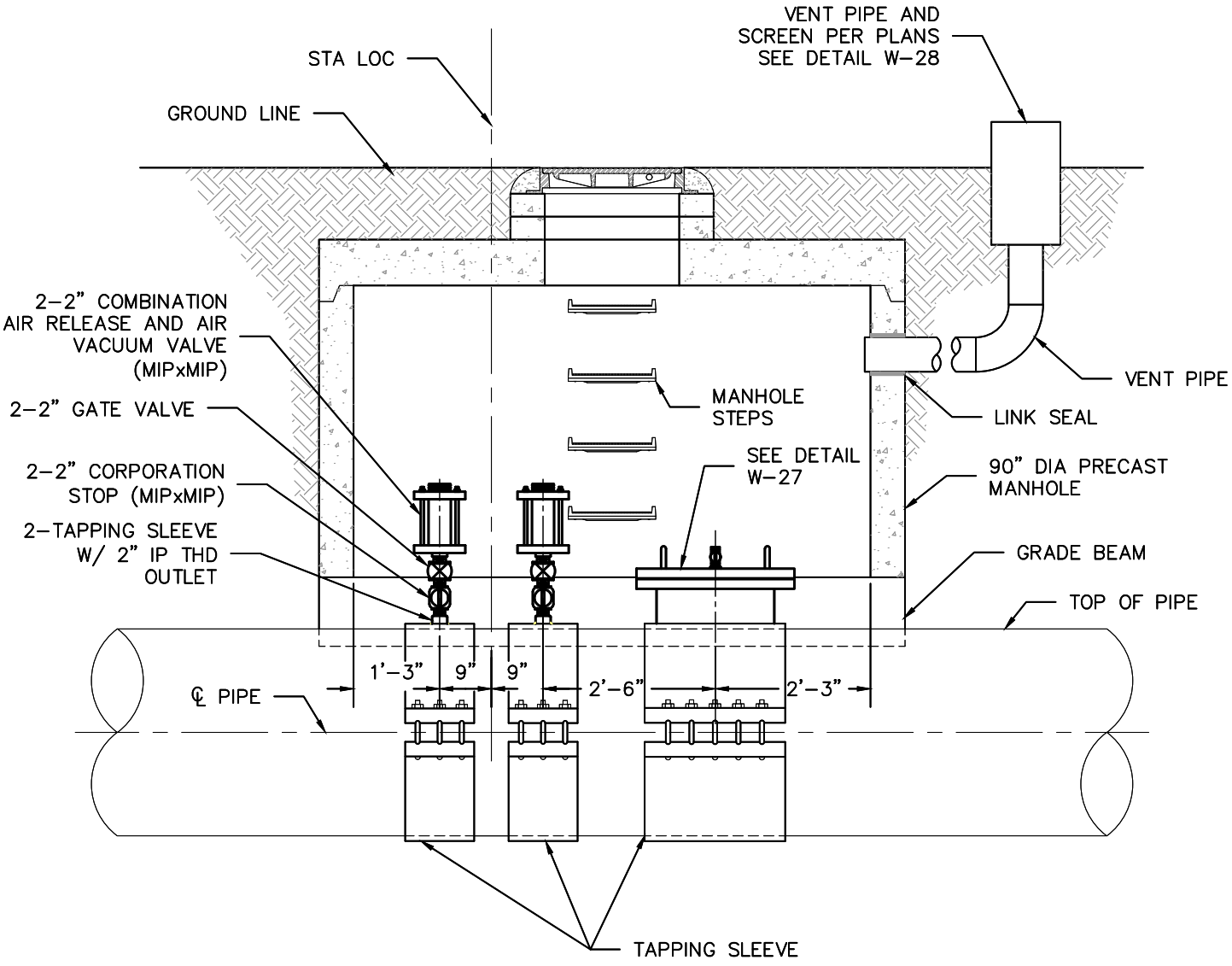
20 INCH ACCESS DETAIL - STEEL

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5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

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DATE APPROVED: 06/2026
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DOUBLE 2 INCH ARV WITH ACCESS - DIP OR PVC

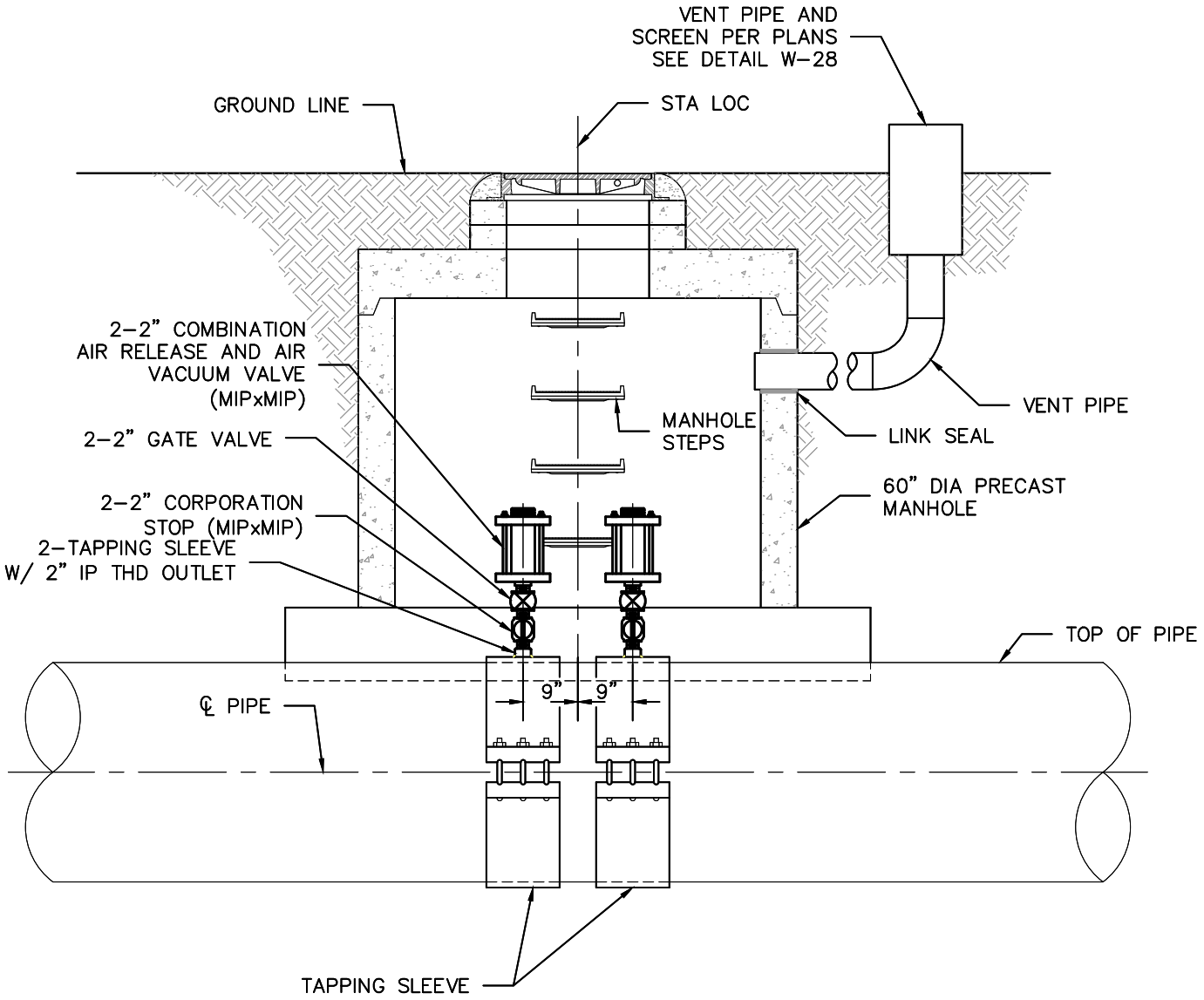
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

