Loveland Water and Power

Water and Wastewater Development Standards

2024 Edition

Effective Date: June 1, 2024

FORWARD

The City of Loveland's Water and Wastewater Development standards are intended to provide guidance for the design, review, and construction of those public utility improvements pertaining to water and wastewater in or under the public right-of-way or dedicated easements.

This document represents an attempt to assist those in the design, review, and construction industry to provide quality and long-lasting public utility improvements and facilities. The document also provides for consistency in the areas of design, review, and construction.

Kevin Gertig
Director of Utilities

CITY OF LOVELAND
WATER AND WASTEWATER DEVELOPMENT STANDARDS
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2024 Edition

The following Standards have been revised from the Standards currently in place and shall be binding and in full force and effective as of the above date.

All 12 versions since the original adoption date of August 2007 along with the following modifications are now known as the 2024 Edition.

The following technical modifications were made to this document:

Chapter/ Appendix (Original)	Section	Revision made to previous Edition	Policy or Technical (P/T)	Cost Impact (Y/N)
1	1.1, 1.4, 1.5, 1.7, 1.8, 1.10	Removed all references to LCUASS, clarified, updated & added definitions, updated inspection references (from Department to Public Works), City's role in enforcement of standards, clarified procedures for Reimbursement Agreements, and reformatted information.	T	no
2	2.1 2.8	Removed references to LCUASS, added SUE, inserted chapter 3, clarified process for record drawings, initial and final acceptance, added new Conditional Initial Acceptance allowance and process to facilitate the early activation of irrigation meters.	T	no
3	3.1	Deleted, entire chapter was moved and merged into chapter 2.	T	no
4	4.2 4.3 4.4 4.5	Added additional info for Design analysis, simplified terminology for development regarding FH spacing and domestic services, conditionally allow inside meters, new dual meter, conditionally allow meters to be installed in pavement, clarified permitted and prohibited improvements within easements including fencing requirements. Added a placeholder for future standards for small lot water infrastructure.	T	no
5	5.2 5.3 5.4 5.5	Added additional info for Design analysis, clarified design to mirror chapter 4, changed name of Manhole to Maintenance Hole, updated MH spacing error, MH size	T	no

	5.6	requirements, clarified service types to match chapter 4, updated interceptor requirements based on current practices and industrial standards, removed duplicative easement info and referenced chapter 4, Dump station signage requirements clarified. Added a placeholder for future standards for small lot wastewater infrastructure.		
6	6.1 6.2	Added 811 notification, removed references to LCUASS, added in Flowable and non-flowable fill references.	T	no
7	7.2 7.3	Clarified that DI fittings are epoxy coated (was only referenced in appendix previously), tracing wire outside of PE encasement, valve turn direction, added 24" meter pits for dual meters, vault floor thickness, reinforced that check valves are prohibited with meter setters, tracing wire tape and wire, activation of meters, fixed error in Bac-T test reporting & in equation for pressure test.	T	no
8	8.2	Updated references to chapter 3 and 10, updated interceptor requirements and abandonment, updated required TV format, required re-televising 90 days prior to final acceptance.	T	no
9	9.2	Renamed as "Concrete" as Cast in place and precast concepts were merged into this single chapter, updated concrete mix design strengths.	T	no
10		Deleted, entire chapter was moved and merged into chapter 9.	T	no
A		Checklist was removed since checklist is maintained and posted on the Current Planning website.	T	no
B		Moved Standard Notes to A.	T	no
C		Removed Notice of non-compliance because forms are provided by Public Works.	T	no
D		Removed Stop Work Order because forms are provided by Public Works.	T	no
E		Removed Field Change Order Request because forms are provided by Public Works.	T	no
F		Moved to B, updated.	T	no
G		Moved to C, all details updated and renumbered.	T	no

CHAPTER 1 -

GENERAL PROVISIONS

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CHAPTER 1 - GENERAL PROVISIONS

1.1 AUTHORITY OF THIS DOCUMENT

A. These Standards, with all future amendments published as Editions, shall be known as the City of Loveland (City) Water and Wastewater Development Standards (Standards).

B. These Standards shall be the governing Standards for Public Water and Wastewater Systems that are designed and installed in conjunction with the City's Development Review Process and are within the City's Growth Management Area (GMA), or other areas whereby the City may own and operate such systems.

C. These Standards shall be used in conjunction with Larimer County Urban Area Street Standards (LCUASS), where applicable. Where conflicts may exist between these Standards and LCUASS, these Standards shall govern for all matters regarding Public Water and Wastewater Systems.

D. These Standards shall be used in conjunction with Title 18 (Unified Development Code) and provisions of Adequate Community Facilities (ACF) Chapter 18.15.03.04 Water Facilities and Services and 18.15.03.05 Wastewater Facilities and Services.

E. These Standards shall be used in conjunction with all applicable federal, state, and local law.

1.2 INTENT AND ADDITIONAL PROVISIONSA

A. The intent of these Standards is to establish minimum acceptable criteria. The Department of Water and Power may allow application or use of alternate and/or additional Resource Standards that are more stringent than these Standards, with prior written approval.

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

1.2.1 Objectives of Standards

A. These Standards shall be the minimum criteria for planning, design, materials, installation, inspection, testing and documentation of Public Water and Wastewater Systems within the City. In special circumstances, as determined by the Department, the use of alternate and/or additional Resource Standards may be required.

B. Design of Water Booster Stations, Wastewater Lift Stations and public wastewater force mains are not contained within these standards. The City has authority and design of those major structures.

C. Provisions of LCUASS govern items not addressed in these Standards; specifically, Soils Investigations and Reports, Permits, Streets, and Traffic Control.

1.2.2 Alternative Resource Standards

A. Upon first obtaining written permission and approval from the Department, 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:

1. AWWA – American Water Works Association (Most Current)
2. ASTM – American Society for Testing and Materials
3. ASCE – American Society of Civil Engineers
4. CDOT – Colorado Department of Transportation Standard Specification for Road and Bridge and M & S Standards
5. IPC – International Plumbing Code (Per City Municipal Code, Title 15)
6. IBC – International Building Code (Per City Municipal Code, Title 15)
7. IFC – International Fire Code (Per City Municipal Code, Title 15)
8. Other, as approved by the Department.

1.3 AUTHORITY

The City has duly created the Department of Water and Power (Department). Whereas the Director or designated representative shall have the authority on behalf of the City to determine that all planning, design, materials, installation, testing and documentation of Public Water and Wastewater Systems are pursuant to these Standards.

1.3.1 Provisions of Service

The Department has the authority under laws of the State of Colorado to provide water and wastewater service to the areas within the City Limits as well as areas outside the City Limits. The city's water and wastewater service boundaries are shown in the current versions of the water master plan and wastewater master plan. There are two water districts that overlap the City's water service area, the Little Thompson Water District, and the Fort Collins Loveland Water District. Water service for future development shall be determined pursuant to the most recent versions of the intergovernmental agreements between the City and each of the water districts, or pursuant to the North Front Range Water Quality Planning Association's current 208 plan.

1.3.2 Service Provisions Outside of Municipal Boundaries

The Department has the authority to provide water and wastewater service to properties in Larimer County outside of the City's municipal boundaries, pursuant to laws of the State of Colorado. The approval of a new service shall be deferred to the City's planning department to determine if annexation is required prior to the Department providing service per Municipal Code sections 13.04.080 & 13.08.080. All owners requesting service for properties located in the County shall complete an Outside City Service Agreement.

1.3.3 Wastewater Service Connection Policy

A. For properties located within 400-feet of the Department's wastewater main, any proposed septic system or revision to an existing septic system which would require a permit from Larimer County Health Department, the property is required to connect to the City's wastewater main.

1. Any request for a variance from this requirement must be submitted in writing to the Water Utilities Manager for consideration.

B. The allowance of septic systems for properties within the City or properties outside of the City and within 400-feet of a wastewater main shall be allowed as long as they remain permitted and functioning per Larimer County Health Department. Also See Municipal Code Section 13.08.010.

1.4 REVISIONS AND UPDATED STANDARDS

A. The Department will maintain these Standards and any amendments hereto. The Department will post these Standards and amendments on the City's Internet website, under the Department's specific website location. The Department does not keep a database of holders of these Standards; consequently, it shall be the responsibility of each holder to verify the most current Standards are being used for any Development Project Area.

B. Revisions to these Standards shall be pursuant to LCUASS 1.6.2 and clarified as follows (replace Local Entity with Department, Local Entity Governing Body with City Council, and Local Entity Engineer with Water Utilities Manager):

1.4.1 Updated Standards

The current version of these standards are posted on the Department's webpage at: www.lovgov.org/wwwds.

1.4.2 Revisions

From time to time, this document will require revisions. Revisions shall be grouped as either policy revisions or technical revisions.

A. Policy Revisions

Policy revisions shall be considered major changes, changes in law and changes that will cause significant increased cost or controversy. Policy revisions also include those changes that relate to the public use and convenience, such as changes in standard street width. Policy revisions require a public hearing process for their adoption. Department staff shall make recommendations to the City Council concerning the proposed policy revision prior to the adoption by the City Council by an ordinance or resolution (as applicable) making such revision. No policy revision shall become effective until it has been properly adopted by the City Council.

B. Technical Revisions

Technical revisions shall consist solely of such minor additions, revisions, and corrections to these Standards as may, in the judgment of the Department, be necessary to better conform to good engineering and/or construction standards and practice. The Water Utilities Manager shall approve only those proposed technical

revisions that: (1) are consistent with all existing policies relevant to the revision, (2) do not result in any significant additional cost to persons affected by the revision, and (3) are consistent with existing law. Technical revisions shall become effective when approved, in writing, by the Water Utilities Manager. If technical revisions are deemed necessary, the revisions may occur through one of two processes.

1. Normal Technical Revision Process. The normal technical revision process will occur during planned periodic revisions. Technical revisions determined necessary by the Water Utilities Manager and Water Engineering Manager shall be accomplished (with or without a public hearing process) through discussion and agreement among all Local Entities.
2. Accelerated Process. The accelerated process may occur outside of the planned periodic revision schedule. If a technical revision is determined to be immediately necessary, the Department may discuss and agree upon the revision. If the Water Utilities Manager and Water Engineering Manager agrees upon such revision, then the change shall be made and the notification given on the web page.

1.5 DEFINITIONS OF TERMS AND ABBREVIATIONS

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

AASHTO – American Association of State Highway and Transportation Officials

ACI – American Concrete Institute

ADU – Accessory Dwelling Unit is a detached dwelling unit as defined by Unified Development Code 18.04.07.02.

AISC – American Institute of Steel Construction

ANSI – American National Standards Institute

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

ARV – Air Relief Valve

ASCE – American Society of Civil Engineers

ASME – American Society of Mechanical Engineers

ASTM – American Society for Testing and Materials

AWG – American Wire Gauge

AWWA – American Water Works Association

BO – Blow Off

BOC – Back of Curb

BOW – Back of (side)Walk

BP – Building Permit

Calendar Day – Each and every day shown on the calendar, beginning and ending at midnight.

CDOT – Colorado Department of Transportation

CDPHE – Colorado Department of Public Health & Environment

City – City of Loveland, Colorado, a Home Rule Municipality pursuant to Colorado State Statutes (also sometimes used interchangeably with Department).

City Attorney- The designated City legal representative for the Department, may be an Assistant City Attorney.

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 City Municipal Code requirements. Typically, CCPs are associated with the City's Development Review and/or Building Permit process. CCPs used for installation of any Public Improvement (including Public Water and Wastewater infrastructure) shall be signed by the Design Engineer and relevant City Divisions, and as such are designated as final CCPs.

Cluster Duplex - See Clustered Housing. A cluster duplex building is counted as two dwelling units.

Clustered Housing Types – Defined by Unified Development Code 18.04.02.08. Clustered housing types are small homes that are arranged in clusters with common parking areas, common open spaces, and in some cases, a common building that includes amenities such as a shared kitchen, conference room, game room, or up to two guest rooms. There are two clustered housing building types: cottages and cluster duplexes.

Code –Loveland Municipal Code

Commercial Use – A zoning term and specific use of property, as defined in the Code, Title 18.

Conditional Initial Acceptance- a Pre-Initial Acceptance phase that allows the Developer to activate a water meter prior to Initial Acceptance.

Construction Costs – The cost of all items and labor necessary to complete installation of Public Improvements, including Public Water and Wastewater 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 and Wastewater 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 City. Agents, employees, workers or sub-contractors employed by the Contractor are also bound by the terms of these Standards.

Cottage – See Clustered Housing. Cottages are detached dwelling units as defined by the UDC. Within a cluster development a cottage that is 800 sf. or less is counted as one-half of a dwelling unit and a cottage that is more than 800 sf. is counted as one dwelling unit.

Days – Intended as calendar days unless specifically stipulated otherwise as Working Days.

Department – The Department of Water and Power, City of Loveland (also sometimes used interchangeably with City).

Design Engineer – The Professional [Civil] Engineer, licensed by the State of Colorado who signs the final Civil Construction Plans, as submitted through the City'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 and Wastewater Systems within Public Rights-of-way, Easements or within any portion of an approved Development Project Area.

Development – See Definition contained in the Unified Development Code as well as "Development Project Area" herein.

Development Agreement – An agreement between the City and the Developer defining certain Public Improvement requirements, costs and other related Development Review project conditions.

Development Construction Permit – Pursuant to LCUASS Chapter 6, a permit to construct Public Improvements within an approved Development Project Area. Typically associated with final signed Civil Construction Plans and issued by the City's Public Works Department prior to beginning installation of Public Improvements.

Development Review Process – The process, pursuant to applicable City Municipal Code, whereby certain residential, commercial, and industrial development is regulated and approved.

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

DIP – Ductile Iron Pipe

Director – The Director of Utilities of the Department of Water and Power, City of Loveland.

DMR – Discharge Monitoring Report

DR – Dimension Ratio (See SDR, Standard Dimension Ratio)

Easement – A right granted to the City 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 City shall require the use of Grant of easement agreements/forms. The agreements/forms must be obtained from the Department, prior to use and/or execution and recordation.

Fees – Monetary charges which compensate the City 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.

FOCR - Field Order Change Request – A written form requesting certain changes or alterations from the original final signed Civil Construction Plans. The request to change an item shall be initiated by the Developer/Contractor/Design Engineer. All proposed changes are routed through the Inspector and should be approved by the

Design Engineer, the Department, and the Inspector, prior to affecting any changes in the field.

Final Acceptance– The Department's documentation and process whereby notification is sent to the Developer/Contractor that the Initial Acceptance and Warranty Period has been satisfactorily completed and that all Public Water and Wastewater Systems are fully accepted by the Department. Such notification shall release the Developer/Contractor from future maintenance obligations.

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

Franchise Agreement – An agreement between the City and private utility companies, specifying terms and conditions for use of the City's Rights-of-way.

GMA - Growth Management Area – The area of real property identified in the City of Loveland Comprehensive Master Plan and Inter-Governmental Agreement 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.

Industrial Use – A zoning term and specific use of property, as defined in the Unified Development Code.

Initial Acceptance – The Department's documentation and process by which the Public Water and/or Wastewater System is accepted into an observation period, whereby the Developer/Contractor is responsible for material and workmanship failures during the warranty period.

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

INV- Invert

JSSA - Joint Sewer Service Agreement – An agreement, approved by the City/Department, for use when two (or more) separate property owners desire to share one common private wastewater service line that connects into a Public Wastewater System main.

LCUASS – Larimer County Urban Area Street Standards, as approved by the City, most current addition.

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.

LFRA – Loveland Fire Rescue Authority

Major Structure - A major structure is a component of the Public Water or Wastewater System that will bring direct benefits to an identifiable area, such as water booster pump stations and sewage lift stations.

MH - Maintenance Hole (Manhole): An access point into the underground wastewater network. Previously known as Manhole.

Manhole – See Maintenace Hole

May – A permissive condition

MJ – Mechanical Joint

MUTCD – Manual of Uniform Traffic Control Devices

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.

Official – A person appointed by the Department to administer these Standards.

Ordinance – A law established by the City.

Original Cost of Design and Construction – The cost of financing, engineering, construction, and any other costs actually and reasonably incurred that are directly attributable to the improvements.

OSHA – Occupational Safety and Health Administration, Federal jurisdiction.

Oversizing Reimbursement Agreement –As further defined and described in Title 13 of the Loveland Municipal Code. A Reimbursement agreement can be requested by the Developer to be between the Developer and the City that describes the terms by which certain costs eligible for reimbursement to the developer by the City

PC – Point of curvature

PCR – Point of curve 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 these Standards or other City related processes.

Phasing Plan – A plan or drawing, typically included in the signed final Civil Construction Plans that defines Public Improvements, including Public Water and Wastewater Improvements, installed in sequence within certain portions of a Development Project Area.

PI – Point of Intersection

Pipe Zone – A certain portion of the Public Water and Wastewater trench identified in the W/WW Standard Drawings

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

Post Indicator Valve – Typically, an above-ground water main appurtenance that identifies the amount of water used during a building/structure fire.

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 Inspector and shall facilitate the review of signed Civil Construction Plans and any proposed Work necessary to install Public Water and Wastewater Systems.

Pretreatment Coordinator – The person responsible to the Director for administration of wastewater pretreatment. The Pretreatment Coordinator may be

authorized to act on behalf of the Director for decisions regarding wastewater pretreatment.

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

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

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 and Wastewater 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 City, is owned, maintained and operated by the City. (See also, Public Water and Wastewater Systems herein)

Public Improvements Opinion of Cost (Cost Estimate) – Unit costs based on those approved by the City 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.

Public Water and Wastewater System – Water and/or wastewater facilities, improvements and related appurtenances that, upon Final Acceptance, are owned, operated and maintained by the Department.

Public Water and Wastewater System Master Plan – A plan and related document, prepared and maintained by the Department, that depict major infrastructure requirements, functions, and operations. (See also W&WMP.)

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 City 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 and Wastewater system.

Re-development – Removal or modification of existing improvements and installation and construction of new improvements as defined in the Unified Development Code.

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 – (Also "public right-of-way.") A public street, way, alley, sidewalk, or easement.

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

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

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.

Shall – A mandatory condition.

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.

Small Lot- *Definition to be determined.*

Standards – These Water and Wastewater Development Standards, inclusive of all codes and other referenced standards.

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 and Wastewater System.

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

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 – Satisfactory completion of certain Work items within an approved Development Project Area, typically prior to the creation of an initial punch list.

Surety – A financial instrument, such as cash, letter of credit, bond or escrow agreement as approved by the City, securing the Developer's responsibility to complete construction of Public Improvements within an approved Development Project Area. Surety may also mean a financial instrument securing the Developers' obligations throughout the Warranty Period.

Third Party Reimbursement Agreement – Described in Title 13 of the Loveland Municipal Code. An agreement, between the Developer who initially installs certain Public Water and/or Wastewater System improvements, and the City, for the purpose of collecting reimbursement for the Developer from certain future Developers that may potentially connect to said improvements.

Validated – A process whereby the Design Engineer reviews and subsequently confirms a certain item or matter is either correct or within the scope of practice, as it relates to the specific item or matter.

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

Warranty Period – Starting from time of Initial Acceptance, a period of time the Developer/Contractor is responsible for material and workmanship defects in the Public Water and Wastewater System, within an approved Development Project Area.

Water Engineering Manager – The person responsible for the technical administration of Public Water and Wastewater systems. The Water Engineering Manager may be authorized to act on behalf of the Director for decisions regarding engineering, construction, and other technical aspects of Department decision making.

Water Utilities Manager – The person responsible for general oversight, authority and administration of Public Water and Wastewater systems. The Water Utilities Manager may be authorized to act on behalf of the Director for decisions regarding Department Policy.

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 and Wastewater Systems, within an approved Development Project Area.

Working Day – Unless approved otherwise by the Department, 7 a.m. to 6 p.m., Monday through Friday, excluding holidays observed by the City.

W&WIDA – Water and Wastewater Impact and Demand Analysis Report

W&WMP – Water and Wastewater Master Plan (See Public Water and Wastewater System Master Plan)

1.6 INTERPRETATION OF STANDARDS

A. In the interpretation and application of the provisions of these Standards, the following principles apply: Whenever a provision of these Standards or any provision in any law, ordinance, resolution, rule, or regulation of any kind contains any restrictions covering any of the same subject matter, the standards that are more restrictive or impose higher standards or requirements shall govern.

These Standards shall not modify or alter any construction plans that have been filed with and accepted by the City prior to the effective date of the official action of the City adopting these Standards. However, when commencing a new phase within a phased development, if changes have been made to the Standards since the original construction plans were approved then the current standards will apply for the phase of construction requested.

1.7 DEVELOPMENT REVIEW PROCEDURES AND POLICIES

1.7.1 General

Reference the City of Loveland Unified Development Code, as applicable.

1.7.2 Variance Processes

A. Variance requests are considered administratively within the Department on a case-by-case basis. All requests for variance from these Standards must be in writing and include the following information:

1. A written Variance Request Letter addressed to the Water Engineering Manager and prepared by a Professional Engineer. The Variance Request Letter shall include exhibits identifying the request and the following:
   a. Identification of the Issue. Identification of the standard to be waived or varied and why the standard is unfeasible or is not in the public interest.
   b. Proposing Alternate Design. Identification of the proposed alternative design or construction criteria. If the proposed alternative design constitutes a plan change, then an Exhibit shall be provided and referenced in the written request.
   c. Comparing to Standards. A thorough description of the variance request including impact on capital and maintenance requirements, costs, and how the new design compares to the standard.
   d. Justification. The Professional Engineer must determine and state that the variance will not be detrimental to the public health, safety and welfare, will not reduce design life of the improvement nor cause the City additional maintenance costs. The proposed plan (as varied) must advance the public purpose of the standard sought to be varied equally well or better than would compliance with such standard.
2. Approval or Denial of Variance. Based upon review of the Variance Request Letter, exhibit, and any additional information submitted, the Water Engineering Manager may approve or deny the variance request. The Water Engineering Manager shall provide the Developer a written response of their decision.
   a. If the Water Engineering Manager approves the variance request, the plans can reflect the proposed variance and the plans will continue to be reviewed and approved within the review process.
   b. If the Water Engineering Manager denies the variance request, the Developer shall subsequently submit revised plans in compliance with these Standards.
3. Appeals to the Director. If a variance request is denied by the Water Engineering Manager, the Developer may appeal the decision to the Director. All appeals shall be processed through the Water Utilities Manager. The Developer shall give written notice of appeal to the Director within ten (10) days after denial by the Water Engineering Manager. The Director shall respond within fifteen (15) working days after receipt of the Developer's notice to appeal. If the Director overturns the Water Engineering Manager's decision, the Developer may then proceed with the requested variance on the plans. If the Director concurs with the Water Engineering Manager's decision, the Developer shall bring the Plans into compliance with these Standards. The Director's decision shall be final.

1.7.3 Off-Site Easements

A. Prior to approval of any development applications which requires acquisition and dedication of off-site utility or utility access easements, the Developer shall provide legal documentation to the satisfaction of the City demonstrating the Developer's ability to obtain such easement without any restrictions and at no cost to the City. Prior to approval of a final plat and construction plan documents all off-site easements must be dedicated and recorded with the County Clerk.

1.7.4 Ditch and Railroad Crossings

A. The Developer is responsible to work with and execute a crossing agreement with the respective owners of any Ditch or Railroad being crossed. The agreement must be recorded prior to the City's approval of the CCPs. The City has the following minimum requirements that need to be included in the agreement:

1. The Agreement must accurately describe the details of the public water or wastewater main making the crossing,
2. The terms, covenants, and conditions of the agreement must be transferrable to the City,
3. After acceptance of the public water or wastewater main by the City the owners shall assign, dedicate, or transfer the water or wastewater main to the City.

1.8 ENFORCEMENT & INSPECTION RESPONSIBILITY

1.8.1 General

These Standards are enforceable by the City at any point in the City's Development Review Process, construction including installation and inspection, and through the warranty period up to Final Acceptance of Public Water and Wastewater Systems.

1.8.2 Inspection Procedures

A. The Inspector shall observe the construction of all public and portions of the private Water and Wastewater Systems installed as shown in the CCP in order to assure conformance with uniformity, proper construction techniques, and that acceptable materials are used during the construction process pursuant to these Standards.

B. Work Schedule

1. Normal working day hours are 7 a.m. to 6 p.m., Monday through Friday. No work shall be permitted on weekends or holidays without written approval from the Inspector.
2. Work requests beyond normal working hours must be submitted to the Inspector a minimum of five (5) working days prior to the requested date. Work activity done at times other than during normal working hours will be invoiced by City to the Developer/Contractor at a rate of $100 per hour with a 4 (four) hour minimum. Initial Acceptance of Public Water and/or Wastewater Improvements shall not occur until payment is received in full.

C. Department Inspection Authority and Duties

1. The Inspector shall be authorized to inspect and enforce these Standards, as applicable. All materials, labor, tools, and certain methods for installation shall be subject to inspection and approval by the Inspector. If the Inspector identifies a neglect, omission or disregard of these Standards, such neglect, omission, or disregard shall be remedied immediately, pursuant to the Inspector's written instructions and these Standards.
2. Not more than one (1) week prior to beginning Work within a Development Project Area, a Pre-construction Meeting shall occur between the Inspector and the Developer/Contractor. A Pre-construction Meeting cannot take place unless the Developer/Contractor has a valid copy of the signed final CCPs and a copy of the Developer's/Contractor's construction schedule for use in the Pre-construction Meeting and has provided a copy of these items to the Inspector. The Developer/Contractor shall be responsible for notifying the Inspector a minimum of forty-eight (48) hours prior to a proposed Pre-Construction Meeting.
3. The Inspector shall have access to the area of installation, materials, labor and tools at all times. Access shall be provided in a manner that does not impede or prohibit such access 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. Rejected workmanship or installation methods shall be satisfactorily corrected, and any rejected materials and tools shall be removed from the premises.
4. The Developer/Contractor shall not cover any portion of the Public Water and Wastewater System until the Inspector has had an opportunity to inspect all workmanship and materials.
5. 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. 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.
6. 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.
7. 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 a FOCR. FOCR forms shall be provided by the Inspector.

8. The Developer/Contractor shall abide by all City and relevant OSHA safety requirements and programs.

D. Material/Soil Testing Reports

1. 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. 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.
2. Whenever, at the discretion of the Department, 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 City. 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. If, after CCPs are signed, the Developer/Contractor desires to change any material from that previously shown, said change(s) shall be accomplished by completion of an FOCR.

1.8.3 Inspection for Major Structures

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

1.9 WATER AND WASTEWATER LARGE DIAMETER PIPE INSTALLATION REQUIRMENTS

1.9.1 General

A. For water lines 16" in diameter and larger, and sanitary sewer lines 15" in diameter and larger, the installation contractor must show reasonable qualifications and experience in the installation of similar infrastructure.

B. A Qualification Document shall be submitted to the Department for approval prior to construction. The Qualification Document shall include at least three similar size projects (diameter and lengths shall be equal to or larger than the proposed installation) that demonstrate to the Department's satisfaction that the Contractor is qualified and capable of the installation. The Water Engineering

Manager shall review the documentation for approval. Information to be included in the Qualification Document is listed below:

1. Name 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.

1.10 PUBLIC WATER AND WASTEWATER EXTENSION, OVERSIZE AND REIMBURSEMENT

1.10.1 General

A. Please see Title 13 of the Loveland Municipal Code for relevant provisions related to water and wastewater main extension, oversizing, and reimbursement.

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

C. All Public Water and Wastewater System mains and major structures providing service to or within a Development Project Area shall be installed at the sole cost of the Developer. Certain mains and major structures are eligible for reimbursement in accordance with Title 13 of the Loveland Municipal Code and these Standards.

D. The establishment of an Oversizing Reimbursement Agreement or a Third Party Reimbursement Agreement is optional.

E. For mains larger than those listed in the tables below, the Department may elect to design and install the main either before the development, with the development, or at a later date.

F. The reimbursement amount shall be increased or decreased to reflect fluctuations in the "Engineering News Record" construction cost index (twenty city average). The date of the construction bid shall establish the initial index value.

G. Recording:

1. An Oversizing Reimbursement Agreement will not be recorded.
2. The City will record the Third Party Reimbursement Agreement with the Larimer County Clerk and Recorder. The Developer shall pay all recording fees.

1.10.2 Agreement Timing

A. The Developer must request the City to establish a Draft Oversize Reimbursement Agreement and/or Third Party Reimbursement Agreement prior to the Department's approval of the CCPs.

B. Within thirty (30) days after Initial Acceptance of the main, the Developer must submit documents for the Department to finalize the previously established drafted Reimbursement Agreement.

C. Any City questions, concerns, or requests for additional information related to such documents must be resolved by the Developer to the City's satisfaction within sixty (60) days of Initial Acceptance. In no case shall a final Reimbursement Agreement be established after Final Acceptance.

1.10.3 Calculation of Reimbursement Amount:

A. Oversizing Reimbursement:

1. Percentages: The Department shall pay the Developer a portion of the eligible costs for the Public Water or Wastewater System in accordance with the following tables:

PERCENTAGE PAID BY THE DEPARTMENT FOR OVERSIZED WATER MAINS				
	SIZE OF WATER MAIN INSTALLED			
SIZE OF WATER MAIN NEEDED	12"	16"	24"	30"
8"	33	50	67	73
12"	0	25	50	60
16"		0	33	47

PERCENTAGE PAID BY THE DEPARTMENT FOR OVERSIZED WASTEWATER MAINS								
	SIZE OF WASTEWATER MAIN INSTALLED							
SIZE OF WASTEWATER MAIN NEEDED	10"	12"	15"	18"	21"	24"	27"	30"
8"	15	25	37	46	53	58	62	65
10"	0	13	27	37	44	50	55	59
12"		0	16	28	36	43	49	53
15"			0	14	24	32	39	44
18"				0	12	22	29	36
21"					0	11	20	27

PERCENTAGE PAID BY THE DEPARTMENT FOR OVERSIZED WASTEWATER MHS

The City will pay 20% of the oversized MH cost

2. Eligible Items:
   a. The Oversizing Reimbursement shall only include the components of the Public Water or Wastewater Systems that were oversized.
   b. Eligible Costs include the cost of the materials for the oversized main, fittings, valves, and service saddles. For wastewater interceptors (larger than 21" in diameter) requiring oversized MHs (larger than 4' in diameter) the oversized MHs are eligible.
   c. The cost of design, engineering, construction management, service lines, fire hydrant, fire hydrant laterals, MHs, trenching, surface repairs, traffic control, and connected lines and appurtenances are not eligible for reimbursement through an Oversizing Reimbursement Agreement, but can be included in a Third Party Reimbursement if applicable.

B. Third Party Reimbursement:
1. Eligible Items:
   a. The Third Party Reimbursement may include the Total Costs to construct the Public Water or Wastewater Systems as determined by invoices for design and engineering, construction, and construction management.
   b. Eligible Costs may include the components of the Public Water or Wastewater System that were not recognized as Eligible Costs and included in an Oversizing Agreement.
2. The final Third Party Reimbursement Agreement shall attach and include competitive bids from at least three (3) qualified contractors.

a. The Developer shall choose the lowest responsible bid.

b. The Water Engineering Manager, in consultation with the City Attorney, may approve a waiver of the three bid requirement upon request by a developer unable to procure three competitive bids so long as the estimated costs are reasonable and justifiable, as determined by the Water Engineering Manager.

3. Determination of reimbursement owed from each encumbered property shall be calculated as follows: (i) total costs; (ii) minus any payment due from the Department for oversizing, if applicable; (iii) divided by the number of encumbered properties and apportioned based on linear footage adjacent to the main.

a. If the line is installed in a right-of-way or in an easement along a property line between two parcels, the property on each side shall pay fifty percent of the reimbursement amount.

1.10.4 Agreement

A. Form: All Oversizing and Third Party Reimbursement Agreements must be in a form approved by the Water Engineering Manager and the City Attorney

B. Draft Agreement shall include:

1. Agreement template, current copy, provided by the Department.
2. Exhibit A: Public Water and Wastewater Extension, Oversize and Reimbursement Policy:
   a. Copy of the referenced sections of the W/WW Development Standards and the Municipal Code.
3. Exhibit B: Depiction of the eligible improvements:
   a. Copy of the most final sheets of the CCP depicting the eligible improvement.
4. Exhibit C: Determination of total costs eligible for reimbursement:
   a. Table provided by the Design Engineer
      1) For Oversizing the Table shall include the item, quantity, **Estimated** unit cost, total cost, and percentage paid by City for the eligible improvements.,
      2) For Third Party the estimate shall include the above but can also include **Estimated** additional costs (design, engineering and construction management) less any oversizing estimate.
5. Exhibit D: *(Required for Third Party only)* Table Listing Encumbered Properties and Reimbursement Amounts
   a. Provided by the Design Engineer, a table showing the following for each encumbered property: Parcel number, name and mailing address of current owner, linear footage adjacent to the main (including any portion of Right-of-way (if applicable); and draft reimbursement amount due.
6. Exhibit E: *(Required for Third Party only)* Map Depicting Encumbered Properties
   a. Provided by the Design Engineer a map depicting the following for each encumbered property: Parcel number, name of current owner, linear

footage adjacent to the main (including any portion of Right-of-way (if applicable); and draft reimbursement amount due.

C. Final Agreement shall be in conformance with the draft agreement, and must include:

1. Agreement template, current copy; provided by Department.
2. Exhibit A: Public Water and Wastewater Extension Oversize and Reimbursement Policy
   a. Current copy of the referenced sections of the W/WW Development Standards and the Municipal Code.
3. Exhibit B: Depiction of the eligible improvements
   a. Copy of the Record Drawing sheets of the CCP depicting the main.
4. Exhibit C: Determination of total costs eligible for reimbursement.
   a. Copy of the three competitive bids or if approved by waiver from Water Engineering Manager copy of the single bid as well as a copy of the approved waiver,
   b. Updated Table from Draft with the actual values and costs. If the actual values differ from draft greater than 10% the costs shall be justified by the Contactor and approved by Staff.
5. Exhibit D: *(Required for Third Party only)* Table Listing Encumbered Properties and Reimbursement Amounts
   a. Updated Table from Draft
6. Exhibit E: *(Required for Third Party only)* Map Depicting Encumbered Properties
   a. Updated Map from Draft.
7. Exhibit F: Evidence of Final Payment
   a. A copy of the final payment to the contractor,
   b. A letter from the contractor certifying received final payment from the Developer,
   c. A letter or certification from all material and equipment vendors and other professional services to show no outstanding liens.

1.10.5 Notification and Collection of Third Party Reimbursement Agreement

A. Notification: After the Third Party Reimbursement Agreement has been recorded by the City with the Larimer County Clerk and Recorder, the Developer shall certify, by affidavit, that all owners of properties obligated to provide reimbursement have been notified in writing through certified mail with return receipt requested. The affidavit and copies of the return receipt are required to be submitted to the City prior to any collection attempts by the City.

B. Collection The City shall attempt to collect the reimbursement as stated in the Third Party Reimbursement Agreement.

1. A minimum service charge equal to one percent of the amount collected may be deducted and retained by the City to cover the City's administrative costs.

CHAPTER 2 -
SUBMITTAL AND REVIEW PROCEDURES

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CHAPTER 2 - SUBMITTAL AND REVIEW PROCEDURES

2.1 GENERAL

2.1.1 General Submittal Criteria and Procedures

A. All plans that include modifications to existing or proposed Public Water and Wastewater Systems, regardless of the sheet title are considered CCP and such shall contain the Water & Power Department – Water/Wastewater signature line within the standard City of Loveland Civil Construction Plans Approval block.

B. In cases where CCPs include Public Water and Wastewater Systems or may be exclusively for Public Water and Wastewater Systems, the CCPs shall be prepared and submitted pursuant to LCUASS, Chapter 3 and these Standards, as applicable.

C. Refer to current CCP checklist provided on Development Services (Current Planning) Website.

D. Expiration of Plan Set – CCP and revised CCP pages shall be valid for a period of three years from the date of approval on the City of Loveland Civil Construction Plans Approval Block by the Transportation Development Division. If the CCP approval block does not contain the Transportation Development Division signature; then the approval date shall be the date of the Water/Wastewater Division signature.

E. When CCPs and Record Drawings are required by the City/Department, these Standards, shall be used for submittal and review procedures.

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

2.1.2 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 Department to discuss the Major Structure Project. Examples of Major Structures include: wastewater lift stations, water booster pump stations, and river or highway crossings.

2.1.3 Subsurface Utiltiy Engineering

A. All development and underground facilities shall meet or exceed the requirements of the Colorado Revised Statute 9-1.5-102 and 103 or as amended.

1. The Department may require potholing during the project design to determine conflicts prior to the approval of the CCP.

B. Potable water mains and force mains shall be locatable using tracer wire. Wastewater mains do not require tracer wire as they are electronically locatable by other means, including robots, sonde, and camera systems.

C. All non-metallic services including potable water, non-potable irrigation water, and wastewater must be locatable up to the structure using tracer wire. Tracer

wire for services shall be terminated in a test station adjacent to the building and be privately maintained. See W/WW Standard Details.

2.2 SUBMITTALS

2.2.1 CCP Checklists

A. Refer to current checklist provided on Development Services -Current Planning Website.

2.2.2 CCPs

A. In addition to the applicable requirements set forth in LCUASS the additional requirements in this section shall apply when preparing CCPs inclusive of, or exclusively for, Public Water and Wastewater Systems.

B. Vertical datum - the CCP shall be based on the current City of Loveland Vertical Datum. The plans (typically cover sheet) shall reference the Vertical Datum and benchmark used for the project and reference the City of Loveland Vertical Control Network NGS Control Benchmark used for the project.

C. Construction Notes - Provide Public Water and Wastewater Systems Notes per Appendix A.

2.2.3 Soils Investigation/Geotechnical Report

When required by the City's Code 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.

2.2.4 Water Impact Demand Analysis

Refer to Chapter 4 of these Standards for the content and requirements for the W&WIDA report.

2.2.5 Wastewater Impact Demand Analysis Report

Refer to Chapter 5 of these Standards for the content and requirements for the W&WIDA report.

2.2.6 Opinion of Cost

Pursuant to LCUASS, an Opinion of Cost for all Public Improvements is required with CCPs. The cost of items related to Public Water and Wastewater Systems must be included in the Public Improvements Opinion of Cost.

2.3 CCP CONTENT

2.3.1 Utility Plan(s) (General)

A. If the proposed Development is relatively small in nature the construction information for the Public Water and/or Wastewater 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 and Wastewater systems. Scale may be 1 inch = 50 feet, 40 feet, or larger. These sheets may also include details and designs for lowerings, crossings, and other special configurations pursuant to Chapter 4 and 5 of these Standards.

D. Plan and profile sheet(s) are required for all sizes of Public Wastewater Systems. Plan view scale may be 1 inch = 50 feet, 40 feet, or larger with profile view scale shown with consistent and relative units to the plan view scale.

E. Plan and profile sheet(s) are required for all Public Water Systems having mains 12 inch or larger. Plan view scale may be 1 inch = 50 feet, 40 feet, or larger with profile view scale shown in consistent and relative units to the plan view scale. A specific profile view/design shall also be required for all lowerings and crossings. In certain instances, plan and profile for any other size of main may also be required, depending on unclear or special circumstances, as determined by the Department.

F. All vertical datum shall be based on the City's latest vertical datum criteria.

G. 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 and Wastewater Systems may be required to extend beyond a particular phase to mitigate acceptable redundancy for water and discharge points for wastewater. 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 and Wastewater 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.

H. Longitudinal stationing based on centerline of main, for all Public Water and Wastewater Systems appurtenances (*e.g.* service lines and associated taps, all fittings, fire hydrants, vaults, blow-offs, air-vacs, MHs, etc.). In general, stationing shall read in ascending order in the direction of the north arrow or to the right. Stationing for Public Wastewater System mains and appurtenances shall typically read in ascending order from the downstream MH to the upstream MH.

I. Horizontal locations for all proposed and existing Public Water and Wastewater Systems shall be identified by linear dimensions or offset stationing to centerline

of Rights-of-way, Easements or Tracts. In some cases, additional horizontal dimensioning may be required for purposes of clarity and further reference. For proposed Public Water and Wastewater 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.

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

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

L. 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 and Wastewater 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, crosspans.
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 Department.

2.3.2 Public Water System Plans

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

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

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

D. 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.

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

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

G. Limits of special bedding, if required.

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

I. Matchlines with stationing and sheet numbering.

J. Construction Phase lines with relative stationing.

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

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

2.3.3 Public Wastewater System Plans

A. MHs with diameters and designation numbers/letters.

B. Type and class of pipe material, length, diameter, and slopes for all mains.

C. Type of pipe material, length, diameter, slopes, and longitudinal stationing at connection points to the main for all service lines.

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

E. Concrete encasements, with stationing.

F. Grease interceptors, with stationing and horizontal ties.

G. Sand and oil interceptors.

H. Other wastewater appurtenances associated with the design.

I. Matchlines with stationing and sheet numbering.

J. Construction Phase lines with relative stationing.

2.3.4 Utility Profile(s) (General)

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.

2.3.5 Public Water Systems Profile

A. 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.

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

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

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

E. 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.

F. For all vertical sweeps, denote full vertical curve data and denote begin and end of vertical curve (VPT, VPC). Denote top of pipe elevations every twenty-five feet throughout entire portion of vertical curve.

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

H. 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.

I. Groundwater barriers with longitudinal stationing.

J. Limits of any special bedding.

K. Limits and type of any insulation.

2.3.6 Public Wastewater System Profile

A. Longitudinal stationing for all MHs and other related appurtenances.

B. Rim and all inflow and outflow invert elevations for each MH.

C. Length, diameter and slope for all mains.

D. Longitudinal stationing for each groundwater barrier/cut-off wall.

E. Longitudinal stationing and vertical elevations for beginning and ending of each steel casing.

F. Pipe joint encasements, with stationing and type of encasement.

G. Vertical clearance dimensions between the proposed main and any existing or proposed nearby or conflicting structure or utility.

H. Longitudinal station for each service line connection to the main.

I. Limits of special bedding, if required.

J. Groundwater limits per approved Geotechnical Report

K. Construction Phase lines with relative stationing.

2.3.7 Utility Details

A. Appendix C includes Standard 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. Any alteration to a Standard Drawing must first be approved by the Department. If approved, alterations must be clearly marked "Revised – *Project Name*" in bold font and shall depict any revisions by cloud.

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

2.3.8 Landscape Plan

A. All existing and proposed water and wastewater 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.

D. If a dedicated irrigation meter is proposed: provide the total irrigated area (not required if hydrozone plan – see the Department's instructions for a hydrozone submittal).

2.4 REVISIONS TO SIGNED CCP

2.4.1 Requests to revise Public Water and Wastewater 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 and Wastewater System shown on the CCP which occur after final signature approval and during the construction.
2. Field revisions shall be administered through a FOCR and may or may not be approved at the discretion of the Inspector. A FOCR shall be submitted by the Contractor to the Inspector. Field revisions shall be administered through the Inspector and reviewed by the Department, after which the Inspector may deny, request revisions, or approve the FOCR. All decisions regarding the FOCR shall be final, unless appealed to the Department's Senior Civil Engineer. The decision of the Senior Civil Engineer shall be final within three days.
   a. If the Inspector approves the Field revision, the Inspector will sign and date the FOCR and provide an approved copy to the Contractor. Contractor may then proceed with the work as noted on the FOCR. The revision shall be clearly denoted on the final Record Drawing sheet(s).
   b. If the Inspector does not approve the Field revision, the Developer/Contractor shall immediately comply with the originally signed CCPs and these Standards, as applicable.

B. Major Revisions

1. Major revisions are revisions to the signed CCPs which are not deemed field revisions and which affect the functional aspects of the Public Water and Wastewater System. Major revisions cannot be approved solely by the Department. The Contractor shall be required to submit the appropriate documents to the City's Planning Division for review by relevant City Departments. Additionally, any Work related to a major revision cannot be allowed to continue until such time as the Department 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 Department deems beyond the scope of the original approval through the City's Development Review Process.

2.5 RECORD DRAWINGS

2.5.1 Required

A. Record Drawings for Public Water and Wastewater Systems are required for all CCPs that have been signed as approved for construction by the Department. Generally, Record Drawings are required for all water mains, fire services, fire hydrants, wastewater mains, and MHs, including water and wastewater services.

2.5.2 Maintenance of CCPs by the Contractor (for use in submitting Record Drawings)

A. CCPs and other documents used for the preparation of Record Drawings should be stored separately from CCPs and other documents used for the actual installation of Public Water and Wastewater Systems.

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

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

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

2.5.3 Content of Record Drawings

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

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

a. Dimensions, grades/slopes, lengths, elevations and details that, in the opinion of the Department, were substantially changed or revised from that shown on the final CCPs.
b. Horizontal and vertical locations of underground utilities and appurtenances that were not shown on the final CCPs, referenced to a minimum of three permanent surface improvements.
c. All dimensions shall be referenced to property corners, if surface improvements have not been constructed.

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

B. 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.

C. Record Drawings shall match the original sheet size.

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

E. Each Sheet (including the title sheet) must be clearly labeled **RECORD DRAWING** in bold font in RED. Below or very near the **RECORD DRAWING** label, the following block in RED, *signed and sealed by a registered Professional Engineer*, must be annotated as follows:

> I _____ certify all Public Water and Wastewater System improvements shown herein, including any noted changes or revisions, are in general conformance with the design/construction documents, pursuant to this Record Drawing copy of the final CCPs.

2.5.4 Submittal Process of Record Drawings

A. The following shall be submitted to the Inspector for review and approval:

1. One electronic copy in PDF format of the entire drawing set with the Public Water and Wastewater Record Drawing sheets in place of the originals.
   a. If a project is phased, a copy of the previous phase must be provided.
2. One electronic copy of the utility plan in CAD format. Format shall be per the current City of Loveland *Digital Submission Standards for Utility Plans*.

B. The Inspector shall have five (5) 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 working days.

C. If further changes are deemed necessary, the Inspector 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 for review.

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 Department.

2.6 WATER SERVICE SUMMARY REPORT

2.6.1 Required

A. A Water Service Summary Report is required to be completed for all residential subdivisions to provide additional information on the placement of the water and wastewater services on the site.

B. Templates and examples of the Report are posted on the Department's website.

2.6.2 Submittal Process

A. If required, the Water Service Summary Report shall be submitted to the Inspector for review and final approval along with Record Drawings.

B. The Inspector shall have five (5) working days either to approve the Water Service Summary Report or contact the person who completed the Report if changes are required. Subsequent approvals/disapprovals shall also be within five working days.

C. If further changes are deemed necessary, the Inspector will contact the person who completed the Report and request a resubmittal. Upon revising the Water Service Summary Report the person who completed the Report shall resubmit the Report to the Inspector.

D. If no further changes are required to the initially submitted Water Service Summary Report it shall be considered approved by the Inspector.

2.7 TESTING & REPORTS

2.7.1 Required

A. Water Mains require the following reports:

1. Bacteriological Test results (from a State Certified Laboratory);
2. A City of Loveland Water Line Pressure Test report (for the hydrostatic test results).
3. A continuity Tracer Wire Test Map and Report showing results (from a Certified Locating Company).

B. Wastewater Mains require the following report:

1. A video recording (in digital format) of the wastewater mains (after flushing).
2. A wastewater main and MH pressure and vacuum test report.

2.7.2 Submittal Process

A. If a City of Loveland 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 all required reports and items shall be provided to the Inspector prior to Initial Acceptance.

2.8 ACCEPTANCE AND WARRANTY

2.8.1 Required

A. Initial and Final Acceptance is required for Public Water and Wastewater Systems shown in CCPs that have been signed as approved for construction by the Department. Generally, Initial and Final Acceptance is required for all water mains, fire services, fire hydrants, wastewater mains, and MHs, including water and wastewater services.

2.8.2 Initial Acceptance

A. Upon the Inspector's acceptance of the following items the Department will issue a letter of Initial Acceptance which notifies the Developer that the Warranty period for Public Water and/or Wastewater Systems may begin, pursuant to these Standards.

1. Record Drawings
2. Water Service Summary Report (if applicable)
3. Testing Reports (as applicable)

B. The Developer is responsible for maintaining and repairing the Public Water and/or Wastewater System during the warranty period.

C. The Warranty period for Public Water and/or Wastewater systems shall be two (2) years and shall start from the date that Initial Acceptance occurs.

D. At any time during the Warranty Period the Department 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 twenty-four (24) hours to complete the repair.
2. If the work is not considered a safety issue, the Developer has ten (10) working 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 Department may choose to make the repairs. If so, the Department will invoice the Developer for any costs for the related work plus a $500 administrative fee. The Department may choose to use the Surety retainage to pay for the repairs.
4. A new warranty period shall not be applied to any repair work performed during the warranty period.

2.8.3 Conditional Initial Acceptance

A. This is a pre-Initial Acceptance phase, allowed case-by-case by the Department for large projects requesting their irrigation meter to be activated prior to meeting all requirements for Initial Acceptance.

B. Upon the Inspector's acceptance of the following items the Department will issue a letter of Conditional Initial Acceptance which allows the Developer to activate a water meter.

1. Record Drawings
2. Water Service Summary Report (if applicable)
3. Testing Reports (as applicable)

C. If a Conditional Initial Acceptance is granted (for a part of the project) the project is still required to obtain Initial Acceptance for the entirety of the project.

D. The Warranty period for the entire project shall only begin once Initial Acceptance is granted. Conditional Initial Acceptance of any portion of the project shall not initial the Warranty period.

2.8.4 Final Acceptance

A. Prior to the completion of the Warranty period the Inspector will re-inspect the Project area.

1. For any public wastewater main, ninety (90) days prior to the completion of the Warranty period, the Developer is required to provide a video recording (in digital format) of the wastewater mains (after flushing).

B. If any new deficiencies are found, either in quality or extent of construction, the Developer shall be notified in writing that these new deficiencies shall be corrected prior to Final Acceptance.

1. The Developer shall have thirty (30) calendar days to complete the work. Time extensions may be granted due to weather constraints.
2. If the Developer does not complete the warranty repairs in the time frame specified, the Department may choose to make the repairs. If so, the Department will invoice the Developer for any costs for the related work plus a $500 administrative fee. The Department may choose to use the Surety retainage to pay for the repairs.

C. Once all deficiencies have been satisfactorily completed the Department will issue a letter of Final Acceptance to the Developer.

D. The Warranty period shall terminate with the Final Acceptance date.

CHAPTER 4 -

WATER DESIGN CRITERIA

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CHAPTER 4 - WATER DESIGN CRITERIA

4.1 GENERAL

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 Department, based on dynamic analysis using the Department's hydraulic model and proposed demands related to the Development Project Area.

In addition to these Standards, alternate Resource Standards may be used or required pursuant to Chapter 1, Section 1.2 of these Standards.

4.1.1 Separate Requirements and Standards

There are separate requirements and standards for booster stations, cross connection and backflow prevention that may be obtained from the Department.

4.1.2 Conformance to Standards and Master Plans

A. All Public Water Systems shall conform to these Standards, the most current version of the W&WMP and other applicable Codes and Standards approved by the Department.

B. Where these Standards are not specific, alternate and/or additional Resource Standards may be used, provided the more stringent requirement is used. The Department 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.

4.1.3 Standard Drawings for Public Water Systems - See Section 2.3.7 and Appendix C of these Standards.

4.1.4 Acceptable Materials – See Appendix B of these Standards**.**

4.2 ANALYSIS CRITERIA

4.2.1 W&WIDA

In conjunction with the City's Development Review Process, the Department may request that the Design Engineer submit a W&WIDA report concurrent with a development application.

4.2.2 Contents & Format of the W&WIDA

At a minimum, the following shall be contained in the W&WIDA:

A. Project location and description: Text identifying the location of the Development Project Area, the nature of the proposed development and the land use. Provide the proposed project zoning and density (DU/acre).

B. Identify the existing water system and proposed connection points to the Public water system. Provide the Master Plan analysis for the area. Identify any offsite areas contributing to demands. Reference and demonstrate

compatibility with any previous W&WIDA that identified the Project area as a contributing area.

C. Calculated water demands for all initial and future phases. Provide as a flow rate in gallons per minute (gpm) and gallons per day (gpd).

1. Average Day Demand (ADD)

Land Use		**Typical ADD/unit**
Residential		
	Single Family Residential and Single Family Attached (2 units)	400 gpd/DU
	Multi-family Residential (3 units or more) as Single Family Attached or condos	320 gpd/DU
Non-Residential*		
	General Commercial: Retail/Offices	0.2 gpd/SF
	Hotels/Motels	75 gpd/room
	Restaurants	3.0 gpd/SF
	Industrial/other commercial	1,200 gpd/acre
	Institutional	800 gpd/acre

*Alternate types of demands can be considered for site specific uses that may not fit into these categories.

2. Max Day Demand (MDD)

   MDD = 2.5 * ADD

3. Peak Hour Demand (PHD)

   PHD = 6.0 * ADD

4. Irrigation Demands
5. Max Day fire flow demand

D. Provide a 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 also include irrigation if dedicated irrigation meters are proposed. Provide an output data report and a corresponding network map showing the location of all nodes and pipes.

E. The design shall verify the Minimum Hydraulic Performance Criteria:

Hydraulic Condition	**Pressure (psi)**
MIN static pressure	45
MAX static pressure	125

MDD + Fire Flow	20
PHD	40

F. Discuss the proposed design results. Identify needs for any special improvements, e.g. PRV's, zone breaks, transmission, or trans-distribution mains, etc. Identify any needs for oversizing pipes in conjunction with the Master Plan. Describe within the system the most hydraulically remote point within the proposed distribution system (i.e., lowest static pressure during ADD, PHD).

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

H. Discuss any deviation from these Standards and provide justification for any proposed variances. All such variances must be approved by the Department prior to approval of the WWIDA.

I. 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.

4.3 WATER SYSTEM DESIGN AND LAYOUT

4.3.1 General

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

B. Typically, within a Development Project Area, water mains and related appurtenances are owned and operated by the Department and located within an Easement or Right-of-way. These mains and related appurtenances shall meet the requirements noted in these Standards.

C. In addition to the Main Extensions and Oversize requirements in Section 1.10 of the Standards, the utility locations, alignments and separations noted herein are required for new construction, rehabilitation and retrofit areas.

D. 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 Department, 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.

E. 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 Department. For each Development Project Area, the Design Engineer shall make provisions regarding applicable utility and hard surface separation requirements, fencing access, landscape separation and Easement widths, noted in these Standards.

4.3.2 System Layout

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 shutdowns, 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 Department must first approve such alternate systems.

B. Trans-Distribution Mains are larger diameter mains that move water between Distribution mains and may have frequent Distribution main connections. Typically, tees and/or individual taps less than 6 inches shall not be allowed on Trans-Distribution mains.

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

4.3.3 Water main sizes

A. Unless specifically indicated in the Water Master Plan, sixteen-inch (16”) mains are required every mile and twelve-inch (12”) mains are required every half-mile. Other distribution mains shall have a minimum diameter of eight inches (8”).

B. Hydrant leads connecting to the potable distribution system shall be six inches (6”) in diameter. Other pipe diameters for hydrant leads are prohibited.

4.3.4 Horizontal Design

A. Location

1. In general public water mains shall be laid with straight alignments using manufactured bends. Manufactured Bends shall be DIP mechanical joint (MJ) type.

2. Within the platted right-of-way and improved public streets, main(s) should generally be located 5 feet from the lip of concrete gutter.
3. A single public water or wastewater main may be installed in a roadway if the street/drive/access road width is at least **23** feet wide. Two wet utility mains (water, wastewater, or storm mains) may be installed in a roadway if the street/drive/access road width is at least **26** feet wide. Road width shall be measured from flowline of concrete gutter when curb and gutter is present.
4. Mains may be located within a parkway or tree lawn area with prior approval from the Department.
5. Mains located within parking areas or open space should be located symmetrically within an Easement.

B. Horizontal Separation

Distance shall be measured from the nearest outside edge of each pipe or related appurtenance.

1. Wet utilities
   a. Public wastewater, public or private stormwater (including underdrains), 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.
2. Dry utilities
   a. Natural gas, electric, cable TV, telephone/ communications and 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).
   b. Light Poles require **6** foot separation.
3. Curb & Gutter, sidewalks, medians and other minor structures:
   a. Public water mains should generally be designed to run parallel 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.) and a minimum of 10 feet horizontally from the outside edge of any building.
4. Other Features: See Section 4.5.

C. Joint Deflections

1. Mains proposed within curved portions of ROWs or easements may be designed utilizing pipe-joint deflections.
   a. DI pipe. Each pipe-joint deflection shall not exceed 80% of that allowed by the Ductile Iron Pipe Research Association's (DIPRA) current publication.
   b. 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.

1) Joint deflections are allowed at Joint Restraint Devices per manufacturer's recommendations.

c. When pipe is deflected at each joint to accommodate horizontal curvilinear alignments, each curved alignment section shall be labeled with curve data on CCP plan & profile views. 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.

d. Pipe bending. Longitudinal, barrel portion pipe bending shall not be allowed.

D. Small Lot Layout Scenarios

1. Utilize dual meter pits, allowances to place water meter pits in pavement, and variance requests.
2. The Department is in the process of employing a Third Party to review and recommend improvements to these standards to further aid Small Lot development.
3. *Additional details to be determined with a future update anticipated to be published as a 2025 Edition.*

4.3.5 Vertical Design

A. Cover. Normal bury depth for all water mains shall be **4.5** feet minimum and **6.0** feet maximum, as measured from finished grade to top of pipe. Approved Crossings and lowerings with less than 4.5 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 slope between all bends (high and low points).

1. If a profile is provided in the CCPs then all portions of uniform grade/pipe shall be denoted mathematically by percent of slope. All bends shall be denoted with a top-of-pipe, vertical 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 view (if included) on the CCPs.
2. Water crossing **over** Wastewater/Stormwater/other dry utilities/non-Potable Systems. When a public water main crosses these types of systems, the water main should cross above, with a minimum 18 inches vertical clearance from such system, and maintain cover pursuant to these Standards.

a. A vertical clearance of less than 18 inches may be allowed, with prior approval from the Department. In these cases, the Department may also require encasement, joint wrap, frost protection, or the use of a solid steel casing pipe.

3. Water crossing **under** Wastewater/Stormwater/other dry utilities/non-Potable Systems. When a public water main crosses under these types of systems, the water main should maintain 18 inches of vertical clearance from such systems. If 18 inches cannot be provided see Lowering Section below.
   a. The joints of the non-potable utility shall be wrapped 10 feet either way of the crossing, at a minimum.
   b. Water mains crossing under or lowered under large utilities (36" in dimeter and larger) shall be required to be installed in a steel casing pipe.
   c. A vertical clearance of less than 18 inches may only be allowed with prior approval from the Department.
      1) For small utility crossings (less than 36" diameter) with less than 18 inches of clearance: the entire width of the trench shall be flowfilled from springline of the water main to springline of the utility pipe.