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	1ST EDITION

DRAWING

W-24



DOUBLE 2 INCH ARV - DIP OR PVC

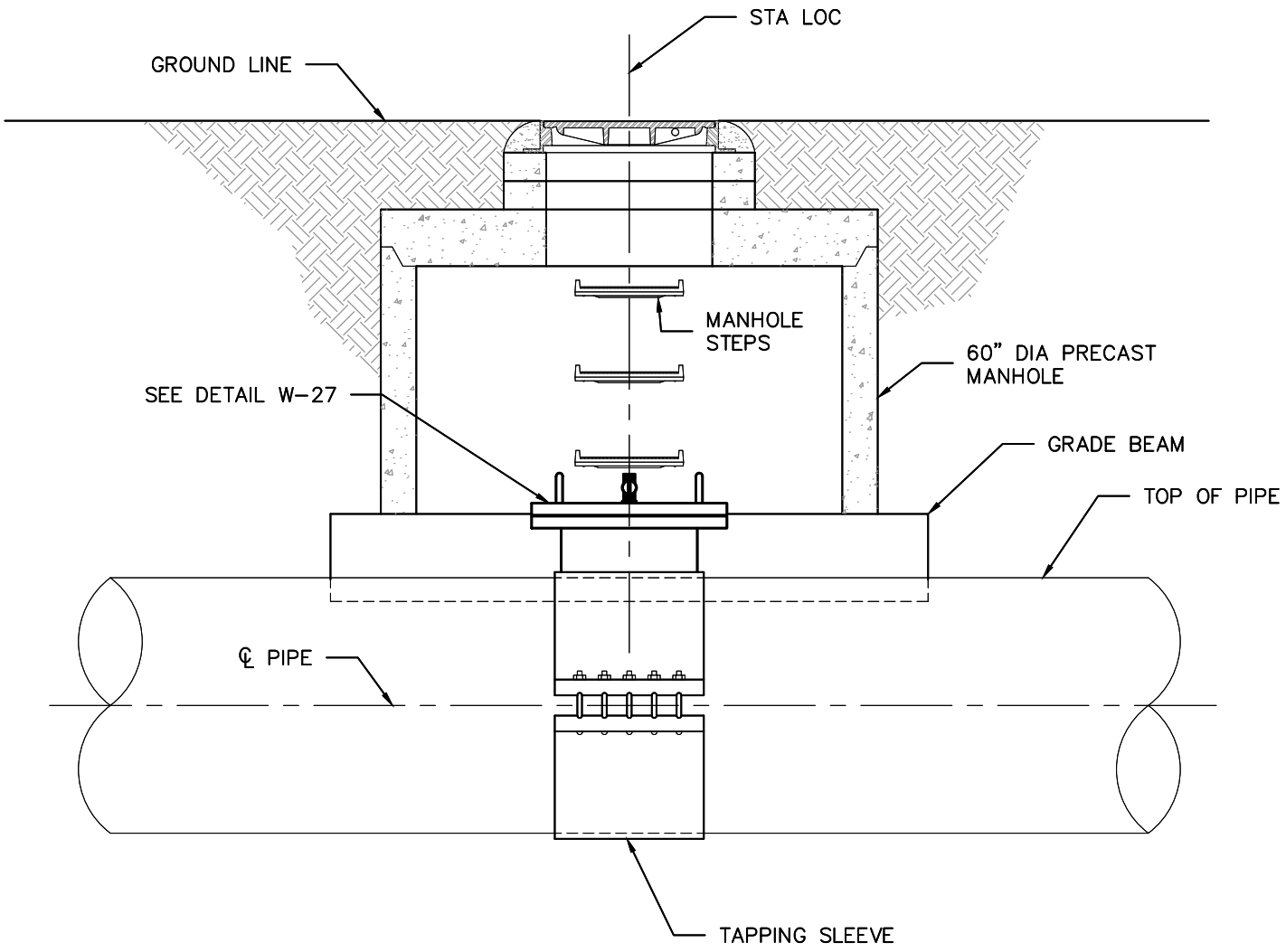
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
DATE APPROVED:	06/2026
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	1ST EDITION

DRAWING

W-25



20 INCH DIA ACCESS - DIP OR PVC

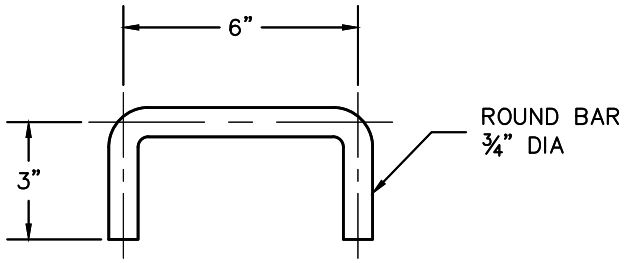
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

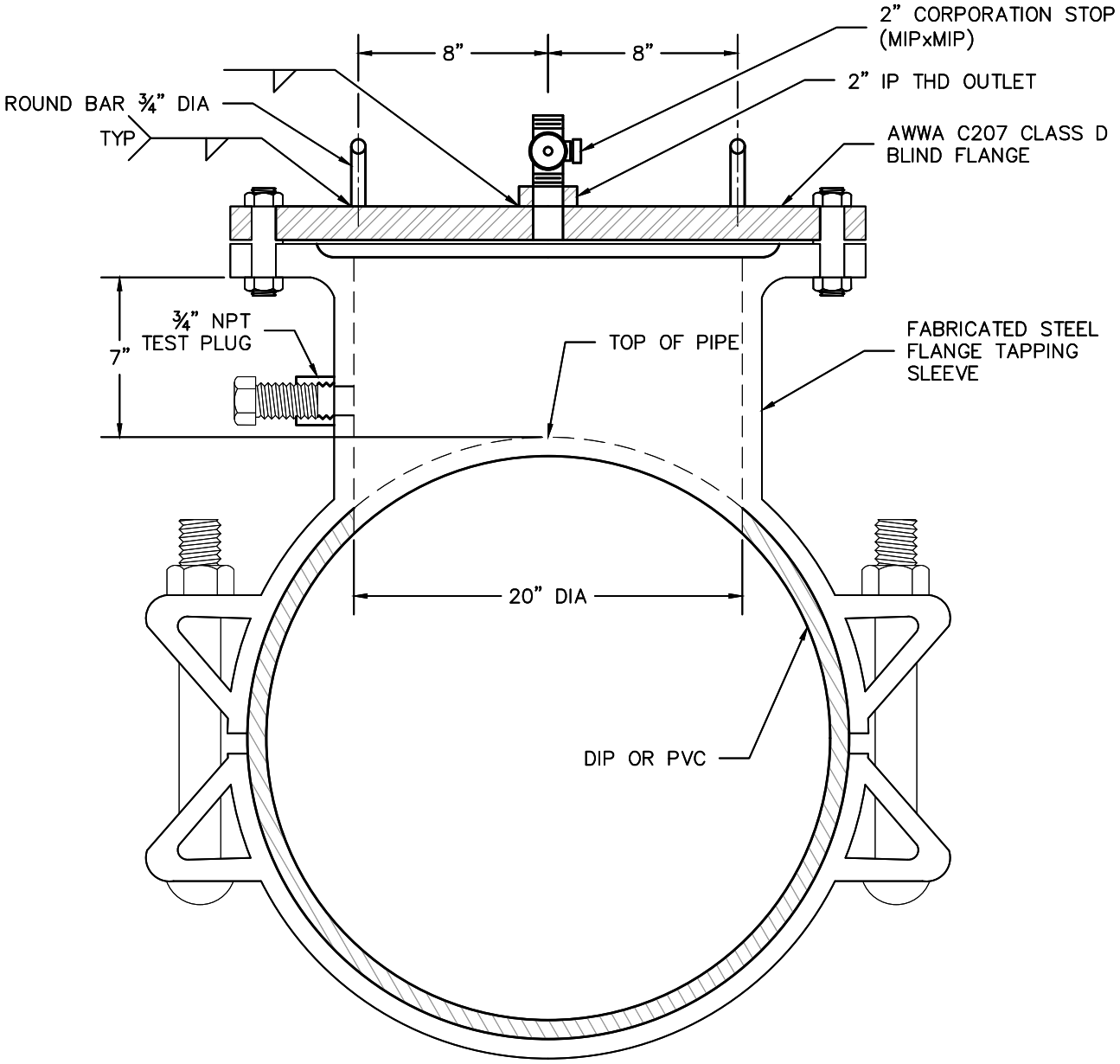
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DATE APPROVED:	06/2026
DATE REVISED:	2026
	1ST EDITION

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W-26



HANDLE



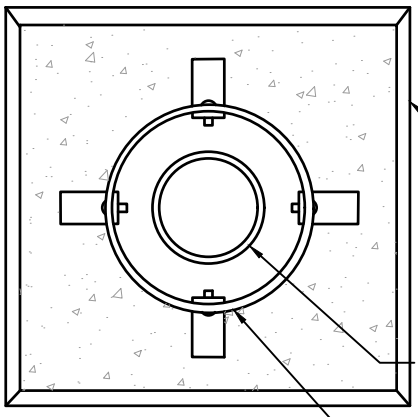
20 INCH DIA ACCESS DETAIL - DIP OR PVC

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
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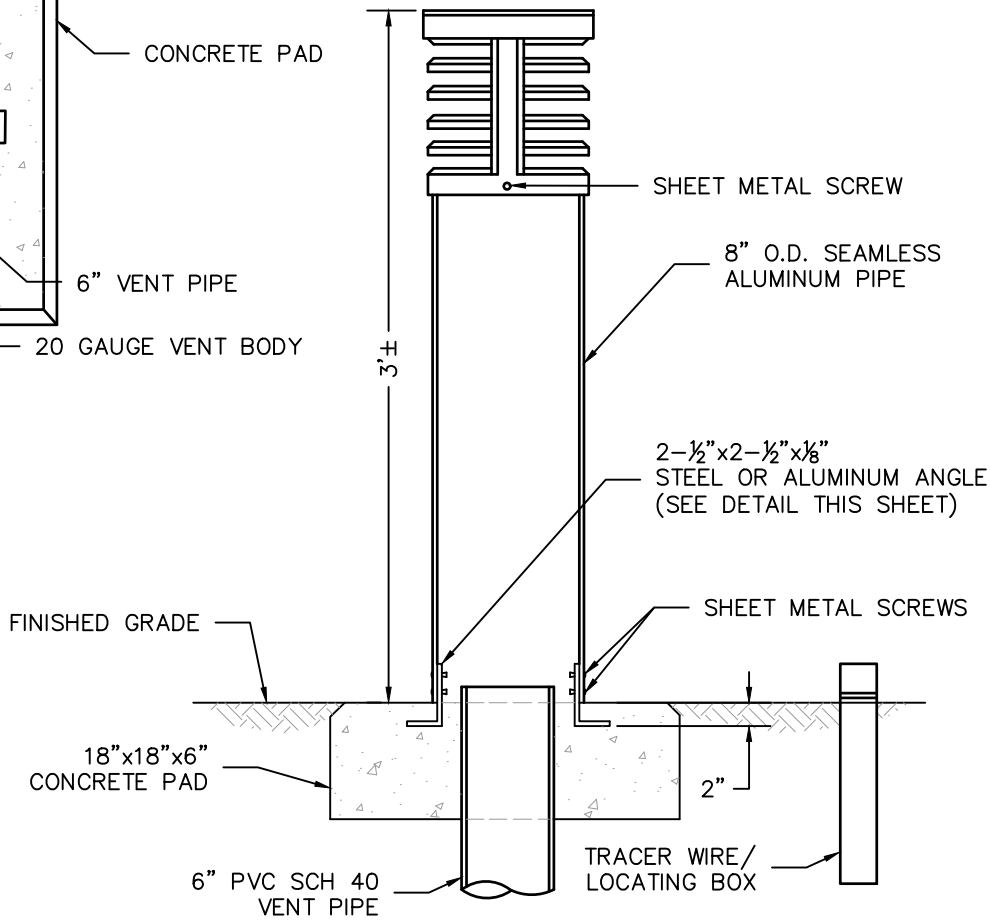
TYPICAL CONSTRUCTION DETAILS

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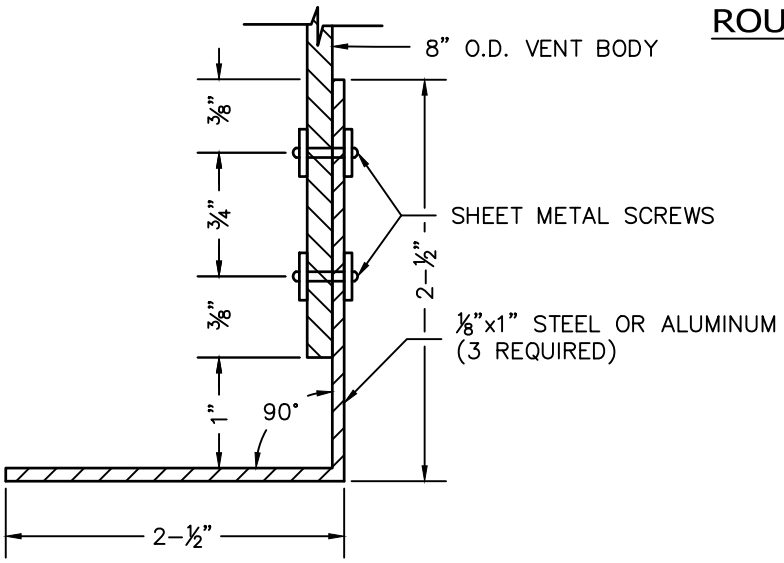
DRAWING
W-27



BASE DETAIL



ROUND VENT SCREEN



NOTES:
1. COLOR SHALL BE FLAT BLACK UNLESS OTHERWISE SPECIFIED.
2. FOR USE IN RESIDENTIAL AREAS ONLY AND AS APPROVED BY THE DISTRICT.

STEEL OR ALUMINUM ANGLE DETAIL

TYPICAL VENT

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5150 SNEAD DRIVE
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970.226.3104

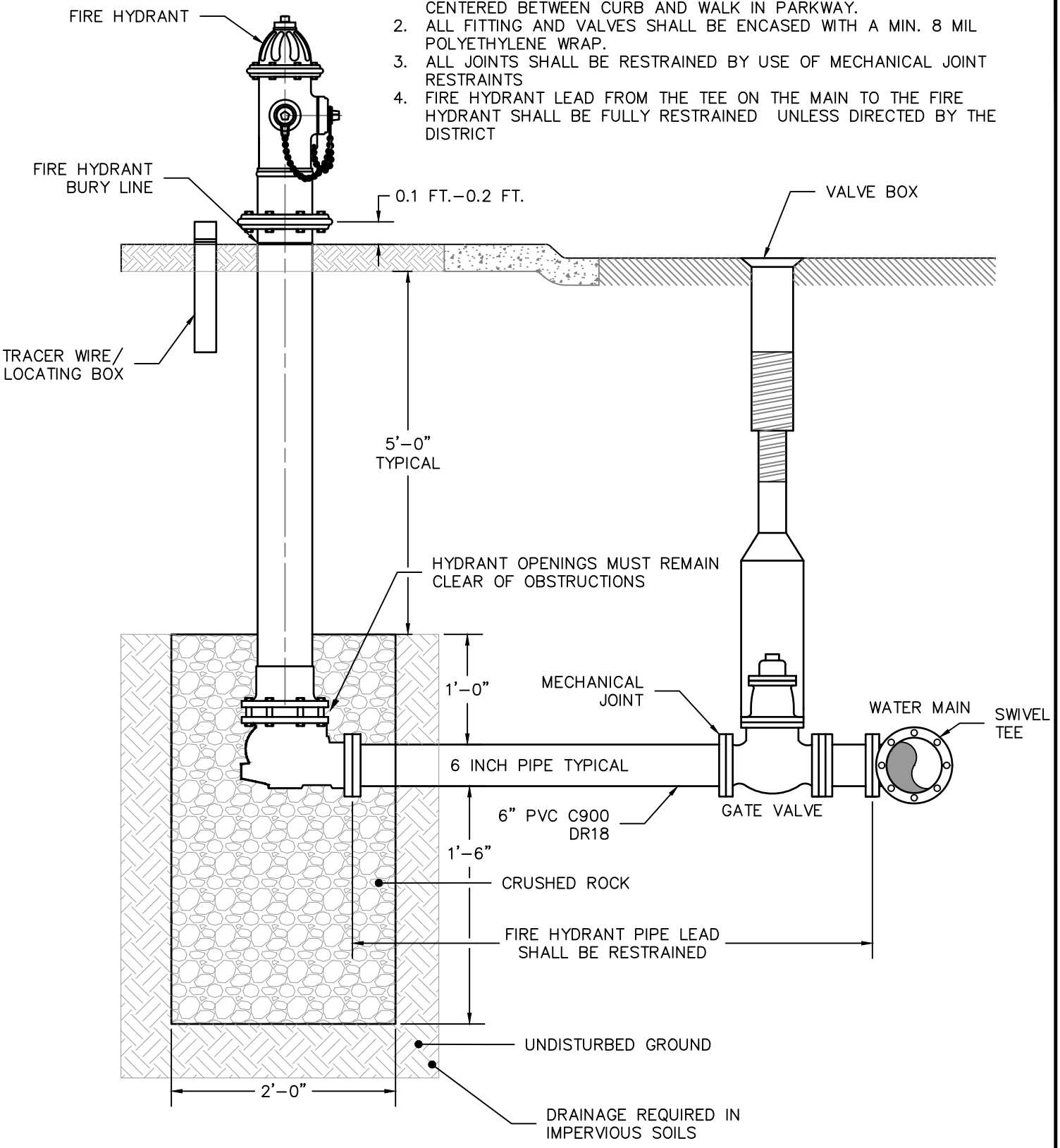
TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
DATE APPROVED:	09/2026
DATE REVISED:	2026
	1ST EDITION