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 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 limits 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 and CP design. Plan and Profile views shall show horizontal and vertical distances to other utilities or structures in the immediate area of the lowering.
2. All lowerings are subject to clearance and frost protection requirements noted in these Standards.
3. Lowerings may be designed utilizing either manufactured bends or pipe-joint deflections (also known as vertical sweeps).
   a. See criteria in 4.3.4.C

E. Ditch Crossings. Crossings with Named Ditch Companies may require that the Developer contact and coordinate with the Ditch Company 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 ROW or easement; a minimum of 10 feet beyond any toe or top of slope of the ditch. Refer to Section 4.4 Steel Casing Pipes and W/WW Standard Drawings for additional requirements.

b. Cut-Off Wall. As required by the Ditch Company 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.

c. Separation. measured from the flow line of the ditch to the top of the casing pipe shall be as determined by the Ditch Company.

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 according to the Ditch Company's criteria.

4.3.6 Dead-Ends/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 City's existing or proposed Public Water System.

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

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

4.3.7 Frost Protection

A. General. To protect from frost, public water mains require a minimum of 4.5-feet of cover, from top of pipe to finished grade.

1. Open Conduits. 3-feet of clearance is required between open conduits (e.g. stormwater boxes, pipes, and culverts) and other open channels that are exposed to the atmosphere and/or free flow of air.
2. Crossings/Lowerings. 18-inch minimum clearance is required
3. Casings. Insulation is typically not required between a water main installed within a casing.

B. When minimum clearances cannot be obtained, insulation shall be provided to protect the public water main through the extents of the insufficient cover or crossing. The insulation needs to be provided plus an additional **10** feet beyond each end along the water main. The Design Engineer shall designate the insulation requirements (thickness x length x width) on the CCPs.

4.3.8 Access Roads

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

B. Access roads shall be a minimum **15** feet in width and 8% maximum longitudinal slope. Access roads shall have a 2% crown or cross slope.

C. Access Roads shall be in the form of a permanent paved public street. Alternatively, Access Roads may be a permanent type material placed on a compacted stable subgrade. Approved materials are 6-inch thick CDOT CL-B concrete (compressive strength of 4,500 psi), 6-inch thick CDOT CL-5 aggregate, combination thereof, or other type approved by the Department. Roads and subgrade need to be designed to HL-93 loading.

D. Turning radius for Access roads should be designed for Type BUS-40 vehicles (per AASHTO) (27.6 foot inside radius, 40 foot centerline radius, 45 foot outside radius).

4.4 APPURTENANCES

4.4.1 Valves

A. Gate valves shall be used on water mains up to and including 12-inch diameter. Butterfly valves shall be used on water mains 16-inch diameter and above. Placement of valves shall be as follows:

1. Typically, on <u>each</u> 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 Trans-Distribution mains.
4. No further than 2,600 feet apart, on Transmission mains.
5. 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.
6. Valves shall be placed on both sides of all crossings within a casing.
7. 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.

B. 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.

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

D. Valves within landscaped or open field areas shall be placed at grade with a 2 foot sqare x 4 inch thick concrete pad around the valve box. The location shall be marked with a permanent marker post with reflective label stating "CITY OF LOVELAND WATER MAIN (OFFSET ___ FT)."

4.4.2 Tapping Saddles & Valves

A. These connections to an active water main are only allowed for a lateral size of one nominal pipe diameter less than the main size. (eg a 8"x6" tap).

1. Size on size wet taps may be allowed with Department approval.
2. For all other connections a Tee connection is required.

4.4.3 Fire Hydrants

A. Spacing. The criteria noted herein are general guidelines and may be changed or varied due to use of sprinklers or other factors as determined by the Loveland Fire Rescue Authority (LFRA.)

1. Single-Family & Two-Family residential developments shall have fire hydrants spaced as follows:
   a. No portion of a structure shall be more than 600 feet from the hydrant as measured via the street.
   b. Hydrants shall not be placed more than 600 feet apart.
2. Commercial, Mixed-Use, Industrial Multi-Family & Attached Single-Family developments shall have fire hydrants spaced as follows:
   a. No portion of a structure shall be more than 400 feet from the hydrant as measured via the street.
   b. Hydrants shall not be placed more than 350 feet apart.
   c. Multiple Hydrants may be required per LFRA criteria.
3. Streets. Where new water mains are extended along/within streets, and where fire hydrants are not required for protection of adjacent structures, fire hydrants shall be provided at a spacing not to exceed 1,000 feet. When the roadway is divided by a median, then fire hydrants must be placed on alternate sides of the roadway every 500 feet.

B. Locations

1. Intersections. Generally, fire hydrants shall be located at each street intersection and placed at the BCR (begin curve radius) or ECR (end curve radius) for curbs and/or sidewalks.
2. Mid-Block. Fire hydrants shall be placed between lots at the extension of the property line.
3. Cul-De-Sac. A fire hydrant may be placed at the terminus of the water line at the end of the cul-de-sac.

C. Clearance / Cover

1. There shall be no permanent structure or obstruction within **10** feet of the nearest edge of a fire hydrant. Shrubs and bushes (upon maturity) cannot be within 5 feet, tree trunks (upon maturity) cannot be within **10** feet of the nearest edge of a fire hydrant. A 3 foot clear zone is require around a fire hydrant.
2. Hydrants shall be located within a Right-of-way or Easement.
3. Fire hydrant leads shall have a minimum 4.5 feet of cover from top-of-pipe to finish contour elevation.
4. Fire hydrant guards are required in areas where hydrants are located in susceptible traffic areas or where no vertical curb is provided. See W/WW Standard Drawings.

4.4.4 Thrust Restraint / Devices

A. All fittings (*e.g.* bends, reducers, tees, crosses, plugs/caps, fire hydrant tees to boots, valves, etc.) shall be restrained by a concrete thrust block and an approved mechanical joint restraint device.

B. Mechanical Joint Restraint

1. Mechanical joint restraint devices shall be used for the following,
   a. All pipe joints within a casing,
   b. All new construction fire hydrant laterals,
   c. Through and beyond all lowerings.
2. The required restraint length shall be determined by the Design Engineer for each occurrence. The Designer shall use a minimum pressure of 150 psi and a safety factor of 1.5.
3. The required restrained length shall be designated on the plan by stationing.

C. Concrete Thrust Blocks: Refer to W/WW Standard Drawings for details and design of typical thrust block configurations.

1. **Gravity Blocks** may be allowed for upper vertical bends when connecting to existing pipe. All vertical gravity blocks shall be sized by the Design Engineer and indicated on the plans.

4.4.5 Services

A. General

1. All public portions of service lines shall be installed having a minimum of 4.5 feet (54 inches) below existing or proposed grade.
2. The private service shall be buried not less than 24" below the required frost line (30") or 4.5 feet (54 inches).
3. Tracer wire shall be required to be installed on all non-metallic pipes and terminate in a Test Station next to the foundation. Tracer wire and Test Stations for services are private.
4. Taps shall not be made within 5 feet of any valve or tee, or 2 feet for all other fittings and joints.
5. All service saddles 1 inch and smaller shall be at least 3 feet between one another when located on the same side of a main and 18 inches if located on opposite sides of a main. All service saddles larger than 1 inch shall be at least 5 feet between one another regardless of the side of the main.
6. There shall be no physical connection between potable water and raw water systems of any type.

B. Domestic Services

1. The material type on the private portion of the service line can change 5 feet past the water meter pit/vault.
2. Domestic services may cross through adjacent lots as long as they are within a dedicated private utility easement.

3. 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.
4. Inside Meter Sets- For a water meter inside of the building then the portion of the water service shall be private from the curb stop to the meter. Department approval is required for any new inside set meter requests.
5. Any meter installed after the City's meter (sub-meter) are considered private and not maintained or read by the City for billing purposes.
6. 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 or Tanks are not allowed for the sole purpose of decreasing the size of the domestic tap/meter and service line.

C. Domestic Service Scenarios Notwithstanding the applicable provisions of the City's Municipal Code, Title 13, the following scenarios shall apply:

1. Residential Single Family Detached or Attached: A dwelling containing one dwelling unit whereby each unit is situated upon its own separate, platted lot, shall be serviced individually by a separate meter for each platted lot. Additional example:

   a. Townhomes where each unit is located on their own lot.

2. Residential Duplex: A dwelling containing two dwelling units where both units are situated upon on a single platted lot, shall have both units served by a shared single meter. Additional example:

   a. ADU: Water service to the ADU shall be connected to the service from the main dwelling after the meter.

3. Residential Multi-Family: A dwelling containing three or more dwelling units. Multi-Family buildings can either be served by a single meter per building or a shared meter serving two or more buildings, however there must be at least one meter per platted lot. Additional examples:

   a. *Townhomes where each unit may be constructed as a Single Family Attached Home, but the series of homes all lie on the same platted lot.*
   b. *Clustered Housing: Cottages & Clustered Duplexes.*

4. Commercial (a building with one or more internal tenant spaces): Each tenant within a building cannot have a separate meter.

   a. *On own lot*: A building situated on its own platted lot shall be serviced by a single tap, service line and meter (including meter pit or vault).
   b. *Within a common lot*: For a lot with multiple buildings, the entire lot can be serviced by a single master meter for all of the buildings or a single meter can be provided for each building.

D. Irrigation Services

1. Irrigation Service 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 the Department to obtain a preliminary design pressure range based off of the City's current Water System Model. The Water System 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 for verifying the final pressure at the time of final design.
3. 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.

E. Fire Services

1. Fire service lines shall be considered privately owned and maintained, from the connection of the service line into the isolation valve, continuing to a building structure.
2. Fire service lines shall be located a minimum of five (5) feet from any domestic service line.
3. Fire service lines shall not be tapped off any portion of a fire hydrant lead.
4. Fire service lines are not required to be metered.
5. 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.
6. 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:
      1) Shall have separate, dedicated taps off the Public Water System main.
      2) Shall not be tapped off any portion of a domestic service line.
      3) 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.
      4) 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.
      5) 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).

4.4.6 Meters

A. Types

1. Single Meter & Dual Meter: Configuration and pit/vault dimensions are detailed in Standard Drawings.
2. Multiple Meter Vault: Individual meters in a multiple meter configuration may not exceed 3/4 inch, with a maximum of five meters within one vault.

B. Location shall be per standard detail.

1. Meter pits and vaults should not be installed within any parking area or parking stall, driveway, or sidewalk area. In certain cases, and with prior approval of the Department, pits/vaults may be installed within these areas, provided appropriate easements, access, and traffic loads are adequately accommodated. In no case shall a meter pit/vault be allowed within a public street/road.
2. Inside Meter Sets: If there is an existing meter inside of a building then the service line from the curb stop to the meter is considered private. Upon redevelopment the city may require that the meter be relocated outside of the building.
3. Landscape and structures (*e.g*. trees and shrubs (upon maturity), boulders, retaining walls, drainage facilities, utility vaults, poles, etc.) shall not be within 10 feet of any outside edge of a meter pit or vault.

C. Couplings 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.

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. For multi meter vaults the tap and service line shall be 1.5”.

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 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 as shown in Table 6-1- AWWA meter standards 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 City'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. Meter Justification Letter

1. Required for all commercial, industrial, multi-family (3 or more units), and irrigation water meters. Final letters are required to be provided in PDF format and signed by the Design Engineer.
2. See required Excel Worksheet "Water Meter Justification Letter" posted on the webpage to be used for all commercial, industrial, and multi-family (3 or more units).
3. See required Excel Worksheet "Irrigation Meter Justification Letter" posted on the Department's webpage to be used for all irrigation meters (including hydrozone).

4.4.7 Air Relief Valves

A. On water mains 12-inch diameter and larger, 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 MHs or vaults.

4.4.8 Blow-Off Valves/Structures

A. On water mains 12-inch diameter and larger, in-line blow-off valves shall generally be placed at severe low points, lowerings, and/or at crossings. 12" mains can use 4" blowoffs and larger mains shall use 6" blowoffs.

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. A 2-inch tap with a 90 degree vertical bend may be made directly into the cap of the main. The bend should 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 has been completed.

3. All fittings for temporary 2-inch blow-offs shall be brass.
4. An adequately sized concrete thrust block shall be poured behind the stub.
5. The blow off may be buried after completion. The location of blow off shall be marked with a tee post.

4.4.9 Pressure Reducing Valves

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

4.4.10 Backflow Prevention Assemblies

A. To prevent contamination of the City's potable water system, a backflow prevention assembly shall be installed where cross connections exist. The assembly shall be placed on the customer side of the water meter and installed per Colorado Cross-Connection Control Manual.

4.4.11 Steel Casing Pipes

A. The Department reserves the right to require a specific pipe material for any public water main casing pipe. Casing pipes shall not be filled with sand or grout.

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

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

D. Cathodic protection of steel casing pipes are required for Major Crossings such as for railroads, rivers, ditches, bridges and large stormwater culverts or if required by the Department.

1. CP design shall be shown on the plans per section 4.4.12.

4.4.12 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 Department for consideration and review.
   a. The Water-Saturated Soil Box method shall be used to measure the resistivity of the soil.
   b. The distance between sample locations shall be at the discretion of the Department, however testing frequency shall not be less than one test for every 400 linear feet of pipe.
   c. Soil samples shall be taken at pipe depth.
   d. Soil samples shall be tested in saturated conditions.

B. Cathodic Protection (CP) Design

1. If the results of the 10-point soils test conclude the soil is corrosive to metallic pipe (10 points or greater), the Design Engineer shall submit to the Department for approval a comprehensive plan with proposed design for cathodic protection. The design shall be completed by a registered PE and National Association of Corrosion Engineers (NACE) certified CP Technologist Certification or higher.
2. Anodes & CP Test Stations: Shall be installed as specified by the results of the CP design.

C. Isolation: Protected water mains shall be insulated from unprotected mains in all cases as necessary. Insulating flanges shall be required for pipe connections which are dissimilar metals. Insulators shall also be required at the outlet end of corporation stops.

D. Joint Bonding: All DIP joints shall be bonded over with the use of copper wires or plates.

E. Polyethylene Encasement: Required for all DIP and/or fitting.

F. Steel Casing: CP is required for all new installations of steel casing pipe. The Engineer shall provide CP design on the plans. A minimum of one anode and test station are required for CP of Steel Casing. No soil testing is required when CP is to be applied exclusively to Steel Casing Pipes.

4.4.13 Groundwater Barriers

A. Groundwater barriers for the water system are not typically required. However, in cases of high groundwater, the Department reserves the right to require groundwater barriers for the water system. This requirement may be enforced by the Department at any time during the project.

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

4.5 EASEMENTS

4.5.1 General

A. An Easement shall encompass all portions of the Public Water and Wastewater System that may extend beyond or outside a platted right-of-way. Easements, when dedicated by a Final Plat, shall be designated as Public Utility Easements, or Public Water Easement or Public Wastewater Easement. Alternately, Easements conveyed by separate instrument shall be granted pursuant to the Department's Grant of Easement forms.

B. Widths:

1. The minimum width for an Easement shall be 25 feet. In no case shall a main or related appurtenance be located closer than 10 feet to the nearest Easement edge.
2. Mains located between two private lots, 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.
3. Easements containing more than one water main shall be increased by an additional 6 feet for each additional main. Easements containing more than one wastewater main shall be increased by an additional 10 feet for each additional main.
4. Easements containing both water and wastewater mains shall be a minimum of 30 feet in width.
5. Easement widths may be required to be increased depending on depth and size of mains.

C. All Public appurtenances (hydrants, meter pits and vaults, MHs, etc.) shall generally be centered within a designated Easement. At a minimum, Easements shall extend 10 feet *beyond* all sides of all any appurtenance.

4.5.2 Restrictions

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

B. Landscape Restrictions.

1. The outside edges of any shrub or bush (upon maturity) shall not be allowed within **5** feet of the nearest outside edge of a public water/wastewater main and/or any related appurtenance.
2. 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/wastewater main and/or any related appurtenance.
3. The outside edge of any ornamental grasses (upon maturity) shall not be allowed within **5** feet of the nearest outside edge of the lid for a public water/wastewater vault or pit.
4. 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/wastewater main and any related appurtenance.

B. Fencing:

1. All permanent fencing located within an Easement will need to be designed as removable for Department maintenance. Fencing crossing easements should be designed to cross perpendicular and gates spanning the easement are preferred to removable fencing. All removable fencing and gate design must be provided for department review.
2. If the entire site is designed to be secured by fencing and gates, the Department shall require 24-hour access. Depending on the gate type this

can be the gate key code and a 24-hour phone number, or a lock provided by the Department daisy chained to the other locks.

C. Prohibited Improvements.

1. Buildings, structures, concrete base kiosks, signs, clustered mailboxes, sheds, walls, overhanging decks, and other substantial structures, shall not be allowed within any portion of an Easement designated to encompass a Public Water/Wastewater System.
2. Permanent signs, walls, etc. shall not be allowed within **10** feet of a public water/wastewater main and any related appurtenance.
3. Temporary improvements will be considered on a case-by-case basis.

CHAPTER 5 -

WASTEWATER DESIGN CRITERIA

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CHAPTER 5 - WASTEWATER DESIGN CRITERIA

5.1 GENERAL

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

In addition to these Standards, alternate Resource Standards may be used or required, pursuant to Chapter 1, Section 1.3 of these Standards.

5.1.1 Separate Requirements and Standards

There are separate requirements and standards for Pre-Treatment and Lift Stations which may be obtained from the Department.

5.1.2 Conformance to Standards and Master Plans

A. All Public Wastewater Systems shall conform to these Standards, the most current version of the W&WMP and other applicable Codes and Standards approved by the Department.

B. Where these Standards are not specific, alternate and/or additional Resource Standards may be used, providing the more stringent requirement is used. The Department 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.

5.1.3 Standard Drawings for Public Wastewater Utility Systems - See Section 2.3.7 and Appendix C of these Standards.

5.1.4 Acceptable Materials -- See Appendix B of these Standards.

5.2 ANALYSIS CRITERIA

5.2.1 W&WIDA

In conjunction with the City's Development Review Process, the Department may request the Design Engineer submit a W&WIDA report concurrent with a development application.

5.2.2 Contents & Format of the W&WIDA

At a minimum, the following shall be contained in the W&WIDA:

A. Project location and description: Text identifying the location of the Development Project Area, the nature of the proposed development and the land use. Provide the proposed project zoning and density (DU/acre).

B. Identify the existing wastewater system and proposed connection points to the public wastewater system. Provide the Master Plan analysis for the area. Identify any offsite areas contributing to the flow. Reference and demonstrate

compatibility with any previous W&WIDA that identified the Project area as a contributing area.

C. Calculate wastewater demands for all initial and future phases. Provide as a flow rate in gallons per minute (gpm) and gallons per day (gpd).

1. Average Daily Flow (ADF)

Land Use		**Typical ADF/unit**
Residential		
	Single Family Residential and Single Family Attached (2 units)	200 gpd/DU
	Multi-family Residential (3 units or more) as Single Family Attached or condos	160 gpd/DU
Non-Residential*		
	General Commercial: Retail/Offices	0.1 gpd/SF
	Hotels/Motels	75 gpd/room
	Restaurants	1.5 gpd/SF
	Industrial/other commercial	600 gpd/acre
	Institutional	400 gpd/acre

*Alternate types of demands can be considered for site specific uses that may not fit into these categories.

2. Peak Design Flow (PDF)

   PDF = PF * ADF + I/I allowance

   where

   PF = 1 + 14/(4+$P^{1/2}$) [Harmon's Peaking Factor] with maximum PF of 5.

   P = the design contributing population in thousands

   Population = 2.5 people/DU

   ADF is in million gallons per day (MGD)

   I/I allowance = 0.1 * ADF

D. Provide a modeling analysis for the proposed wastewater system showing all collection lines and connections to the existing wastewater system. Provide an output data report and a corresponding network map showing MHs and pipes.

1. Manning coefficient for PVC shall be 0.013.
2. Data report shall include a table of pipe segments, inverts, depths, slopes, minimum and maximum design flow rates, minimum and maximum velocity, and maximum d/D.

3. For all large area analysis, the design shall route flows through the proposed piping network and take into account the length of pipe and time of concentration within the pipe.

E. The design shall verify the Minimum Hydraulic Performance Criteria for allowable Depth and Velocity.

F. Discuss the proposed design results. Identify the needs for any special improvements. Identify any needs for oversizing pipes in conjunction with the Master Plan. If a lift station is proposed, provide justification and discuss why other alternatives to a lift station were not chosen. Describe within the system the most hydraulically restrictive point within the proposed collection system (i.e., greatest d/D during Peak Flow, lowest velocity during ADF).

G. Discuss any deviation from these Standards and provide justification for any proposed variances. All such variances must be approved by the Department prior to approval of the WWIDA.

H. The report shall include an overall map showing wastewater collection system layout with the following information:

1. Map Scale (max 1" = 200 ft.), North Arrow, Vicinity Map
2. Proposed and existing Easements and Rights-of-way
3. Offsite wastewater mains, proposed basin delineation and future areas that could be serviced by a main or lift station.
4. Topography, utility crossings, and any proposed lift stations.
5. Other existing and proposed utilities that might affect the proposed system layout or performance.

5.2.3 Hydraulic Design

A. Sizing. The wastewater design flow shall be the daily peak flow plus wet weather infiltration and inflow. Downstream of a lift station force main, the maximum pumping rate must also be included.

1. Manning's Equation shall be used to compute the required pipe size.

$$Q = \frac{1.486}{n} \cdot A \cdot R^{\frac{2}{3}} \cdot \sqrt{S}$$

Q = flow in (cfs)

n = Manning's Coefficient 0.013

A = Area of Flow (ft^2)

R = Hydraulic Radius (A/P)

Where P = wetted perimeter

S = Slope of Pipe (ft/ft)

2. Minimum Sizes. The minimum size for any public wastewater main is 8 inch. The minimum private service size is 4 inch.
3. Force mains. Force Main sizing is addressed in a separate Sewage Lift Station Standards document.

B. Depth. The maximum allowable depth to diameter ratio in a wastewater main shall be d/D = 0.5 for sewers up to 15 inch diameter, for wastewater mains larger than 15-inch a d/D = 0.75 is allowable.

Where: d = Depth of Flow
D = Diameter of Pipe

C. Velocity. The wastewater mains should be designed so that the design flow is greater than 2 fps. Upon written approval of the Department, the design flow may be lower than 2 fps. However, in no case shall it be less than 1.5 fps. The design velocity shall not exceed 10 fps.

D. Slopes. The following table gives the minimum and maximum allowable slopes for wastewater mains. The minimum slopes are based on a mean velocity of 2 fps when the pipe is full, and the maximum slopes are based upon a velocity of 10 fps when the pipe is flowing full. In no case shall the service line slope be less than 0.0104 ft/ft.

Diameter (inches)	Minimum Slope (Percent)	Maximum Slope (Percent)
Services		
4	2.08%	21.02%
6	1.04%	12.25%
Mains		
8	0.40%	8.34%
10	0.28%	6.20%
12	0.22%	4.86%
15	0.15%	3.61%
18	0.12%	2.83%
21	0.10%	2.30%
24	0.08%	1.93%

5.3 WASTEWATER SYSTEM DESIGN AND LAYOUT

5.3.1 General

A. The City's Public Wastewater System includes Interceptor, Trunk and Collection mains (gravity and force) and related appurtenances. Other specific Public Wastewater System components may include Lift Stations.

B. Typically, within a Development Project Area, wastewater mains and related appurtenances are owned and operated by the Department and located within an Easement or Right-of-way. These mains and related appurtenances shall meet the requirements noted in these Standards.

C. In addition to the Main Extensions and Oversize requirements in Section 1.10 of the Standards, the utility locations, alignments and separations noted herein are required for new construction, rehabilitation and retrofit areas.

D. 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 Department. For each Development Project Area, the Design Engineer shall make provisions regarding applicable utility and hard surface separation requirements, fencing access, landscape separation and Easement widths, noted in these Standards.

5.3.2 Horizontal Design

A. Alignment/Location

1. Within the platted right-of-way or Easement, main(s) should be located at the centerline of the right-of-way or Easement. In cases where a raised median is proposed, the main shall be located 10 feet west or south of the centerline, outside of the raised median flow-line.
2. Public wastewater mains shall be laid with straight horizontal (& vertical) alignments between MHs. Joint deflection shall not be allowed.
3. End of run. All runs shall end in a MH, including runs that may terminate at a future construction phase line.
   a. Cul-de-sac. Mains shall be extended to an acceptable point within the cul-de-sac and terminated in a MH.
   b. Last lot. Mains shall extend to a point 5-feet beyond the last wastewater service.

B. Small Lot Layout Scenario

1. Option to utilize shared sewer service between lots (requires a Joint Sewer Service Agreement).
2. The Department is in the process of employing a Third Party to review and recommend improvements to these standards to further aid Small Lot development.
3. *Additional details to be determined with a future update anticipated to be published as a 2025 Edition.*

C. Horizontal Separation

Distance shall be measured from the nearest outside edge of each pipe or related appurtenance.

1. Wet utilities
   a. Public water, public or private stormwater, public or private reclaimed water and any related appurtenance running parallel to a public wastewater main and/or related appurtenance shall not be closer than **10** feet.
   b. Underdrains not specifically designed to mitigate trench stability for the public wastewater system, shall be a minimum **10** feet horizontally clear from any portion of the public wastewater system.
2. Dry Utilities
   a. Natural gas, electric, cable TV, telephone/communications and all appurtenances) shall not be closer than **6** feet (outside edge to outside edge) to any portion of the public wastewater system.
   b. Light Poles require **6** foot separation.
3. Curb & Gutter, sidewalks, medians and other structures:
   a. Public wastewater mains should generally be designed to run parallel 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.) and a minimum of 12.5 feet horizontally from the outside edge of any building.

4. Other Features: See Section 4.5

5.3.3 Vertical Design

A. Cover.

1. Normal bury depth for wastewater mains is generally **8** feet of cover from finish grade to top-of-pipe.
2. Minimum depth of cover shall be **3** feet, as measured from finished grade to top-of-pipe.
3. Deep Mains**.** When mains have greater than **20** feet of cover, calculations shall be submitted by the Design Engineer showing the proposed pipe material and bedding design is adequate, from a short- and long-term structural standpoint.

B. Crossings. When a wastewater main crosses another public or private utility, irrigation or drainage ditch, the crossing design shall protect the main and utility's structural integrity, 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 view on the CCPs.
2. Wastewater crossing **over or under** Water Systems. See Section 4.3.5.C
3. Wastewater crossing **over** Storm Drain Systems. When a public wastewater main crosses these types of systems the wastewater main should cross above, with a minimum 18 inches vertical clearance from the storm drain, and maintain minimum cover .
    a. A vertical clearance of less than 18 inches may be allowed, with prior approval from the Department. For large storm drains (36 in diameter and larger) with less than 18 inches of clearance: the entire width of the wastewater main trench shall be flowfilled.
4. Wastewater crossing **under** Storm Drain Systems. When a public wastewater main crosses under these systems the wastewater main should maintain 18 inches of vertical clearance from such systems.
    a. A vertical clearance of less than 18 inches may be allowed, with prior approval from the Department.
        1) For small storm drains (less than 36" diameter) with less than 18 inches of clearance: the entire width of the storm drain trench shall be flowfilled from 4" below springline of the wastewater main to springline of the storm drain.
        2) For large storm drains (36" in diameter and larger) with less than 18 inches of clearance: the wastewater main shall be installed in a steel casing pipe.
    b. Wastewater mains crosses under large utilities (36" and larger) shall be required to be installed in a steel casing pipe.

C. Ditch Crossings. Crossings with Named Ditch Companies may require that the Developer contact and coordinate with the Ditch Companies 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/easement; a minimum of 10 feet beyond any toe or top of slope of the ditch. Refer to Section 5.4.5 Steel Casing Pipes and W/WW Standard Drawings for additional requirements.

b. Cut-Off Wall. As required by the Ditch Company a clay or concrete cut-off wall shall be placed on both ends of the casing pipe; extending vertically to 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 flowline of the ditch to the top of the casing pipe.

d. Rehabilitation. All ditches shall be restored according to the ditch owner's criteria.

5.3.4 Future Connections

A. Extension into Future Phases: In cases where a main will extend into a future phase within the Development Project Area, the main shall terminate into a permanent MH. The MH shall be located not closer than 10 feet to a phase line and shall be contained within an easement or right-of-way. The MH shall not include stubs or knockouts to accommodate any future connection(s).

5.3.5 Access Roads

A. Permanent unobstructed access to every MH is required.

B. See Section 4.3.8 for Access Road requirements.

5.4 APPURTENANCES

5.4.1 MHs (new cast-in-place and pre-cast)

A. Placement

1. Spacing. Typical spacing between MHs shall be 400 feet with a maximum spacing of 500 feet may be allowed.
2. Points of Change. MHs shall be placed at every change in direction, grade, size of main and at connections to existing Public Wastewater System mains. MHs shall typically not be allowed to have less than a 90 degree angle between the incoming and outgoing mains.
3. End of runs. MHs shall be placed at the end of all wastewater runs, regardless of permanent or temporary status.
4. Location. MHs should not be located in the traveled-way/wheel path of a paved public street. MHs should not be located closer than 5' to the lip of curb and gutter.

a. MHs on runs crossing field areas may be buried only with prior Department approval.

5. Watertight. Typically, MHs should not be placed in areas subject to surface runoff, flooding or ponding. If placement of MHs within these areas cannot be avoided, all barrel, cone and base joints shall be permanently water proofed (damp proof) and shall also have watertight ring and covers.

6. Locking Lid. MHs placed within areas designated by the Department as "restricted access", shall have a locking lid with the rim permanently bolted to the MH cone section.

B. Size

1. MHs shall be sized based on the largest main connection. Minimum MH diameter sizes for mains 18 inches or less shall be 4 feet, for 20 to 24 inches 5 feet, and over 24 inches 6 feet. Sizes are minimums, based on straight/through alignments.

2. Larger MHs may be required to accommodate multiple incoming mains or large radius horizontal flow-line channel bends.

C. Inverts

1. Drops.

a. Preferred flowline channel drop through MHs is 0.2 foot; however, a minimum of 0.1 feet drop on straight/through alignments will be accepted if grade is critical.

b. MHs with horizontal flow-line channel bends greater than 30 degrees and/or with interconnecting mains, shall have a minimum 0.2 feet drop

2. Size Change.

a. When a smaller main joins a larger main, the mains shall be typically set such that elevation of the crowns of the two pipes are equal.

b. For lateral connections to interceptor mains, the invert of the lateral should be placed at the crown of the interceptor. This includes service line connections.

D. Drop MHs are discouraged and may be allowed on a case-by-case basis. If approved, drop MHs shall be designed as follows:

1. External Drop. Preferred.

2. Internal Drop. Allowed for deep wastewater mains when the external drop structure would be infeasible.

E. Hydrogen Sulfide Resistance. MHs located in areas with a high probability of hydrogen sulfide corrosion shall be constructed with, or coated with, Hydrogen Sulfide resistant materials (see Appendix B for approved materials.) Typical locations for such MHs include, at force-main discharge points, drop MHs or on large diameter mains with turbulent flows. As directed by the Department, new MHs installed on interceptors on which other MHs have been coated, shall also be coated.

1. Calming MHs. MHs located at the terminus of a force main shall be coated with Hydrogen Sulfide resistant materials. If the force main is privately

owned and maintained then the Calming MH shall also be private, with the public portion beginning at the gravity outlet of the Calming MH.

2. The number of MHs to be coated with Hydrogen Sulfide resistant materials downstream of a Calming MH is two (2) at a minimum. Additional MHs may be required to be coated by the Department based on the size of the force main discharge.

5.4.2 Groundwater Barriers / Cut-Off Walls

A. Groundwater barriers and/or Cut-off walls shall be installed with all Public Wastewater Systems.

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

C. Groundwater barriers are typically located upstream of wastewater MHs. Groundwater barriers shall be spaced a maximum distance of 400 feet apart.

D. Groundwater barriers/walls 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/walls 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 pipe. This requirement applies in all cases, including those locations near or adjacent to a natural waterway, pond/lake, or irrigation ditch.

E. Groundwater barriers/walls shall be installed on both sides of any natural waterway, pond/lake, or irrigation ditch. Other requirements may apply due to specific criteria from each ditch company.

F. Groundwater barriers need to be shown on the wastewater main profiles.

5.4.3 Services

A. General

1. All wastewater service lines, from the point of connection (including the physical connection joint to a main or to a manufactured wye/saddle) into a residential, commercial or industrial building, shall be owned and maintained by the respective building and/or property owner.
2. All wastewater service lines shall connect to the sewer main unless otherwise approved. The Pretreatment Coordinator may require a commercial or industrial facility to install a private "Sampling" MH prior to connection to the city sewer main.
3. For that portion of a service line situated within the right-of-way or easement, the Department shall review and approve materials and installation of said service line.

B. Location/Size

1. The service line shall not be installed less than 24 inches below finished grade.
2. Residential services are typically 4 inch in size. Commercial services are typically 4-inch or 6-inch. Services 8-inches or larger are considered

private (including any associated MHs) and need to be designated as Private on the plans.

3. Services shall be connected to the main, a minimum of 5-feet from any MH.
4. All 4-inch and 6-inch service saddles shall be at least 3-feet between one another when located on the same side of a main and 18-inches if located on opposite sides of a main.
5. Within the right-of-way or easement, the service line shall not have any additional bends or fittings beyond the 45° wye (GxS or Gasket x Spigot), except as needed as approved by the City.
6. Service lines shall not cross any portion of an adjacent private lot without being situated in a private wastewater service easement.
7. A joint/shared service line may cross portions of adjacent private lots; provided a JSSA is executed between the parties and, any appropriate private easement(s) is executed to the satisfaction of this Department. A JSSA form can be found on the Department's website.

C. Service Scenarios – Notwithstanding the applicable provisions of the City's Municipal Code, Title 13, the following scenarios shall apply:

1. Residential Single Family Detached or Attached: A dwelling containing one dwelling unit whereby each unit is situated upon its own separate, platted lot, shall be serviced individually by a separate wastewater service for each platted lot. Additional example:
   a. *Townhomes where each unit is located on their own lot.*
2. Residential Duplex: A dwelling containing two dwelling units where both units are situated upon a single platted lot, shall have both units served by a single wastewater service. Additional example:
   a. *ADU: Wastewater service to the ADU shall be connected to the service from the main dwelling prior to the connection to the main.*
3. Residential Multi-Family A dwelling containing three or more dwelling units. Multi-Family buildings can either be served by a wastewater service per building or a shared wastewater service between buildings, however there shall be an appropriately sized wastewater service corresponding to each domestic water meter. Additional examples:
   a. *Townhomes where each unit may be constructed as a Single Family Attached Home, but the series of homes all lie on the same communal lot.*
   b. *Clustered Housing: Cottages & Clustered Duplexes.*
4. Commercial (a building with one or more internal tenant spaces): Each tenant within a building cannot have a separate service. There shall be an appropriately sized wastewater service corresponding to each domestic water meter.

D. Private mains – Typically all mains 8" and larger shall be considered public. Any service line that is upsized to 8" or larger based on slope concerns is still considered a private service and will not be maintained by the Department. Because the private wastewater system is connected to the public wastewater

system all private mains and MHs shall be installed per the criteria for public mains and MHs. Private MHs shall meet the standards required for vacuum testing. Inspection results will need to be provided to the inspector prior to initial acceptance.

5.4.4 Grease, Sand / Oil Interceptors

A. General

1. Sand / Oil and Grease Interceptors are privately owned and maintained and shall be shown on the CCPs. The interior piping shall be installed in accordance with W/WW Standard Details Precast or Cast-in- Place devices are installed.
2. The interior piping of the device shall not be modified if an approved alternative pretreatment technology (e.g., pre-manufactured interceptor) is installed. Refer to the Appendix for an approved list of manufacturers.
3. Unless approved otherwise by this Department, interceptor vaults shall be located external to the building being served. The interceptor shall also be situated upon the dedicated, platted lot for the building served. The interceptor shall not be located in a drive-thru area and location in parking spaces should be avoided. The entire portion of each interceptor vault shall be accessible at all times for pumping, maintenance and inspection.
4. If a Precast or Cast-in-Place device is installed, the interceptor shall have two compartments; the smallest (outlet side) shall be at least one-third the capacity of the entire interceptor. Other grease removal devices may be allowed by the Pretreatment Coordinator if it is shown that an alternative pretreatment technology is equally effective in controlling the discharge of fats, oil, and grease.
5. Grease interceptors shall provide adequate retention time at peak flow for removing fats, oils and grease from wastewater.
6. Interceptor capacity shall be sized by the Design Engineer using the City's most current adopted Building and Plumbing Codes, or other acceptable methods of sizing. Sizing calculations shall be provided at the time of building permit.
7. If the calculated volume/size is within 10% of the next smallest available size of interceptor, the smaller interceptor may be approved for installation.

B. Grease Traps

1. Reference the International Plumbing Code, as adopted by the City of Loveland.
2. A flow control or restrictor device is required. If the device is external to the grease trap it must be accessible at all times for maintenance and examination.
3. Grease traps rated at less than 50 gpm/100 lbs. capacity are not permitted.
4. Grease traps shall be accessible at all times for cleaning, maintenance and examination.
5. Grease trap locations shall comply with Larimer County Health Department requirements.

C. Combination Sand and Oil Interceptors

1. Combination sand & oil interceptors smaller than 300 gallons shall **not** be allowed.

D. Venting

1. Interceptors shall be vented in accordance with the City's current adopted Building and Plumbing Codes.

E. Seal joints/openings

1. Piping through interceptor walls shall be sealed with an approved sealant for the intended use of the interceptor to prevent infiltration and exfiltration.
2. Appropriate sealant shall be used to join applicable interceptor sections to prevent infiltration and exfiltration.

F. Domestic Waste

1. Domestic wastewater shall not enter or flow through any portion of an interceptor. All domestic wastewater flows shall connect into a service line pursuant to 5.4.3.B herein and downstream of any interceptor.

G. Certification

1. The Design Engineer may be required to certify the appropriate treatment device was installed in accordance with final signed CCPs and manufacturer's recommendations. A certification form may be obtained from the Department.

5.4.5 Steel Casing Pipes

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

B. Cathodic protection of steel casing pipes are required for Major Crossings such as for railroads, rivers, ditches, bridges and large stormwater culverts or if required by the Department.

1. CP design shall be shown on the plans per section 4.4.12.

5.5 EASEMENTS

An Easement shall encompass all portions of the Public Wastewater System that may extend beyond or outside a platted right-of-way. Easements, when dedicated by a Final Plat, shall be designated as Public Utility Easements, exclusively for the Public Wastewater System. Alternately, Easements conveyed by separate instrument shall be granted pursuant to the Department's easement agreement forms. See Section 4.5 for criteria.

5.6 RECREATIONAL VEHICLE (RV) DUMP STATIONS

The following information specifies the design requirements for the installation of a sanitary waste dump station for the discharge of wastewater from the holding tank(s) of a recreational vehicle (i.e. boat, camper, motorhome) to the City's wastewater system.

Other designs may be submitted for city staff to evaluate on a case-by-case basis.

Refer to Drawing RV-1, RV-2 and RV-3 for details. In addition, refer to Chapter 4 and Appendices of this manual for additional information and drawings.

5.6.1 Requirements

A. A dump station shall:

1. be located so that there is no infiltration of storm or flood waters into the sanitary sewer,
2. be positioned so that it is usable from the driver's side of the vehicle,
3. be designed to be easily accessible to the entrance and exit area of the facility,
4. be located to prevent unauthorized use, and
5. have an impervious surface surrounding the dump station.

B. The dump station shall not be used to discharge waste from any non-recreational vehicle, or any other wastes, chemicals, or substances.

5.6.2 Permits

A. The Pretreatment Coordinator may issue a discharge permit or other control mechanism to any dump station facility at its discretion. A discharge permit or control mechanism may contain such conditions as, but not limited to:

1. Lock hatch when not in use so RV customer has to obtain the key.
2. RV customer fills out a form.
3. Utility customer submit a form for applicable sewer charge(s).
4. Video system footage retainage.

5.6.3 Water Supply (Non-Potable)

A. The dump station shall include a metered source of water to flush the discharge area and to determine usage and any potential additional costs.

B. The water supply to the dump station shall have an approved reduced pressure backflow assembly upstream of the water tower or other acceptable device. This water shall be labeled as "Non-Potable" or have other acceptable signage (refer to section 5.6.6 Signage below).

C. A water tower (such as the Romort or Trumbull Water Tower) with a vacuum breaker at the highest point, or other acceptable device, shall be installed.

D. An adequate length of flexible hose for washing the concrete pan and flushing the drain shall be provided. Hoses used for washing down and flushing the dump station pad shall not exceed the length necessary to reach the entire dump station discharge pad. Preferably, the hose should retract when not in use so it does not contact the concrete pad or rest on the ground surface.

5.6.4 Potable Water Fill Station

A. A potable water fill station, if desired, shall be installed a minimum of 50 feet from the dump station. An approved reduced pressure backflow assembly shall be required for this specific line.

5.6.5 Discharge Pad

A. Each dump station shall be equipped with a concrete pad surrounding the drain. The concrete pad shall meet the following requirements:

1. Be four feet by four feet in size with a slope of ¼ inch per foot to the drain.
2. Be a minimum of four inches in thickness.
3. Have a drain opening of four inches in diameter with a foot-operated, self-closing locking hatch which forms a tight seal with the drain.
4. Have a 6-inch-high curb around the perimeter of the pad.
5. Have a drainpipe from the pad to the sanitary sewer that is 4 inches in diameter and of material suitable for domestic wastewater service.
6. The sanitary sewer piping shall be installed to maintain at least a 10 foot horizontal separation from any potable water supply line and meet the minimum separations outlined in Section 5.3.2.B.

B. Each dump station shall be equipped with appropriate signage. Signage requirements are outlined in Section 5.6.6.

5.6.6 Signage

A. Legible signage shall be provided at each dump station as indicated below.

B. Sign "A" shall include the following describing RV waste disposal requirements:

1. Use is for Recreational Vehicles only.
2. Dumping of Non-RV waste is prohibited.
3. Place end securely in drain opening while holding hatch cover open with foot.
4. Flush away spillage on surface into drain.
5. No RV waste shall discharge to floor trench(es) (Add only if applicable).
6. Violators are subject to fines as outlined in Section 13.10.1006 of Loveland's Municipal Code. Fines may be assessed per violation per day.

C. Sign "B" shall include the following information regarding the water supply for the dump station:

1. DANGER: Non-potable water NOT for consumption.
2. Potable water available at watering station (Add only if applicable).

D. A sign to alert customers the area is under video surveillance.

5.6.7 Video Surveillance and Recording

A. 24-hour video surveillance and recording shall be required to provide a clear view of the dump station and wash station discharge points. Requirements for duration of video storage will be determined as a condition of approval.

5.6.8 Lift Station Screening Apparatus

A. Any dump station, campground, or other discharge point receiving waste from a recreational vehicle discharging to a private lift station connected to city sewer services shall install and maintain at their expense a Screening Apparatus in the lift station. The Screening Apparatus shall capture and remove waste other than human bodily waste and toilet paper (including, but not limited to, wipes, plastics, rags, feminine hygiene products, etc.). Any Screening Apparatus shall be approved by the Pretreatment Coordinator prior to installation.

CHAPTER 6 -

TRENCHING, BACKFILLING AND COMPACTION

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CHAPTER 6 - TRENCHING, BACKFILLING AND COMPACTION

6.1 GENERAL

6.1.1 Scope

A. This chapter addresses trenching and backfilling including subsurface drainage, dewatering, preparation of subgrades, pipe bedding, backfilling, compacting, Construction Staking and finish grading for Public Water and Wastewater Systems.

6.1.2 Larimer County Urban Area Street Standards

A. Replacement and repair of plantings, landscaping, sprinkler systems, surface obstructions, pavement, driveways, sidewalks, curbs, gutters, and similar surfaces shall be in accordance with the LCUASS – Chapter 25 (Reconstruction and Repair).

6.1.3 Quality Assurance

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

ASTM D698 --- Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

ASTM D6938 --- Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

ASTM D1556 --- Standard Test Method for Density and Unit Weight of Soil In Place by the Sand-Cone Method.

ASTM D1557 --- Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

ASTM D4253 --- Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

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

B. Construction Staking

1. All Public Water and Wastewater Systems shall be Construction Staked by, or under the direct supervision of, a Professional Land Surveyor licensed in the State of Colorado.
2. Survey notes and other Construction Staking notes shall be entered into a bound, water resistant data book. All survey data/books shall be available for review upon request by the Inspector.
3. Adequate Construction Staking shall be provided to establish acceptable horizontal and vertical control. In cases where conflicts may exist or additional Construction Staking may assist the Inspector in determining compliance with signed CCPs, the Developer/Contractor/Land Surveyor shall supply such staking at no cost to the Department.

4. Cut/offset Construction Stakes shall be placed at a location whereby the stakes are not destroyed during trenching and backfill operations and can be easily read/identified by the Inspector. If Construction Stakes are destroyed in any manner, the stakes shall be replaced at the direction and request of the Inspector.
5. The only acceptable method for verifying and confirming horizontal and vertical layout during actual installation of Public Water and Wastewater Systems shall be by certified laser device or cut/offset Construction Stakes.

C. Job Conditions, during installation

1. Drainage and Groundwater
   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 dewatering permit will be required.
      2) Permit applications may take 30 days or more to be reviewed by the Colorado Department of Public Health and Environment.
   b. Water that is encountered in the trench shall be removed to the extent necessary to provide firm subgrade, permit connections to be made in dry conditions, and prevent the entrance of water into the pipeline.
   c. Surface runoff shall be diverted as necessary to keep excavations and trenches free from water during construction.
   d. 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.
   e. The pipe under construction shall not be used for dewatering.
2. Sequencing
   a. Not more than 300 linear feet of open trench excavation and pipe installation will be allowed at any time. This distance may be amended, with the Department's approval, based upon job conditions.
   b. Initial trench backfill shall be performed within 300 linear feet of pipeline installation. This distance may be amended, with the Department's approval, based upon job conditions. At the end of each day, pipes in trenches are to be plugged and capped.
   c. 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.
   d. 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.
      1) Contractor shall be solely responsible for construction site safety.
      2) All excavations shall be properly barricaded, signed, and protected to prevent unauthorized access.

3. Underground Obstructions
   a. The Design Engineer and/or Contractor shall field verify all Record Drawing information obtained from the Department, prior to start of any Work within the Development Project Area.
   b. Contractor shall notify each utility owner and request utilities to be field located by surface reference.
   c. The request for the location of utilities shall be made in accordance with Colorado Revised Statute 9-1.5-102.
   d. The Contractor shall expose and verify the size, location, and elevation of all underground utilities and other obstructions, sufficiently in advance of construction to permit changes to be made to the CCP, and to secure approval of those changes.
   e. In the event there is a conflict, the Contractor shall notify the Department and the affected utility company.
   f. In the event there is a conflict, the proposed work may be modified, at the Department's discretion and with the Design Engineer's concurrence.
   g. 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.
   h. If the Contractor removes any underground obstructions, the following shall apply:
      1) Drainage culverts may be salvaged and reused, if written approval is first obtained from the applicable City/County or State agency.
      2) Other underground obstructions shall be replaced or repaired as directed and first approved by the affected City/County or State agency.
      3) Field drains shall be repaired or replaced to their original condition, or better.
4. Maintenance and Correction
   a. Trench settlement, including any related damage to pavement, curb and gutter, sidewalks or other structures, which occurs during the warranty period, shall be the responsibility of the Developer/Contractor.
   b. The Developer/Contractor shall be responsible for obtaining all necessary permits to affect repairs within the Right-of-way or Easement.
   c. The Developer/Contractor shall coordinate all repairs with the appropriate City Departments, including this Department.

6.2 MATERIALS

6.2.1 Stabilization Material

A. If the existing soil in the trench bottom is judged to be unsuitable by the Department, a minimum of the top 6-inches of the pipe subgrade shall be removed and replaced with a stabilization material.

B. Stabilization material is crusher-run rock, conforming to ASTM D448, or CDOT Table 703-2 No. 357, or an approved substitute.

Stabilization Material	
Size	Percent Passing
2”	95-100
1”	35-70
1/2”	10-30
#4	0-5

C. In all situations where stabilization material is required, geotextile fabric shall be placed in between stabilization material, and pipe bedding.

1. Geotextile fabric shall meet the requirements of CDOT 712.08 (AASHTO M-288) Class A fabric.
   a. Grab strength: 180 lbs. (ASTM D4632)
   b. Seam strength: 160 lbs. (ASTM D4632)
   c. Puncture strength: 80 lbs. (ASTM D4833)
   d. Trapezoid tear: 50 lbs. (ASTM D4533)
   e. Apparent opening size (AOS): less than 0.297 mm. (greater than No. 50 sieve) (ASTM D4751)
   f. Permeability, cm/s: k fabric > k soil for all classes (ASTM D4491)
   g. Ultraviolet degradation at 500 hours: 50% strength retained for all classes. (ASTM D4355)

6.2.2 Pipe Zone Bedding Materials

A. The bedding area shall extend from 4 inches (or 1/4 O.D., whichever greater) below the bottom of the pipe to 12 inches above the top of the pipe, herein known as the “Pipe Zone”.

B. Bedding shall not compromise the integrity of poly-wrap or other material/covering used to protect the pipe system from corrosion or other conditions.

C. Public Water System Pipe Zone bedding: shall be granular material, uniformly graded, sand conforming to ASTM C33 or CDOT Table 703-2, for fine aggregate.

Public Water System bedding	
Size	Percent Passing
3/8”	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

D. Hydrant gravel: shall be a well-graded crushed stone or gravel, conforming to CDOT Table 703-2 No. 67.

Hydrant gravel bedding	
Size	Percent Passing
1”	100
3/4”	90-100
3/8”	20-55
#4	0-10
#8	0-5

E. Public Wastewater System Bedding: shall be granular material, uniformly graded, crushed material, conforming to either of the following:

1. CDOT Table 703-2 No. 67

Public Wastewater System bedding (No. 67)	
Size	Percent Passing
1"	100
¾"	90-100
3/8”	20-55
#4	0-10
#8	0-5

2. CDOT Table 703-2 No. 8 (aka squeegee)

Public Wastewater System bedding (No. 8)	
Size	Percent Passing
1/2"	100
3/8"	85-100
#4	10-30
#8	0-10
#16	0-5

F. Services:

1. The water services should be bedded with the same material as the main line.
2. The wastewater service should be bedded with the same material as the main line.

6.2.3 Groundwater Barriers

A. Clay groundwater barriers shall meet the following soil classifications:

CH - inorganic clays of high plasticity, fat clays.

SC - clayey sands, sand-clay mixtures.

CL - inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, clean clays.

B. Concrete shall not be used unless specifically approved by the Department. Concrete used in ground water barriers shall meet the requirements of Chapter 9, Concrete.

6.2.4 Trench Backfill Material

A. Trench backfill material shall be placed from the top of the Pipe Zone to the ground surface or to the bottom of the pavement section, whichever is applicable.

B. Ordinary/Native Backfill-

1. Material shall consist of material excavated from the site and be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, rocks or stones which are larger than 6 inches, in any dimension, or other materials considered unacceptable by the Inspector.
2. Rocks or stones, which are larger than 3 inches, in any dimension, shall not be placed within one foot of the pipe or within one foot of the top of the trench backfill.

C. Imported Backfill- material imported from off-site locations.

1. Material shall be free of rock or gravel larger than 3 inches, and free of debris, waste, frozen materials, vegetation and other deleterious matter. Material shall meet the acceptable ASTM soil classification groups for locally available material.
2. Topsoil shall not be used as fill.

D. Structure Backfill- material shall meet Class 1 Structure backfill, conforming to CDOT Standard Specifications Section 703.08

CL 1 Structure Backfill Material	
Size	Percent Passing
2”	100
#4	30-100
#50	10-60
#200	5-20

E. Flowable Fill- material shall be required for utility trench backfill in existing pavement or as directed by the Inspector.

1. Vibration of flowable fill shall be required unless directed by the Inspector.
2. The maximum desired 28-day strength is 60 psi. The combination of material listed above, or an equivalent, may be used to obtain the desired flowable fill. Flowable fill shall not be used as a temporary or permanent street surface.
3. Trenches shall be initially backfilled to the level of the original surface. After flowable fill has cured, the top surface of the flowable fill shall be removed to the depth necessary to allow repair of the permanent surface.
4. The approved mix for flowable fill is shown below:

Flowable Fill	
Ingredients	Pounds/Cubic Yard
Cement* *fly ash may be used if approved by the Inspector	42 (0.45 sack)
Water	325 (39 gallons as needed)
Course Aggregate (No.57)	1700
Sand (ASTM C-33)	1845

F. Conventional Backfill– known as “nonflowable fill.”

1. Backfill Lifts- Backfill material shall be placed in uniform loose lifts, not to exceed 8 inches prior to compaction. Lift heights can be altered

provided the contractor submits a Geotechnical Report with recommendations larger lifts and the type of compaction equipment used and meets minimum compaction densities to be reviewed and approved by the Inspector.

2. Compaction- Each lift placed shall be compacted to a density not less than 95 percent of maximum density, in accordance with AASHTO T99 and at the moisture content as specified in the soils or pavement design report. If the moisture content is not specified, soils shall be compacted at +/- 2 percent.

6.2.5 Native Seed Mix (if used)

A. Mix Design

1. Modifications to the following mix design can only be made with prior approval of the City.

Scientific Name	Common Name	Variety	% in Mix	Lbs PLS /acre drill seed method	Lbs PLS/acre broadcast seeding method
Pascopyrum smithii	Western wheatgrass	Arriba	8.1	2.8	5.6
Bouteloua gracilis	Blue grama	Hachita, Lovington	0.43	0.15	0.3
Schizachyrium scoparium	Little bluestem	Pastura, Cimarron	1	0.35	0.7
Buchloe dactyloides	Buffalograss	Sharps Improved, Tatanka, Cody	57.7	20	40
Bouteloua curtipendula	Sideoats grama	Vaughn, El Reno, Niner	3.9	1.35	2.7
Stipa viridula	Green needlegrass	Lodorm	28.9	10	20

B. Mulch: Weed Free Hay

C. Weed-control: Herbicides and pesticides shall be EPA registered and approved

6.3 CONSTRUCTION

6.3.1 Preparation

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

B. Topsoil shall be segregated from non-organic trench excavation material, and debris. Sod shall be either ground up into the topsoil or segregated and disposed of. No sod pieces greater than 3 inches shall remain in the topsoil.

C. Topsoil and other soil with organics or other unsuitable material shall not be placed as trench backfill.

6.3.2 Trenching

A. Trenches shall be excavated by open cut methods, except where boring or tunneling is shown on signed CCPs, or as otherwise approved by the Department.

B. Trench width shall be maintained to within three (3) inches of that specified on Standard Drawings .

C. 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.

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

E. Trench alignment shall be sufficiently accurate to permit pipe to be aligned properly with minimum clearances between the pipe and sidewalls of the trench (or trench box) pursuant to Standard Drawing W-1 and WW-1of these Standards.

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

G. If the trench bottom is rock, the Contractor shall over-excavate the trench bottom and backfill and compact with suitable bedding material. The minimum over-excavation depth shall be 12 inches below the bottom of the pipe. The trench width through the extents of the rock excavation shall match the trench width above the top of rock elevation. The Department may allow blasting within rock, with prior approval.

H. Over-excavation shall be backfilled and compacted with acceptable Bedding Material or Stabilization Material at the Department's discretion.

I. Contractor shall follow the most current regulations concerning excavations set forth by OSHA. Trench safety is the sole responsibility of the contractor

J. Trench support is the sole responsibility of the Contractor. The Department's presence in no way implies approval of trench support methods being utilized. The Department/Inspector reserves the right not to enter a trench which, in the Inspector's opinion, may be unsafe.

6.3.3 Pipe Zone and Subgrade

A. Pipe Zone trench bottom shall be graded uniformly to provide clearance for each bell and barrel section of pipe.

B. Loose material, water, and foreign objects shall be removed from the trench bottom.

C. The Contractor shall provide a firm trench bottom, which is suitable for application of Pipe Zone bedding material.

D. Wherever wet or unstable material is encountered in the bottom of the trench, said material shall be over-excavated to a depth of 6 inches, minimum.

1. The over-excavation shall be backfilled with Stabilization Material and compacted as required by the Department.
2. Use geotextile where necessary around Stabilization Material and on the subgrade to stabilize subgrade and prevent fines from migrating into granular materials.
3. The Department may require the Contractor to provide an opinion from a Geotechnical Engineer if the Department determines the conditions merit special investigation.

6.3.4 Stockpiling Excavated Materials

A. Suitable material for backfilling shall be stockpiled in an orderly manner, and stored away from the edge of the trench.

B. Contractor shall dispose of unsuitable or excess excavated materials.

C. Excavated material shall not be stockpiled against or over existing structures or appurtenances.

D. Excavated materials shall not be stockpiled beyond, or in a manner not consistent with an approved erosion control plan.

6.3.5 Pipe Zone Bedding

A. Reference Standard Drawings.

B. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the pipe, including services at all points between bell ends, or pipe joints.

C. Pipe shall not be supported by the bells.

D. A minimum of 4 inches of bedding shall be placed prior to the installation of the pipe, including services.

E. Bedding material shall not be dropped on unsupported pipe or pipe, which is supported only at the ends. Pipe shall be uniformly supported before continuing with bedding lifts.

F. Bedding material shall not be placed in a manner that could damage protective coating, poly wrap, or similar elements of the pipe system.

G. Bedding material shall be consolidated under and around the pipe.

H. To prevent lateral displacement, bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.

I. Care shall be taken when installing pipe to prevent damage to protective coatings, poly wrap, or similar elements of the pipe system. Workers shall not walk on coated or protected pipe.

J. Any pipe coatings, poly wrap, or other surface damage shall be repaired according to manufacturer/supplier recommendations and in a manner acceptable to the Department prior to backfilling.

6.3.6 Groundwater Barriers / Cut-Off Walls

A. Groundwater barriers / Cut-Off Walls shall be constructed in a manner that impedes passage of water through the entire portions of the trench pipe zone and backfill material. Reference Standard Drawings.

6.3.7 Backfilling and Compaction

A. All trench backfill shall be mechanically compacted, including services.

1. No compaction shall be done by use of a drop hammer compactor.
2. Compaction shall not be performed by jetting or water settling.

B. Backfill of pipe and appurtenances and around vaults and valve boxes shall be compacted in a manner which is capable of producing the required results.

C. Backfill material shall be deposited in uniform horizontal layers which shall not exceed eight inches (compacted depth), in all areas, unless otherwise approved by the Department.

D. Equipment or backfilling methods which damage the pipe, pipe coatings, poly wrap, or other elements of the pipe system shall not be utilized.

E. Sheeting removal (if utilized)

1. Do not remove sheeting prior to backfilling.
2. Use effective methods to protect the construction, other structures, utilities and properties during sheeting removal.
3. Voids left by sheeting removal shall be filled with dry sand.
4. Sheeting which is left in place shall be cut off at an elevation 18 inches below the finish grade of unpaved areas, or 24 inches below the subgrade of paved areas.

F. Topsoil shall be replaced to the depth of stripping over all areas, which are to be reseeded or otherwise restored. See Section 6.3.10 for reseeding.