DRAWING
W-28

NOTES:

1. FIRE HYDRANTS SHALL BE LOCATED 2' MIN. FROM BACK OF CURB OR BACK EDGE OF SIDEWALK OR 10' MIN FROM EDGE OF PAVEMENT IF NO CURB IS PRESENT. FOR DETACHED WALK, HYDRANT SHOULD BE CENTERED BETWEEN CURB AND WALK IN PARKWAY.
2. ALL FITTING AND VALVES SHALL BE ENCASED WITH A MIN. 8 MIL POLYETHYLENE WRAP.
3. ALL JOINTS SHALL BE RESTRAINED BY USE OF MECHANICAL JOINT RESTRAINTS
4. FIRE HYDRANT LEAD FROM THE TEE ON THE MAIN TO THE FIRE HYDRANT SHALL BE FULLY RESTRAINED UNLESS DIRECTED BY THE DISTRICT

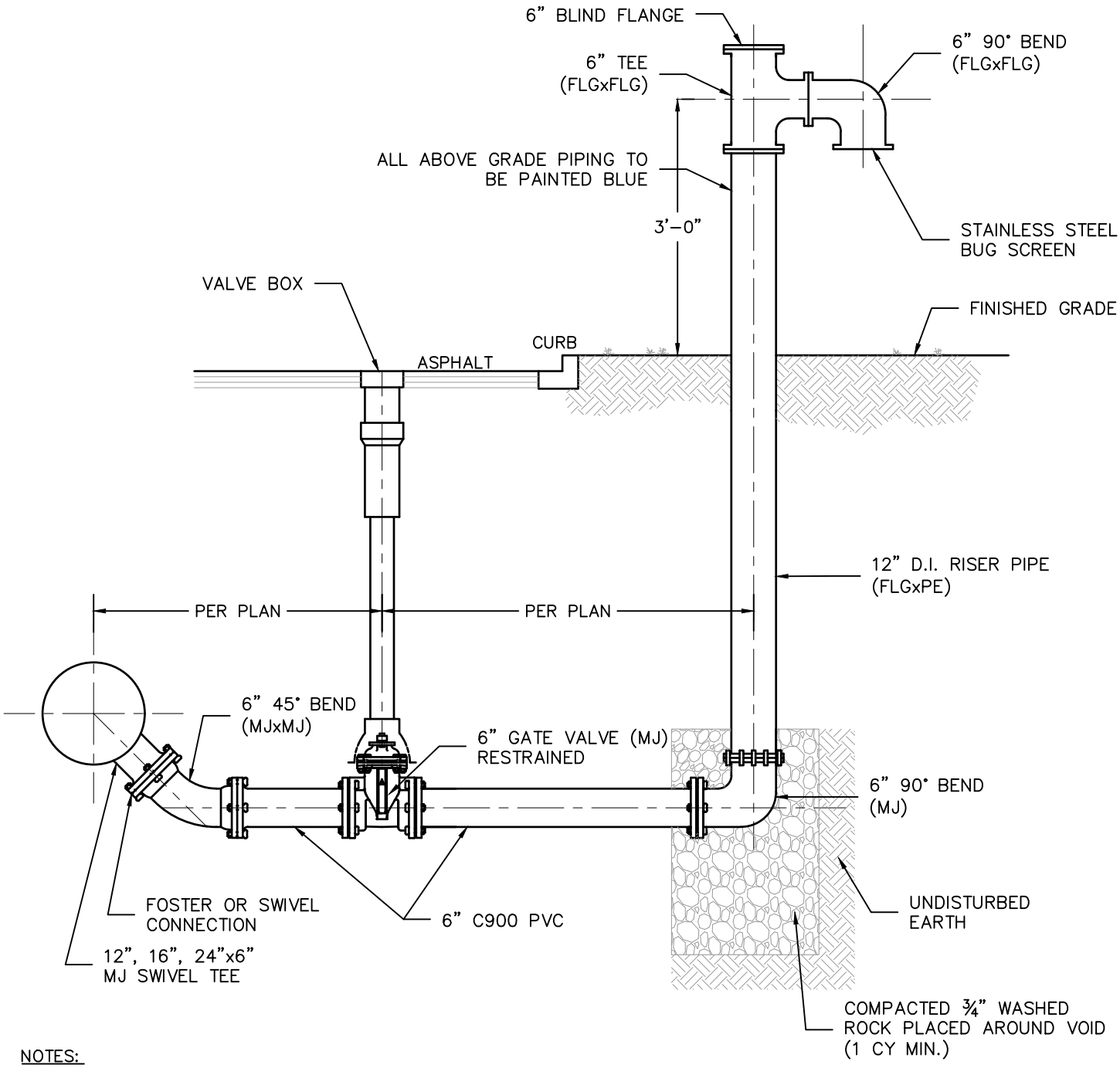


TYPICAL FIRE HYDRANT DETAIL

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

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DATE APPROVED: 06/2026	**W-29**
DATE REVISED: 2026	
1ST EDITION	



NOTES:
1. DIP MATERIALS MAY BE INSTALLED INSTEAD OF PVC, IF APPROVED BY THE DISTRICT.
2. SEE 31 23 35 FOR TYPICAL TRENCH AND BACKFILL REQUIREMENTS.

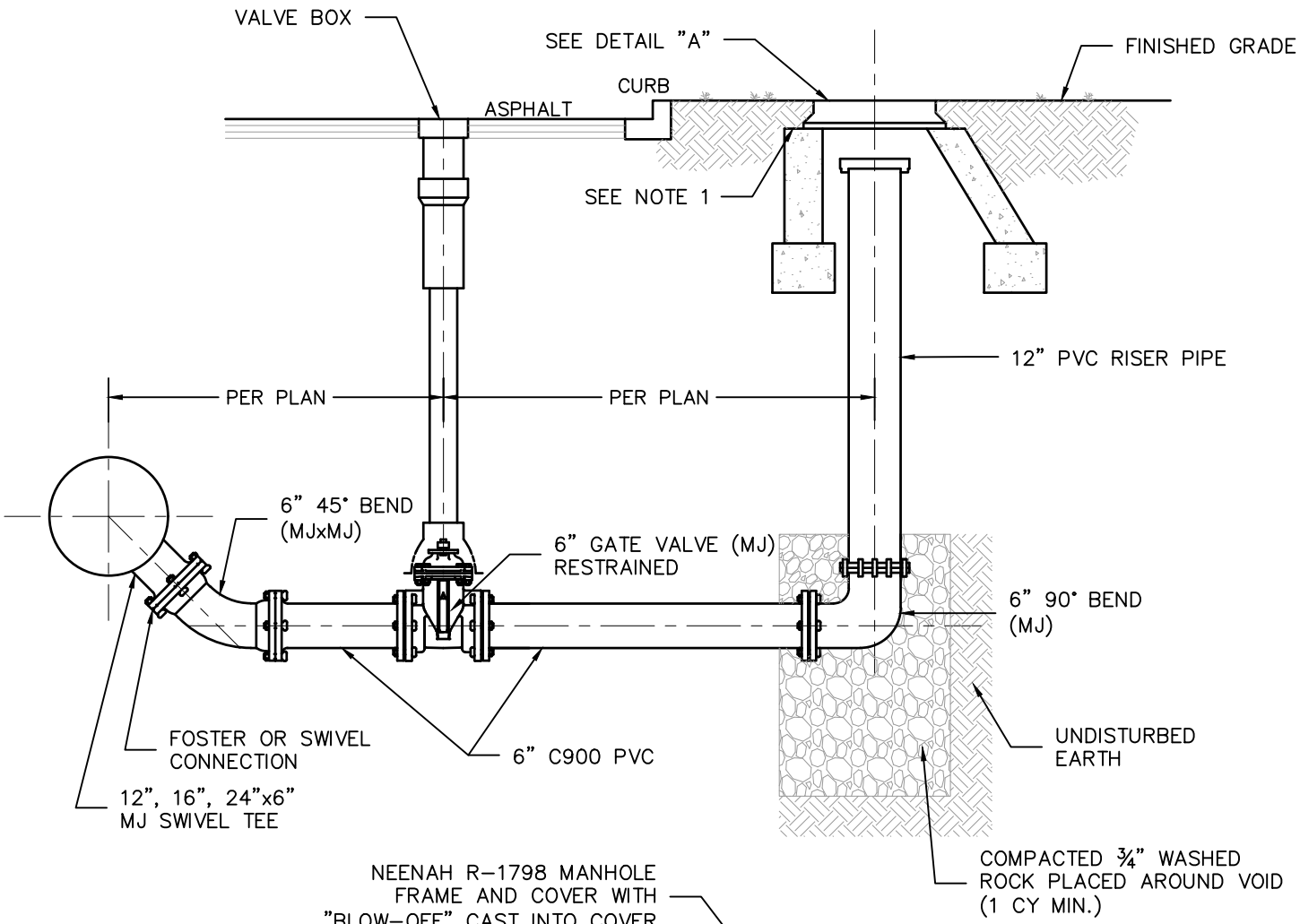
ABOVE GRADE BLOWOFF

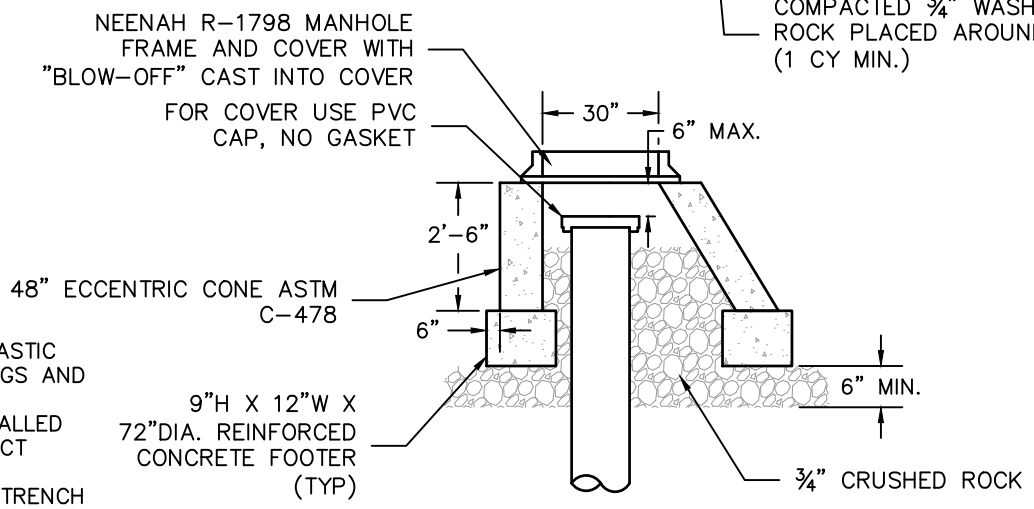
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
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W-30A





DETAIL A

NOTES:

1. INSTALL ONE PREFORMED PLASTIC GASKET BETWEEN GRADE RINGS AND FRAME.
2. DIP MATERIALS MAY BE INSTALLED INSTEAD OF PVC, PER DISTRICT STANDARDS.
3. SEE 31 23 35 FOR TYPICAL TRENCH AND BACKFILL REQUIREMENTS.

DETAIL APPROVED FOR	
PROJECT NAME	PHASE
APPROVED BY	DATE

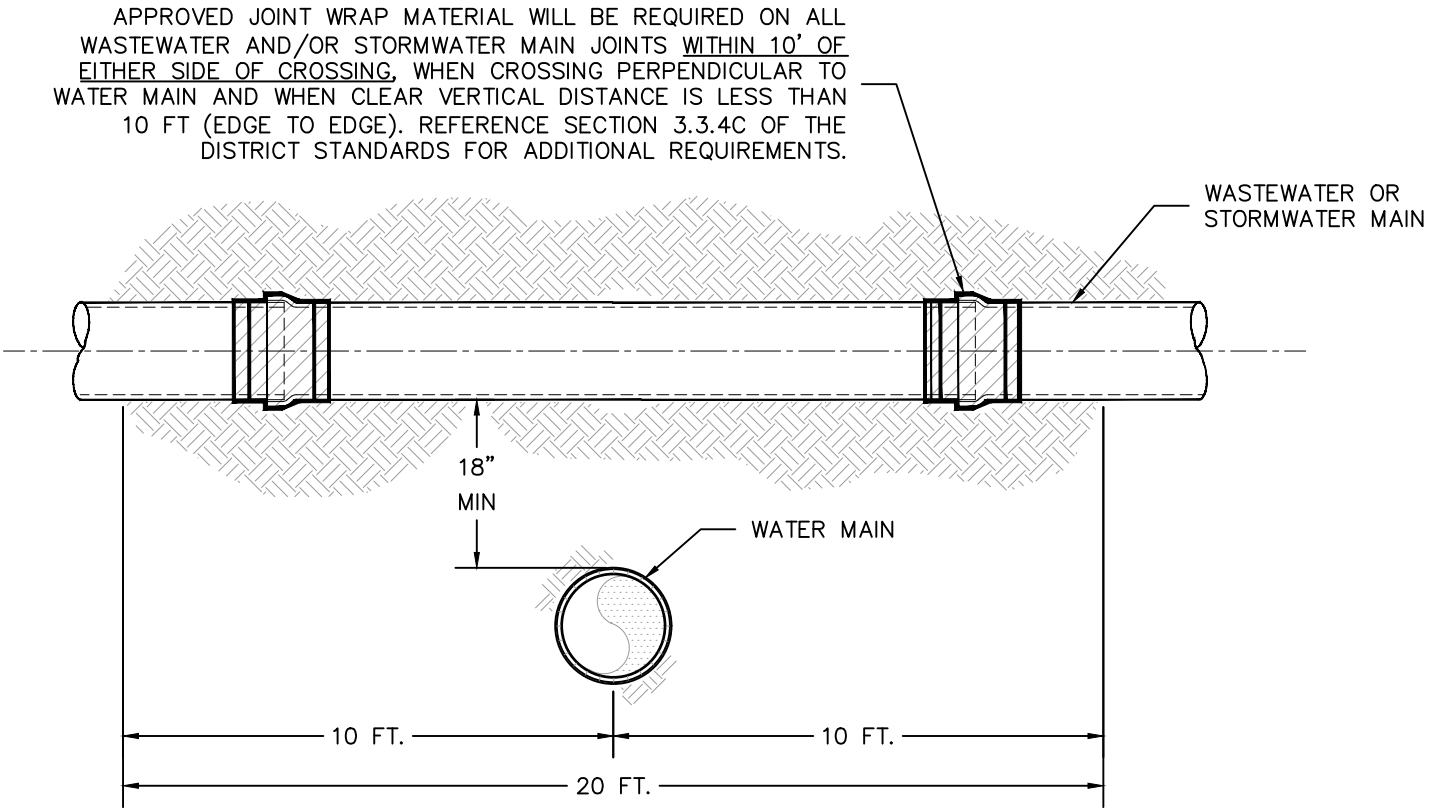
BELOW GRADE BLOWOFF

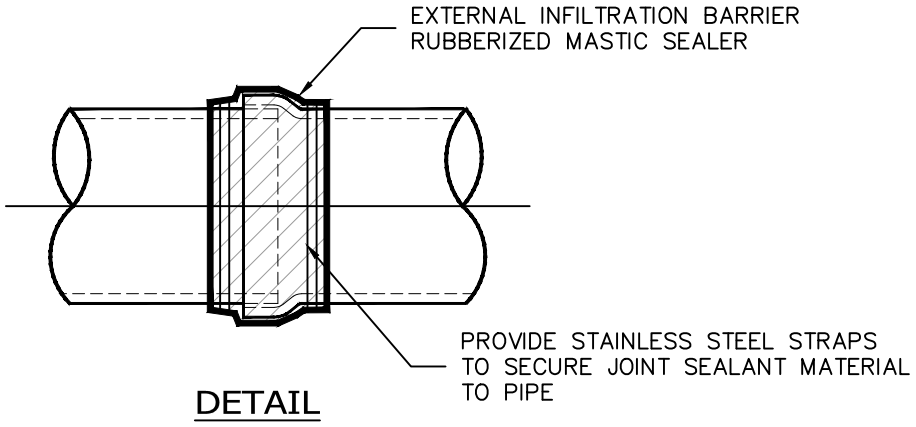
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
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TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE
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W-30B





DETAIL

NOTES:

1. EXTERNAL JOINT SEALANT SHALL MEET ASTM C-877, TYPE II (MESH REINFORCED), WITH ADDITIONAL STAINLESS STEEL BAND. INSTALL PER MANUFACTURERS INSTRUCTIONS.
2. CROSSINGS LESS THAN 18 INCHES ARE TYPICALLY NOT ALLOWED. SPECIAL CASES MAY BE ALLOWED WITH PRIOR APPROVAL BY THE DISTRICT.