6.3.8 MH Frames and Valve Boxes

A. Prior to completion of backfilling, MH frames, vault frames and water valve boxes shall be raised to subgrade. MH adjustment shims shall not exceed eight (8) inches.

B. Valve boxes and MH/vault rings shall be straight and properly aligned.

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

D. Construction materials and foreign matter shall be removed from the interior of MHs, vaults and valve boxes immediately. Care shall be taken to insure foreign matter dies not enter the wastewater collection system.

E. Asphalt or oil which covers a MH lid or valve box cover shall be removed and the lid or cover replaced so access to the structure is available.

6.3.9 Field Quality Control

A. This section applies to all Public Water and Wastewater System mains and appurtenances. All tests shall be the responsibility of the Developer/Contractor and shall reflect results in accordance with these Standards.

B. Field moisture/density testing control

1. Field tests will be conducted to determine compliance of moisture/density requirements in accordance with ASTM D6938. Moisture/density testing may also be performed according to ASTM D1556. Where inconsistent or conflicting test results are obtained other methods of determining in place moisture and density may be required.
2. Moisture/density tests are the responsibility of the Contractor, and shall be performed by a private Geotechnical Consultant.
    a. The Department may elect to perform separate moisture and density tests for compliance of the work at any time.
    b. Test results are for discreet locations only and do not guaranty acceptance for trenches or backfill zones in their entirety.
3. The method of testing the compacted material shall be determined by the Geotechnical Consultant or the Department. The validity of the results shall be the responsibility of the Geotechnical Consultant.
4. Test results shall be submitted to the Department by the Contractor or the Geotechnical Consultant within 24 hours of the test, or by the end of the next working day.
5. Copies of the field work sheets are acceptable.
6. Results of all moisture and density tests shall be submitted to the Department and approved by the Department prior to acceptance of water and wastewater systems. Approved test results shall be available on the job site.
7. Moisture/density test shall be performed at a depth not more than 2 feet above the top of the pipe bedding and in 2-foot increments up to the final grade.
8. Moisture/density test shall be performed at a minimum of 200 lineal feet, as measured along the length of the pipe, or as determined by the Department. Testing may be requested at an increased frequency and/or at specific locations.
9. A minimum of one test shall be performed for every 2 vertical feet of compacted backfill material. Test locations shall be staggered within each lift so that successive lifts are not tested in the same location.

10. Moisture/density tests shall be performed on trench backfill, a minimum of one time for each service line installed. Certain cases may require additional tests, as required by the Department/Inspector.
11. Tests for Public Water System appurtenances.
    a. Moisture/density tests in the vicinity of vaults and valve boxes shall be performed at a maximum of 1 foot away from the vault sections or valve box.
    b. Tests shall be performed in random directions from the vault or valve box, on separate lifts. A minimum of two tests shall be performed at each valve box and vault location.
12. Tests for Public Wastewater System appurtenances.
    a. Moisture and density tests in the vicinity of MHs shall be performed at a maximum of one (1) foot away from the MH section. If nuclear test methods provide uncertain or inconsistent results due to the proximity of the structure, sand cone tests or other approved methods will be used.
    b. At least one test shall be made in all four directions from each MH and at different elevations.
13. Failed test areas shall be recompacted and retested at Contractor's expense.
14. Compaction and moisture content shall be to the following minimum standards unless recommended otherwise by the geotechnical engineer and approved in writing by the Department. (Reference ASTM D698 or AASHTO T99, unless otherwise indicated).
    a. Groundwater barrier material: 95% of maximum standard Proctor dry density (ASTM D698) between optimum moisture content and three percent over optimum moisture content.
    b. Pipe Zone bedding: 85% of relative density (ASTM D4253 & D4254)
    c. Trench backfill: 95% of standard Proctor maximum dry density (ASTM D698).
15. Moisture content.
    a. The acceptable range of moisture content for compacted trench backfill will be within two percent (+/-) of the optimum moisture content determined by the standard Proctor test (ASTM D698) unless recommended otherwise by the geotechnical engineer and approved in writing by the Department.
    b. If water is added to the material, the material shall be harrowed, disked, bladed, or otherwise worked to ensure a uniform moisture condition.

6.3.10 Seeding (if used)

A. All disturbed areas shall be restored to natural grade, and reclaimed.

B. Seeding can only be done during the months of March to May or October to November.

C. Fine grade the proposed area to be seeded to establish an even gradient over the entire surface. Provide even transition areas between changes in slope.

D. Clear topsoil of roots, plants, sod, stones, lumps, and other material harmful to plant growth and the appearance of a smooth finish grade. Provide positive surface drainage of planted areas.

E. Limit soil preparation to areas which will be planted in the immediate future.

F. Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in the air or that clods will not break readily. Apply water if necessary to bring soil to optimum moisture content for tilling and planting. Maintain within 2 percent above or below optimum moisture content at all times during the work.

G. Rip existing soil to a depth of eight (8) inches minimum in one direction a minimum of eighteen (18) inches apart. Soils that have been over compacted by traffic shall be ripped or tilled to break up restrictive layers and then harrowed or rolled to firm the seed bed. The seed bed shall be friable enough to allow seed to be placed at the proper depth. Remove any stones larger than eight (8) inches.

H. Seed shall be uniformly sown by drill or by broadcast methods (seeding rates shall be doubled the amounts specified for broadcast if hand broadcast). Hydroseeding shall not be used. Do not drill or sow seed during high winds or when the ground is frozen or otherwise unable to be worked.

I. The reseeded areas shall be mulched with weed free hay. Straw shall not be used as mulch. The hay shall be crimped in to the soil.

J. Protect seeded areas against erosion.

CHAPTER 7 -
PUBLIC WATER SYSTEM, MATERIALS AND INSTALLATION

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CHAPTER 7 - PUBLIC WATER SYSTEM, MATERIALS AND INSTALLATION

7.1 GENERAL

7.1.1 Scope

A. This chapter addresses minimum acceptable materials and certain installation methods for the City's Public Water System. Separate Standards for design, materials and installation can be provided, upon request to the Department, for Booster/Pump Stations.

B. Specific/approved manufacture type(s) for each material is identified in the materials list, Appendix B

C. Pipe material shall be consistent for each size/diameter of pipe used throughout the entire portion of a Development Project Area. Pipe material shall not be interchanged except where another type of pipe material is specifically indicated and approved by the Department.

D. Pipe shall be furnished with all necessary fittings, flanges, specials and other accessories, as noted in these Standards on final signed CCPs.

7.2 MATERIALS

7.2.1 Pipe, Related Fittings and Appurtenances

A. Ductile Iron Pipe (DIP)

1. With push-on joints, shall be manufactured in accordance with AWWA C151/ANSI A21.51.
    1. 12 inches and smaller in diameter shall be Pressure Class 350.
    2. Larger than 12 inches in diameter shall be Pressure Class 250.
2. With flanged joints, shall be manufactured in accordance with AWWA C115/ANSI A21.15.
    1. Flanged ductile iron pipe with threaded flanges shall be Class 53 pipe.
3. Nominal laying lengths shall be either 18 or 20 feet.
4. Except when making closure connections to fittings, random/cut lengths of pipe shall not be allowed.
5. Joints
    1. Mechanical and push-on joints shall be manufactured in accordance with AWWA C111/ANSI A21.11
    2. Unless approved otherwise, gaskets shall be as recommended by the manufacturer.
    3. Lubricant shall be as specified by the pipe manufacturer.
    4. Nuts and bolts shall be high-strength low-alloy COR-TEN, manufactured in accordance with AWWA C111/ANSI A21.11.
    5. Ductile iron pipe with threaded flanged joints shall be manufactured in accordance with AWWA C115/ANSI A21.15.

6. Flanges shall be sized and drilled in accordance with ASME/ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings, Class 125. Flange nuts and bolts to be 304 stainless steel.

6. Pipe Coating and Lining
    1. Ductile iron pipe shall have a bituminous coating on the pipe exterior, unless otherwise specified.
    2. The minimum thickness of the bituminous coating shall be one (1) mil.
    3. Ductile iron pipe shall have standard thickness cement mortar linings in accordance with AWWA Standard C104/A21.4.
7. Corrosion Control: See Section H

B. Polyvinyl Chloride Pipe (PVC)

1. With push-on joints, shall be manufactured in accordance with AWWA C900 or AWWA C909.
    1. DR **18** (Pressure Rating 235) for all water mains and fire hydrant laterals.
2. PVC pipe shall have nominal laying lengths of 20 feet.
3. Unless approved otherwise by the Department, all PVC pipe used for mains, fire hydrant, and fire service lines shall be "blue" color.
4. Except when making closure connections to fittings, random/cut lengths of pipe shall not be allowed.
5. Pipe joint/gasket lubricant shall be as specified by the pipe manufacturer.

C. Steel Casing Pipe

1. Smooth steel casing pipe shall conform to ASTM A139, Grade B (No hydro).
2. Minimum yield point of smooth steel casing pipe shall be 35,000 psi.
3. Clean used casing pipe in good condition and conforming to the requirements of this specification may be used with the prior approval of the Design Engineer and Department.
4. No exterior coating is required, unless the agency having jurisdiction (other than the Department) requires the use of an exterior coating.
5. Minimum wall thickness of smooth steel casing pipe shall be:

Table 7.1-Casing pipe minimum wall thickness (From BNSF guidelines)

Nominal Diameter (inches)	Minimum Thickness (non-coated) (inches)	Minimum Thickness (coated) (inches)
14 and under	0.188	0.188
16	0.281	0.219
18	0.312	0.250
20 and 22	0.344	0.281
24	0.375	0.312

26	0.406	0.344
28	0.138	0.375
30	0.469	0.406
32	0.500	0.438
34 and 36	0.531	0.469
38, 40, and 42	0.563	0.500
44 and 46	0.594	0.531
48	0.625	0.563
50	0.656	0.594
52	0.688	0.625
54	0.719	0.656
56 and 58	0.750	0.688
60	0.781	0.719
62	0.813	0.750
64	0.844	0.718
66 and 68	0.875	0.813
70	0.906	0.844
72	0.938	0.875

6. The ends of smooth steel casing pipe shall be beveled for field welding.
7. Increased pipe strength shall be provided as necessary to withstand jacking loads.
8. Casing Seals
    1. Casing seals shall be constructed of high-density rubber.
    2. Straps for casing seals shall be stainless steel.
9. Casing Spacers
    1. Casing spacers shall support the carrier pipe.
    2. Casing spacers shall be constructed of stainless steel with polymer or plastic runners.
        1) Metal surfaces, not stainless steel, will be coated with an epoxy polyamide or a coal-tar enamel exterior coating conforming to AWWA C203, Section 2.
        2) Minimum thickness of the coating shall be 16 mils.

D. Fittings and Couplings for DIP and PVC pipe

1. Fittings and couplings shall be manufactured in accordance with AWWA C104, C110, and C111. Compact fittings, pursuant to AWWA C153 are preferred.
2. All fittings shall be mechanical joint.

3. Fittings and couplings shall be made of ductile iron, and have a minimum working pressure rating of 250 psi and shall be epoxy coated.
4. Couplings between a branch on a cross or tee and a valve shall be a manufactured type coupling (*e.g.* "Foster" connection).

E. Tracing Wire/Test Stations

1. All water mains, regardless of pipe material, shall be installed with tracing wire.
2. Direct Bury: Tracing wire shall be a standard, single strand, No. 12 AWG, insulated solid copper wire, blue in color.
3. Trenchless Application: A separate materials submittal will be required to be submitted and approved by the Department prior to installation.
4. Tracing wire shall be terminated within valve boxes or in test stations see Standard Drawings.

F. Mechanical Joint Restraint Devices

1. Devices may be either full concentric circle or wedge load types.
2. Type 304 stainless steel bolts are required.
3. All DI fittings shall be epoxy coated.

G. Joint Restraint Warning Tape

1. Tape shall be placed along the entire length of restrained pipe length, laid typically on top of the pipe.
2. Tape shall be 6 inches wide and have the following two lines of wording:

   CAUTION CAUTION

   RESTRAINED JOINT WATERLINE BELOW

H. Marker Posts

1. Marker Posts should be similar to Carsonite CRM-375 with reflective labels.
2. For major transmission mains markers should be 4 inch steel posts filled with concrete. Post should be 5 foot tall buried 3 feet in a 12 inch diameter 3,000 psi concrete base that extends 6 inches below the post. Posts shall be painted orange. Place white 12"x18" metal sign with black letters stating the following information: City of Loveland, X" (diameter) Water Main, Year installed, and any necessary offset. In open fields signs shall be placed at every bend and valve.

I. Corrosion Protection

1. <u>Polyethylene Encasement</u>
   1. Required for DIP pipe and/or fittings
   2. Encasement shall conform to AWWA C105 A21.5.
   3. The minimum thickness of the polyethylene shall be eight (8) mils.
   4. The color shall be natural.
   5. All fittings shall be double wrapped.
   6. Tracing wire shall be taped to outside of encasement.
2. <u>Isolation</u>:

1. Ties to dissimilar metals shall be dielectrically isolated by means of insulating flange kits, insulated dressers, etc…

3. Joint Bonding:
   1. DIP Joints shall be bonded over with the use of two (2) copper wires, exothermically welded at both ends. Copper plates may be used instead of wires.
      1) Size bond wire according to pipe diameter.

Pipe Size	Bond Wire Size
4" - 12"	#8
16" - 36"	#4
42" and larger	#2

   2. Exothermic welds shall be accomplished with Cadweld or approved equal.
   3. Exothermic welds shall be capped with Handy Cap II by Royston Laboratories, Inc. Handy Cap application procedure:
   4. The weld and the disturbed surface of the pipe shall be treated with a primer recommended by the manufacturer of the weld cap.

4. Anodes:
   1. Shall be Magnesium type and conform to the following specifications:

Aluminum (Al)	0.10% maximum
Manganese (Mn)	0.50 to 1.30%
Zinc (Zn)	0.00
Silicon (Si)	0.00
Copper (Cu)	0.02% maximum
Nickel (Ni)	0.001% maximum
Iron (Fe)	0.03% maximum
Other Impurities - each	0.05% maximum
Total	0.03% maximum
Magnesium (Mg)	Balance

   2. The minimum anode size shall be 17 pounds.
   3. Anodes shall come prepackaged in special backfill material consisting of 75% ground hydrated gypsum, 20% powdered bentonite and 5% anhydrous sodium sulfate. The backfill shall have a grain size such that 100% is capable of passing through a 20 mesh screen and 50% will be retained by a 100 mesh screen. The backfill mixture shall be firmly packaged around the magnesium anode within a cotton bag by means of adequate vibration.
   4. Anode lead wires
      1) Lead wired shall be No. 12 AWG solid THHN wire black in color. Lead wires shall be a minimum of 10 feet in length.

5. CP Test Stations
   1. The locations shall be shown on the CCPs
   2. Test wires shall be No. 12 AWG solid THHN wire; red in color for steel pipe and blue in color for DIP

3. Test wires shall be brought to the surface and terminated into a CP test station. See Appendix F for approved type.
4. A Carsonite type flexible marker shall be placed at the test station location or may be placed at a reasonable off-set to the station. The marker shall clearly be labeled "City of Loveland Water Main CP Test Station" and if applicable also provide space for indication of a horizontal off-set, in linear feet. Overall color of the marker shall be blue.

7.2.2 Main Valves

A. General

1. Valves shall be black topped and open counter-clockwise (left). Valve Top color shall correspond to the opening direction: red (open right) and black (open left).
2. Valves shall be capable of satisfactory operation with flow in either direction.
3. All valves shall be supplied with mechanical restraint joints.
4. Valve bonnet and packing bolts and nuts shall be type 304 Stainless Steel.
5. Buried valves shall have a 2-inch square operating nut.
6. Valves placed in vaults shall have a valve operator approved by the Department.

B. Resilient-Seated Gate Valves

1. 4-inch thru 12-inch shall be a resilient-seat type and manufactured in accordance with AWWA C509. Alternate valves, pursuant to AWWA C515 may be allowed, with prior approval of the Department.

C. Tapping Valves

1. Shall be resilient-seat type and manufactured in accordance with AWWA C509. Alternate valves, pursuant to AWWA C515 may be allowed, with prior approval of the Department.
2. Shall be equipped with an alignment ring on the flanged side of the valve and be equipped with a test plug.

D. Butterfly Valves, 16 inch and larger

1. Shall be installed in a vault.
2. Shall be manufactured in accordance with AWWA C504 with special attention, pursuant to Section 1.1.1.4 of AWWA C504.
3. Operator torque as specified in AWWA C504, Appendix A.
4. Position:
    1. For use in horizontal position.
    2. Operator horizontal to valve.
5. Shall be located within a vault per Standard Drawings.

E. Valve Boxes

1. Reference Standard Drawing.

F. Air Relief/Vacuum Relief Valves

1. Reference Standard Drawing.
2. Air relief and vacuum relief valves shall have an integral type assembly to function both as an air release and vacuum valve.
3. 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.
4. Size of air relief and vacuum relief valves shall be as noted on the CCP.
5. Taps for air relief valves and vacuum relief valves shall be made as indicated on the Construction Drawing, unless otherwise directed by the Department.
6. Piping and fittings shall be brass.
7. Connections: The inlet connection of air relief and vacuum relief valves shall be a minimum of 2 inches in diameter conforming to AWWA C800.
8. Air relief and vacuum relief valves shall be watertight to a pressure of 200 psi.

G. Check Valves

1. Check valves shall be rated at a working pressure of 150 psi.

7.2.3 Fire Hydrants

A. Fire hydrants shall be manufactured in accordance with AWWA C502.

B. Fire hydrant assembly valves shall open clockwise (right) with a square operating nut.

C. Fire hydrants shall be delivered with paint applied by the manufacture. Hydrants bodies shall be painted Orange. (See Appendix F for paint specifications).

D. All fire hydrant extensions shall be installed per the manufacturer's instructions.

E. There should only be one stem extension between the upper and lower stem.

7.2.4 Blow-Offs

A. Blow-offs shall be pursuant to Standard Drawings.

7.2.5 Meters, Pits, Vaults and Related Appurtenances

A. Meters

1. Meters manufactured by Sensus Technologies, Inc, shall be the only meters allowed.
2. 3/4 inch and 1-inch meters and readouts are supplied and installed by the Department.
    1. Exception: within a new subdivision 3/4-inch meters pits and appurtenances are typically acquired and installed by the Developer. The Department will install the meters and inspect the pits and service prior to initial acceptance.
3. Meters larger than 1-inch shall be supplied by the Developer. After final acceptance the meters become owned and maintained by the Department.

B. Meter Pits -3/4-inch and 1-inch meters shall be placed in meter pits. Reference Standard Drawings.

1. Pits shall be 20-inches (for single meters) or 24-inches (for dual meters) in diameter, a minimum of 48-inches in length, and shall be constructed of rigid Polyethylene.
2. Pit bonnets shall be constructed of cast iron with cap type top lid and frost-proof inner lids.
3. The minimum allowable opening for meter pit covers shall be 11-inches diameter.
4. Pit covers shall have a 27/32 inch worm-lock with a Standard Waterworks pentagon head.
5. Concrete base for meter pits shall meet the requirements of Chapter 9 and shall be drilled with 1" diameter holes to allow for drainage.
6. Risers/extensions can be added to the top of the pit to achieve appropriate depth. Risers shall be 20-inches in diameter.

C. Meter Vaults - 1-1/2 thru 6-inch meters shall be placed in meter vaults. Reference Standard Drawings.

1. Vaults shall be precast concrete. 1-1/2 inch and 2-inch vaults shall lie on 12" wide x 8' long x 9" high concrete grade beams. 3-inch, 4-inch, and 6-inch vaults shall have an integral 6-inch minimum thick concrete floor with a 10-inch diameter sump/drain hole in the corner.
2. Vault MH ring and covers shall be cast iron with a minimum 24-inch diameter opening. Ring and covers may also need to be manufactured to meet AASHTO HL-93 load ratings, as approved by the Department.
3. Vault covers shall have the word "water" cast in the lid.
4. Vault covers shall be pre-drilled with a 1-7/8 inch hole and capped, to accept remote read devices.
5. Watertight seals shall be provided for all vault penetrations and ring and cover sections.

D. Tapping Saddles

1. 3/4-inch through 2-inch tapping saddles shall be constructed of:
    1. Stainless steel body with solid stainless steel strap.
    2. Nuts, bolts, accessories shall be in accordance with manufacturer specifications.
    3. Inlets shall be threaded.
2. 4-inch and larger tapping saddles shall be constructed with:
    a. Epoxy coated ductile iron or stainless steel flanges, attached to a full wrap stainless steel body with full wrap gaskets.

E. Corporation Stops - used for taps 2-inches and smaller

1. Shall conform to AWWA C800.
2. Shall be full opening ball type and constructed of NL brass.
3. Inlet threads for tapping saddles shall be threaded only.
4. Shall be supplied with thread x QCTS compression connections.

F. Service Lines

1. Copper services (3/4-inch through 2-inch) shall conform to AWWA C800, Type K only.
2. 4-inch and larger service lines can be DIP or PVC, in accordance with these Standards.

G. Curb Stops - used for services 2-inches and smaller

1. Shall conform to AWWA C800.
2. Shall have QCTS compression x QCTS compression connections at both ends.
3. Shall be ball type full opening constructed of NL brass.
4. Shall have a valve box top, if allowed by the Department to lie within the sidewalk or pavement.
5. Shall be Minneapolis screw on style with no operating/extension/shut-off rod allowed.

H. Meter Setters

1. Shall have QCTS compression x QCTS compression connections at both ends.
2. Shall be constructed of NL brass.
3. 3/4-inch and 1-inch meter setters shall have a meter stop inlet valve with a lockwing.
4. 1½-inch and 2-inch meter setters shall have a meter stop inlet valve with a lockwing, and a built-in locking by-pass.
5. Meter setters with integrated check valves are prohibited.

I. Touch Read Devices

1. Are supplied by the Department to be installed by the Contractor.
2. For ¾ inch and 1 inch meter pits the devices shall be placed on the wall of the building.
3. For ¾ inch multiple meter precast vaults the devices shall be stack mounted on the nearest building,
4. Touch read devices mounted on buildings may be on either side of the building, but not more than 5' from the front of the building or more than 5' above finished grade.
5. Touch read devices shall not be placed behind any fence.
6. For 1-1/2 inch and larger vaults, MH lids shall be drilled for the device.
7. Conduits shall be ½ inch PVC and have wire pre-installed.

7.2.6 Foam Insulation

A. Conformance: ASTM C578, Type VI
B. Minimum thickness: 2 inches.
C. Thermal resistance aged R-value per inch @ 75° F mean temperature: 5.0
D. Compressive strength: 100 psi
E. Water absorption: less than 0.7 % by volume
F. Water vapor permeance: less than 0.6 perms

7.2.7 Concrete Thrust Restraints

A. Concrete thrust restraints shall meet the requirements of Chapter 9 Concrete.

7.2.8 Vaults (General)

A. Vaults can be constructed of Precast Concrete or Cast-in-Place Concrete. Vaults shall be furnished with all accessories, including base, cone section and ring & cover.

B. Mortar

1. Mortar shall be Sand-Cement grout, using the following ratio of ingredients:
    1. One part Portland Cement; conforming to ASTM C150, Type I, IA, II, IIA.
    2. Two parts sand; conforming to ASTM C144.
    3. One half (1/2) part hydrated lime; conforming to ASTM C207, Type S.

C. Grout

1. Grout shall be pre-mixed, non-metallic, non-aggregate, and non-shrink, using the following ratio of ingredients:
    1. One part Portland Cement; conforming to ASTM C150, Type I, IA, II, IIA,
    2. One part sand; conforming to ASTM C144,
    3. One part shrinkage correcting aggregate.

D. Ring and Cover

1. Rings for built-up construction shall be 8 inches in height.
2. 4-inch rings may be acceptable for street overlays or repaving, with written approval from the Department.
3. Water-tight installations
    1. Vaults shall not be located in areas subject to flooding from surface runoff.
    2. Vaults shall not be located in areas where ponding or storm detention may occur.
    3. Vaults shall have a watertight, bolted type cover having an integral O-ring type gasket that can be bolted closed.

E. Preformed Plastic Gaskets

1. Preformed plastic gaskets shall conform to AASHTO M198 and Federal Specification SS-S-00210(210A)
2. Gaskets must be pliable at the time of installation at a temperature of 10^{o} F. and above without being heated.
3. Primer is required on all joints. Primer shall be supplied by the gasket manufacturer.

7.3 CONSTRUCTION AND INSTALLATION

7.3.1 Product Delivery, Storage and Handling

A. Do not drop materials or equipment. Use slings, pipe tongs, skids or other controlled methods for handling materials and equipment.

B. Care must be taken to prevent damage to materials and equipment by impact, bending, compression, abrasion or other deleterious handling.

C. Damaged materials and equipment shall not be installed.

D. Lubricant shall not be stored or handled in a manner that will cause contamination.

E. Rubber gaskets shall be stored in a location that protects them from deterioration.

F. Store materials and equipment in accordance with the manufacturer's specifications.

G. Pipe, fittings and joints shall be kept free from dirt, oil and grease.

H. Take special precautions to keep internal parts of materials and equipment clean for use in the potable water system.

I. PVC pipe

1. Store pipe on a surface which provides even support for the pipe barrel.
2. Do not store pipe in such a way as to be supported by the bell.
3. Pipe which exhibits excessive signs of ultraviolet deterioration shall not be used.

J. DI Pipe

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

K. Steel Casing Pipe

1. Pipe shall be handled, stored, and protected in a manner to prevent damage to materials.
2. Contractor shall provide a smooth, continuous, and uniform casing pipe without voids.
3. 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.

L. Fire hydrants shall be handled, stored, and protected in such a manner as to prevent damage to materials, coatings, and finishes.

7.3.2 Inspection

A. Pipe barrel, joints and fittings shall be free of dirt or other foreign objects prior to installation.

B. Pipe, joints and fittings with cracks, dents, abrasions, damaged linings or coatings, or other flaws shall be rejected.

C. Damaged and defective materials and equipment shall be marked and stored separately. The Inspector may request removal of such materials and equipment from the site.

D. Valves, valve boxes, and other system components shall be examined for cracks, dents, abrasions, and other flaws.

7.3.3 Preparation

A. Reference Chapter 6, Trenching, Backfilling and Compaction.

B. Stabilization materials shall be required for water mains where unstable soil exists.

C. Bedding material shall be placed in the trench bottom to a minimum of 4 inches, and bell holes and depression shall be dug in the bedding to provide a uniform and continuous bearing support for the pipe at every point between bell holes.

7.3.4 Cutting the Pipe

A. The pipe shall be cut smooth, straight, and at right angles to the pipe axis, with saws or pipe cutters designed specifically for the material.

B. The cut end of the pipe shall be beveled in accordance with the manufacturer's recommendations.

C. Burrs shall be removed and all dust shall be wiped off of the jointing surface.

7.3.5 Connections

A. The location and elevation of the existing pipe shall be verified prior to start of Work. The Developer/Contractor shall notify the Inspector if locations and/or elevations vary substantially from the final CCPs.

7.3.6 Joints

A. Dirt, oil, grit, and other foreign matter shall be removed from the inside of the bell and outside of the spigot.

B. 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.

C. Preparatory to making pipe joints, all surfaces of the joint shall be clean and dry.

D. The lubricated joint shall be kept clean until joined.

E. 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 joint.

F. The pipe shall be joined to the tolerances recommended by the manufacturer.

G. The pipe shall be set in position and checked for line and grade using care to keep the joint absolutely free of dirt.

H. When final grade is achieved, the joint shall be carefully pushed together until the assembly mark on the spigot is aligned with the end of the pipe, using approved methods of leverage.

I. Care shall be taken so that the bell end of the pipe will not be deflected.

J. The seating of the gasket shall be checked around the entire circumference of the pipe by visual and feeler gauge inspection.

K. Stabbing the pipe shall not be allowed.

L. Previously completed joints shall not be disturbed during the jointing operation.

M. Joints shall be watertight and free from leaks.

N. Upon Initial Acceptance and throughout the warranty period, the Contractor shall be responsible for repair of any leak, and other damages resulting from improper workmanship or defective materials.

7.3.7 Job Conditions

A. Foreign material, including trench water, shall not be permitted in the pipe.

B. Debris, tools, clothing, or other material shall not be permitted in the pipe.

C. In order to prevent anything from entering the pipe, the open ends of the pipe shall be plugged with a restrained, watertight plug when pipe laying is not in progress.

D. Effective measures shall be used to prevent uplifting or floating of the pipeline prior to completion of the backfilling operations.

E. Pipe shall not be installed under the following conditions:

1. When the trench contains water.
2. When weather conditions are unsuitable.
    1. Temperature is less than 10ºF. Written approval is required from the Department when the temperature is 10ºF or less.
    2. Snowing heavily.
    3. Raining heavily.
    4. High winds.
3. When the trench bottom is unstable.

F. Do not use damaged materials or equipment for installation in the system.

7.3.8 Pipe Installation

A. Unless approved otherwise by the Department, horizontal and vertical pipe alignment(s) shall not deviate more than 0.50 feet from that shown on final signed CCPs.

1. Pipe shall be installed in accordance with the pipe material specification.

2. Pipe shall be laid and maintained at required lines and grades as shown on the final signed CCPs.

B. Pipe shall be installed with the bells pointing in the direction that installation is progressing.

C. The pipeline shall be installed so that a uniform/consistent positive or negative grade is maintained between the designed high and low points.

D. Prevent the opening of joints during bedding and backfilling operations.

E. If restrained joints are used, the joint restrain tape should be installed directly on top of the pipe.

7.3.9 Tracing wire

A. Tracing wire shall be installed with all waterline pipe regardless of material type.

B. Tracing wire shall be attached to the top of each barrel section of pipe with approved tape, tape shall be wrapped fully around the pipe. Wire shall be knotted so that it cannot be pulled out or away from pipe.

C. Tracing wire shall be brought to the surface on the inside of a test station behind every fire hydrant or at the end of a dead-end run. The valve box top on test station shall be 12-inches away from the fire hydrant. Reference Standard Drawing .

1. Four (4) feet of wire shall be installed inside of the valve box and coiled inside the valve box at the top.
2. Tracing wire shall not be attached to the valve box. .

D. Splicing

1. Connect wires together at tees and crosses.
2. Wires shall be connected/spliced using splicing kits from either “3M” or “Dryconn”.

E. Tying to an existing water main

1. Connect new tracing wire to existing tracing wire (see Splicing) if available.
2. If existing tracing wire is not available, and tying into an existing metallic water main then cadweld the new tracing wire to the existing water main.

F. Testing

1. Tracing wire shall pass testing prior to Initial Acceptance.
2. Testing shall be performed by a 3rd party testing company.
3. Pass current through wire and demonstrate that the tracing wire is capable of locating the pipe.
4. If wire will not pass current testing, locate break in circuit and repair and test until tracer wire works in accordance with its intended use.

7.3.10 Concrete Thrust Restraint

A. When utilized, concrete thrust blocks and anchors shall be sized and placed pursuant to these Standards.

B. The minimum size of thrust blocks shall be determined from the table provided in the Standard Drawings.

C. The concrete thrust block bearing surface shall be excavated into undisturbed soil. The concrete thrust block shall be extended from the fitting or valve to be blocked, to solid undisturbed earth.

D. If soil is to be disturbed, making a concrete thrust block or thrust anchor unusable, alternate restraining systems must be approved by the Department prior to pipeline installation.

E. Loose soil shall be disposed of, and the location where the thrust block is to be placed shall be carefully shaped to provide a uniform bearing surface of the required size.

F. The concrete thrust block bottom shall be flat, and sides shall be vertical.

G. Concrete thrust blocks shall be constructed so that all joints and weep holes are clear and accessible.

H. Concrete shall be separated from all fittings, valves and hydrants by an 8 mil. polyethylene film.

I. The concrete thrust block shall be formed to provide access to fittings, valves, hydrants, and appurtenances.

J. Concrete shall not be placed directly on or over fittings, nuts, bolts, flanges, etc.

K. The Department shall be notified 24 hours before concrete is placed.

7.3.11 Casing Pipe Installation

A. Vertical and horizontal offset staking shall be provided at each end of casing pipe installations.

B. Casing pipe shall be installed at the grade and alignment shown on the CCP.

1. Grade and alignment shall meet the vertical and horizontal allowances for the system for which it is installed.

C. Casing pipe shall be installed as indicated in the CCP, whether by open trench excavation, boring or jacking.

7.3.12 Carrier Pipe Installation

A. Carrier pipe shall be installed at the grade shown on the CCP.

B. Each section of pipe shall have a minimum of three (3) casing spacers. Redwood skids are not allowed.

C. All joints of the main within the casing shall be restrained. Joint restraint can either be accomplished through the use of restrained joint casing spacers or standard joint restraint with casing spacers.

D. Seal the end of the casing pipe with casing seals after the installation of the carrier pipe to protect against the infiltration of backfill into the casing pipe.

7.3.13 Corrosion Protection

A. Protection of Metal Surfaces

1. 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 paint shall be applied to ferrous metal rods, rebar, clamps, bolts, nuts and other accessories subject to submergence or contact with earth or fill material, and are not encased in concrete.
        1) The first coat of coal tar paint shall be applied to a dry, clean surface.
        2) The first coat of coal tar paint shall be allowed to dry before the second coat is applied.
2. Ferrous metal rods, rebar, clamps, bolts, nuts and other accessories subject to submergence or contact with earth or fill material, and not encased in concrete shall be protected with coal tar paint or a rubberized spray-on undercoating, and wrapped by a minimum 8 mil. Polyethylene film.

B. Magnesium Anodes

1. Anodes and CP test stations shall be installed by the thermite weld process.
2. The anode lead wire shall be placed in a way that does not strain the connection during backfilling and compaction.
3. Anodes shall be installed vertically in native soils, a minimum of 10 feet laterally from the water main to be protected or a minimum of 6 feet laterally from any casings to be protected..
4. Place the top of the anode below the centerline of the pipe. However, anode spacing and lateral distance can be adjusted from permanent obstacles at the approval of the Department.
5. Anodes shall be soaked with a minimum of 5 gallons of water before backfilling.
6. Anodes shall be backfilled and tamped with native soil in 6-inch layers. Sand is not permissible.

C. Wiring

1. Underground wires, cables and connections shall be buried with a 6-inches minimum separation from other underground structures.
2. Cut bond wire to shortest length practicable, including some slack, for given span. Locate bond wire welds on pipe and fittings. Horizontal welds are preferred, but where there is insufficient space on fitting vertical welds are permitted. Where multiple parallel bond wires are involved, space wires neatly and without wires crossing each other.
3. Do not splice bond wires. Entirely replace bond wires broken during construction. Re-weld loose weld connections.
4. If insulation of bond wire is damaged between welds, repair insulation by: thoroughly clean damaged area and 6-inches either side of it. Wrap

minimum of 1 overlapping layer of rubberized electrical tape around damaged area and extend at least 2-inches each side. Wrap two overlapping layers of plastic electrical tape around rubberized tape and extend at least 1-inch beyond rubberized tape at each end.

5. Wiring shall be backfilled with material free from rocks and debris that could damage the insulation.

D. Exothermic Welds/Brazing

1. Prior to brazing, an area of the structure three inches square shall be cleaned to bright metal with a grinder or file. Also remove 1-inch of insulation from each end of wire.
2. Weld conductor to pipe. Brazing techniques shall comply with the anode manufacturer's recommendations. Only proper size cartridges and welders will be permissible.
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. Test the thermite weld connection by striking the weld several blows on the side using a one pound hammer. Top of weld may be hammered flat if necessary.
5. Apply Handy Cap:
    1. Clean all mud, dirt, grease, oil and other contaminants from the metals surface and any part of the mill applied coating which is to be covered. Apply a coat of Royston Roybond 747 primer and allow to dry to a non-glossy appearance, which will take about 5 minutes, depending on humidity and temperature.
    2. Remove the release paper from the bottom of the Royston Handy cap; bend the plastic sheet inward at the serrations when applying to small diameter pipe. Position and place the handy cap on the welded area with the tunnel over the lead wire.
    3. Push the dome of the cap firmly into the weld area. Lift the lead wire away from the pipe and squeeze the black rubber compound completely around and underneath the wire. Push the lead wire back down on the pipe and press the elastomeric compound into firm contact with the pipe over the entire area.
    4. When coating or wrapping the Handy Cap, remove the narrow strips of plastic release film on the top of the cap. This will assure maximum protection with a positive waterproof seal.

E. CP Test Stations

1. Provide a minimum of 48-inches of slack, coiled in each box.
2. Install marker post.

F. Insulators

1. All isolating devices shall be properly installed per manufacturer recommendations and tested to ensure proper functionality.

G. Continuity Testing

1. The Contractor will be responsible for performing any continuity testing on bonded pipelines. Testing shall be performed by a NACE certified CP Technologist, or registered PE with a minimum of 2 years of CP field experience. Any breaks in the continuity or broken test leads shall be repaired. Test records shall be furnished to the Department prior to acceptance of the project

7.3.14 Installation of Appurtenances

A. Valves, meters, hydrants and other appurtenances shall be installed at the locations shown on the final signed CCPs.

B. Measurements of the actual location of appurtenances shall be made prior to backfilling for recording in the Project Record Drawings.

C. Temporary blow-offs installed by the Developer/Contractor shall be abandoned at the main, prior to Initial Acceptance.

D. Fabricated Steel Tapping Saddles

1. The Contractor shall use a Department designated welder for all fabricated steel tapping saddles including service taps required to be welded to an existing steel water main. All costs for the welder shall be the Contractor's responsibility.

7.3.15 Valves

A. General

1. Valves shall be installed in a manner whereby the operating nut and valve box are plumb, in the vertical position. Valves shall be installed in accordance with the manufacturer's recommendations. Valves shall be installed as shown on final signed CCPs.
2. Valve Operation- Valves, unless specifically approved otherwise by the Inspector, shall be operated ONLY by the Department.

B. Valve Boxes

1. Shall be installed on all buried valves.
2. Shall be installed so that no stress is transmitted to the valve.
3. Valve boxes set over the valve shall be centered, plumb and directly over the operating nut.
4. The soil around the valve box assembly shall be carefully compacted to minimize misalignment and future settling of the backfill.

C. Riser Stems

1. Shall be used when the depth from finish surface to top of valve nut is greater than 8-feet. In these cases, the extension/stem shall be installed such that there is approximately 5-feet from finish surface to top of extension/stem nut.
2. Where riser stems are used to extend the vertical height of an operating nut, the riser stem shall be securely pinned/connected to the valve operating nut. The riser stem shall be coated to prevent corrosion and shall have a centering plate to keep it centered within valve box assembly.

D. Tapping Valves & Sleeves

1. 4-inch thru 12-inch: These taps are made the Department. Saddles/sleeves shall be equipped with a threaded test hole and shall be installed such that the test hole is on top. Prior to proceeding with a wet tap, saddles/sleeves shall be tested by the Department (200 psi with no leakage for 5 minutes).
2. Wet taps larger than 12-inches: The Contractor shall use a Department approved tapping Contractor for the tap. All costs for the tap shall be the Contractor's responsibility.
3. Spacing requirements between wet taps shall be 2-feet from an existing joint to edge of wet tap and 5-feet centerline spacing between two wet taps.

7.3.16 Fire Hydrants

A. Construction Staking shall be provided which identifies vertical (to top of hydrant body flange) and horizontal locations of all fire hydrants.

B. The fire hydrant shall be installed vertically plumb with the pumper nozzle facing toward the vehicle access unless shown otherwise on the final signed CCPs.

C. When thrust blocks are used, care shall be taken so that hydrant drain holes remain free of obstructions.

D. After pouring the thrust block, hydrant gravel shall be placed to a depth of 12-inches above the hydrant shoe.

E. Hydrant drain holes shall remain free of obstructions.

F. The ground surrounding the fire hydrant shall slope away from the hydrant at a minimum grade of 2%.

G. After installation of the fire hydrant is complete, the oil/grease reservoir shall be checked to ensure that it is full.

H. If it is necessary to fill the oil/grease reservoir, it shall be filled with the oil/grease specified by the hydrant manufacturer. Oil and grease shall be FDA approved. Grease the caps with FDA approved (food grade) grease.

I. If a hydrant is raised, no more than one extension section can be used, unless approved otherwise by the Department.

J. Fire hydrants accepted by the Department shall be operated ONLY by the Department.

K. Prior to Initial Acceptance, and pursuant to the Inspector's direction, fire hydrants with marks and/or scratches shall be "field" repainted using ONLY the manufacturer's specified paint.

7.3.17 Services Lines, Meters and Appurtenances

A. Installation of Service Taps and Meters

1. Prior to initial acceptance:

a. All service taps are installed by the Contractor. The taps and service lines shall be installed prior to disinfection and pressure testing of the main and are subject to inspection and testing, pursuant to these Standards.
b. For 3/4-inch and 1-inch services: the Department will provide and install the meters only.
c. For 1-1/2 inch and larger services: The Contractor is responsible to obtain and install the meter and appurtenances.
d. Taps shall be made with a tapping saddle in accordance with these specifications and the manufacturer's recommendations, unless approved otherwise by the Department.
e. Tapping equipment shall be of good quality, used for the purpose intended and used in accordance with manufacturer's instructions.

2. After initial acceptance (Wet taps):
   a. For 3/4-inch and 1-inch services: the Department shall make the service tap, provide, and install the meter.
   b. For 1-1/2 inch and larger services: the Contractor shall supply all materials for the service including the meter. The Department shall make the service tap and the Developer shall install the meter.
   c. For any service taps on an existing steel main, the Contractor shall pay for a Department approved welder to weld on a "weld-o-let" service tap. The Contractor shall supply all materials for the service tap and the Department shall make the service tap.
3. A 4" x 4" wood post shall be placed at the end of the pig tail. The post shall extend a minimum of 2 feet above the finished grade.

B. Maintenance and Correction

1. The Developer/Contractor shall maintain and repair service lines, meter pits, and any associated appurtenances which leak, were installed incorrectly, or otherwise prove to be defective, throughout the entire warranty period.

C. Location of Service Taps

1. Taps shall not be made within 5 feet of any valve or tee, or 2 feet for all other fittings and joints.
2. Taps shall be made at the 2:00 o'clock and/or 10:00 o'clock position.
3. Made on the same side of the pipe and within 10-feet of each other (measured along the pipe length) taps shall be alternately staggered by fifteen degrees between each tap.

D. Service Lines

1. For newly installed service lines, there shall be no tees, connections, or couplings between the corporation stop and curb stop valves. For reconstruction or retrofit instances, a maximum of one coupling per service line may be allowed between the corporation stop and curb stop valves. All couplings shall be compression x compression.
2. Service lines shall be uniform in size from the corporation stop to the connection point to the meter yoke assembly.

3. Bedding material for services is specified in Chapter 6 on Trenching.
4. All trenches for service lines are subject to compaction specifications pursuant to these Standards.

E. Curb Stops

1. Curb stops for ¾-inch and 1-inch shall be installed inside meter pits only.
2. When meter vaults are used for other sizes of service lines, the curb stop shall be installed outside the vault. The following additional items shall apply.
   a. The Contractor shall adjust the curb stop box to 1/2- inch above final grade prior to final inspection.
   b. Curb stop box shall be fully extended.
   c. Curb stop box shall be plumb.
3. There shall be no tees, connections and couplings installed between the curb stop and the meter setter or copper horn.

F. Meter Pits and Vaults

1. Contractor shall adjust meter pits and vaults to the horizontal location and to the final grade as determined by the grade stake.
2. Grade stakes shall be a placed a minimum of five (5) feet from the location of the meter pit.
3. Contractor shall not disturb grade stakes prior to inspection of the service by the Department.
4. Exterior meter settings shall be installed according to the manufacturer's recommendations.
5. The ground surrounding meter pits and vaults shall slope away from the lid at a minimum grade of 2 percent, toward the street.
6. Plumbing connections (*e.g*. construction water, temporary water, etc.) shall not be made to any portion of a service line or meter assembly.
7. On the outlet (customer) side – All tees, connections, and other couplings shall be no closer than five (5) feet from the outside edge of a meter box, pit, or vault wall.
8. On the inlet (City) side - Tees, connections, and couplings shall not be installed between the curb stop and the meter setter.
9. The meter box, pit or vault shall be adjusted to 1/2-inch above final grade if the surrounding grade is changed. Contractor to use appropriate height Riser/Extensions.
10. Touch read devices mounted on buildings may be on either side of the building, but not more than 5' from the front of the building or more than 5' above finished grade. Touch read devices shall not be placed behind any fence.

G. Service Line Inspections

1. The Contractor shall ensure that the curb stop and corporation stop remain exposed until after the inspection and the approval for backfill is given by the Department for all meter pits.

2. Tap and service inspections shall be scheduled by the Contractor with the Department. A minimum of 48 hours' notice is required on tap and service inspections.
3. The water service shall be turned on at the curb stop by the Department, only after the service line, curb stop, stop box, and meter setter is installed and tested.
4. Meter pits and stop boxes shall be at finished grade at time of Initial Acceptance.
5. If the stop box or meter pit is damaged, bent, or otherwise unacceptable to the Department, the Developer/Contractor shall be responsible for replacing the damaged stop box and/or meter pit prior to Initial Acceptance.
6. If grade changes are made during the warranty period, Contractor/Builder shall repair.

H. Activation of Meters

1. Meters once installed shall only be operated by the Department.
2. After Conditional Initial Acceptance or Initial Acceptance, the Contractor can request that a meter be installed/activated. All required submittals, fees and standard installation requirements are required to be satisfied prior to the activation of any meter.

7.3.18 Abandonment

A. Abandonment of vaults

1. Remove the ring and cover, grade rings, and concrete cover.
2. Cut a 1-foot square hole through the floor of the vault.
3. Seal inlet and outlet piping with concrete.
4. Fill the vault with gravel.
5. Restore surface to match preexisting conditions.

B. Abandonment of water mains

1. Shut off isolating valves and verify valves are watertight. If unable to obtain a watertight shut-off, either install a new isolation valve to provide a watertight shut-off or remove the existing valve and install a mechanically restrained cap. The Department shall first approve either method, prior to installation of a valve or cap.
2. Remove valve boxes/lids.
3. Remove a section of piping on the downstream side of isolation valves and pour either a concrete “seal” or install a MJ cap on all open ends of the abandoned main.
4. Remove curb stop boxes on abandoned sections of the piping.
5. Restore all surfaces to match preexisting conditions.
6. The Department may require flowfill or flashfill for larger mains on a case-by-case basis depending on pipe location and surface conditions.

C. Abandonment of Domestic Services on Active Mains

1. As required by the Department either take the main out of service or turn the corp stop off.
2. As required by the Department either cap/plug the corp stop or remove the corp stop (and saddle) and install a stainless steel repair clamp/sleeve on the main.
3. Remove a 12-inch section of service line, near the main.
4. Remove the curb stop box.
5. Restore all surfaces to match preexisting conditions.

D. Abandonment of Fire services on Active Mains

1. As required by the Department either take the main out of service or turn the valve off.
2. As required by the Department either cap/plug the valve or remove the valve and install a stainless steel repair clamp/sleeve on the main.
3. Remove a 12-inch section of service line, near the main.
4. Remove the valve box.
5. Restore all surfaces to match preexisting conditions.

E. Demolition of structures with active services

1. As approved by the Department, active services may remain on a lot after the structure has been removed as long as there is redevelopment potential that will utilize the service in the future.

7.3.19 Disinfection

A. The Developer/Contractor is responsible for the disinfection and testing of water lines.

B. Product Delivery, Storage and Handling

1. Reference the Forwards to AWWA B300 and AWWA C651.
2. Contractor is responsible for safety of all materials and procedures for disinfection.

C. Materials

1. Hypochlorite. Reference AWWA B300.
    1. Hypochlorite for use in swimming pools is not allowed.

D. Disinfection Procedures

1. Contractor, with Department approval, shall satisfactorily disinfect and flush new water lines prior to placing them in service, in accordance with AWWA C651. <u>All services (including saddle/sleeve, corp stop/valve, service line and curb stop), hydrants, and all related appurtenances, shall be installed prior to beginning the disinfection procedure.</u>
2. Precautions will be taken to avoid contamination when water mains are cut into or repaired. When isolation of a section of line is possible, the continuous feed or slug method of chlorination will be used, followed by thorough flushing as described below. If a main cannot be isolated or if it is required to minimize time that customers are without water, the new

pipe, fittings, and valves required for connection shall be spray-disinfected or swabbed with a minimum of one percent Hypochlorite solution.

3. Contractor shall have the water tested by a water quality laboratory approved for such testing by the Colorado Department of Health.
4. Filling Pipe
    1. Only Department personnel shall operate existing valves to prevent the disinfecting solution from flowing back into the line supplying the water.
    2. Where permanent air relief valves are not available, the Contractor shall install corporation stops at high points in the water line, in order to evacuate air.
    3. All corporation stops which were installed to facilitate evacuation of air from the water main shall be removed and plugged after the water main is filled, and prior to pressure testing.
5. Preliminary Flushing
    1. The pipelines shall be flushed by the Department at a minimum velocity of 2.5 ft/sec., in order to remove foreign material prior to disinfection.
6. Methods
    1. General
        1) The Department, together, with the Developer/Contractor, shall determine the most appropriate disinfection method.
        2) The Contractor shall sample and test water from the pipe system extremities until clear, potable water is obtained.
    2. Tablet/Granular Method
        1) During construction, calcium hypochlorite granules or tablets shall be placed at the upstream end of each section of pipe, and at the upstream end of each branch main. The quantity of granules used shall be as shown in Table 1, AWWA C651.
        2) Introduce water into the pipes at a velocity no greater than 1 ft./sec.
        3) 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 parts per million of chlorine throughout the entire length of the main. The chlorinated water shall be flushed within 5 days unless otherwise approved by the Department.
    3. Continuous-feed Method (for Rechlorination)
        1) The continuous-feed method of disinfecting water mains consists of completely filling the main to remove all air pockets, flushing the completed main to remove the particulates, and filling the main with potable water chlorinated so that after a 24 hour holding period in the main, there will be a free chlorine residual of not less than 25 parts per million.
        2) 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 (Reference Section 3.2 of AWWA C651).

3) Chlorinated water shall be introduced into the water lines at a point approved by the Department at a constant, measured rate so that the chlorine concentration is maintained at a minimum of 25 parts per million of free chlorine (Reference Table 4 of AWWA C651). Fill the entire main with the chlorine solution.

4) 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.

5) The chlorinated water shall be retained in the main for a minimum of 24 hours, at which time the treated water in all portions of the main shall have a free residual of not less than 10 parts per million.

7. Final Flushing & Dechlorination
   1. 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 1 part per million.
   2. Discharge guidelines for the heavily chlorinated flushed water shall follow current State of Colorado Guidelines for Low Risk Discharge. Removal of any residual chlorine is required for any discharge whereby the chlorine will not be dissipated prior to reaching a classified State Surface Water (stream, creek, gully, ditch, or river, weather dry or flowing). Dechlorination, if necessary, may be achieved by allowing water to stand uncovered (in a local detention pond for example) or by dechlorination methods (using a portable dechlorinator for example). The Contractor shall be responsible for determining and providing the means necessary for the dechlorinization. Reference Appendix C of AWWA C651, for a list of neutralizing chemicals typically used for neutralizing chlorine.
8. Bacteriological Tests
   1. The Contractor shall schedule sampling with the Department and submit test results upon completion of testing.
   2. The Contractor shall collect samples from the pipeline after final flushing and pressure testing, but prior to placing water lines in service, and have the water tested for bacteriological quality to show the absence of total coliform and e-coli.
   3. The number and frequency of samples shall be determined by the Department based upon AWWA C651.
   4. Testing shall be performed by a laboratory that is certified to run Bacteriological water samples the Colorado Department of Public Health and Environment.
9. Repetition of Procedure
   1. If the initial disinfection, or subsequent disinfections, 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.

2. If the residual is less than 10 parts per million, the water lines shall be re-chlorinated by the continuous-feed method of chlorination and retested.

E. Delayed Activation

1. All newly installed water mains that are not activated immediately (upon receiving passing Bacteriological test results), shall be flushed and tested prior to activating the mains.
    1. The amount of time allowed before re-testing is required shall be determined by the Inspector.
    2. If the test results fail, see Repetition of Procedure requirements above.

7.3.20 Hydrostatic Testing

A. Once the pipeline has been filled and disinfected, and backfilling has been completed and approved, a pressure test shall be conducted.

B. The Contractor shall provide all equipment and personnel to perform the hydrostatic test.

1. Test equipment shall be able to maintain a continuous internal pipe pressure of 150 psi and accurately measure leakage from the pipe over a 2-hour minimum test period.
2. The maximum allowable pressure gauge increment shall be 5 psi.
3. A water meter shall be used to measure the amount of water used in pressurizing the system.

C. The Department will record times, leakage readings and pressure over the test period. The Contractor shall certify the results of the test. This Certification is required to be submitted prior to Initial Acceptance.

D. Testing shall not occur until at least 7 days have elapsed since the last concrete thrust restraint was cast.

1. A minimum of 72 hours shall elapse if high-early-strength concrete is used.

E. Testing shall not occur until after the pipeline has been chlorinated and flushed.

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

G. Unless prior permission is given by the Department, the hydrostatic pressure test shall be performed against all valves within the new piping system.

H. Pressure Test

1. "Leakage" is the quantity of water that must be added to the pipeline to maintain a pressure of within 5 psi of the specified test pressure, after the air has been expelled and the pipe has been filled with water.
2. Test Pressure
    1. For ductile iron pipe and PVC pipe, the minimum test pressure shall be 150 psi for 2 hours.
    2. Fire lines shall be tested at 200 psi for 2 hours.
    3. A residual pressure of within 5 psi of the test pressure shall be maintained for a minimum of 2 hours.

4. Test pressures shall be "running" pressures, constantly maintained by the test equipment. Static tests shall not be allowed.

3. The maximum allowable leakage for each test section of ductile iron pipe, and PVC pipe is determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

where, L = testing allowable (makeup water) leakage, in gallons per hour.

S = length of pipe tested, in feet.

D = nominal pipe diameter, in inches

P = average test pressure during the hydrostatic test, in psi (gauge)

I. Testing and Leakage (Reference AWWA C600)

1. Unless prior written permission is given by the Department, a test section shall not be any longer than the length of pipe between adjacent line valves.
2. When testing against closed existing valves, an additional testing allowance per closed valve of 0.0078 gal/hour/inch of nominal valve size will be allowed.
3. There will be no additional leakage allowance for resilient seat valves.
4. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.
5. Testing through fire hydrants shall be allowed.

J. Passing

1. If the tests disclose leakage greater than that specified, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.
2. With the exception of obvious leaks, passing of the pressure test shall be on the basis of maximum allowable leakage per section tested.
3. Visible leaks shall be repaired regardless of maximum allowable leakage.

CHAPTER 8 -

PUBLIC WASTEWATER SYSTEM, MATERIALS AND INSTALLATION

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CHAPTER 8 - PUBLIC WASTEWATER SYSTEM, MATERIALS AND INSTALLATION

8.1 GENERAL

8.1.1 Scope

A. This chapter addresses the installation of wastewater systems, and includes the acceptable products, materials, and construction practices which may be used in the installation of the wastewater system.

B. There are separate requirements and standards for lift stations and force mains that may be obtained from the Department.

8.2 MATERIALS

8.2.1 Pipe, Related Fittings and Appurtenances

A. Polyvinal Chloride Pipe (PVC)

1. The same type of pipe material shall be used for each size pipe. Pipe material shall not be interchanged, except where another type of pipe material is specifically indicated and approved by the Department.
2. Plastic wastewater pipe and fittings shall be made from PVC components conforming to ASTM D1784.
3. Pipe shall be furnished with fittings, specials and other accessories.
4. 4 inch through 15-inch plastic gravity wastewater pipe and all fittings shall be manufactured in accordance with ASTM D3034. The Dimension ratio (DR) shall be 35 (DR35) which has a Pipe Stiffness (PS) of 46 psi (PS46). Mains 20 ft and deeper shall comply with DR 26 with a PS of 115 psi (PS115).
5. 18 inch through 48-inch plastic gravity wastewater pipe and all fittings shall be manufactured in accordance with ASTM F679 and the pipe stiffness (PS) shall be 46 psi (PS46). Mains 20 ft and deeper shall comply with ASTM F679, with a PS of 115 psi (PS115).

B. Ductile Iron Pipe (DIP)

1. DIP pipe may be allowed, with prior approval by the Department.
2. DIP pipe and fittings shall conform to AWWA C151 and ASTM A746 and be lined with a material that protects against damage from the effects of hydrogen sulfide. Standard Cement Mortar Lining (CML) will not be acceptable.
3. When used, DIP shall be furnished with all fittings, specials and other accessories.

C. Steel Casing Pipe

1. See Section 7.2.1.C. of these Standards for requirements

D. Joints

1. Joints shall be of the push-on bell and spigot type and shall be manufactured in accordance with ASTM D3212.
2. Gaskets shall be of O-ring type and manufactured in accordance with ASTM F477.
3. Bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket, which is positively retained.
4. Lubricant shall be provided by the pipe manufacturer.

E. Service Connections

1. The Contractor shall place wyes, tees, stubs, and risers where required by the approved construction plans.
2. Watertight plugs shall be installed in each branch pipe or stub.
3. As-built measurements shall be made to the nearest MH before backfilling.

F. Marker Posts

1. Marker Posts should be similar to Carsonite CRM-375 with reflective labels.
2. For major transmission mains markers should be 4 inch steel posts filled with concrete. Post should be 5 foot tall buried 3 feet in a 12 inch diameter 3,000 psi concrete base that extends 6 inches below the post. Posts shall be painted orange. Place white 12”x18” metal sign with red letters stating the following information: City of Loveland, X” (diameter) Wastewater Main, Year installed, and any necessary offset. In open fields signs shall be placed at every MH.

G. Corrosion Protection

1. See Section 7.2.1.I of these Standards for requirements.

8.2.2 MHs

A. Can be precast or cast-in place. Reference Chapter 9 & Standard Drawings.

B. MHs shall be furnished with all accessories, base, cone section and ring and cover.

C. Mortar

1. Mortar shall be Sand-Cement grout, using the following ratio of ingredients:
   a. One part Portland Cement; conforming to ASTM C150, Type V.
   b. Two parts sand; conforming to ASTM C144.
   c. One half part hydrated lime; conforming to ASTM C207, Type S.

D. Grout

1. Grout shall be pre-mixed, non-metallic, non-aggregate, and non-shrink using the following ratio of ingredients:
   a. One part Portland Cement; conforming to ASTM C150, Type I, I1, II, IIA,
   b. One part sand; conforming to ASTM C144,
   c. One part shrinkage correcting aggregate.

E. Ring and Cover

1. Rings for built-up construction shall be 8 inches in height.
2. 4-inch rings may be acceptable for street overlays or repaving, with written approval of the Department.

F. Water-tight installations

1. MHs shall not be located in areas subject to flooding from surface runoff.
2. MHs shall not be located in areas where ponding or storm detention may occur.
3. If the possibility of surface runoff cannot be avoided or if a MH is located in the 100-year flood plain the MH shall have a watertight, bolted type cover having an integral O-ring type gasket, that can be bolted closed.