JOINT WRAP

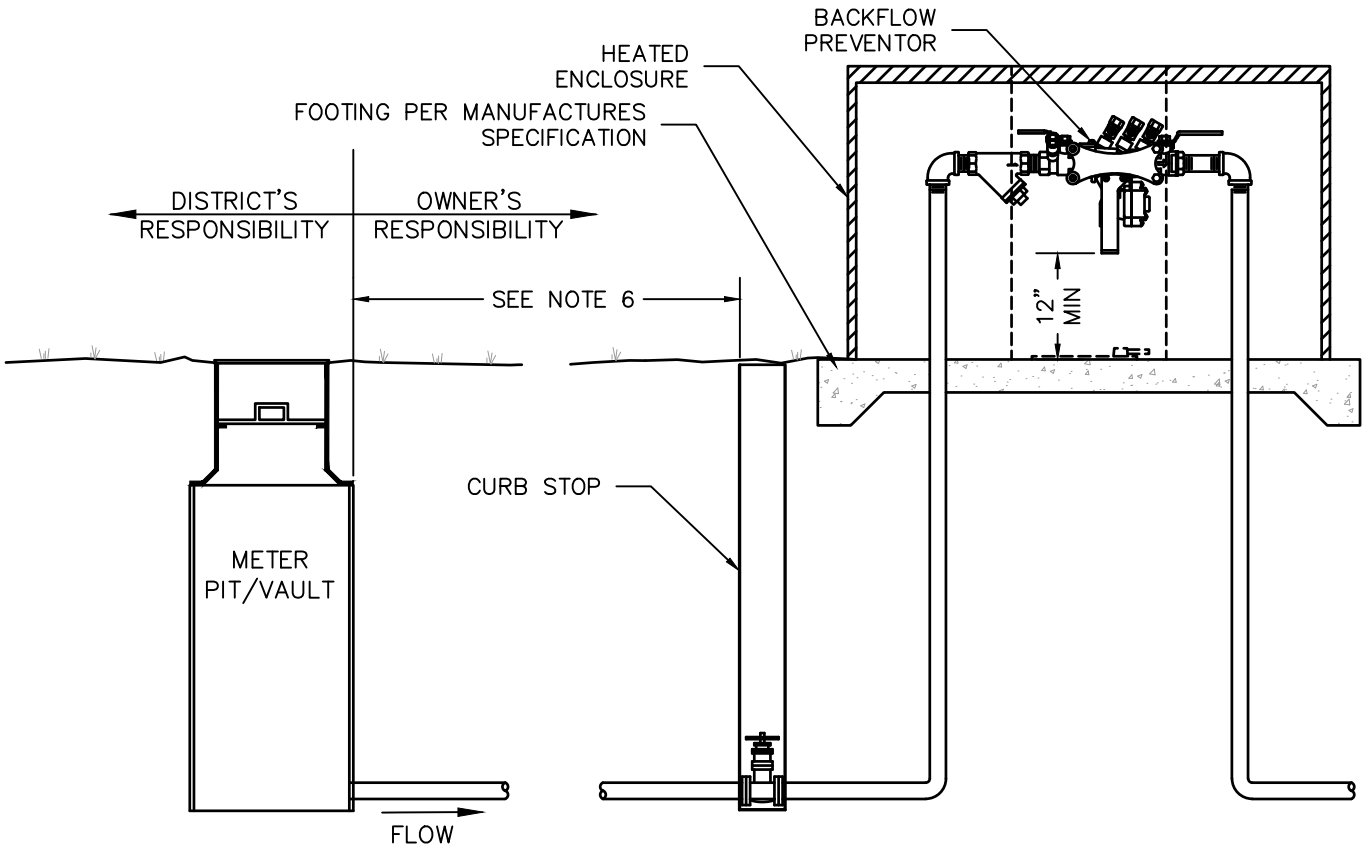
FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
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TYPICAL CONSTRUCTION DETAILS

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NOTES:

1. BACKFLOW PREVENTOR EXTERIOR ENCLOSURE SHALL BE HEATED.
2. OWNER/CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE PROPER PERMITS FROM BUILDING DEPARTMENT (PLUMBING AND ELECTRICAL).
3. OWNER IS RESPONSIBILITY FOR GETTING ELECTRICAL SERVICE TO THE ENCLOSURE AND ALL WORK SHALL BE COMPLETED BY AN ELECTRICIAN.
4. ALL ELECTRICAL OUTLETS SHALL BE WATER PROOF/WATER TIGHT.
5. OWNER SHALL ACKNOWLEDGE ELECTRICAL HAZARD WITH WATER SYSTEM.
6. CURB STOP VALVE SHALL BE MINIMUM DISTANCE FROM OUTSIDE OF METER PIT/VAULT BASED ON SERVICE SIZED:
   - ¾" TO 2" CURB STOP VALVE TO BE LOCATED A MINIMUM OF 6' FROM NEAREST EDGE OF METER PIT/VAULT
   - 3", 4" AND 6" CURB STOP VALVE TO BE LOCATED A MINIMUM OF 10' FROM NEAREST EDGE OF METER PIT/VAULT
7. SERVICE LINE SHUT OFF VALVE CAN NOT BE STOP AND WASTE VALVE.
8. ALL DEVICES SHALL BE ASSE/USC APPROVED.
9. ADEQUATE DRAIN TO DAYLIGHT FOR RELIEF VALVE DISCHARGE.
10. BACKFLOW PREVENTOR ENCLOSURE SHALL HAVE ADEQUATE ROOM FOR TESTING AND MAINTENANCE. IF PARALLEL DEVICES ARE REQUIRED ENCLOSURE SHALL BE SIZED ACCORDINGLY.
11. BACKFLOW PREVENTOR NEEDS TO BE A MINIMUM OF 12" ABOVE ENCLOSURE FLOOR OR CONCRETE PAD.
12. DO NOT BLOW AIR THROUGH THE BACKFLOW ASSEMBLY.
13. NO CONNECTIONS BEFORE BACKFLOW PERVENTOR SHALL BE PERMITTED WITH THE EXCEPTIONS OF CURB STOP.

DETAIL APPROVED FOR	
PROJECT NAME	PHASE
APPROVED BY	DATE

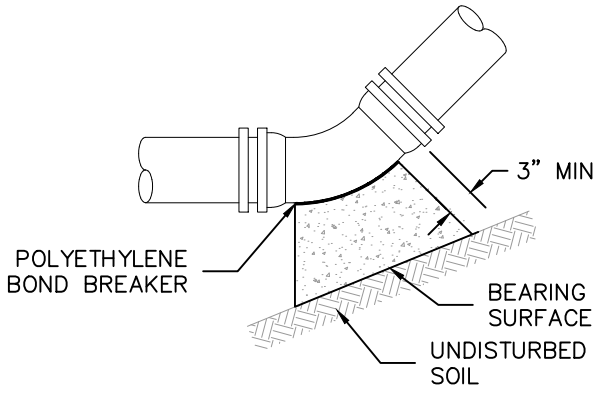
BACKFLOW ENCLOSURE

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
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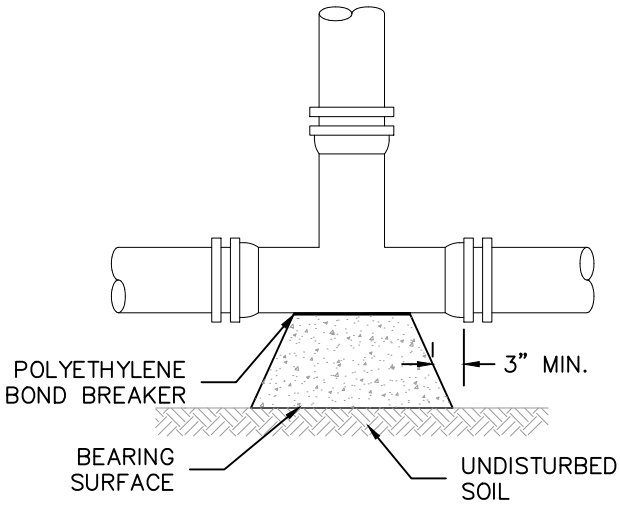
TYPICAL CONSTRUCTION DETAILS

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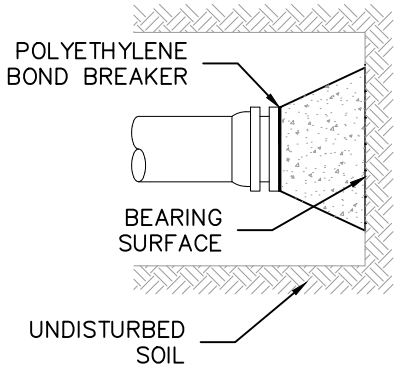
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W-32



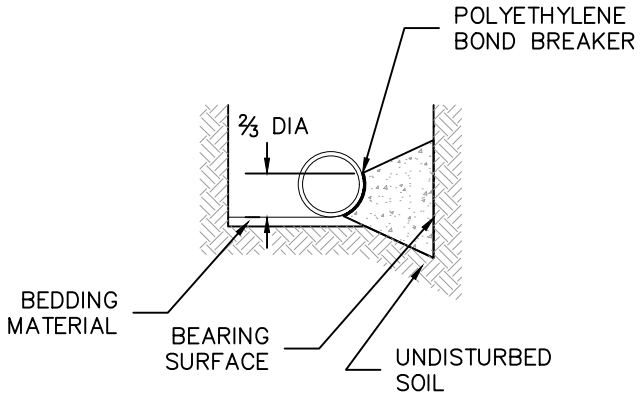
TYPICAL BEND



TEE



PLUG



TYPICAL CROSS-SECTION

MINMUM BEARING SURFACE AREA (SQ. FT.)					
PIPE SIZE	BENDS				TEE OR PLUG
	11 ¼°	22 ½°	45°	90°	
6"	0.7	1.4	2.9	5.3	3.8
8"	1.2	2.5	5.0	9.3	6.5
12"	2.6	5.2	10.2	18.8	13.3

NOTES:
1. BEARING SURFACE AREAS SHOWN IN CHART ARE MINIMUM.
2. ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE.
3. DATA IN TABLE IS BASED ON A PIPELINE TEST PRESSURE OF 150 PSI (MIN.) AND A SOIL BEARING CAPACITY OF 1,000 LB/SQ. FT. ADJUST THE DIMENSIONS AS REQUIRED TO SUIT THE FIELD CONDITIONS ENCOUNTERED BY ENGINEER.
4. THRUST BLOCKS ON PIPE LARGER THAN 12 INCHES DIAMETER SHALL BE DESIGNED FOR CONDITIONS EXISTING AT THE INSTALLATION SITE.

DETAIL APPROVED FOR	
PROJECT NAME	PHASE
APPROVED BY	DATE

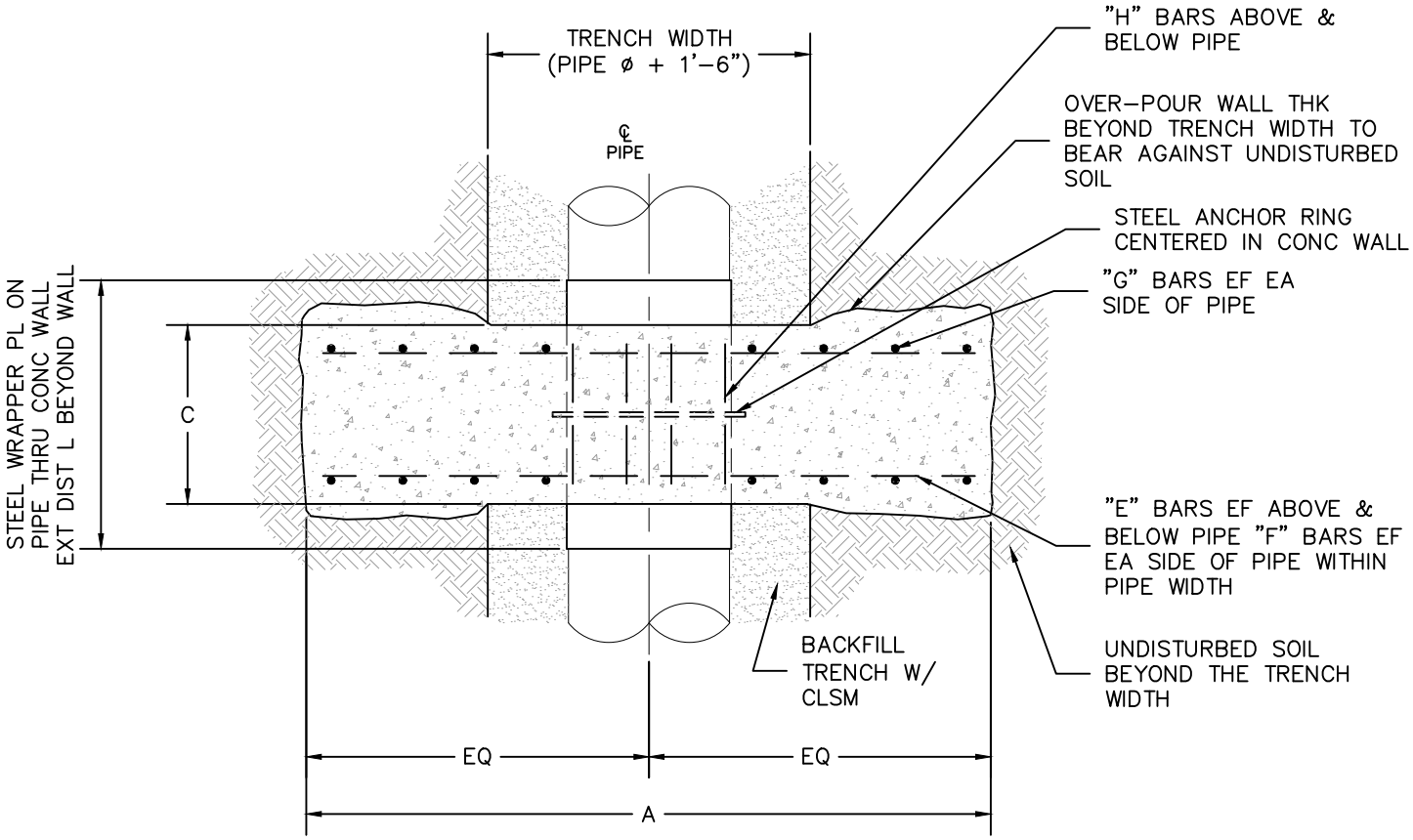
TYPICAL CONCRETE THRUST BLOCKS

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
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TYPICAL CONSTRUCTION DETAILS

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DRAWING
W-TB



PLAN

(SEE TW-02 FOR ELEVATION & TYPICAL SECTION)

	CONCRETE WALL DIMENSIONS			CONCRETE WALL REINFORCEMENT					THICKENED STEEL PIPE AT THRUST WALL (NOTE 1)		STEEL ANCHOR RING		
PIPE ø (NOMINAL)	WIDTH A	DEPTH B	THK C	"E" BARS	"F" BARS	"G" BARS	"H" BARS	"J" BARS	EXT LENGTH L	MIN TOTAL THK M	HEIGHT N	MIN THK P	MIN WELD SIZE Tw
24"	12'-0"	6'-0"	1'-10"	4-#6	3-#6	7-#6	4-#4	2-#6x6'-0"	7"	1/2"	1 1/2"	1/2"	1/4"
30"	18'-0"	7'-6"	3'-0"	4-#6	3-#6	7-#6	4-#4	2-#6x6'-0"	6"	3/4"	2"	5/8"	5/16"
36"	21'-0"	9'-0"	3'-9"	6-#9	4-#9	12-#7	4-#4	3-#6x8'-0"	10"	1"	2"	1"	5/16"

NOTES:

1. THE MINIMUM WRAPPER PLATE THICKNESS (TR) SHALL BE DIMENSION (M) LESS THE BASE PIPE THICKNESS (TS). THE FILLET WELD SIZE SHALL BE EQUAL TO THE THINNEST OF THE WRAPPER PLATE (TR) OR (TS).
2. CONCRETE SHALL BE CLASS D STRUCTURAL CONCRETE IN ACCORDANCE WITH SPECIFICATION SECTION 03 30 00.
3. DESIGN THRUST PRESSURES = 150 POUNDS PER SQUARE INCH + 70 POUNDS PER SQUARE INCH WATER HAMMER = 220 POUNDS PER SQUARE INCH FOR THE LARGEST PIPE DIAMETER INFLUENCING THE VALVE ADJACENT TO THE THRUST WALL.
4. DESIGN ALLOWABLE PASSIVE BEARING PRESSURES ARE LOCATION SPECIFIC AS PROVIDED IN THE PROJECT GEOTECHNICAL AND ENVIRONMENTAL EVALUATION.
5. FIELD COORDINATE ALL EXISTING UTILITIES AND OBSTRUCTIONS PRIOR TO THRUST WALL EXCAVATION.