G. Rubberized Gaskets

1. All MH sections shall have two (2) Gaskets per section joint (inside and outside).
2. Gaskets shall conform to AASHTO M198 and Federal Specification SS-S-00210(210A)
3. Gaskets must be pliable at the time of installation at a temperature of 10° F. and above without being heated.
4. Primer is required on all joints. Primer shall be supplied by the gasket manufacturer.
5. For existing pipe penetrations: A flexible pipe-to-MH connection is required.

H. Lining

1. The Department may require MHs to be coated with a special lining in areas subject to high corrosion.
2. Lining shall be applied at a minimum of 60 mils and in accordance with manufactures recommendations.

I. Coating

1. The Department may require MHs to be dampproofed for MHs subject to high groundwater.
2. Dampproof coatings shall be factory applied.
3. The determination for the need for a dampprooofing coating shall be made by the Department upon review of the soils report and shown on the approved construction plans, or determined in the field if unexpected groundwater conditions are encountered.

8.2.3 Grease, Sand & Oil Interceptors

A. Precast Concrete Sections or Cast-in-Place Bases Reference Chapter 9.

B. Requirements for mortar, grout, gaskets, and other appurtenances shall be the same as for MHs.

C. Furnish with all accessories, including base, and ring & cover. Covers to be marked "SEWER".

D. Grease removal device shall be constructed of steel, cast iron, or polyethylene and shall have a full gas-tight cover.

E. Water jacketed connection to grease removal devices are not allowed.

F. Refer to Appendix B for a list of approved manufacturers. Other grease removal devices may be allowed by the Department if shown that an alternative pretreatment technology is equally effective in controlling the discharge of fats, oil, and grease.

8.3 CONSTRUCTION AND INSTALLATION

8.3.1 Product Delivery, Storage and Handling

A. Do not drop materials or equipment. Use slings, pipe tongs, skids or other controlled methods for handling materials and equipment.

B. Care must be taken to prevent damage to materials and equipment by impact, bending, compression, abrasion or other deleterious handling.

C. Damaged materials and equipment shall not be installed.

D. Lubricant shall not be stored or handled in a manner that will cause contamination.

E. Store materials and equipment in accordance with the manufacturer's specifications.

F. Pipe shall be stored on a surface that will provide an even support for the pipe barrel. Do not store in a manner that supports the pipe by the bell.

G. Pipe, fittings and joints shall be kept free from dirt, oil and grease.

H. Steel Casing Pipe: See also Section 7.3.1.K. of these Standards

8.3.2 Inspection

A. Pipe barrel, joints and fittings shall be free of dirt or other foreign objects prior to installation.

B. Pipe, joints and fittings with cracks, dents, abrasions or other flaws shall be rejected.

C. Pipe, joints and fittings with damaged linings or coatings shall be rejected.

D. MHs with cracks or other flaws shall be rejected.

E. No wastewater pipe may be covered or backfilled until inspection of pipe and bedding has been made.

8.3.3 Preparation

A. Reference Chapter 6, Trenching, Backfilling and Compaction.

B. Stabilization materials shall be required for the wastewater system where unstable soil exists.

C. Bedding material shall be placed in the trench bottom to a minimum of 4 inches, and bell holes and depression shall be dug in the bedding to provide a

uniform and continuous bearing support for the pipe at every point between bell holes.

8.3.4 Cutting the Pipe

A. The pipe shall be cut smooth, straight, and at right angles to the pipe axis, with saws or pipe cutters designed specifically for the material.

B. The cut end of the pipe shall be beveled in accordance with the manufacturer's recommendations.

C. Burrs shall be removed and all dust shall be wiped off of the jointing surface.

8.3.5 Connections

A. The location and elevation of the existing pipes and MH inverts shall be verified prior to construction.

B. Connections to existing pipes shall be made with an approved full-circle stainless steel coupling device.

8.3.6 Joints

A. Dirt, oil, grit, and other foreign matter shall be removed from the inside of the bell and outside of the spigot.

B. 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.

C. Preparatory to making pipe joints, all surfaces of the joint shall be clean and dry.

D. The lubricated joint shall be kept clean.

E. 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 joint.

F. The pipe shall be joined to the tolerances recommended by the manufacturer.

G. The pipe shall be set in position and checked for line and grade using care to keep the joint absolutely free of dirt.

H. When final grade is achieved, the joint shall be carefully pushed together until the assembly mark on the spigot is aligned with the end of the pipe using approved methods of leverage.

I. Care shall be taken so that the bell end of the pipe will not be deflected.

J. The seating of the gasket shall be checked around the entire circumference of the pipe by visual and feeler gauge inspection.

K. Stabbing the pipe shall not be allowed.

L. Previously completed joints shall not be disturbed during the jointing operation.

M. Joints shall be watertight and free from leaks.

N. After the initial acceptance of the wastewater system, the Contractor shall be responsible for the repair of any leak, high spots or low spots resulting from improper workmanship or materials, discovered within the warranty period.

8.3.7 Job Conditions

A. Foreign material, including trench water, shall not be permitted in the pipe.

1. The wastewater pipe being installed shall not be used to dewater the trench.
2. Water shall be prevented from entering the wastewater pipe already in service or pipe previously accepted by the Department.

B. Debris, tools, clothing, or other material shall not be permitted in the pipe.

C. In order to prevent anything from entering the pipe, the open ends of the pipe shall be plugged with a restrained, watertight plug when pipe laying is not in progress.

D. Effective measures shall be used to prevent uplifting or floating of the pipeline prior to completion of the backfilling operations.

E. Pipe shall not be installed under the following conditions:

1. When trench water is entering the pipe.
2. When weather conditions are unsuitable.
    a. Temperature is less than 10ºF. Written approval is required from the Department when the temperature is 10ºF or less.
    b. Snowing heavily.
    c. Raining heavily.
    d. High winds.
3. When the trench bottom is unstable.

F. Do not use damaged materials or equipment for installation in the system.

8.3.8 Pipe Installation

A. Pipe centerline shall not deviate from the signed CCPs horizontal alignment by more than 0.15 feet. To insure proper installation pipe shall be installed using a Pipe Laser to determine alignment and grade, and by no other means.

B. Pipe invert, for the entire run/reach of pipe between MHs, shall not deviate from the signed CCPs vertical alignment by more than 0.04 feet. The Department may require a more stringent requirement in critical situations.

C. Pipe shall be laid and maintained at required lines and grades as specified in the approved Construction Drawings.

D. Pipe installation shall be constructed continuously on an upgrade from an existing structure; except when approved by the Department.

1. Pipe shall be installed so that the bells are pointing uphill.
2. Grade/pipe invert changes shall not be allowed within any run/reach between MHs.

E. Employ effective measures to prevent the opening of joints during bedding and backfilling operations.

F. Bedding material shall not be dropped onto unsupported pipe, which has been set to alignment and grade.

1. The pipe shall be secured in place with the specified granular bedding material consolidated under and around the pipe.
2. The Contractor shall prevent the opening of joints during bedding and backfilling operations.

G. The joint shall be completed and the pipe adjusted to the correct line and grade as each length of pipe is placed in the trench.

H. The pipe shall be secured in place by careful installation of bedding material.

I. Concrete encasement shall be provided where indicated on the Construction Drawings or required by these specifications.

8.3.9 Casing Pipe/ Carrier Pipe Installations

A. See Sections 7.3.11 & 7.3.12 of these Standards.

8.3.10 Corrosion Protection

A. See Section 7.3.13 of these Standards.

8.3.11 MH Construction

A. MHs shall be installed at the location and to the elevation shown on the Construction Drawings, or as approved by the Department to accommodate field conditions.

B. Measurements of the actual location and elevation of sanitary main inverts shall be made for recording in the Record Drawings by the Design Engineer.

C. Standard MHs shall be installed in accordance with Standard Drawing.

D. Flat-top MHs shall be installed in accordance with Standard Drawings.

1. Flat-top MHs are required whenever the distance between the finished road surface and a MH barrel section does not allow room for a cone section.
2. Access holes for flat-top MHs shall be offset from center.

E. MHs shall be set plumb.

F. Precast concrete adjustment rings shall be used to bring the ring and cover to grade.

G. The total height from the top of a MH cone section, or flat-top MH, to the finish street grade, shall not exceed 16 inches.

H. The adjustment rings shall be flush with the inside of the MH.

I. Joint surfaces shall be kept clean, dry, and warm during installation.

J. Rubberized gasket material shall be used for joining the precast concrete section to the MH base, joining the precast MH sections, joining the adjustment rings, and joining the ring to the adjustment rings.

K. Rubberized gaskets shall be installed as follows:

1. Clean the joint surfaces prior to priming.
2. Apply primer on all joint surfaces in contact with gasket material.
3. Place two gaskets per joint except as noted below.
   a. One gasket may be used for joining of the adjustment rings.
   b. One gasket may be used for joining the ring to the adjustment ring.
4. Overlap the gasket material, 6 inches.
5. Leave protective paper on the outside of gaskets during application and remove when the joint is ready to be joined.
6. Excess gasket shall be trimmed flush to the interior wall after vacuum testing.

L. Lifting holes and other imperfections shall be filled with an approved non-shrink grout, to provide a smooth finished appearance.

M. If groundwater is observed to be above the top of the pipe, the exterior surfaces of MHs shall have a dampproof coating all joints on the riser sections be applied with external joint wrap.

N. For buried MHs, wrap the ring and cover with plastic.

8.3.12 Service Connections

A. Service connections shall be installed at the locations designated on the approved Construction Drawings.

B. The centerline of the service branch shall be inclined upward at a 45º angle.

C. Service connections on existing mains shall be installed using a saddle, and tapping shall be performed by Department crews only.

D. Wastewater services shall be extended at a constant grade to a point behind the utility easement.

E. The end of wastewater services shall be plugged with an airtight plug.

F. The end of all wastewater services shall be marked with a 2" x 4" wooden marker.

G. Wooden markers shall be installed per Standard Drawing.

8.3.13 Abandonment

A. Abandonment of MHs.

1. Remove the ring and cover, grade rings, and cone section.
2. Seal the inlet and outlet piping with concrete.
3. Fill the MH sections with flow-fill.

B. Abandonment of wastewater mains.

1. Place a watertight plug in the end of pipe to be abandoned.

2. Pour a concrete seal on the end of the pipe.
3. The Department may require flowfill or flashfill for larger mains on a case by case basis depending on pipe location and surface conditions.

C. Abandonment of wastewater services.

1. Abandon service at the outside of the wye at the main.
2. Place a watertight plug in the end of service.
3. A concrete seal may be required over the plug for services on VCP mains.
4. CIPP Point Repair may be used. Work needs to be performed by a contractor acceptable to the Department. Submit both pre-lining and post-lining videos to the Department prior to acceptance.

D. Abandonment of wastewater services inside MHs.

1. Place a watertight plug in the end of service to be abandoned. Allow 3”-4” of space.
2. Place Grout inside the service, against the plug, to the outer edge of the MH.
3. Reform and repair invert or bench as necessary

E. Abandonment/Removal of grease or sand/oil interceptors.

1. A licensed waste hauler shall remove all liquid and solid waste from the grease or sand/oil interceptor. Documentation (e.g., a manifest) shall be provided to demonstrate the waste was properly disposed of.
2. Indicate on the demolition plan if the interceptor is going to removed or abandoned in place.
3. The waste line from the building to the interceptor shall be removed if it will not be reused. If the waste line will be reused, the line shall be securely capped.
4. Where an interceptor is directly connected to the sewer main, it shall be abandoned by “point repair” or abandoned at the main in accordance with Section C above.
5. Where the interceptor discharge line joins the building sewer line, the line shall be capped on the section of pipe connected to the building sewer.
6. Vent and drain lines may need to be removed or properly placed out of service in accordance with building/plumbing code.
7. Following abandonment or removal of the interceptor, an inspection is required by the Department prior to backfilling.

F. Demolition of building structures with active services.

1. If approved by the Department, active services may remain on a lot after the structure has been removed as long as there is redevelopment potential that will utilize the service in the future.

8.3.14 Testing Wastewater Systems

A. Prior to Initial Acceptance, the Developer/Contractor shall perform (in sequential order) and be financially responsible for the following:

1. **Test wastewater mains and services with a low-pressure air test.**
   a. A test section shall not be any longer than the length of pipe between adjacent MHs.
   b. Testing of wastewater mains shall be per UNI-BELL PVC Pipe Association UNI-B-6, Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe, latest revision.
   c. The low-pressure air test shall occur after completion of the backfilling and compaction.
   d. If the Inspector determines that reliable and uniform results are produced by the Contractor's construction techniques, the low air pressure air test may occur after initial backfill and compaction.
2. **Additional Tests required by the Inspector**
   a. If, after visual inspection of the wastewater main, the Inspector finds there is a problem, the Department may require alignment, infiltration, exfiltration and/or deflection tests.
   b. A mandrel test is required on all 12 inch and larger mains.
3. **Vacuum test all MHs.**
   a. MHs shall be tested before the ring and cover and grade adjustment rings are installed, and after backfill and compaction is complete.
   b. Pipes entering the MH shall be plugged and braced.
   c. A vacuum of 10-inches of mercury shall be drawn.
   d. The vacuum pump shall be turned-off and the time monitored.
   e. The vacuum must not drop more than 1-inch for the duration of the time indicated in the following table:

Specified MH Test Duration	
MH Diameter (Inches)	*Duration (min:sec)*
48	*1:00*
60	*1:15*
72	*1:30*

   f. MHs that fail the vacuum test shall have the defects located and repaired. All repairs shall be made from outside the MH.
   g. Repair and repeat testing of the failed MH shall be performed at contractor's expense until the testing requirements are met.
   h. Repair methods shall be approved by the Inspector prior to proceeding.
   i. The Inspector shall record times and pressure and vacuum readings during the test period.
4. **Jet/Wash & Televise wastewater mains.**
   a. All publicly dedicated wastewater lines shall be televised.

b. A recording of the line shall be made and submitted to the Department.

c. The recording shall be made using a color camera, self-propelled, having sufficient light to show detail of problem areas and joints.

d. Camera speed shall not exceed 3 feet per second.

e. If problems or concerns are seen by the operator, then the camera shall be backed up and an extended look at the area will be recorded.

f. Recordings will have time, date, and footage displayed. Digital records will be provided.

g. MH identification numbers supplied by the Department and shall be recorded on the digital record.

h. Dirty mains shall be jetted and televised again at the Developer's/Contractor's expense. This shall be repeated until the mains are cleaned to the satisfaction of the Department.

i. If paving has not been completed prior to the date of the recording, a subsequent recording shall be required after all paving operations have been completed.

j. 90 days prior to final acceptance the mains shall be re-televised.

B. The Contractor shall provide all equipment and personnel to perform the required tests.

CHAPTER 9 -

CONCRETE

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CHAPTER 9 - CONCRETE

9.1 GENERAL

9.1.1 Scope

A. This chapter covers precast and cast-in-place concrete for thrust restraints, encasements, cut-off walls, cast-in-place concrete structure bases such as MHs, vaults, and grease traps. The chapter will cover materials requirements, forms, reinforcing steel, finishing and curing, and other appurtenant work.

9.2 MATERIALS

9.2.1 Cement

A. Cement shall be Portland Cement conforming to ASTM C150.

B. Type.

1. Thrust restraints, cut-off walls: Type I or II
   a. High early strength (12, 24, or 48 hour) concrete mixtures may be used with prior approval of the Department.
   b. Acceptable type of early strength cement is Type III, or an approved equal.
2. Cast-in-place concrete structure bases: Type V.
3. Fly Ash, if approved, shall be Class C or Class F conforming to ASTM C618. Class C fly ash is NOT allowed for use on Public Wastewater Systems or if sulfate resistant concrete is required. Fly ash, if approved as a cement replacement, shall not exceed 20%.

9.2.2 Aggregates

A. Fine aggregate shall be clean, sharp, natural sand conforming to ASTM C33.

B. Course aggregate shall be clean, strong crushed gravel or stone conforming to ASTM C33. Gradation shall be as specified under concrete mixes.

9.2.3 Water

A. Water shall conform to ASTM C94 and be free from silt, organic matter, alkali, salts, and other impurities.

9.2.4 Admixtures

A. An air-entraining agent shall be used in concrete conforming to ASTM C260. Total air content shall be 5 to 8 percent.

B. Accelerators shall conform to ASTM C494 and ACI 306.

C. A water-reducing admixture may be used, if approved by the Department.

1. 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.

9.2.5 Concrete Mix Design

A. Thrust restraints and concrete encasements shall have a minimum of 6 sacks per cubic yard and shall develop a minimum compressive strength of 4500 psi after 28 days.

B. Cast-in-place concrete structure bases shall have a minimum of 6 sacks per cubic yard and shall develop a minimum compressive strength of 4500 psi after 28 days.

C. Concrete cut-off walls shall have a minimum of 5½ sacks per cubic yard, and shall develop a minimum compressive strength of 2000 psi after 28 days.

D. Concrete shall have a maximum allowable water/cement ratio of 0.50 by weight.

E. The water/cement ratio may be increased to 0.56, by weight, if a water-reducing agent is used.

F. Slump: 4 inch maximum.

G. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94.

9.2.6 Concrete Reinforcement

A. Deformed reinforcing bars shall conform to ASTM A996.

1. Rebars shall be either Grade 40 or 60.

B. Welded steel wire fabric shall conform to ASTM A185.

C. Fiber mesh reinforcement: 1.5 lbs/cubic yard of fiber mesh or approved equivalent.

9.2.7 Forms

A. Plywood shall be waterproof, resin-bonded, exterior type.

B. Lumber shall be straight, uniform width and thickness, free from knots, offsets, hole and dents.

C. Form oil shall be light colored paraffin oil, or other non-staining material.

9.2.8 Precast Concrete Products

A. Barrels, bases, cone sections and flat slab tops of MHs shall conform to ASTM C478 and shall be made with Type V cement conforming to ASTM C150.

1. Unless written permission is obtained from the Department, flat slab tops will be used on vaults.
2. Reference the Standard Drawings on MHs to determine when MHs shall be conical or flat-top MHs.

3. Cone sections shall be the eccentric type unless approved otherwise by the Department.

B. Grease, Sand & Oil Interceptors precast sections shall conform to ASTM C478 and shall be made with Type V Cement conforming to ASTM C150.

C. Barrels, bases, cone sections and flat slab tops for water meter pit bases, water meter vaults, and precast concrete vaults shall conform to ASTM C478, and shall be made with Type I or II Cement conforming to ASTM C150.

1. Water meter pit bases shall be 4000 psi concrete with fiber reinforcing.
   a. Provide a 1 inch drain hole.
   b. Accommodate polyethylene meter pits.

D. Reinforcing Materials shall conform to ASTM C478.

1. Rebars shall be either Grade 40 or 60.
2. Minimum reinforcement for bases of MHs shall consist of welded wire fabric, 4x4 – W4xW4, reference ASTM C478.

E. Fine and coarse aggregate shall conform to ASTM C33.

F. Water shall be free from objectionable quantities of silt, organic matter, alkali, salts, and other impurities.

1. Requirements on mortar, grout, ring and cover, steps, and preformed plastic gaskets shall be as specified in Chapter 8 on the Wastewater System.

9.3 CONSTRUCTION

9.3.1 Cast-in Place Concrete:

A. Product Delivery, Storage and Handling

1. Ready-Mixed Concrete:
   a. All concrete must be delivered to the site from a ready-mix plant via revolving-drum truck.
   b. The maximum elapsed time from the time water is added to the mix until the concrete is in place shall not exceed 1 1/2 hours when concrete is transported in revolving-drum truck bodies.
2. Reinforcing Steel:
   a. Carefully handle and store on supports to keep the steel from coming in contact with the ground.
   b. Remove mud, oil, loose rust or mill scale and other foreign materials prior to placing concrete.
3. Rust or mill scale which is "tight" will be permissible without cleaning or brushing, provided weights, dimensions, cross sectional area, and tensile properties meet the requirements of ASTM A996.

B. Cast Forms and Subgrade

1. Forms shall be constructed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings.

2. Do not remove forms or disturb forms until the concrete has attained sufficient strength to safely support dead and live loads.
3. Subgrade surfaces under concrete placements containing less than 25 percent material passing a No. 4 sieve shall be covered with 8 mil polyethylene film to protect concrete from loss of water.
   a. Lap joints at least 4 inches.
4. Moisten subgrade prior to placement, but do not cause water to pond, nor muddy or soft spots to appear.

C. Placing

1. Convey concrete to the point of final deposit by methods that will prevent the separation of materials.
2. During and immediately after placement concrete shall be worked around reinforcement and embedment and worked into corners of the forms.
3. During and immediately after placement thoroughly vibrate and consolidate concrete around reinforcements, embedment, and corners of forms.
   a. Use mechanical vibrators that will maintain at least 9000 cycles per minute when immersed in concrete. Minimum horsepower per vibrator shall be 1½ hp.
   b. Vibration of concrete will occur for an adequate length of time to obtain adequate consolidation (generally 5 to 15 seconds) without over-vibration causing the fines to separate. Do not use vibrators to transport concrete laterally in forms.
4. Concrete shall not be placed unless the air temperature adjacent to the concrete placement is 30ºF and rising. There shall not be any frost in the subgrade.
5. Cease placement if the temperature is falling and drops below 40ºF.
6. The temperature of the mix shall not be less than 50ºF, or more than 90ºF at the time of the placement.
7. If heated mixing water and/or an accelerator is used, the above temperature restrictions may be waived with prior written permission from the Department.
8. Water shall not be heated to a temperature exceeding 150ºF.
9. To facilitate the placement of concrete in hot weather, the aggregate and the water may be cooled.

D. Finishing: MH bases, benches and inverts shall be true to line and grade and smoothed with a light broom finish.

E. Curing

1. Finished concrete shall be cured by protecting it against moisture loss, rapid temperature change, and from rain, flowing water and mechanical injury for a minimum of 72 hours after placement.
2. Concrete shall be maintained at a minimum temperature of 50ºF during the curing period.

3. The contractor is responsible for protecting the concrete until Initial Acceptance.

9.3.2 Precast Concrete

A. Product Delivery, Storage and Handling

1. Precast concrete parts shall be handled, stored, and protected in a manner that will prevent damage to materials.

B. Preparation

1. Reference Chapter 6 on Trenching for requirements on subgrade, stabilization material, and bedding. Use the bedding material for wastewater pipe for bedding of vaults and MHs.

C. Construction

1. Vaults and MHs shall be set plumb and to grade.
2. Sections shall be joined using preformed gaskets.
3. Joints shall be clean, dry and primed.
4. Lifting holes shall be filled with an approved non-shrink grout.
5. Any steps removed from MHs shall be filled with an approved non-shrink grout.

APPENDIX A

PUBLIC WATER/WASTEWATER STANDARD NOTES

APPENDIX A

Attention: ***In addition to applicable LCUASS notes, the following specific notes for Public Water and/or Wastewater System improvements shall be placed on CCPs.***

Public Water/Wastewater Standard Notes

1. In addition to meeting applicable LCUASS, State or Federal Standards, all materials, workmanship and construction of Public Water and Wastewater System improvements shall meet or exceed the standards set forth in the *City of Loveland Water and Wastewater Development Standards*. In cases of conflict between the *City of Loveland Water and Wastewater Development Standards* and LCUASS, relating to water and/or wastewater systems, the *City of Loveland Water and Wastewater Development Standards* shall take precedence. In cases of conflict between these signed CCPs and applicable standards, the most restrictive standard shall apply, unless approved by the Department.
2. The Contractor shall notify the City Inspector at least 2 Working Days prior to the start of any Public Water and/or Wastewater System improvements. A Pre-Construction meeting with the City Inspector and the Contractor is required prior to commencement of any construction of Public Water and Wastewater System improvements.
3. The Developer/Contractor shall be responsible for obtaining all necessary permits and/or easements from all applicable agencies. The Contractor shall be responsible for notifying affected parties for any water and/or wastewater shutdowns.
4. The Contractor shall have a copy of the approved CCPs and any applicable permits and agreements onsite at all times. It is the Contractor's responsibility to maintain a set of CCPs to be used for the Record Drawings. The current copy of the W/WW Development Standards can be found at www.lovgov.org/wwwds.
5. Prior to Initial and/or Conditional Initial Acceptance of the Public Water and/or Wastewater System, the Contractor shall provide to the Inspector and the Inspector shall accept the following items: Record Drawings for Water and/or Wastewater, a Water Service Summary Report (if applicable) and all required Testing Reports.
6. After Conditional Initial Acceptance or Initial Acceptance, the Contractor can request that a meter be installed/activated. All required submittals, fees and standard installation requirements are required to be satisfied prior to the activation of any meter. For all Hydrozone programs a Soil Amendment Affidavit and a Hydrozone Agreement is also due prior to activation.
7. Only Water Department staff shall activate any water meter.
8. Minimum bury depth of water mains is 4.5 feet
9. Separation requirements for surface improvements from outside of the public water and wastewater system: 10 feet to tree trunks (upon maturity), walls and permanent structures including footings and foundations for signs; 6 feet for light poles; and 5 feet for shrubs and large grasses.

APPENDIX B

APPROVED MATERIALS LIST

APPENDIX B - APPROVED MATERIALS LIST

*Note: *Manufacturers are arranged alphabetically*
**To have items considered to be added to this list see the submittal procedures at the end of this Appendix.*

PUBLIC WATER SYSTEM

Pipe Material

DIP
American Ductile Iron Pipe (ACIPCO)
Pacific States Cast Iron Pipe Company
U.S. Pipe

PVC-C900
Diamond Plastics
J-M Eagle
Westlake Pipe and Fittings
VinylTech

PVC-C900, With Internal Joint restraint	
J-M Eagle	Eagle Loc 900
Diamond Plastics	Lok-21
IPEX, Inc.	TerraBrute (CIOD) (suitable for HDD)
Westlake Pipe and Fittings	Certa-Lok RJ & RJIB, Aquaspring

Ductile Iron Fittings (MJ) *(All DI fittings shall be epoxy coated, all solid sleeves shall be Long Sleeves)*

Romac Industries
Sigma Corporation
SIP Industries
Star Pipe Products
Tyler Union

Tapping Sleeves

Cascade Waterworks Mfg.	CST-SL
Clow Valve Co	Stainless Steel
Ford Meter Box Co	Stainless Steel
Mueller Co	H304
Powerseal Pipeline Products Corp	3490MJ
Romac Industries, Inc.	SST
Smith Blair Inc	Stainless Steel

Weld on Tapping Saddles for Steel Pipes

Ford Meter Box Co	FWS-2400-8
Romac Industries, Inc.	FTS445

Tapping Gate Valves

American Flow Control	Series 2500
Clow Valve Co	
Mueller Co	
M & H Valve Co	

Gate Valves (stainless 304 bolts)

American AVK Company	Series 25 Resilient Wedge
American Flow Control	Series 2500
Clow Valve Co	
M & H Valve Co	
Mueller Co	

Butterfly Valves

AV-TEK	DEX double eccentric
Clow Valve Co/M&H Valve Co	Style 4500 (3”-24”) & Style 1450 (30”-54”)
DeZurik	AWWA C504
Mueller	Lineseal III or XPII
Pentair	Keystone RMI Dubex
Valmatic	Series 2000

Air Relief Valves

for 2” and smaller	A.R.I.	D-040
greater than 2”	DeZurik	APCO
	Valmatic	203C
VENT PIPE	TBD	

Pressure Reduction Valves

¾” – 2”	Watts	25AUB-LF
3” – larger	Cla-Val	100 Series
	Watts	M Series

Check Valves

American Flow Control
DeZurik
G.A. Industries, LLC
Mueller Co
Valmatic
Watts

Valve Boxes (*5¼-inch shaft, screw-type with the word “WATER” cast into the lid. Valve boxes for fire service lines shall have a locking lid assembly)*

Castings Inc.	Series 6850 with drop lid
SIP Industries	6000-6020; 6116-6118 screw; 6301-6308; 6351-6354; 6355-6356 (fire service)

Tyler Union	Series 6860 with a #6 base and drop lid Series 6850 with drop lid
EJ	Series 8550 6800 set with H-20 load rating

Fire Hydrants *(NST threads only)*

American AVK	Series 27, Modern Style
American Flow Control	Waterous Pacer, WB67-250
Clow	Medallion, F-2545
Kennedy Valve	Guardian, K-81D

Paint type and color:

Sherwin Williams, Modified Kem 400 Enamel (w/urethane)	Orange - Federal 595, Standard #12473

2" Blow-off hydrants

The Kupferle Foundry Company	Eclipse No. 85 Box Hydrant

Service tapping saddles

A.Y. McDonald Mfg. Co	4855A
Cascade Waterworks Mfg. (add)	CNS2
Ford Meter Box Co, Inc	FS303 and FC202
Mueller	DR2S
Power Seal Pipeline Products Corp	3412 AS
Romac Industries Inc	306 and 202NS
Smith-Blair Inc	372

Service lines

3/4" – 2"	Type K Copper - AWWA C800
4" and larger	PVC and DIP may be used

Corporation Stops *(ball valve, QCTS compression only)*

A.Y. McDonald Mfg. Co.	
Ford Meter Box Co.	
Mueller	

Curb Stops (*with ball valves, QCTS compression only)*

A.Y. McDonald Mfg. Co.	
Cambridge Brass	
Ford Meter Box Co.	
Mueller	

Curb Stop Boxes *(1.5" and 2", Minneapolis Style)*

A.Y. McDonald Mfg. Co	5622
Mueller	Mark II - H-10304

Service Line Couplings *(QCTS compression only)*

A.Y. McDonald Mfg. Co.
Cambridge Brass

Ford Meter Box Co.
Mueller

Meter Setters *(NL, QCTS compression x QCTS compression, with padlock wing)*

3/4" -7.5" lay length and 1" – 10.75" lay length	*1 1/2" and 2" – dual ball valve style only*
A.Y. McDonald Mfg. Co	A.Y. McDonald Mfg. Co
Cambridge Brass	
Ford Meter Box Co	Ford Meter Box Co
Mueller	Mueller

Touch Read Wires

20 gauge Thermostate 3 wire with brown jacket

Meter Pits- *require a metal frost proof lid*

Pits	*3/4" and 1"*	Sigma	Raven 20"x48" Round Pit (single) 24"x48" (dual)
Risers/Extensions	*3/4" and 1"*	Sigma	Raven Round Extension
Bonnett	*3/4" and 1"*	Castings Inc	W32CI
		EJ	2420Z2 Frame, 2405 Cover

Meters

3/4" – 1"	Sensus	Iperl/SR2
1.5" and larger	Sensus	OMNI (+) C2
1.5" and larger (irrigation only)	Sensus	OMNI (+) T2

Joint restraint devices

EBBA	Megalug
Ford Meter Box Co.	UniFlange
Sigma	OneLok
SIP Industries	EZ Grip
Star Pipe Products	All but 200 series
Tyler Union	Tufgrip

Foster type adapters

INFACT Corp

Rigid board Foam insulation

Amoco	Amofoam RCX
Dow Styrofoam	100 high load
Owens Corning	Formular 400 or 404

MH Ring & Covers for Vaults *(24" Diameter, "WATER" shall be cast into all covers and shall be predrilled for touch read and plugged by the manufacturer)*

Standard ring and cover	
Castings Inc.	MH-310-24 CI, MH-400-24 CI
D&L Foundry & Supply	A-1019
EJ	2425Z Frame, 2400A Cover
Neenah	R-1706

Watertight ring and cover	
Castings Inc.	MH-310-24 Bolt Down CI, MH-400-24 CI
D&L Foundry & Supply	E-1161
EJ	W824ZPT DI Duoseal
Neenah	R-6464-F

Test Stations

for cathodic protection	Brooks Products	1-RT
	Farwest Corrosion	1-RT

for locating wire	C.P. Test Services Inc.	Mini Box

Steel Pipe Wrap

Protecto Wrap	200 & 200 GT Cold Applied Pipe Tape used with 1170 Primer

Polywrap Pipe Wrap

PVC Pipe wrapping tape	Trumbull – 10 mil, 2” wide

PUBLIC WASTEWATER SYSTEM

Pipe Material

DIP *(must have Protecto 401 interior coating)*
American Ductile Iron Pipe (ACIPCO)
Griffin Pipe Products Company
Pacific States Cast Iron Pipe Company
U.S. Pipe

PVC- SDR35/ SDR26
Diamond Plastics
J-M Eagle
Westlake
VinylTech

PVC - With Internal Joint restraint	
Westlake	CertaFlo Green Line & Yelomine

MH Ring & Cover *("SEWER" shall be cast into all covers)*

Standard ring and cover	
Castings Inc.	MH-310-24 CI, MH-400-24 CI
D&L Foundry & Supply	A-1161- A-1163
EJ	2420Z2 Frame, 2400A cover
Neenah	R-1706

Watertight ring and cover	
Castings Inc.	MH-310-24 Bolt Down CI, MH-400-24 CI
D & L Foundry and Supply	E-1161
EJ	W824ZPT DI Duoseal
Neenah	R-6464-F

Adjustable slope MH rings	
East Jordan Iron Works	Precision cover systems
Land Tech Systems	HDPE traffic rated riser rings
PCSI	Fully adjustable MH system

MH Pipe Penetration Gaskets

For new MHs:	
A-Lok	
Kor-N-Seal	
Press Seal Gasket Corporation	Cast-a-seal
For core drill applications (flexible pipe-to-MH connections)	
PSX	Direct Drive

MH Preformed Gaskets

Concrete Sealants Inc	Conseal CS-202

General Sealants Inc	GS #79 or #4
Henry Company	RubR-Nek
Hamilton Kent	Kent Seal, Butyl Rubber Sealant

MH Lining *(as required, for new MHs only)*

Environmental Coatings LLC	Sewer Shield 100 & 150
RLS Inc	Raven 405
Spectra Shield	Liner System
Sprayroq, Inc	Spray Wall
Warren Environnemental	S-301

MH Dampproofing

DECO 20	damp proof coating
Sonneborn	Hydrocide 600

External Joint Wrap for MH Riser Section

Henry Company	RU 716-RubR-Nek
Conseal	CS-212

External Joint Wrap for Pipe

Mar Mac Construction Products Co	MacWrap

Pipe Coupling Devices *(Pre-formed adjustable pipe couplings w/stainless steel bands)*

Mission Rubber Co	"Flex-Seal" or "Heavy Weight"
Joints Coupling	Custom Repair Couplings
Fernco	

Service Connector *(CIP taps only)*

ADS	Inserta Tee

Service Tracing Wire

Copperhead	Ground Rod ANO-12

Grease, Sand / Oil Interceptors (*Non-Precast or Non-Cast-in-place devices. Note list of manufacturers may not be inclusive.)*

Endura
Schier
Zurn Green Turtle
Goslyn
Big Dipper

STEEL CASING PIPE

Casing Seals

Advance Products & Systems, Inc	Model AC or Innerlynx
Cascade Waterworks Mfg	CCES
Canusa	Seal Kit CSK
CCI	ESC, ESW
Pipeline Seal and Insulator, Inc	Model C, W, S & Link-Seal

Casing Spacers

Restrained Spacers	
Cascade Waterworks Manufacturing	Model CCS-JR
Ford Meter Box Co.	Uni-Flange

Standard Spacers	
Advance Products & Systems, Inc.	Model SS1
Cascade Waterworks Manufacturing	Model CCS
CCI	Model CSS
Pipeline Seal and Insulator, Inc.	Model S

Test Stations

for cathodic protection	Brooks Products	1-RT
	Farwest Corrosion	1-RT

Procedure for amending the Approved Material List:

1. Contractors, suppliers, and manufacturers desiring to submit alternatives for approval and inclusion in these Standards, shall provide a digital submittal package by email with the following information:
   a. Description of the material or equipment to be considered including manufacturer's name, type, and model number of material or equipment. Do not provide any information not applicable to the submittal.
   b. Manufacture's cut sheet/standard drawings/schematics/diagrams, etc.
   c. Detailed operation and maintenance and disassembly information for maintenance if applicable.
   d. Applicable standards, e.g. ASTM or Federal Specification numbers, etc.
   e. Descriptive literature for paint and coating systems.
   f. Description of where parts may be ordered and anticipated time for delivery of parts.
   g. Point of origin for materials and manufacturing.
   h. Contact information of local municipalities that also use your product.
   i. Manufacturer's warranties.

2. The Submittal needs to be received by the Department by the first Thursday in December. The Department may then request additional information to supplement or clarify the submitted material data.

3. The Department will review the submittal requests annually, typically in the first quarter of the year.

4. If approved, the material will be added to the approved list. If rejected, the Department will notify the applicant of the Department decision.

5. If changes were made, the Department will post the current Approved Materials List on the internet within one month of the annual review.

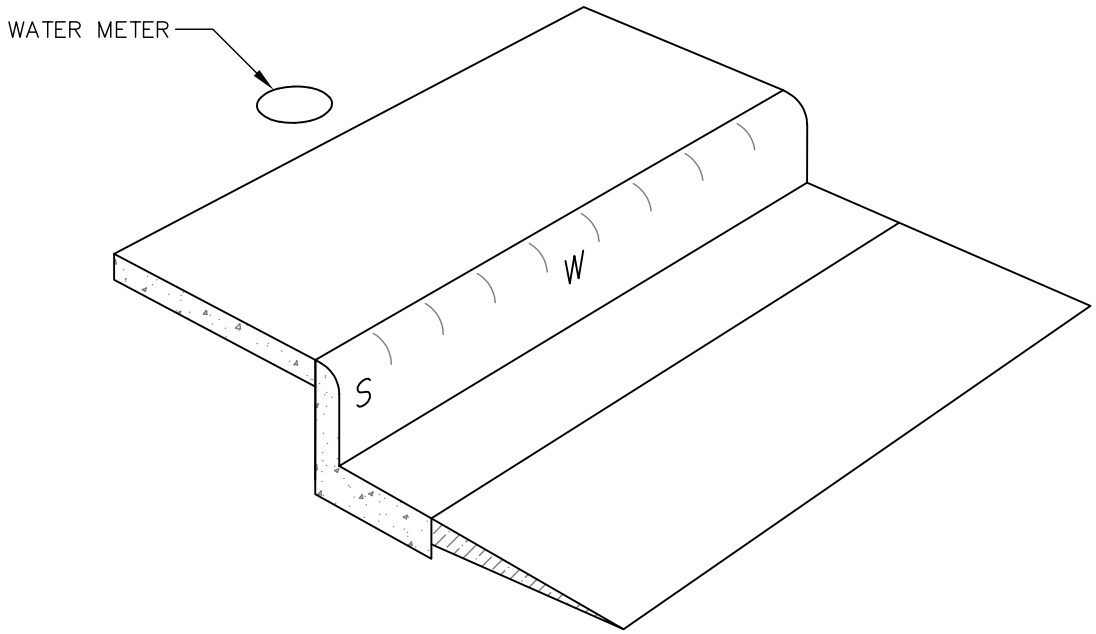
APPENDIX C

W/WW STANDARD DRAWINGS

APPENDIX C – W/WW STANDARD DRAWINGS

General W/WW Standard Details	**W-100**	SIDEWALK MARKINGS
	W-101	WATER & WASTEWATER TRACER WIRE
	W-102	PIPE JOINT ENCASEMENT
	W-103	GROUNDWATER BARRIER
	W-104	STEEL CASING
	W-105	CATHODIC PROTECTION
Water Standard Details	**W-1**	WATER MAIN TRENCH
	W-2	VALVE BOX ASSEMBY/LOCATION
	W-3	FIRE HYDRANT ASSEMBLY
	W-4	FIRE HYDRANT GUARDS
	W-5	3/4” & 1” SINGLE WATER METER PIT
	W-6	3/4” DUAL WATER METER PIT
	W-7A	3/4" & 1" WATER SERVICE PROFILE-ATTACHED WALK
	W-7D	3/4" & 1" WATER SERVICE PROFILE-DETACHED WALK
	W-8A	CENTERLINE OFFSET SERVICE PLAN – ATTACHED WALK
	W-8D	CENTERLINE OFFSET SERVICE PLAN – DETACHED WALK
	W-9A	PAIRED SERVICE PLAN-ATTACHED WALK
	W-9D	PAIRED SERVICE PLAN-DETACHED WALK
	W-10A	DUAL METER PIT SERVICE PLAN-ATTACHED WALK
	W-10D	DUAL METER PIT SERVICE PLAN-DETACHED WALK
	W-11	3/4" MULTIPLE WATER METER VAULT
	W-12	1 1/2" & 2" WATER METER VAULT
	W-13	3", 4" & 6" WATER METER VAULT
	W-14	PRESSURE REDUCING VALVE VAULT
	W-15	2" AIR AND VACUUM RELEASE VALVE
	W-16	TEMPORARY BLOW OFF
	W-17	INLINE BLOWOFF STRUCTURE (12", 16", & 24" MAINS)
	W-18	BUTTERFLY VALVE VAULT
	W-19	WATERLINE LOWERING
	W-20	WATERLINE DITCH/OBSTRUCTION CROSSING W/ CASING
	W-21	STANDARD CONCRETE THRUST BLOCKS
	W-22	POLYETHYLENE PIPE WRAP
	W-23	WATER SERVICE ENTRY

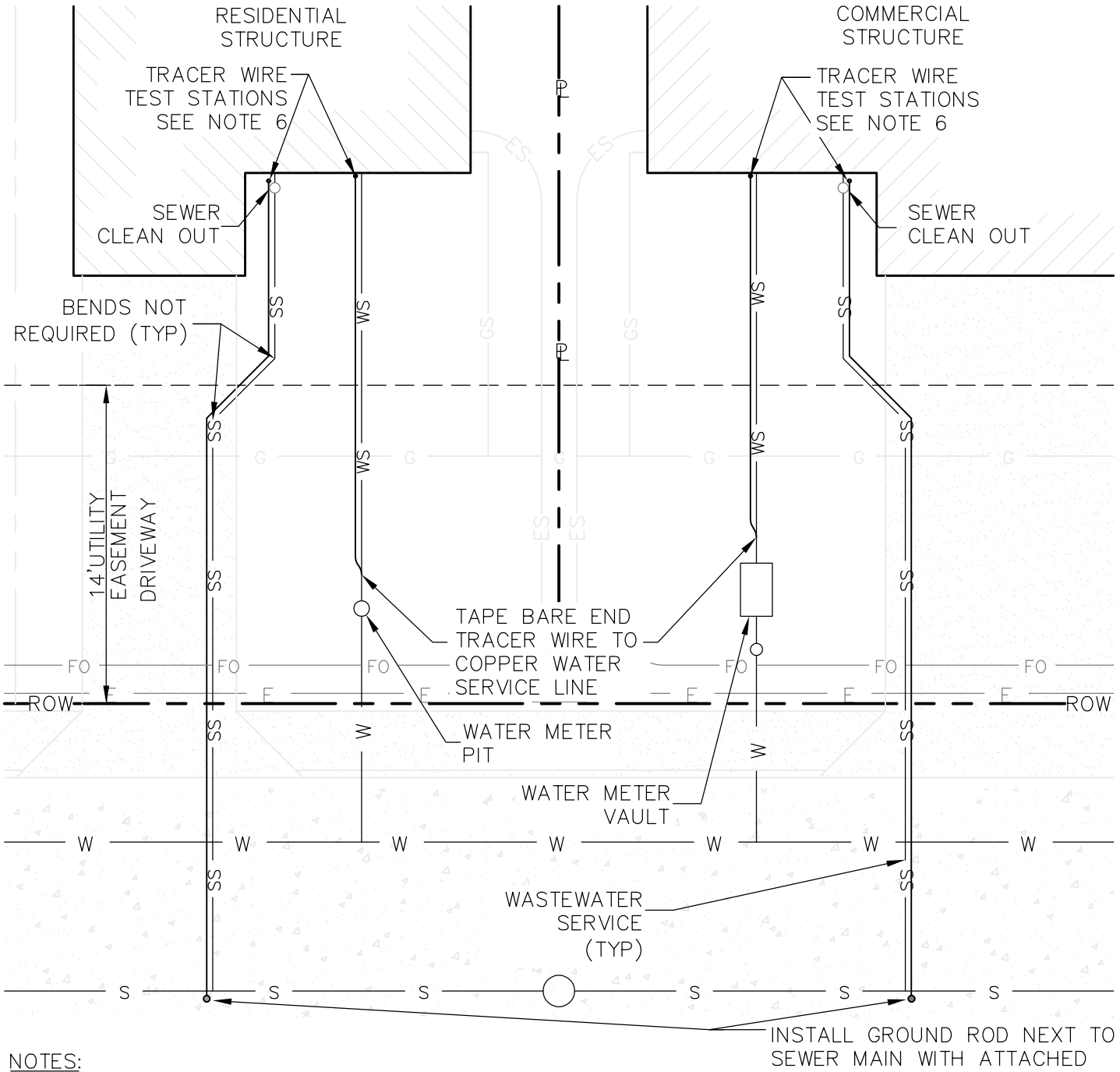
	W-24	IRRIGATION SYSTEM SERVICE
	W-25	BACKFLOW PREVENTOR HEATED ENCLOSURE
	W-26	WATER SAMPLE STATION
Wastewater Standard Details	**WW-1**	WASTEWATER MAIN TRENCH
	WW-2	STANDARD MAINTENANCE HOLE
	WW-3	FLAT-TOP MAINTENANCE HOLE
	WW-4	CONNECTION TO EXISTING MAINTENANCE HOLE
	WW-5	INSIDE/OUTSIDE DROP MAINTENANCE HOLE
	WW-6	WASTEWATER SERVICE CONNECTION
	WW-7	WASTEWATER & DITCH/OBSTRUCTION CROSSING W/CASING
	WW-8	TYPICAL GREASE INTERCEPTOR
	WW-9	TYPICAL SAND & OIL INTERCEPTOR
RV Dump Details	**RV-1**	EXAMPLE RV DUMP SITE DESIGN LAYOUT
	RV-2	EXAMPLE RV DUMP SITE DESIGN DETAILS
	RV-3	EXAMPLE RV DUMP- WATER VALVING & BACKFLOW



ANNOTATION TO BE CAST OR CUT INTO CURB HEAD
MARK AS FOLLOWS:
W FOR WATER SERVICE
S FOR SEWER SERVICE
X FOR DRY UTILITIES (POWER, FIBER, TELEPHONE)

SIDEWALK MARKINGS

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-100

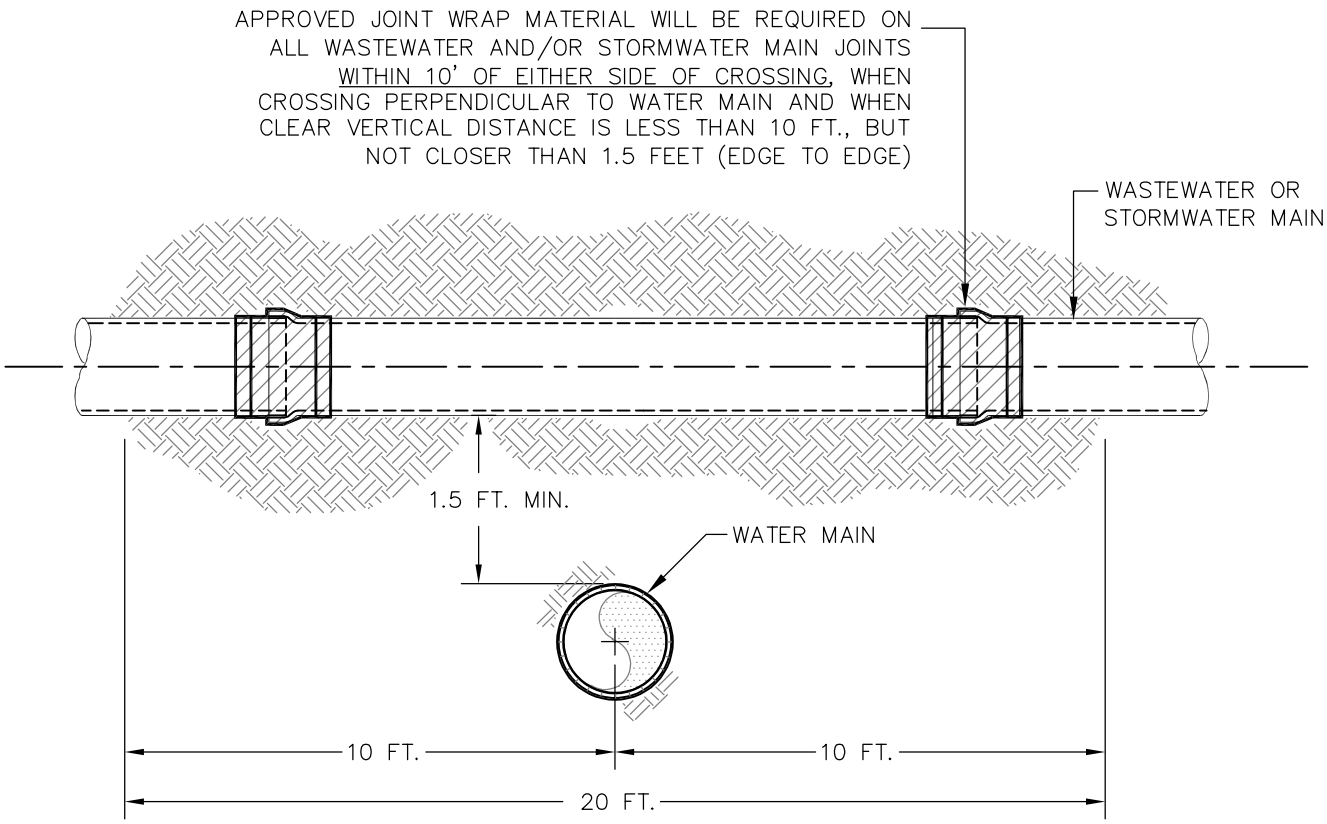


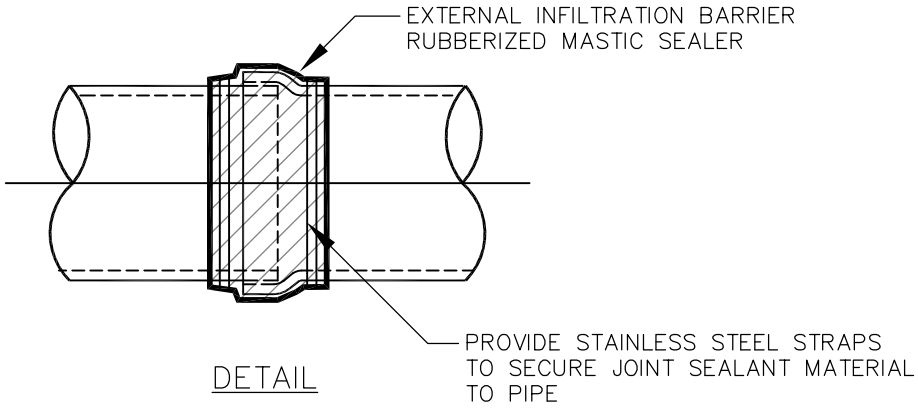
NOTES:

1. TRACER WIRE IS REQUIRED FOR ALL NON-METALLIC PIPES.
2. PLACE TRACER WIRE ON TOP OF PIPE AND TAPE WIRE TO PIPE EVERY 10' MINIMUM.
3. GROUND ROD SHALL BE INSTALLED INTO UNDISTURBED SOIL AND PLACED AT TEE/TAP ON OPPOSITE SITE OF MAIN FROM DIRECTION OF TEE/TAP AND WITHIN 12" OF HORIZONTAL SEPARATION OF THE WASTEWATER MAIN OR MH.
4. ONLY ONE UNDERGROUND WIRE SPLICE WILL BE ALLOWED. SPLICE SHALL BE IN A GEL CAP SPLICE KIT SUITABLE FOR UNDERGROUND INSTALLATION.
5. FOR SEWER SERVICE STUBS FOR FUTURE CONNECTIONS PROVIDE A MINIMUM OF TWO FEET OF TRACER WIRE WRAPPED AND TAPED TO MARKER POST.
6. INSTALL TRACER WIRE TEST STATION AT FOUNDATION FOR WATER AND NEXT TO CLEAN-OUT FOR SEWER.
7. ALL TEST STATIONS ARE PRIVATE AND SHALL BE CLEARLY LABELED.

WATER AND WASTEWATER SERVICE TRACER WIRE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-101





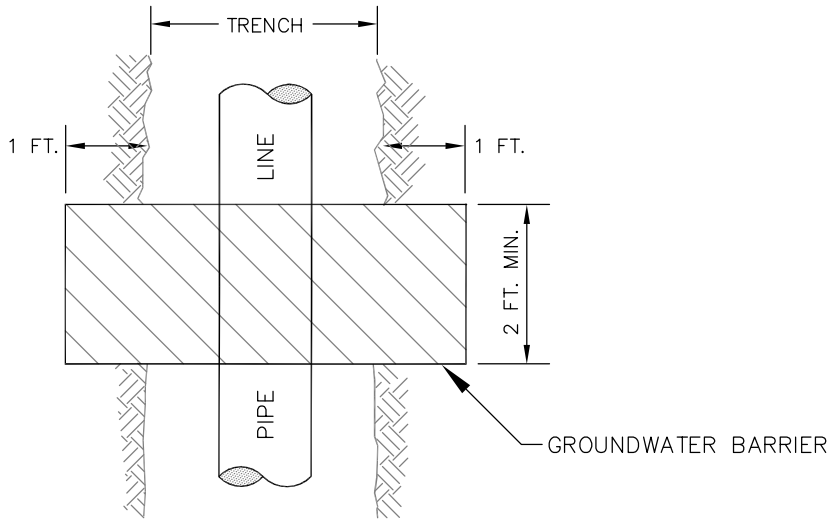
DETAIL

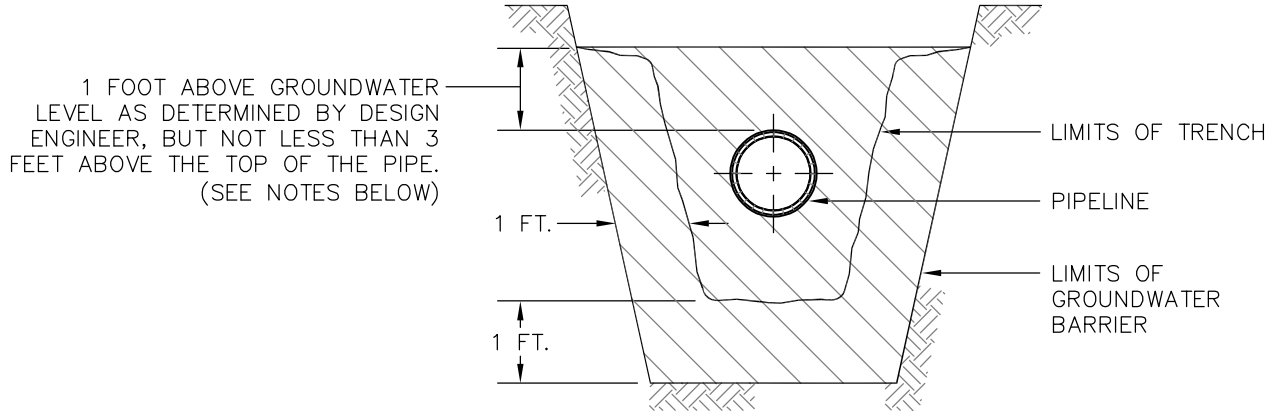
NOTES:

1. EXTERNAL JOINT SEALANT SHALL MEET ASTM C-877, TYPE II (MESH REINFORCED), WITH ADDITIONAL STAINLESS STEEL BAND. INSTALL PER MANUFACTURERS INSTRUCTIONS.

PIPE JOINT ENCASEMENT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-102



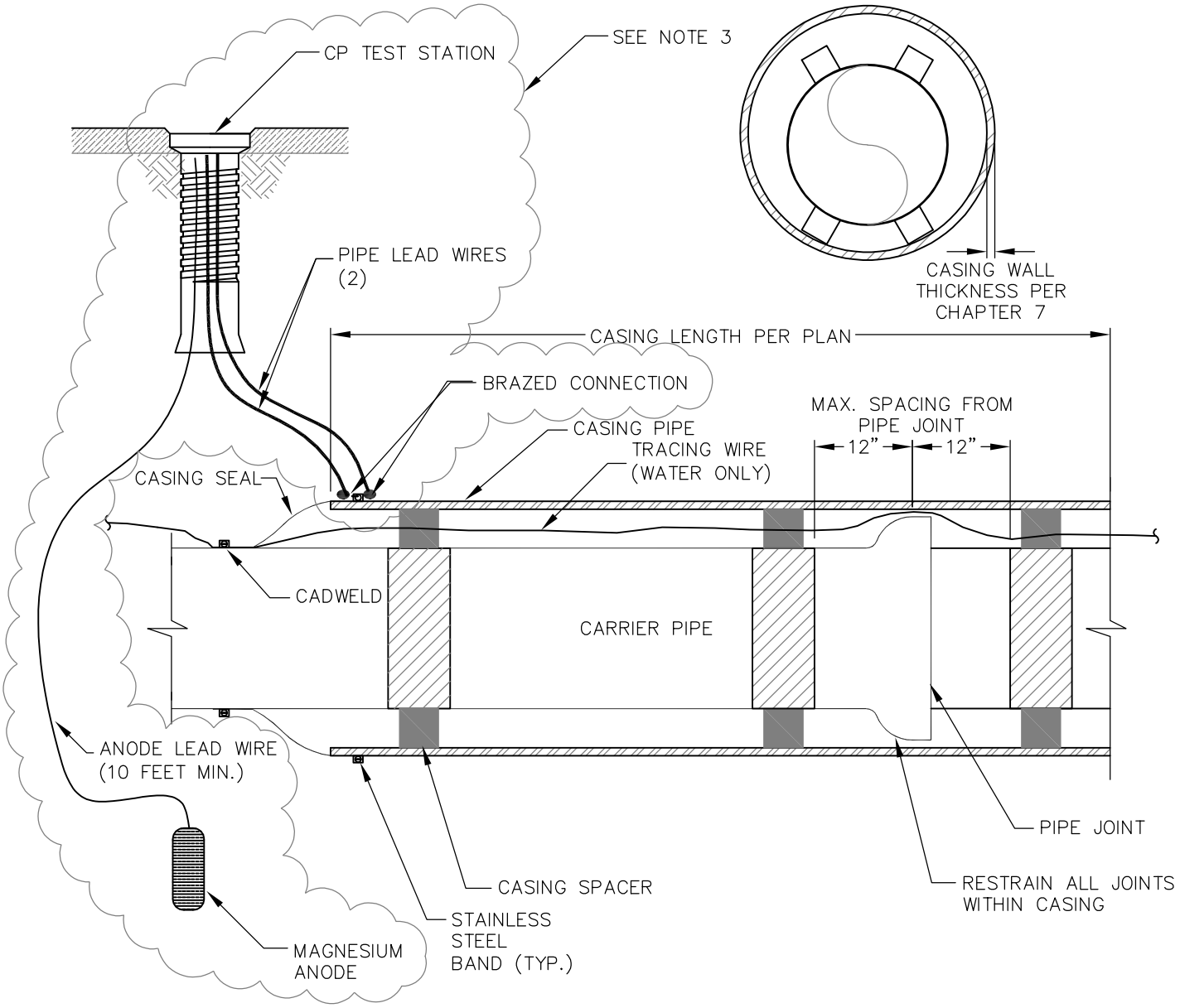


NOTES:

1. WALL EXTENDS A MINIMUM OF 12" INTO UNDISTURBED SOIL ON EACH SIDE AND ON BOTTOM OF TRENCH.
2. SPACE GROUNDWATER BARRIERS A MAXIMUM OF 400 FEET APART.
3. BARRIERS ARE TYPICALLY LOCATED UPSTREAM OF MHS FOR WASTEWATER MAINS.
4. THE GROUNDWATER BARRIER SHALL EXTEND TO A POINT ONE FOOT ABOVE THE GROUNDWATER LEVEL AS SHOWN IN THE APPROVED PROJECT GEOTECHNICAL INVESTIGATION REPORT.
5. SEE CHAPTER 6 FOR BARRIER MATERIAL

GROUNDWATER BARRIER

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 08/07 DATE REVISED: 2017 8TH EDITION	DRAWING W-103



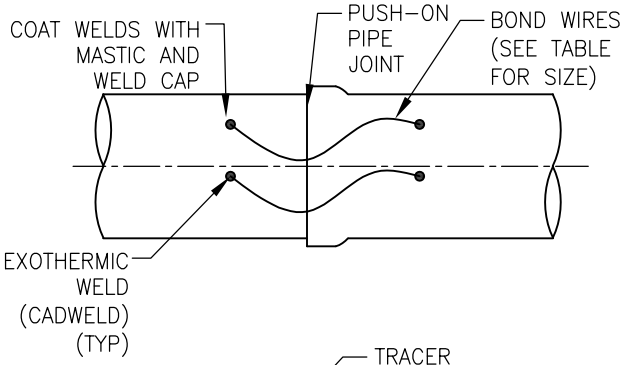
NOTES:

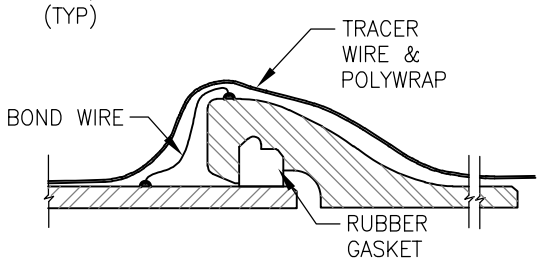
1. EACH SECTION OF PIPE WITHIN CASING SHALL HAVE A MINIMUM OF (3) CASING SPACERS/SKIDS. THE MIDDLE SPACER/SKID SHALL BE CENTERED BETWEEN PIPE JOINTS.
2. EACH PIPE JOINT WITHIN THE CASING SHALL BE RESTRAINED.
3. ANODES AND TEST STATIONS ARE REQUIRED BY THE DEPARTMENT FOR MAJOR CROSSINGS (RAILROADS/RIVERS/DITCHES) AND LARGE STORMWATER CULVERTS. THE SIZE OF THE ANODES AND THE LOCATIONS OF THE CP TEST STATIONS SHALL BE SHOWN ON THE PLANS.
4. EXTEND TRACING WIRE THROUGH CASING (WATER APPLICATIONS ONLY).
5. SEE ADDITIONAL CATHODIC PROTECTION INFORMATION ON DETAIL W–105.

STEEL CASING

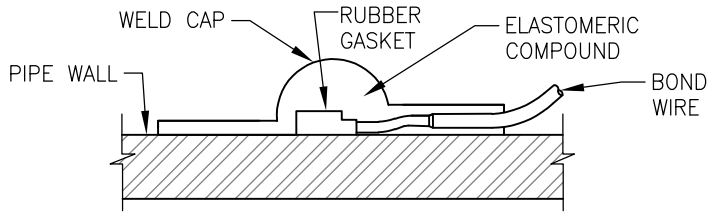
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–104

PIPE SIZE	BOND WIRE SIZE
4"–12"	#8
16"–36"	#4
42" AND LARGER	#2



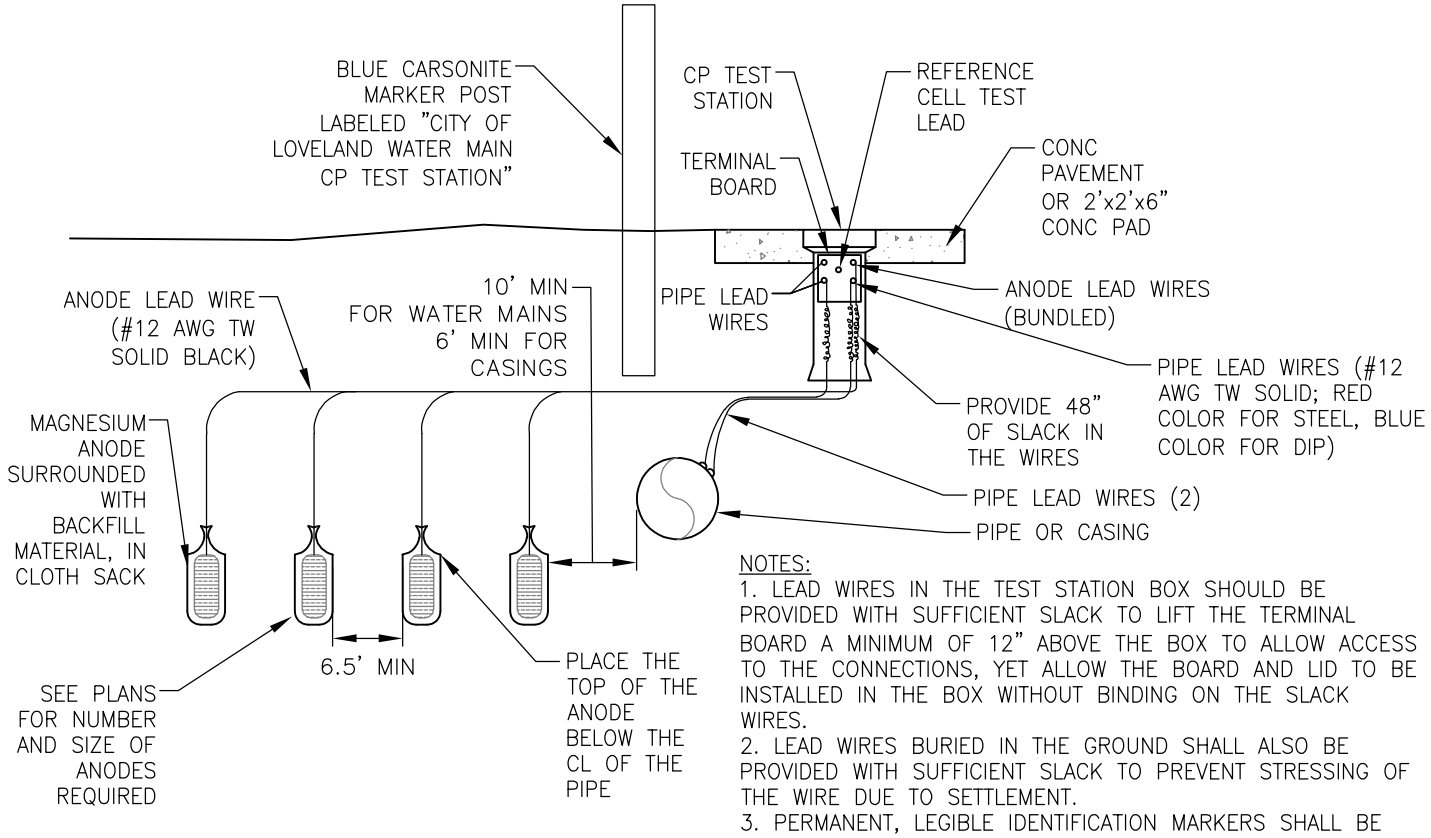


PIPE JOINT BOND DETAIL



EXOTHERMIC WELD (CADWELD) CONNECTION 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.



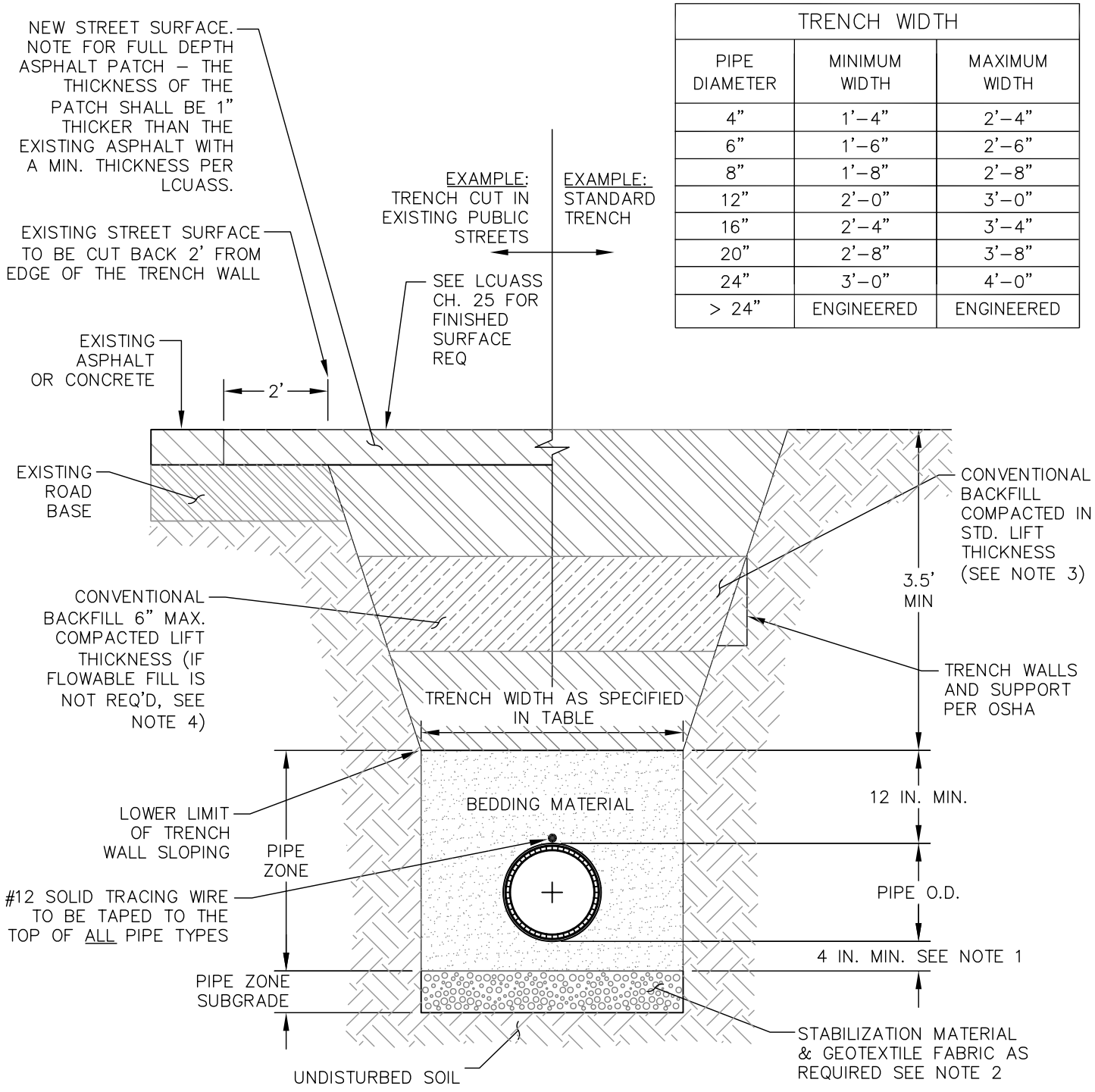
ANODE AND TEST STATION DETAIL

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 TEST 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

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-105

TRENCH WIDTH		
PIPE DIAMETER	MINIMUM WIDTH	MAXIMUM WIDTH
4"	1'–4"	2'–4"
6"	1'–6"	2'–6"
8"	1'–8"	2'–8"
12"	2'–0"	3'–0"
16"	2'–4"	3'–4"
20"	2'–8"	3'–8"
24"	3'–0"	4'–0"
> 24"	ENGINEERED	ENGINEERED

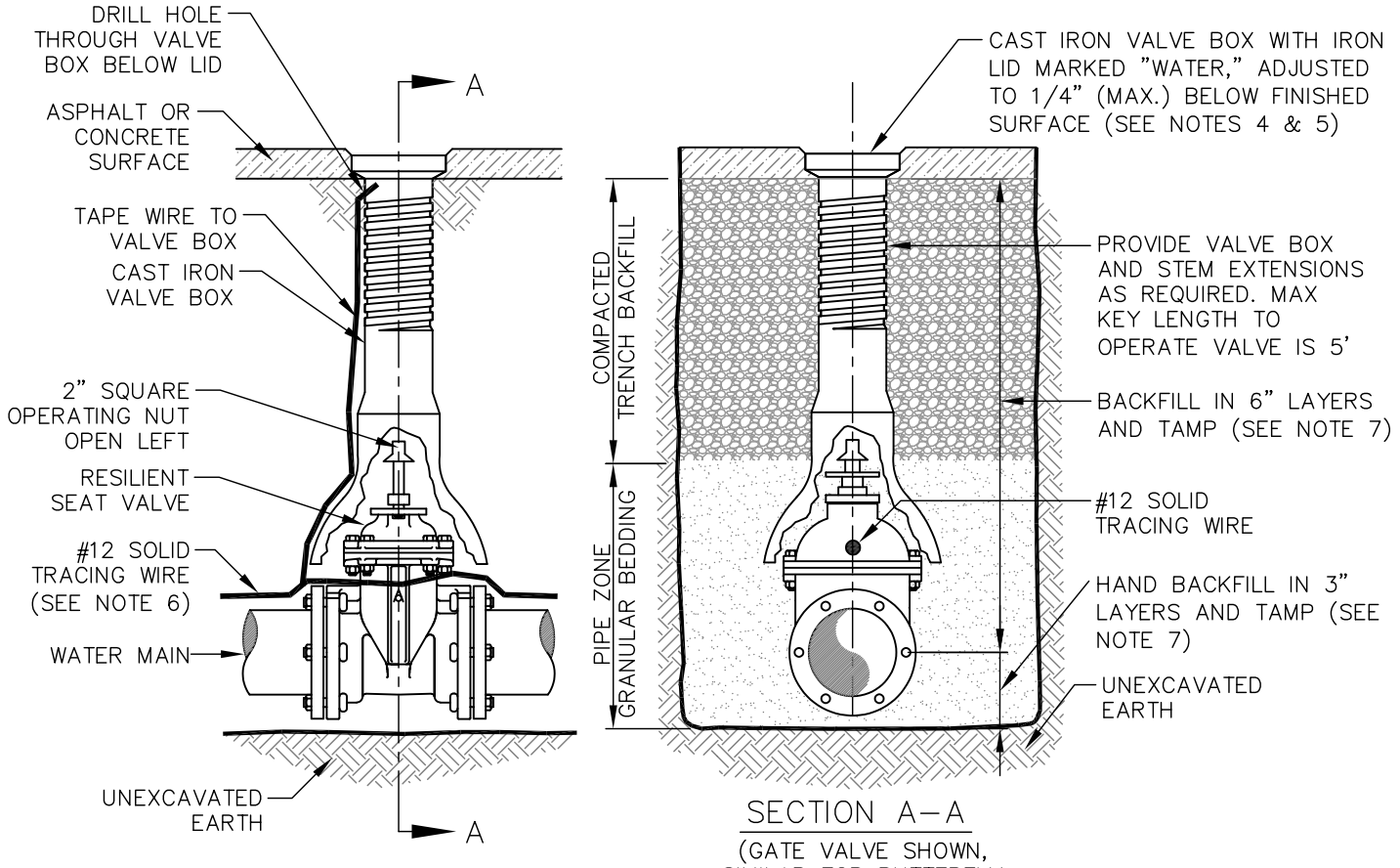


NOTES:

1. GRANULAR MATERIAL SHALL BE A MINIMUM OF 4–INCHES BELOW PIPE OR 1/4 PIPE DIAMETER, WHICHEVER IS GREATER.
2. STABILIZATION MATERIAL MAY BE REQUIRED BY THE DEPARTMENT TO REPLACE THE TOP 6–INCHES OF THE PIPE SUBGRADE. INSTALL GEOTEXTILE FABRIC BETWEEN THE STABILIZATION MATERIAL AND PIPE BEDDING.
3. TRENCH REQUIREMENTS WITHIN OPEN AREAS OR AREAS TO BE DEVELOPED SHALL BE PURSUANT TO DEPARTMENT STANDARDS.
4. WHERE THE SURROUNDING SOILS ARE NON–EXPANSIVE, A FLOWABLE FILL MAY BE SUBSTITUTED FOR BACKFILL MATERIAL.

WATER MAIN TRENCH

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–1

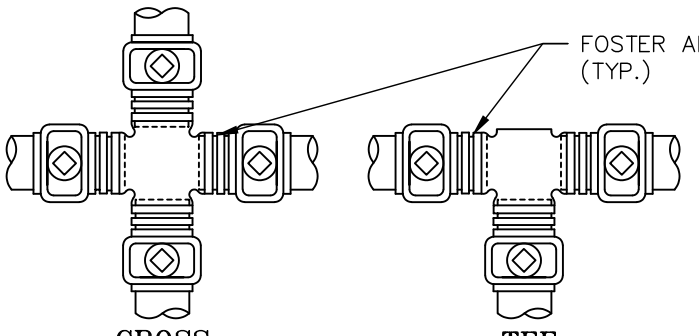


SECTION A–A

(GATE VALVE SHOWN, SIMILAR FOR BUTTERFLY VALVE)

NOTES:

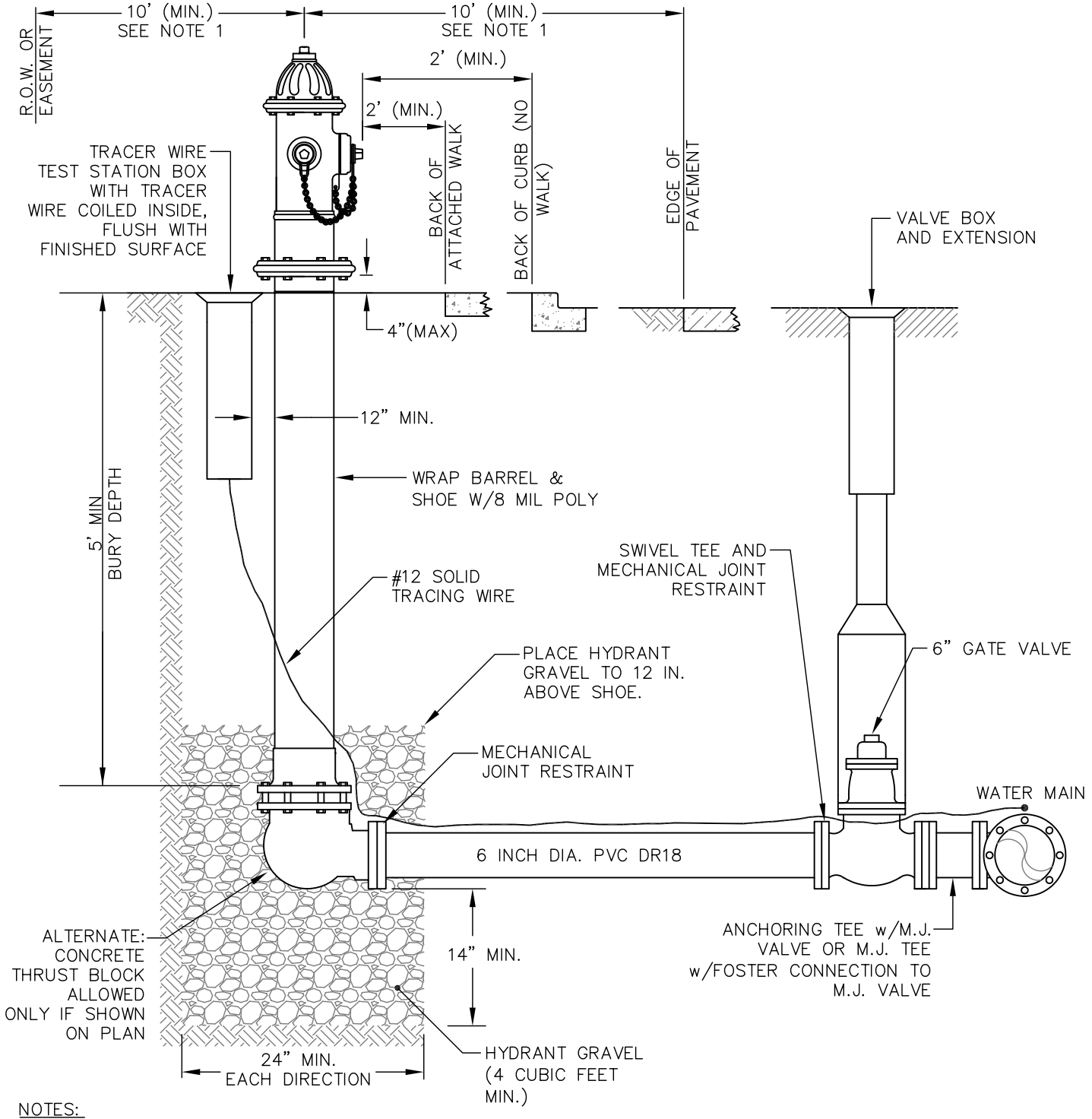
1. ALL VALVES SHALL BE ENCASED IN A MINIMUM 8 MIL. POLYETHYLENE WRAP. TAPE SHALL BE USED TO CLOSE SEAMS AND SECURE TO PIPE.
2. ALL VALVES BOXES SHALL BE OF CAST IRON CONSTRUCTION, TWO PIECE THREADED ADJUSTABLE DESIGN PER DEPARTMENT STANDARDS.
3. ALL–THREAD RODS AND NUTS SHALL BE 316 STAINLESS STEEL.
4. WITHIN OPEN AREAS OR AREAS TO BE DEVELOPED IN THE FUTURE, VALVE BOX LID MAY BE DEPRESSED OR HAVE A 24" DIAMETER ROUND, 6" THICK CONCRETE PAD. MARK VALVE LOCATION WITH MARKER POST WITH REFLECTIVE LABEL STATING "CITY OF LOVELAND WATER MAIN OFFSET ___ FT."
5. FOR FIRE SERVICE LINES ONLY: LIDS SHALL BE LOCKING TYPE.
6. TRACER WIRE TO BE TYPICALLY DAYLIGHTED AT FIRE HYDRANT. IF HYDRANT IS NOT AVAILABLE, PROVIDE AT MAINLINE VALVE AS SHOWN ABOVE AND COIL A MINIMUM OF 3' OF TRACER WIRE IN VALVE BOX.
7. COMPACTION AND TESTING REQUIREMENTS SHALL BE PURSUANT TO DEPARTMENT STANDARDS.
8. RESTRAINT FOR VALVES TO A FITTING CAN BE MADE DIRECTLY WITH FOSTER ADAPTERS OR BY MECHANICAL JOINT RESTRAINT. EXAMPLE FOSTER ADAPTER CONNECTIONS ARE DETAILED BELOW:



CROSS TEE

VALVE BOX ASSEMBLY/LOCATION

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–2

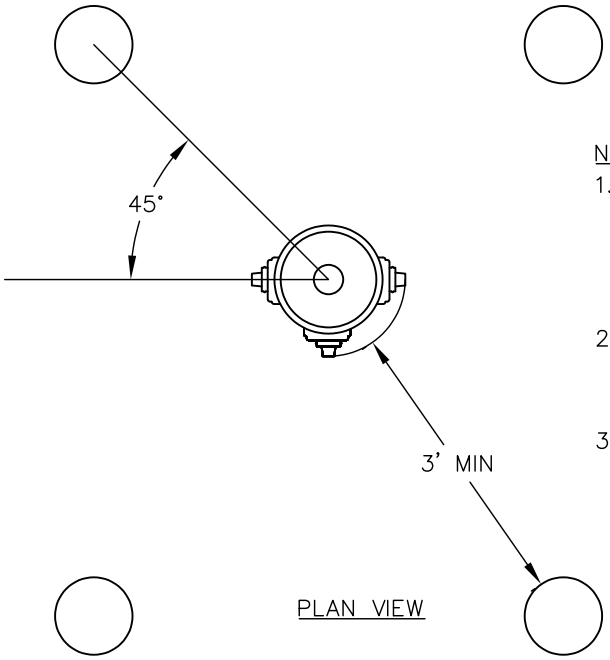


NOTES:

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. WHEN HYDRANTS ARE PAIRED WITH METERS ON THE LOT LINE (ALTERNATE SERVICE PLAN ATTACHED WALK) THE HYDRANTS SHOULD BE SET BACK 3' TO MATCH THE METER SETBACK.
2. ALL FITTINGS AND VALVES SHALL BE ENCASED WITH A MINIMUM 8 MIL POLYETHYLENE WRAP.
3. ALL JOINTS SHALL BE RESTRAINED BY USE OF MECHANICAL JOINT RESTRAINTS.
4. SEE CHAPTER 6 OF THE STANDARDS FOR COMPACTION AND TESTING REQUIREMENTS.
5. BOLLARDS MAY BE REQUIRED IF NO CURB IS PRESENT.
6. FACE THE PUMPER NOZZLE TO THE STREET, UNLESS SPECIFIED ON THE PLANS.

FIRE HYDRANT ASSEMBLY

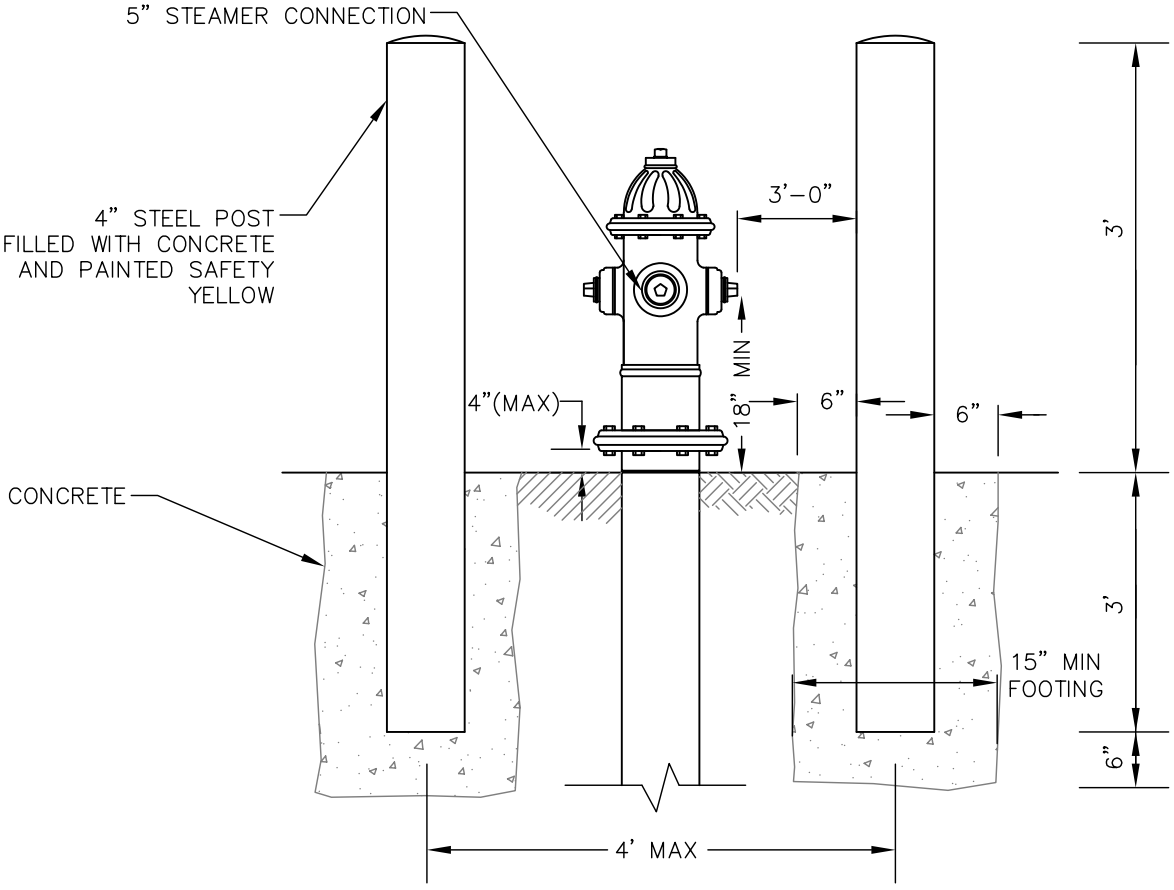
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-3



PLAN VIEW

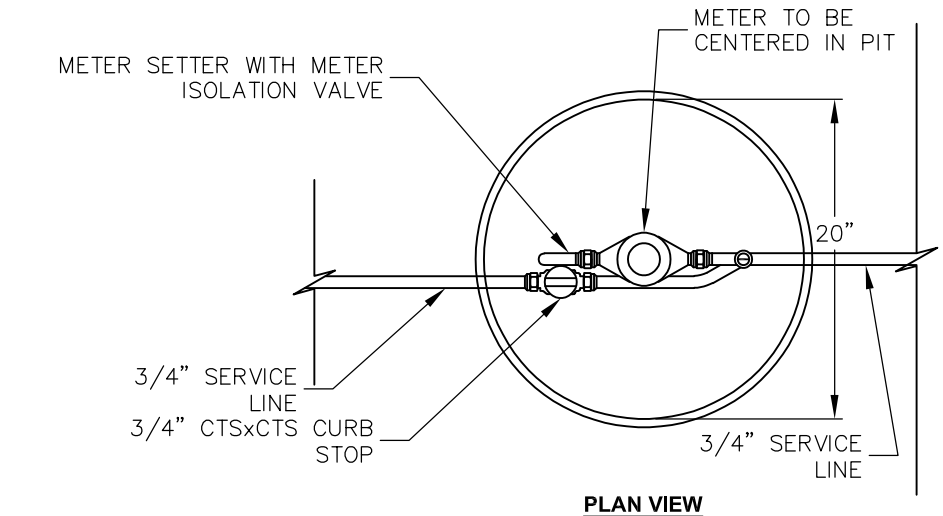
NOTES:

1. TO BE USED IN COMMERCIAL OR INDUSTRIAL AREAS WHERE HYDRANTS ARE UNPROTECTED FROM THE MAIN FLOW OF TRAFFIC.
2. STEAMER CONNECTION ON FIRE HYDRANT SHOULD FACE THE STREET.
3. PAINT COLOR SHALL BE SAFETY YELLOW.



FIRE HYDRANT GUARDS

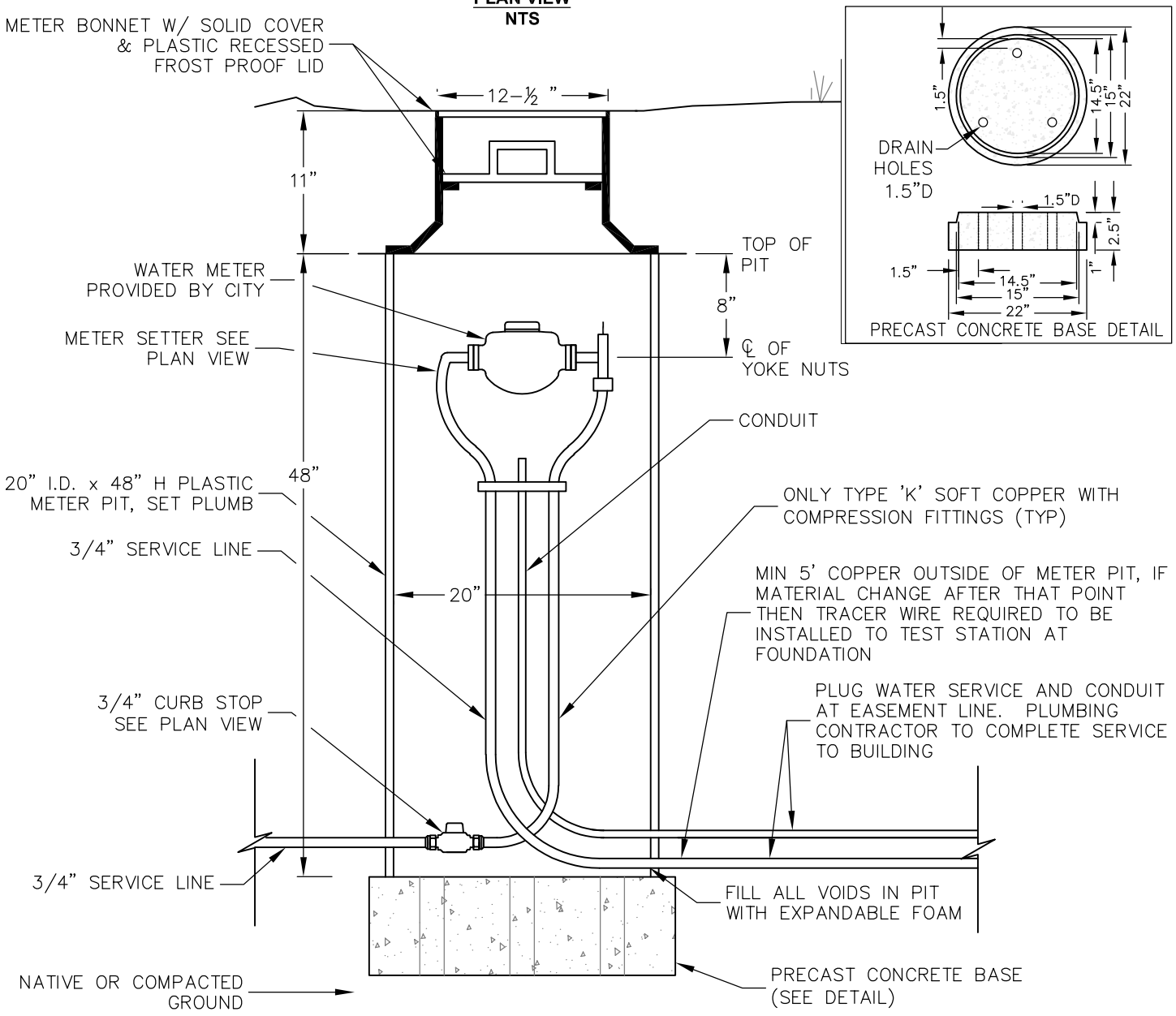
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-4



PLAN VIEW
NTS

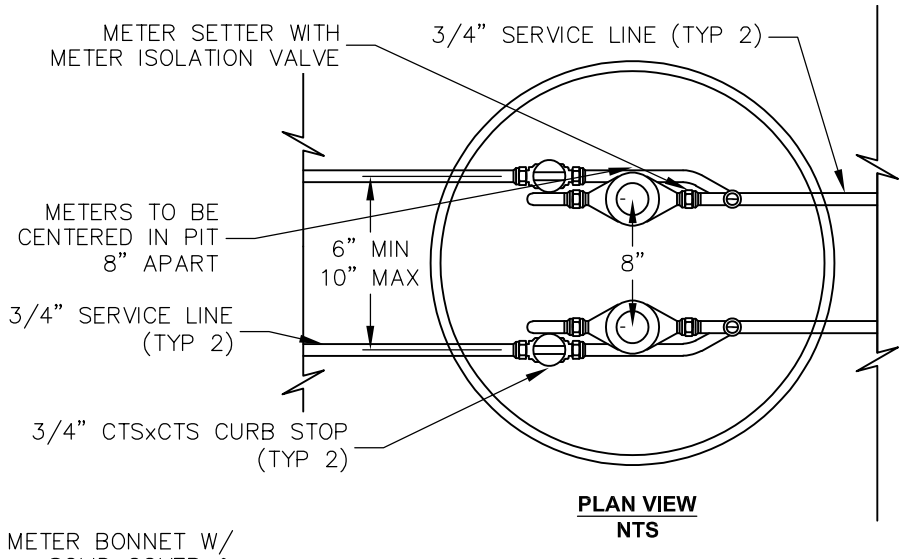
NOTES:

1. METER PITS SHALL BE LOCATED PER THE CITY OF LOVELAND DEVELOPMENT STANDARDS AND DETAILS, AND PER THE CONSTRUCTION PLANS.
2. IF NOT INSTALLED BY MANUFACTURER, CONTRACTOR TO CUT OUT NEW SERVICE ENTRY & EXIT OPENINGS TO MATCH MANUFACTURER SPECIFIED SIZES.
4. FOR 1" METERS THE TAP, SERVICE LINE, AND CURB STOP SHALL ALL BE 1" IN SIZE.
5. CONCRETE FOR PRECAST CONCRETE BASE SHALL BE FIBER REINFORCED CONCRETE WITH A COMPRESSIVE STRENGTH OF 3,000 PSI



3/4" & 1" SINGLE WATER METER PIT

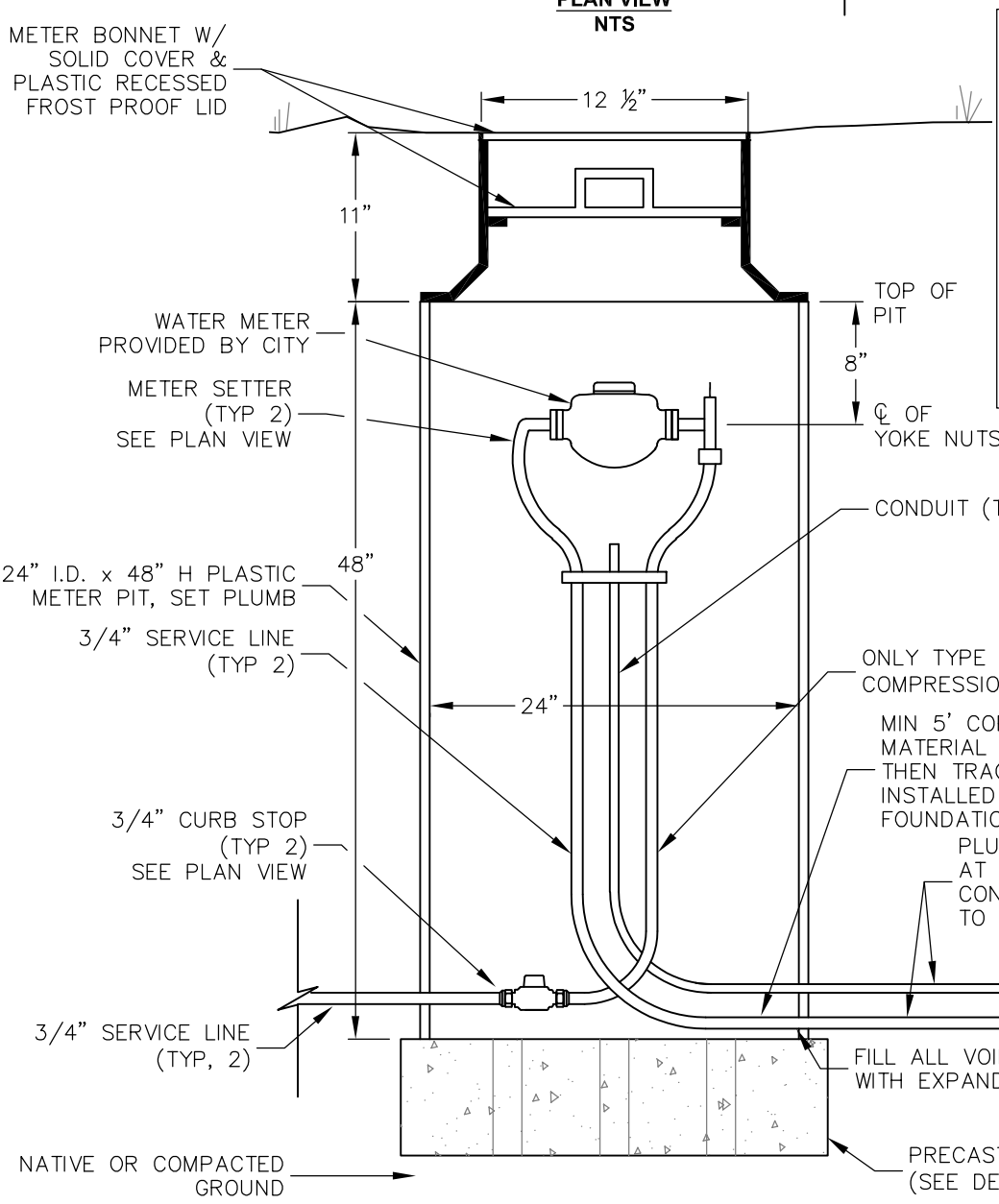
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-5

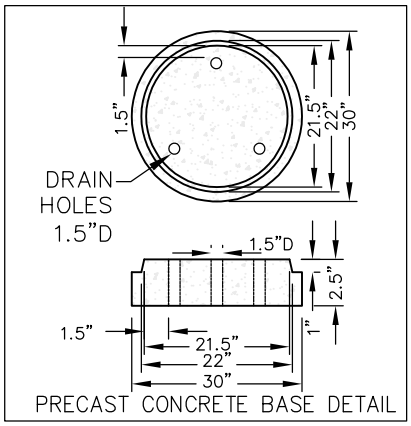


PLAN VIEW
NTS

NOTES:

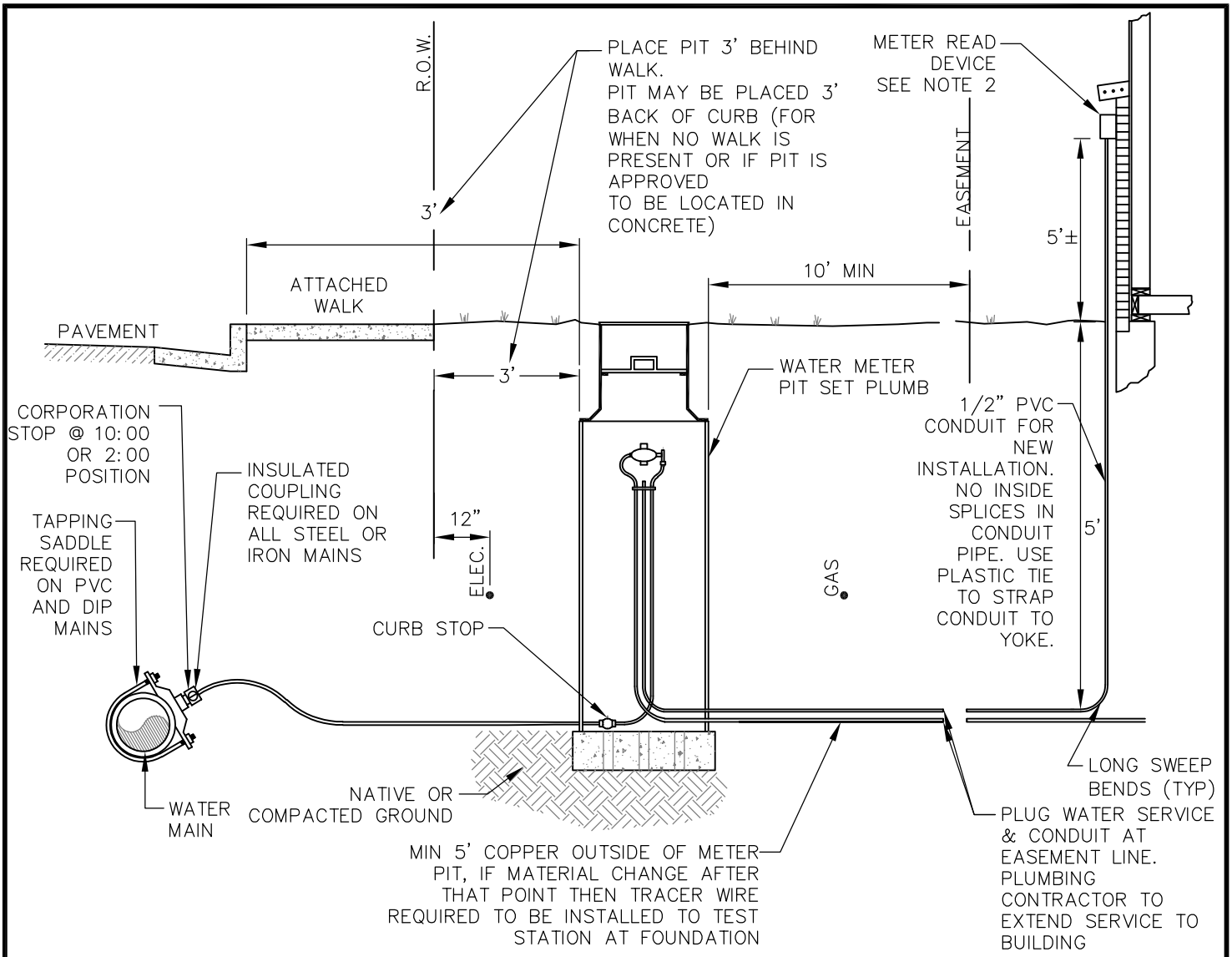
1. METER PITS SHALL BE LOCATED PER THE CITY OF LOVELAND DEVELOPMENT STANDARDS AND DETAILS AND PER THE CONSTRUCTION PLANS.
2. TAPPING SADDLES SHALL BE AS SPECIFIED PER CITY DEVELOPMENT STANDARDS AND DETAILS.
3. CONTRACTOR TO CUT OUT NEW SERVICE ENTRY & EXIT OPENINGS AS SHOWN IN PLAN VIEW. OPENINGS TO MATCH MANUFACTURER SPECIFIED SIZES. NO SERVICES SHALL SHARE A COMMON OPENING.
4. CONCRETE FOR PRECAST CONCRETE BASE SHALL BE FIBER REINFORCED CONCRETE WITH A COMPRESSIVE STRENGTH OF 3,000 PSI.





3/4" DUAL WATER METER PIT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-6



NOTES:

1. UNLESS APPROVED BY THE DEPARTMENT, METER PITS SHALL NOT BE LOCATED WITHIN DRIVEWAYS OR SIDEWALKS, OR WHERE VEHICULAR TRAFFIC MAY BE ENCOUNTERED.

2. WHEN INSTALLED IN LANDSCAPED AREAS, THE BONNET/LID ELEVATIONS SHALL BE 1/2" ABOVE FINISH GRADE. WHEN INSTALLED IN HARD FINISHED SURFACE AREAS, BONNET/LID SHALL BE FLUSH WITH FINISH SURFACE. GROUND SURROUNDING METER PIT SHALL SLOPE AWAY FROM LID AT 1/4" PER FT MINIMUM. BARREL RISERS/EXTENSIONS CAN BE ADDED TO ACHIEVE DEPTH AS NECESSARY.

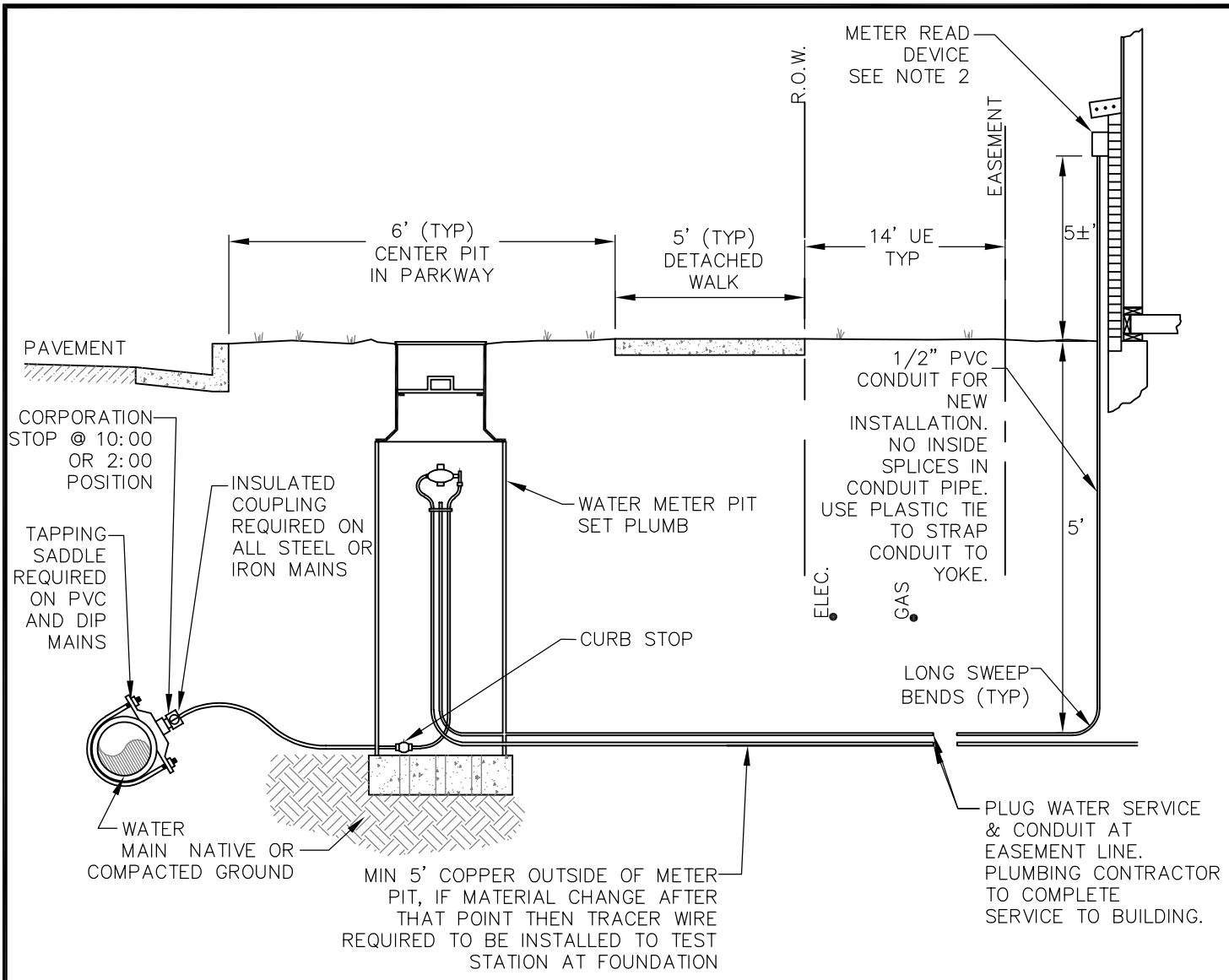
3. METER READ DEVICE TO BE INSTALLED ON EITHER SIDE OF THE BUILDING, IF PLACED NOT MORE THAN 5' FROM THE FRONT OF THE BUILDING AND NOT BEHIND ANY FENCE.

4. THE PROPERTY OWNER SHALL PROVIDE ALL NECESSARY MAINTENANCE, REPAIR AND REPLACEMENT OF THE SERVICE LINE FROM DOWNSTREAM OF METER PIT TO AND WITHIN THE BUILDING WHICH IT SERVES. THE CITY WILL MAINTAIN THE SERVICE LINE FROM THE MAIN TO THE PIT, WATER METER, METER YOKE, METER PIT AND METER RELATED APPURTENANCES.

5. MIN LANDSCAPE SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.

3/4" & 1" WATER SERVICE PROFILE – ATTACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–7A



NOTES:

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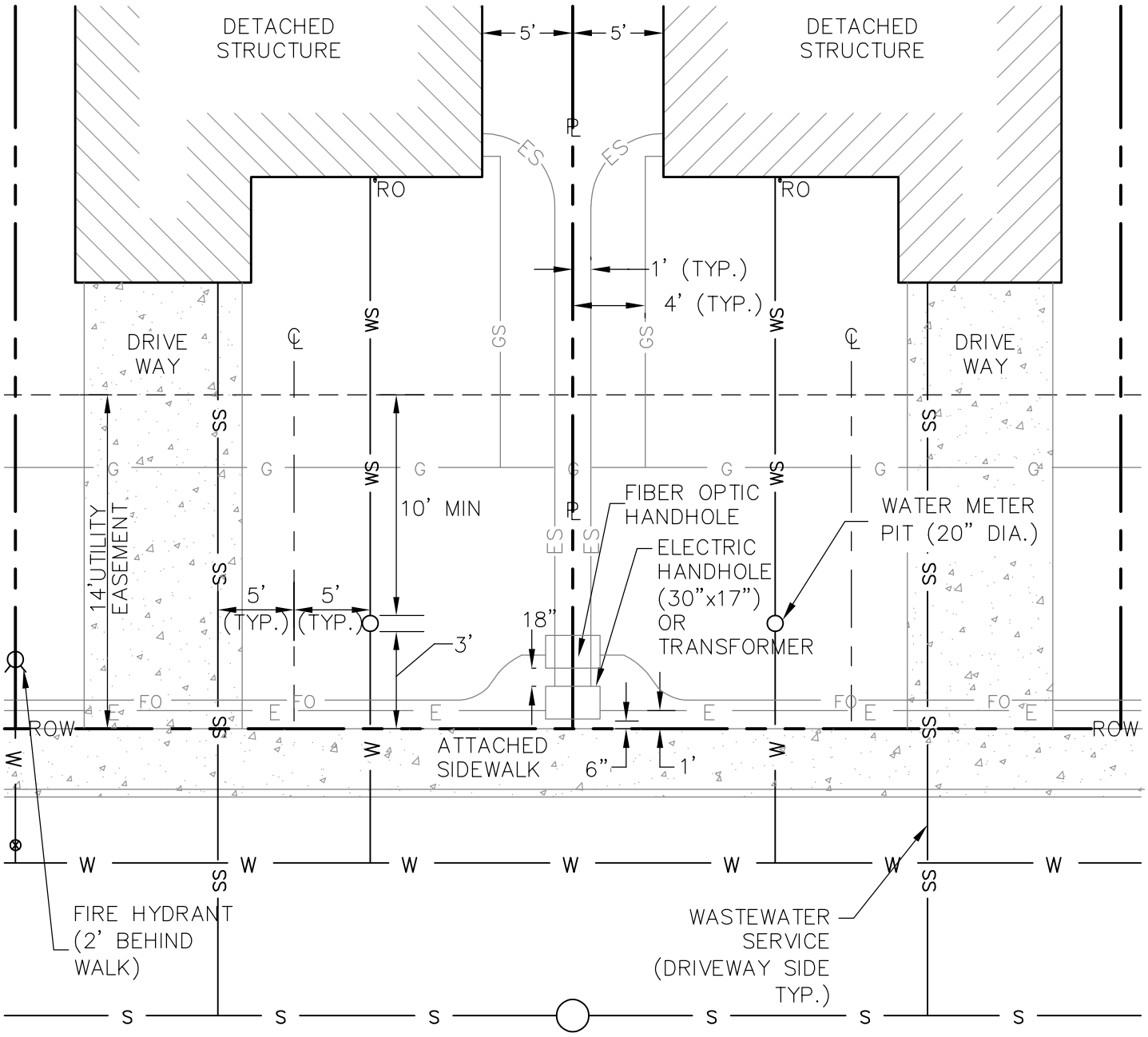
3. METER READ DEVICE TO BE INSTALLED ON EITHER SIDE OF THE BUILDING, IF PLACED NOT MORE THAN 5' FROM THE FRONT OF THE BUILDING AND NOT BEHIND ANY FENCE.

4. THE PROPERTY OWNER SHALL PROVIDE ALL NECESSARY MAINTENANCE, REPAIR AND REPLACEMENT OF THE SERVICE LINE FROM DOWNSTREAM OF METER PIT TO AND WITHIN THE BUILDING WHICH IT SERVES. THE CITY WILL MAINTAIN THE SERVICE LINE FROM THE MAIN TO THE PIT, WATER METER, METER YOKE, METER PIT AND METER RELATED APPURTENANCES.

5. MIN LANDSCAPE SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.

3/4" & 1" WATER SERVICE PROFILE – DETACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–7D

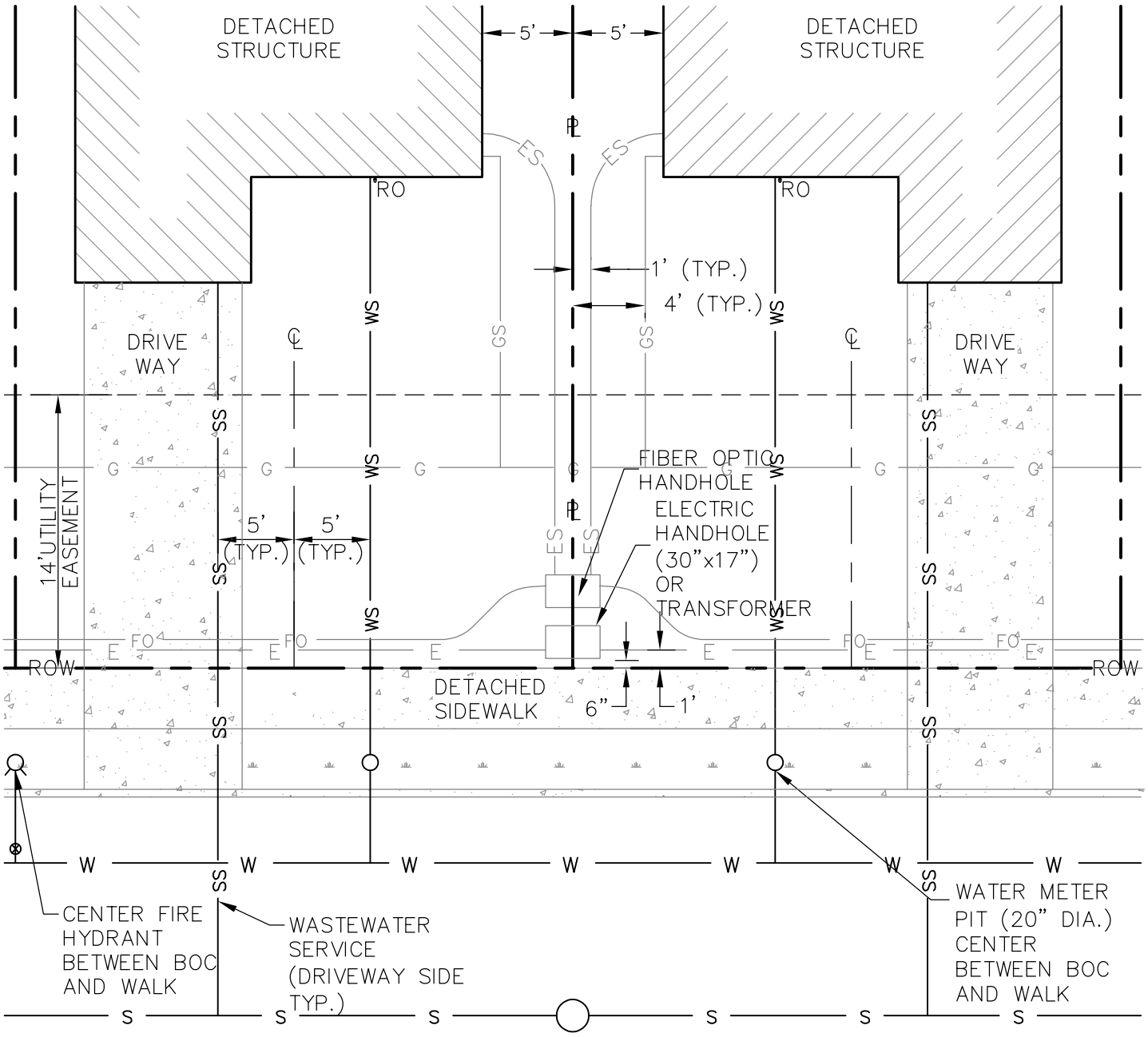


NOTES:

1. WATER METER PITS SHALL NOT BE LOCATED WITHIN DRIVEWAYS, SIDEWALKS, DRAINAGEWAYS OR SWALES. WATER METERS SHALL BE 5' MIN FROM ANY DRIVEWAYS.
2. TYPICAL ELEVATION OF WATER METER PIT IS 0.2 FT ABOVE BACK OF WALK ELEVATION.
3. MIN SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.
4. SEWER AND WATER SERVICE SHALL BE A MINIMUM 10 FEET APART HORIZONTALLY.
5. WASTEWATER SERVICE SHALL BE CONSTRUCTED ON THE SHORTEST AND STRAIGHTEST ROUTE POSSIBLE WITH NO MORE THAN TWO 90° BENDS.
6. THE PORTION OF THE WATER SERVICE PIPE BETWEEN THE WATER MAIN AND THE CURB STOP AND/OR WATER METER WHEN INSTALLED MUST BE IN CONTINUOUS STRAIGHT JOINTS AND PERPENDICULAR, IF POSSIBLE, TO THE LINE OF THE MAIN. WATER SERVICES STUBBED INTO THE PROPERTY LINE SHALL BE OF SUFFICIENT LENGTH TO ALLOW DIRECT CONNECTION TO THE METER YOKE.
7. WATER SERVICE LOCATIONS SHALL BE MARKED WITH "W" ON THE CURB. SANITARY SEWER SERVICE LOCATIONS SHALL BE MARKED WITH "S" ON THE CURB. MARKINGS SHALL BE NEATLY STAMPED, CHISELED OR SAW CUT. PAINTED MARKING IS NOT ALLOWED.