DETAIL APPROVED FOR	
PROJECT NAME	PHASE
APPROVED BY	DATE

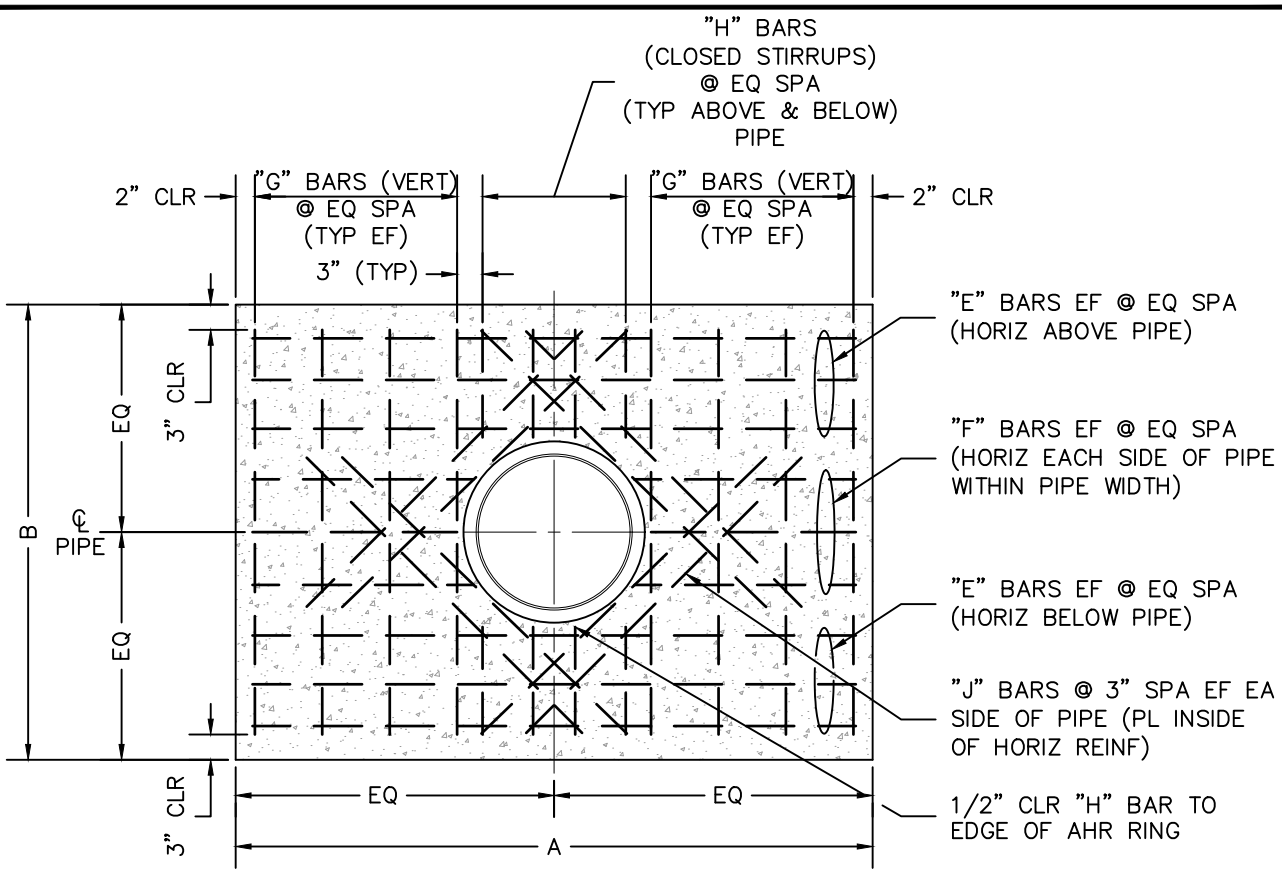
TYPICAL THRUST WALL - PLAN VIEW

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

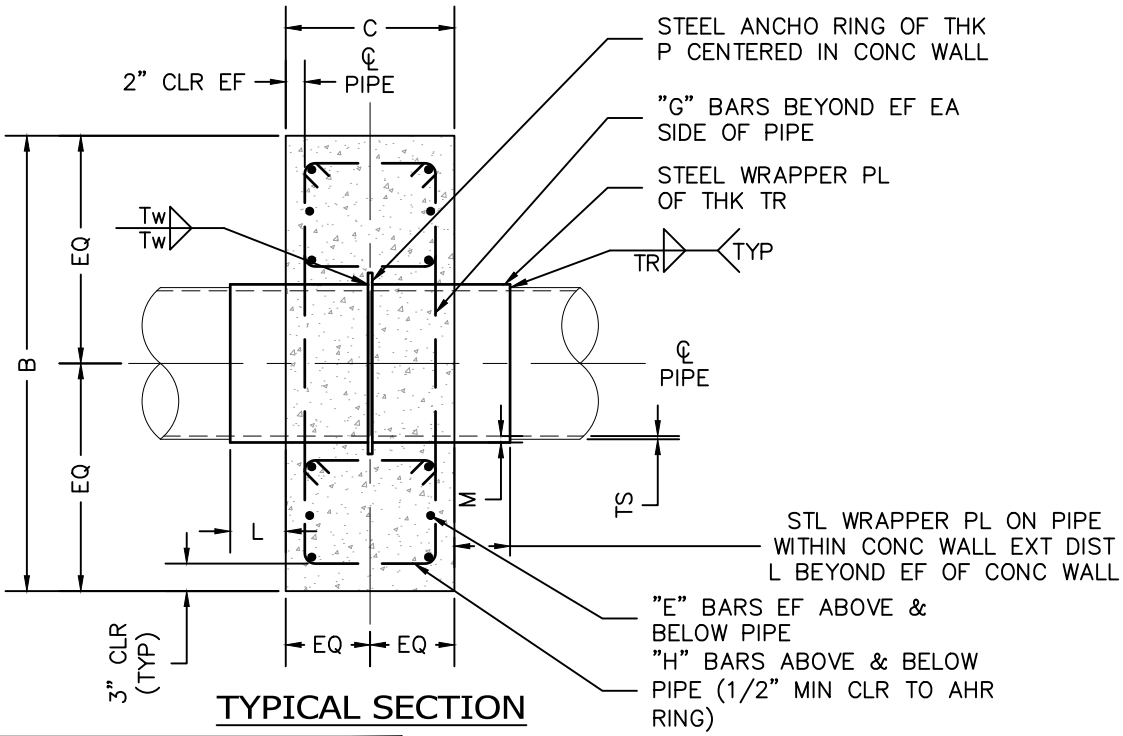
TYPICAL CONSTRUCTION DETAILS

SCALE: NOT TO SCALE
DATE APPROVED: 06/2026
DATE REVISED: 2026
1ST EDITION

DRAWING
TW-01



ELEVATION



TYPICAL SECTION

DETAIL APPROVED FOR	
PROJECT NAME	PHASE
APPROVED BY	DATE

TYPICAL THRUST WALL - SECTION

FORT COLLINS-LOVELAND WATER DISTRICT
5150 SNEAD DRIVE
FORT COLLINS, CO 80525
970.226.3104

TYPICAL CONSTRUCTION DETAILS

SCALE:	NOT TO SCALE
DATE APPROVED:	06/2026
DATE REVISED:	2026
	1ST EDITION

DRAWING

TW-02