CENTERLINE OFFSET SERVICE PLAN–ATTACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–8A



NOTES:

1. WATER METER PITS SHALL NOT BE LOCATED WITHIN DRIVEWAYS, SIDEWALKS, DRAINAGEWAYS OR SWALES. WATER METERS SHALL BE 5' MIN FROM ANY DRIVEWAYS.
2. TYPICAL ELEVATION OF WATER METER PIT IS FLUSH BETWEEN WALK AND BACK OF CURB.
3. MIN SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.
4. SEWER AND WATER SERVICE SHALL BE A MINIMUM 10 FEET APART HORIZONTALLY.
5. WASTEWATER SERVICE SHALL BE CONSTRUCTED ON THE SHORTEST AND STRAIGHTEST ROUTE POSSIBLE WITH NO MORE THAN TWO 90° BENDS.
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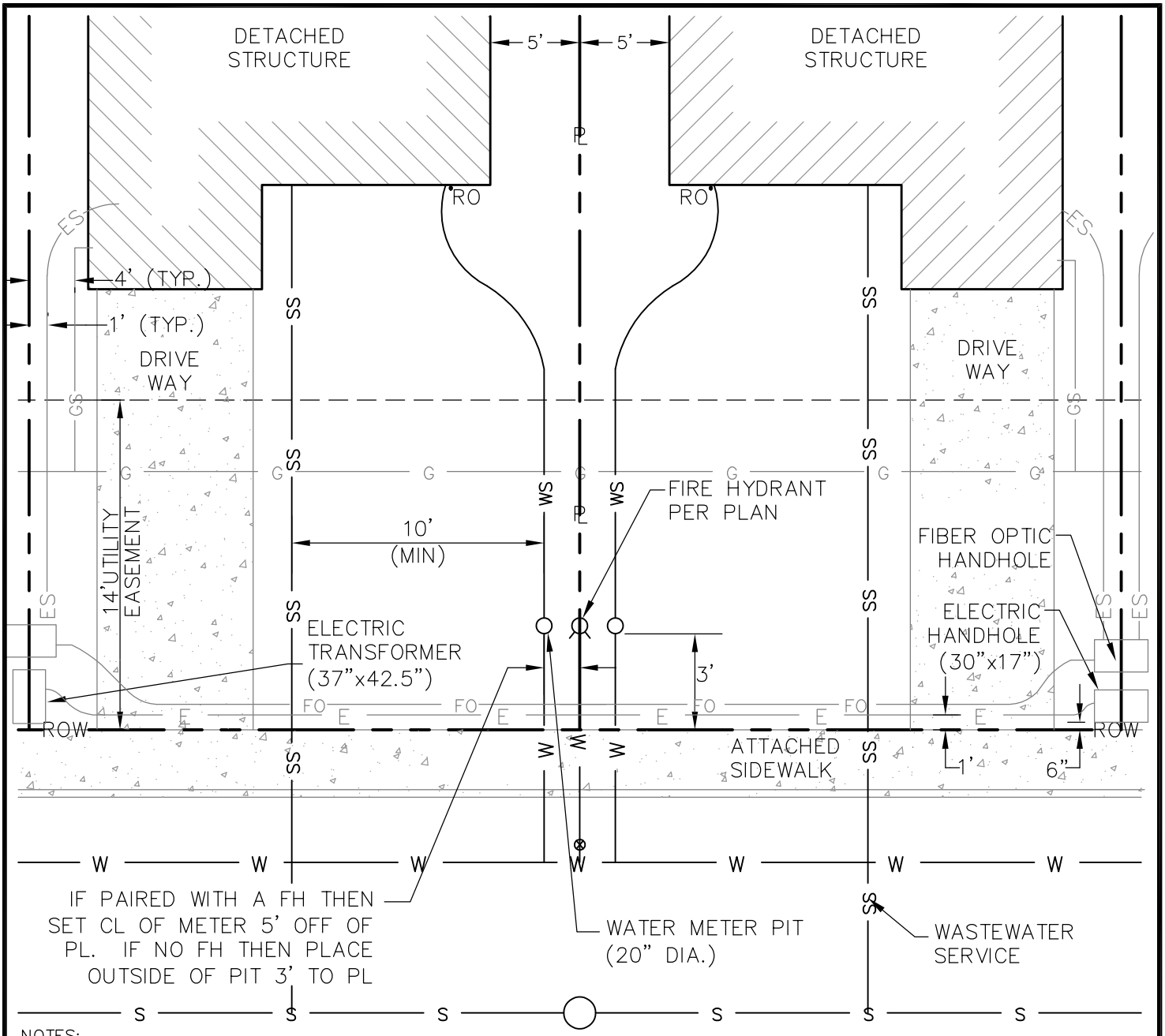
CENTERLINE OFFSET SERVICE PLAN–DETACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–8D

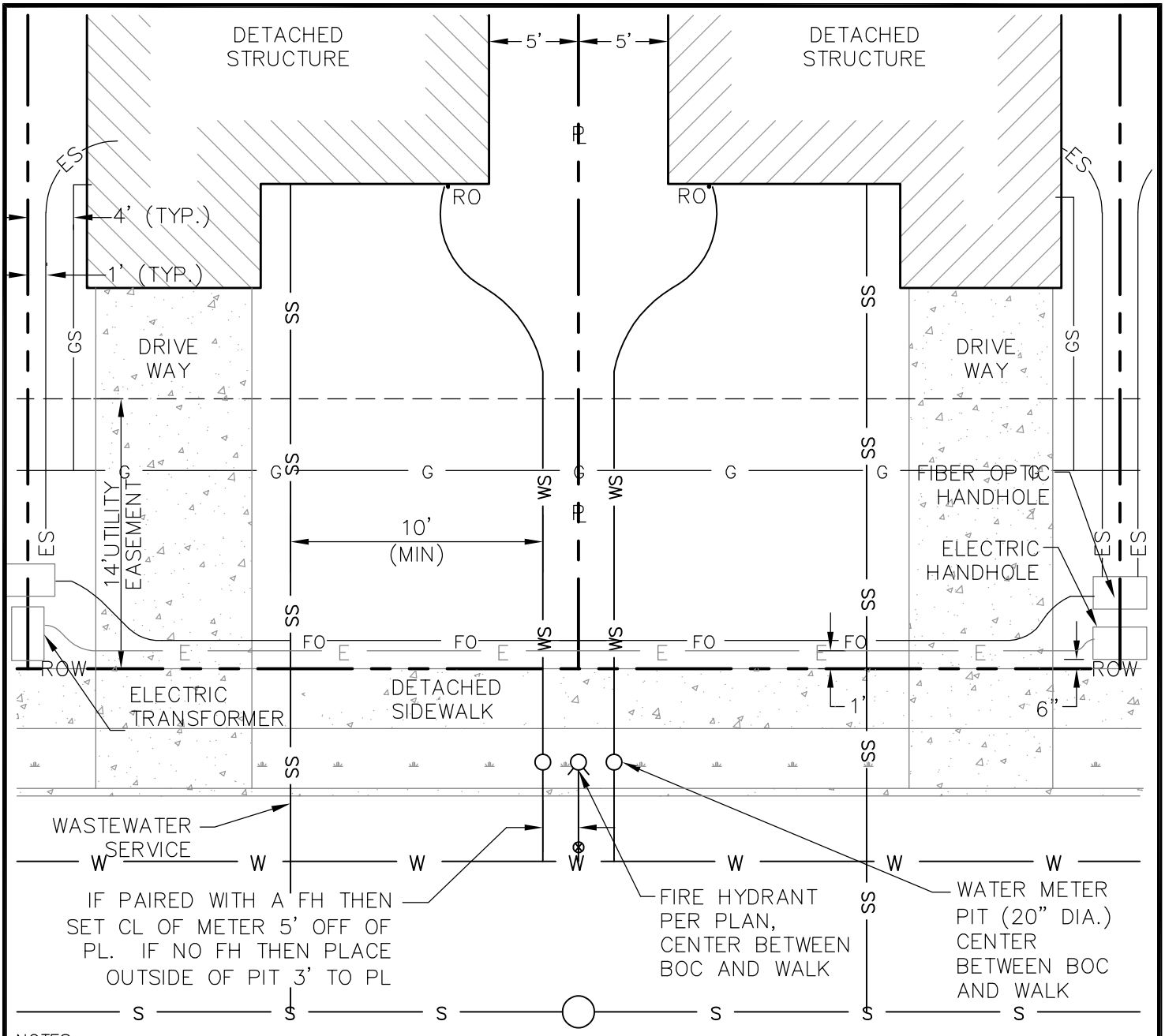


NOTES:

1. THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR PROVIDING THE APPROVED POWER LAYOUT INCLUDING TRANSFORMERS & HANDHOLDS ON THE UTILITY PLAN TO CONFIRM THE LOCATIONS OF THE PAIRED WATER SERVICES.
2. WATER METER PITS SHALL NOT BE LOCATED WITHIN SIDEWALKS, DRAINAGEWAYS OR SWALES. PITS SHALL BE 5' MIN FROM ANY DRIVEWAYS UNLESS APPROVED BY THE DEPARTMENT.
3. TYPICAL ELEVATION OF WATER METER PIT IS 0.2 FT ABOVE BACK OF WALK ELEVATION.
4. MIN SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES & ORNAMENTAL GRASSES = 5'.
5. WATER AND WASTEWATER SERVICE INSTALLATION INCLUDING SEPARATION SHALL BE AS REQUIRED BY THE IPC.
6. MINIMUM SEPARATION BETWEEN SERVICE SADDLES ARE AS FOLLOWS: FOR 1–INCH & SMALLER: 3–FEET APART WHEN LOCATED ON SAME SIDE OF MAIN & 18–INCHES APART IF ON OPPOSITE SIDES OF MAIN. FOR LARGER THAN 1–INCH: 3–FEET APART REGARDLESS OF SIDE OF MAIN.
7. THE PORTION OF THE WATER SERVICE PIPE BETWEEN THE WATER MAIN & THE WATER METER MUST BE INSTALLED WITHOUT JOINTS & PERPENDICULAR TO THE MAIN. WATER SERVICES STUBBED INTO THE PROPERTY SHALL BE OF SUFFICIENT LENGTH TO ALLOW DIRECT CONNECTION TO THE CURB STOP.
8. WASTEWATER SERVICE STUBBED INTO THE LOT SHALL BE CONSTRUCTED ON THE SHORTEST AND STRAIGHTEST ROUTE POSSIBLE TO THE BACK OF THE UTILITY EASEMENT.
9. CURB MARKINGS SHALL BE REQUIRED PER STANDARD DETAIL.

PAIRED SERVICE PLAN–ATTACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–9A



NOTES:

1. THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR PROVIDING THE APPROVED POWER LAYOUT INCLUDING TRANSFORMERS & HANDHOLDS ON THE UTILITY PLAN TO CONFIRM THE LOCATIONS OF THE PAIRED WATER SERVICES.
2. WATER METER PITS SHALL NOT BE LOCATED WITHIN SIDEWALKS, DRAINAGEWAYS OR SWALES. PITS SHALL BE 5' MIN FROM ANY DRIVEWAYS UNLESS APPROVED BY THE DEPARTMENT.
3. TYPICAL ELEVATION OF WATER METER PIT IS 0.2 FT ABOVE BACK OF WALK ELEVATION.
4. MIN SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES & ORNAMENTAL GRASSES = 5'.
5. WATER AND WASTEWATER SERVICE INSTALLATION INCLUDING SEPARATION SHALL BE AS REQUIRED BY THE IPC.
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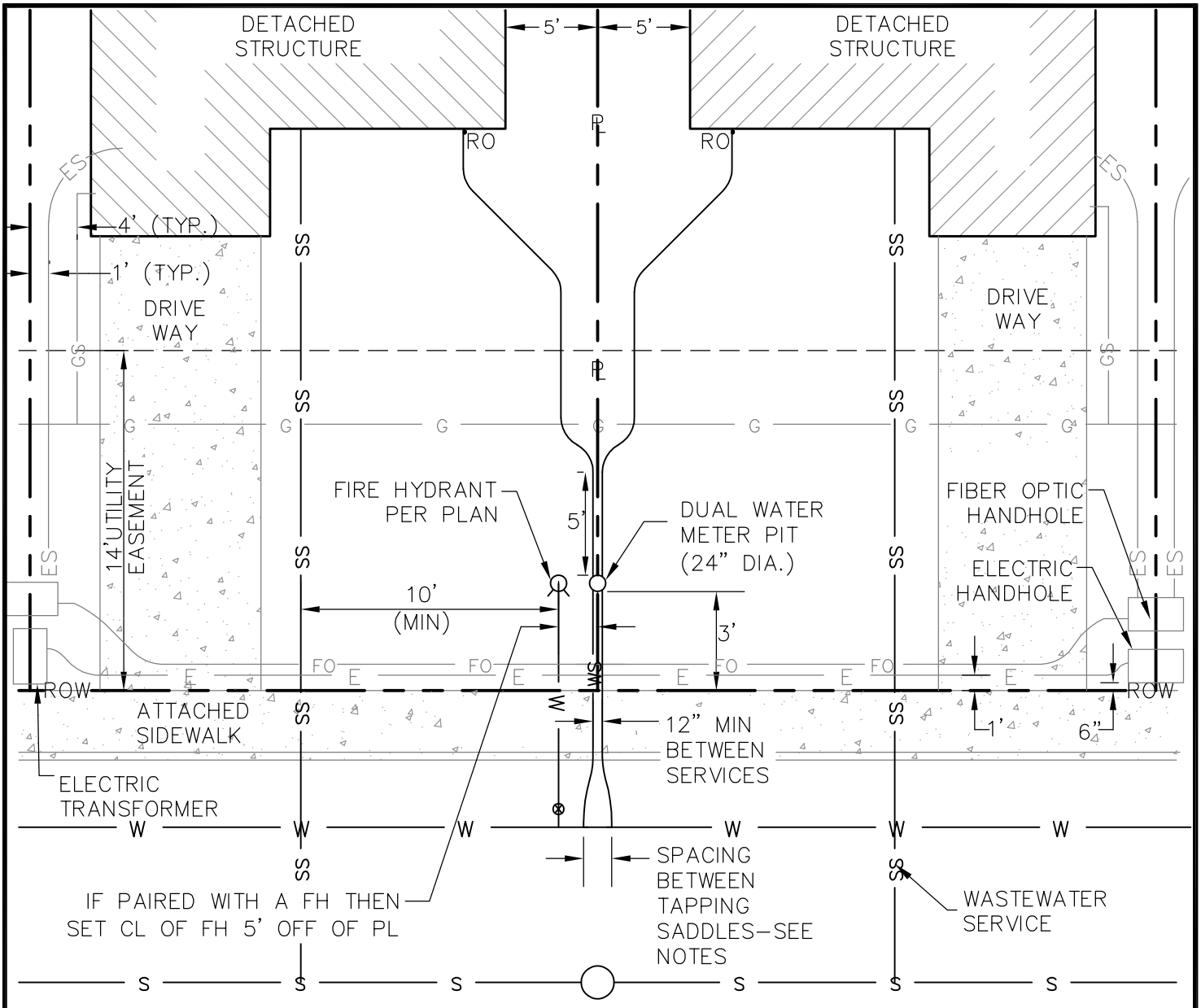
7. THE PORTION OF THE WATER SERVICE PIPE BETWEEN THE WATER MAIN & THE WATER METER MUST BE INSTALLED WITHOUT JOINTS & PERPENDICULAR TO THE MAIN. WATER SERVICES STUBBED INTO THE PROPERTY SHALL BE OF SUFFICIENT LENGTH TO ALLOW DIRECT CONNECTION TO THE CURB STOP.
8. WASTEWATER SERVICE STUBBED INTO THE LOT SHALL BE CONSTRUCTED ON THE SHORTEST AND STRAIGHTEST ROUTE POSSIBLE TO THE BACK OF THE UTILITY EASEMENT.
9. CURB MARKINGS SHALL BE REQUIRED PER STANDARD DETAIL.

PAIRED SERVICE PLAN – DETACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–9D

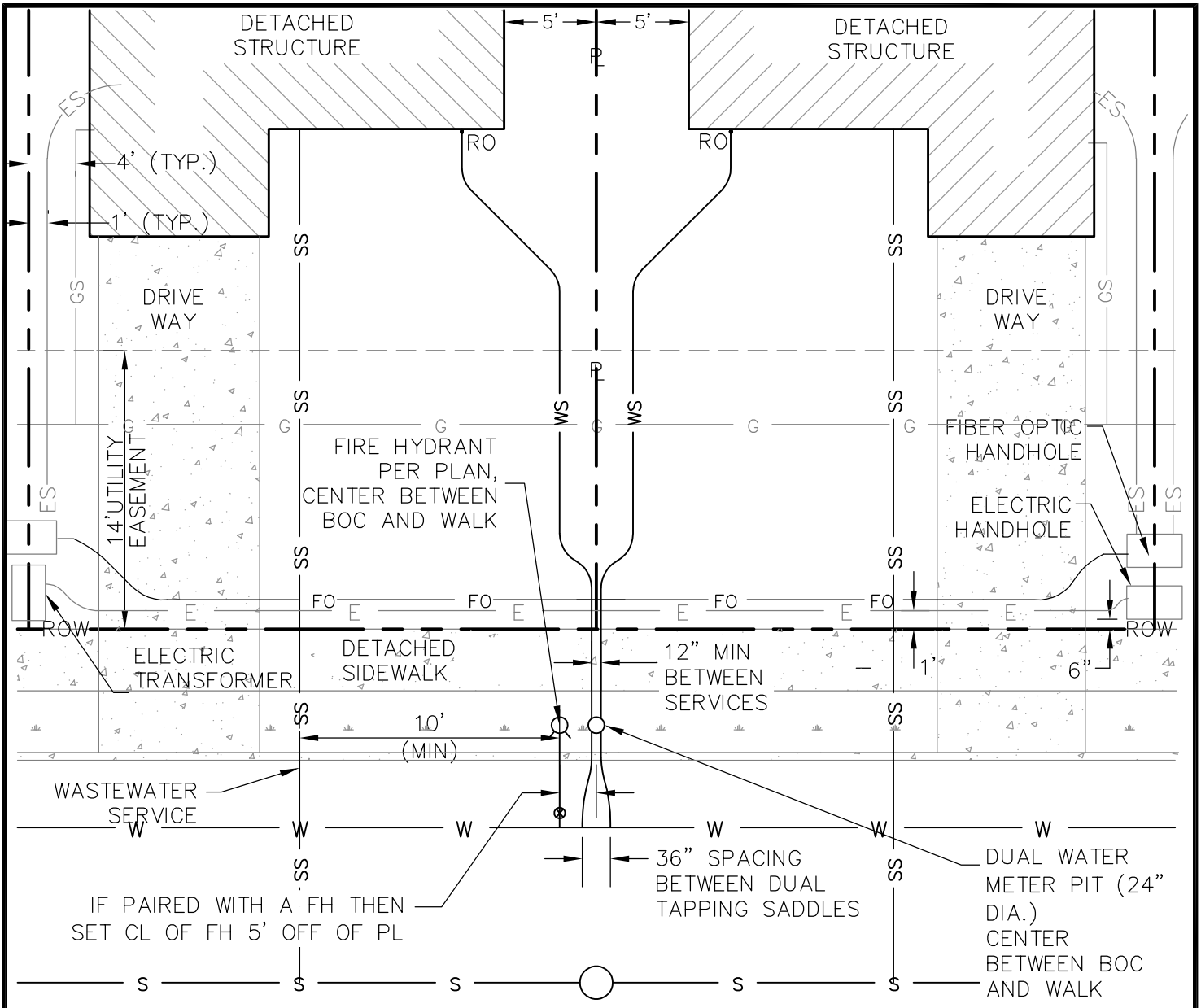


NOTES:

1. THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR PROVIDING THE APPROVED POWER LAYOUT INCLUDING TRANSFORMERS & HANDHOLDS ON THE UTILITY PLAN TO CONFIRM THE LOCATIONS OF THE PAIRED WATER SERVICES.
2. WATER METER PITS SHALL NOT BE LOCATED WITHIN SIDEWALKS, DRAINAGEWAYS OR SWALES. PITS SHALL BE 5' MIN FROM ANY DRIVEWAYS UNLESS APPROVED BY THE DEPARTMENT.
3. TYPICAL ELEVATION OF WATER METER PIT IS 0.2 FT ABOVE BACK OF WALK ELEVATION.
4. MIN SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES & ORNAMENTAL GRASSES = 5'.
5. WATER AND WASTEWATER SERVICE INSTALLATION INCLUDING SEPARATION SHALL BE AS REQUIRED BY THE IPC.
6. MINIMUM SEPARATION BETWEEN SERVICE SADDLES ARE AS FOLLOWS: FOR 1—INCH & SMALLER: 3—FEET APART WHEN LOCATED ON SAME SIDE OF MAIN & 18—INCHES APART IF ON OPPOSITE SIDES OF MAIN. FOR LARGER THAN 1—INCH: 5—FEET APART REGARDLESS OF SIDE OF MAIN.
7. THE PORTION OF THE WATER SERVICE PIPE BETWEEN THE WATER MAIN & THE WATER METER MUST BE INSTALLED WITHOUT JOINTS & PERPENDICULAR TO THE MAIN. WATER SERVICES STUBBED INTO THE PROPERTY SHALL BE OF SUFFICIENT LENGTH TO ALLOW DIRECT CONNECTION TO THE CURB STOP.
8. WASTEWATER SERVICE STUBBED INTO THE LOT SHALL BE CONSTRUCTED ON THE SHORTEST AND STRAIGHTEST ROUTE POSSIBLE TO THE BACK OF THE UTILITY EASEMENT.
9. CURB MARKINGS SHALL BE REQUIRED PER STANDARD DETAIL.

DUAL METER PIT SERVICE PLAN—ATTACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W—10A

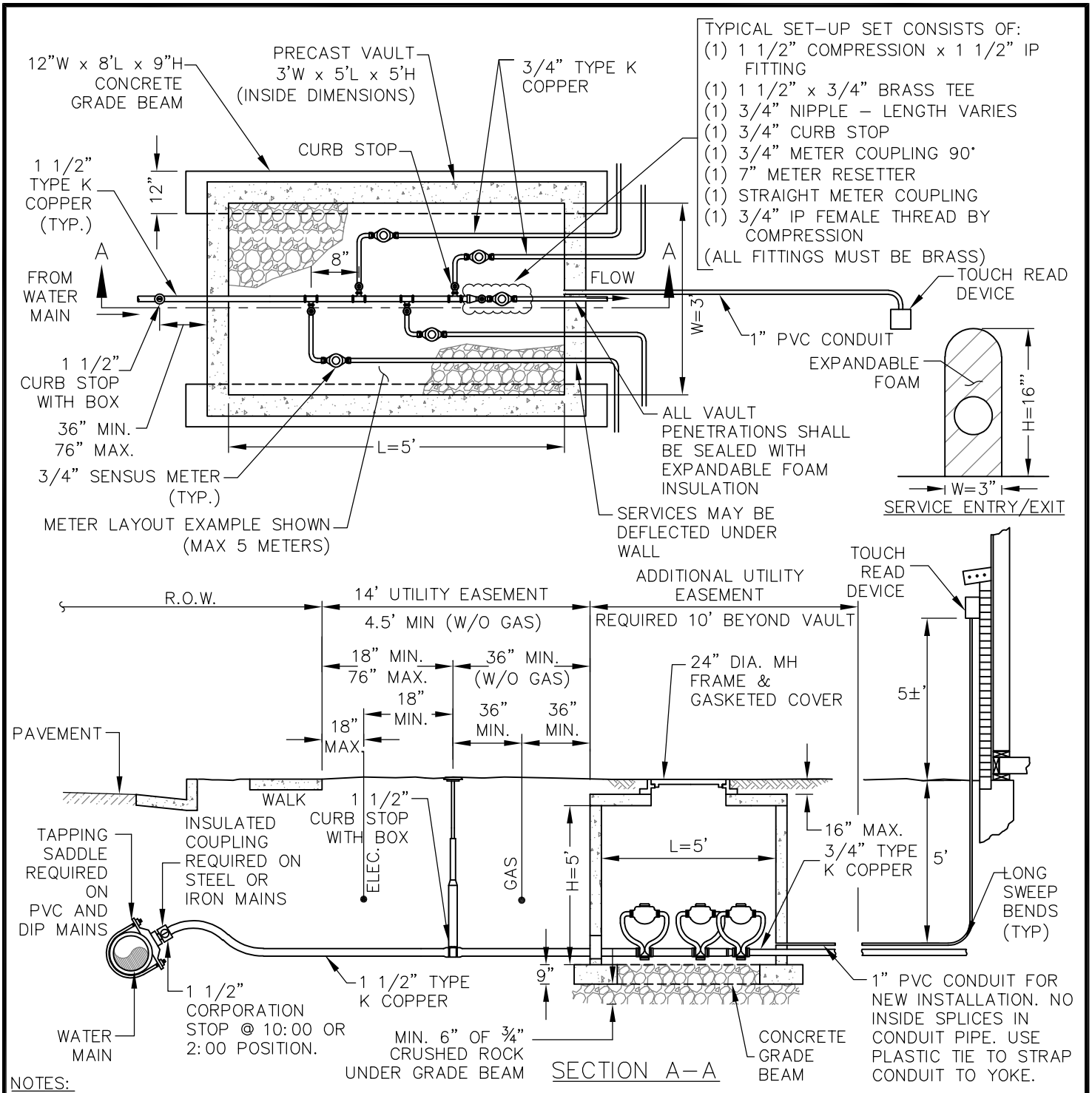


NOTES:

1. THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR PROVIDING THE APPROVED POWER LAYOUT INCLUDING TRANSFORMERS & HANDHOLDS ON THE UTILITY PLAN TO CONFIRM THE LOCATIONS OF THE PAIRED WATER SERVICES.
2. WATER METER PITS SHALL NOT BE LOCATED WITHIN SIDEWALKS, DRAINAGEWAYS OR SWALES. PITS SHALL BE 5' MIN FROM ANY DRIVEWAYS UNLESS APPROVED BY THE DEPARTMENT.
3. TYPICAL ELEVATION OF WATER METER PIT IS 0.2 FT ABOVE BACK OF WALK ELEVATION.
4. MIN SEPARATION BETWEEN METER PITS TO TREES = 10', BUSHES & ORNAMENTAL GRASSES = 5'.
5. WATER AND WASTEWATER SERVICE INSTALLATION INCLUDING SEPARATION SHALL BE AS REQUIRED BY THE IPC.
6. MINIMUM SEPARATION BETWEEN SERVICE SADDLES ARE AS FOLLOWS: FOR 1–INCH & SMALLER: 3–FEET APART WHEN LOCATED ON SAME SIDE OF MAIN & 18–INCHES APART IF ON OPPOSITE SIDES OF MAIN. FOR LARGER THAN 1–INCH: 5–FEET APART REGARDLESS OF SIDE OF MAIN.
7. THE PORTION OF THE WATER SERVICE PIPE BETWEEN THE WATER MAIN & THE WATER METER MUST BE INSTALLED WITHOUT JOINTS & PERPENDICULAR TO THE MAIN. WATER SERVICES STUBBED INTO THE PROPERTY SHALL BE OF SUFFICIENT LENGTH TO ALLOW DIRECT CONNECTION TO THE CURB STOP.
8. WASTEWATER SERVICE STUBBED INTO THE LOT SHALL BE CONSTRUCTED ON THE SHORTEST AND STRAIGHTEST ROUTE POSSIBLE TO THE BACK OF THE UTILITY EASEMENT.
9. CURB MARKINGS SHALL BE REQUIRED PER STANDARD DETAIL.

DUAL METER PIT SERVICE PLAN–DETACHED WALK

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–10D

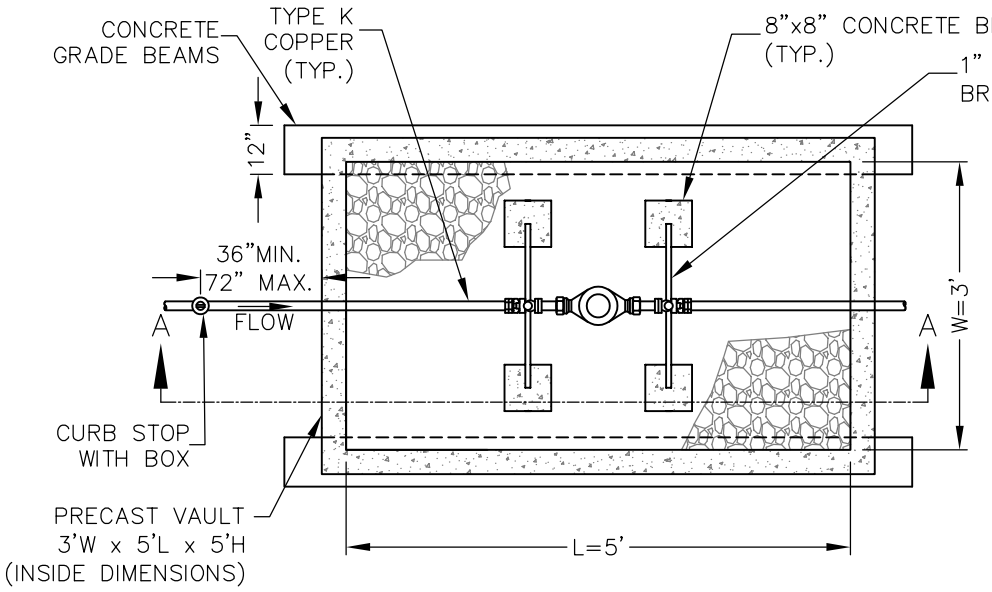


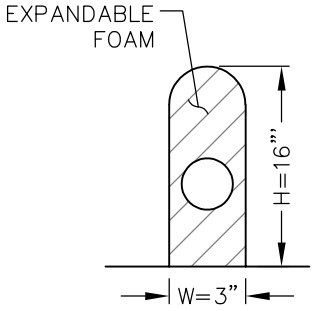
NOTES:

1. METER VAULT SHALL BE DESIGNED IN ACCORDANCE WITH ASTM C858 AND FOR AASHTO HL-93 LOADING. WALLS AND LID SHALL BE 6" THICK. WALLS & LIDS SHALL BE CAST AS SEPARATE COMPONENTS; EACH SHALL BE CAST MONOLITHICALLY. CONCRETE FC=4000 PSI. BURY VAULT 16" MAX BELOW SURFACE. ADJUST MH COVER TO GRADE WITH CONCRETE GRADE RINGS.
2. TOUCH READ DEVICE SHALL BE STACK MOUNTED ON THE NEAREST BUILDING AND NOT LOCATED BEHIND A FENCE.
3. HIGH PRESSURE AREAS WILL REQUIRE A PRV. INSTALL PRV IN BUILDING.
4. TYPE K-COPPER SERVICE AND COMPRESSION FITTING ONLY.
5. WALL PENETRATIONS FOR SERVICE ENTRY AND EXIT MAY BE DOGHOUSE STYLE, HOWEVER SHALL NOT EXCEED 3"Wx16"H. ALL VAULT PENETRATIONS SHALL BE SEALED WITH EXPANDABLE FOAM.
6. CURB STOP TO BE MINNEAPOLIS SCREW ON STYLE EXCLUDING EXTENSION.
7. SEPARATION BETWEEN METER VAULTS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.

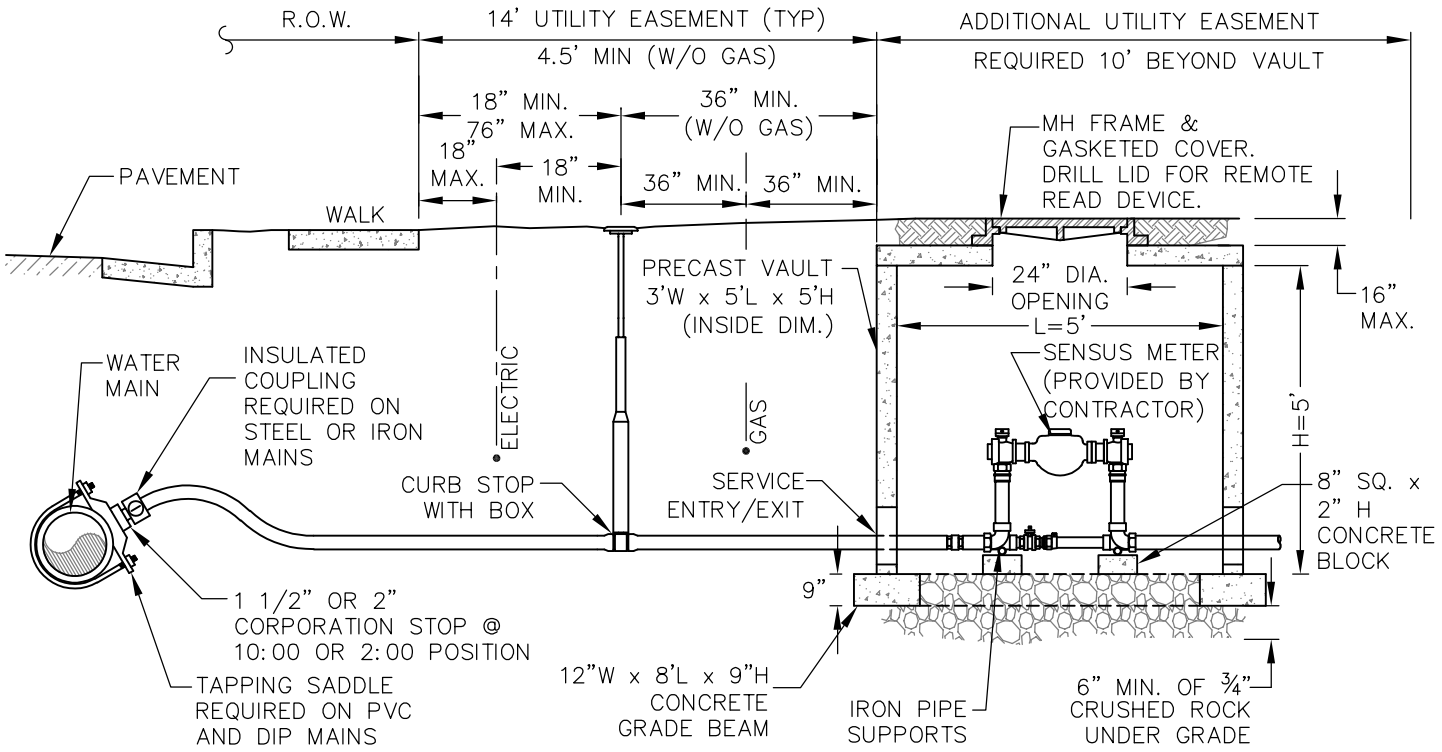
3/4" MULTIPLE WATER METER VAULT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-11





SERVICE ENTRY/EXIT



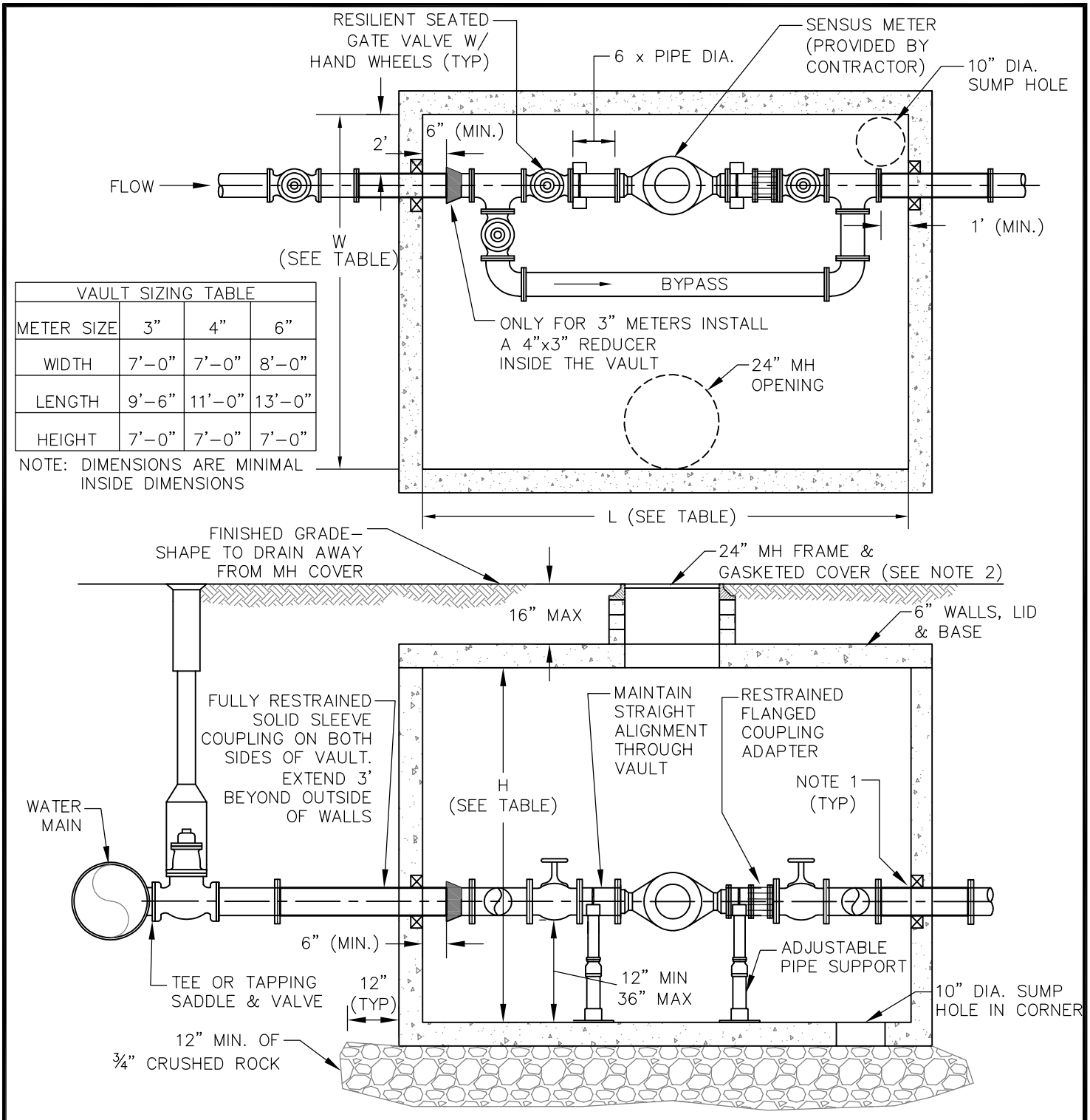
SECTION A–A

NOTES:

1. METER VAULT SHALL BE DESIGNED IN ACCORDANCE WITH ASTM C858 AND FOR AASHTO HL–93 LOADING. WALLS AND LID SHALL BE 6" THICK. WALLS & LIDS SHALL BE CAST AS SEPARATE COMPONENTS; EACH SHALL BE CAST MONOLITHICALLY. CONCRETE FC=4000 PSI. BURY VAULT 16" MAX BELOW SURFACE. ADJUST MH COVER TO GRADE WITH CONCRETE GRADE RINGS.
2. HIGH PRESSURE AREAS WILL REQUIRE A PRV. INSTALL PRV IN BUILDING.
3. TYPE K–COPPER SERVICE AND COMPRESSION FITTING ONLY.
4. WALL PENETRATIONS FOR SERVICE ENTRY AND EXIT MAY BE DOGHOUSE STYLE, HOWEVER SHALL NOT EXCEED 3"Wx16"H. ALL VAULT PENETRATIONS SHALL BE SEALED WITH EXPANDABLE FOAM.
5. CURB STOP TO BE MINNEAPOLIS SCREW ON STYLE EXCLUDING EXTENSION.
6. SEPARATION BETWEEN METER VAULTS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.

1–1/2" & 2" WATER METER VAULT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–12



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"

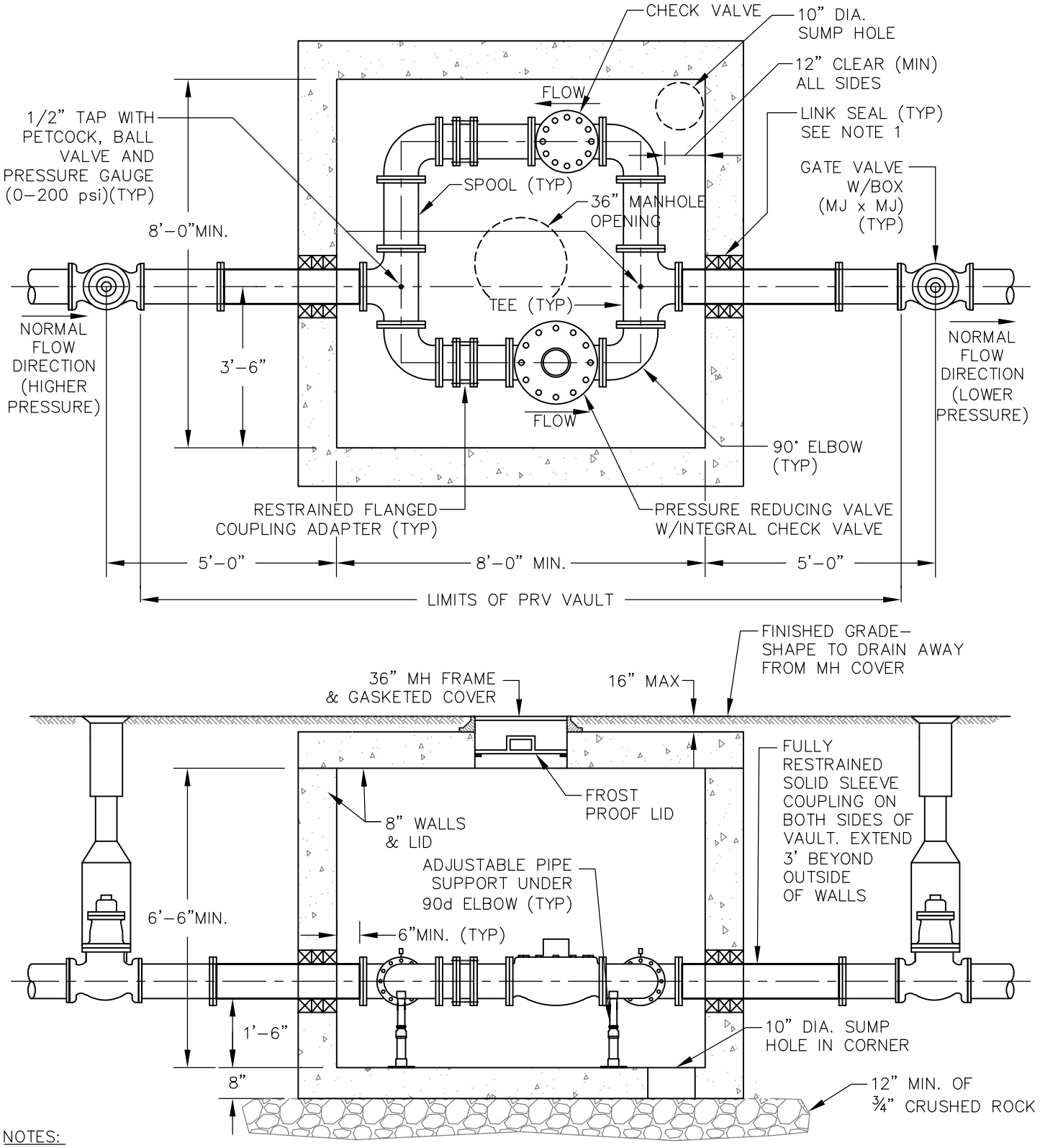
NOTE: DIMENSIONS ARE MINIMAL INSIDE DIMENSIONS

NOTES:

1. SEAL EACH VAULT PENETRATION WITH LINK-SEAL UNIT USING 316 S.S HARDWARE.
2. BURY VAULT 16" BELOW SURFACE. ADJUST MH 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 DESIGNED IN ACCORDANCE WITH ASTM C858. WALLS & LIDS SHALL BE CAST AS SEPARATE COMPONENTS; EACH SHALL BE CAST MONOLITHICALLY. CONCRETE FC=4000 PSI MIN.
5. SEPARATION BETWEEN METER VAULTS TO TREES = 10', BUSHES AND ORNAMENTAL GRASSES = 5'.

3", 4" & 6" WATER METER VAULT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-13

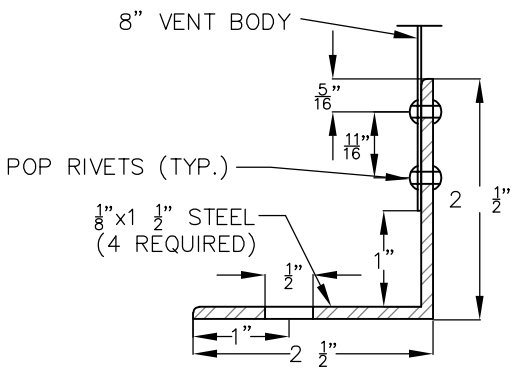


NOTES:

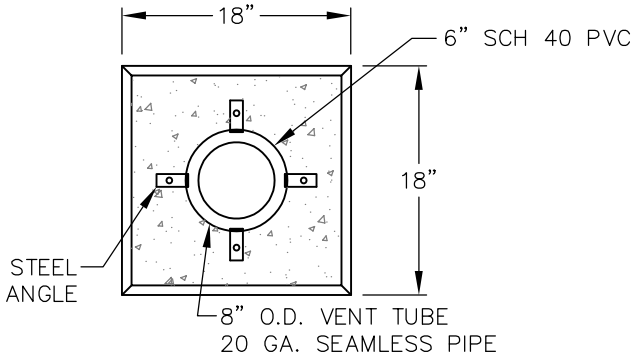
1. SEAL EACH VAULT PENETRATION WITH LINK–SEAL UNIT USING 316 S.S HARDWARE.
2. ALL JOINTS WITHIN VAULT SHALL BE FLANGED CONNECTIONS.
3. VAULT SHALL BE DESIGNED FOR AASHTO HL–93 LOADING. FLOORS AND WALLS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM C858. WALLS & LIDS SHALL BE CAST AS SEPARATE COMPONENTS; EACH SHALL BE CAST MONOLITHICALLY. CONCRETE FC=4000 PSI MIN. PLACE RAM–NEK BETWEEN WALLS AND LID.
4. CHECK VALVE SHALL OPERATE IN THE REVERSE DIRECTION OF FLOW FROM THE PRESSURE REDUCING VALVE.

PRESSURE REDUCING VALVE VAULT

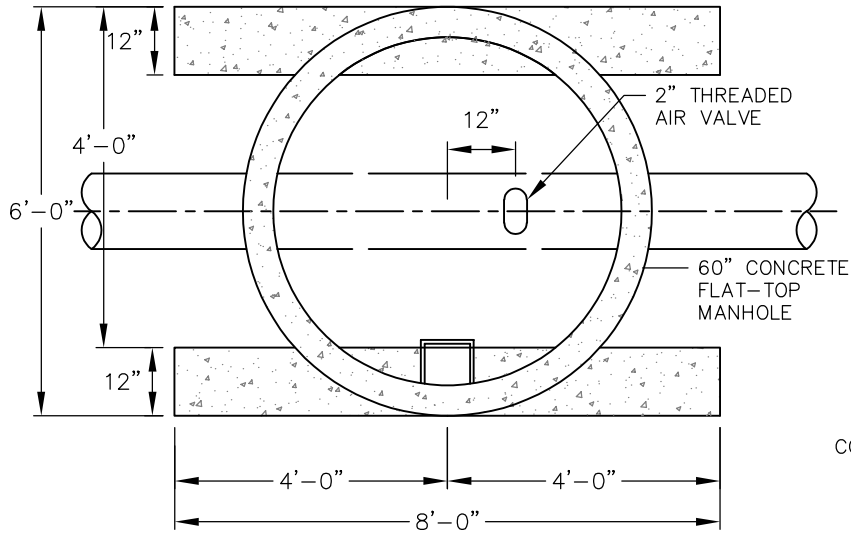
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–14

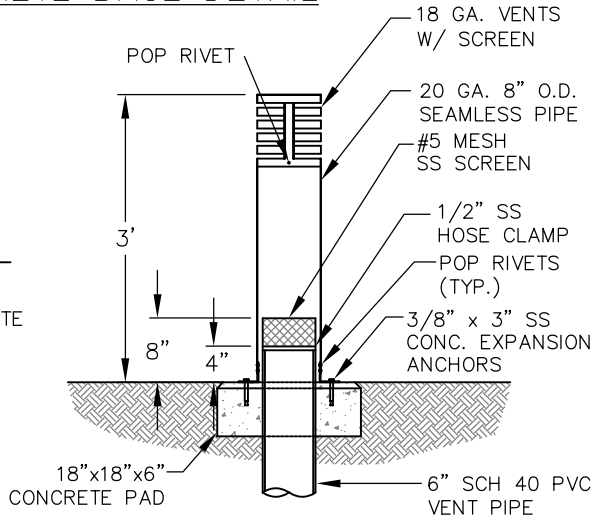


STEEL ANGLE DETAIL



CONCRETE BASE DETAIL

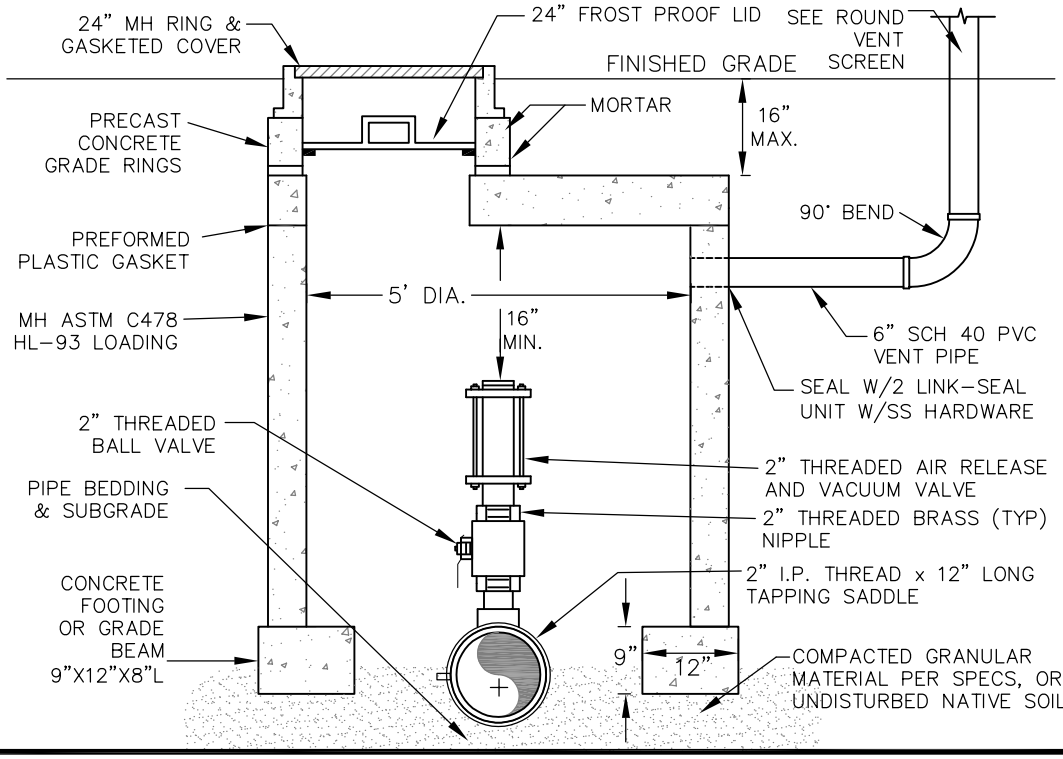




ROUND VENT SCREEN

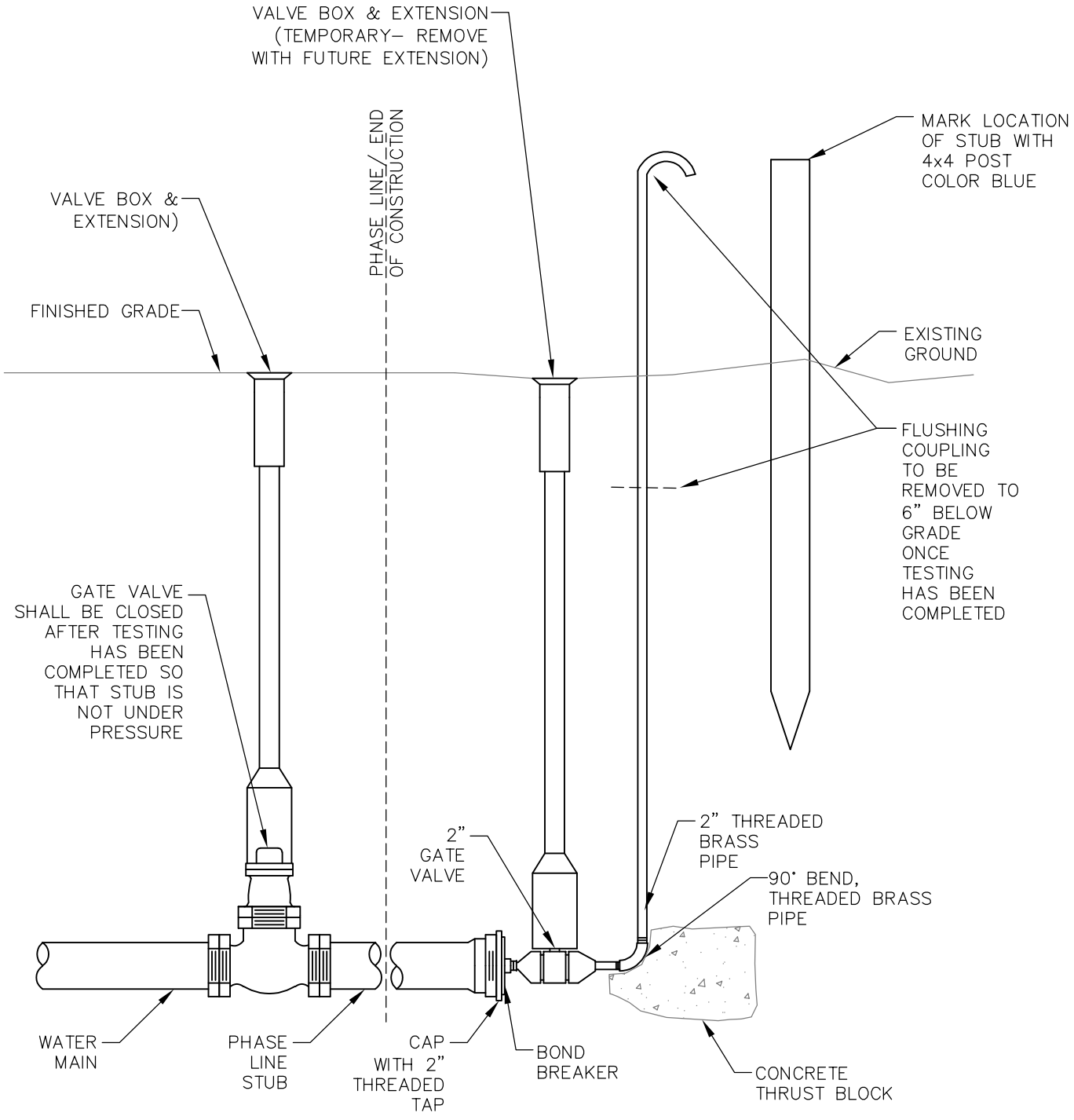
NOTES:

1. CONCRETE PAD TO BE 3000 PSI. PROVIDE 3/4" CHAMFER ON EXPOSED EDGES.
2. VENT PIPES SHALL BE PRIMED AND COATED BLACK.



2" AIR AND VACUUM RELEASE VALVE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-15

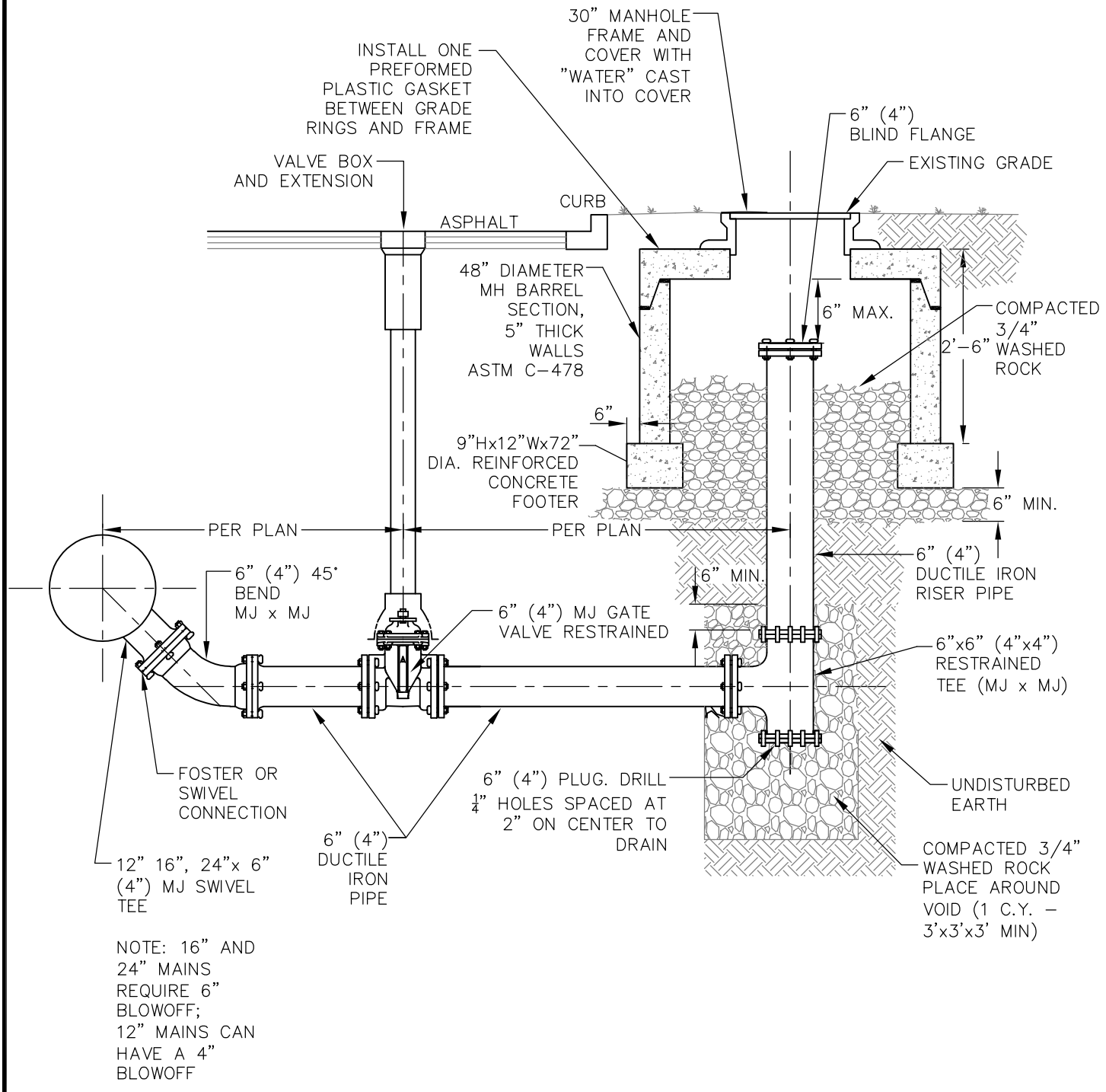


NOTE:

1. ALL FITTINGS TO BE RESTRAINED

TEMPORARY BLOW–OFF

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–16

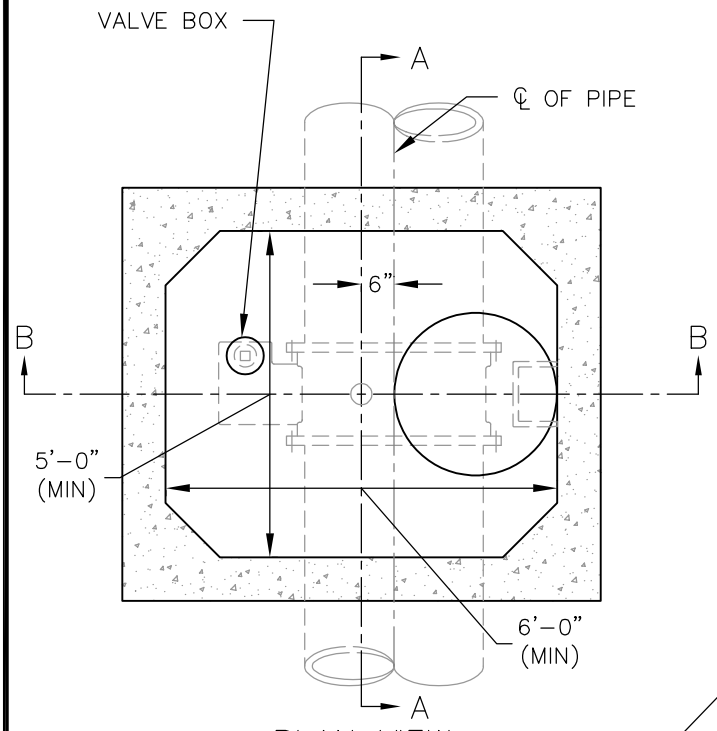


INLINE BLOWOFF STRUCTURE (12", 16" & 24" MAINS)

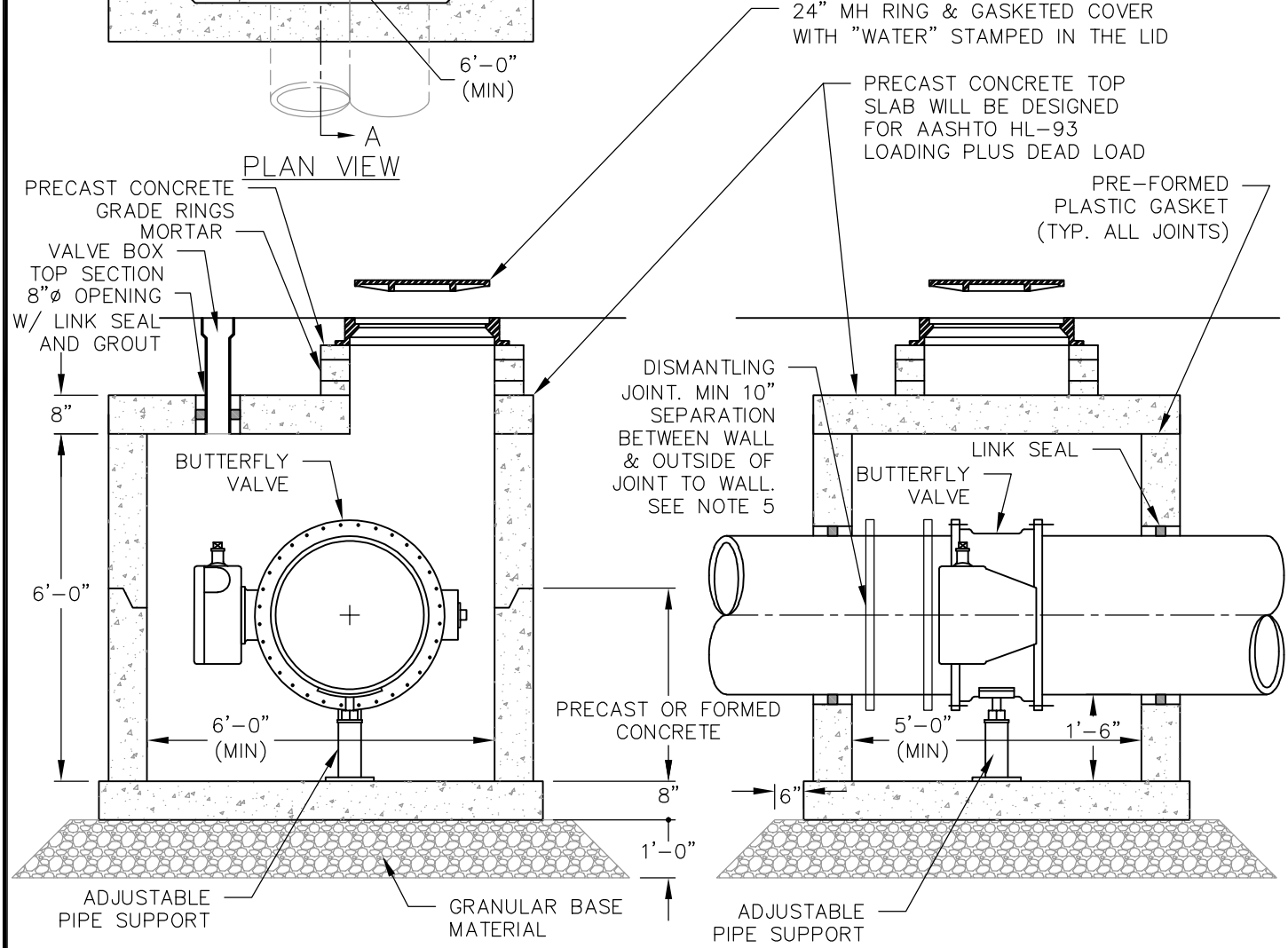
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-17

NOTES:

1. EXTERNAL VAULT DIMENSION VARY BASED ON PRECAST REQUIREMENTS.
2. BUTTERFLY VALVE OPERATORS SHALL BE LOCATED ON THE NORTHERLY OR WESTERLY 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 MECHANICAL JOINT RESTRAINTS.
5. BUTTERFLY VALVES INSTALLED WITH FLANGED CONNECTIONS SHALL INCLUDE A RESTRAINED FLANGED COUPLING ADAPTER OR DISMANTLING JOINT ON ONE SIDE
6. VAULTS FOR 30" & LARGER DIAMETER PIPES MAY BE REQUIRED TO BE LARGER THAN SHOWN. FINAL DIMENSIONS NEED TO BE COORDINATED WITH THE CITY



PLAN VIEW

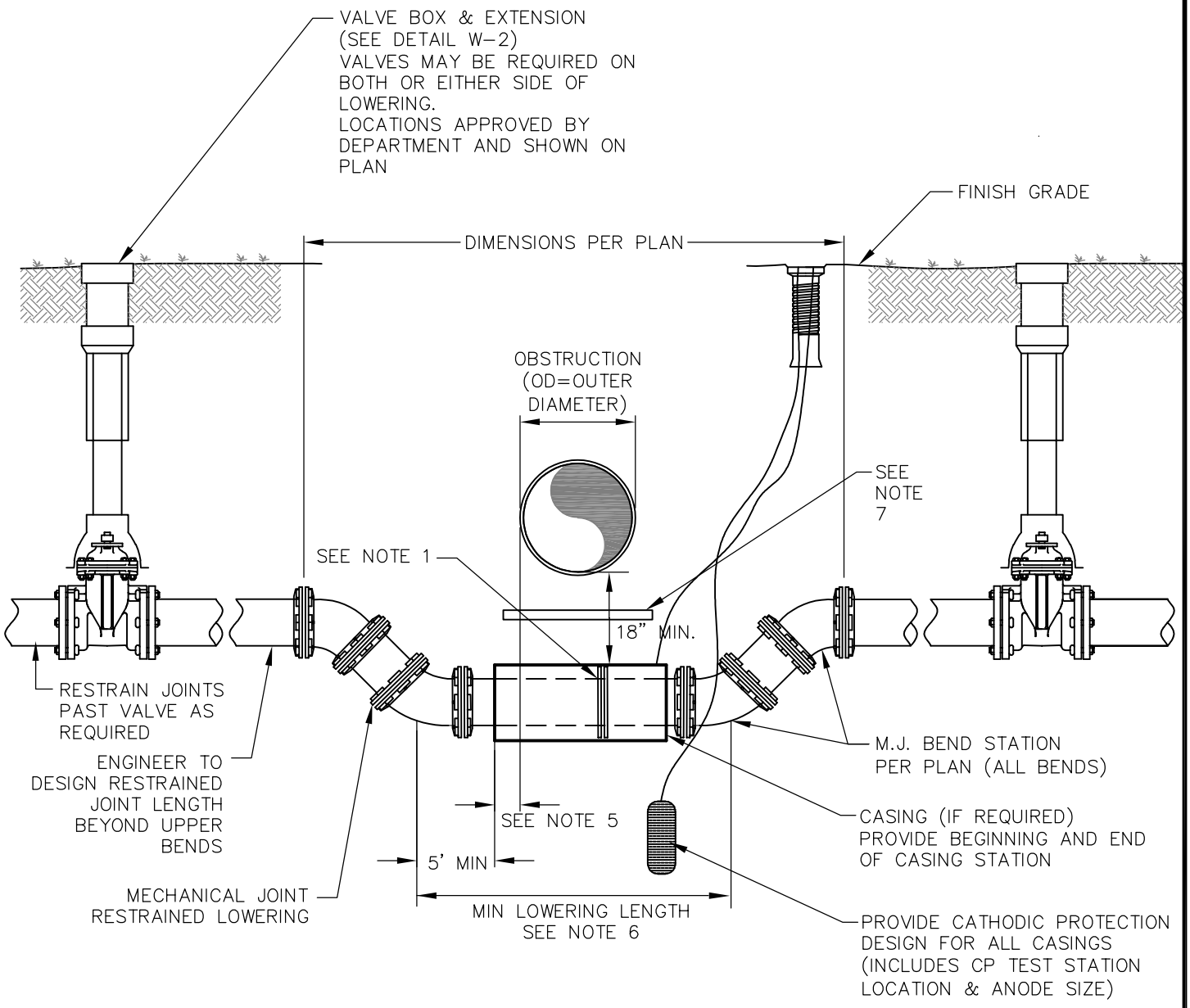


SECTION A-A

SECTION B-B

BUTTERFLY VALVE VAULT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-18

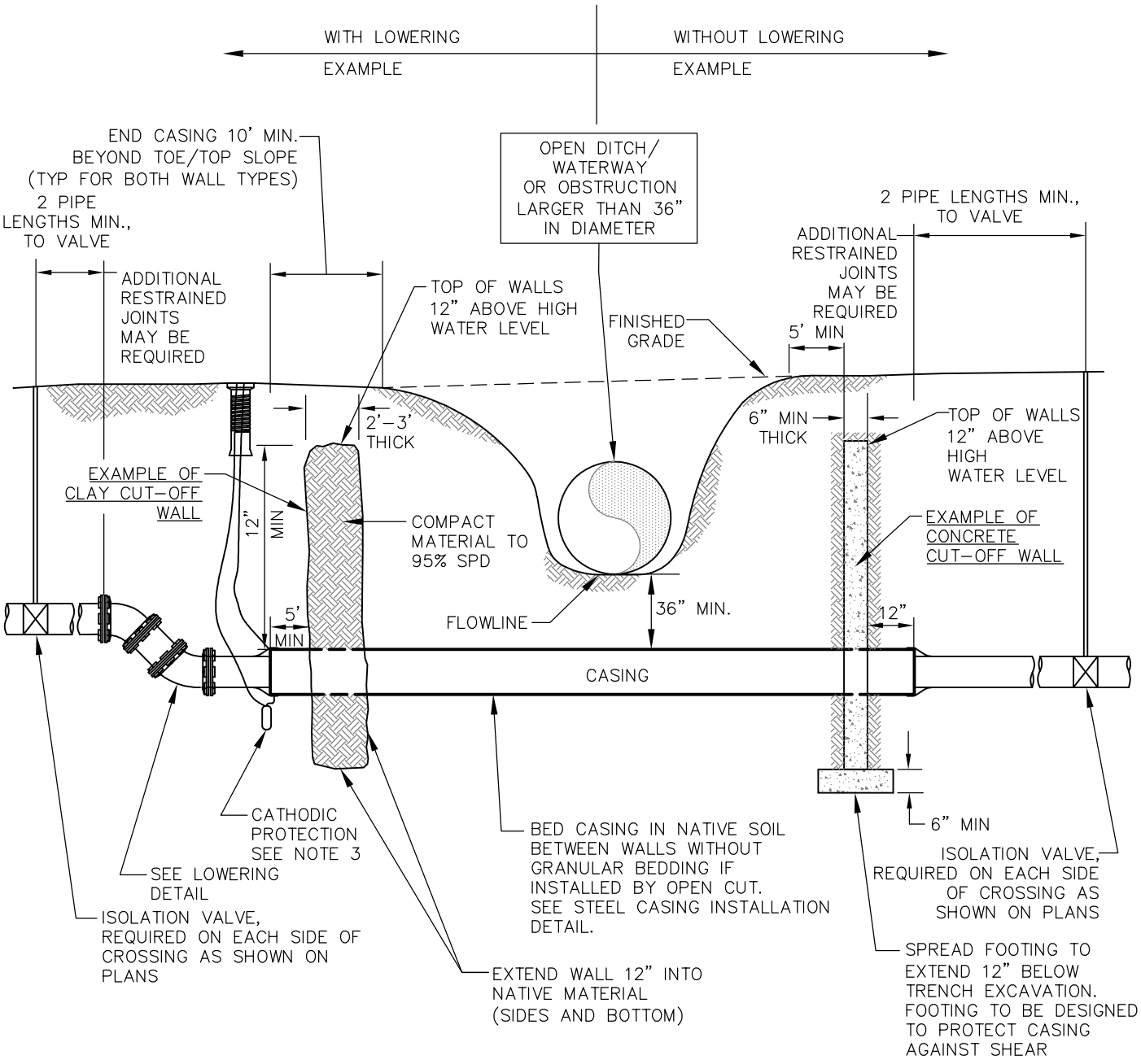


NOTES:

1. ENTIRE LOWERING TO BE RESTRAINED BY MECHANICAL JOINT RESTRAINT INCLUDING ANY JOINTS WITHIN A CASING. TOTAL RESTRAINED LENGTH OF LOWERING SHALL BE STATIONED
2. ALL METALLIC PIPE, FITTINGS, AND APPURTENANCES SHALL BE WRAPPED IN 8 MIL POLYETHYLENE.
3. ALL FITTINGS, VALVES, PIPE LENGTHS, CASING ENDS, ETC. SHALL BE STATIONED AND HAVE VERTICAL ELEVATIONS TO TOP OF PIPE.
4. FOR DITCH CROSSINGS, CUTOFF WALLS MAY BE REQUIRED. CROSSING DESIGN MUST BE APPROVED BY DITCH COMPANY.
5. EXTEND CASING 5' BEYOND OUTER EDGE OF OBSTRUCTION. IF WATERLINE IS ≥ 10 FEET IN DEPTH THE CASING SHALL BE EXTEND 10' BEYOND OUTER EDGE.
6. LOWER BENDS SHALL BE PLACED 5' BEYOND THE OBSTRUCTION OR OUTSIDE EDGE OF CASING. WITHOUT A CASING L=10'+OD OF PIPE.
7. FREEZE PROTECTION SHALL BE PROVIDED IF REQUIRED. BOARD TO BE PLACED MIDWAY BETWEEN PIPES. ENGINEER TO PROVIDE LENGTH X WIDTH X THICKNESS DESIGN ON PLAN.

WATERLINE LOWERING

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-19

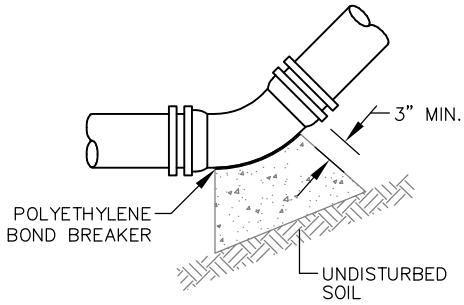


NOTE:

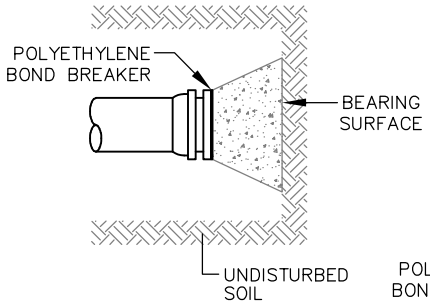
1. ALL CUT-OFF WALLS MAY EITHER BE CLAY OR CONCRETE. ALL CUT-OFF WALLS SHALL BE SPECIFICALLY DESIGNED BY THE DESIGN ENGINEER AND SHALL BE CONSISTENT WITH THESE STANDARDS AND THOSE OF THE ENTITY/OBSTRUCTION BEING CROSSED.
2. ALL JOINTS TO BE RESTRAINED WITHIN CASING.
3. PROVIDE CATHODIC PROTECTION DESIGN FOR ALL CASINGS (INCLUDING CP TEST STATION LOCATION & ANODE SIZE) ON PLANS.

WATERLINE DITCH/OBSTRUCTION CROSSING W/CASING

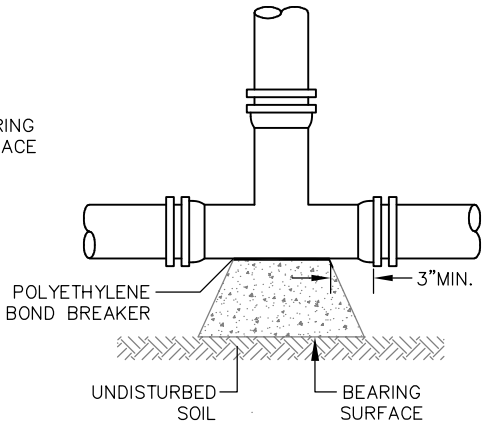
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 08/07 DATE REVISED: 01/10	DRAWING W-20



TYPICAL BEND

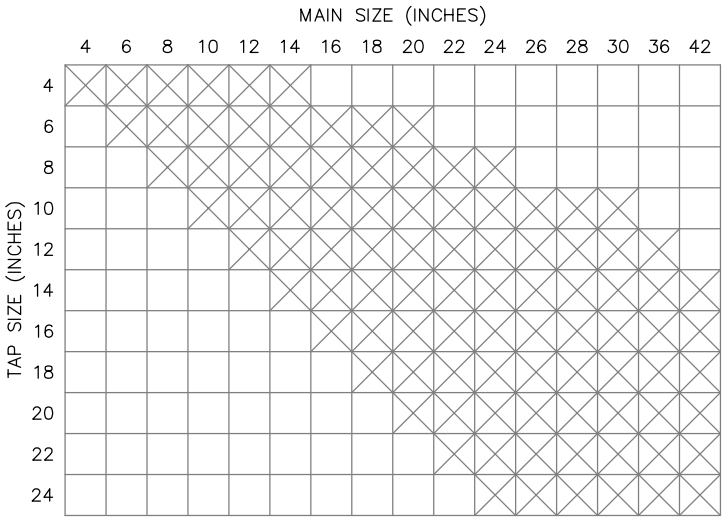


DEAD END



TEE

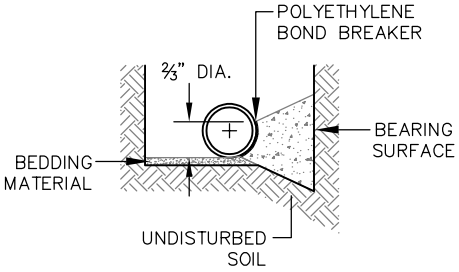
TABLE OF TAPS REQUIRING CONCRETE THRUST BLOCKS



LEGEND

☒ INDICATES CONCRETE THRUST BLOCK REQUIRED

☐ INDICATES CONCRETE THRUST BLOCK SIZE THAT REQUIRES SPECIAL DESIGN APPROVAL BY THE DEPARTMENT.



TYPICAL CROSS-SECTION

TABLE OF REQUIRED BEARING AREAS (SQ. FT.)

PIPE SIZE	HORIZONTAL BENDS				TEES/DEAD ENDS
	90°	45°	22-1/2°	11-1/4°	
3"	2.0	1.1	0.6	0.3	1.4
4"	3.1	1.7	0.8	0.4	2.2
6"	6.8	3.7	1.9	0.9	4.8
8"	12.2	6.6	3.4	1.7	8.6
10"	18.6	10.1	5.1	2.6	13.2
12"	26.6	14.4	7.3	3.7	18.8
14"	36.2	19.6	10.0	5.0	25.6
16"	47.0	25.4	13.0	6.5	33.3
18"	59.4	32.1	16.4	8.2	42.0
20"	73.1	39.5	20.2	10.1	51.7
24"	105.3	57.0	29.1	14.6	74.5
30"	163.4	88.4	45.1	22.7	115.6
36"	234.8	127.1	64.8	32.5	166.0

NOTES:

1. ALL METALLIC PIPE, FITTINGS, AND APPURTENANCES TO BE WRAPPED WITH 8 MIL POLYETHYLENE.
2. PIPE INSTALLED UNDER CONDITIONS DIFFERENT FROM THOSE NORMALLY ENCOUNTERED SHALL REQUIRE THRUST BLOCKS DESIGNED FOR THOSE PARTICULAR CONDITIONS.
3. ALL THRUST BLOCKS TO BE 3000 P.S.I. CONCRETE.
4. CALCULATIONS MADE WITH THIS TABLE ASSUME 100 P.S.I. INTERNAL STATIC PRESSURE AND 1,000 LBS./SQ.FT. SOIL BEARING CAPACITY AND A SAFETY FACTOR OF 1.5. FOR STATIC PRESSURES GREATER THAN 100 P.S.I. AND/OR SOIL BEARING CAPACITY LESS THAN 1000 LBS/SQ. FT., THE DESIGN ENGINEER SHALL PROVIDE SPECIFIC CALCULATIONS FOR DEPARTMENTAL REVIEW AND APPROVAL.
5. LOWER VERTICAL GRAVITY BLOCKS MAY BE SIZED FROM THIS TABLE. UPPER VERTICAL GRAVITY BLOCKS SHALL BE SIZED BY THE DESIGN ENGINEER.

STANDARD CONCRETE THRUST BLOCKS

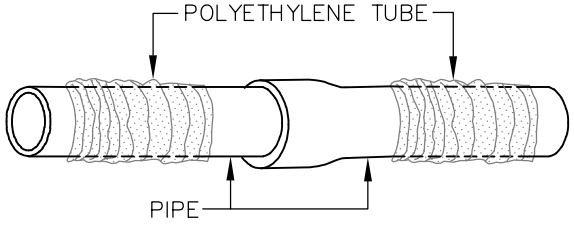
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-21

AWWA C-105 METHOD "A" FIELD INSTALLATION STEPS:

STEP 1 – CUT 8 MIL POLYETHYLENE TUBE TO A LENGTH APPROXIMATELY 2-FT LONGER THAN THE PIPE SECTION.

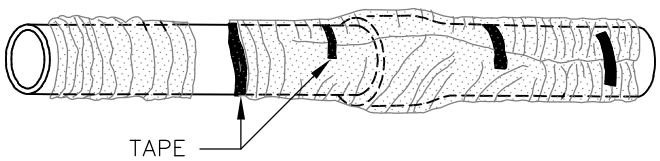
STEP 2 – PLACE POLYETHYLENE TUBE ON PIPE PRIOR TO LOWERING IT INTO TRENCH.

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.



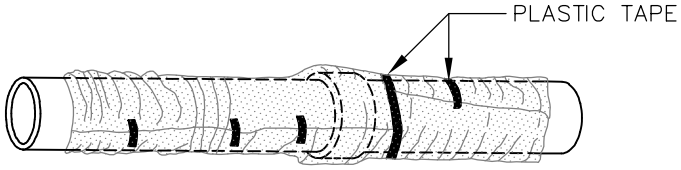
STEP 3

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 4

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.



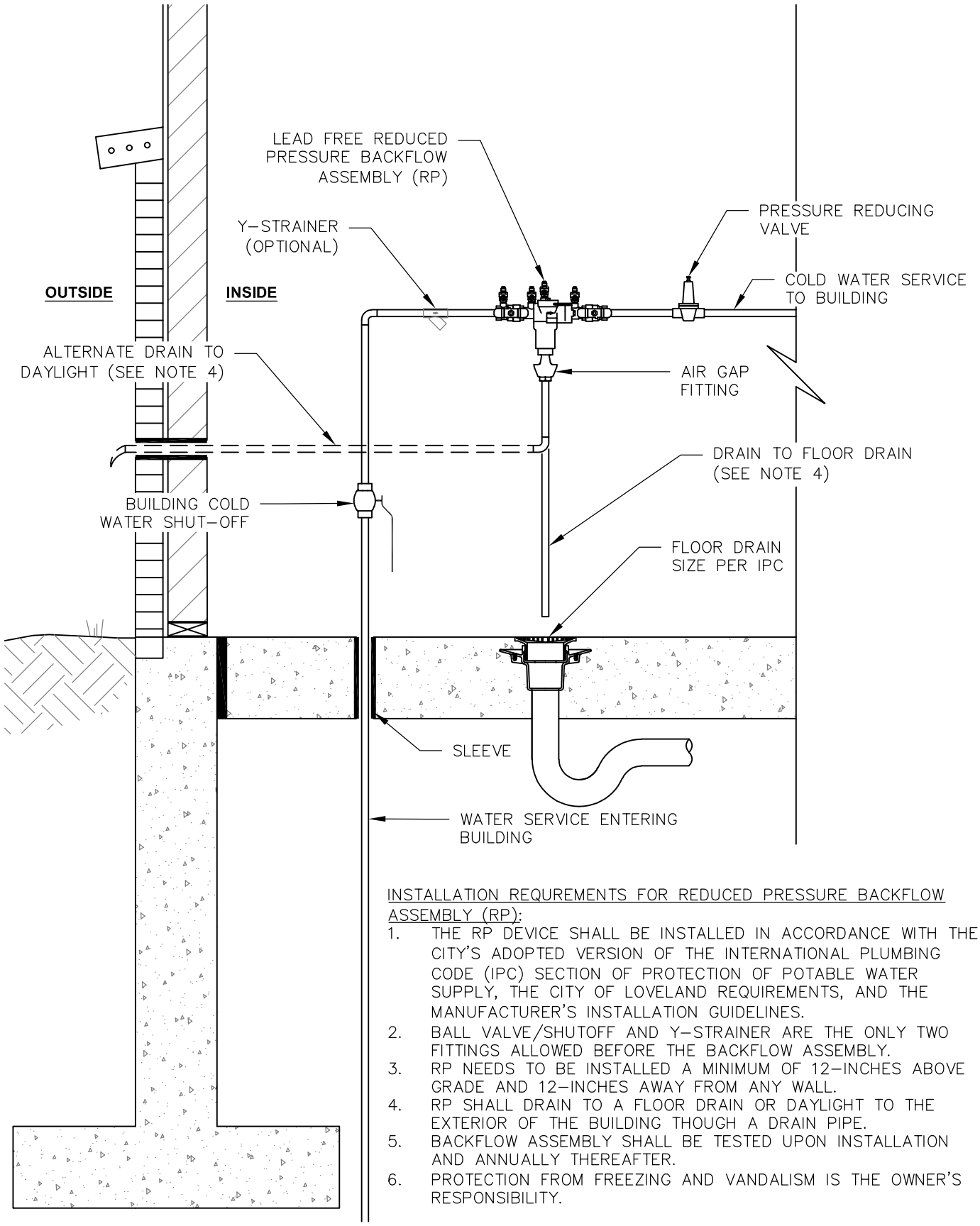
STEP 5

STEP 6 – CAREFULLY BACKFILL WITH CLEAN MATERIAL THAT WILL NOT DAMAGE ENCASEMENT.

NOTE:
1. TAPE TRACER WIRE TO OUTSIDE OF PIPE WRAP.
2. MAKE TAPS BY WRAPPING THREE LAYERS OF TAPE AROUND THE PIPE TO COVER THE TAPPING MACHINE AREA. INSTALL CORPORATION STOP THROUGH THE TAPE AND POLYETHYLENE TUBE.

POLYETHYLENE PIPE WRAP

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-22

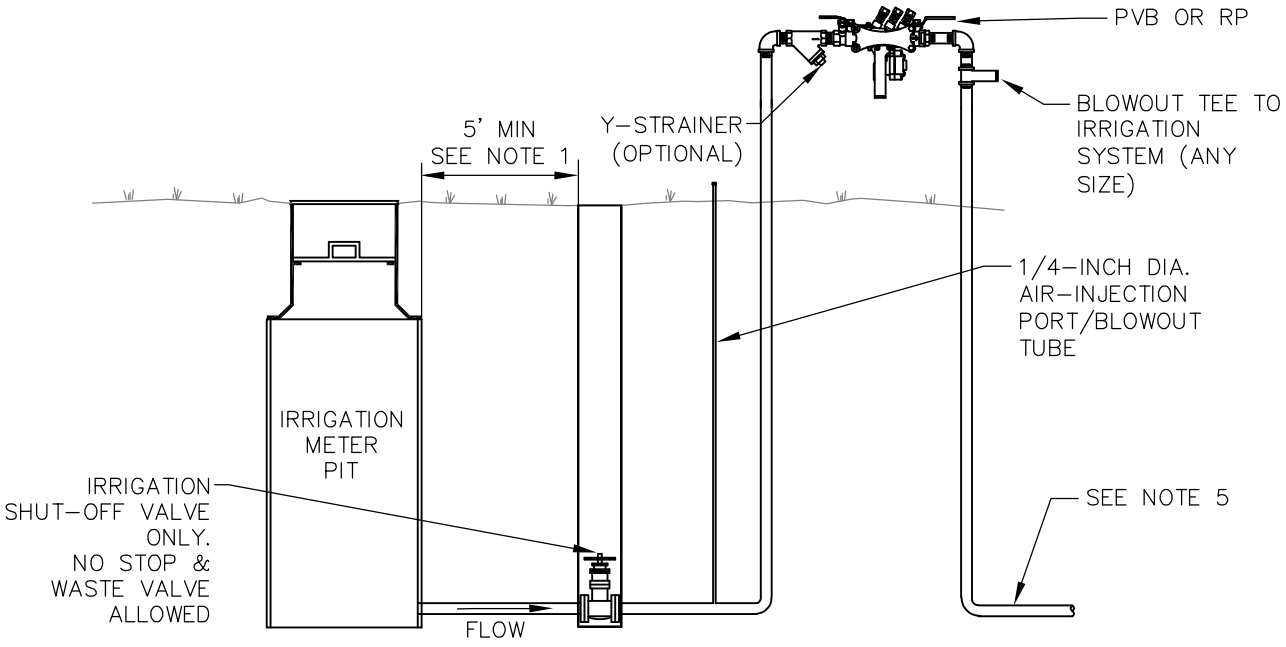


INSTALLATION REQUREMENTS FOR REDUCED PRESSURE BACKFLOW ASSEMBLY (RP):

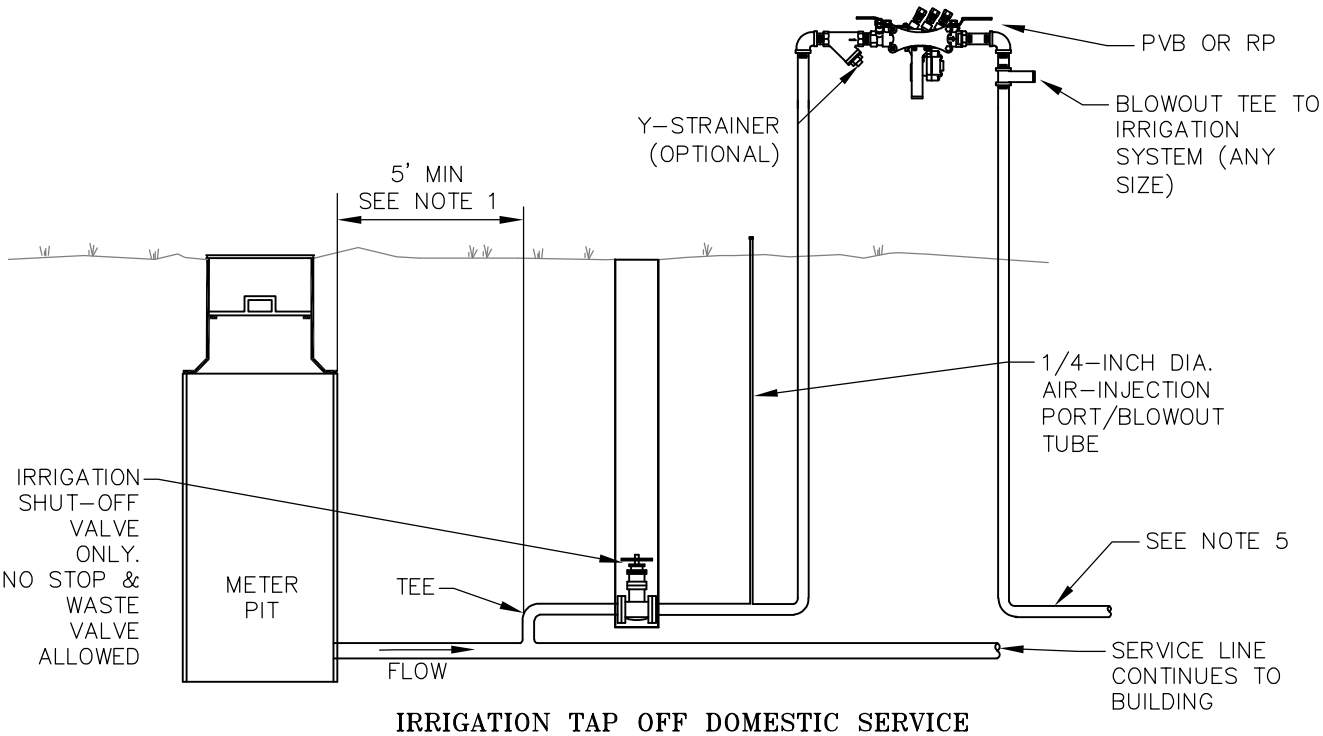
1. THE RP DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE CITY'S ADOPTED VERSION OF THE INTERNATIONAL PLUMBING CODE (IPC) SECTION OF PROTECTION OF POTABLE WATER SUPPLY, THE CITY OF LOVELAND REQUIREMENTS, AND THE MANUFACTURER'S INSTALLATION GUIDELINES.
2. BALL VALVE/SHUTOFF AND Y–STRAINER ARE THE ONLY TWO FITTINGS ALLOWED BEFORE THE BACKFLOW ASSEMBLY.
3. RP NEEDS TO BE INSTALLED A MINIMUM OF 12–INCHES ABOVE GRADE AND 12–INCHES AWAY FROM ANY WALL.
4. RP SHALL DRAIN TO A FLOOR DRAIN OR DAYLIGHT TO THE EXTERIOR OF THE BUILDING THOUGH A DRAIN PIPE.
5. BACKFLOW ASSEMBLY SHALL BE TESTED UPON INSTALLATION AND ANNUALLY THEREAFTER.
6. PROTECTION FROM FREEZING AND VANDALISM IS THE OWNER'S RESPONSIBILITY.

WATER SERVICE ENTRY LAYOUT

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–23



DESIGNATED IRRIGATION METER & SERVICE



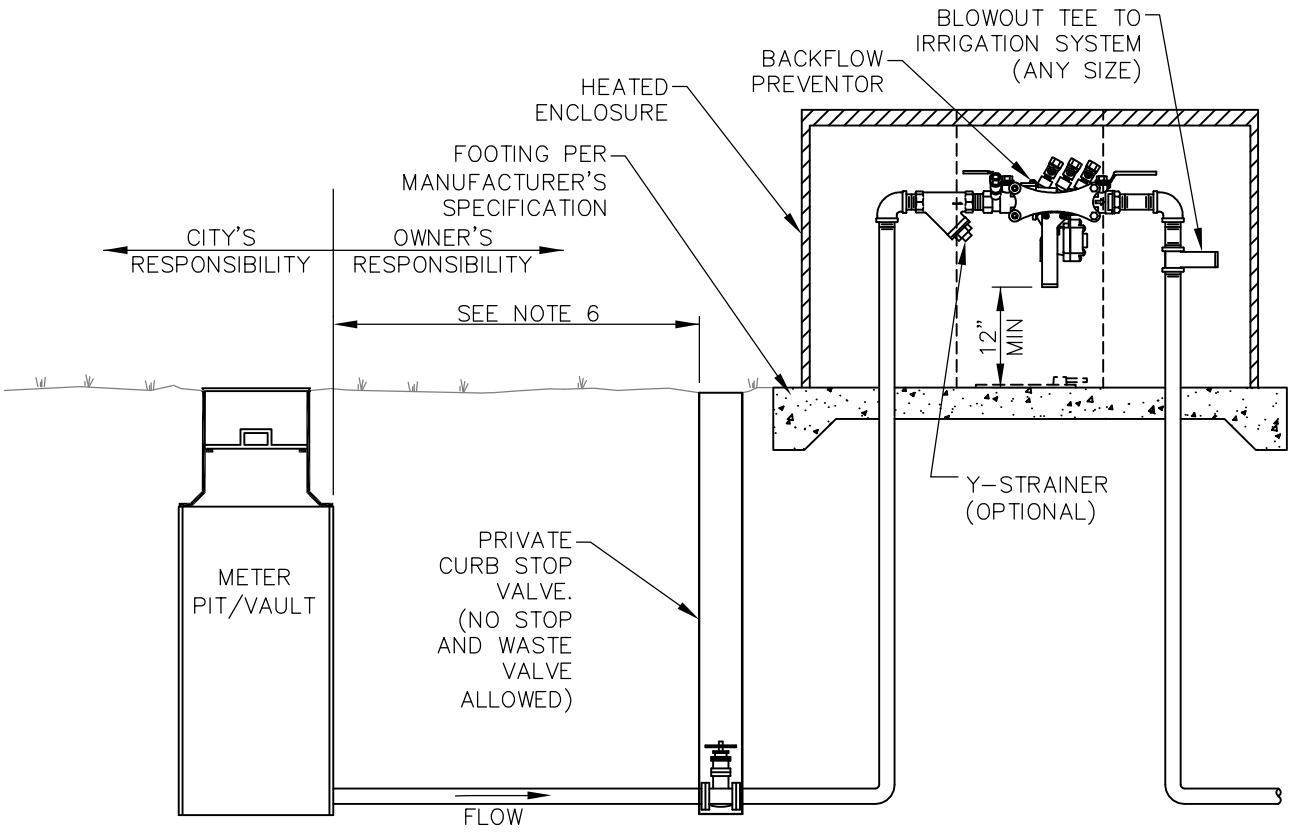
IRRIGATION TAP OFF DOMESTIC SERVICE

NOTES:

1. IRRIGATION SHUT-OFF VALVE TEE SHALL BE 5-FOOT MINIMUM DISTANCE FROM OUTSIDE OF METER PIT.
2. PVB NEEDS TO BE 12-INCHES ABOVE THE HIGHEST SPRINKLER HEAD. RP NEEDS TO BE 12" ABOVE THE GROUND.
3. DO NOT BLOW AIR THROUGH THE BACKFLOW ASSEMBLY.
4. IRRIGATION SYSTEMS WHICH USE COMPRESSED AIR TO PURGE THE SYSTEM SHALL NOT HAVE AIR INJECTION PORTS LARGER THAN 1/4-INCH DIAMETER UPSTREAM OF THE BACKFLOW PREVENTOR.
5. AIR-INJECTOR PORT LOCATED DOWNSTREAM OF BACKFLOW PREVENTOR CAN BE ANY SIZE.
6. BACKFLOW ASSEMBLY SHALL BE TESTED UPON INSTALLATION AND ANNUALLY THEREAFTER.

IRRIGATION SYSTEM SERVICE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-24

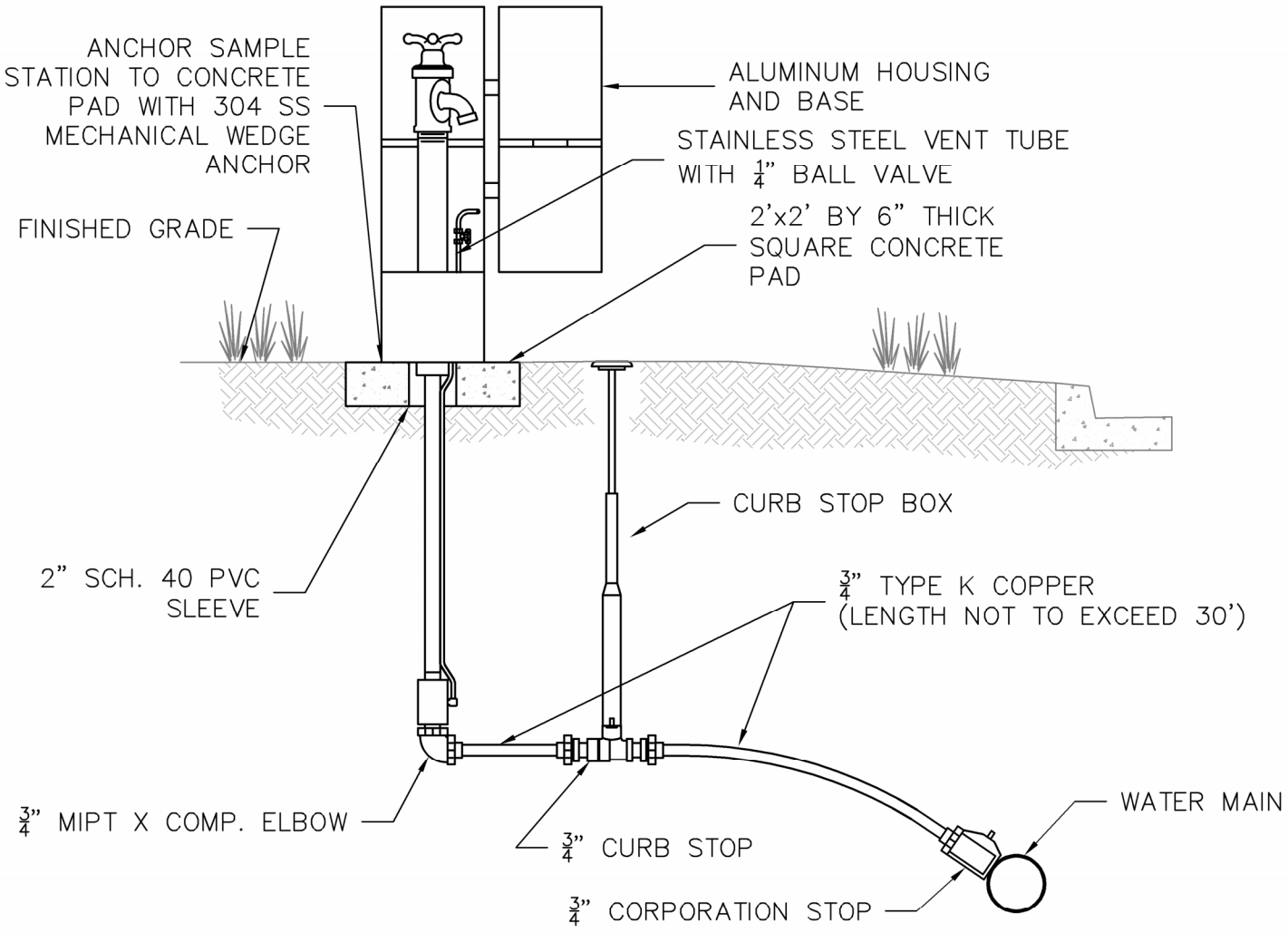


NOTES:

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. ALL ELECTRICAL OUTLETS SHALL BE WATERPROOF/WATER TIGHT. OWNER SHALL ACKNOWLEDGE THAT THERE IS AN ELECTRICAL HAZARD WITH WATER SYSTEM.
4. SEPARATION DISTANCE BETWEEN THE PRIVATE CURB STOP VALVE AND THE OUTSIDE OF METER PIT/VAULT SHALL BE BASED ON SERVICE SIZE:
   - $\frac{3}{4}$" TO 2" – 5' MINIMUM
   - 3", 4" AND 6" – 10' MINIMUM
5. ALL DEVICES SHALL BE ASSE/USC APPROVED.
6. ENCLOSURE TO ALLOW ADEQUATE DRAINAGE IN THE EVENT OF RELIEF VALVE DISCHARGE.
7. BACKFLOW PREVENTOR ENCLOSURE SHALL HAVE ADEQUATE ROOM FOR TESTING AND MAINTENANCE. IF PARALLEL DEVICES ARE REQUIRED ENCLOSURE SHALL BE SIZED ACCORDINGLY.
8. BACKFLOW PREVENTOR NEEDS TO BE A MINIMUM OF 12" ABOVE ENCLOSURE FLOOR OR CONCRETE PAD.
9. DO NOT BLOW AIR THROUGH THE BACKFLOW ASSEMBLY. USE THE BLOWOUT TEE.
10. THERE SHALL BE NO CONNECTIONS BEFORE THE BACKFLOW PREVENTOR WITH THE EXCEPTION OF THE CURB STOP.
11. BACKFLOW ASSEMBLY SHALL BE TESTED UPON INSTALLATION AND ANNUALLY THEREAFTER.

BACKFLOW PREVENTOR HEATED ENCLOSURE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W-25



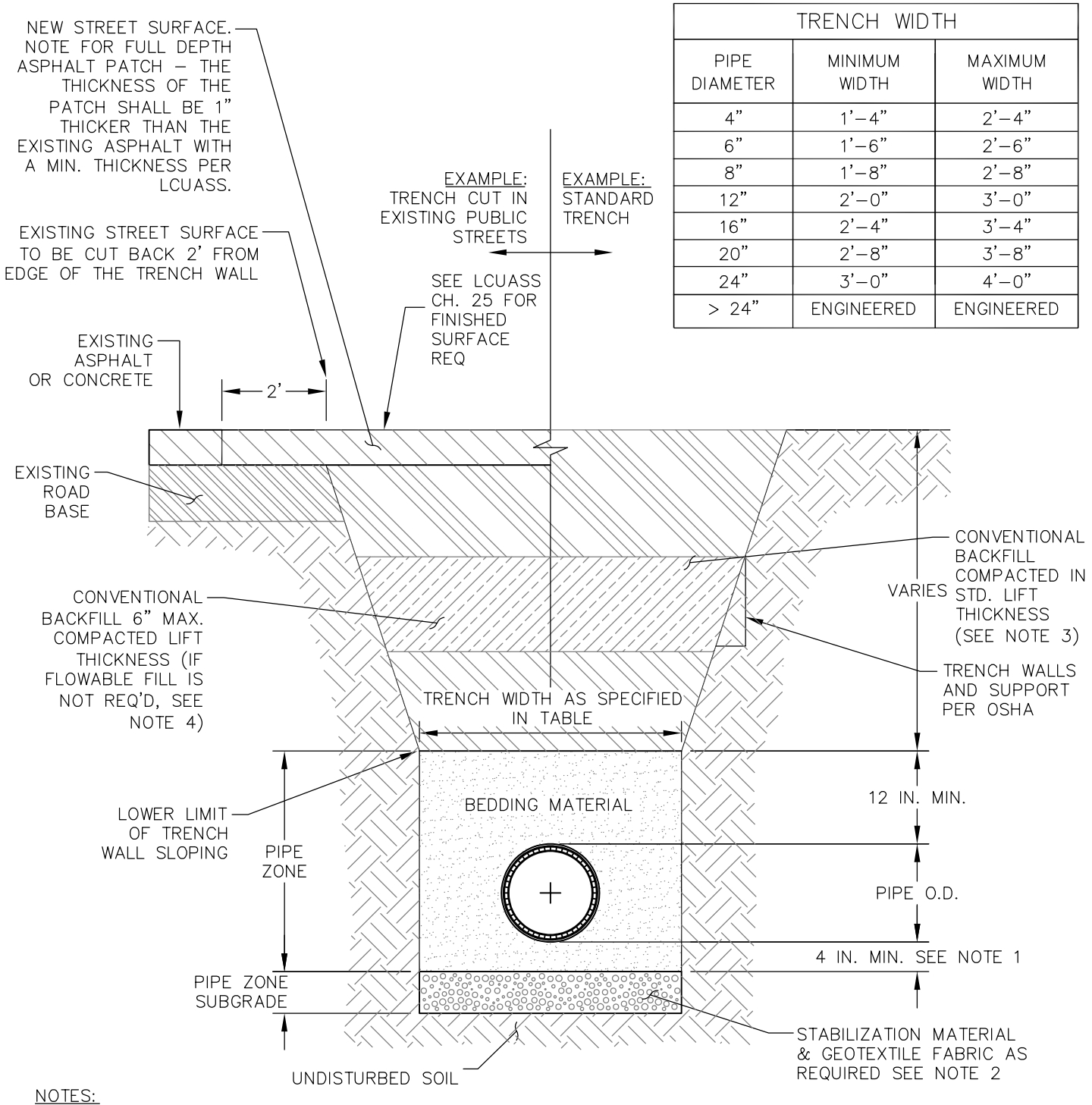
NOTES:

1. SAMPLING STATIONS SHALL BE ECLIPSE NO. 88–SS (MANUFACTURED BY KUPFERLE FOUNDRY) WITH 4.5' BURY DEPTH, 3/4" FIPT INLET AND 3/4" UNTHREADED NOZZLE.
2. STATION SHALL BE ENCLOSED IN A LOCKABLE, NON–REMOVABLE ALUMINUM–CAST HOUSING.
3. STATION INCLUDING ELBOW SHALL BE SUPPLIED BY THE CONTRACTOR.
4. INSTALLL THE STATION PER PLANS AND COORDINATE WITH THE INSPECTOR.
5. LOCK SHALL BE PROVIDED BY THE DEPARTMENT.

POTABLE WATER SAMPLE STATION

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING W–26

TRENCH WIDTH		
PIPE DIAMETER	MINIMUM WIDTH	MAXIMUM WIDTH
4"	1'–4"	2'–4"
6"	1'–6"	2'–6"
8"	1'–8"	2'–8"
12"	2'–0"	3'–0"
16"	2'–4"	3'–4"
20"	2'–8"	3'–8"
24"	3'–0"	4'–0"
> 24"	ENGINEERED	ENGINEERED

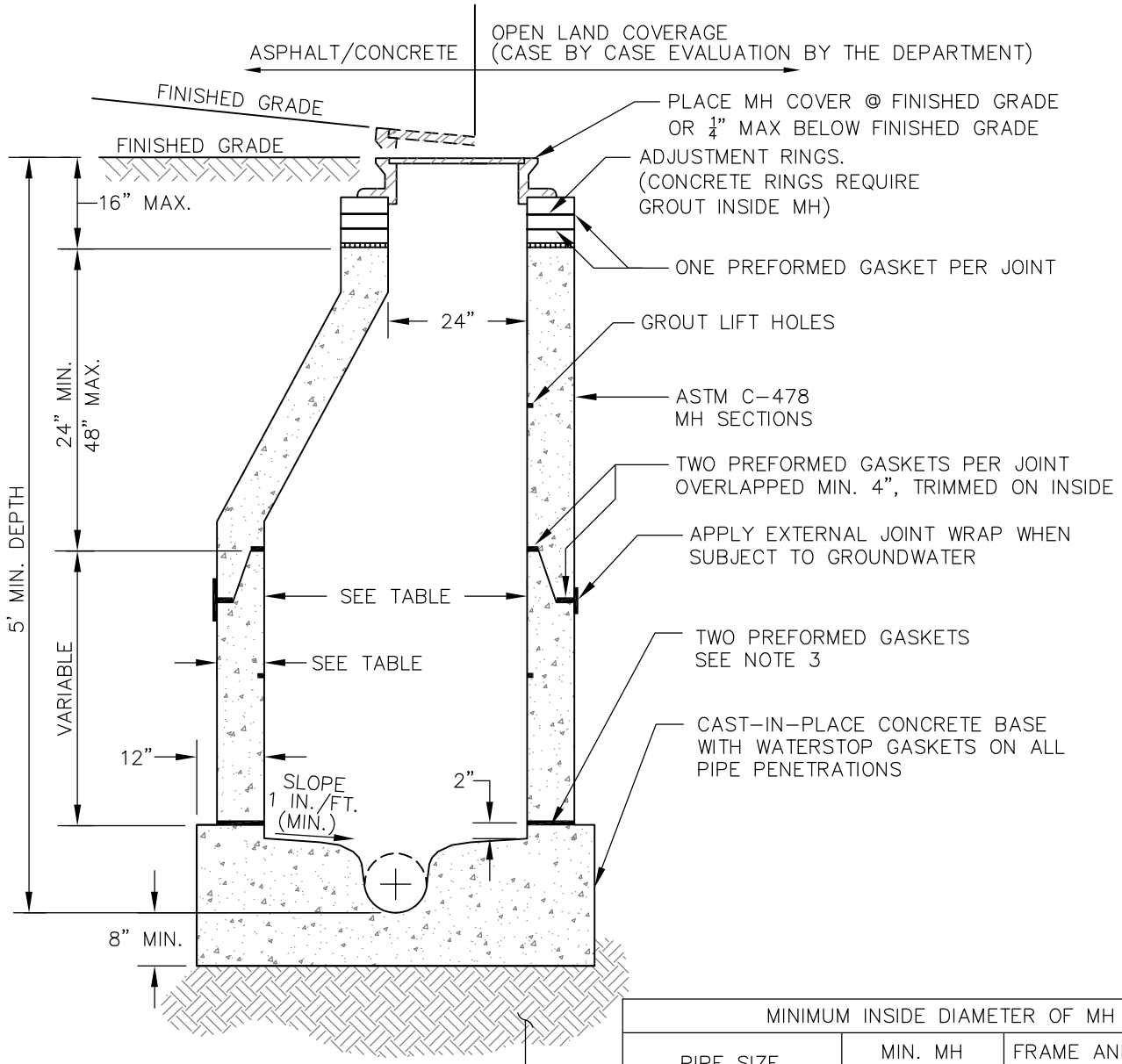


NOTES:

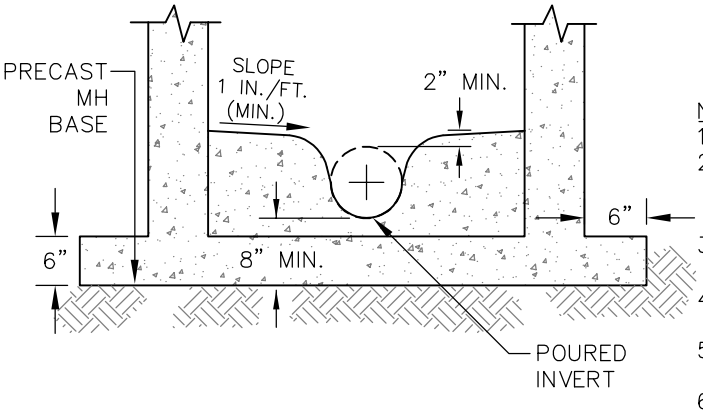
1. GRANULAR MATERIAL SHALL BE A MINIMUM OF 4–INCHES BELOW PIPE OR 1/4 PIPE DIAMETER, WHICHEVER IS GREATER.
2. STABILIZATION MATERIAL MAY BE REQUIRED BY THE DEPARTMENT TO REPLACE THE TOP 6–INCHES OF THE PIPE SUBGRADE. INSTALL GEOTEXTILE FABRIC BETWEEN THE STABILIZATION MATERIAL AND PIPE BEDDING.
3. TRENCH REQUIREMENTS WITHIN OPEN AREAS OR AREAS TO BE DEVELOPED SHALL BE PURSUANT TO DEPARTMENT STANDARDS.
4. WHERE THE SURROUNDING SOILS ARE NON–EXPANSIVE, A FLOWABLE FILL MAY BE SUBSTITUTED FOR BACKFILL MATERIAL.

WASTEWATER MAIN TRENCH

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW–1



MINIMUM INSIDE DIAMETER OF MH			
PIPE SIZE	MIN. MH DIAMETER	FRAME AND COVER DIA.	MH WALL THICKNESS
18 IN. OR LESS	48 IN.	24 IN.	5 IN.
20 TO 24 INCHES	60 IN.	24 IN.	6 IN.
OVER 24 INCHES	72 IN.	24 IN.	7 IN.



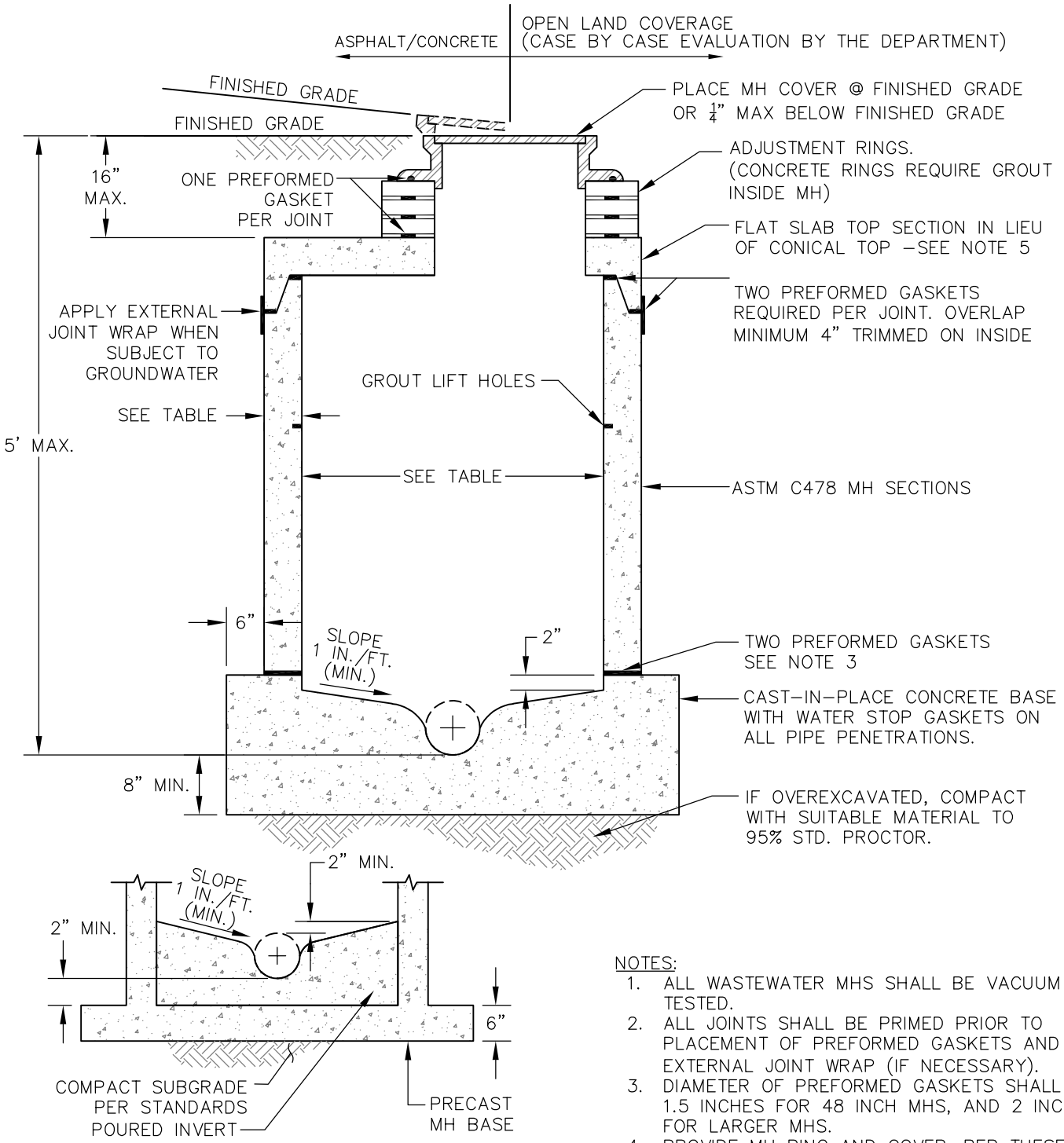
ALTERNATE PRECAST BASE

NOTES:

1. ALL WASTEWATER MHS SHALL BE VACUUM TESTED.
2. ALL JOINTS SHALL BE PRIMED PRIOR TO PLACEMENT OF PREFORMED PLASTIC GASKETS AND EXTERNAL JOINT WRAP (IF NECESSARY).
3. DIAMETER OF PREFORMED GASKETS SHALL BE 1.5" FOR 48" MHS AND 2" FOR LARGER MHS.
4. PROVIDE RING AND COVER, PER THE STANDARDS, AND ADJUST CONSISTENT WITH SLOPE OF FINISH GRADE.
5. ANY STEPS INSTALLED NEED TO BE REMOVED PRIOR TO ACCEPTANCE. ALL HOLES NEED TO BE GROUTED.
6. MHS NOT LOCATED IN HARDSCAPE MAY REQUIRE A LOCATING BOLLARD.

STANDARD MAINTENANCE HOLE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW-2



ALTERNATE PRECAST BASE

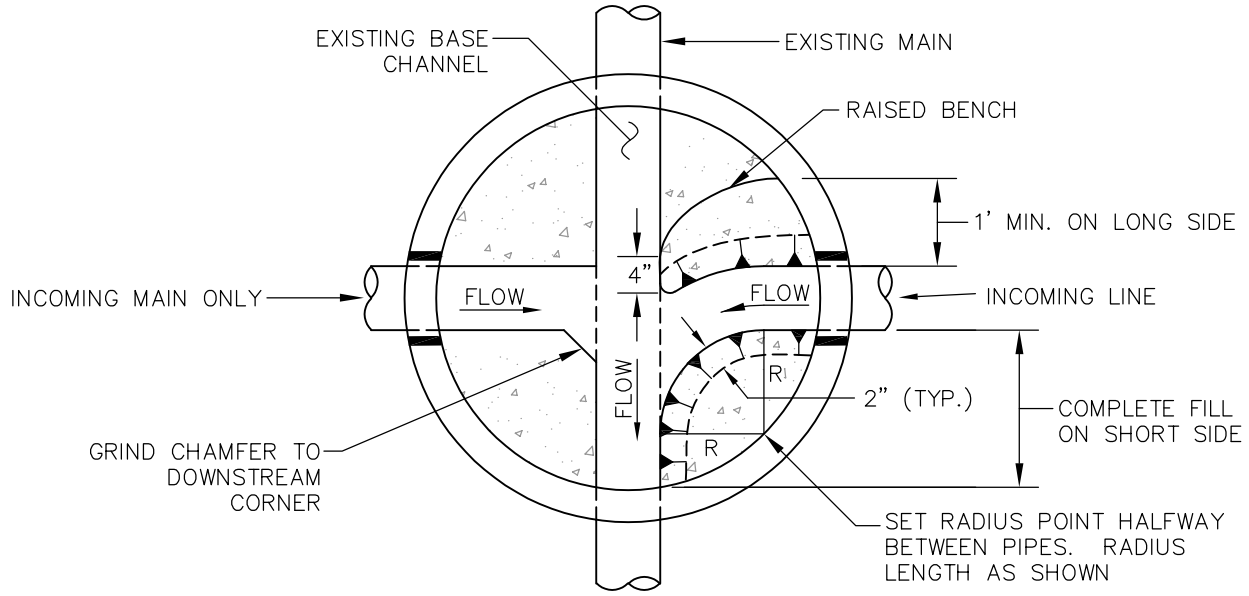
MINIMUM INSIDE DIAMETER OF MH			
PIPE SIZE	MIN. MH DIAMETER	FRAME AND COVER DIA.	MH WALL THICKNESS
18 IN. OR LESS	48 IN.	24 IN.	5 IN.
20 TO 24 INCHES	60 IN.	24 IN.	6 IN.
OVER 24 INCHES	72 IN.	24 IN.	7 IN.

NOTES:

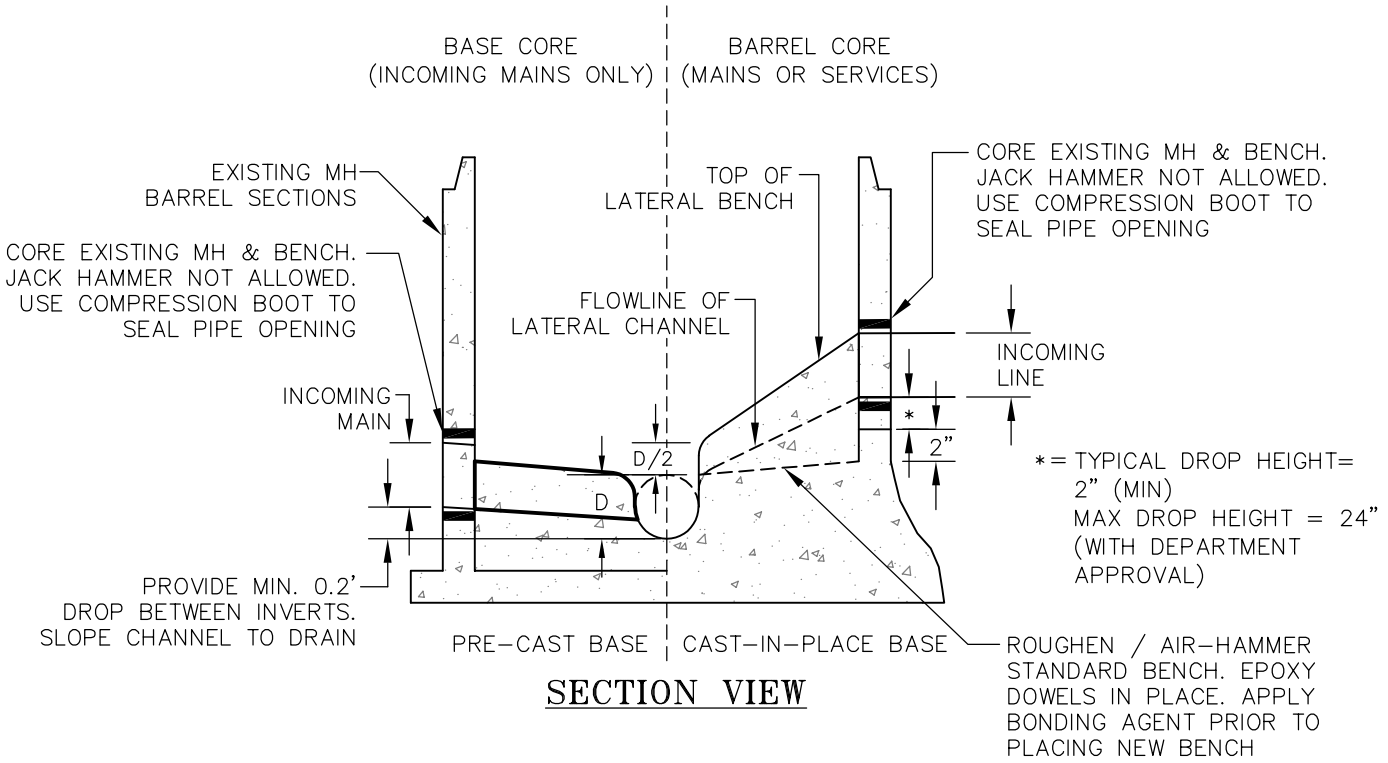
1. ALL WASTEWATER MHS SHALL BE VACUUM TESTED.
2. ALL JOINTS SHALL BE PRIMED PRIOR TO PLACEMENT OF PREFORMED GASKETS AND EXTERNAL JOINT WRAP (IF NECESSARY).
3. DIAMETER OF PREFORMED GASKETS SHALL BE 1.5 INCHES FOR 48 INCH MHS, AND 2 INCHES FOR LARGER MHS.
4. PROVIDE MH RING AND COVER, PER THESE STANDARDS, AND ADJUST CONSISTENT WITH SLOPE OF FINISH GRADE.
5. IF THE DISTANCE FROM THE MH COVER TO THE INVERT IS LESS THAN 3 FEET THE ACCESS HOLE SHALL BE CENTERED.
6. ANY STEPS INSTALLED NEED TO BE REMOVED PRIOR TO ACCEPTANCE. ALL HOLES NEED TO BE GROUTED.
7. MHS NOT LOCATED IN HARDSCAPE MAY REQUIRE A LOCATING BOLLARD.

FLAT–TOP MAINTENANCE HOLE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW–3



PLAN VIEW

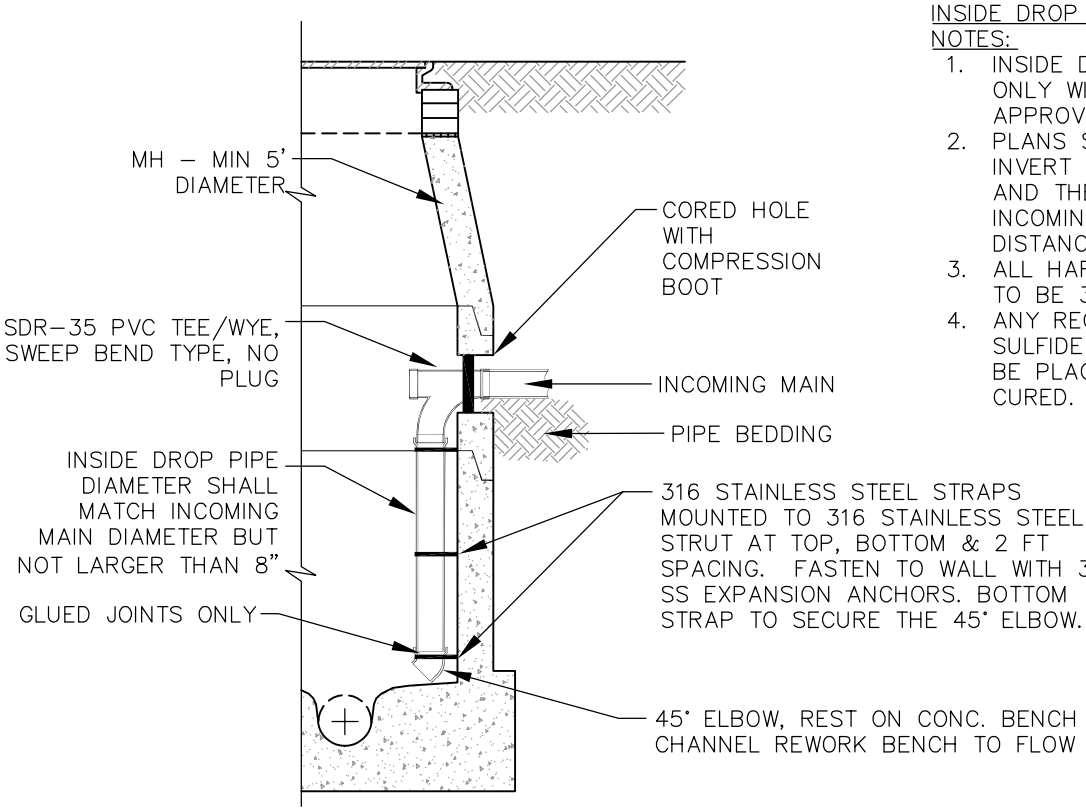


SECTION VIEW

NOTES:
1. CHANNELS SHALL BE CONCRETE, SHAPED TO FULLY CONTAIN THE FULL HEIGHT OF THE INCOMING PIPE AT THE MH WALL, SLOPING TO HALF THE PIPE DIAMETER AT THE MAIN CHANNEL.
2. INVERT SHAPING SHALL DIRECT FLOW TOWARD THE DOWNSTREAM END OF THE MH.
3. CONCRETE SHALL BE READY-MIXED MIN. 4500 PSI. SLUMP AS REQUIRED.
4. ANY REQUIRED HYDROGEN SULFIDE RESISTANT LINING SHALL BE PLACED AFTER BASE IS CURED.

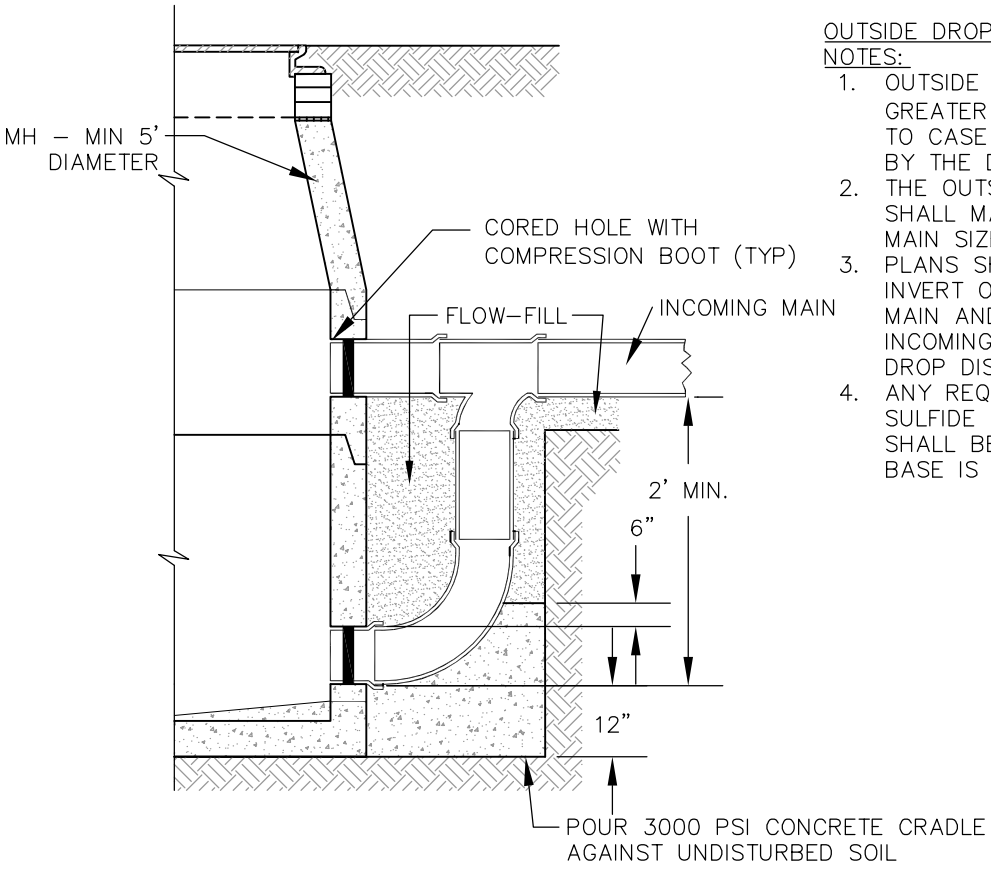
CONNECTION TO EXISTING MAINTENANCE HOLE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW-4



INSIDE DROP MH
NOTES:

1. INSIDE DROPS ARE ALLOWED ONLY WITH DEPARTMENT APPROVAL.
2. PLANS SHALL INDICATE THE INVERT OF THE INCOMING MAIN AND THE INVERT OF THE INCOMING SERVICE AND THE DROP DISTANCE.
3. ALL HARDWARE WITHIN THE DROP TO BE 316 STAINLESS STEEL
4. ANY REQUIRED HYDROGEN SULFIDE RESISTANT LINING SHALL BE PLACED AFTER BASE IS CURED.

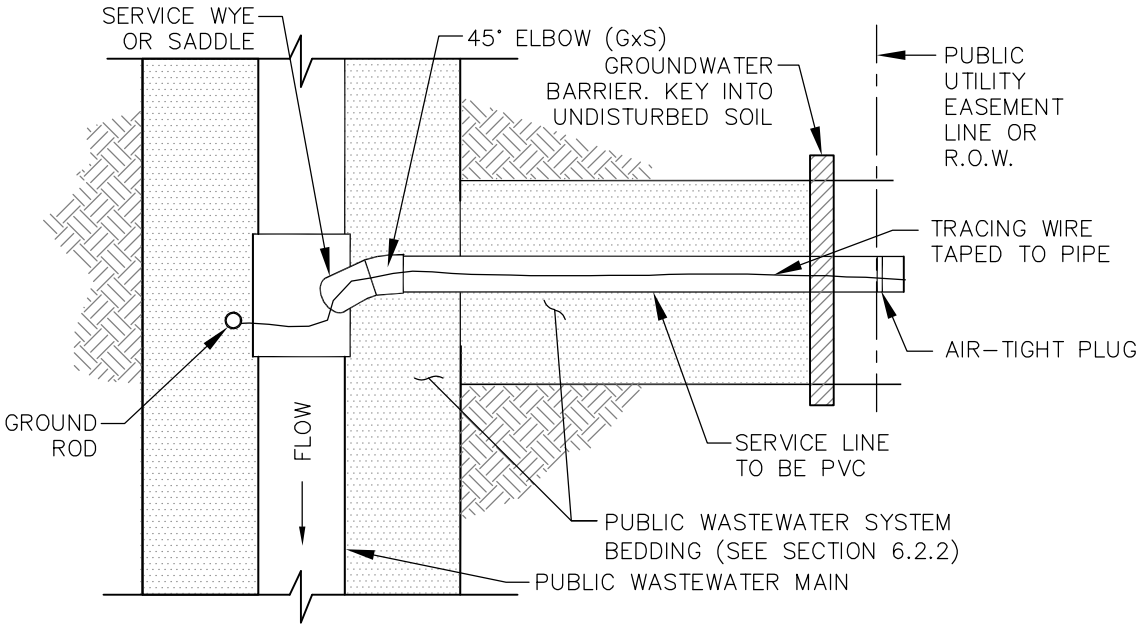


OUTSIDE DROP MH
NOTES:

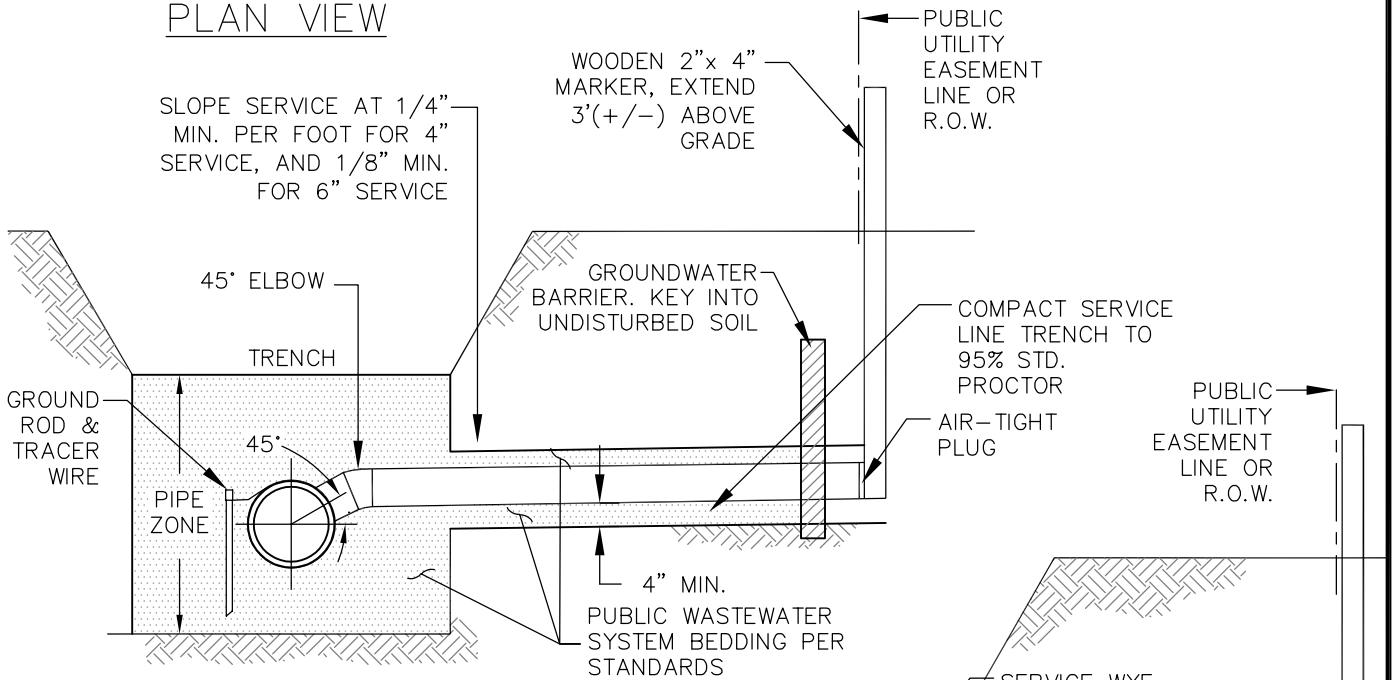
1. OUTSIDE DROPS FOR MAINS GREATER THAN 8" IS SUBJECT TO CASE BY CASE APPROVAL BY THE DEPARTMENT.
2. THE OUTSIDE DROP PIPE SIZE SHALL MATCH THE INCOMING MAIN SIZE.
3. PLANS SHALL INDICATE THE INVERT OF THE INCOMING MAIN AND THE INVERT OF THE INCOMING SERVICE AND THE DROP DISTANCE.
4. ANY REQUIRED HYDROGEN SULFIDE RESISTANT LINING SHALL BE PLACED AFTER BASE IS CURED.

INSIDE/OUTSIDE DROP MAINTENANCE HOLE

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW–5



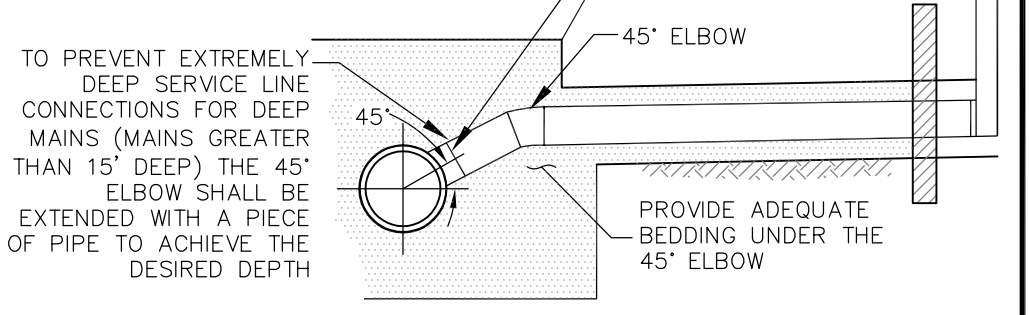
PLAN VIEW



CROSS SECTION

NOTE:

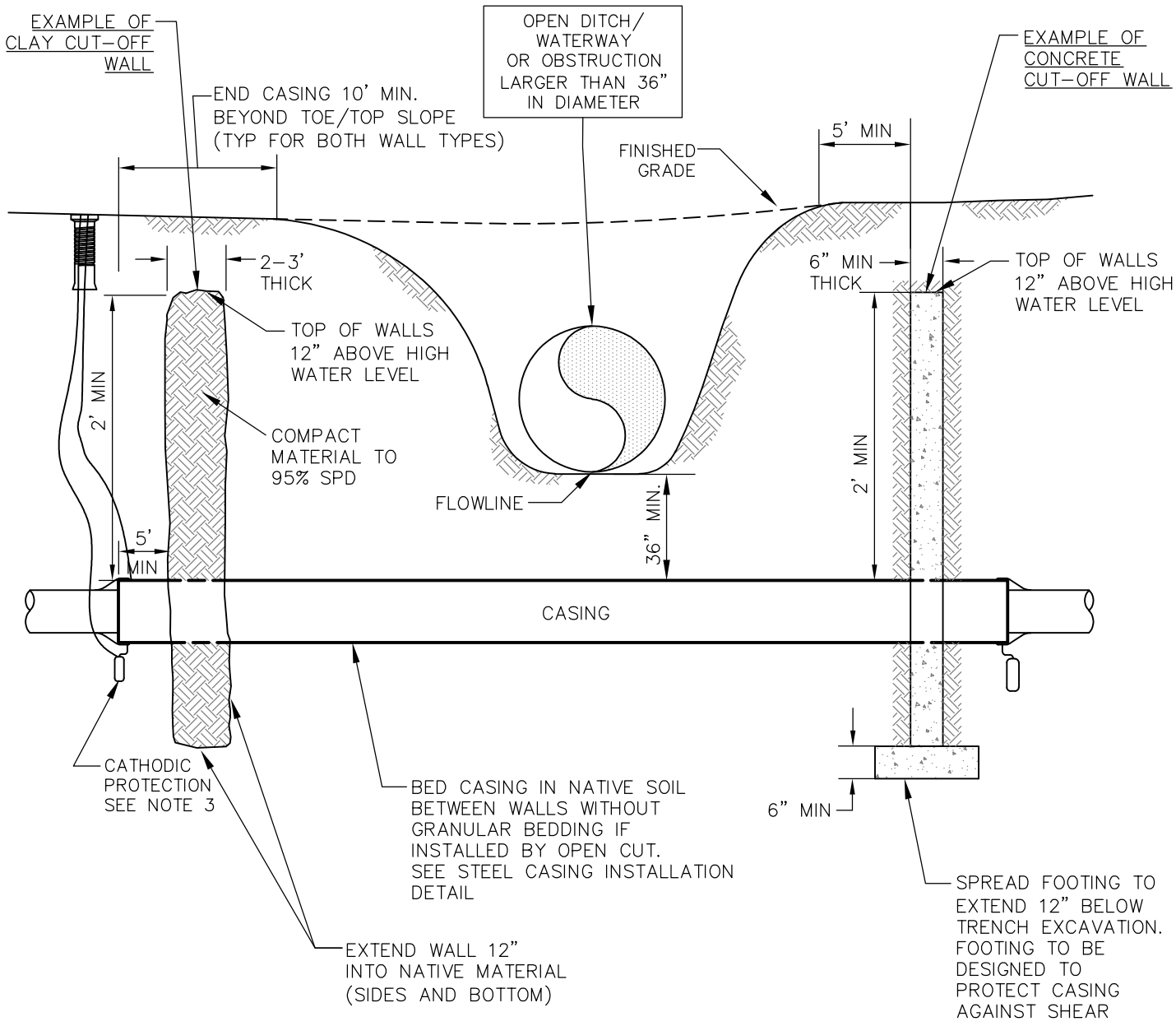
1. ALL 4–INCH AND 6–INCH SERVICE SADDLES SHALL BE AT LEAST 3–FEET BETWEEN ONE ANOTHER WHEN LOCATED ON THE SAME SIDE OF A MAIN AND 18–INCHES IF LOCATED ON OPPOSITE SIDES OF A MAIN.



DEEP MAIN EXAMPLE

WASTEWATER SERVICE CONNECTION

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW–6

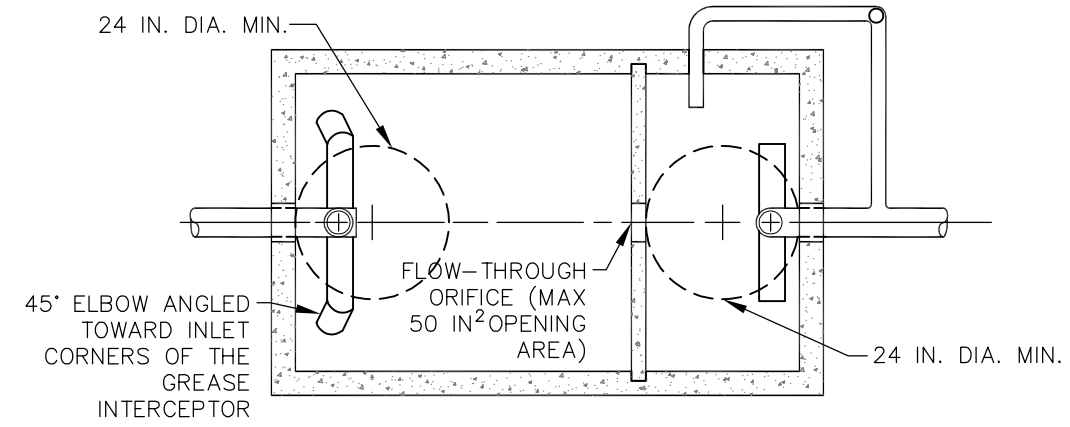


NOTE:

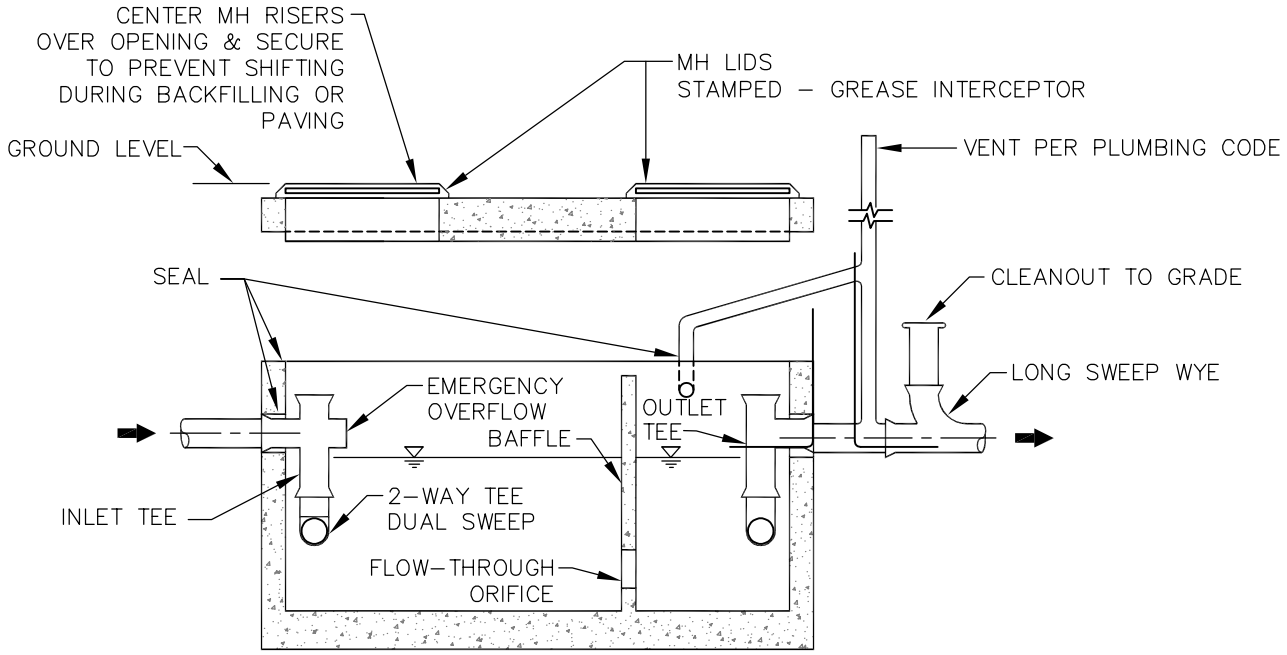
1. ALL CUT-OFF WALLS MAY EITHER BE CLAY OR CONCRETE. ALL CUT-OFF WALLS SHALL BE SPECIFICALLY DESIGNED BY THE DESIGN ENGINEER AND SHALL BE CONSISTENT WITH THESE STANDARDS AND THOSE OF THE ENTITY/OBSTRUCTION BEING CROSSED.
2. ALL JOINTS TO BE RESTRAINED WITHIN CASING.
3. PROVIDE CATHODIC PROTECTION DESIGN FOR ALL CASINGS (INCLUDING CP TEST STATION LOCATION & ANODE SIZE) ON PLANS.

WASTEWATER & DITCH/OBSTRUCTION CROSSING W/CASING

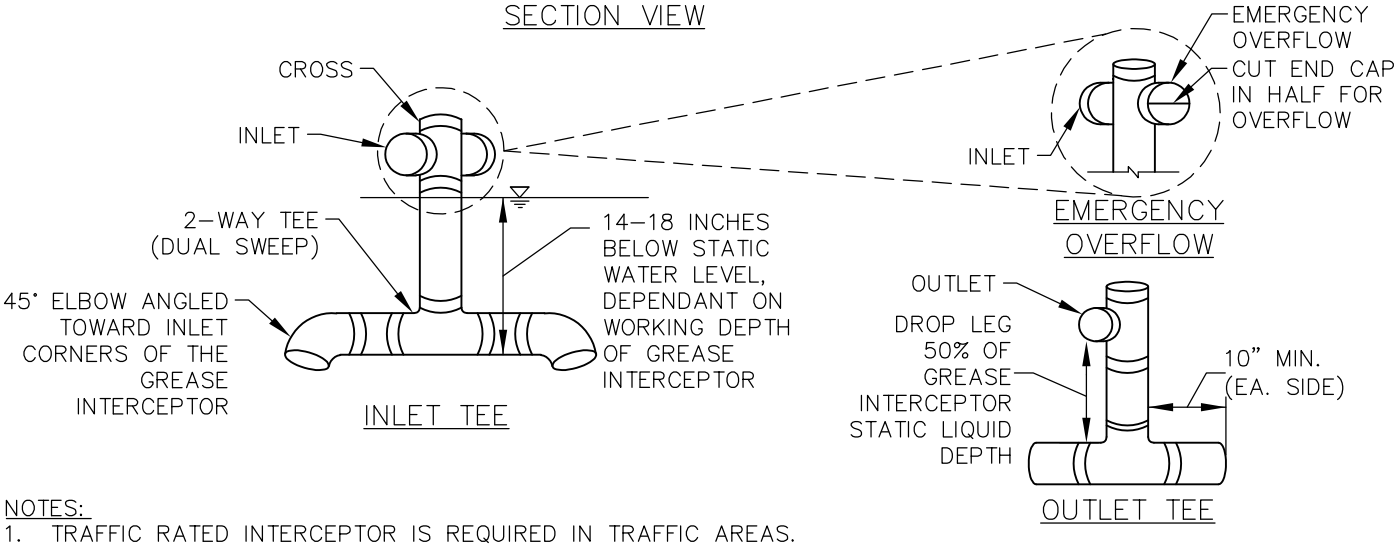
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW-7



PLAN VIEW



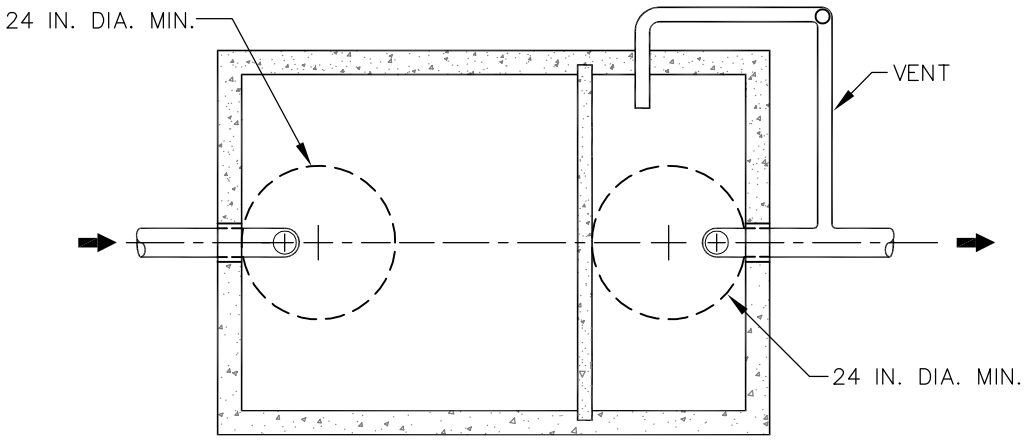
SECTION VIEW



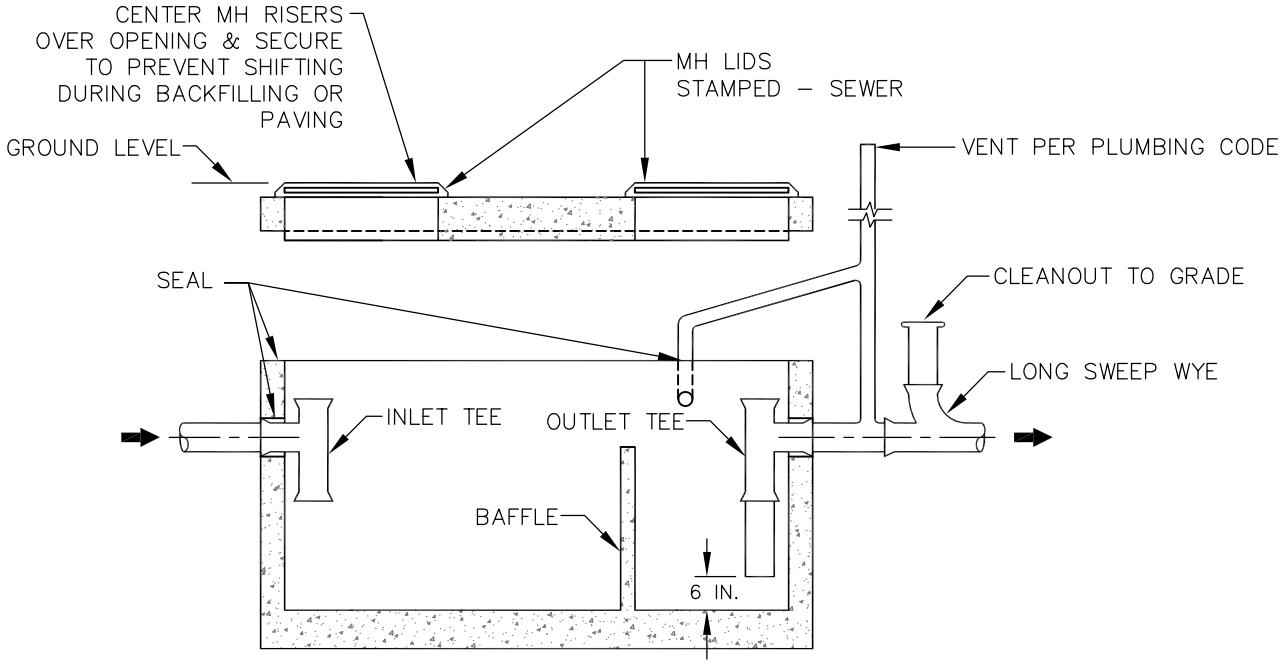
NOTES:
1. TRAFFIC RATED INTERCEPTOR IS REQUIRED IN TRAFFIC AREAS.
2. ACTUAL CONFIGURATION OF INTERCEPTOR MAY VARY BETWEEN MANUFACTURERS.
3. DESIGNER SHOULD CHECK WITH SUPPLIER FOR EXACT DIMENSIONS.

TYPICAL GREASE INTERCEPTOR

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW–8



PLAN VIEW

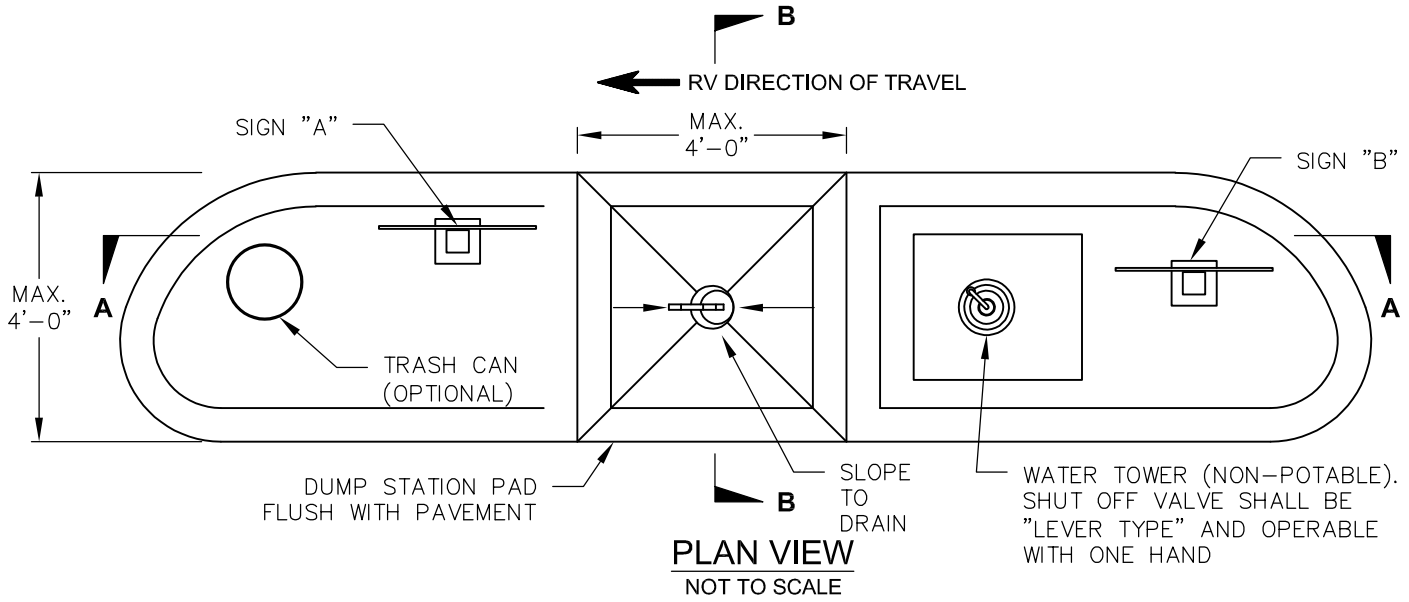


SECTION VIEW

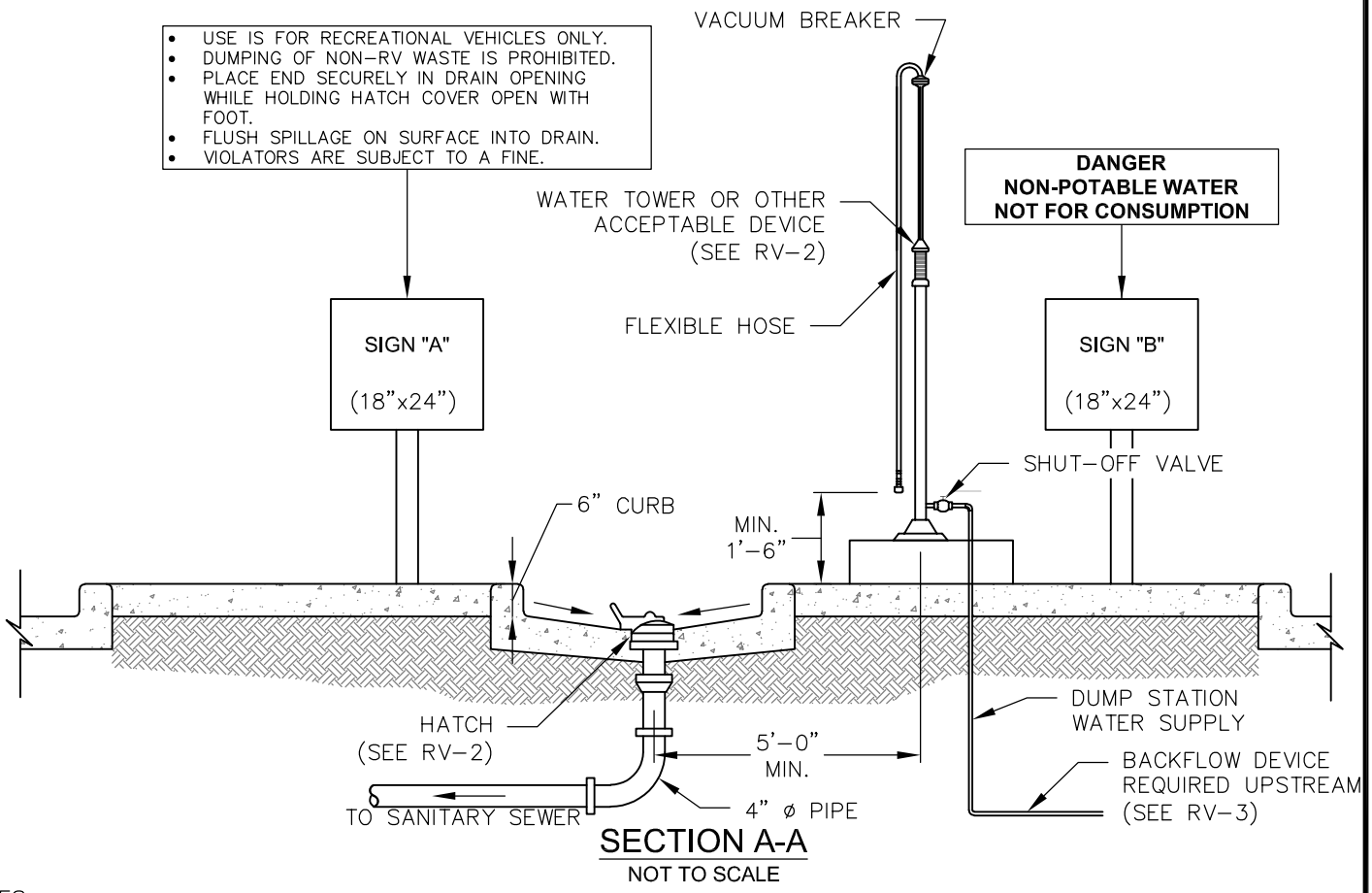
NOTES:
1. TRAFFIC RATED INTERCEPTOR IS REQUIRED IN TRAFFIC AREAS.
2. ACTUAL CONFIGURATION OF INTERCEPTOR MAY VARY BETWEEN MANUFACTURERS.
3. DESIGNER SHOULD CHECK WITH SUPPLIER FOR EXACT DIMENSIONS.

TYPICAL SAND & OIL INTERCEPTOR

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING WW–9



PLAN VIEW
NOT TO SCALE



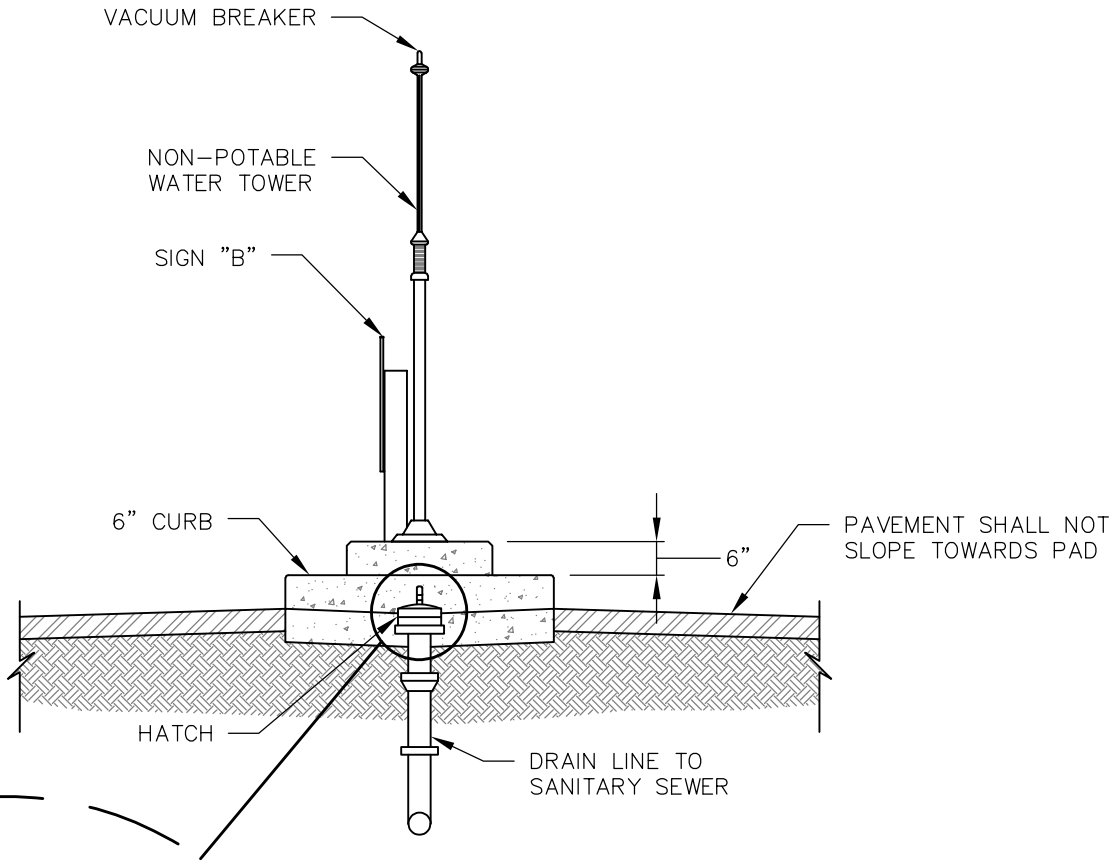
SECTION A-A
NOT TO SCALE

NOTES:

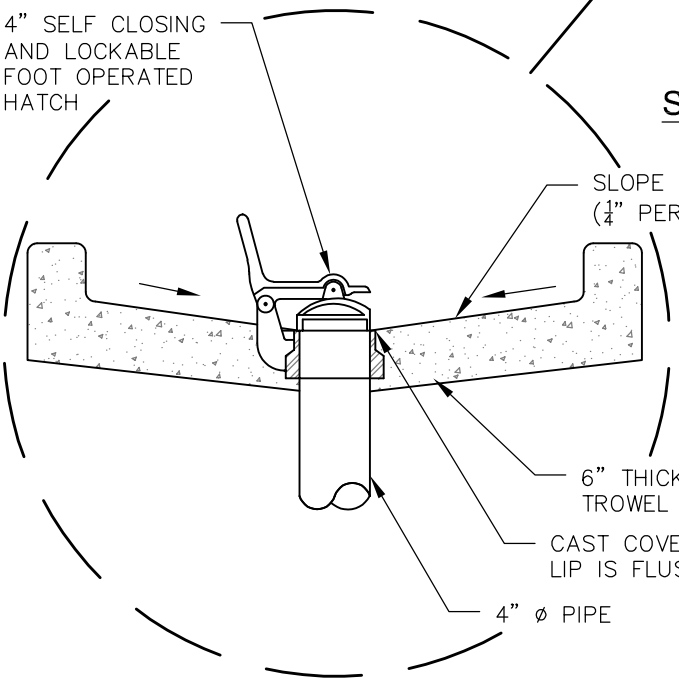
1. THESE FIGURES ARE CONCEPTUAL LAYOUTS.
2. THESE DRAWINGS ARE NOT TO BE USED AS CONSTRUCTION DRAWINGS.
3. SIGN "A" SHALL BE PLACED ADJACENT TO DUMP STATION.
4. SIGN "B" SHALL BE PLACED ON HOSE BIB.
5. OWNER TO PROVIDE TRASH DISPOSAL.
6. POTABLE WATER FILL STATION SHALL BE PLACED A MINIMUM OF 75 FEE FROM DUMP STATION.
7. ALL WATER FIXTURES SHALL BE BACKFLOW PROTECTED.

EXAMPLE RV DUMP SITE DESIGN LAYOUT

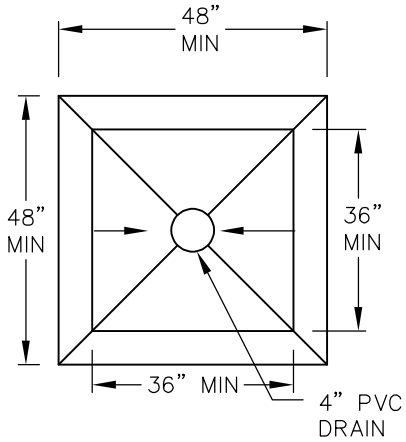
CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING RV-1



SECTION B-B
NOT TO SCALE



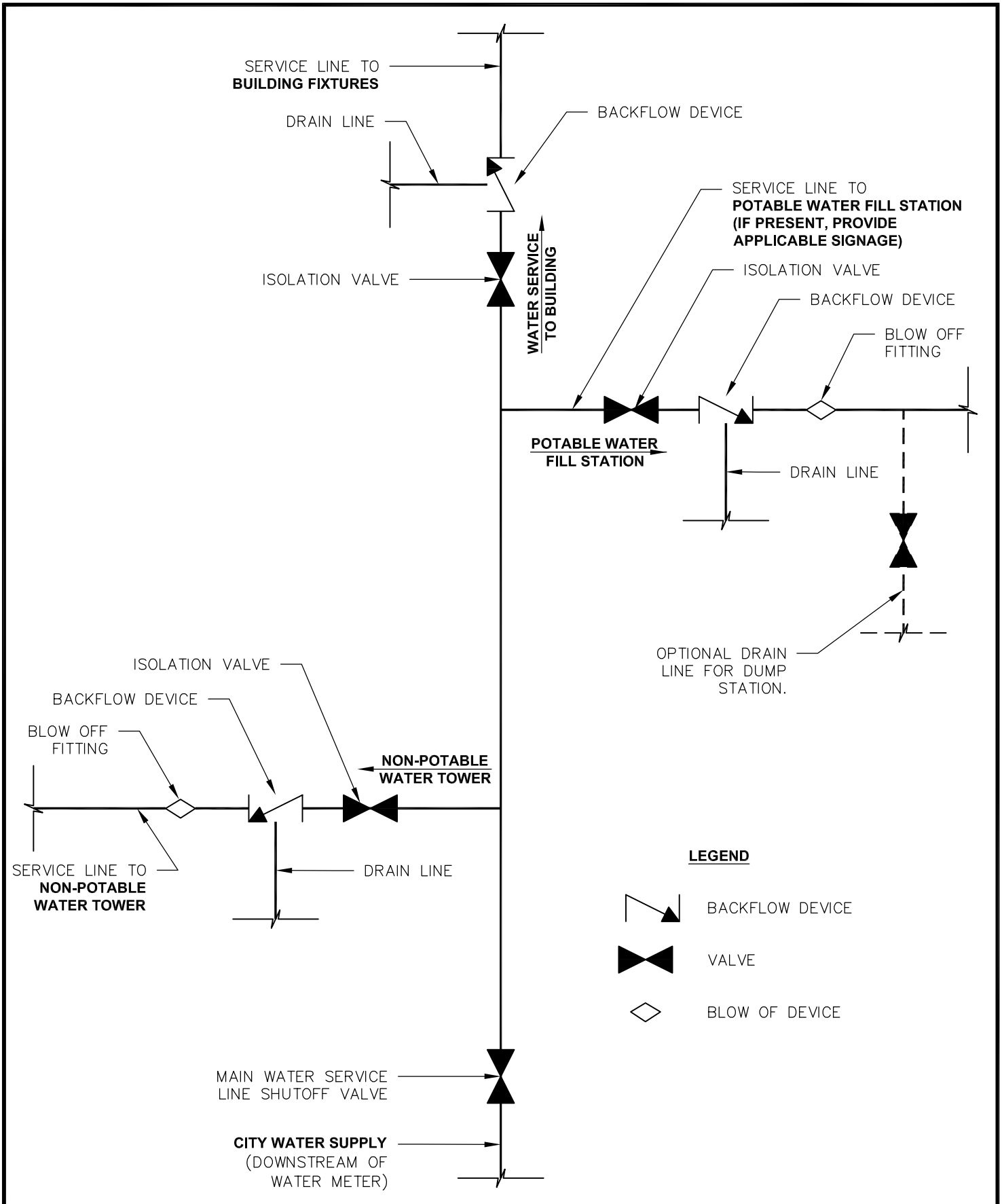
SELF CLOSING HATCH DETAIL
NOT TO SCALE



DRAIN TOP VIEW
NOT TO SCALE

EXAMPLE RV DUMP SITE DESIGN DETAILS

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING RV–2



EXAMPLE RV DUMP – WATER VALVING & BACKFLOW

CITY OF LOVELAND DEPARTMENT OF WATER AND POWER	W/WW CONSTRUCTION DRAWINGS	DATE APPROVED: 2024 DATE REVISED: 2024 EDITION	DRAWING RV–3